



Junos[®] OS

Multicast Feature Guide for Security Devices

Release

12.1X46-D10



Modified: 2016-05-26

Juniper Networks, Inc.
1133 Innovation Way
Sunnyvale, California 94089
USA
408-745-2000
www.juniper.net

Juniper Networks, Junos, Steel-Belted Radius, NetScreen, and ScreenOS are registered trademarks of Juniper Networks, Inc. in the United States and other countries. The Juniper Networks Logo, the Junos logo, and JunosE are trademarks of Juniper Networks, Inc. All other trademarks, service marks, registered trademarks, or registered service marks are the property of their respective owners.

Juniper Networks assumes no responsibility for any inaccuracies in this document. Juniper Networks reserves the right to change, modify, transfer, or otherwise revise this publication without notice.

Junos[®] OS Multicast Feature Guide for Security Devices
12.1X46-D10
Copyright © 2016, Juniper Networks, Inc.
All rights reserved.

The information in this document is current as of the date on the title page.

YEAR 2000 NOTICE

Juniper Networks hardware and software products are Year 2000 compliant. Junos OS has no known time-related limitations through the year 2038. However, the NTP application is known to have some difficulty in the year 2036.

END USER LICENSE AGREEMENT

The Juniper Networks product that is the subject of this technical documentation consists of (or is intended for use with) Juniper Networks software. Use of such software is subject to the terms and conditions of the End User License Agreement ("EULA") posted at <http://www.juniper.net/support/eula.html>. By downloading, installing or using such software, you agree to the terms and conditions of that EULA.

Table of Contents

	About the Documentation	xxiii
	Documentation and Release Notes	xxiii
	Supported Platforms	xxiii
	Using the Examples in This Manual	xxiii
	Merging a Full Example	xxiv
	Merging a Snippet	xxiv
	Documentation Conventions	xxv
	Documentation Feedback	xxvii
	Requesting Technical Support	xxvii
	Self-Help Online Tools and Resources	xxvii
	Opening a Case with JTAC	xxviii
Part 1	Overview	
Chapter 1	Multicast Overview	3
	Multicast Overview	3
	Comparing Multicast to Unicast	3
	IP Multicast Uses	5
	IP Multicast Terminology	6
	Multicast Leaf and Branch Terminology	7
	IP Multicast Addressing	8
	Multicast Addresses	8
	Layer 2 Frames and IPv4 Multicast Addresses	9
	Multicast Interface Lists	10
	Multicast Routing Protocols	11
	T Series Router Multicast Performance	13
	PIM Overview	13
	Basic PIM Network Components	15
Chapter 2	Multicast Supported Standards	17
	Supported IP Multicast Protocol Standards	17
Part 2	Configuration	
Chapter 3	Protocol-Independent Multicast	21
	Configuring Basic PIM Settings	21
	PIM Configuration Statements	22
	Changing the PIM Version	24
	Modifying the PIM Hello Interval	24
	Preserving Multicast Performance by Disabling Response to the ping Utility	25
	PIM on Aggregated Interfaces	26

Configuring PIM Trace Options	26
Disabling PIM	28
Disabling the PIM Protocol	29
Disabling PIM on an Interface	29
Disabling PIM for a Family	30
Disabling PIM for a Rendezvous Point	30
Configuring a Designated Router for PIM	31
Configuring Interface Priority for the PIM Designated Router Selection	31
Configuring PIM Designated Router Election on Point-to-Point Links	32
Examples: Configuring PIM Sparse Mode	33
Understanding PIM Sparse Mode	33
Rendezvous Point	35
RP Mapping Options	35
Designated Router	36
Tunnel Services PICs and Multicast	36
Enabling PIM Sparse Mode	37
Configuring PIM Join Load Balancing	38
Modifying the Join State Timeout	41
Example: Enabling Join Suppression	41
Example: Configuring PIM Sparse Mode over an IPsec VPN	46
Example: Configuring Multicast for Virtual Routers with IPv6 Interfaces	50
Example: Configuring Bidirectional PIM	54
Understanding Bidirectional PIM	54
Designated Forwarder Election	56
Bidirectional PIM Modes	57
Bidirectional Rendezvous Points	57
PIM Bootstrap and Auto-RP Support	58
IGMP and MLD Support	58
Bidirectional PIM and Graceful Restart	58
Junos OS Enhancements to Bidirectional PIM	59
Limitations of Bidirectional PIM	59
Example: Configuring Bidirectional PIM	60
Configuring Static RP	72
Understanding Static RP	73
Configuring Local PIM RPs	73
Configuring the Static PIM RP Address on the Non-RP Routing Device	75
Example: Configuring Anycast RP	76
Understanding RP Mapping with Anycast RP	76
Example: Configuring Multiple RPs in a Domain with Anycast RP	77
Example: Configuring PIM Anycast With or Without MSDP	79
Configuring a PIM Anycast RP Router Using Only PIM	83
Configuring PIM Bootstrap Router	84
Understanding PIM Bootstrap Router	84
Configuring PIM Bootstrap Properties for IPv4	85
Configuring PIM Bootstrap Properties for IPv4 or IPv6	86
Example: Rejecting PIM Bootstrap Messages at the Boundary of a PIM Domain	87
Example: Configuring PIM BSR Filters	88

Configuring PIM Auto-RP	88
Understanding PIM Auto-RP	88
Configuring PIM Auto-RP	89
Configuring Embedded RP	93
Understanding Embedded RP for IPv6 Multicast	93
Configuring PIM Embedded RP for IPv6	95
Configuring PIM Filtering	96
Understanding Multicast Message Filters	96
Filtering MAC Addresses	96
Filtering RP and DR Register Messages	96
Filtering MSDP SA Messages	97
Configuring Interface-Level PIM Neighbor Policies	98
Filtering Outgoing PIM Join Messages	99
Filtering Incoming PIM Join Messages	100
Configuring Register Message Filters on a PIM RP and DR	101
Examples: Configuring PIM RPT and SPT Cutover	103
Understanding Multicast Rendezvous Points, Shared Trees, and Rendezvous-Point Trees	103
Building an RPT Between the RP and Receivers	105
PIM Sparse Mode Source Registration	105
Multicast Shortest-Path Tree	108
SPT Cutover	109
SPT Cutover Control	112
Example: Configuring the PIM Assert Timeout	112
Example: Configuring the PIM SPT Threshold Policy	114
Configuring PIM and the Bidirectional Forwarding Detection (BFD) Protocol ...	118
Understanding Bidirectional Forwarding Detection Authentication for PIM	118
BFD Authentication Algorithms	119
Security Authentication Keychains	119
Strict Versus Loose Authentication	120
Configuring BFD for PIM	120
Configuring BFD Authentication for PIM	121
Configuring BFD Authentication Parameters	122
Viewing Authentication Information for BFD Sessions	123
Example: Configuring Nonstop Active Routing for PIM	124
Understanding Nonstop Active Routing for PIM	124
Example: Configuring Nonstop Active Routing with PIM	125
Configuring PIM Sparse Mode Graceful Restart	136
Configuring PIM Dense Mode	137
Understanding PIM Dense Mode	137
Configuring PIM Dense Mode Properties	139
Configuring PIM Sparse-Dense Mode	140
Understanding PIM Sparse-Dense Mode	140
Mixing PIM Sparse and Dense Modes	140
Configuring PIM Sparse-Dense Mode Properties	141
PIM Join Load Balancing on Multipath MVPN Routes Overview	141
Example: Configuring PIM Join Load Balancing On Next-Generation Multicast VPN	145

Chapter 4	Multicast Routing Options	155
	Examples: Configuring Reverse Path Forwarding	155
	Understanding Multicast Reverse Path Forwarding	155
	RPF Table	156
	Multicast RPF Configuration Guidelines	157
	Example: Configuring a Dedicated PIM RPF Routing Table	158
	Example: Configuring RPF Policies	161
	Example: Configuring PIM RPF Selection	163
	Example: Configuring Source-Specific Multicast	167
	Understanding PIM Source-Specific Mode	167
	PIM SSM	168
	Source-Specific Multicast Groups Overview	170
	Example: Configuring Source-Specific Multicast Groups with Any-Source Override	171
	Example: Configuring an SSM-Only Domain	174
	Example: Configuring PIM SSM on a Network	175
	Example: Configuring SSM Mapping	176
	Example: Configuring SSM Maps for Different Groups to Different Sources	178
	Multiple SSM Maps and Groups for Interfaces	178
	Example: Configuring Multiple SSM Maps Per Interface	179
	Examples: Configuring Bandwidth Management	182
	Understanding Bandwidth Management for Multicast	182
	Bandwidth Management and PIM Graceful Restart	183
	Bandwidth Management and Source Redundancy	183
	Logical Systems and Bandwidth Oversubscription	183
	Example: Defining Interface Bandwidth Maximums	184
	Example: Configuring Multicast with Subscriber VLANs	187
	Configuring Multicast Routing Over IP Demux Interfaces	200
	Classifying Packets by Egress Interface	201
	Examples: Configuring the Multicast Forwarding Cache	203
	Understanding the Multicast Forwarding Cache	203
	Example: Configuring the Multicast Forwarding Cache	203
	Example: Configuring a Multicast Flow Map	206
	Example: Configuring Ingress PE Redundancy	210
	Understanding Ingress PE Redundancy	210
	Example: Configuring Ingress PE Redundancy	210
	Configuring PIM-to-IGMP and PIM-to-MLD Message Translation	215
	Understanding PIM-to-IGMP and PIM-to-MLD Message Translation	215
	Configuring PIM-to-IGMP Message Translation	217
	Configuring PIM-to-MLD Message Translation	218
Chapter 5	Internet Group Management Protocol	221
	Configuring IGMP	221
	Understanding Group Membership Protocols	221
	Understanding IGMP	222
	Configuring IGMP	223
	Enabling IGMP	224
	Modifying the IGMP Host-Query Message Interval	225
	Modifying the IGMP Query Response Interval	226

	Specifying Immediate-Leave Host Removal for IGMP	226
	Filtering Unwanted IGMP Reports at the IGMP Interface Level	227
	Accepting IGMP Messages from Remote Subnetworks	228
	Modifying the IGMP Last-Member Query Interval	228
	Modifying the IGMP Robustness Variable	229
	Limiting the Maximum IGMP Message Rate	230
	Changing the IGMP Version	230
	Enabling IGMP Static Group Membership	231
	Recording IGMP Join and Leave Events	237
	Limiting the Number of IGMP Multicast Group Joins on Logical Interfaces	238
	Tracing IGMP Protocol Traffic	239
	Disabling IGMP	241
	IGMP and Nonstop Active Routing	241
	Example: Configuring SSM Maps for Different Groups to Different Sources	241
	Multiple SSM Maps and Groups for Interfaces	241
	Example: Configuring Multiple SSM Maps Per Interface	242
Chapter 6	Multicast Listener Discovery	247
	Examples: Configuring MLD	247
	Understanding MLD	247
	Configuring MLD	250
	Enabling MLD	251
	Modifying the MLD Version	252
	Modifying the MLD Host-Query Message Interval	252
	Modifying the MLD Query Response Interval	253
	Modifying the MLD Last-Member Query Interval	254
	Specifying Immediate-Leave Host Removal for MLD	254
	Filtering Unwanted MLD Reports at the MLD Interface Level	255
	Example: Modifying the MLD Robustness Variable	256
	Limiting the Maximum MLD Message Rate	257
	Enabling MLD Static Group Membership	258
	Example: Recording MLD Join and Leave Events	265
	Configuring the Number of MLD Multicast Group Joins on Logical Interfaces	267
	Tracing MLD Protocol Traffic	268
	Disabling MLD	269
Chapter 7	Internet Group Management Protocol Snooping	271
	Example: Configuring IGMP Snooping	271
	Understanding Multicast Snooping	271
	Understanding IGMP Snooping	272
	IGMP Snooping Interfaces and Forwarding	273
	IGMP Snooping and Proxies	273
	Multicast-Router Interfaces and IGMP Snooping Proxy Mode	274
	Host-Side Interfaces and IGMP Snooping Proxy Mode	275

	IGMP Snooping and Bridge Domains	275
	Configuring IGMP Snooping	275
	Configuring VLAN-Specific IGMP Snooping Parameters	276
	Example: Configuring IGMP Snooping	277
	Configuring IGMP Snooping Trace Operations	283
Chapter 8	Multicast Snooping	287
	Example: Configuring Multicast Snooping	287
	Understanding Multicast Snooping	287
	Understanding Multicast Snooping and VPLS Root Protection	288
	Configuring Multicast Snooping	288
	Example: Configuring Multicast Snooping	289
	Enabling Bulk Updates for Multicast Snooping	294
	Enabling Multicast Snooping for Multichassis Link Aggregation Group Interfaces	295
Chapter 9	Automatic Multicast Tunneling	297
	Example: Configuring Automatic IP Multicast Without Explicit Tunnels	297
	Understanding AMT	297
	AMT Applications	298
	AMT Operation	300
	Configuring the AMT Protocol	301
	Configuring Default IGMP Parameters for AMT Interfaces	303
	Example: Configuring the AMT Protocol	305
Chapter 10	Session Announcement Protocol	309
	Configuring the Session Announcement Protocol	309
Chapter 11	Multicast Source Discovery Protocol	311
	Examples: Configuring MSDP	311
	Configuring MSDP	311
	Example: Configuring MSDP in a Routing Instance	312
	Configuring the Interface to Accept Traffic from a Remote Source	320
	Example: Configuring MSDP with Active Source Limits and Mesh Groups	320
	Tracing MSDP Protocol Traffic	326
	Disabling MSDP	327
Chapter 12	Pragmatic General Multicast	329
	Configuring PGM	329
	Understanding Pragmatic General Multicast	329
	PGM Architecture and PGM Routers	330
	PGM-Enabled Source	331
	PGM-Enabled Receivers	331
	PGM-Enabled Routers	332
	PGM Configuration Guidelines	333

Chapter 13	Distance Vector Multicast Routing Protocol	335
	Examples: Configuring DVMRP	335
	Understanding DVMRP	335
	Configuring DVMRP	336
	Example: Configuring DVMRP	336
	Example: Configuring DVMRP to Announce Unicast Routes	340
	Tracing DVMRP Protocol Traffic	343
Chapter 14	PIM Configuration Statements	345
	accept-remote-source	348
	address (Anycast RPs)	349
	address (Bidirectional Rendezvous Points)	350
	address (Local RPs)	351
	address (Static RPs)	352
	algorithm	353
	anycast-pim	354
	assert-timeout	355
	authentication	356
	auto-rp	357
	backoff-period	358
	bfd-liveness-detection	359
	bidirectional (Interface)	360
	bidirectional (RP)	361
	bootstrap	362
	bootstrap-export	363
	bootstrap-import	364
	bootstrap-priority	365
	dense-groups	366
	detection-time (BFD for PIM)	367
	df-election	368
	disable (PIM Graceful Restart)	368
	disable (PIM)	369
	dr-election-on-p2p	370
	dr-register-policy	370
	embedded-rp	371
	export (Bootstrap)	372
	export (PIM)	372
	family (Bootstrap)	373
	family (Disable PIM)	374
	family (Local RP)	375
	graceful-restart	376
	group (RPF Selection)	377
	group-ranges	378
	hello-interval	379
	hold-time (PIM)	380
	import (Bootstrap)	381
	import (PIM)	382
	infinity	383
	interface	384

join-load-balance	385
join-prune-timeout	386
key-chain	386
local	387
local-address	388
loose-check	389
mapping-agent-election	390
maximum-rps	391
minimum-interval (PIM BFD Liveness Detection)	392
minimum-interval (PIM BFD Transmit Interval)	393
minimum-receive-interval	394
mode	395
multiplier	396
neighbor-policy	396
next-hop (PIM RPF Selection)	397
no-adaptation (PIM BFD Liveness Detection)	397
no-bidirectional-mode	398
offer-period	399
override (PIM static RP)	400
override-interval	401
pim	402
prefix-list (PIM RPF Selection)	405
priority (Bootstrap)	406
priority (PIM Interfaces)	407
priority (PIM RPs)	408
propagation-delay	409
reset-tracking-bit	410
restart-duration	411
rib-group	412
robustness-count	413
rp	414
rp-register-policy	416
rp-set	417
rpf-selection	418
source (PIM RPF Selection)	419
spt-threshold	420
static	421
threshold (PIM BFD Detection Time)	422
threshold (PIM BFD Transmit Interval)	423
traceoptions	424
transmit-interval (PIM BFD Liveness Detection)	427
tunnel-devices	428
version (BFD)	429
version (PIM)	430
vpn-group-address	431
wildcard-source (PIM RPF Selection)	431

Chapter 15	IGMP Configuration Statements	433
	accounting (Per Interface)	434
	accounting (Protocol)	434
	disable	435
	exclude	435
	group	436
	group-count	437
	group-increment	437
	group-limit	438
	group-policy	438
	igmp	439
	immediate-leave	441
	interface	442
	maximum-transmit-rate	443
	oif-map	443
	passive (IGMP)	444
	promiscuous-mode	445
	query-interval	445
	query-last-member-interval	446
	query-response-interval	447
	robust-count	448
	source	449
	source-count	450
	source-increment	450
	ssm-map	451
	ssm-map-policy (IGMP)	451
	static	452
	traceoptions	453
	version	455
Chapter 16	MLD Configuration Statements	457
	accounting (Per Interface)	458
	accounting (Protocol)	458
	disable	458
	exclude	459
	group	460
	group-count	461
	group-increment	461
	group-limit	462
	group-policy	462
	immediate-leave	463
	interface	464
	maximum-transmit-rate	465
	mld	466
	oif-map	467
	passive (MLD)	468
	query-interval	469
	query-last-member-interval	469
	query-response-interval	470

	robust-count	470
	source	471
	source-count	471
	source-increment	472
	ssm-map	472
	ssm-map-policy (MLD)	473
	static	474
	traceoptions	475
	version	477
Chapter 17	IGMP Snooping Configuration Statements	479
	group	480
	group-limit	481
	host-only-interface	482
	igmp-snooping	483
	immediate-leave	485
	interface	486
	multicast-router-interface	487
	proxy	488
	query-interval	489
	query-last-member-interval	490
	query-response-interval	491
	robust-count	492
	source	493
	source-address	493
	static	494
	traceoptions	495
	vlan	497
Chapter 18	Multicast Snooping Configuration Statements	499
	flood-groups	500
	forwarding-cache	500
	graceful-restart	501
	ignore-stp-topology-change	501
	multicast-snooping-options	502
	multichassis-lag-replicate-state	503
	nexthop-hold-time	503
	threshold	504
	traceoptions	505
Chapter 19	Multicast Routing Options Configuration Statements	507
	asm-override-ssm	508
	backup-pe-group	509
	backups	510
	bandwidth	511
	flow-map	512
	forwarding-cache (Flow Maps)	513
	forwarding-cache (Multicast)	513
	interface (Routing Options)	514
	interface (Scoping)	515

	local-address	516
	maximum-bandwidth	517
	multicast	518
	no-qos-adjust	520
	pim-to-igmp-proxy	521
	pim-to-mld-proxy	522
	policy (Flow Maps)	523
	policy (SSM Maps)	523
	prefix	524
	redundant-sources	524
	reverse-oif-mapping	525
	rpf-check-policy	526
	scope	527
	scope-policy	528
	source	529
	ssm-groups	530
	ssm-map (Multicast Routing Options)	531
	subscriber-leave-timer	532
	threshold	533
	timeout (Flow Maps)	534
	timeout (Multicast)	535
	upstream-interface	536
Chapter 20	AMT Configuration Statements	537
	accounting	538
	amt (IGMP)	539
	amt (Protocols)	540
	anycast-prefix	541
	defaults	542
	family	543
	group-policy	544
	inet	544
	local-address	545
	query-interval	546
	query-response-interval	547
	relay (IGMP)	548
	relay (Protocols)	549
	robust-count	550
	secret-key-timeout	551
	ssm-map	551
	traceoptions	552
	tunnel-limit	554
	version	555
Chapter 21	Session Announcement Protocol Configuration Statements	557
	disable	557
	listen	558
	sap	559

Chapter 22	MSDP Configuration Statements	561
	active-source-limit	562
	authentication-key	563
	data-encapsulation	564
	default-peer	565
	disable	566
	export	567
	group	568
	import	569
	local-address	570
	maximum	571
	mode	572
	msdp	573
	peer	575
	rib-group	576
	source	577
	threshold	578
	traceoptions	579
Chapter 23	PGM Configuration Statements	583
	pgm	583
	traceoptions	584
Chapter 24	DVMRP Configuration Statements	587
	disable	587
	dvmrp	588
	export	589
	hold-time (DVMRP)	589
	import	590
	interface	590
	metric	591
	mode	591
	rib-group	592
	traceoptions	593
Part 3	Administration	
Chapter 25	PIM Operational Commands	599
	clear pim join	600
	clear pim join-distribution	602
	clear pim register	604
	clear pim statistics	606
	request pim multicast-tunnel rebalance	609
	show pim bidirectional df-election	610
	show pim bidirectional df-election interface	613
	show pim bootstrap	616
	show pim interfaces	618
	show pim join	621
	show pim neighbors	630
	show pim rps	634

	show pim source	641
	show pim statistics	644
Chapter 26	Multicast Routing Options Operational Commands	655
	show multicast backup-pe-groups	656
	show multicast flow-map	658
	show multicast interface	660
	show multicast route	662
	show multicast rpf	668
	show multicast scope	672
	show multicast sessions	674
	show policy	677
Chapter 27	IGMP Operational Commands	679
	clear igmp membership	680
	clear igmp statistics	683
	show igmp group	685
	show igmp interface	689
	show multicast pim-to-igmp-proxy	693
	show igmp statistics	695
Chapter 28	MLD Operational Commands	699
	clear mld membership	700
	clear mld statistics	701
	show mld group	702
	show mld interface	706
	show mld statistics	709
	show multicast pim-to-mld-proxy	712
Chapter 29	IGMP Snooping Operational Commands	715
	clear igmp snooping membership	716
	clear igmp snooping statistics	717
	show igmp snooping interface	718
	show igmp snooping membership	721
	show igmp snooping statistics	725
Chapter 30	Multicast Snooping Operational Commands	729
	clear multicast snooping statistics	730
	show multicast snooping route	731
	show multicast snooping statistics	734
	show route table	737
Chapter 31	AMT Operational Commands	747
	clear amt statistics	748
	clear amt tunnel	749
	show amt statistics	750
	show amt summary	753
	show amt tunnel	755
Chapter 32	Session Announcement Protocol Operational Commands	759
	show sap listen	760

Chapter 33	MSDP Operational Commands	763
	show msdp	764
	show msdp source	766
	show msdp source-active	768
	show msdp statistics	770
	show multicast usage	772
	show route table	775
Chapter 34	PGM Operational Commands	785
	clear pgm negative-acknowledgments	786
	clear pgm source-path-messages	787
	clear pgm statistics	788
	show pgm negative-acknowledgments	789
	show pgm source-path-messages	791
	show pgm statistics	792
Chapter 35	DVMRP Operational Commands	795
	show dvmrp interfaces	796
	show dvmrp neighbors	798
	show dvmrp prefix	800
	show dvmrp prunes	802
Part 4	Index	
	Index	807

List of Figures

Part 1	Overview	
Chapter 1	Multicast Overview	3
	Figure 1: Multicast Terminology in an IP Network	7
	Figure 2: Converting MAC Addresses to Multicast Addresses	10
Part 2	Configuration	
Chapter 3	Protocol-Independent Multicast	21
	Figure 3: Rendezvous Point as Part of the RPT and SPT	35
	Figure 4: Join Suppression	43
	Figure 5: PIM Sparse Mode over an IPsec VPN	46
	Figure 6: Virtual Router Instance with Three Interfaces	51
	Figure 7: Example PIM Sparse-Mode Tree	55
	Figure 8: Example Bidirectional PIM Tree	56
	Figure 9: Bidirectional PIM with Statically Configured rendezvous points	61
	Figure 10: Extracting the Embedded RP IPv6 Address	94
	Figure 11: Building an RPT Between the RP and the Receiver	105
	Figure 12: PIM Register Message and PIM Join Message Exchanged	106
	Figure 13: Traffic Sent from the Source to the RP Router	107
	Figure 14: Traffic Sent from the RP Router Toward the Receiver	107
	Figure 15: Receiver DR Sends a PIM Join Message to the Source	109
	Figure 16: PIM Prune Message Is Sent from the Receiver's DR Toward the RP Router	110
	Figure 17: RP Router Receives PIM Prune Message	110
	Figure 18: RP Router Sends a PIM Prune Message to the Source DR	111
	Figure 19: Source's DR Stops Sending Duplicate Multicast Packets Toward the RP Router	111
	Figure 20: PIM Assert Topology	113
	Figure 21: Nonstop Active Routing in PIM Domain	127
	Figure 22: Multicast Traffic Flooded from the Source Using PIM Dense Mode	138
	Figure 23: Prune Messages Sent Back to the Source to Stop Unwanted Multicast Traffic	139
	Figure 24: PIM Join Load Balancing	143
	Figure 25: PIM Join Load Balancing on Next-Generation MVPN	148
Chapter 4	Multicast Routing Options	155
	Figure 26: Multicast Routers and the RPF Check	156
	Figure 27: PIM RPF Selection	165
	Figure 28: Receiver Announces Desire to Join Group G and Source S	169
	Figure 29: Router 3 (Last-Hop Router) Joins the Source Tree	169

	Figure 30: (S,G) State Is Built Between the Source and the Receiver	170
	Figure 31: Receiver Sends Messages to Join Group G and Source S	171
	Figure 32: Router 3 (Last-Hop Router) Joins the Source Tree	172
	Figure 33: (S,G) State Is Built Between the Source and the Receiver	172
	Figure 34: Simple RPF Topology	172
	Figure 35: Network on Which to Configure PIM SSM	175
	Figure 36: Multicast with Subscriber VLANs	191
Chapter 6	Multicast Listener Discovery	247
	Figure 37: Routers Start Up on a Subnet	248
	Figure 38: Querier Router Is Determined	249
	Figure 39: General Query Message Is Issued	249
	Figure 40: Reports Are Received by the Querier Router	249
	Figure 41: Host Has No Interested Receivers and Sends a Done Message to Router	250
	Figure 42: Host Address Timer Expires and Address Is Removed from Multicast Address List	250
Chapter 7	Internet Group Management Protocol Snooping	271
	Figure 43: Networks Without IGMP Snooping Configured	280
	Figure 44: Networks With IGMP Snooping Configured	281
Chapter 8	Multicast Snooping	287
	Figure 45: VPLS Multihoming Topology	292
Chapter 9	Automatic Multicast Tunneling	297
	Figure 46: Automatic Multicast Tunneling Connectivity	298
	Figure 47: AMT Gateway Topology	306
Chapter 11	Multicast Source Discovery Protocol	311
	Figure 48: MSDP in a VRF Instance Topology	316
	Figure 49: Source-Active Message Flooding	323
Chapter 12	Pragmatic General Multicast	329
	Figure 50: PGM Architecture and General Operation	333

List of Tables

	About the Documentation	xxiii
	Table 1: Notice Icons	xxv
	Table 2: Text and Syntax Conventions	xxv
Part 1	Overview	
Chapter 1	Multicast Overview	3
	Table 3: Multicast Routing Protocols Compared	12
Part 2	Configuration	
Chapter 3	Protocol-Independent Multicast	21
	Table 4: Tunnel PIC Requirements for IPv4 and IPv6 Multicast	37
	Table 5: Local RP and Auto-RP Message Types	89
	Table 6: PIM Join Filter Match Conditions	100
Chapter 4	Multicast Routing Options	155
	Table 7: ASM and SSM Terminology	168
Chapter 5	Internet Group Management Protocol	221
	Table 8: IGMP Event Messages	238
Chapter 6	Multicast Listener Discovery	247
	Table 9: MLD Event Messages	265
Chapter 11	Multicast Source Discovery Protocol	311
	Table 10: MSDP Source-Active Message Filter Match Conditions	314
	Table 11: Source-Active Message Flooding Explanation	323
Part 3	Administration	
Chapter 25	PIM Operational Commands	599
	Table 12: show pim bidirectional df-election Output Fields	610
	Table 13: show pim bidirectional df-election interface Output Fields	613
	Table 14: show pim bootstrap Output Fields	616
	Table 15: show pim interfaces Output Fields	618
	Table 16: show pim join Output Fields	622
	Table 17: show pim neighbors Output Fields	631
	Table 18: show pim rps Output Fields	635
	Table 19: show pim source Output Fields	642
	Table 20: show pim statistics Output Fields	645
Chapter 26	Multicast Routing Options Operational Commands	655

	Table 21: show multicast backup-pe-groups Output Fields	656
	Table 22: show multicast flow-map Output Fields	658
	Table 23: show multicast interface Output Fields	660
	Table 24: show multicast route Output Fields	663
	Table 25: show multicast rpf Output Fields	669
	Table 26: show multicast scope Output Fields	672
	Table 27: show multicast sessions Output Fields	674
	Table 28: show policy Output Fields	677
Chapter 27	IGMP Operational Commands	679
	Table 29: show igmp group Output Fields	685
	Table 30: show igmp interface Output Fields	689
	Table 31: show multicast pim-to-igmp-proxy Output Fields	693
	Table 32: show igmp statistics Output Fields	695
Chapter 28	MLD Operational Commands	699
	Table 33: show mld group Output Fields	702
	Table 34: show mld interface Output Fields	706
	Table 35: show mld statistics Output Fields	709
	Table 36: show multicast pim-to-mld-proxy Output Fields	712
Chapter 29	IGMP Snooping Operational Commands	715
	Table 37: show igmp snooping interface Output Fields	718
	Table 38: show igmp snooping membership Output Fields	721
	Table 39: show igmp snooping statistics Output Fields	725
Chapter 30	Multicast Snooping Operational Commands	729
	Table 40: show multicast snooping route Output Fields	732
	Table 41: show multicast snooping statistics Output Fields	734
Chapter 31	AMT Operational Commands	747
	Table 42: show amt statistics Output Fields	750
	Table 43: show amt summary Output Fields	753
	Table 44: show amt tunnel Output Fields	755
Chapter 32	Session Announcement Protocol Operational Commands	759
	Table 45: show sap listen Output Fields	760
Chapter 33	MSDP Operational Commands	763
	Table 46: show msdp Output Fields	764
	Table 47: show msdp source Output Fields	767
	Table 48: show msdp source-active Output Fields	769
	Table 49: show msdp statistics Output Fields	770
	Table 50: show multicast usage Output Fields	773
Chapter 34	PGM Operational Commands	785
	Table 51: show pgm negative-acknowledgments Output Fields	789
	Table 52: show pgm source-path-messages Output Fields	791
	Table 53: show pgm statistics Output Fields	792
Chapter 35	DVMRP Operational Commands	795
	Table 54: show dvmrp interfaces Output Fields	796

Table 55: show dvmrp neighbors Output Fields	798
Table 56: show dvmrp prefix Output Fields	800
Table 57: show dvmrp prunes Output Fields	802

About the Documentation

- Documentation and Release Notes on page xxiii
- Supported Platforms on page xxiii
- Using the Examples in This Manual on page xxiii
- Documentation Conventions on page xxv
- Documentation Feedback on page xxvii
- Requesting Technical Support on page xxvii

Documentation and Release Notes

To obtain the most current version of all Juniper Networks® technical documentation, see the product documentation page on the Juniper Networks website at <http://www.juniper.net/techpubs/>.

If the information in the latest release notes differs from the information in the documentation, follow the product Release Notes.

Juniper Networks Books publishes books by Juniper Networks engineers and subject matter experts. These books go beyond the technical documentation to explore the nuances of network architecture, deployment, and administration. The current list can be viewed at <http://www.juniper.net/books>.

Supported Platforms

For the features described in this document, the following platforms are supported:

- LN Series

Using the Examples in This Manual

If you want to use the examples in this manual, you can use the **load merge** or the **load merge relative** command. These commands cause the software to merge the incoming configuration into the current candidate configuration. The example does not become active until you commit the candidate configuration.

If the example configuration contains the top level of the hierarchy (or multiple hierarchies), the example is a *full example*. In this case, use the **load merge** command.

If the example configuration does not start at the top level of the hierarchy, the example is a *snippet*. In this case, use the **load merge relative** command. These procedures are described in the following sections.

Merging a Full Example

To merge a full example, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration example into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following configuration to a file and name the file **ex-script.conf**. Copy the **ex-script.conf** file to the **/var/tmp** directory on your routing platform.

```
system {
  scripts {
    commit {
      file ex-script.xml;
    }
  }
}
interfaces {
  fxp0 {
    disable;
    unit 0 {
      family inet {
        address 10.0.0.1/24;
      }
    }
  }
}
```

2. Merge the contents of the file into your routing platform configuration by issuing the **load merge** configuration mode command:

```
[edit]
user@host# load merge /var/tmp/ex-script.conf
load complete
```

Merging a Snippet

To merge a snippet, follow these steps:

1. From the HTML or PDF version of the manual, copy a configuration snippet into a text file, save the file with a name, and copy the file to a directory on your routing platform.

For example, copy the following snippet to a file and name the file **ex-script-snippet.conf**. Copy the **ex-script-snippet.conf** file to the **/var/tmp** directory on your routing platform.

```
commit {
  file ex-script-snippet.xml; }
```

2. Move to the hierarchy level that is relevant for this snippet by issuing the following configuration mode command:

```
[edit]
user@host# edit system scripts
[edit system scripts]
```

3. Merge the contents of the file into your routing platform configuration by issuing the **load merge relative** configuration mode command:

```
[edit system scripts]
user@host# load merge relative /var/tmp/ex-script-snippet.conf
load complete
```

For more information about the **load** command, see the *CLI User Guide*.

Documentation Conventions

Table 1 on page xxv defines notice icons used in this guide.

Table 1: Notice Icons

Icon	Meaning	Description
	Informational note	Indicates important features or instructions.
	Caution	Indicates a situation that might result in loss of data or hardware damage.
	Warning	Alerts you to the risk of personal injury or death.
	Laser warning	Alerts you to the risk of personal injury from a laser.
	Tip	Indicates helpful information.
	Best practice	Alerts you to a recommended use or implementation.

Table 2 on page xxv defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
Bold text like this	Represents text that you type.	To enter configuration mode, type the configure command: user@host> configure

Table 2: Text and Syntax Conventions (*continued*)

Convention	Description	Examples
Fixed-width text like this	Represents output that appears on the terminal screen.	<code>user@host> show chassis alarms</code> <code>No alarms currently active</code>
<i>Italic text like this</i>	<ul style="list-style-type: none">Introduces or emphasizes important new terms.Identifies guide names.Identifies RFC and Internet draft titles.	<ul style="list-style-type: none">A policy <i>term</i> is a named structure that defines match conditions and actions.<i>Junos OS CLI User Guide</i>RFC 1997, <i>BGP Communities Attribute</i>
<i>Italic text like this</i>	Represents variables (options for which you substitute a value) in commands or configuration statements.	Configure the machine's domain name: [edit] root@# set system domain-name <i>domain-name</i>
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	<ul style="list-style-type: none">To configure a stub area, include the stub statement at the [edit protocols ospf area area-id] hierarchy level.The console port is labeled CONSOLE.
< > (angle brackets)	Encloses optional keywords or variables.	stub <default-metric <i>metric</i>>;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	broadcast multicast (<i>string1</i> <i>string2</i> <i>string3</i>)
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	rsvp { # Required for dynamic MPLS only
[] (square brackets)	Encloses a variable for which you can substitute one or more values.	community name members [<i>community-ids</i>]
Indentation and braces ({ })	Identifies a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } }
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	}
GUI Conventions		
Bold text like this	Represents graphical user interface (GUI) items you click or select.	<ul style="list-style-type: none">In the Logical Interfaces box, select All Interfaces.To cancel the configuration, click Cancel.

Table 2: Text and Syntax Conventions (*continued*)

Convention	Description	Examples
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select Protocols>Ospf .

Documentation Feedback

We encourage you to provide feedback, comments, and suggestions so that we can improve the documentation. You can provide feedback by using either of the following methods:

- Online feedback rating system—On any page of the Juniper Networks TechLibrary site at <http://www.juniper.net/techpubs/index.html>, simply click the stars to rate the content, and use the pop-up form to provide us with information about your experience. Alternately, you can use the online feedback form at <http://www.juniper.net/techpubs/feedback/>.
- E-mail—Send your comments to techpubs-comments@juniper.net. Include the document or topic name, URL or page number, and software version (if applicable).

Requesting Technical Support

Technical product support is available through the Juniper Networks Technical Assistance Center (JTAC). If you are a customer with an active J-Care or Partner Support Service support contract, or are covered under warranty, and need post-sales technical support, you can access our tools and resources online or open a case with JTAC.

- JTAC policies—For a complete understanding of our JTAC procedures and policies, review the *JTAC User Guide* located at <http://www.juniper.net/us/en/local/pdf/resource-guides/7100059-en.pdf>.
- Product warranties—For product warranty information, visit <http://www.juniper.net/support/warranty/>.
- JTAC hours of operation—The JTAC centers have resources available 24 hours a day, 7 days a week, 365 days a year.

Self-Help Online Tools and Resources

For quick and easy problem resolution, Juniper Networks has designed an online self-service portal called the Customer Support Center (CSC) that provides you with the following features:

- Find CSC offerings: <http://www.juniper.net/customers/support/>
- Search for known bugs: <http://www2.juniper.net/kb/>
- Find product documentation: <http://www.juniper.net/techpubs/>
- Find solutions and answer questions using our Knowledge Base: <http://kb.juniper.net/>

- Download the latest versions of software and review release notes:
<http://www.juniper.net/customers/csc/software/>
- Search technical bulletins for relevant hardware and software notifications:
<http://kb.juniper.net/InfoCenter/>
- Join and participate in the Juniper Networks Community Forum:
<http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <http://www.juniper.net/cm/>

To verify service entitlement by product serial number, use our Serial Number Entitlement (SNE) Tool: <https://tools.juniper.net/SerialNumberEntitlementSearch/>

Opening a Case with JTAC

You can open a case with JTAC on the Web or by telephone.

- Use the Case Management tool in the CSC at <http://www.juniper.net/cm/>.
- Call 1-888-314-JTAC (1-888-314-5822 toll-free in the USA, Canada, and Mexico).

For international or direct-dial options in countries without toll-free numbers, see <http://www.juniper.net/support/requesting-support.html>.

PART 1

Overview

- [Multicast Overview on page 3](#)
- [Multicast Supported Standards on page 17](#)

CHAPTER 1

Multicast Overview

- [Multicast Overview on page 3](#)
- [PIM Overview on page 13](#)

Multicast Overview

IP has three fundamental types of addresses: unicast, broadcast, and multicast. A *unicast address* is used to send a packet to a single destination. A *broadcast address* is used to send a datagram to an entire subnetwork. A *multicast address* is used to send a datagram to a set of hosts that can be on different subnetworks and that are configured as members of a multicast group.

A multicast datagram is delivered to destination group members with the same best-effort reliability as a standard unicast IP datagram. This means that multicast datagrams are not guaranteed to reach all members of a group or to arrive in the same order in which they were transmitted. The only difference between a multicast IP packet and a unicast IP packet is the presence of a group address in the IP header destination address field. Multicast addresses use the Class D address format.



NOTE: On all SRX Series devices, reordering is not supported for multicast fragments. Reordering of unicast fragments is supported.

Individual hosts can join or leave a multicast group at any time. There are no restrictions on the physical location or the number of members in a multicast group. A host can be a member of more than one multicast group at any time. A host does not have to belong to a group to send packets to members of a group.

Routers use a group membership protocol to learn about the presence of group members on directly attached subnetworks. When a host joins a multicast group, it transmits a group membership protocol message for the group or groups that it wants to receive and sets its IP process and network interface card to receive frames addressed to the multicast group.

Comparing Multicast to Unicast

The Junos OS routing protocol process supports a wide variety of routing protocols. These routing protocols carry network information among routers not only for *unicast* traffic

streams sent between one pair of clients and servers, but also for *multicast* traffic streams containing video, audio, or both, between a single server source and many client receivers. The routing protocols used for multicast differ in many key ways from unicast routing protocols.

Information is delivered over a network by three basic methods: unicast, broadcast, and multicast.

The differences among unicast, broadcast, and multicast can be summarized as follows:

- Unicast: One-to-one, from one source to one destination.
- Broadcast: One-to-all, from one source to all possible destinations.
- Multicast: One-to-many, from one source to multiple destinations expressing an interest in receiving the traffic.



NOTE: This list does not include a special category for many-to-many applications, such as online gaming or videoconferencing, where there are many sources for the same receiver and where receivers often double as sources. Many-to-many is a service model that repeatedly employs one-to-many multicast and therefore requires no unique protocol. The original multicast specification, RFC 1112, supports both the any-source multicast (ASM) many-to-many model and the source-specific multicast (SSM) one-to-many model.

With unicast traffic, many streams of IP packets that travel across networks flow from a single source, such as a website server, to a single destination such as a client PC. Unicast traffic is still the most common form of information transfer on networks.

Broadcast traffic flows from a single source to all possible destinations reachable on the network, which is usually a LAN. Broadcasting is the easiest way to make sure traffic reaches its destinations.

Television networks use broadcasting to distribute video and audio. Even if the television network is a cable television (CATV) system, the source signal reaches all possible destinations, which is the main reason that some channels' content is scrambled. Broadcasting is not feasible on the Internet because of the enormous amount of unnecessary information that would constantly arrive at each end user's device, the complexities and impact of scrambling, and related privacy issues.

Multicast traffic lies between the extremes of unicast (one source, one destination) and broadcast (one source, all destinations). Multicast is a "one source, many destinations" method of traffic distribution, meaning only the destinations that explicitly indicate their need to receive the information from a particular source receive the traffic stream.

On an IP network, because destinations (clients) do not often communicate directly with sources (servers), the routers between source and destination must be able to determine the topology of the network from the unicast or multicast perspective to avoid routing

traffic haphazardly. Multicast routers replicate packets received on one input interface and send the copies out on multiple output interfaces.

In IP multicast, the source and destination are almost always hosts and not routers. Multicast routers distribute the multicast traffic across the network from source to destinations. The multicast router must find multicast sources on the network, send out copies of packets on several interfaces, prevent routing loops, connect interested destinations with the proper source, and keep the flow of unwanted packets to a minimum. Standard multicast routing protocols provide most of these capabilities, but some router architectures cannot send multiple copies of packets and so do not support multicasting directly.

IP Multicast Uses

Multicast allows an IP network to support more than just the unicast model of data delivery that prevailed in the early stages of the Internet. Multicast, originally defined as a host extension in RFC 1112 in 1989, provides an efficient method for delivering traffic flows that can be characterized as one-to-many or many-to-many.

Unicast traffic is not strictly limited to data applications. Telephone conversations, wireless or not, contain digital audio samples and might contain digital photographs or even video and still flow from a single source to a single destination. In the same way, multicast traffic is not strictly limited to multimedia applications. In some data applications, the flow of traffic is from a single source to many destinations that require the packets, as in a news or stock ticker service delivered to many PCs. For this reason, the term *receiver* is preferred to *listener* for multicast destinations, although both terms are common.

Network applications that can function with unicast but are better suited for multicast include collaborative groupware, teleconferencing, periodic or “push” data delivery (stock quotes, sports scores, magazines, newspapers, and advertisements), server or website replication, and distributed interactive simulation (DIS) such as war simulations or virtual reality. Any IP network concerned with reducing network resource overhead for one-to-many or many-to-many data or multimedia applications with multiple receivers benefits from multicast.

If unicast were employed by radio or news ticker services, each radio or PC would have to have a separate traffic session for each listener or viewer at a PC (this is actually the method for some Web-based services). The processing load and bandwidth consumed by the server would increase linearly as more people “tune in” to the server. This is extremely inefficient when dealing with the global scale of the Internet. Unicast places the burden of packet duplication on the server and consumes more and more backbone bandwidth as the number of users grows.

If broadcast were employed instead, the source could generate a single IP packet stream using a broadcast destination address. Although broadcast eliminates the server packet duplication issue, this is not a good solution for IP because IP broadcasts can be sent only to a single subnetwork, and IP routers normally isolate IP subnetworks on separate interfaces. Even if an IP packet stream could be addressed to literally go everywhere, and there were no need to “tune” to any source at all, broadcast would be extremely inefficient because of the bandwidth strain and need for uninterested hosts to discard

large numbers of packets. Broadcast places the burden of packet rejection on each host and consumes the maximum amount of backbone bandwidth.

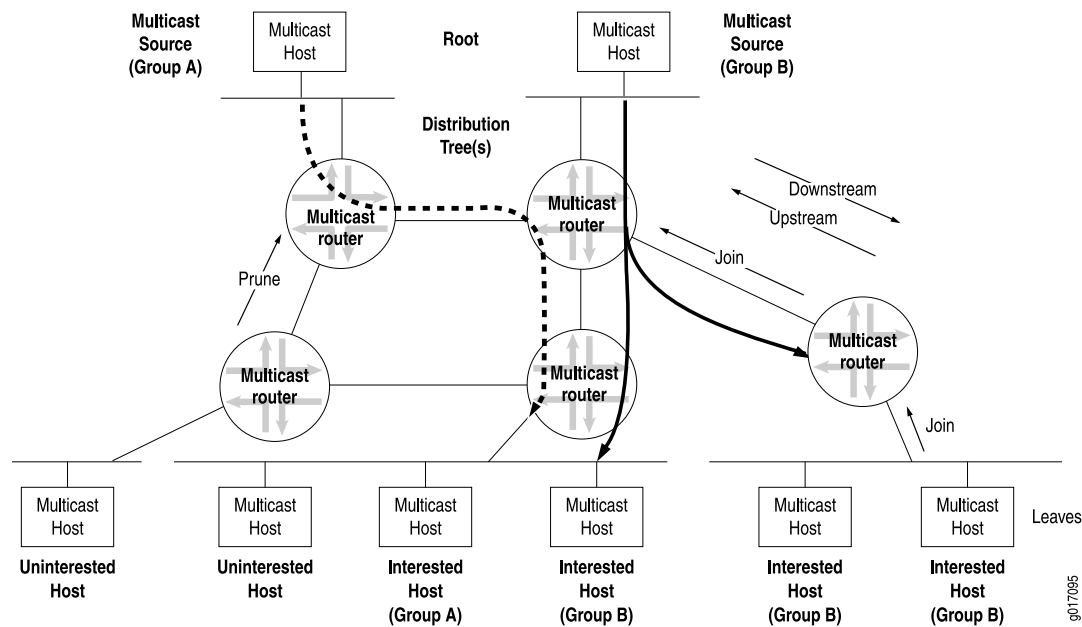
For radio station or news ticker traffic, multicast provides the most efficient and effective outcome, with none of the drawbacks and all of the advantages of the other methods. A single source of multicast packets finds its way to every *interested* receiver. As with broadcast, the transmitting host generates only a single stream of IP packets, so the load remains constant whether there is one receiver or one million. The network routers replicate the packets and deliver the packets to the proper receivers, but only the replication role is a new one for routers. The links leading to subnets consisting of entirely uninterested receivers carry no multicast traffic. Multicast minimizes the burden placed on sender, network, and receiver.

IP Multicast Terminology

Multicast has its own particular set of terms and acronyms that apply to IP multicast routers and networks. [Figure 1 on page 7](#) depicts some of the terms commonly used in an IP multicast network.

In a multicast network, the key component is the *router*, which is able to replicate packets and is therefore multicast-capable. The routers in the IP multicast network, which has exactly the same topology as the unicast network it is based on, use a *multicast routing protocol* to build a *distribution tree* that connects receivers (preferred to the multimedia implications of listeners, but listeners is also used) to *sources*. In multicast terminology, the distribution tree is *rooted at the source* (the root of the distribution tree is the source). The interface on the router leading toward the source is the *upstream* interface, although the less precise terms *incoming* or *inbound* interface are used as well. To keep bandwidth use to a minimum, it is best for only one upstream interface on the router to receive multicast packets. The interface on the router leading toward the receivers is the *downstream* interface, although the less precise terms *outgoing* or *outbound* interface are used as well. There can be 0 to $N-1$ downstream interfaces on a router, where N is the number of logical interfaces on the router. To prevent looping, the upstream interface must never receive copies of downstream multicast packets.

Figure 1: Multicast Terminology in an IP Network



Routing loops are disastrous in multicast networks because of the risk of repeatedly replicated packets. One of the complexities of modern multicast routing protocols is the need to avoid routing loops, packet by packet, much more rigorously than in unicast routing protocols.

Multicast Leaf and Branch Terminology

Each subnetwork with hosts on the router that has at least one interested receiver is a *leaf* on the distribution tree. Routers can have multiple leaves on different interfaces and must send a copy of the IP multicast packet out on each interface with a leaf. When a new leaf subnetwork is added to the tree (that is, the interface to the host subnetwork previously received no copies of the multicast packets), a new *branch* is built, the leaf is joined to the tree, and replicated packets are sent out on the interface. The number of leaves on a particular interface does not affect the router. The action is the same for one leaf or a hundred.

When a branch contains no leaves because there are no interested hosts on the router interface leading to that IP subnetwork, the branch is *pruned* from the distribution tree, and no multicast packets are sent out that interface. Packets are replicated and sent out multiple interfaces only where the distribution tree branches at a router, and no link ever carries a duplicate flow of packets.

Collections of hosts all receiving the same stream of IP packets, usually from the same multicast source, are called *groups*. In IP multicast networks, traffic is delivered to multicast groups based on an IP multicast address, or *group address*. The groups determine the location of the leaves, and the leaves determine the branches on the multicast network.

IP Multicast Addressing

Multicast uses the Class D IP address range (224.0.0.0 through 239.255.255.255). Class D addresses are commonly referred to as *multicast addresses* because the entire classful address concept is obsolete. Multicast addresses can never appear as the source address in an IP packet and can only be the destination of a packet.

Multicast addresses usually have a prefix length of /32, although other prefix lengths are allowed. Multicast addresses represent logical groupings of receivers and not physical collections of devices. Blocks of multicast addresses can still be described in terms of prefix length in traditional notation, but only for convenience. For example, the multicast address range from 232.0.0.0 through 232.255.255.255 can be written as 232.0.0.0/8 or 232/8.

Internet service providers (ISPs) do not typically allocate multicast addresses to their customers because multicast addresses relate to content, not to physical devices. Receivers are not assigned their own multicast addresses, but need to know the multicast address of the content. Sources need to be assigned multicast addresses only to produce the content, not to identify their place in the network. Every source and receiver still needs an ordinary, unicast IP address.

Multicast addressing most often references the receivers, and the source of multicast content is usually not even a member of the multicast group for which it produces content. If the source needs to monitor the packets it produces, monitoring can be done locally, and there is no need to make the packets traverse the network.

Many applications have been assigned a range of multicast addresses for their own use. These applications assign multicast addresses to sessions created by that application. You do not usually need to statically assign a multicast address, but you can do so.

Multicast Addresses

Multicast host group addresses are defined to be the IP addresses whose high-order four bits are 1110, giving an address range from 224.0.0.0 through 239.255.255.255, or simply 224.0.0.0/4. (These addresses also are referred to as Class D addresses.)

The Internet Assigned Numbers Authority (IANA) maintains a list of registered IP multicast groups. The base address 224.0.0.0 is reserved and cannot be assigned to any group. The block of multicast addresses from 224.0.0.1 through 224.0.0.255 is reserved for local wire use. Groups in this range are assigned for various uses, including routing protocols and local discovery mechanisms.

The range from 239.0.0.0 through 239.255.255.255 is reserved for administratively scoped addresses. Because packets addressed to administratively scoped multicast addresses do not cross configured administrative boundaries, and because administratively scoped multicast addresses are locally assigned, these addresses do not need to be unique across administrative boundaries.

Layer 2 Frames and IPv4 Multicast Addresses

Multicasting on a LAN is a good place to start an investigation of multicasting at Layer 2. At Layer 2, multicast deals with media access control (MAC) frames and addresses instead of IPv4 or IPv6 packets and addresses. Consider a single LAN, without routers, with a multicast source sending to a certain group. The rest of the hosts are receivers interested in the multicast group's content. So the multicast source host generates packets with its unicast IP address as the source, and the multicast group address as the destination.

Which MAC addresses are used on the frame containing this packet? The packet source address—the unicast IP address of the host originating the multicast content—translates easily and directly to the MAC address of the source. But what about the packet's destination address? This is the IP multicast group address. Which destination MAC address for the frame corresponds to the packet's multicast group address?

One option is for LANs simply to use the LAN broadcast MAC address, which guarantees that the frame is processed by every station on the LAN. However, this procedure defeats the whole purpose of multicast, which is to limit the circulation of packets and frames to interested hosts. Also, hosts might have access to many multicast groups, which multiplies the amount of traffic to noninterested destinations. Broadcasting frames at the LAN level to support multicast groups makes no sense.

However, there is an easy way to effectively use Layer 2 frames for multicast purposes. The MAC address has a bit that is set to 0 for unicast (the LAN term is *individual address*) and set to 1 to indicate that this is a multicast address. Some of these addresses are reserved for multicast groups of specific vendors or MAC-level protocols. Internet multicast applications use the range 0x01-00-5E-00-00-00 to 0x01-00-5E-FF-FF-FF. Multicast receivers (hosts running TCP/IP) listen for frames with one of these addresses when the application joins a multicast group. The host stops listening when the application terminates or the host leaves the group at the packet layer (Layer 3).

This means that 3 bytes, or 24 bits, are available to map IPv4 multicast addresses at Layer 3 to MAC multicast addresses at Layer 2. However, all IPv4 addresses, including multicast addresses, are 32 bits long, leaving 8 IP address bits left over. Which method of mapping IPv4 multicast addresses to MAC multicast addresses minimizes the chance of “collisions” (that is, two different IP multicast groups at the packet layer mapping to the same MAC multicast address at the frame layer)?

First, it is important to realize that all IPv4 multicast addresses begin with the same 4 bits (**1110**), so there are really only 4 bits of concern, not 8. A LAN must not drop the last bits of the IPv4 address because these are almost guaranteed to be host bits, depending on the subnet mask. But the high-order bits, the leftmost address bits, are almost always network bits, and there is only one LAN (for now).

One other bit of the remaining 24 MAC address bits is reserved (an initial **0** indicates an Internet multicast address), so the 5 bits following the initial **1110** in the IPv4 address are dropped. The 23 remaining bits are mapped, one for one, into the last 23 bits of the MAC address. An example of this process is shown in [Figure 2 on page 10](#).

Figure 2: Converting MAC Addresses to Multicast Addresses

1	IPv4 header multicast destination address	232.	224.	202.	181	
	Written in hexadecimal	E8	E0	CA	B5	
	Written in binary	1110 1000 1	110 0000	1100 1010	1011 0101	
2	Ignore the first 9 bits and copy the remaining 23 bits	X	110 0000	1100 1010	1011 0101	
3	First bit X = 0 for Internet; X = 1 for other	0	110 0000	1100 1010	1011 0101	
4	Written in hexadecimal		60	CA	B5	
5	MAC address in hexadecimal	01 : 00 : 5E : E0 : CA : B5				
6	Drop last 24 bits	01 : 00 : 5E :				
7	Copy the multicast bits	01 : 00 : 5E : 60 : CA : B5				
8	MAC frame destination address 01:00:5E:60:CA:B5 corresponds to multicast IPv4 address 232.224.202.181					

g016859

Note that this process means that there are 32 (2^5) IPv4 multicast addresses that could map to the same MAC multicast addresses. For example, multicast IPv4 addresses 224.8.7.6 and 229.136.7.6 translate to the same MAC address (0x01-00-5E-08-07-06). This is a real concern, and because the host could be interested in frames sent to both of those multicast groups, the IP software must reject one or the other.



NOTE: This “collision” problem does not exist in IPv6 because of the way IPv6 handles multicast groups, but it is always a concern in IPv4. The procedure for placing IPv6 multicast packets inside multicast frames is nearly identical to that for IPv4, except for the MAC destination address 0x3333 prefix (and the lack of “collisions”).

Once the MAC address for the multicast group is determined, the host's operating system essentially orders the LAN interface card to join or leave the multicast group. Once joined to a multicast group, the host accepts frames sent to the multicast address as well as the host's unicast address and ignores other multicast group's frames. It is possible for a host to join and receive multicast content from more than one group at the same time, of course.

Multicast Interface Lists

To avoid multicast routing loops, every multicast router must always be aware of the interface that leads to the source of that multicast group content by the shortest path. This is the upstream (incoming) interface, and packets are never to be forwarded back toward a multicast source. All other interfaces are potential downstream (outgoing) interfaces, depending on the number of branches on the distribution tree.

Routers closely monitor the status of the incoming and outgoing interfaces, a process that determines the *multicast forwarding state*. A router with a multicast forwarding state for a particular multicast group is essentially “turned on” for that group's content.

Interfaces on the router's outgoing interface list send copies of the group's packets received on the incoming interface list for that group. The incoming and outgoing interface lists might be different for different multicast groups.

The multicast forwarding state in a router is usually written in either (S,G) or (*,G) notation. These are pronounced “ess comma gee” and “star comma gee,” respectively. In (S,G), the S refers to the unicast IP address of the source for the multicast traffic, and the G refers to the particular multicast group IP address for which S is the source. All multicast packets sent from this source have S as the source address and G as the destination address.

The asterisk (*) in the (*,G) notation is a wildcard indicating that the state applies to any multicast application source sending to group G. So, if two sources are originating exactly the same content for multicast group 224.1.1.2, a router could use (*,224.1.1.2) to represent the state of a router forwarding traffic from both sources to the group.

Multicast Routing Protocols

Multicast routing protocols enable a collection of multicast routers to build (join) distribution trees when a host on a directly attached subnet, typically a LAN, wants to receive traffic from a certain multicast group.

There are several multicast routing protocols:

- **Distance Vector Multicast Routing Protocol (DVMRP)**—The first of the multicast routing protocols and hampered by a number of limitations that make this method unattractive for large-scale Internet use. DVMRP is a dense-mode-only protocol, and uses the flood-and-prune or implicit join method to deliver traffic everywhere and then determine where the uninterested receivers are. DVMRP uses source-based distribution trees in the form (S,G).
- **Multicast OSPF (MOSPF)**—Extends OSPF for multicast use, but only for dense mode. However, MOSPF has an explicit join message, so routers do not have to flood their entire domain with multicast traffic from every source. MOSPF uses source-based distribution trees in the form (S,G).
- ***Bidirectional PIM mode***—A variation of PIM. Bidirectional PIM builds bidirectional shared trees that are rooted at a rendezvous point (RP) address. Bidirectional traffic does not switch to shortest path trees as in PIM-SM and is therefore optimized for routing state size instead of path length. This means that the end-to-end latency might be longer compared to PIM sparse mode. Bidirectional PIM routes are always wildcard-source (*,G) routes. The protocol eliminates the need for (S,G) routes and data-triggered events. The bidirectional (*,G) group trees carry traffic both upstream from senders toward the RP, and downstream from the RP to receivers. As a consequence, the strict reverse path forwarding (RPF)-based rules found in other PIM modes do not apply to bidirectional PIM. Instead, bidirectional PIM (*,G) routes forward traffic from all sources and the RP. Bidirectional PIM routers must have the ability to accept traffic on many potential incoming interfaces. Bidirectional PIM scales well because it needs no source-specific (S,G) state. Bidirectional PIM is recommended in deployments with many dispersed sources and many dispersed receivers.

- PIM *dense mode***—In this mode of PIM, the assumption is that almost all possible subnets have at least one receiver wanting to receive the multicast traffic from a source, so the network is *flooded* with traffic on all possible branches, then pruned back when branches do not express an interest in receiving the packets, explicitly (by message) or implicitly (time-out silence). This is the *dense mode* of multicast operation. LANs are appropriate networks for dense-mode operation. Some multicast routing protocols, especially older ones, support only dense-mode operation, which makes them inappropriate for use on the Internet. In contrast to DVMRP and MOSPF, PIM dense mode allows a router to use any unicast routing protocol and performs RPF checks using the unicast routing table. PIM dense mode has an implicit join message, so routers use the flood-and-prune method to deliver traffic everywhere and then determine where the uninterested receivers are. PIM dense mode uses source-based distribution trees in the form (S,G), as do all dense-mode protocols. PIM also supports sparse-dense mode, with mixed sparse and dense groups, but there is no special notation for that operational mode. If *sparse-dense mode* is supported, the multicast routing protocol allows some multicast groups to be sparse and other groups to be dense.
- PIM *sparse mode***—In this mode of PIM, the assumption is that very few of the possible receivers want packets from each source, so the network establishes and sends packets only on branches that have at least one leaf indicating (by message) an interest in the traffic. This multicast protocol allows a router to use any unicast routing protocol and performs reverse-path forwarding (RPF) checks using the unicast routing table. PIM sparse mode has an *explicit* join message, so routers determine where the interested receivers are and send join messages upstream to their neighbors, building trees from receivers to the rendezvous point (RP). PIM sparse mode uses an RP router as the initial source of multicast group traffic and therefore builds distribution trees in the form (*,G), as do all sparse-mode protocols. PIM sparse mode migrates to an (S,G) source-based tree if that path is shorter than through the RP for a particular multicast group's traffic. WANs are appropriate networks for sparse-mode operation, and indeed a common multicast guideline is not to run dense mode on a WAN under any circumstances.
- Core Based Trees (CBT)**—Shares all of the characteristics of PIM sparse mode (sparse mode, explicit join, and shared (*,G) trees), but is said to be more efficient at finding sources than PIM sparse mode. CBT is rarely encountered outside academic discussions. There are no large-scale deployments of CBT, commercial or otherwise.

The differences among the multicast routing protocols are summarized in [Table 3 on page 12](#).

Table 3: Multicast Routing Protocols Compared

Multicast Routing Protocol	Dense Mode	Sparse Mode	Implicit Join	Explicit Join	(S,G) SBT	(*G) Shared Tree
DVMRP	Yes	No	Yes	No	Yes	No
MOSPF	Yes	No	No	Yes	Yes	No
PIM dense mode	Yes	No	Yes	No	Yes	No

Table 3: Multicast Routing Protocols Compared (*continued*)

Multicast Routing Protocol	Dense Mode	Sparse Mode	Implicit Join	Explicit Join	(S,G) SBT	(*G) Shared Tree
PIM sparse mode	No	Yes	No	Yes	Yes, maybe	Yes, initially
Bidirectional PIM	No	No	No	Yes	No	Yes
CBT	No	Yes	No	Yes	No	Yes

It is important to realize that retransmissions due to a high bit-error rate on a link or overloaded router can make multicast as inefficient as repeated unicast. Therefore, there is a trade-off in many multicast applications regarding the session support provided by the Transmission Control Protocol (TCP) (but TCP always resends missing segments), or the simple drop-and-continue strategy of the User Datagram Protocol (UDP) datagram service (but reordering can become an issue). Modern multicast uses UDP almost exclusively.

T Series Router Multicast Performance

The Juniper Networks T Series Core Routers handle extreme multicast packet replication requirements with a minimum of router load. Each memory component replicates a multicast packet twice at most. Even in the worst-case scenario involving maximum fan-out, when 1 input port and 63 output ports need a copy of the packet, the T Series routing platform copies a multicast packet only six times. Most multicast distribution trees are much sparser, so in many cases only two or three replications are necessary. In no case does the T Series architecture have an impact on multicast performance, even with the largest multicast fan-out requirements.



NOTE: On all high-end SRX Series devices, during RG1 failover with multicast traffic and high number of multicast sessions, the failover delay is from 90 through 120 seconds for traffic to resume on the secondary node. The delay of 90 through 120 seconds is only for the first failover. For subsequent failovers, the traffic resumes within 8 through 18 seconds.

PIM Overview

The predominant multicast routing protocol in use on the Internet today is Protocol Independent Multicast, or PIM. The type of PIM used on the Internet is PIM sparse mode. PIM sparse mode is so accepted that when the simple term “PIM” is used in an Internet context, some form of sparse mode operation is assumed.

PIM emerged as an algorithm to overcome the limitations of dense-mode protocols such as the Distance Vector Multicast Routing Protocol (DVMRP), which was efficient for dense clusters of multicast receivers, but did not scale well for the larger, sparser, groups encountered on the Internet. The Core Based Trees (CBT) Protocol was intended to support sparse mode as well, but CBT, with its all-powerful core approach, made

placement of the core critical, and large conference-type applications (many-to-many) resulted in bottlenecks in the core. PIM was designed to avoid the dense-mode scaling issues of DVMRP and the potential performance issues of CBT at the same time.

PIM is one of the most rapidly evolving specifications on the Internet today. Since its introduction in 1995, PIM has already seen two major revisions to its packet structure (PIM version 1 [PIMv1] and PIM version 2 [PIMv2]), two major RFCs (RFC 2362 obsoleted RFC 2117), and numerous drafts describing major components of PIM, such as many-to-many trees and source-specific multicast (SSM). Long-lasting RFCs are not a feature of PIM, and virtually all of PIM must be researched, understood, and implemented directly from Internet drafts. In fact, no current RFC describes PIMv1 at all. The drafts have all expired, and PIMv1 was never issued as an official RFC.

PIM itself is not nonstandard or unstable, however. PIM has been a promising multicast routing protocol since its inception, especially PIM sparse mode, the first real sparse-mode multicast routing protocol. Work continues on PIM in a number of areas, from bidirectional trees to network management, and the rapid pace of development makes drafts essential for PIM.

PIMv1 and PIMv2 can coexist on the same router and even on the same interface. The main difference between PIMv1 and PIMv2 is the packet format. PIMv1 messages use Internet Group Management Protocol (IGMP) packets, whereas PIMv2 has its own IP protocol number (103) and packet structure. All routers connecting to an IP subnet such as a LAN must use the same PIM version. Some PIM implementations can recognize PIMv1 packets and automatically switch the router interface to PIMv1. Because the difference between PIMv1 and PIMv2 involves the message format, but not the meaning of the message or how the router processes the PIM message, a router can easily mix PIMv1 and PIMv2 interfaces.

PIM is used for efficient routing to multicast groups that might span wide-area and interdomain internetworks. It is called “protocol independent” because it does not depend on a particular unicast routing protocol. Junos OS supports bidirectional mode, sparse mode, dense mode, and sparse-dense mode.

PIM operates in several modes: bidirectional mode, sparse mode, dense mode, and sparse-dense mode. In sparse-dense mode, some multicast groups are configured as dense mode (flood-and-prune, [S,G] state) and others are configured as sparse mode (explicit join to rendezvous point [RP], [*G] state).

PIM drafts also establish a mode known as PIM source-specific mode, or PIM SSM. In PIM SSM there is only one specific source for the content of a multicast group within a given domain.

Because the PIM mode you choose determines the PIM configuration properties, you first must decide whether PIM operates in bidirectional, sparse, dense, or sparse-dense mode in your network. Each mode has distinct operating advantages in different network environments.

- In sparse mode, routers must join and leave multicast groups explicitly. Upstream routers do not forward multicast traffic to a downstream router unless the downstream router has sent an explicit request (by means of a join message) to the rendezvous point (RP) router to receive this traffic. The RP serves as the root of the shared multicast delivery tree and is responsible for forwarding multicast data from different sources to the receivers.

Sparse mode is well suited to the Internet, where frequent interdomain join messages and prune messages are common.

- Bidirectional PIM is similar to sparse mode, and is especially suited to applications that must scale to support a large number of dispersed sources and receivers. In bidirectional PIM, routers build shared bidirectional trees and do not switch to a source-based tree. Bidirectional PIM scales well because it needs no source-specific (S,G) state. Instead, it builds only group-specific (*G) state.
- Unlike sparse mode and bidirectional mode, in which data is forwarded only to routers sending an explicit PIM join request, dense mode implements a *flood-and-prune* mechanism, similar to the Distance Vector Multicast Routing Protocol (DVMRP). In dense mode, a router receives the multicast data on the incoming interface, then forwards the traffic to the outgoing interface list. Flooding occurs periodically and is used to refresh state information, such as the source IP address and multicast group pair. If the router has no interested receivers for the data, and the outgoing interface list becomes empty, the router sends a PIM prune message upstream.

Dense mode works best in networks where few or no prunes occur. In such instances, dense mode is actually more efficient than sparse mode.

- Sparse-dense mode, as the name implies, allows the interface to operate on a per-group basis in either sparse or dense mode. A group specified as “dense” is not mapped to an RP. Instead, data packets destined for that group are forwarded by means of PIM dense mode rules. A group specified as “sparse” is mapped to an RP, and data packets are forwarded by means of PIM sparse-mode rules. Sparse-dense mode is useful in networks implementing auto-RP for PIM sparse mode.

Basic PIM Network Components

PIM dense mode requires only a multicast source and series of multicast-enabled routers running PIM dense mode to allow receivers to obtain multicast content. Dense mode makes sure that all multicast traffic gets everywhere by periodically flooding the network with multicast traffic, and relies on prune messages to make sure that subnets where all receivers are uninterested in that particular multicast group stop receiving packets.

PIM sparse mode is more complicated and requires the establishment of special routers called *rendezvous points (RPs)* in the network core. These routers are where upstream join messages from interested receivers meet downstream traffic from the source of the

multicast group content. A network can have many RPs, but PIM sparse mode allows only one RP to be active for any multicast group.

If there is only one RP in a routing domain, the RP and adjacent links might become congested and form a single point of failure for all multicast traffic. Thus, multiple RPs are the rule, but the issue then becomes how other multicast routers find the RP that is the source of the multicast group the receiver is trying to join. This RP-to-group mapping is controlled by a special *bootstrap router (BSR)* running the PIM BSR mechanism. There can be more than one bootstrap router as well, also for single-point-of-failure reasons.

The bootstrap router does not have to be an RP itself, although this is a common implementation. The bootstrap router's main function is to manage the collection of RPs and allow interested receivers to find the source of their group's multicast traffic.

PIM SSM can be seen as a subset of a special case of PIM sparse mode and requires no specialized equipment other than that used for PIM sparse mode (and IGMP version 3).

Bidirectional PIM RPs, unlike RPs for PIM sparse mode, do not need to perform PIM Register tunneling or other specific protocol action. Bidirectional PIM RPs implement no specific functionality. RP addresses are simply a location in the network to rendezvous toward. In fact, for bidirectional PIM, RP addresses need not be loopback interface addresses or even be addresses configured on any router, as long as they are covered by a subnet that is connected to a bidirectional PIM-capable router and advertised to the network.

- Related Documentation**
- [Supported IP Multicast Protocol Standards on page 17](#) in the *Multicast Feature Guide for Security Devices*

CHAPTER 2

Multicast Supported Standards

- [Supported IP Multicast Protocol Standards on page 17](#)

Supported IP Multicast Protocol Standards

Junos OS substantially supports the following RFCs and Internet drafts, which define standards for IP multicast protocols, including the Distance Vector Multicast Routing Protocol (DVMRP), Internet Group Management Protocol (IGMP), Multicast Listener Discovery (MLD), Multicast Source Discovery Protocol (MSDP), Pragmatic General Multicast (PGM), Protocol Independent Multicast (PIM), Session Announcement Protocol (SAP), and Session Description Protocol (SDP).

- RFC 1112, *Host Extensions for IP Multicasting* (defines IGMP Version 1)
- RFC 2236, *Internet Group Management Protocol, Version 2*
- RFC 2327, *SDP: Session Description Protocol*
- RFC 2710, *Multicast Listener Discovery (MLD) for IPv6*
- RFC 2858, *Multiprotocol Extensions for BGP-4*
- RFC 3031, *Multiprotocol Label Switching Architecture*
- RFC 3376, *Internet Group Management Protocol, Version 3*
- RFC 3590, *Source Address Selection for the Multicast Listener Discovery (MLD) Protocol*
- RFC 4601, *Protocol Independent Multicast – Sparse Mode (PIM-SM): Protocol Specification (Revised)*
- RFC 4607, *Source-Specific Multicast for IP*
- RFC 5015, *Bidirectional Protocol Independent Multicast (BIDIR-PIM)*
- *Using IGMPv3 and MLDv2 for Source-Specific Multicast*
- Internet draft draft-ietf-l3vpn-2547bis-mcast-10.txt, *Multicast in MPLS/BGP IP VPNs*
- Internet draft draft-ietf-l3vpn-2547bis-mcast-bgp-08.txt, *BGP Encodings and Procedures for Multicast in MPLS/BGP IP VPNs*
- Internet draft draft-ietf-pim-sm-bsr-05.txt, *Bootstrap Router (BSR) Mechanism for PIM*

The scoping mechanism is not supported.

- Internet draft draft-raggarwa-l3vpn-2547-mvpn-00.txt, *Base Specification for Multicast in BGP/MPLS VPNs* (expires December 2004)

The following RFCs and Internet drafts do not define standards, but provide information about multicast protocols and related technologies. The IETF classifies them variously as “Best Current Practice,” “Experimental,” or “Informational.”

- RFC 1075, *Distance Vector Multicast Routing Protocol*
- RFC 2362, *Protocol Independent Multicast-Sparse Mode (PIM-SM): Protocol Specification*
- RFC 2365, *Administratively Scoped IP Multicast*
- RFC 2547, *BGP/MPLS VPNs*
- RFC 2974, *Session Announcement Protocol*
- RFC 3208, *PGM Reliable Transport Protocol Specification*
- RFC 3446, *Anycast Rendezvous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP)*
- RFC 3569, *An Overview of Source-Specific Multicast (SSM)*
- RFC 3618, *Multicast Source Discovery Protocol (MSDP)*
- RFC 3810, *Multicast Listener Discovery Version 2 (MLDv2) for IPv6*
- RFC 3973, *Protocol Independent Multicast – Dense Mode (PIM-DM): Protocol Specification (Revised)*
- RFC 4364, *BGP/MPLS IP Virtual Private Networks (VPNs)*
- Internet draft draft-ietf-idmr-dvmrp-v3-11.txt, *Distance Vector Multicast Routing Protocol*
- Internet draft draft-ietf-mboned-ssm232-08.txt, *Source-Specific Protocol Independent Multicast in 232/8*
- Internet draft draft-ietf-mmusic-sap-00.txt, *SAP: Session Announcement Protocol*
- Internet draft draft-rosen-vpn-mcast-07.txt, *Multicast in MPLS/BGP VPNs*

Only section 7, “Data MDT: Optimizing flooding,” is supported.

**Related
Documentation**

- *Accessing Standards Documents on the Internet*

PART 2

Configuration

- [Protocol-Independent Multicast on page 21](#)
- [Multicast Routing Options on page 155](#)
- [Internet Group Management Protocol on page 221](#)
- [Multicast Listener Discovery on page 247](#)
- [Internet Group Management Protocol Snooping on page 271](#)
- [Multicast Snooping on page 287](#)
- [Automatic Multicast Tunneling on page 297](#)
- [Session Announcement Protocol on page 309](#)
- [Multicast Source Discovery Protocol on page 311](#)
- [Pragmatic General Multicast on page 329](#)
- [Distance Vector Multicast Routing Protocol on page 335](#)
- [PIM Configuration Statements on page 345](#)
- [IGMP Configuration Statements on page 433](#)
- [MLD Configuration Statements on page 457](#)
- [IGMP Snooping Configuration Statements on page 479](#)
- [Multicast Snooping Configuration Statements on page 499](#)
- [Multicast Routing Options Configuration Statements on page 507](#)
- [AMT Configuration Statements on page 537](#)
- [Session Announcement Protocol Configuration Statements on page 557](#)
- [MSDP Configuration Statements on page 561](#)
- [PGM Configuration Statements on page 583](#)
- [DVMRP Configuration Statements on page 587](#)

CHAPTER 3

Protocol-Independent Multicast

- [Configuring Basic PIM Settings on page 21](#)
- [Configuring a Designated Router for PIM on page 31](#)
- [Examples: Configuring PIM Sparse Mode on page 33](#)
- [Example: Configuring Bidirectional PIM on page 54](#)
- [Configuring Static RP on page 72](#)
- [Example: Configuring Anycast RP on page 76](#)
- [Configuring PIM Bootstrap Router on page 84](#)
- [Configuring PIM Auto-RP on page 88](#)
- [Configuring Embedded RP on page 93](#)
- [Configuring PIM Filtering on page 96](#)
- [Examples: Configuring PIM RPT and SPT Cutover on page 103](#)
- [Configuring PIM and the Bidirectional Forwarding Detection \(BFD\) Protocol on page 118](#)
- [Example: Configuring Nonstop Active Routing for PIM on page 124](#)
- [Configuring PIM Dense Mode on page 137](#)
- [Configuring PIM Sparse-Dense Mode on page 140](#)
- [PIM Join Load Balancing on Multipath MVPN Routes Overview on page 141](#)
- [Example: Configuring PIM Join Load Balancing On Next-Generation Multicast VPN on page 145](#)

Configuring Basic PIM Settings

- [PIM Configuration Statements on page 22](#)
- [Changing the PIM Version on page 24](#)
- [Modifying the PIM Hello Interval on page 24](#)
- [Preserving Multicast Performance by Disabling Response to the ping Utility on page 25](#)
- [PIM on Aggregated Interfaces on page 26](#)
- [Configuring PIM Trace Options on page 26](#)
- [Disabling PIM on page 28](#)

PIM Configuration Statements

To configure PIM, include the **pim** statement:

```
pim {
  disable;
  default-vpn-source {
    interface-name interface-name;
  }
  assert-timeout seconds;
  dense-groups {
    addresses;
  }
  dr-election-on-p2p;
  export;
  graceful-restart {
    disable;
    no-bidirectional-mode;
    restart-duration seconds;
  }
  import [ policy-names ];
  interface interface-name {
    bidirectional {
      df-election {
        backoff-period milliseconds;
        offer-period milliseconds;
        robustness-count number;
      }
    }
  }
  import;
  hello-interval seconds;
  mode bidirectional-sparse | bidirectional-sparse-dense | (dense | sparse |
    sparse-dense);
  neighbor-policy [ policy-names ];
  override-interval milliseconds;
  priority number;
  propagation-delay milliseconds;
  reset-tracking-bit;
  version version;
}
join-load-balance;
join-prune-timeout;
nonstop-routing {
  disable;
}
override-interval milliseconds;
propagation-delay milliseconds;
reset-tracking-bit;
rib-group {
  inet group-name;
  inet6 group-name;
}
rp {
  auto-rp {
    (announce | discovery | mapping);
```

```

(mapping-agent-election | no-mapping-agent-election);
}
bidirectional {
  address address {
    group-ranges {
      destination-ip-prefix </prefix-length>;
    }
    hold-time seconds;
    priority number;
  }
}
bootstrap {
  family (inet | inet6) {
    export [ policy-names ];
    import [ policy-names ];
    priority number;
  }
}
bootstrap-export [ policy-names ];
bootstrap-import [ policy-names ];
bootstrap-priority number;
dr-register-policy [ policy-names ];
embedded-rp {
  group-ranges {
    destination-ip-prefix </prefix-length>;
  }
  maximum-rps limit;
}
local {
  family (inet | inet6) {
    address address;
    anycast-pim {
      rp-set {
        address address <forward-msdp-sa>;
      }
      local-address address;
    }
    disable;
    group-ranges {
      destination-ip-prefix </prefix-length>;
    }
    hold-time seconds;
    override;
    priority number;
  }
}
rp-register-policy [ policy-names ];
static {
  address address {
    override;
    version version;
    group-ranges {
      destination-ip-prefix </prefix-length>;
    }
    spt-threshold {
      infinity [ policy-names ];
    }
  }
}

```

```

    }
    traceoptions {
        file filename <files number> <size size> <world-readable | no-world-readable>;
        flag flag <flag-modifier> <disable>;
    }
}
}
}
}

```

You can include this statement at the following hierarchy levels:

- [edit protocols]
- [edit routing-instance *routing-instance-name* protocols]
- [edit logical-systems *logical-system-name* protocols]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols]

By default, PIM is disabled.



NOTE: You cannot configure PIM within a nonforwarding instance. If you try to do so, the router displays a commit check error and does not complete the configuration commit process.

Changing the PIM Version

All systems on a subnet must run the same version of PIM.

The default PIM version can be version 1 or version 2, depending on the mode you are configuring. PIMv1 is the default for rendezvous point (RP) mode (at the [edit protocols pim rp static address *address*] hierarchy level). However, PIMv2 is the default for interface mode (at the [edit protocols pim interface *interface-name*] hierarchy level). Explicitly configured versions override the defaults.

To configure the PIM version, include the **version** statement:

```
version (1 | 2);
```

Modifying the PIM Hello Interval

Routing devices send hello messages at a fixed interval on all PIM-enabled interfaces. By using hello messages, routing devices advertise their existence as PIM routing devices on the subnet. With all PIM-enabled routing devices advertised, a single DR for the subnet is established.

When a routing device is configured for PIM, it sends a hello message at a 30-second default interval. The interval range is from 0 through 255. When the interval counts down to 0, the routing device sends another hello message, and the timer is reset. A routing device that receives no response from a neighbor in 3.5 times the interval value drops

the neighbor. In the case of a 30-second interval, the amount of time a routing device waits for a response is 105 seconds.

If a PIM hello message contains the holdtime option, the neighbor timeout is set to the holdtime sent in the message. If a PIM hello message does not contain the holdtime option, the neighbor timeout is set to the default hello hold time.

To modify how often the routing device sends hello messages out of an interface:

1. Configure the interface globally or in the routing instance. This example shows the configuration for the routing instance.

```
[edit routing-instances PIM.master protocols pim interface fe-3/0/2.0]
user@host# set hello-interval 255
```

2. Verify the configuration by checking the **Hello Option Holdtime** field in the output of the **show pim neighbors detail** command.

```
user@host> show pim neighbors detail
Instance: PIM.master
Interface: fe-3/0/2.0
Address: 192.168.195.37, IPv4, PIM v2, Mode: Sparse
Hello Option Holdtime: 255 seconds
Hello Option DR Priority: 1
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
Join Suppression supported
Rx Join: Group Source Timeout
225.1.1.1 192.168.195.78 0
225.1.1.1 0

Interface: lo0.0
Address: 10.255.245.91, IPv4, PIM v2, Mode: Sparse
Hello Option Holdtime: 255 seconds
Hello Option DR Priority: 1
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
Join Suppression supported

Interface: pd-6/0/0.32768
Address: 0.0.0.0, IPv4, PIM v2, Mode: Sparse
Hello Option Holdtime: 255 seconds
Hello Option DR Priority: 0
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
Join Suppression supported
```

Preserving Multicast Performance by Disabling Response to the ping Utility

The ping utility uses ICMP Echo messages to verify connectivity to any device with an IP address. However, in the case of multicast applications, a single ping sent to a multicast address can degrade the performance of routers because the stream of packets is replicated multiple times.

You can disable the router's response to ping (ICMP Echo) packets sent to multicast addresses. The system responds normally to unicast ping packets.

To disable the router's response to ping packets sent to multicast addresses:

1. Include the **no-multicast-echo** statement:

```
[edit system]
user@host# set no-multicast-echo
```

2. Verify the configuration by checking the **echo drops with broadcast or multicast destination address** field in the output of the **show system statistics icmp** command.

```
user@host> show system statistics icmp

icmp:
0 drops due to rate limit
0 calls to icmp_error
0 errors not generated because old message was icmp
Output histogram:
echo reply: 21
0 messages with bad code fields
0 messages less than the minimum length
0 messages with bad checksum
0 messages with bad source address
0 messages with bad length
100 echo drops with broadcast or multicast destination address
0 timestamp drops with broadcast or multicast destination address
Input histogram:
echo: 21
21 message responses generated
```

PIM on Aggregated Interfaces

You can configure several Protocol Independent Multicast (PIM) features on an interface regardless of its PIM mode (bidirectional, sparse, dense, or sparse-dense mode).

If you configure PIM on an aggregated (**ae-** or **as-**) interface, each of the interfaces in the aggregate is included in the multicast output interface list and carries the single stream of replicated packets in a load-sharing fashion. The multicast aggregate interface is “expanded” into its constituent interfaces in the next-hop database.

Configuring PIM Trace Options

Tracing operations record detailed messages about the operation of routing protocols, such as the various types of routing protocol packets sent and received, and routing policy actions. You can specify which trace operations are logged by including specific tracing flags. The following table describes the flags that you can include.

Flag	Description
all	Trace all operations.
assert	Trace assert messages, which are used to resolve which of the parallel routers connected to a multiaccess LAN is responsible for forwarding packets to the LAN.
autorp	Trace bootstrap, RP, and auto-RP messages.
bidirectional-df-election	Trace bidirectional PIM designated-forwarder (DF) election events.

Flag	Description
bootstrap	Trace bootstrap messages, which are sent periodically by the PIM domain's bootstrap router and are forwarded, hop by hop, to all routers in that domain.
general	Trace general events.
graft	Trace graft and graft acknowledgment messages.
hello	Trace hello packets, which are sent so that neighboring routers can discover one another.
join	Trace join messages, which are sent to join a branch onto the multicast distribution tree.
mdt	Trace messages related to multicast data tunnels.
normal	Trace normal events.
nsr-synchronization	Trace nonstop routing synchronization events
packets	Trace all PIM packets.
policy	Trace poison-route-reverse packets.
prune	Trace prune messages, which are sent to prune a branch off the multicast distribution tree.
register	Trace register and register-stop messages. Register messages are sent to the RP when a multicast source first starts sending to a group.
route	Trace routing information.
rp	Trace candidate RP advertisements.
state	Trace state transitions.
task	Trace task processing.
timer	Trace timer processing.

In the following example, tracing is enabled for all routing protocol packets. Then tracing is narrowed to focus only on PIM packets of a particular type. To configure tracing operations for PIM:

1. (Optional) Configure tracing at the routing options level to trace all protocol packets.

```
[edit routing-options traceoptions]
user@host# set file all-packets-trace
user@host# set flag all
```

2. Configure the filename for the PIM trace file.

```
[edit protocols pim traceoptions]  
user@host# set file pim-trace
```

3. (Optional) Configure the maximum number of trace files.

```
[edit protocols pim traceoptions]  
user@host# set file files 5
```

4. (Optional) Configure the maximum size of each trace file.

```
[edit protocols pim traceoptions]  
user@host# set file size 1m
```

5. (Optional) Enable unrestricted file access.

```
[edit protocols pim traceoptions]  
user@host# set file world-readable
```

6. Configure tracing flags. Suppose you are troubleshooting issues with PIM version 1 control packets that are received on an interface configured for PIM version 2. The following example shows how to trace messages associated with this problem.

```
[edit protocols pim traceoptions]  
user@host# set flag packets | match "Rx V1 Require V2"
```

7. View the trace file.

```
user@host> file list /var/log  
user@host> file show /var/log/pim-trace
```

Disabling PIM

By default, when configured, the PIM protocol is enabled on all interfaces for all families. If desired, you can disable PIM at the protocol, interface, or family hierarchy levels.

The hierarchy in which you configure PIM is critical. In general, the most specific configuration takes precedence. However, if PIM is disabled at the protocol level, then any disable statements with respect to an interface or family are ignored.

For example, the order of precedence for disabling PIM on a particular interface family is:

1. If PIM is disabled at the **[edit protocols pim interface *interface-name* family]** hierarchy level, then PIM is disabled for that interface family.
2. If PIM is not configured at the **[edit protocols pim interface *interface-name* family]** hierarchy level, but is disabled at the **[edit protocols pim interface *interface-name*]** hierarchy level, then PIM is disabled for all families on the specified interface.
3. If PIM is not configured at either the **[edit protocols pim interface *interface-name* family]** hierarchy level or the **[edit protocols pim interface *interface-name*]** hierarchy level, but is disabled at the **[edit protocols pim]** hierarchy level, then the PIM protocol is disabled globally for all interfaces and all families.

The following sections describe how to disable PIM at the various hierarchy levels.

- [Disabling the PIM Protocol on page 29](#)
- [Disabling PIM on an Interface on page 29](#)
- [Disabling PIM for a Family on page 30](#)
- [Disabling PIM for a Rendezvous Point on page 30](#)

Disabling the PIM Protocol

You can explicitly disable the PIM protocol. Disabling the PIM protocol disables the protocol for all interfaces and all families. This is accomplished at the **[edit protocols pim]** hierarchy:

```
[edit protocols]
pim {
  disable;
}
```

To disable the PIM protocol:

1. Include the **disable** statement.

```
user@host# set protocols pim disable
```

2. (Optional) Verify your configuration settings before committing them by using the **show protocols pim** command.

```
user@host# run show protocols pim
```

Disabling PIM on an Interface

You can disable the PIM protocol on a per-interface basis. This is accomplished at the **[edit protocols pim interface *interface-name*]** hierarchy:

```
[edit protocols]
pim {
  interface interface-name {
    disable;
  }
}
```

To disable PIM for an interface:

1. Include the **disable** statement.

```
user@host# set protocols pim interface fe-0/1/0 disable
```

2. (Optional) Verify your configuration settings before committing them by using the **show protocols pim** command.

```
user@host# run show protocols pim
```

Disabling PIM for a Family

You can disable the PIM protocol on a per-family basis. This is accomplished at the **[edit protocols pim family]** hierarchy:

```
[edit protocols]
pim {
  family inet {
    disable;
  }
  family inet6 {
    disable;
  }
}
```

To disable PIM for a family:

1. Include the **disable** statement.

```
user@host# set protocols pim family inet disable
user@host# set protocols pim family inet6 disable
```

2. (Optional) Verify your configuration settings before committing them by using the **show protocols pim** command.

```
user@host# run show protocols pim
```

Disabling PIM for a Rendezvous Point

You can disable the PIM protocol for a rendezvous point (RP) on a per-family basis. This is accomplished at the **[edit protocols pim rp local family]** hierarchy:

```
[edit protocols]
pim {
  rp {
    local {
      family inet {
        disable;
      }
      family inet6 {
        disable;
      }
    }
  }
}
```

To disable PIM for an RP family:

1. Use the **disable** statement.

```
user@host# set protocols pim rp local family inet disable
user@host# set protocols pim rp local family inet6 disable
```

2. (Optional) Verify your configuration settings before committing them by using the **show protocols pim** command.

```
user@host# run show protocols pim
```

Related Documentation

- [Configuring PIM Auto-RP on page 88](#)
- [Configuring PIM Bootstrap Router on page 84](#)
- [Configuring PIM Dense Mode on page 137](#)
- [Configuring a Designated Router for PIM on page 31](#)
- [Configuring PIM Filtering on page 96](#)
- [Example: Configuring Nonstop Active Routing for PIM on page 124](#)
- [Examples: Configuring PIM RPT and SPT Cutover on page 103](#)
- [Examples: Configuring PIM Sparse Mode on page 33](#)
- [Configuring PIM Sparse-Dense Mode on page 140](#)
- [Configuring PIM and the Bidirectional Forwarding Detection \(BFD\) Protocol on page 118](#)

Configuring a Designated Router for PIM

- [Configuring Interface Priority for the PIM Designated Router Selection on page 31](#)
- [Configuring PIM Designated Router Election on Point-to-Point Links on page 32](#)

Configuring Interface Priority for the PIM Designated Router Selection

By default, every PIM interface has the lowest probability (priority 0) of being selected as the DR. Configuring the interface DR priority helps ensure that changing an IP address does not alter your forwarding model.

To configure the interface DR priority:

1. Configure the interface globally or in the routing instance. This example shows the configuration for the routing instance.

```
[edit routing-instances PIM.master protocols pim interface ge-0/0/0.0]
user@host# set priority 5
```

2. Verify the configuration by checking the **Hello Option DR Priority** field in the output of the **show pim neighbors detail** command.

```
user@host> show pim neighbors detail
```

```
Instance: PIM.master
Interface: ge-0/0/0.0
Address: 192.168.195.37, IPv4, PIM v2, Mode: Sparse
Hello Option Holdtime: 65535 seconds
Hello Option DR Priority: 5
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
Join Suppression supported
Rx Join: Group Source Timeout
225.1.1.1 192.168.195.78 0
225.1.1.1 0
```

```
Interface: lo0.0
Address: 10.255.245.91, IPv4, PIM v2, Mode: Sparse
Hello Option Holdtime: 65535 seconds
```

```
Hello Option DR Priority: 1
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
Join Suppression supported
```

```
Interface: pd-6/0/0.32768
Address: 0.0.0.0, IPv4, PIM v2, Mode: Sparse
Hello Option Holdtime: 65535 seconds
Hello Option DR Priority: 0
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
Join Suppression supported
```

Configuring PIM Designated Router Election on Point-to-Point Links

To comply with the latest PIM drafts, enable designated router (DR) election on all PIM interfaces, including point-to-point (P2P) interfaces. (DR election is enabled by default on all other interfaces.) One of the two routers might join a multicast group on its P2P link interface. The DR on that link is responsible for initiating the relevant join messages.

To enable DR election on point-to-point interfaces:

1. On both point-to-point link routers, configure the router globally or in the routing instance. This example shows the configuration for the routing instance.

```
[edit routing-instances PIM.master protocols pim]
user@host# set dr-election-on-p2p
```
2. Verify the configuration by checking the **State** field in the output of the **show pim interfaces** command. The possible values for the **State** field are DR, NotDR, and P2P. When a point-to-point link interface is elected to be the DR, the interface state becomes DR instead of P2P.
3. If the **show pim interfaces** command continues to report the P2P state, consider running the **restart routing** command on both routers on the point-to-point link. Then recheck the state.



CAUTION: Do not restart a software process unless specifically asked to do so by your Juniper Networks customer support representative. Restarting a software process during normal operation of a routing platform could cause interruption of packet forwarding and loss of data.

```
[edit]
user@host# run restart routing
```

Related Documentation

- [Configuring PIM Auto-RP on page 88](#)
- [Configuring PIM Bootstrap Router on page 84](#)
- [Configuring PIM Dense Mode on page 137](#)
- [Configuring PIM Filtering on page 96](#)
- [Example: Configuring Nonstop Active Routing for PIM on page 124](#)
- [Examples: Configuring PIM RPT and SPT Cutover on page 103](#)

- [Examples: Configuring PIM Sparse Mode on page 33](#)
- [Configuring PIM Sparse-Dense Mode on page 140](#)
- [Configuring PIM and the Bidirectional Forwarding Detection \(BFD\) Protocol on page 118](#)
- [Configuring Basic PIM Settings on page 21](#)

Examples: Configuring PIM Sparse Mode

- [Understanding PIM Sparse Mode on page 33](#)
- [Designated Router on page 36](#)
- [Tunnel Services PICs and Multicast on page 36](#)
- [Enabling PIM Sparse Mode on page 37](#)
- [Configuring PIM Join Load Balancing on page 38](#)
- [Modifying the Join State Timeout on page 41](#)
- [Example: Enabling Join Suppression on page 41](#)
- [Example: Configuring PIM Sparse Mode over an IPsec VPN on page 46](#)
- [Example: Configuring Multicast for Virtual Routers with IPv6 Interfaces on page 50](#)

Understanding PIM Sparse Mode

A Protocol Independent Multicast (PIM) sparse-mode domain uses reverse-path forwarding (RPF) to create a path from a data source to the receiver requesting the data. When a receiver issues an explicit join request, an RPF check is triggered. A (*,G) PIM join message is sent toward the RP from the receiver's designated router (DR). (By definition, this message is actually called a join/prune message, but for clarity in this description, it is called either join or prune, depending on its context.) The join message is multicast hop by hop upstream to the ALL-PIM-ROUTERS group (224.0.0.13) by means of each router's RPF interface until it reaches the RP. The RP router receives the (*,G) PIM join message and adds the interface on which it was received to the outgoing interface list (OIL) of the rendezvous-point tree (RPT) forwarding state entry. This builds the RPT connecting the receiver with the RP. The RPT remains in effect, even if no active sources generate traffic.



NOTE: State—the (*,G) or (S,G) entries—is the information used for forwarding unicast or multicast packets. S is the source IP address, G is the multicast group address, and * represents any source sending to group G. Routers keep track of the multicast forwarding state for the incoming and outgoing interfaces for each group.

When a source becomes active, the source DR encapsulates multicast data packets into a PIM register message and sends them by means of unicast to the RP router.

If the RP router has interested receivers in the PIM sparse-mode domain, it sends a PIM join message toward the source to build a shortest-path tree (SPT) back to the source.

The source sends multicast packets out on the LAN, and the source DR encapsulates the packets in a PIM register message and forwards the message toward the RP router by means of unicast. The RP router receives PIM register messages back from the source, and thus adds a new source to the distribution tree, keeping track of sources in a PIM table. Once an RP router receives packets natively (with S,G), it sends a register stop message to stop receiving the register messages by means of unicast.

In actual application, many receivers with multiple SPTs are involved in a multicast traffic flow. To illustrate the process, we track the multicast traffic from the RP router to one receiver. In such a case, the RP router begins sending multicast packets down the RPT toward the receiver's DR for delivery to the interested receivers. When the receiver's DR receives the first packet from the RPT, the DR sends a PIM join message toward the source DR to start building an SPT back to the source. When the source DR receives the PIM join message from the receiver's DR, it starts sending traffic down all SPTs. When the first multicast packet is received by the receiver's DR, the receiver's DR sends a PIM prune message to the RP router to stop duplicate packets from being sent through the RPT. In turn, the RP router stops sending multicast packets to the receiver's DR, and sends a PIM prune message for this source over the RPT toward the source DR to halt multicast packet delivery to the RP router from that particular source.

If the RP router receives a PIM register message from an active source but has no interested receivers in the PIM sparse-mode domain, it still adds the active source into the PIM table. However, after adding the active source into the PIM table, the RP router sends a register stop message. The RP router discovers the active source's existence and no longer needs to receive advertisement of the source (which utilizes resources).



NOTE: If the number of PIM join messages exceeds the configured MTU, the messages are fragmented in IPv6 PIM sparse mode. To avoid the fragmentation of PIM join messages, the multicast traffic receives the interface MTU instead of the path MTU.

The major characteristics of PIM sparse mode are as follows:

- Routers with downstream receivers join a PIM sparse-mode tree through an explicit join message.
- PIM sparse-mode RPs are the routers where receivers meet sources.
- Senders announce their existence to one or more RPs, and receivers query RPs to find multicast sessions.
- Once receivers get content from sources through the RP, the last-hop router (the router closest to the receiver) can optionally remove the RP from the shared distribution tree (*G) if the new source-based tree (S,G) is shorter. Receivers can then get content directly from the source.

The transitional aspect of PIM sparse mode from shared to source-based tree is one of the major features of PIM, because it prevents overloading the RP or surrounding core links.

There are related issues regarding source, RPs, and receivers when sparse mode multicast is used:

- Sources must be able to send to all RPs.
- RPs must all know one another.
- Receivers must send explicit join messages to a known RP.
- Receivers initially need to know only one RP (they later learn about others).
- Receivers can explicitly prune themselves from a tree.
- Receivers that never transition to a source-based tree are effectively running Core Based Trees (CBT).

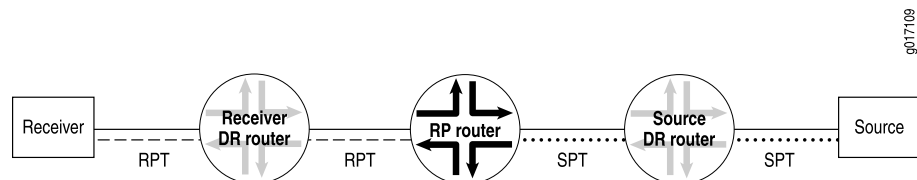
PIM sparse mode has standard features for all of these issues.

Rendezvous Point

The RP router serves as the information exchange point for the other routers. All routers in a PIM domain must provide mapping to an RP router. It is the only router that needs to know the active sources for a domain—the other routers just need to know how to reach the RP. In this way, the RP matches receivers with sources.

The RP router is downstream from the source and forms one end of the shortest-path tree. As shown in [Figure 3 on page 35](#), the RP router is upstream from the receiver and thus forms one end of the rendezvous-point tree.

Figure 3: Rendezvous Point as Part of the RPT and SPT



The benefit of using the RP as the information exchange point is that it reduces the amount of state in non-RP routers. No network flooding is required to provide non-RP routers information about active sources.

RP Mapping Options

RPs can be learned by one of the following mechanisms:

- Static configuration
- Anycast RP
- Auto-RP
- Bootstrap router

We recommend a static RP mapping with anycast RP and a bootstrap router (BSR) with auto-RP configuration, because static mapping provides all the benefits of a bootstrap router and auto-RP without the complexity of the full BSR and auto-RP mechanisms.

Designated Router

In a PIM sparse mode (PIM-SM) domain, there are two types of designated routers to consider:

- The receiver DR sends PIM join and PIM prune messages from the receiver network toward the RP.
- The source DR sends PIM register messages from the source network to the RP.

Neighboring PIM routers multicast periodic PIM hello messages to each other every 30 seconds (the default). The PIM hello message usually includes a holdtime value for the neighbor to use, but this is not a requirement. If the PIM hello message does not include a holdtime value, a default timeout value (in Junos OS, 105 seconds) is used. On receipt of a PIM hello message, a router stores the IP address and priority for that neighbor. If the DR priorities match, the router with the highest IP address is selected as the DR.

If a DR fails, a new one is selected using the same process of comparing IP addresses.



NOTE: In PIM dense mode (PIM-DM), a DR is elected by the same process that PIM-SM uses. However, the only time that a DR has any effect in PIM-DM is when IGMPv1 is used on the interface. (IGMPv2 is the default.) In this case, the DR also functions as the IGMP Query Router because IGMPv1 does not have a Query Router election mechanism.

Tunnel Services PICs and Multicast

On Juniper Networks routers, data packets are encapsulated and de-encapsulated into tunnels by means of hardware and not the software running on the router processor. The hardware used to create tunnel interfaces on M Series and T Series routers is a Tunnel Services PIC. If Juniper Networks M Series Multiservice Edge Routers and Juniper Networks T Series Core Routers are configured as rendezvous points or IP version 4 (IPv4) PIM sparse-mode DRs connected to a source, a Tunnel Services PIC is required. Juniper Networks MX Series Ethernet Services Routers do not require Tunnel Services PICs.

In PIM sparse mode, the source DR takes the initial multicast packets and encapsulates them in PIM register messages. The source DR then unicasts the packets to the PIM sparse-mode RP router, where the PIM register message is de-encapsulated.

When a router is configured as a PIM sparse-mode RP router (by specifying an address using the **address** statement at the **[edit protocols pim rp local]** hierarchy level) and a Tunnel PIC is present on the router, a PIM register de-encapsulation interface, or **pd** interface, is automatically created. The **pd** interface receives PIM register messages and de-encapsulates them by means of the hardware.

If PIM sparse mode is enabled and a Tunnel Services PIC is present on the router, a PIM register encapsulation interface (**pe** interface) is automatically created for each RP address. The **pe** interface is used to encapsulate source data packets and send the

packets to RP addresses on the PIM DR and the PIM RP. The **pe** interface receives PIM register messages and encapsulates the packets by means of the hardware.

Do not confuse the configurable **pe** and **pd** hardware interfaces with the nonconfigurable **pime** and **pimd** software interfaces. Both pairs encapsulate and de-encapsulate multicast packets, and are created automatically. However, the **pe** and **pd** interfaces appear only if a Tunnel Services PIC is present. The **pime** and **pimd** interfaces are not useful in situations requiring the **pe** and **pd** interfaces.

If the source DR is the RP, then there is no need for PIM register messages and consequently no need for a Tunnel Services PIC.

When PIM sparse mode is used with IP version 6 (IPv6), a Tunnel PIC is required on the RP, but not on the IPv6 PIM DR. The lack of a Tunnel PIC requirement on the IPv6 DR applies only to IPv6 PIM sparse mode and is not to be confused with IPv4 PIM sparse-mode requirements.

Table 4 on page 37 shows the complete matrix of IPv4 and IPv6 PIM Tunnel PIC requirements.

Table 4: Tunnel PIC Requirements for IPv4 and IPv6 Multicast

IP Version	Tunnel PIC on RP	Tunnel PIC on DR
IPv4	Yes	Yes
IPv6	Yes	No

Enabling PIM Sparse Mode

In PIM sparse mode (PIM-SM), the assumption is that very few of the possible receivers want packets from a source, so the network establishes and sends packets only on branches that have at least one leaf indicating (by message) a desire for the traffic. WANs are appropriate networks for sparse-mode operation.

By default, PIM is disabled. When you enable PIM, it operates in sparse mode by default. You do not need to configure Internet Group Management Protocol (IGMP) version 2 for a sparse mode configuration. After you enable PIM, by default, IGMP version 2 is also enabled.

All systems on a subnet must run the same version of PIM.

The default PIM version can be version 1 or version 2, depending on the mode you are configuring. PIMv1 is the default for rendezvous point (RP) mode (at the **[edit protocols pim rp static address address]** hierarchy level). However, PIMv2 is the default for interface mode (at the **[edit protocols pim interface interface-name]** hierarchy level). Explicitly configured versions override the defaults. The following example explicitly configures PIMv2 on the interfaces.

You can configure PIM sparse mode globally or for a routing instance. This example shows how to configure PIM sparse mode globally on all interfaces. It also shows how to configure a static RP router and how to configure the non-RP routers.

To configure the router properties for PIM sparse mode:

1. Configure the static RP router.

```
[edit protocols pim]
user@host# set rp local family inet address 192.168.3.253
```

2. Configure the RP router interfaces. When configuring all interfaces, exclude the **fxp0.0** management interface by including the **disable** statement for that interface.

```
[edit protocols pim]
user@host# set interface all mode sparse
user@host# set interface all version 2
user@host# set interface fxp0.0 disable
```

3. Configure the non-RP routers. Include the following configuration on all of the non-RP routers.

```
[edit protocols pim]
user@host# set rp static address 198.58.3.253 version 2
user@host# set interface all mode sparse
user@host# set interface all version 2
user@host# set interface fxp0.0 disable
```

4. Monitor the operation of PIM sparse mode.

- **show pim interfaces**
- **show pim join**
- **show pim neighbors**
- **show pim rps**

Configuring PIM Join Load Balancing

By default, PIM join messages are sent toward a source based on the RPF routing table check. If there is more than one equal-cost path toward the source, then one upstream interface is chosen to send the join message. This interface is also used for all downstream traffic, so even though there are alternative interfaces available, the multicast load is concentrated on one upstream interface and routing device.

For PIM sparse mode, you can configure PIM join load balancing to spread join messages and traffic across equal-cost upstream paths (interfaces and routing devices) provided

by unicast routing toward a source. PIM join load balancing is only supported for PIM sparse mode configurations.

PIM join load balancing is supported on draft-rosen multicast VPNs (also referred to as dual PIM multicast VPNs). PIM join load balancing is not supported on multiprotocol BGP-based multicast VPNs (also referred to as next-generation Layer 3 VPN multicast). When PIM join load balancing is enabled in a draft-rosen Layer 3 VPN scenario, the load balancing is achieved based on the join counts for the far-end PE routing devices, not for any intermediate P routing devices.

If an internal BGP (IBGP) multipath forwarding VPN route is available, the Junos OS uses the multipath forwarding VPN route to send join messages to the remote PE routers to achieve load balancing over the VPN.

By default, when multiple PIM joins are received for different groups, all joins are sent to the same upstream gateway chosen by the unicast routing protocol. Even if there are multiple equal-cost paths available, these alternative paths are not utilized to distribute multicast traffic from the source to the various groups.

When PIM join load balancing is configured, the PIM joins are distributed equally among all equal-cost upstream interfaces and neighbors. Every new join triggers the selection of the least-loaded upstream interface and neighbor. If there are multiple neighbors on the same interface (for example, on a LAN), join load balancing maintains a value for each of the neighbors and distributes multicast joins (and downstream traffic) among these as well.

Join counts for interfaces and neighbors are maintained globally, not on a per-source basis. Therefore, there is no guarantee that joins for a particular source are load-balanced. However, the joins for all sources and all groups known to the routing device are load-balanced. There is also no way to administratively give preference to one neighbor over another: all equal-cost paths are treated the same way.

You can configure message filtering globally or for a routing instance. This example shows the global configuration.

You configure PIM join load balancing on the non-RP routers in the PIM domain.

1. Determine if there are multiple paths available for a source (for example, an RP) with the output of the **show pim join extensive** or **show pim source** commands.

```
user@host> show pim join extensive
Instance: PIM.master Family: INET

Group: 224.1.1.1
Source: *
RP: 10.255.245.6
Flags: sparse,rptree,wildcard
Upstream interface: t1-0/2/3.0
Upstream neighbor: 192.168.38.57
Upstream state: Join to RP
Downstream neighbors:
  Interface: t1-0/2/1.0
    192.168.38.16 State: JOIN Flags; SRW Timeout: 164
Group: 224.2.127.254
Source: *
```

```

RP: 10.255.245.6
Flags: sparse,rptree,wildcard
Upstream interface: so-0/3/0.0
Upstream neighbor: 192.168.38.47
Upstream state: Join to RP
Downstream neighbors:
  Interface: t1-0/2/3.0
    192.168.38.16 State: JOIN Flags; SRW Timeout: 164

```

Note that for this router, the RP at IP address 10.255.245.6 is the source for two multicast groups: 224.1.1.1 and 224.2.127.254. This router has two equal-cost paths through two different upstream interfaces (**t1-0/2/3.0** and **so-0/3/0.0**) with two different neighbors (192.168.38.57 and 192.168.38.47). This router is a good candidate for PIM join load balancing.

2. On the non-RP router, configure PIM join load balancing.

```

[edit protocols pim rp]
user@host# set static address 10.10.10.1
user@host# set interface all mode sparse version 2
user@host# set join-load-balance

```

The static address is the address of the RP.

3. Monitor the operation.

If load balancing is enabled for this router, the number of PIM joins sent on each interface is shown in the output for the **show pim interfaces** command.

```

user@host> show pim interfaces
Instance: PIM.master

```

Name	Stat	Mode	IP V	State	NbrCnt	JoinCnt	DR address
lo0.0	Up	Sparse	4 2	DR	0	0	10.255.168.58
pe-1/2/0.32769	Up	Sparse	4 2	P2P	0	0	
so-0/3/0.0	Up	Sparse	4 2	P2P	1	1	
t1-0/2/1.0	Up	Sparse	4 2	P2P	1	0	
t1-0/2/3.0	Up	Sparse	4 2	P2P	1	1	
lo0.0	Up	Sparse	6 2	DR	0	0	fe80::2a0:a5ff:4b7

Note that the two equal-cost paths shown by the **show pim interfaces** command now have nonzero join counts. If the counts differ by more than one and were zero (0) when load balancing commenced, an error occurs (joins before load balancing are not redistributed). The join count also appears in the **show pim neighbors detail** output:

```

user@host> show pim neighbors detail
Interface: so-0/3/0.0

```

```

Address: 192.168.38.46, IPv4, PIM v2, Mode: Sparse, Join Count: 0
Hello Option Holdtime: 65535 seconds
Hello Option DR Priority: 1
Hello Option Generation ID: 1689116164
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms

```

```

Address: 192.168.38.47, IPv4, PIM v2, Join Count: 1
BFD: Disabled
Hello Option Holdtime: 105 seconds 102 remaining
Hello Option DR Priority: 1
Hello Option Generation ID: 792890329
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms

```


Interface: t1-0/2/3.0

```
Address: 192.168.38.56, IPv4, PIM v2, Mode: Sparse, Join Count: 0
Hello Option Holdtime: 65535 seconds
Hello Option DR Priority: 1
Hello Option Generation ID: 678582286
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
```

```
Address: 192.168.38.57, IPv4, PIM v2, Join Count: 1
BFD: Disabled
Hello Option Holdtime: 105 seconds 97 remaining
Hello Option DR Priority: 1
Hello Option Generation ID: 1854475503
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
```

Note that the join count is nonzero on the two load-balanced interfaces toward the upstream neighbors.

PIM join load balancing only takes effect when the feature is configured. Prior joins are not redistributed to achieve perfect load balancing. In addition, if an interface or neighbor fails, the new joins are redistributed among remaining active interfaces and neighbors. However, when the interface or neighbor is restored, prior joins are not redistributed. The **clear pim join-distribution** command redistributes the existing flows to new or restored upstream neighbors. Redistributing the existing flows causes traffic to be disrupted, so we recommend that you perform PIM join redistribution during a maintenance window.

Modifying the Join State Timeout

This section describes how to configure the join state timeout.

A downstream router periodically sends join messages to refresh the join state on the upstream router. If the join state is not refreshed before the timeout expires, the join state is removed.

By default, the join state timeout is 210 seconds. You can change this timeout to allow additional time to receive the join messages. Because the messages are called join-prune messages, the name used is the **join-prune-timeout** statement.

To modify the timeout, include the **join-prune-timeout** statement:

```
user@host# set protocols pim join-prune-timeout 230
```

The join timeout value can be from 210 through 240 seconds.

Example: Enabling Join Suppression

This example describes how to enable PIM join suppression.

- [Requirements on page 42](#)
- [Overview on page 42](#)
- [Configuration on page 44](#)
- [Verification on page 45](#)

Requirements

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure PIM Sparse Mode on the interfaces. See [“Enabling PIM Sparse Mode” on page 37](#).

Overview

PIM join suppression enables a router on a multiaccess network to defer sending join messages to an upstream router when it sees identical join messages on the same network. Eventually, only one router sends these join messages, and the other routers suppress identical messages. Limiting the number of join messages improves scalability and efficiency by reducing the number of messages sent to the same router.

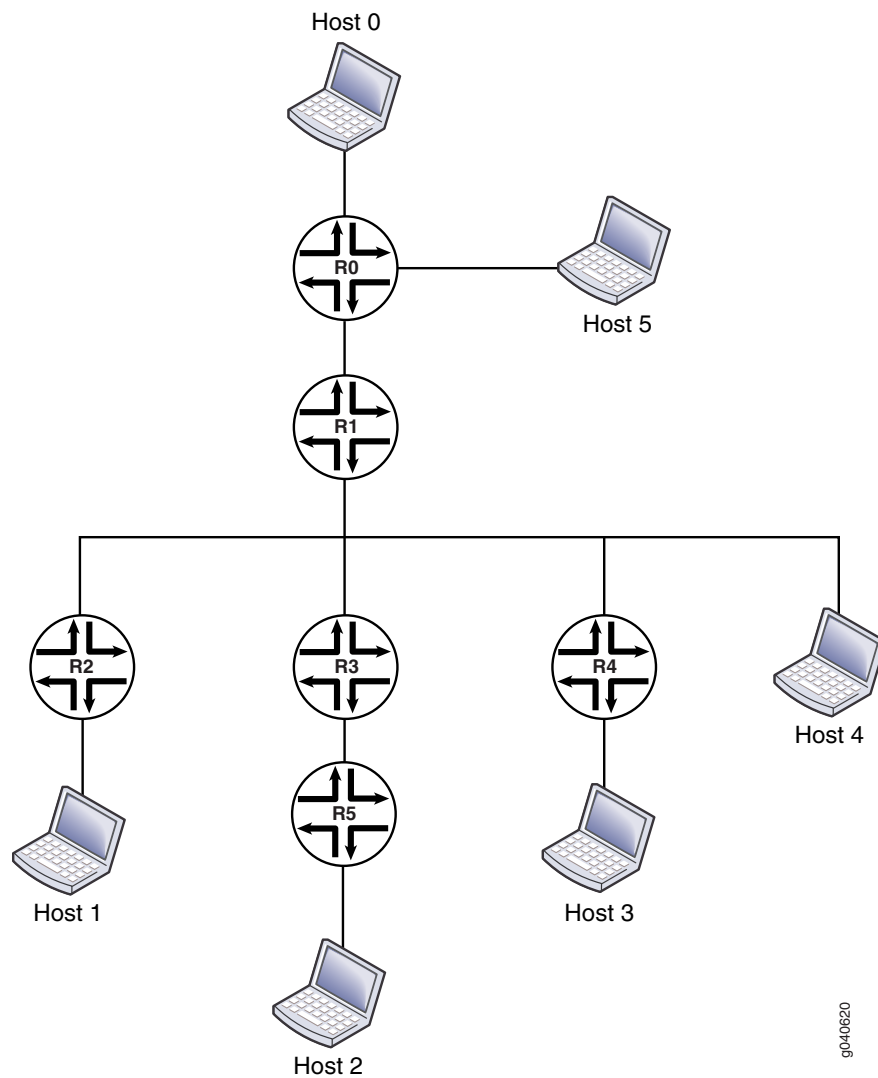
This example includes the following statements:

- **override-interval**—Sets the maximum time in milliseconds to delay sending override join messages. When a router sees a prune message for a join it is currently suppressing, it waits before it sends an override join message. Waiting helps avoid multiple downstream routers sending override join messages at the same time. The override interval is a random timer with a value of 0 through the maximum override value.
- **propagation-delay**—Sets a value in milliseconds for a prune pending timer, which specifies how long to wait before executing a prune on an upstream router. During this period, the router waits for any prune override join messages that might be currently suppressed. The period for the prune pending timer is the sum of the **override-interval** value and the value specified for **propagation-delay**.
- **reset-tracking-bit**—Enables PIM join suppression on each multiaccess downstream interface. This statement resets a tracking bit field (T-bit) on the LAN prune delay hello option from the default of 1 (join suppression disabled) to 0 (join suppression enabled).

When multiple identical join messages are received, a random join suppression timer is activated, with a range of 66 through 84 milliseconds. The timer is reset each time join suppression is triggered.

[Figure 4 on page 43](#) shows the topology used in this example.

Figure 4: Join Suppression



The items in the figure represent the following functions:

- Host 0 is the multicast source.
- Host 1, Host 2, Host 3, and Host 4 are receivers.
- Router R0 is the first-hop router and the RP.
- Router R1 is an upstream router.
- Routers R2, R3, R4, and R5 are downstream routers in the multicast LAN.

This example shows the configuration of the downstream devices: Routers R2, R3, R4, and R5.

Configuration

CLI Quick Configuration To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
[edit]
set protocols pim traceoptions file pim.log
set protocols pim traceoptions file size 5m
set protocols pim traceoptions file world-readable
set protocols pim traceoptions flag join detail
set protocols pim traceoptions flag prune detail
set protocols pim traceoptions flag normal detail
set protocols pim traceoptions flag register detail
set protocols pim rp static address 10.255.112.160
set protocols pim interface all mode sparse
set protocols pim interface all version 2
set protocols pim interface fxp0.0 disable
set protocols pim reset-tracking-bit
set protocols pim propagation-delay 500
set protocols pim override-interval 4000
```

Step-by-Step Procedure The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure PIM join suppression on a non-RP downstream router in the multicast LAN:

1. Configure PIM sparse mode on the interfaces.

```
[edit]
user@host# edit protocols pim
[edit protocols pim]
user@host# set rp static address 10.255.112.160
[edit protocols pim]
user@host# set interface all mode sparse version 2
[edit protocols pim]
user@host# set interface all version 2
[edit protocols pim]
user@host# set interface fxp0.0 disable
```

2. Enable the join suppression timer.

```
[edit protocols pim]
user@host# set reset-tracking-bit
```

3. Configure the prune override interval value.

```
[edit protocols pim]
user@host# set override-interval 4000
```

4. Configure the propagation delay of the link.

```
[edit protocols pim]
user@host# set propagation-delay 500
```

5. (Optional) Configure PIM tracing operations.

```
[edit protocols pim]
user@host# set traceoptions file pim.log size 5m world-readable
[edit protocols pim]
user@host# set traceoptions flag join detail
[edit protocols pim]
user@host# set traceoptions flag normal detail
[edit protocols pim]
user@host# set traceoptions flag register detail
```

6. If you are done configuring the device, commit the configuration.

```
[edit protocols pim]
user@host# commit
```

Results

From configuration mode, confirm your configuration by entering the **show protocols** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show protocols
pim {
  traceoptions {
    file pim.log size 5m world-readable;
    flag join detail;
    flag prune detail;
    flag normal detail;
    flag register detail;
  }
  rp {
    static {
      address 10.255.112.160;
    }
  }
  interface all {
    mode sparse;
    version 2;
  }
  interface fxp0.0 {
    disable;
  }
  reset-tracking-bit;
  propagation-delay 500;
  override-interval 4000;
}
```

Verification

To verify the configuration, run the following commands on the upstream and downstream routers:

- **show pim join extensive**
- **show multicast route extensive**

Example: Configuring PIM Sparse Mode over an IPsec VPN

IPsec VPNs create secure point-to-point connections between sites over the Internet. The Junos OS implementation of IPsec VPNs supports multicast and unicast traffic. The following example shows how to configure PIM sparse mode for the multicast solution and how to configure IPsec to secure your traffic.

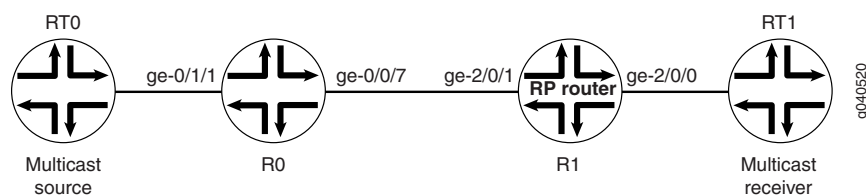
The configuration shown in this example works on the following platforms:

- M Series and T Series routers with one of the following PICs:
 - Adaptive Services (AS) PIC
 - Multiservices (MS) PIC
- JCS1200 platform with a Multiservices PIC (MS-500)

The tunnel endpoints do not need to be the same platform type. For example, the device on one end of the tunnel can be a JCS1200 router, while the device on the other end can be a standalone T Series router. The two routers that are the tunnel endpoints can be in the same autonomous system or in different autonomous systems.

In the configuration shown in this example, OSPF is configured between the tunnel endpoints. In [Figure 5 on page 46](#), the tunnel endpoints are R0 and R1. The network that contains the multicast source is connected to R0. The network that contains the multicast receivers is connected to R1. R1 serves as the statically configured rendezvous point (RP).

Figure 5: PIM Sparse Mode over an IPsec VPN



To configure PIM sparse mode with IPsec:

1. On R0, configure the incoming Gigabit Ethernet interface.


```
[edit interfaces]
user@host# set ge-0/1/1 description "incoming interface"
user@host# set ge-0/1/1 unit 0 family inet address 10.20.0.1/30
```
2. On R0, configure the outgoing Gigabit Ethernet interface.


```
[edit interfaces]
user@host# set ge-0/0/7 description "outgoing interface"
user@host# set ge-0/0/7 unit 0 family inet address 10.10.1.1/30
```
3. On R0, configure unit 0 on the **sp-** interface. The Junos OS uses unit 0 for service logging and other communication from the services PIC.


```
[edit interfaces]
user@host# set sp-0/2/0 unit 0 family inet
```

4. On R0, configure the logical interfaces that participate in the IPsec services. In this example, unit 1 is the inward-facing interface. Unit 1001 is the interface that faces the remote IPsec site.

```
[edit interfaces]
user@host# set sp-0/2/0 unit 1 family inet
user@host# set sp-0/2/0 unit 1 service-domain inside
user@host# set sp-0/2/0 unit 1001 family inet
user@host# set sp-0/2/0 unit 1001 service-domain outside
```

5. On R0, direct OSPF traffic into the IPsec tunnel.

```
[edit protocols ospf]
user@host# set area 0.0.0.0 interface sp-0/2/0.1
user@host# set parea 0.0.0.0 interface ge-0/1/1.0 passive
user@host# set area 0.0.0.0 interface lo0.0
```

6. On R0, configure PIM sparse mode. This example uses static RP configuration. Because R0 is a non-RP router, configure the address of the RP router, which is the routable address assigned to the loopback interface on R1.

```
[edit protocols pim]
user@host# set rp static address 10.255.0.156
user@host# set interface sp-0/2/0.1
user@host# set interface ge-0/1/1.0
user@host# set interface lo0.0
```

7. On R0, create a rule for a bidirectional dynamic IKE security association (SA) that references the IKE policy and the IPsec policy.

```
[edit services ipsec-vpn rule ipsec_rule]
user@host# set term ipsec_dynamic then remote-gateway 10.10.1.2
user@host# set term ipsec_dynamic then dynamic ike-policy ike_policy
user@host# set term ipsec_dynamic then dynamic ipsec-policy ipsec_policy
user@host# set match-direction input
```

8. On R0, configure the IPsec proposal. This example uses the Authentication Header (AH) Protocol.

```
[edit services ipsec-vpn ipsec proposal ipsec_prop]
user@host# set protocol ah
user@host# set authentication-algorithm hmac-md5-96
```

9. On R0, define the IPsec policy.

```
[edit services ipsec-vpn ipsec policy ipsec_policy]
user@host# set perfect-forward-secrecy keys group1
user@host# set proposals ipsec_prop
```

10. On R0, configure IKE authentication and encryption details.

```
[edit services ipsec-vpn ike proposal ike_prop]
user@host# set authentication-method pre-shared-keys
user@host# set dh-group group1
user@host# set authentication-algorithm md5
user@host# set encryption-algorithm 3des-cbc
```

11. On R0, define the IKE policy.

```
[edit services ipsec-vpn ike policy ike_policy]
user@host# set proposals ike_prop
```

```
user@host# set pre-shared-key ascii-text
"$9$nuDo6CuREyvWxO1LNbsZGFn/AOR8LNws4"
```

12. On R0, create a service set that defines IPsec-specific information. The first command associates the IKE SA rule with IPsec. The second command defines the address of the local end of the IPsec security tunnel. The last two commands configure the logical interfaces that participate in the IPsec services. Unit 1 is for the IPsec inward-facing traffic. Unit 1001 is for the IPsec outward-facing traffic.

```
[edit services service-set ipsec_svc]
user@host# set ipsec-vpn-rules ipsec_rule
user@host# set ipsec-vpn-options local-gateway 10.10.1.1
user@host# set next-hop-service inside-service-interface sp-0/2/0.1
user@host# set next-hop-service outside-service-interface sp-0/2/0.1001
```

13. On R1, configure the incoming Gigabit Ethernet interface.

```
[edit interfaces]
user@host# set ge-2/0/1 description "incoming interface"
user@host# set ge-2/0/1 unit 0 family inet address 10.10.1.2/30
```

14. On R1, configure the outgoing Gigabit Ethernet interface.

```
[edit interfaces]
user@host# set ge-2/0/0 description "outgoing interface"
user@host# set ge-2/0/0 unit 0 family inet address 10.20.0.5/30
```

15. On R1, configure the loopback interface.

```
[edit interfaces]
user@host# set lo0.0 family inet address 10.255.0.156
```

16. On R1, configure unit 0 on the **sp-** interface. The Junos OS uses unit 0 for service logging and other communication from the services PIC.

```
[edit interfaces]
user@host# set sp-2/1/0 unit 0 family inet
```

17. On R1, configure the logical interfaces that participate in the IPsec services. In this example, unit 1 is the inward-facing interface. Unit 1001 is the interface that faces the remote IPsec site.

```
[edit interfaces]
user@host# set sp-2/1/0 unit 1 family inet
user@host# set sp-2/1/0 unit 1 service-domain inside
user@host# set sp-2/1/0 unit 1001 family inet
user@host# set sp-2/1/0 unit 1001 service-domain outside
```

18. On R1, direct OSPF traffic into the IPsec tunnel.

```
[edit protocols ospf]
user@host# set area 0.0.0.0 interface sp-2/1/0.1
user@host# set area 0.0.0.0 interface ge-2/0/0.0 passive
user@host# set area 0.0.0.0 interface lo0.0
```

19. On R1, configure PIM sparse mode. R1 is an RP router. When you configure the local RP address, use the shared address, which is the address of R1's loopback interface.

```
[edit protocols pim]
user@host# set rp local address 10.255.0.156
user@host# set interface sp-2/1/0.1
```



```

user@host# set interface ge-2/0/0.0
user@host# set interface lo0.0 family inet

```

20. On R1, create a rule for a bidirectional dynamic Internet Key Exchange (IKE) security association (SA) that references the IKE policy and the IPsec policy.

```

[edit services ipsec-vpn rule ipsec_rule]
user@host# set term ipsec_dynamic from source-address 192.168.195.34/32
user@host# set term ipsec_dynamic then remote-gateway 10.10.1.1
user@host# set term ipsec_dynamic then dynamic ike-policy ike_policy
user@host# set term ipsec_dynamic then dynamic ipsec-policy ipsec_policy
user@host# set match-direction input

```

21. On R1, define the IPsec proposal for the dynamic SA.

```

[edit services ipsec-vpn ipsec proposal ipsec_prop]
user@host# set protocol ah
user@host# set authentication-algorithm hmac-md5-96

```

22. On R1, define the IPsec policy.

```

[edit services ipsec-vpn ipsec policy ipsec_policy]
user@host# set perfect-forward-secrecy keys group1
user@host# set proposals ipsec_prop

```

23. On R1, configure IKE authentication and encryption details.

```

[edit services ipsec-vpn ike proposal ike_prop]
user@host# set authentication-method pre-shared-keys
user@host# set dh-group group1
user@host# set authentication-algorithm md5
user@host# set encryption-algorithm 3des-cbc

```

24. On R0, define the IKE policy.

```

[edit services ipsec-vpn ike policy ike_policy]
user@host# set proposals ike_prop
user@host# set pre-shared-key ascii-text
"$9$twR6pORlMxNbHsds4aHkCtuBhr-dsoaU"

```

25. On R1, create a service set that defines IPsec-specific information. The first command associates the IKE SA rule with IPsec. The second command defines the address of the local end of the IPsec security tunnel. The last two commands configure the logical interfaces that participate in the IPsec services. Unit 1 is for the IPsec inward-facing traffic. Unit 1001 is for the IPsec outward-facing traffic.

```

[edit services service-set ipsec_svc]
user@host# set ipsec-vpn-rules ipsec_rule
user@host# set ipsec-vpn-options local-gateway 10.10.1.2
user@host# set next-hop-service inside-service-interface sp-2/1/0.1
user@host# set next-hop-service outside-service-interface sp-2/1/0.1001

```

To verify the configuration, run the following commands:

Check which RPs the various routers have learned about.

```

user@host> show pim rps extensive inet

```

Check that the IPsec SA negotiation is successful.

```
user@host> show services ipsec-vpn ipsec security-associations
```

Check that the IKE SA negotiation is successful.

```
user@host> show services ipsec-vpn ike security-associations
```

Check that traffic is traveling over the IPsec tunnel.

```
user@host> show services ipsec-vpn ipsec statistics
```

Example: Configuring Multicast for Virtual Routers with IPv6 Interfaces

A virtual router is a type of simplified routing instance that has a single routing table. This example shows how to configure PIM in a virtual router.

- [Requirements on page 50](#)
- [Overview on page 50](#)
- [Configuration on page 51](#)
- [Verification on page 53](#)

Requirements

Before you begin, configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.

Overview

You can configure PIM for the **virtual-router** instance type as well as for the **vrf** instance type. The **virtual-router** instance type is similar to the **vrf** instance type used with Layer 3 VPNs, except that it is used for non-VPN-related applications.

The **virtual-router** instance type has no VPN routing and forwarding (VRF) import, VRF export, VRF target, or route distinguisher requirements. The **virtual-router** instance type is used for non-Layer 3 VPN situations.

When PIM is configured under the **virtual-router** instance type, the VPN configuration is not based on RFC 2547, *BGP/MPLS VPNs*, so PIM operation does not comply with the Internet draft draft-rosen-vpn-mcast-07.txt, *Multicast in MPLS/BGP VPNs*. In the **virtual-router** instance type, PIM operates in a routing instance by itself, forming adjacencies with PIM neighbors over the routing instance interfaces as the other routing protocols do with neighbors in the routing instance.

This example includes the following general steps:

1. On R1, configure a virtual router instance with three interfaces (**ge-0/0/0.0**, **ge-0/1/0.0**, and **ge-0/1/1.0**).
2. Configure PIM and the RP.
3. Configure an MLD static group containing interfaces **ge-0/1/0.0** and **ge-0/1/1.0**.

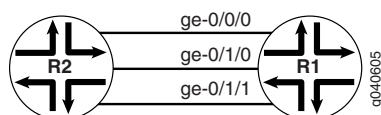
After you configure this example, you should be able to send multicast traffic from R2 through **ge-0/0/0** on R1 to the static group and verify that the traffic egresses from **ge-0/1/0.0** and **ge-0/1/1.0**.



NOTE: Do not include the `group-address` statement for the virtual-router instance type.

Figure 6 on page 51 shows the topology for this example.

Figure 6: Virtual Router Instance with Three Interfaces



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
[edit]
set interfaces ge-0/0/0 unit 0 family inet6 address 2001:4:4:4::1/64
set interfaces ge-0/1/0 unit 0 family inet6 address 2001:24:24:24::1/64
set interfaces ge-0/1/1 unit 0 family inet6 address 2001:7:7:7::1/64
set protocols mld interface ge-0/1/0.0 static group ff0e::10
set protocols mld interface ge-0/1/1.0 static group ff0e::10
set routing-instances mvrfl instance-type virtual-router
set routing-instances mvrfl interface ge-0/0/0.0
set routing-instances mvrfl interface ge-0/1/0.0
set routing-instances mvrfl interface ge-0/1/1.0
set routing-instances mvrfl protocols pim rp local family inet6 address 2001:1:1:1::1
set routing-instances mvrfl protocols pim interface ge-0/0/0.0
set routing-instances mvrfl protocols pim interface ge-0/1/0.0
set routing-instances mvrfl protocols pim interface ge-0/1/1.0
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure multicast for virtual routers:

1. Configure the interfaces.

```
[edit]
user@host# edit interfaces
[edit interfaces]
user@host# set ge-0/0/0 unit 0 family inet6 address 2001:4:4:4::1/64
[edit interfaces]
user@host# set ge-0/1/0 unit 0 family inet6 address 2001:24:24:24::1/64
[edit interfaces]
user@host# set ge-0/1/1 unit 0 family inet6 address 2001:7:7:7::1/64
[edit interfaces]
user@host# exit
```

2. Configure the routing instance type.

```
[edit]
user@host# edit routing-instances
[edit routing-instances]
user@host# set mvrfl instance-type virtual-router
```

3. Configure the interfaces in the routing instance.

```
[edit routing-instances]
user@host# set mvrfl interface ge-0/0/0
[edit routing-instances]
user@host# set mvrfl interface ge-0/1/0
[edit routing-instances]
user@host# set mvrfl interface ge-0/1/1
```

4. Configure PIM and the RP in the routing instance.

```
[edit routing-instances]
user@host# set mvrfl protocols pim rp local family inet6 address 2001:1:1:1::1
```

5. Configure PIM on the interfaces.

```
[edit routing-instances]
user@host# set mvrfl protocols pim interface ge-0/0/0
[edit routing-instances]
user@host# set mvrfl protocols pim interface ge-0/1/0
[edit routing-instances]
user@host# set mvrfl protocols pim interface ge-0/1/1
[edit routing-instances]
user@host# exit
```

6. Configure the MLD group.

```
[edit]
user@host# edit protocols mld
[edit protocols mld]
user@host# set interface ge-0/1/0.0 static group ff0e::10
[edit protocols mld]
user@host# set interface ge-0/1/1.0 static group ff0e::10
```

7. If you are done configuring the device, commit the configuration.

```
[edit routing-instances]
user@host# commit
```

Results

Confirm your configuration by entering the **show interfaces**, **show routing-instances**, and **show protocols** commands.

```
user@host# show interfaces
ge-0/0/0 {
  unit 0 {
    family inet6 {
      address 2001:4:4:4::1/64;
    }
  }
}
```

```

}
ge-0/1/0 {
  unit 0 {
    family inet6 {
      address 2001:24:24:24::1/64;
    }
  }
}
ge-0/1/1 {
  unit 0 {
    family inet6 {
      address 2001:7:7:7::1/64;
    }
  }
}

```

user@host# show routing-instances

```

mvrfl {
  instance-type virtual-router;
  interface ge-0/0/0.0;
  interface ge-0/1/0.0;
  interface ge-0/1/1.0;
  protocols {
    pim {
      rp {
        local {
          family inet6 {
            address 2001:1:1:1::1;
          }
        }
      }
      interface ge-0/0/0.0;
      interface ge-0/1/0.0;
      interface ge-0/1/1.0;
    }
  }
}

```

user@host# show protocols

```

mld {
  interface ge-0/1/0.0 {
    static {
      group ff0e::10;
    }
  }
  interface ge-0/1/1.0 {
    static {
      group ff0e::10;
    }
  }
}

```

Verification

To verify the configuration, run the following commands:

- [show mld group](#)
- [show mld interface](#)
- [show mld statistics](#)
- [show multicast interface](#)
- [show multicast route](#)
- [show multicast rpf](#)
- [show pim interfaces](#)
- [show pim join](#)
- [show pim neighbors](#)
- [show route forwarding-table](#)
- [show route instance](#)
- [show route table](#)

Related Documentation

- [Configuring PIM Auto-RP on page 88](#)
- [Configuring PIM Bootstrap Router on page 84](#)
- [Configuring PIM Dense Mode on page 137](#)
- [Configuring a Designated Router for PIM on page 31](#)
- [Configuring PIM Filtering on page 96](#)
- [Example: Configuring Nonstop Active Routing for PIM on page 124](#)
- [Examples: Configuring PIM RPT and SPT Cutover on page 103](#)
- [Configuring PIM Sparse-Dense Mode on page 140](#)
- [Configuring PIM and the Bidirectional Forwarding Detection \(BFD\) Protocol on page 118](#)
- [Configuring Basic PIM Settings on page 21](#)

Example: Configuring Bidirectional PIM

- [Understanding Bidirectional PIM on page 54](#)
- [Example: Configuring Bidirectional PIM on page 60](#)

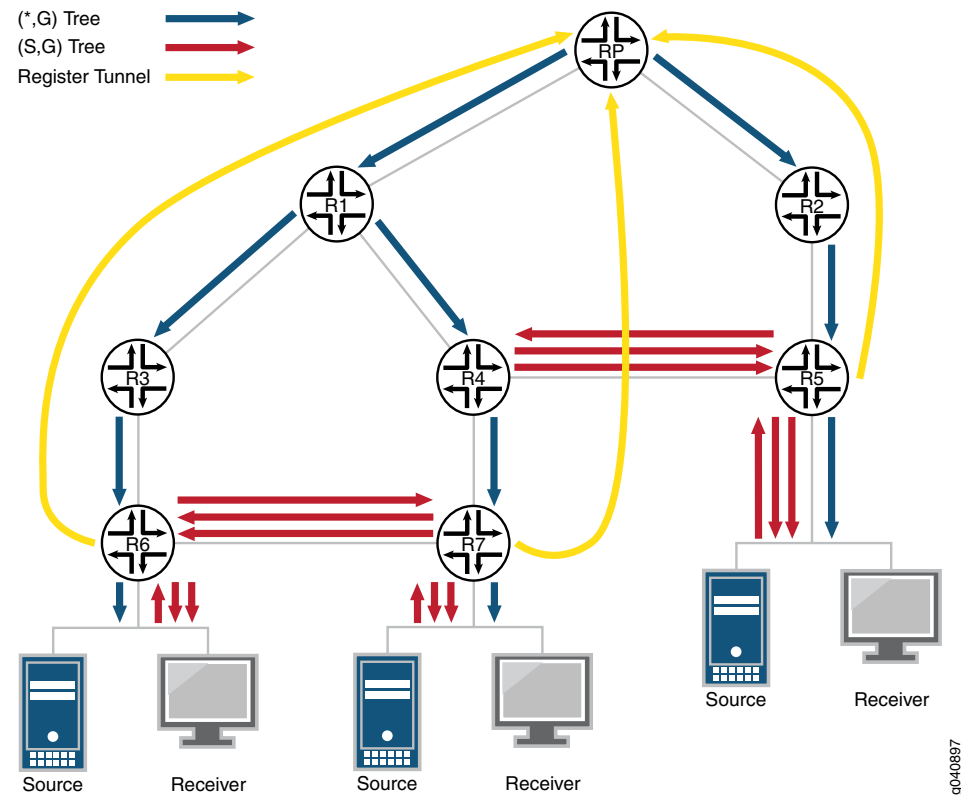
Understanding Bidirectional PIM

Bidirectional PIM (PIM-Bidir) is specified by the IETF in RFC 5015, *Bidirectional Protocol Independent Multicast (BIDIR-PIM)*. It provides an alternative to other PIM modes, such as PIM sparse mode (PIM-SM), PIM dense mode (PIM-DM), and PIM source-specific multicast (SSM). In bidirectional PIM, multicast groups are carried across the network over bidirectional shared trees. This type of tree minimizes the amount of PIM routing state information that must be maintained, which is especially important in networks with numerous and dispersed senders and receivers. For example, one important

application for bidirectional PIM is distributed inventory polling. In many-to-many applications, a multicast query from one station generates multicast responses from many stations. For each multicast group, such an application generates a large number of (S,G) routes for each station in PIM-SM, PIM-DM, or SSM. The problem is even worse in applications that use bursty sources, resulting in frequently changing multicast tables and, therefore, performance problems in routers.

Figure 7 on page 55 shows the traffic flows generated to deliver traffic for one group to and from three stations in a PIM-SM network.

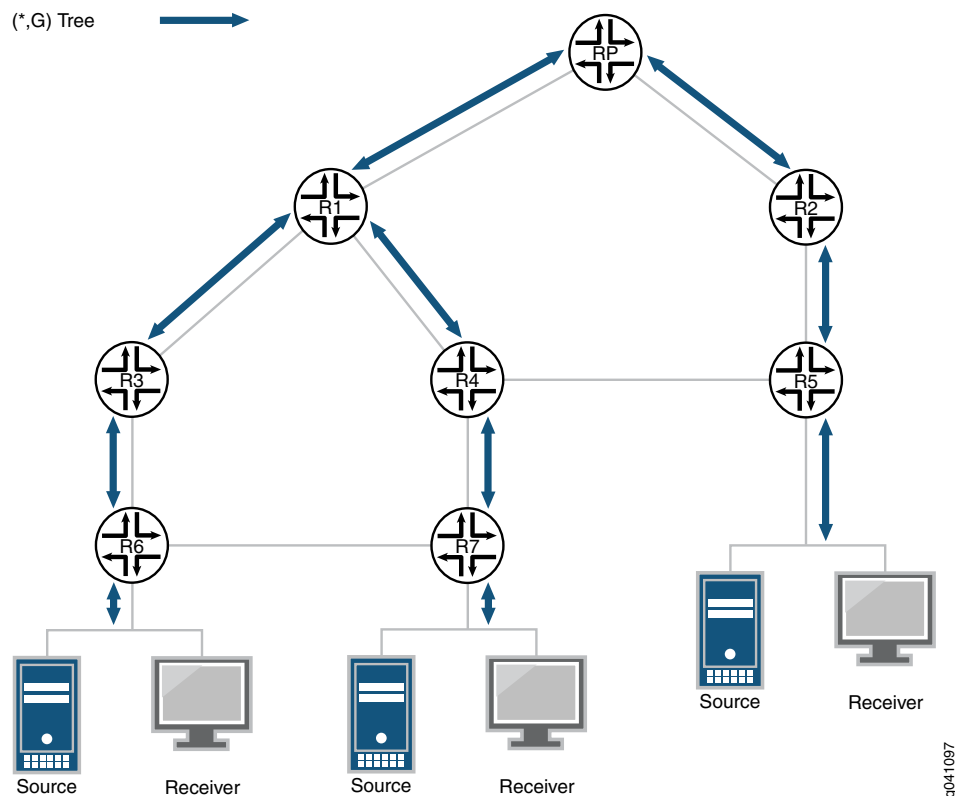
Figure 7: Example PIM Sparse-Mode Tree



Bidirectional PIM solves this problem by building only group-specific (*,G) state. Thus, only a single (*,G) route is needed for each group to deliver traffic to and from all the sources.

Figure 8 on page 56 shows the traffic flows generated to deliver traffic for one group to and from three stations in a bidirectional PIM network.

Figure 8: Example Bidirectional PIM Tree



Bidirectional PIM builds bidirectional shared trees that are rooted at a rendezvous point (RP) address. Bidirectional traffic does not switch to shortest path trees (SPTs) as in PIM-SM and is therefore optimized for routing state size instead of path length. Bidirectional PIM routes are always wildcard-source (*,G) routes. The protocol eliminates the need for (S,G) routes and data-triggered events. The bidirectional (*,G) group trees carry traffic both upstream from senders toward the RP, and downstream from the RP to receivers. As a consequence, the strict reverse path forwarding (RPF)-based rules found in other PIM modes do not apply to bidirectional PIM. Instead, bidirectional PIM routes forward traffic from all sources and the RP. Thus, bidirectional PIM routers must have the ability to accept traffic on many potential incoming interfaces.

Designated Forwarder Election

To prevent forwarding loops, only one router on each link or subnet (including point-to-point links) is a designated forwarder (DF). The responsibilities of the DF are to forward downstream traffic onto the link toward the receivers and to forward upstream traffic from the link toward the RP address. Bidirectional PIM relies on a process called DF election to choose the DF router for each interface and for each RP address. Each bidirectional PIM router in a subnet advertises its interior gateway protocol (IGP) unicast route to the RP address. The router with the best IGP unicast route to the RP address wins the DF election. Each router advertises its IGP route metrics in DF Offer, Winner, Backoff, and Pass messages.

Junos OS implements the DF election procedures as stated in RFC 5015, except that Junos OS checks RP unicast reachability before accepting incoming DF messages. DF messages for unreachable rendezvous points are ignored.

Bidirectional PIM Modes

In the Junos OS implementation, there are two modes for bidirectional PIM: bidirectional-sparse and bidirectional-sparse-dense. The differences between bidirectional-sparse and bidirectional-sparse-dense modes are the same as the differences between sparse mode and sparse-dense mode. Sparse-dense mode allows the interface to operate on a per-group basis in either sparse or dense mode. A group specified as “dense” is not mapped to an RP. Use bidirectional-sparse-dense mode when you have a mix of bidirectional groups, sparse groups, and dense groups in your network. One typical scenario for this is the use of auto-RP, which uses dense-mode flooding to bootstrap itself for sparse mode or bidirectional mode. In general, the dense groups could be for any flows that the network design requires to be flooded.

Each group-to-RP mapping is controlled by the RP **group-ranges** statement and the **ssm-groups** statement.

The choice of PIM mode is closely tied to controlling how groups are mapped to PIM modes, as follows:

- **bidirectional-sparse**—Use if all multicast groups are operating in bidirectional, sparse, or SSM mode.
- **bidirectional-sparse-dense**—Use if multicast groups, except those that are specified in the **dense-groups** statement, are operating in bidirectional, sparse, or SSM mode.

Bidirectional Rendezvous Points

You can configure group-range-to-RP mappings network-wide statically, or only on routers connected to the RP addresses and advertise them dynamically. Unlike rendezvous points for PIM-SM, which must de-encapsulate PIM Register messages and perform other specific protocol actions, bidirectional PIM rendezvous points implement no specific functionality. RP addresses are simply a location in the network to rendezvous toward. In fact, RP addresses need not be loopback interface addresses or even be addresses configured on any router, as long as they are covered by a subnet that is connected to a bidirectional PIM-capable router and advertised to the network.

Thus, for bidirectional PIM, there is no meaningful distinction between static and local RP addresses. Therefore, bidirectional PIM rendezvous points are configured at the **[edit protocols pim rp bidirectional]** hierarchy level, not under **static** or **local**.

The settings at the **[edit protocol pim rp bidirectional]** hierarchy level function like the settings at the **[edit protocols pim rp local]** hierarchy level, except that they create bidirectional PIM RP state instead of PIM-SM RP state.

Where only a single local RP can be configured, multiple bidirectional rendezvous points can be configured having group ranges that are the same, different, or overlapping. It is also permissible for a group range or RP address to be configured as bidirectional and either static or local for sparse-mode.

If a bidirectional PIM RP is configured without a group range, the default group range is 224/4 for IPv4. For IPv6, the default is ff00::/8. You can configure a bidirectional PIM RP group range to cover an SSM group range, but in that case the SSM or DM group range takes precedence over the bidirectional PIM RP configuration for those groups. In other words, because SSM always takes precedence, it is not permitted to have a bidirectional group range equal to or more specific than an SSM or DM group range.

PIM Bootstrap and Auto-RP Support

Group ranges for the specified RP address are flagged by PIM as bidirectional PIM group-to-RP mappings and, if configured, are advertised using PIM bootstrap or auto-RP. Dynamic advertisement of bidirectional PIM-flagged group-to-RP mappings using PIM bootstrap, and auto-RP is controlled as normal using the **bootstrap** and **auto-rp** statements.

Bidirectional PIM RP addresses configured at the **[edit protocols pim rp bidirectional address]** hierarchy level are advertised by auto-RP or PIM bootstrap if the following prerequisites are met:

- The routing instance must be configured to advertise candidate rendezvous points by way of auto-RP or PIM bootstrap, and an auto-RP mapping agent or bootstrap router, respectively, must be elected.
- The RP address must either be configured locally on an interface in the routing instance, or the RP address must belong to a subnet connected to an interface in the routing instance.

IGMP and MLD Support

Internet Group Management Protocol (IGMP) version 1, version 2, and version 3 are supported with bidirectional PIM. Multicast Listener Discovery (MLD) version 1 and version 2 are supported with bidirectional PIM. However, in all cases, only anysource multicast (ASM) state is supported for bidirectional PIM membership.

The following rules apply to bidirectional PIM:

- IGMP and MLD (*G) membership reports trigger the PIM DF to originate bidirectional PIM (*G) join messages.
- IGMP and MLD (S,G) membership reports do not trigger the PIM DF to originate bidirectional PIM (*G) join messages.

Bidirectional PIM and Graceful Restart

Bidirectional PIM accepts packets for a bidirectional route on multiple interfaces. This means that some topologies might develop multicast routing loops if all PIM neighbors are not synchronized with regard to the identity of the designated forwarder (DF) on each link. If one router is forwarding without actively participating in DF elections, particularly after unicast routing changes, multicast routing loops might occur.

If graceful restart for PIM is enabled and bidirectional PIM is enabled, the default graceful restart behavior is to continue forwarding packets on bidirectional routes. If the gracefully

restarting router was serving as a DF for some interfaces to rendezvous points, the restarting router sends a DF Winner message with a metric of 0 on each of these RP interfaces. This ensures that a neighbor router does not become the DF due to unicast topology changes that might occur during the graceful restart period. Sending a DF Winner message with a metric of 0 prevents another PIM neighbor from assuming the DF role until after graceful restart completes. When graceful restart completes, the gracefully restarted router sends another DF Winner message with the actual converged unicast metric.

The `no-bidirectional-mode` statement at the `[edit protocols pim graceful-restart]` hierarchy level overrides the default behavior and disables forwarding for bidirectional PIM routes during graceful restart recovery, both in cases of simple routing protocol process (rpd) restart and graceful Routing Engine switchover. This configuration statement provides a very conservative alternative to the default graceful restart behavior for bidirectional PIM routes. The reason to discontinue forwarding of packets on bidirectional routes is that the continuation of forwarding might lead to short-duration multicast loops in rare double-failure circumstances.

Junos OS Enhancements to Bidirectional PIM

In addition to the functionality specified in RFC 5015, the following functions are included in the Junos OS implementation of bidirectional PIM:

- Source-only branches without PIM join state
- Support for both IPv4 and IPv6 domain and multicast addresses
- Nonstop routing (NSR) for bidirectional PIM routes
- Support for bidirectional PIM in logical systems
- Support for non-forwarding and virtual router instances

Limitations of Bidirectional PIM

The Junos OS implementation of bidirectional PIM does not support the following functionality:

- SNMP for bidirectional PIM.
- Graceful Routing Engine switchover is configurable with bidirectional PIM enabled, but bidirectional routes do not forward packets during the switchover.
- Multicast VPNs (Draft Rosen and NextGen).

The bidirectional PIM protocol does not support the following functionality:

- Embedded RP
- Anycast RP

Example: Configuring Bidirectional PIM

This example shows how to configure bidirectional PIM, as specified in RFC 5015, *Bidirectional Protocol Independent Multicast (BIDIR-PIM)*.

- [Requirements on page 60](#)
- [Overview on page 60](#)
- [Configuration on page 62](#)
- [Verification on page 66](#)

Requirements

This example uses the following hardware and software components:

- Eight Juniper Networks routers that can be M120, M320, MX Series, or T Series platforms. To support bidirectional PIM, M Series platforms must have I-chip FPCs. M7i, M10i, M40e, and other older M Series routers do not support bidirectional PIM.
- Junos OS Release 12.1 or later running on all eight routers.

Overview

Compared to PIM sparse mode, bidirectional PIM requires less PIM router state information. Because less state information is required, bidirectional PIM scales well and is useful in deployments with many dispersed sources and receivers.

In this example, two rendezvous points are configured statically. One RP is configured as a phantom RP. A phantom RP is an RP address that is a valid address on a subnet, but is not assigned to a PIM router interface. The subnet must be reachable by the bidirectional PIM routers in the network. For the other (non-phantom) RP in this example, the RP address is assigned to a PIM router interface. It can be assigned to either the loopback interface or any physical interface on the router. In this example, it is assigned to a physical interface.

OSPF is used as the interior gateway protocol (IGP) in this example. The OSPF metric determines the designated forwarder (DF) election process. In bidirectional PIM, the DF establishes a loop-free shortest-path tree that is rooted at the RP. On every network segment and point-to-point link, all PIM routers participate in DF election. The procedure selects one router as the DF for every RP of bidirectional groups. This router forwards multicast packets received on that network upstream to the RP. The DF election uses the same tie-break rules used by PIM assert processes.

This example uses the default DF election parameters. Optionally, at the **[edit protocols pim interface (interface-name | all) bidirectional]** hierarchy level, you can configure the following parameters related to the DF election:

- The robustness-count is the minimum number of DF election messages that must be lost for election to fail.
- The offer period is the interval to wait between repeated DF Offer and Winner messages.

- The backoff period is the period that the acting DF waits between receiving a better DF Offer and sending the Pass message to transfer DF responsibility.

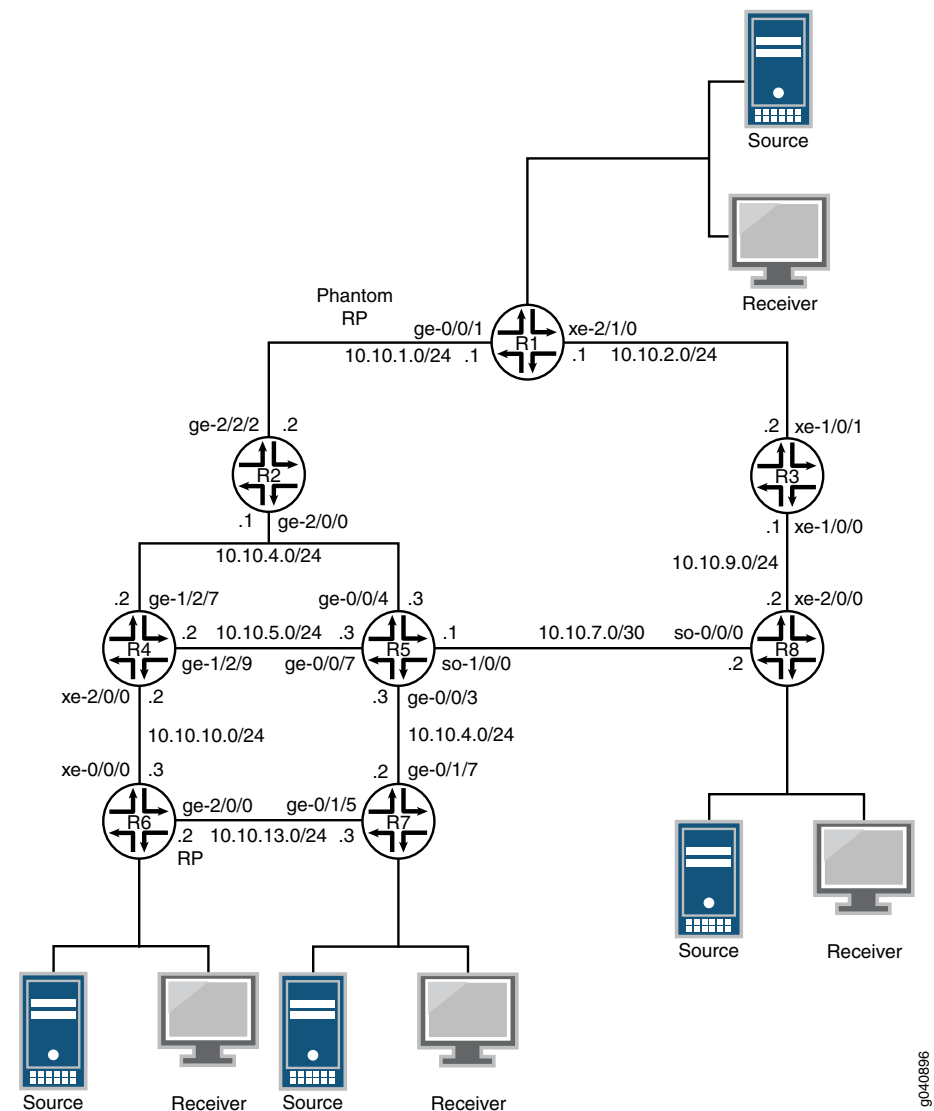
This example uses bidirectional-sparse-dense mode on the interfaces. The choice of PIM mode is closely tied to controlling how groups are mapped to PIM modes, as follows:

- **bidirectional-sparse**—Use if all multicast groups are operating in bidirectional, sparse, or SSM mode.
- **bidirectional-sparse-dense**—Use if multicast groups, except those that are specified in the **dense-groups** statement, are operating in bidirectional, sparse, or SSM mode.

Topology Diagram

Figure 9 on page 61 shows the topology used in this example.

Figure 9: Bidirectional PIM with Statically Configured rendezvous points



Configuration

CLI Quick Configuration	To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the [edit] hierarchy level.
Router R1	<pre> set interfaces ge-0/0/1 unit 0 family inet address 10.10.1.1/24 set interfaces xe-2/1/0 unit 0 family inet address 10.10.2.1/24 set interfaces lo0 unit 0 family inet address 10.255.11.11/32 set protocols ospf area 0.0.0.0 interface ge-0/0/1.0 set protocols ospf area 0.0.0.0 interface xe-2/1/0.0 set protocols ospf area 0.0.0.0 interface lo0.0 set protocols ospf area 0.0.0.0 interface fxp0.0 disable set protocols pim traceoptions file df set protocols pim traceoptions flag bidirectional-df-election detail set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24 set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24 set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24 set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24 set protocols pim interface ge-0/0/1.0 mode bidirectional-sparse-dense set protocols pim interface xe-2/1/0.0 mode bidirectional-sparse-dense </pre>
Router R2	<pre> set interfaces ge-2/0/0 unit 0 family inet address 10.10.4.1/24 set interfaces ge-2/2/2 unit 0 family inet address 10.10.1.2/24 set interfaces lo0 unit 0 family inet address 10.255.22.22/32 set protocols ospf area 0.0.0.0 interface fxp0.0 disable set protocols ospf area 0.0.0.0 interface ge-2/2/2.0 set protocols ospf area 0.0.0.0 interface lo0.0 set protocols ospf area 0.0.0.0 interface ge-2/0/0.0 set protocols pim traceoptions file df set protocols pim traceoptions flag bidirectional-df-election detail set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24 set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24 set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24 set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24 set protocols pim interface fxp0.0 disable set protocols pim interface ge-2/0/0.0 mode bidirectional-sparse-dense set protocols pim interface ge-2/2/2.0 mode bidirectional-sparse-dense </pre>
Router R3	<pre> set interfaces xe-1/0/0 unit 0 family inet address 10.10.9.1/24 set interfaces xe-1/0/1 unit 0 family inet address 10.10.2.2/24 set interfaces lo0 unit 0 family inet address 10.255.33.33/32 set protocols ospf area 0.0.0.0 interface xe-1/0/1.0 set protocols ospf area 0.0.0.0 interface lo0.0 set protocols ospf area 0.0.0.0 interface fxp0.0 disable set protocols ospf area 0.0.0.0 interface xe-1/0/0.0 set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24 set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24 set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24 set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24 set protocols pim interface xe-1/0/1.0 mode bidirectional-sparse-dense set protocols pim interface xe-1/0/0.0 mode bidirectional-sparse-dense </pre>

Router R4

```

set interfaces ge-1/2/7 unit 0 family inet address 10.10.4.2/24
set interfaces ge-1/2/8 unit 0 family inet address 10.10.5.2/24
set interfaces xe-2/0/0 unit 0 family inet address 10.10.10.2/24
set interfaces lo0 unit 0 family inet address 10.255.44.44/32
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols ospf area 0.0.0.0 interface ge-1/2/7.0
set protocols ospf area 0.0.0.0 interface ge-1/2/8.0
set protocols ospf area 0.0.0.0 interface xe-2/0/0.0
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols pim traceoptions file df
set protocols pim traceoptions flag bidirectional-df-election detail
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim interface xe-2/0/0.0 mode bidirectional-sparse-dense
set protocols pim interface ge-1/2/7.0 mode bidirectional-sparse-dense
set protocols pim interface ge-1/2/8.0 mode bidirectional-sparse-dense

```

Router R5

```

set interfaces ge-0/0/3 unit 0 family inet address 10.10.12.3/24
set interfaces ge-0/0/4 unit 0 family inet address 10.10.4.3/24
set interfaces ge-0/0/7 unit 0 family inet address 10.10.5.3/24
set interfaces so-1/0/0 unit 0 family inet address 10.10.7.1/30
set interfaces lo0 unit 0 family inet address 10.255.55.55/32
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface ge-0/0/7.0
set protocols ospf area 0.0.0.0 interface ge-0/0/4.0
set protocols ospf area 0.0.0.0 interface so-1/0/0.0
set protocols ospf area 0.0.0.0 interface ge-0/0/3.0
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim interface ge-0/0/7.0 mode bidirectional-sparse-dense
set protocols pim interface ge-0/0/4.0 mode bidirectional-sparse-dense
set protocols pim interface so-1/0/0.0 mode bidirectional-sparse-dense
set protocols pim interface ge-0/0/3.0 mode bidirectional-sparse-dense

```

Router R6

```

set interfaces xe-0/0/0 unit 0 family inet address 10.10.10.3/24
set interfaces ge-2/0/0 unit 0 family inet address 10.10.13.2/24
set interfaces lo0 unit 0 family inet address 10.255.66.66/32
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols ospf area 0.0.0.0 interface ge-2/0/0.0
set protocols ospf area 0.0.0.0 interface xe-0/0/0.0
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim interface fxp0.0 disable
set protocols pim interface xe-0/0/0.0 mode bidirectional-sparse-dense
set protocols pim interface ge-2/0/0.0 mode bidirectional-sparse-dense

```

Router R7

```

set interfaces ge-0/1/5 unit 0 family inet address 10.10.13.3/24

```

```

set interfaces ge-0/1/7 unit 0 family inet address 10.10.12.2/24
set interfaces lo0 unit 0 family inet address 10.255.77.77/32
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface ge-0/1/5.0
set protocols ospf area 0.0.0.0 interface ge-0/1/7.0
set protocols ospf area 0.0.0.0 interface lo0.0
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim interface ge-0/1/5.0 mode bidirectional-sparse-dense
set protocols pim interface ge-0/1/7.0 mode bidirectional-sparse-dense

```

Router R8

```

set interfaces so-0/0/0 unit 0 family inet address 10.10.7.2/30
set interfaces xe-2/0/0 unit 0 family inet address 10.10.9.2/24
set interfaces lo0 unit 0 family inet address 10.255.88.88/32
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface xe-2/0/0.0
set protocols ospf area 0.0.0.0 interface so-0/0/0.0
set protocols pim traceoptions file df
set protocols pim traceoptions flag bidirectional-df-election detail
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 224.1.1.0/24
set protocols pim rp bidirectional address 10.10.13.2 group-ranges 225.1.1.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 224.1.3.0/24
set protocols pim rp bidirectional address 10.10.1.3 group-ranges 225.1.3.0/24
set protocols pim interface xe-2/0/0.0 mode bidirectional-sparse-dense
set protocols pim interface so-0/0/0.0 mode bidirectional-sparse-dense

```

Router R1

Step-by-Step Procedure To configure Router R1:

1. Configure the router interfaces.

```

[edit interfaces]
user@R1# set ge-0/0/1 unit 0 family inet address 10.10.1.1/24
user@R1# set xe-2/1/0 unit 0 family inet address 10.10.2.1/24
user@R1# set lo0 unit 0 family inet address 10.255.11.11/32

```

2. Configure OSPF on the interfaces.

```

[edit protocols ospf area 0.0.0.0]
user@R1# set interface ge-0/0/1.0
user@R1# set interface xe-2/1/0.0
user@R1# set interface lo0.0
user@R1# set interface fxp0.0 disable

```

3. Configure the group-to-RP mappings.

```

[edit protocols pim rp bidirectional]
user@R1# set address 10.10.1.3 group-ranges 224.1.3.0/24
user@R1# set address 10.10.1.3 group-ranges 225.1.3.0/24
user@R1# set address 10.10.13.2 group-ranges 224.1.1.0/24
user@R1# set address 10.10.13.2 group-ranges 225.1.1.0/24

```


The RP represented by IP address 10.10.1.3 is a phantom RP. The 10.10.1.3 address is not assigned to any interface on any of the routers in the topology. It is, however, a reachable address. It is in the subnet between Routers R1 and R2.

The RP represented by address 10.10.13.2 is assigned to the **ge-2/0/0** interface on Router R6.

4. Enable bidirectional PIM on the interfaces.

```
[edit protocols pim]
user@R1# set interface ge-0/0/1.0 mode bidirectional-sparse-dense
user@R1# set interface xe-2/1/0.0 mode bidirectional-sparse-dense
```

5. (Optional) Configure tracing operations for the DF election process.

```
[edit protocols pim]
user@R1# set traceoptions file df
user@R1# set traceoptions flag bidirectional-df-election detail
```

Results

From configuration mode, confirm your configuration by entering the **show interfaces** and **show protocols** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@R1# show interfaces
ge-0/0/1 {
  unit 0 {
    family inet {
      address 10.10.1.1/24;
    }
  }
}
xe-2/1/0 {
  unit 0 {
    family inet {
      address 10.10.2.1/24;
    }
  }
}
lo0 {
  unit 0 {
    family inet {
      address 10.255.11.11/32;
    }
  }
}
}

user@R1# show protocols
ospf {
  area 0.0.0.0 {
    interface ge-0/0/1.0;
    interface xe-2/1/0.0;
    interface lo0.0;
    interface fxp0.0 {
      disable;
    }
  }
}
```

```
    }  
  }  
  pim {  
    rp {  
      bidirectional {  
        address 10.10.1.3 { # phantom RP  
          group-ranges {  
            224.1.3.0/24;  
            225.1.3.0/24;  
          }  
        }  
        address 10.10.13.2 {  
          group-ranges {  
            224.1.1.0/24;  
            225.1.1.0/24;  
          }  
        }  
      }  
    }  
  }  
  interface ge-0/0/1.0 {  
    mode bidirectional-sparse-dense;  
  }  
  interface xe-2/1/0.0 {  
    mode bidirectional-sparse-dense;  
  }  
  traceoptions {  
    file df;  
    flag bidirectional-df-election detail;  
  }  
}
```

If you are done configuring the router, enter **commit** from configuration mode.

Repeat the procedure for every Juniper Networks router in the bidirectional PIM network, using the appropriate interface names and addresses for each router.

Verification

Confirm that the configuration is working properly.

- [Verifying Rendezvous Points on page 67](#)
- [Verifying Messages on page 67](#)
- [Checking the PIM Join State on page 67](#)
- [Displaying the Designated Forwarder on page 69](#)
- [Displaying the PIM Interfaces on page 69](#)
- [Checking the PIM Neighbors on page 69](#)
- [Checking the Route to the Rendezvous Points on page 70](#)
- [Verifying Multicast Routes on page 70](#)
- [Viewing Multicast Next Hops on page 72](#)

Verifying Rendezvous Points

Purpose Verify the group-to-RP mapping information.

Action user@R1> `show pim rps`
 Instance: PIM.master
 Address family INET

RP address	Type	Mode	Holdtime	Timeout	Groups	Group prefixes
10.10.1.3	static	bidir	150	None	2	224.1.3.0/24 225.1.3.0/24
10.10.13.2	static	bidir	150	None	2	224.1.1.0/24 225.1.1.0/24

Verifying Messages

Purpose Check the number of DF election messages sent and received, and check bidirectional join and prune error statistics.

Action user@R1> `show pim statistics`

PIM Message type	Received	Sent	Rx errors
V2 Hello	16	34	0
...			
V2 DF Election	18	38	0
...			

Global Statistics

...

Rx Bidir Join/Prune on non-Bidir if	0
Rx Bidir Join/Prune on non-DF if	0

Checking the PIM Join State

Purpose Confirm the upstream interface, neighbor, and state information.

Action user@R1> `show pim join extensive`
 Instance: PIM.master Family: INET
 R = Rendezvous Point Tree, S = Sparse, W = Wildcard

```
Group: 224.1.1.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.13.2
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0
  Upstream neighbor: 10.10.1.2
  Upstream state: None
  Bidirectional accepting interfaces:
    Interface: ge-0/0/1.0    (RPF)
    Interface: lo0.0        (DF Winner)
```

```
Group: 224.1.3.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.1.3
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0 (RP Link)
  Upstream neighbor: Direct
  Upstream state: Local RP
  Bidirectional accepting interfaces:
    Interface: ge-0/0/1.0    (RPF)
    Interface: lo0.0        (DF Winner)
    Interface: xe-2/1/0.0    (DF Winner)
```

```
Group: 225.1.1.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.13.2
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0
  Upstream neighbor: 10.10.1.2
  Upstream state: None
  Bidirectional accepting interfaces:
    Interface: ge-0/0/1.0    (RPF)
    Interface: lo0.0        (DF Winner)
```

```
Group: 225.1.3.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.1.3
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0 (RP Link)
  Upstream neighbor: Direct
  Upstream state: Local RP
  Bidirectional accepting interfaces:
    Interface: ge-0/0/1.0    (RPF)
    Interface: lo0.0        (DF Winner)
    Interface: xe-2/1/0.0    (DF Winner)
```

Meaning The output shows a (*G-range) entry for each active bidirectional RP group range. These entries provide a hierarchy from which the individual (*G) routes inherit RP-derived state (upstream information and accepting interfaces). These entries also provide the control plane basis for the (*, G-range) forwarding routes that implement the sender-only branches of the tree.

Displaying the Designated Forwarder

Purpose Display RP address information and confirm the DF elected.

Action user@R1> `show pim bidirectional df-election`
 Instance: PIM.master Family: INET

RPA: 10.10.1.3
 Group ranges: 224.1.3.0/24, 225.1.3.0/24
 Interfaces:

ge-0/0/1.0	(RPL)	DF: none
lo0.0	(Win)	DF: 10.255.179.246
xe-2/1/0.0	(Win)	DF: 10.10.2.1

RPA: 10.10.13.2
 Group ranges: 224.1.1.0/24, 225.1.1.0/24
 Interfaces:

ge-0/0/1.0	(Lose)	DF: 10.10.1.2
lo0.0	(Win)	DF: 10.255.179.246
xe-2/1/0.0	(Lose)	DF: 10.10.2.2

Displaying the PIM Interfaces

Purpose Verify that the PIM interfaces have bidirectional-sparse-dense (SDB) mode assigned.

Action user@R1> `show pim interfaces`
 Instance: PIM.master

Stat = Status, V = Version, NbrCnt = Neighbor Count,
 S = Sparse, D = Dense, B = Bidirectional,
 DR = Designated Router, P2P = Point-to-point link,
 Active = Bidirectional is active, NotCap = Not Bidirectional Capable

Name	Stat	Mode	IP	V	State	NbrCnt	JoinCnt(sg/*g)	DR address
ge-0/0/1.0	Up	SDB	4	2	NotDR,Active	1	0/0	10.10.1.2
lo0.0	Up	SDB	4	2	DR,Active	0	9901/100	10.255.179.246
xe-2/1/0.0	Up	SDB	4	2	NotDR,Active	1	0/0	10.10.2.2

Checking the PIM Neighbors

Purpose Check that the router detects that its neighbors are enabled for bidirectional PIM by verifying that the **B** option is displayed.

Action user@R1> `show pim neighbors`

Instance: PIM.master

B = Bidirectional Capable, G = Generation Identifier,

H = Hello Option Holdtime, L = Hello Option LAN Prune Delay,

P = Hello Option DR Priority, T = Tracking Bit

Interface	IP V Mode	Option	Uptime Neighbor addr
ge-0/0/1.0	4 2	HPLGBT	00:06:46 10.10.1.2
xe-2/1/0.0	4 2	HPLGBT	00:06:46 10.10.2.2

Checking the Route to the Rendezvous Points

Purpose Check the interface route to the rendezvous points.

Action user@R1> `show route 10.10.13.2`

inet.0: 56 destinations, 56 routes (55 active, 0 holddown, 1 hidden)

+ = Active Route, - = Last Active, * = Both

```
10.10.13.0/24      *[OSPF/10] 00:04:35, metric 4
                   > to 10.10.1.2 via ge-0/0/1.0
```

user@R1> `show route 10.10.1.3`

inet.0: 56 destinations, 56 routes (55 active, 0 holddown, 1 hidden)

+ = Active Route, - = Last Active, * = Both

```
10.10.1.0/24      *[Direct/0] 00:06:25
                   > via ge-0/0/1.0
```

Verifying Multicast Routes

Purpose Verify the multicast traffic route for each group.

For bidirectional PIM, the `show multicast route extensive` command shows the (*,G/prefix) forwarding routes and the list of interfaces that accept bidirectional PIM traffic.

Action user@R1> `show multicast route extensive`
Family: INET

```

Group: 224.0.0.0/4
  Source: *
  Incoming interface list:
    lo0.0 ge-0/0/1.0 xe-4/1/0.0
  Downstream interface list:
    ge-0/0/1.0
  Session description: zeroconfaddr
  Statistics: 0 kbps, 0 pps, 0 packets
  Next-hop ID: 2097157
  Incoming interface list ID: 559
  Upstream protocol: PIM
  Route state: Active
  Forwarding state: Forwarding
  Cache lifetime/timeout: forever
  Wrong incoming interface notifications: 0

Group: 224.1.1.0/24
  Source: *
  Incoming interface list:
    lo0.0 ge-0/0/1.0
  Downstream interface list:
    ge-0/0/1.0
  Session description: NOB Cross media facilities
  Statistics: 0 kbps, 0 pps, 0 packets
  Next-hop ID: 2097157
  Incoming interface list ID: 579
  Upstream protocol: PIM
  Route state: Active
  Forwarding state: Forwarding
  Cache lifetime/timeout: forever
  Wrong incoming interface notifications: 0

Group: 224.1.3.0/24
  Source: *
  Incoming interface list:
    lo0.0 ge-0/0/1.0 xe-4/1/0.0
  Downstream interface list:
    ge-0/0/1.0
  Session description: NOB Cross media facilities
  Statistics: 0 kbps, 0 pps, 0 packets
  Next-hop ID: 2097157
  Incoming interface list ID: 556
  Upstream protocol: PIM
  Route state: Active
  Forwarding state: Forwarding
  Cache lifetime/timeout: forever
  Wrong incoming interface notifications: 0

Group: 225.1.1.0/24
  Source: *
  Incoming interface list:
    lo0.0 ge-0/0/1.0
  Downstream interface list:
    ge-0/0/1.0
  Session description: Unknown
  Statistics: 0 kbps, 0 pps, 0 packets
  Next-hop ID: 2097157

```

```

Incoming interface list ID: 579
Upstream protocol: PIM
Route state: Active
Forwarding state: Forwarding
Cache lifetime/timeout: forever
Wrong incoming interface notifications: 0

```

```

Group: 225.1.3.0/24
Source: *
Incoming interface list:
  lo0.0 ge-0/0/1.0 xe-4/1/0.0
Downstream interface list:
  ge-0/0/1.0
Session description: Unknown
Statistics: 0 kbps, 0 pps, 0 packets
Next-hop ID: 2097157
Incoming interface list ID: 556
Upstream protocol: PIM
Route state: Active
Forwarding state: Forwarding
Cache lifetime/timeout: forever
Wrong incoming interface notifications: 0

```

Meaning For information about how the incoming and outgoing interface lists are derived, see the forwarding rules in RFC 5015.

Viewing Multicast Next Hops

Purpose Verify that the correct accepting interfaces are shown in the incoming interface list.

```

Action user@R1> show multicast next-hops
Family: INET
ID      Refcount KRefCount Downstream interface
2097157      10         5 ge-0/0/1.0

```

```

Family: Incoming interface list
ID      Refcount KRefCount Downstream interface
579      5         2 lo0.0
          ge-0/0/1.0
556      5         2 lo0.0
          ge-0/0/1.0
          xe-4/1/0.0
559      3         1 lo0.0
          ge-0/0/1.0
          xe-4/1/0.0

```

Meaning The nexthop IDs for the outgoing and incoming next hops are referenced directly in the **show multicast route extensive** command.

Configuring Static RP

- [Understanding Static RP on page 73](#)
- [Configuring Local PIM RPs on page 73](#)
- [Configuring the Static PIM RP Address on the Non-RP Routing Device on page 75](#)

Understanding Static RP

You can configure a static rendezvous point (RP) configuration that is similar to static routes. A static configuration has the benefit of operating in PIM version 1 or version 2. When you configure the static RP, the RP address that you select for a particular group must be consistent across all routers in a multicast domain.

A static configuration is simple and convenient. However, if the statically defined RP router becomes unreachable, there is no automatic failover to another RP router. To remedy this problem, you can use anycast RP.

Configuring Local PIM RPs

Local RP configuration makes the routing device a statically defined RP. Consider statically defining an RP if the network does not have many different RPs defined or if the RP assignment does not change very often. The Junos IPv6 PIM implementation supports only static RP configuration. Automatic RP announcement and bootstrap routers are not available with IPv6.

You can configure a local RP globally or for a routing instance. This example shows how to configure a local RP in a routing instance for IPv4 or IPv6.

To configure the routing device's RP properties:

1. Configure the routing instance as the local RP.

```
[routing-instances VPN-A protocols pim]
user@host# set rp local
```

2. Configure the IP protocol family and IP address.

IPv6 PIM hello messages are sent to every interface on which you configure **family inet6**, whether at the PIM level of the hierarchy or not. As a result, if you configure an interface with both **family inet** at the **[edit interface *interface-name*]** hierarchy level and **family inet6** at the **[edit protocols pim interface *interface-name*]** hierarchy level, PIM sends both IPv4 and IPv6 hellos to that interface.

By default, PIM operates in sparse mode on an interface. If you explicitly configure sparse mode, PIM uses this setting for all IPv6 multicast groups. However, if you configure sparse-dense mode, PIM does not accept IPv6 multicast groups as dense groups and operates in sparse mode over them.

```
[edit routing-instances VPN-A protocols pim rp local]
user@host# set family inet6 address 2001:db8:85a3::8a2e:370:7334
user@host# set family inet address 10.1.2.254
```

3. (IPv4 only) Configure the routing device's RP priority.



NOTE: The priority statement is not supported for IPv6, but is included here for informational purposes. The routing device's priority value for becoming the RP is included in the bootstrap messages that the routing device sends. Use a smaller number to increase the likelihood that the routing device becomes the RP for local multicast groups. Each PIM routing device uses the priority value and other factors to determine the candidate RPs for a particular group range. After the set of candidate RPs is distributed, each routing device determines algorithmically the RP from the candidate RP set using a hash function. By default, the priority value is set to 1. If this value is set to 0, the bootstrap router can override the group range being advertised by the candidate RP.

```
[edit routing-instances VPN-A protocols pim rp local]
user@host# set priority 5
```

4. Configure the groups for which the routing device is the RP.

By default, a routing device running PIM is eligible to be the RP for all IPv4 or IPv6 groups (224.0.0.0/4 or FF70::/12 to FFF0::/12). The following example limits the groups for which this routing device can be the RP.

```
[edit routing-instances VPN-A protocols pim rp local]
user@host# set group-ranges fec0::/10
user@host# set group-ranges 10.1.2.0/24
```

5. (IPv4 only) Modify the local RP hold time.

If the local routing device is configured as an RP, it is considered a candidate RP for its local multicast groups. For candidate RPs, the hold time is used by the bootstrap router to time out RPs, and applies to the bootstrap RP-set mechanism. The RP hold time is part of the candidate RP advertisement message sent by the local routing device to the bootstrap router. If the bootstrap router does not receive a candidate RP advertisement from an RP within the hold time, it removes that routing device from its list of candidate RPs. The default hold time is 150 seconds.

```
[edit routing-instances VPN-A protocols pim rp local]
user@host# set hold-time 200
```

6. (Optional) Override dynamic RP for the specified group address range.

If you configure both static RP mapping and dynamic RP mapping (such as auto-RP) in a single routing instance, allow the static mapping to take precedence for the given static RP group range, and allow dynamic RP mapping for all other groups.

If you exclude this statement from the configuration and you use both static and dynamic RP mechanisms for different group ranges within the same routing instance, the dynamic RP mapping takes precedence over the static RP mapping, even if static RP is defined for a specific group range.

```
[edit routing-instances VPN-A protocols pim rp local]
user@host# set override
```

7. Monitor the operation of PIM by running the **show pim** commands. Run **show pim ?** to display the supported commands.

Configuring the Static PIM RP Address on the Non-RP Routing Device

Consider statically defining an RP if the network does not have many different RPs defined or if the RP assignment does not change very often. The Junos IPv6 PIM implementation supports only static RP configuration. Automatic RP announcement and bootstrap routers are not available with IPv6.

You configure a static RP address on the non-RP routing device. This enables the non-RP routing device to recognize the local statically defined RP. For example, if R0 is a non-RP router and R1 is the local RP router, you configure R0 with the static RP address of R1. The static IP address is the routable address assigned to the loopback interface on R1. In the following example, the loopback address of the RP is 2001:db8:85a3::8a2e:370:7334.

You can configure a static RP address globally or for a routing instance. This example shows how to configure a static RP address in a routing instance for IPv6.

To configure the static RP address:

1. On a non-RP routing device, configure the routing instance to point to the routable address assigned to the loopback interface of the RP.

```
[routing-instances VPN-A protocols pim rp]
user@host# set static address 2001:db8:85a3::8a2e:370:7334
```



NOTE: Logical systems are also supported. You can configure a static RP address in a logical system only if the logical system is not directly connected to a source.

2. (Optional) Set the PIM sparse mode version.

For each static RP address, you can optionally specify the PIM version. The default PIM version is version 1.

```
[edit routing-instances VPN-A protocols pim rp]
user@host# set static address 2001:db8:85a3::8a2e:370:7334 version 2
```



NOTE: The default PIM version can be version 1 or version 2, depending on the mode you are configuring. PIM version 1 is the default for RP mode ([edit pim rp static address *address*]). PIM version 2 is the default for interface mode ([edit pim interface *interface-name*]). Explicitly configured versions override the defaults.

3. (Optional) Set the group address range.

By default, a routing device running PIM is eligible to be the RP for all IPv4 or IPv6 groups (224.0.0.0/4 or FF70::/12 to FFF0::/12). The following example limits the groups for which the 2001:db8:85a3::8a2e:370:7334 address can be the RP.

```
[edit routing-instances VPN-A protocols pim rp]
user@host# set static address 2001:db8:85a3::8a2e:370:7334 group-ranges fec0::/10
```

The RP that you select for a particular group must be consistent across all routers in a multicast domain.

4. (Optional) Override dynamic RP for the specified group address range.

If you configure both static RP mapping and dynamic RP mapping (such as auto-RP) in a single routing instance, allow the static mapping to take precedence for the given static RP group range, and allow dynamic RP mapping for all other groups.

If you exclude this statement from the configuration and you use both static and dynamic RP mechanisms for different group ranges within the same routing instance, the dynamic RP mapping takes precedence over the static RP mapping, even if static RP is defined for a specific group range.

```
[edit routing-instances VPN-A protocols pim rp static address
  2001:db8:85a3::8a2e:370:7334]
user@host# set override
```

5. Monitor the operation of PIM by running the **show pim** commands. Run **show pim ?** to display the supported commands.

**Related
Documentation**

- [Configuring PIM Auto-RP on page 88](#)
- [Configuring PIM Bootstrap Router on page 84](#)
- [Configuring a Designated Router for PIM on page 31](#)
- [Examples: Configuring PIM Sparse Mode on page 33](#)
- [Configuring Basic PIM Settings on page 21](#)

Example: Configuring Anycast RP

- [Understanding RP Mapping with Anycast RP on page 76](#)
- [Example: Configuring Multiple RPs in a Domain with Anycast RP on page 77](#)
- [Example: Configuring PIM Anycast With or Without MSDP on page 79](#)
- [Configuring a PIM Anycast RP Router Using Only PIM on page 83](#)

Understanding RP Mapping with Anycast RP

Having a single active rendezvous point (RP) per multicast group is much the same as having a single server providing any service. All traffic converges on this single point, although other servers are sitting idle, and convergence is slow when the resource fails. In multicast specifically, there might be closer RPs on the shared tree, so the use of a single RP is suboptimal.

For the purposes of load balancing and redundancy, you can configure anycast RP. You can use anycast RP within a domain to provide redundancy and RP load sharing. When an RP fails, sources and receivers are taken to a new RP by means of unicast routing. When you configure anycast RP, you bypass the restriction of having one active RP per multicast group, and instead deploy multiple RPs for the same group range. The RP routers share one unicast IP address. Sources from one RP are known to other RPs that

use the Multicast Source Discovery Protocol (MSDP). Sources and receivers use the closest RP, as determined by the interior gateway protocol (IGP).

Anycast means that multiple RP routers share the same unicast IP address. Anycast addresses are advertised by the routing protocols. Packets sent to the anycast address are sent to the nearest RP with this address. Anycast addressing is a generic concept and is used in PIM sparse mode to add load balancing and service reliability to RPs.

Anycast RP is defined in Internet draft draft-ietf-mboned-anycast-rp-08.txt, *Anycast RP Mechanism Using PIM and MSDP*. To access Internet RFCs and drafts, go to the IETF website at <http://www.ietf.org>.

Example: Configuring Multiple RPs in a Domain with Anycast RP

This example shows how to configure anycast RP on each RP router in the PIM-SM domain. With this configuration you can deploy more than one RP for a single group range. This enables load balancing and redundancy.

- [Requirements on page 77](#)
- [Overview on page 77](#)
- [Configuration on page 77](#)
- [Verification on page 79](#)

Requirements

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure PIM Sparse Mode on the interfaces. See “[Enabling PIM Sparse Mode](#)” on [page 37](#).

Overview

When you configure anycast RP, the RP routers in the PIM-SM domain use a shared address. In this example, the shared address is 10.1.1.2/32. Anycast RP uses Multicast Source Discovery Protocol (MSDP) to discover and maintain a consistent view of the active sources. Anycast RP also requires an RP selection method, such as static, auto-RP, or bootstrap RP. This example uses static RP and shows only one RP router configuration.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

RP Routers

```
set interfaces lo0 unit 0 family inet address 192.168.132.1/32 primary
set interfaces lo0 unit 0 family inet address 10.1.1.2/32
set protocols msdp local-address 192.168.132.1
```

```
set protocols msdp peer 192.168.12.1
set protocols pim rp local address 10.1.1.2
set routing-options router-id 192.168.132.1
```

Non-RP Routers `set protocols pim rp static address 10.1.1.2`

Step-by-Step Procedure The following example requires that you navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure anycast RP:

1. On each RP router in the domain, configure the shared anycast address on the router's loopback address.

```
[edit interfaces]
user@host# set lo0 unit 0 family inet address 10.1.1.2/32
```

2. On each RP router in the domain, make sure that the router's regular loopback address is the primary address for the interface, and set the router ID.

```
[edit interfaces]
user@host# set lo0 unit 0 family inet address 192.168.132.1/32 primary
```

```
[edit routing-options]
user@host# set router-id 192.168.132.1
```

3. On each RP router in the domain, configure the local RP address, using the shared address.

```
[edit protocols pim]
user@host# set rp local address 10.1.1.2
```

4. On each RP router in the domain, create MSDP sessions to the other RPs in the domain.

```
[edit protocols msdp]
user@host# set local-address 192.168.132.1
user@host# set peer 192.168.12.1
```

5. On each non-RP router in the domain, configure a static RP address using the shared address.

```
[edit protocols pim]
user@host# set rp static address 10.1.1.2
```

6. If you are done configuring the devices, commit the configuration.

```
user@host# commit
```

Results

From configuration mode, confirm your configuration by entering the **show interfaces**, **show protocols**, and **show routing-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show interfaces
```

```

lo0 {
  unit 0 {
    family inet {
      address 192.168.132.1/32 {
        primary;
      }
      address 10.1.1.2/32;
    }
  }
}

```

On the RP routers:

```

user@host# show protocols
msdp {
  local-address 192.168.132.1;
  peer 192.168.12.1;
}
pim {
  rp {
    local {
      address 10.1.1.2;
    }
  }
}

```

On the non-RP routers:

```

user@host# show protocols
pim {
  rp {
    static {
      address 10.1.1.2;
    }
  }
}

user@host# show routing-options
router-id 192.168.132.1;

```

Verification

To verify the configuration, run the `show pim rps extensive inet` command.

Example: Configuring PIM Anycast With or Without MSDP

When you configure anycast RP, you bypass the restriction of having one active rendezvous point (RP) per multicast group, and instead deploy multiple RPs for the same group range. The RP routers share one unicast IP address. Sources from one RP are known to other RPs that use the Multicast Source Discovery Protocol (MSDP). Sources and receivers use the closest RP, as determined by the interior gateway protocol (IGP).

You can use anycast RP within a domain to provide redundancy and RP load sharing. When an RP stops operating, sources and receivers are taken to a new RP by means of unicast routing.

You can configure anycast RP to use PIM and MSDP for IPv4, or PIM alone for both IPv4 and IPv6 scenarios. Both are discussed in this section.

We recommend a static RP mapping with anycast RP over a bootstrap router and auto-RP configuration because it provides all the benefits of a bootstrap router and auto-RP without the complexity of the BSR and auto-RP mechanisms.

All systems on a subnet must run the same version of PIM.

The default PIM version can be version 1 or version 2, depending on the mode you are configuring. PIMv1 is the default RP mode (at the **[edit protocols pim rp static address address]** hierarchy level). However, PIMv2 is the default for interface mode (at the **[edit protocols pim interface interface-name]** hierarchy level). Explicitly configured versions override the defaults. This example explicitly configures PIMv2 on the interfaces.

The following example shows an anycast RP configuration for the RP routers, first with MSDP and then using PIM alone, and for non-RP routers.

1. For a network using an RP with MSDP, configure the RP using the **lo0** loopback interface, which is always up. Include the **address** statement and specify the unique and routable router ID and the RP address at the **[edit interfaces lo0 unit 0 family inet]** hierarchy level. In this example, the router ID is **198.58.3.254** and the shared RP address is **198.58.3.253**. Include the **primary** statement for the first address. Including the **primary** statement selects the router's primary address from all the preferred addresses on all interfaces.

```
interfaces {
  lo0 {
    description "PIM RP";
    unit 0 {
      family inet {
        address 198.58.3.254/32;
        primary;
        address 198.58.3.253/32;
      }
    }
  }
}
```

2. Specify the RP address. Include the **address** statement at the **[edit protocols pim rp local]** hierarchy level (the same address as the secondary **lo0** interface).

For all interfaces, include the **mode** statement to set the mode to **sparse** and the **version** statement to specify PIM version 2 at the **[edit protocols pim rp local interface all]** hierarchy level. When configuring all interfaces, exclude the **fxp0.0** management interface by including the **disable** statement for that interface.

```
protocols {
  pim {
    rp {
      local {
        family inet;
        address 198.58.3.253;
      }
      interface all {
```



```

        mode sparse;
        version 2;
    }
    interface fxp0.0 {
        disable;
    }
}
}

```

3. Configure MSDP peering. Include the **peer** statement to configure the address of the MSDP peer at the **[edit protocols msdp]** hierarchy level. For MSDP peering, use the unique, primary addresses instead of the anycast address. To specify the local address for MSDP peering, include the **local-address** statement at the **[edit protocols msdp peer]** hierarchy level.

```

protocols {
  msdp {
    peer 198.58.3.250 {
      local-address address 198.58.3.254;
    }
  }
}

```



NOTE: If you need to configure a PIM RP for both IPv4 and IPv6 scenarios, perform Step 4 and Step 5. Otherwise, go to Step 6.

4. Configure an RP using the **lo0** loopback interface, which is always up. Include the **address** statement to specify the unique and routable router address and the RP address at the **[edit interfaces lo0 unit 0 family inet]** hierarchy level. In this example, the router ID is **198.58.3.254** and the shared RP address is **198.58.3.253**. Include the **primary** statement on the first address. Including the **primary** statement selects the router's primary address from all the preferred addresses on all interfaces.

```

interfaces {
  lo0 {
    description "PIM RP";
    unit 0 {
      family inet {
        address 198.58.3.254/32 {
          primary;
        }
        address 198.58.3.253/32;
      }
    }
  }
}

```

5. Include the **address** statement at the **[edit protocols pim rp local]** hierarchy level to specify the RP address (the same address as the secondary **lo0** interface).

For all interfaces, include the **mode** statement to set the mode to **sparse**, and the **version** statement to specify PIM version 2 at the **[edit protocols pim rp local interface**

all] hierarchy level. When configuring all interfaces, exclude the **fxp0.0** management interface by including the **disable** statement for that interface.

Include the **anycast-pim** statement to configure anycast RP without MSDP (for example, if IPv6 is used for multicasting). The other RP routers that share the same IP address are configured using the **rp-set** statement. There is one entry for each RP, and the maximum that can be configured is 15. For each RP, specify the routable IP address of the router and whether MSDP source active (SA) messages are forwarded to the RP.

MSDP configuration is not necessary for this type of IPv4 anycast RP configuration.

```
protocols {
  pim {
    rp {
      local {
        family inet {
          address 198.58.3.253;
          anycast-pim {
            rp-set {
              address 198.58.3.240;
              address 198.58.3.241 forward-msdp-sa;
            }
            local-address 198.58.3.254; #If not configured, use lo0 primary
          }
        }
      }
    }
  }
  interface all {
    mode sparse;
    version 2;
  }
  interface fxp0.0 {
    disable;
  }
}
```

6. Configure the non-RP routers. The anycast RP configuration for a non-RP router is the same whether MSDP is used or not. Specify a static RP by adding the address at the **[edit protocols pim rp static]** hierarchy level. Include the **version** statement at the **[edit protocols pim rp static address]** hierarchy level to specify PIM version 2.

```
protocols {
  pim {
    rp {
      static {
        address 198.58.3.253 {
          version 2;
        }
      }
    }
  }
}
```

7. Include the **mode** statement at the **[edit protocols pim interface all]** hierarchy level to specify sparse mode on all interfaces. Then include the **version** statement at the **[edit protocols pim rp interface all mode]** to configure all interfaces for PIM version 2. When configuring all interfaces, exclude the **fxp0.0** management interface by including the **disable** statement for that interface.

```
protocols {
  pim {
    interface all {
      mode sparse;
      version 2;
    }
    interface fxp0.0 {
      disable;
    }
  }
}
```

Configuring a PIM Anycast RP Router Using Only PIM

In this example, configure an RP using the **lo0** loopback interface, which is always up. Use the **address** statement to specify the unique and routable router address and the RP address at the **[edit interfaces lo0 unit 0 family inet]** hierarchy level. In this case, the router ID is 198.58.3.254/32 and the shared RP address is 198.58.3.253/32. Add the flag statement **primary** to the first address. Using this flag selects the router's primary address from all the preferred addresses on all interfaces.

```
interfaces {
  lo0 {
    description "PIM RP";
    unit 0 {
      family inet {
        address 198.58.3.254/32 {
          primary;
        }
        address 198.58.3.253/32;
      }
    }
  }
}
```

Add the **address** statement at the **[edit protocols pim rp local]** hierarchy level to specify the RP address (the same address as the secondary **lo0** interface).

For all interfaces, use the **mode** statement to set the mode to **sparse**, and include the **version** statement to specify PIM version 2 at the **[edit protocols pim rp local interface all]** hierarchy level. When configuring all interfaces, exclude the **fxp0.0** management interface by adding the **disable** statement for that interface.

Use the **anycast-pim** statement to configure anycast RP without MSDP (for example, if IPv6 is used for multicasting). The other RP routers that share the same IP address are configured using the **rp-set** statement. There is one entry for each RP, and the maximum that can be configured is 15. For each RP, specify the routable IP address of the router and whether MSDP source active (SA) messages are forwarded to the RP.

```
protocols {
  pim {
    rp {
      local {
        family inet {
          address 198.58.3.253;
          anycast-pim {
            rp-set {
              address 198.58.3.240;
              address 198.58.3.241 forward-msdp-sa;
            }
            local-address 198.58.3.254; #If not configured, use lo0 primary
          }
        }
      }
    }
  }
  interface all {
    mode sparse;
    version 2;
  }
  interface fxp0.0 {
    disable;
  }
}
```

MSDP configuration is not necessary for this type of IPv4 anycast RP configuration.

**Related
Documentation**

- [Configuring PIM Auto-RP on page 88](#)
- [Configuring PIM Bootstrap Router on page 84](#)
- [Configuring a Designated Router for PIM on page 31](#)
- [Examples: Configuring PIM Sparse Mode on page 33](#)
- [Configuring Basic PIM Settings on page 21](#)

Configuring PIM Bootstrap Router

- [Understanding PIM Bootstrap Router on page 84](#)
- [Configuring PIM Bootstrap Properties for IPv4 on page 85](#)
- [Configuring PIM Bootstrap Properties for IPv4 or IPv6 on page 86](#)
- [Example: Rejecting PIM Bootstrap Messages at the Boundary of a PIM Domain on page 87](#)
- [Example: Configuring PIM BSR Filters on page 88](#)

Understanding PIM Bootstrap Router

To determine which router is the RP, all routers within a PIM sparse-mode domain collect bootstrap messages. A PIM sparse-mode domain is a group of routers that all share the same RP router. The domain bootstrap router initiates bootstrap messages, which are

sent hop by hop within the domain. The routers use bootstrap messages to distribute RP information dynamically and to elect a bootstrap router when necessary.

Configuring PIM Bootstrap Properties for IPv4

For correct operation, every multicast router within a PIM domain must be able to map a particular multicast group address to the same Rendezvous Point (RP). The bootstrap router mechanism is one way that a multicast router can learn the set of group-to-RP mappings. Bootstrap routers are supported in IPv4 and IPv6.



NOTE: For legacy configuration purposes, there are two sections that describe the configuration of bootstrap routers: one section for both IPv4 and IPv6, and this section, which is for IPv4 only. The method described in “[Configuring PIM Bootstrap Properties for IPv4 or IPv6](#)” on page 86 is recommended. A commit error occurs if the same IPv4 bootstrap statements are included in both the IPv4-only and the IPv4-and-IPv6 sections of the hierarchy. The error message is “duplicate IPv4 bootstrap configuration.”

To determine which routing device is the RP, all routing devices within a PIM domain collect bootstrap messages. A PIM domain is a contiguous set of routing devices that implement PIM. All are configured to operate within a common boundary. The domain's bootstrap router initiates bootstrap messages, which are sent hop by hop within the domain. The routing devices use bootstrap messages to distribute RP information dynamically and to elect a bootstrap router when necessary.

You can configure bootstrap properties globally or for a routing instance. This example shows the global configuration.

To configure the bootstrap router properties:

1. Configure the bootstrap priority.

By default, each routing device has a bootstrap priority of 0, which means the routing device can never be the bootstrap router. A priority of 0 disables the function for IPv4 and does not cause the routing device to send bootstrap router packets with a 0 in the priority field. The routing device with the highest priority value is elected to be the bootstrap router. In the case of a tie, the routing device with the highest IP address is elected to be the bootstrap router. A simple bootstrap configuration assigns a bootstrap priority value to a routing device.

```
[edit protocols pim rp]
user@host# set bootstrap-priority 3
```

2. (Optional) Create import and export policies to control the flow of IPv4 bootstrap messages to and from the RP, and apply the policies to PIM. Import and export policies are useful when some of the routers in your PIM domain have interfaces that connect to other PIM domains. Configuring a policy prevents bootstrap messages from crossing domain boundaries. The **bootstrap-import** statement prevents messages from being imported into the RP. The **bootstrap-export** statement prevents messages from being exported from the RP.

```
[edit protocols pim rp]
user@host# set bootstrap-import pim-bootstrap-import
user@host# set bootstrap-export pim-bootstrap-export
```

3. Configure the policies.

```
[edit policy-options policy-statement pim-bootstrap-import]
user@host# set from interface se-0/0/0
user@host# set then reject
```

```
[edit policy-options policy-statement pim-bootstrap-export]
user@host# set from interface se-0/0/0
user@host# set then reject
```

4. Monitor the operation of PIM bootstrap routers by running the **show pim bootstrap** command.

Configuring PIM Bootstrap Properties for IPv4 or IPv6

For correct operation, every multicast router within a PIM domain must be able to map a particular multicast group address to the same Rendezvous Point (RP). The bootstrap router mechanism is one way that a multicast router can learn the set of group-to-RP mappings. Bootstrap routers are supported in IPv4 and IPv6.



NOTE: For legacy configuration purposes, there are two sections that describe the configuration of bootstrap routers: one section for IPv4 only, and this section, which is for both IPv4 and IPv6. The method described in this section is recommended. A commit error occurs if the same IPv4 bootstrap statements are included in both the IPv4-only and the IPv4-and-IPv6 sections of the hierarchy. The error message is “duplicate IPv4 bootstrap configuration.”

To determine which routing device is the RP, all routing devices within a PIM domain collect bootstrap messages. A PIM domain is a contiguous set of routing devices that implement PIM. All devices are configured to operate within a common boundary. The domain's bootstrap router initiates bootstrap messages, which are sent hop by hop within the domain. The routing devices use bootstrap messages to distribute RP information dynamically and to elect a bootstrap router when necessary.

You can configure bootstrap properties globally or for a routing instance. This example shows the global configuration.

To configure the bootstrap router properties:

1. Configure the bootstrap priority.

By default, each routing device has a bootstrap priority of 0, which means the routing device can never be the bootstrap router. The routing device with the highest priority value is elected to be the bootstrap router. In the case of a tie, the routing device with the highest IP address is elected to be the bootstrap router. A simple bootstrap configuration assigns a bootstrap priority value to a routing device.



NOTE: In the IPv4-only configuration, specifying a bootstrap priority of 0 disables the bootstrap function and does not cause the routing device to send BSR packets with a 0 in the priority field. In the configuration shown here, specifying a bootstrap priority of 0 does not disable the function, but causes the routing device to send BSR packets with a 0 in the priority field. To disable the bootstrap function in the IPv4 and IPv6 configuration, delete the `bootstrap` statement.

```
user@host# edit protocols pim rp
user@host# set bootstrap family inet priority 3
```

2. (Optional) Create import and export policies to control the flow of bootstrap messages to and from the RP, and apply the policies to PIM. Import and export policies are useful when some of the routers in your PIM domain have interfaces that connect to other PIM domains. Configuring a policy prevents bootstrap messages from crossing domain boundaries. The **import** statement prevents messages from being imported into the RP. The **export** statement prevents messages from being exported from the RP.

```
[edit protocols pim rp]
user@host# set bootstrap family inet import pim-bootstrap-import
user@host# set bootstrap family inet export pim-bootstrap-export
```

3. Configure the policies.

```
[edit policy-options policy-statement pim-bootstrap-import]
user@host# set from interface se-0/0/0
user@host# set then reject
user@host# exit
user@host# edit policy-options policy-statement pim-bootstrap-export
user@host# set from interface se-0/0/0
user@host# set then reject
```

4. Monitor the operation of PIM bootstrap routers by running the `show pim bootstrap` command.

Example: Rejecting PIM Bootstrap Messages at the Boundary of a PIM Domain

In this example, the `from interface so-0-1/0 then reject` policy statement rejects bootstrap messages from the specified interface (the example is configured for both IPv4 and IPv6 operation):

```
protocols {
  pim {
    rp {
      bootstrap {
        family inet {
          priority 1;
          import pim-import;
          export pim-export;
        }
        family inet6 {
          priority 1;
          import pim-import;
        }
      }
    }
  }
}
```

```
        export pim-export;
    }
}
}
}
policy-options {
    policy-statement pim-import {
        from interface so-0/1/0;
        then reject;
    }
    policy-statement pim-export {
        to interface so-0/1/0;
        then reject;
    }
}
```

Example: Configuring PIM BSR Filters

Configure a filter to prevent BSR messages from entering or leaving your network. Add this configuration to all routers:

```
protocols {
    pim {
        rp {
            bootstrap-import no-bsr;
            bootstrap-export no-bsr;
        }
    }
}
policy-options {
    policy-statement no-bsr {
        then reject;
    }
}
```

Related Documentation

- [Configuring PIM Auto-RP on page 88](#)
- [Configuring a Designated Router for PIM on page 31](#)
- [Examples: Configuring PIM Sparse Mode on page 33](#)
- [Configuring Basic PIM Settings on page 21](#)

Configuring PIM Auto-RP

- [Understanding PIM Auto-RP on page 88](#)
- [Configuring PIM Auto-RP on page 89](#)

Understanding PIM Auto-RP

You can configure a more dynamic way of assigning rendezvous points (RPs) in a multicast network by means of auto-RP. When you configure auto-RP for a router, the router learns the address of the RP in the network automatically and has the added advantage of operating in PIM version 1 and version 2.

Although auto-RP is a nonstandard (non-RFC-based) function that typically uses dense mode PIM to advertise control traffic, it provides an important failover advantage that simple static RP assignment does not. You can configure multiple routers as RP candidates. If the elected RP fails, one of the other preconfigured routers takes over the RP functions. This capability is controlled by the auto-RP mapping agent.

Configuring PIM Auto-RP

For correct operation, every multicast router within a PIM domain must be able to map a particular multicast group address to the same rendezvous point (RP). The auto-RP mechanism is one way that a multicast router can learn the set of group-to-RP mappings. Auto-RP automatically distributes mapping information to routing devices. It simplifies use of multiple RPs for different multicast group ranges, thus allowing multiple RPs to act as backups for each other. Auto-RP relies on a router to act as the RP mapping agent. Potential RPs announce themselves to the mapping agent, and the mapping agent resolves any conflicts.

The mapping agent sends the multicast group-RP mapping information to the other routers using PIM dense mode. The specific groups used are 224.0.1.39 and .40. The first (.39) is used to advertise, the second (.40) is used for discovery. Because PIM dense mode is necessary to enable auto-RP to work, which in turn enables PIM sparse mode to work, you must configure PIM sparse-dense mode in the PIM domains that use auto-RP.

Although auto-RP is a nonstandard (non-RFC-based) function requiring dense mode PIM to advertise control traffic, it provides an important failover advantage that static RP assignment does not. That is, you can configure multiple routing devices as RP candidates. If the elected RP fails, one of the other preconfigured routing devices takes over the RP functions. This capability is controlled by the auto-RP mapping agent.

Auto-RP operates in PIM version 1 and version 2.

In most cases, how the routing device handles auto-RP discovery, announce, or mapping messages depends on whether the routing device is an RP (configured as local RP) or not. [Table 5 on page 89](#) shows how the routing device behaves depending on the local RP configuration.

Table 5: Local RP and Auto-RP Message Types

Auto-RP Message Type	Local RP?	Routing Device Behavior
discovery	No	Listen for auto-RP mapping messages.
discovery	Yes	Listen for auto-RP mapping messages.
announce	No	Listen for auto-RP mapping messages.
announce	Yes	Listen for auto-RP mapping messages. Send auto-RP announce messages.

Table 5: Local RP and Auto-RP Message Types (*continued*)

Auto-RP Message Type	Local RP?	Routing Device Behavior
mapping	No	Listen for auto-RP mapping messages. Listen for auto-RP announce messages. If elected mapping agent, send auto-RP mapping messages.
mapping	Yes	Listen for auto-RP mapping messages. Send auto-RP announce messages. Listen for auto-RP announce messages. If elected mapping agent, send auto-RP mapping messages.



NOTE: If the routing device receives auto-RP announcements split across multiple messages, the routing device loses the information in the previous part of the message as soon as the next part of the message is received.

You can configure auto-RP properties globally or for a routing instance. This example shows the global configuration.

To configure auto-RP properties:

1. Configure PIM in sparse-dense mode on all routing devices in the PIM domain.

```
[edit protocols pim]
user@host# edit
user@host# set interface all mode sparse-dense
```

This configuration allows the routing device to operate in sparse mode for most groups and dense mode for others. The default is to operate in sparse mode unless the routing device is specifically informed of a dense mode group.

2. Configure a routable loopback interface address on all routing devices in the PIM domain.

The routing device joins the auto-RP groups on the configured interfaces and on the loopback interface **lo0.0**. For auto-RP to work correctly, configure a routable IP address on the loopback interface. The router ID is used as the address for auto-RP updates. You cannot use the loopback address 127.0.0.1. Also, you must enable PIM sparse-dense mode on the **lo0.0** interface if you do not specify **interface all**.

```
[edit interfaces lo0.0 unit 0 family inet]
user@host# set address 192.168.0.3 preferred
```

3. Configure the two multicast dense groups on all the routing devices.

Auto-RP requires multicast flooding to announce potential RP candidates and to discover the elected RPs in the network. Multicast flooding occurs through a PIM dense mode model, where group 224.0.1.39 is used for **announce** messages and group 224.0.1.40 is used for **discovery** messages.

```
[edit protocols pim]
```

```
user@host# set dense-groups 224.0.1.39/32
user@host# set dense-groups 224.0.1.40/32
```



TIP: Step 3 is required. When auto-RP is enabled, the auto-RP announce group (224.0.1.39) and auto-RP-discovery group (224.0.1.40) must be configured explicitly as dense groups. When the auto-RP discovery group is not configured as a dense group, auto-RP is not enabled. When the auto-RP announce group is not configured as a dense group, auto-RP is enabled in the discovery mode only, and mapping and announce modes are disabled.

4. Configure the auto-RP **announce** option.

At least one routing device in the PIM domain must announce auto-RP messages and at least one must map them, or you can configure a routing device to perform both functions.

When a routing device sends announce messages in the network, it is advertising itself as a candidate RP. A routing device configured with this option must also be configured as an RP, or announce messages are not sent.

```
[edit protocols pim rp]
user@host# set local address 192.168.0.1
user@host# set auto-rp announce
```



NOTE: You cannot include the `auto-rp announce` option at the `[edit logical-systems logical-system-name routing-instances routing-instance-name protocols pim]` hierarchy level.

5. Configure the auto-RP mapping agent.

The mapping agent sends discovery messages to the network, informing all routing devices in a multicast group of which RP to use. If the mapping agent is also an RP, the **mapping** option also allows the routing device to send auto-RP announcements (mapping on an RP allows the routing device to perform both the announcement and mapping functions).

```
[edit protocols pim rp]
user@host# set auto-rp mapping
```

If the mapping agent is also an RP, configure the mapping agent as a local RP.

```
[edit protocols pim rp]
user@host# set local address 192.168.0.2
```

6. Configure mapping agent election.

If you configure the **mapping** option on more than one routing device in the PIM domain, configure mapping agent election on each potential mapping agent.

Auto-RP specifications state that mapping agents do not send mapping messages if they receive messages from a mapping agent with a higher IP address. However,

some vendors' mapping agents continue to announce mappings, even in the presence of higher-addressed mapping agents. In other words, some mapping agents will always send mapping messages.

The default auto-RP operation is to perform mapping agent election. To explicitly configure mapping agent election, you can include the **mapping-agent-election** statement. When this option is configured, the mapping agent will stop sending mapping messages if it receives messages from a mapping agent with a higher IP address.

```
[edit protocols pim rp]
user@host# set auto-rp mapping mapping-agent-election
```

Mapping message suppression is disabled with the **no-mapping-agent-election** statement. When this option is configured, the mapping agent will always send mapping messages even in the presence of higher-addressed mapping agents.

To disable mapping agent election for compatibility with other vendors' equipment, include the **no-mapping-agent-election** statement.

```
[edit protocols pim rp]
user@host# set auto-rp mapping no-mapping-agent-election
```

7. Configure the remaining routing devices in the PIM domain to discover the RP.

Discovery enables the routing devices to receive and process discovery messages from the mapping agent. This is the most basic auto-RP option.

```
[edit protocols pim rp]
user@host# set auto-rp discovery
```

8. Monitor the operation of PIM auto-RP routers by running the following commands:

- **show pim interfaces**
- **show pim rps**

9. Issue the **show pim rps extensive** command to see information about how an RP is learned, what groups it handles, and the number of groups actively using the RP.

```
user@host> show pim rps extensive
RP: 192.168.5.1
Learned from 192.168.5.1 via: auto-rp
Time Active: 00:34:29
Holdtime: 150 with 108 remaining
Device Index: 6
Subunit: 32769
Interface: pd-0/0/0.32769
Group Ranges:
  224.0.0.0/4
Active groups using RP:
  224.2.2.100
  total 1 groups active
Register State for RP:
Group      Source FirstHop      RP Address      StateRP address Type Holdtime
Timeout
```

In the example, the RP at 192.168.5.1 was learned through auto-RP. The RP is able to support all groups in the 224.0.0.0/4 range (all possible groups). The local router has sent PIM control traffic for the 224.2.2.100 group to the RP.

Additionally, the presence of a Tunnel Physical Interface Card (PIC) in an RP router creates a de-encapsulation interface, which allows the RP to receive multicast traffic from the source. This interface is indicated by **pd-0/0/0.32769**.

- Related Documentation**
- [Configuring PIM Bootstrap Router on page 84](#)
 - [Configuring a Designated Router for PIM on page 31](#)
 - [Examples: Configuring PIM Sparse Mode on page 33](#)
 - [Configuring Basic PIM Settings on page 21](#)

Configuring Embedded RP

- [Understanding Embedded RP for IPv6 Multicast on page 93](#)
- [Configuring PIM Embedded RP for IPv6 on page 95](#)

Understanding Embedded RP for IPv6 Multicast

Global IPv6 multicast between routing domains has been possible only with source-specific multicast (SSM) because there is no way to convey information about IPv6 multicast RPs between PIM sparse mode RPs. In IPv4 multicast networks, this information is conveyed between PIM RPs using MSDP, but there is no IPv6 support in current MSDP standards. IPv6 uses the concept of an embedded RP to resolve this issue without requiring SSM. This feature embeds the RP address in an IPv6 multicast address.

All IPv6 multicast addresses begin with 8 1-bits (1111 1111) followed by a 4-bit flag field normally set to 0011. The flag field is set to 0111 when embedded RP is used. Then the low-order bits of the normally reserved field in the IPv6 multicast address carry the 4-bit RP interface identifier (RIID).

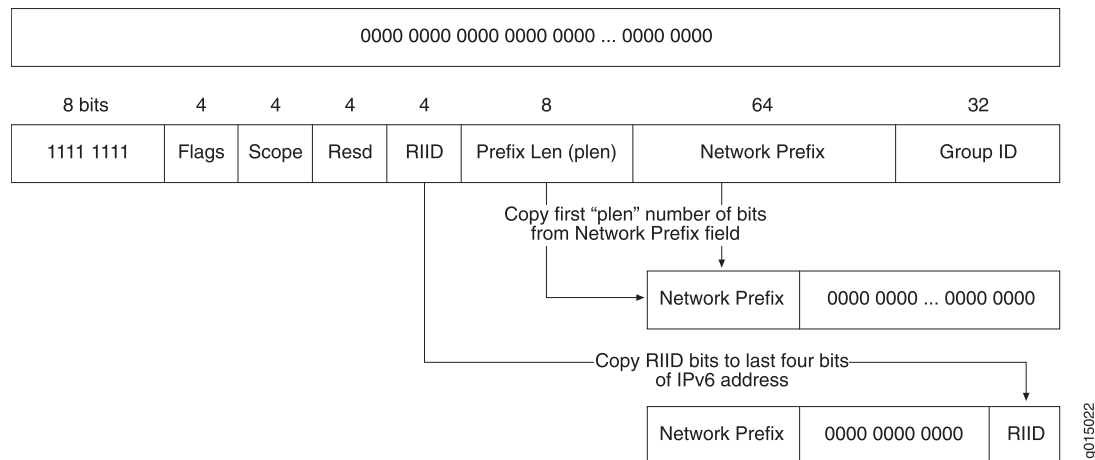
When the IPv6 address of the RP is embedded in a unicast-prefix-based any-source multicast (ASM) address, all of the following conditions must be true:

- The address must be an IPv6 multicast address and have 0111 in the flags field (that is, the address is part of the prefix FF70::/12).
- The 8-bit prefix length (plen) field must not be all 0. An all 0 plen field implies that SSM is in use.
- The 8-bit prefix length field value must not be greater than 64, which is the length of the network prefix field in unicast-prefix-based ASM addresses.

The routing platform derives the value of the interdomain RP by copying the prefix length field number of bits from the 64-bit network prefix field in the received IPv6 multicast address to an empty 128-bit IPv6 address structure and copying the last bits from the 4-bit RIID. For example, if the prefix length field bits have the value 32, then the routing platform copies the first 32 bits of the IPv6 multicast address network prefix field to an all-0 IPv6 address and appends the last four bits determined by the RIID. See [Figure 10 on page 94](#) for an illustration of this process.

Figure 10: Extracting the Embedded RP IPv6 Address

Start with empty 128 bit IPv6 address structure



For example, the administrator of IPv6 network 2001:DB8::/32 sets up an RP for the 2001:DB8:BEEF:FEED::/96 subnet. In that case, the received embedded RP IPv6 ASM address has the form:

FF70:y40:2001:DB8:BEEF:FEED::/96

and the derived RP IPv6 address has the form:

2001:DB8:BEEF:FEED::y

where **y** is the RIID (**y** cannot be 0).

When configured, the routing platform checks for embedded RP information in every PIM join request received for IPv6. The use of embedded RP does not change the processing of IPv6 multicast and RPs in any way, except that the embedded RP address is used if available and selected for use. There is no need to specify the IPv6 address family for embedded RP configuration because the information can be used only if IPv6 multicast is properly configured on the routing platform.

The following receive events trigger extraction of an IPv6 embedded RP address on the routing platform:

- Multicast Listener Discovery (MLD) report for an embedded RP multicast group address
- PIM join message with an embedded RP multicast group address
- Static embedded RP multicast group address associated with an interface
- Packets sent to an embedded RP multicast group address received on the DR

The embedded RP node discovered through these events is added if it does not already exist on the routing platform. The routing platform chooses the embedded RP as the RP for a multicast group before choosing an RP learned through BSRs or a statically configured RP. The embedded RP is removed whenever all PIM join states using this RP are removed or the configuration changes to remove the embedded RP feature.

Configuring PIM Embedded RP for IPv6

You configure embedded RP to allow multidomain IPv6 multicast networks to find RPs in other routing domains. Embedded RP embeds an RP address inside PIM join messages and other types of messages sent between routing domains. Global IPv6 multicast between routing domains has been possible only with source-specific multicast (SSM) because there is no way to convey information about IPv6 multicast RPs between PIM sparse mode RPs. In IPv4 multicast networks, this information is conveyed between PIM RPs using MSDP, but there is no IPv6 support in current MSDP standards. IPv6 uses the concept of an embedded RP to resolve this issue without requiring SSM. Thus, embedded RP enables you can deploy IPv6 with any-source multicast (ASM).

Embedded RP is disabled by default.

When you configure embedded RP for IPv6, embedded RPs are preferred to RPs discovered by IPv6 any other way. You configure embedded RP independent of any other IPv6 multicast properties. This feature is applied only when IPv6 multicast is properly configured.

You can configure embedded RP globally or for a routing instance. This example shows the routing instance configuration.

To configure embedded RP for IPv6 PIM sparse mode:

1. Define which multicast addresses or prefixes can embed RP address information. If messages within a group range contain embedded RP information and the group range is not configured, the embedded RP in that group range is ignored. Any valid unicast-prefix-based ASM address can be used as a group range. The default group range is FF70::/12 to FFF0::/12. Messages with embedded RP information that do not match any configured group ranges are treated as normal multicast addresses.

```
[edit routing-instances vpn-A protocols pim rp embedded-rp]
user@host# set group-ranges fec0::/10
```

If the derived RP address is not a valid IPv6 unicast address, it is treated as any other multicast group address and is not used for RP information. Verification fails if the extracted RP address is a local interface, unless the routing device is configured as an RP and the extracted RP address matches the configured RP address. Then the local RP determines whether it is configured to act as an RP for the embedded RP multicast address.

2. Limit the number of embedded RPs created in a specific routing instance. The range is from 1 through 500. The default is 100.

```
[edit routing-instances vpn-A protocols pim rp]
user@host# set maximum-rps 50
```

3. Monitor the operation by running the **show pim rps** and **show pim statistics** commands.

Related Documentation

- [Configuring PIM Auto-RP on page 88](#)
- [Configuring PIM Bootstrap Router on page 84](#)
- [Configuring a Designated Router for PIM on page 31](#)

- [Examples: Configuring PIM Sparse Mode on page 33](#)
- [Configuring Basic PIM Settings on page 21](#)

Configuring PIM Filtering

- [Understanding Multicast Message Filters on page 96](#)
- [Filtering MAC Addresses on page 96](#)
- [Filtering RP and DR Register Messages on page 96](#)
- [Filtering MSDP SA Messages on page 97](#)
- [Configuring Interface-Level PIM Neighbor Policies on page 98](#)
- [Filtering Outgoing PIM Join Messages on page 99](#)
- [Filtering Incoming PIM Join Messages on page 100](#)
- [Configuring Register Message Filters on a PIM RP and DR on page 101](#)

Understanding Multicast Message Filters

Multicast sources and routers generate a considerable number of control messages, especially when using PIM sparse mode. These messages form distribution trees, locate rendezvous points (RPs) and designated routers (DRs), and transition from one type of tree to another. In most cases, this multicast messaging system operates transparently and efficiently. However, in some configurations, more control over the sending and receiving of multicast control messages is necessary.

You can configure multicast filtering to control the sending and receiving of multicast control messages.

Filtering MAC Addresses

When a router is exclusively configured with multicast protocols on an interface, multicast sets the interface media access control (MAC) filter to multicast promiscuous mode, and the number of multicast groups is unlimited. However, when the router is not exclusively used for multicasting and other protocols such as OSPF, Routing Information Protocol version 2 (RIPv2), or Network Time Protocol (NTP) are configured on an interface, each of these protocols individually requests that the interface program the MAC filter to pick up its respective multicast group only. In this case, without multicast configured on the interface, the maximum number of multicast MAC filters is limited to 20. For example, the maximum number of interface MAC filters for protocols such as OSPF (multicast group 224.0.0.5) is 20, unless a multicast protocol is also configured on the interface.

No configuration is necessary for MAC filters.

Filtering RP and DR Register Messages

You can filter Protocol Independent Multicast (PIM) register messages sent from the designated router (DR) or to the rendezvous point (RP). The PIM RP keeps track of all active sources in a single PIM sparse mode domain. In some cases, more control over

which sources an RP discovers, or which sources a DR notifies other RPs about, is desired. A high degree of control over PIM register messages is provided by RP and DR register message filtering. Message filtering also prevents unauthorized groups and sources from registering with an RP router.

Register messages that are filtered at a DR are not sent to the RP, but the sources are available to local users. Register messages that are filtered at an RP arrive from source DRs, but are ignored by the router. Sources on multicast group traffic can be limited or directed by using RP or DR register message filtering alone or together.

If the action of the register filter policy is to discard the register message, the router needs to send a register-stop message to the DR. Register-stop messages are throttled to prevent malicious users from triggering them on purpose to disrupt the routing process.

Multicast group and source information is encapsulated inside unicast IP packets. This feature allows the router to inspect the multicast group and source information before sending or accepting the PIM register message.

Incoming register messages to an RP are passed through the configured register message filtering policy before any further processing. If the register message is rejected, the RP router sends a register-stop message to the DR. When the DR receives the register-stop message, the DR stops sending register messages for the filtered groups and sources to the RP. Two fields are used for register message filtering:

- Group multicast address
- Source address

The syntax of the existing policy statements is used to configure the filtering on these two fields. The **route-filter** statement is useful for multicast group address filtering, and the **source-address-filter** statement is useful for source address filtering. In most cases, the action is to **reject** the register messages, but more complex filtering policies are possible.

Filtering cannot be performed on other header fields, such as DR address, protocol, or port. In some configurations, an RP might not send register-stop messages when the policy action is to discard the register messages. This has no effect on the operation of the feature, but the router will continue to receive register messages.

When anycast RP is configured, register messages can be sent or received by the RP. All the RPs in the anycast RP set need to be configured with the same RP register message filtering policies. Otherwise, it might be possible to circumvent the filtering policy.

Filtering MSDP SA Messages

Along with applying MSDP source active (SA) filters on all external MSDP sessions (in and out) to prevent SAs for groups and sources from leaking in and out of the network, you need to apply bootstrap router (BSR) filters. Applying a BSR filter to the boundary of a network prevents foreign BSR messages (which announce RP addresses) from leaking into your network. Since the routers in a PIM sparse-mode domain need to know the address of only one RP router, having more than one in the network can create issues.

If you did not use multicast scoping to create boundary filters for all customer-facing interfaces, you might want to use PIM join filters. Multicast scopes prevent the actual multicast data packets from flowing in or out of an interface. PIM join filters prevent PIM sparse-mode state from being created in the first place. Since PIM join filters apply only to the PIM sparse-mode state, it might be more beneficial to use multicast scoping to filter the actual data.



NOTE: When you apply firewall filters, firewall action modifiers, such as **log**, **sample**, and **count**, work only when you apply the filter on an inbound interface. The modifiers do not work on an outbound interface.

Configuring Interface-Level PIM Neighbor Policies

You can configure a policy to filter unwanted PIM neighbors. In the following example, the PIM interface compares neighbor IP addresses with the IP address in the policy statement before any hello processing takes place. If any of the neighbor IP addresses (primary or secondary) match the IP address specified in the prefix list, PIM drops the hello packet and rejects the neighbor.

If you configure a PIM neighbor policy after PIM has already established a neighbor adjacency to an unwanted PIM neighbor, the adjacency remains intact until the neighbor hold time expires. When the unwanted neighbor sends another hello message to update its adjacency, the router recognizes the unwanted address and rejects the neighbor.

To configure a policy to filter unwanted PIM neighbors:

1. Configure the policy. The neighbor policy must be a properly structured policy statement that uses a prefix list (or a route filter) containing the neighbor primary address (or any secondary IP addresses) in a prefix list, and the **reject** option to reject the unwanted address.

```
[edit policy-options]
```

```
user@host# set prefix-list nbrGroup 1 20.20.20.1/32
```

```
user@host# set policy-statement nbr-policy from prefix-list nbrGroup1
```

```
user@host# set policy-statement nbr-policy then reject
```

2. Configure the interface globally or in the routing instance. This example shows the configuration for the routing instance.

```
[edit routing-instances PIM.master protocols pim]
```

```
user@host# set neighbor-policy nbr-policy
```

3. Verify the configuration by checking the **Hello dropped on neighbor policy** field in the output of the **show pim statistics** command.

Filtering Outgoing PIM Join Messages

When the core of your network is using MPLS, PIM join and prune messages stop at the customer edge (CE) routers and are not forwarded toward the core, because these routers do not have PIM neighbors on the core-facing interfaces. When the core of your network is using IP, PIM join and prune messages are forwarded to the upstream PIM neighbors in the core of the network.

When the core of your network is using a mix of IP and MPLS, you might want to filter certain PIM join and prune messages at the upstream egress interface of the CE routers.

You can filter PIM sparse mode (PIM-SM) join and prune messages at the egress interfaces for IPv4 and IPv6 in the upstream direction. The messages can be filtered based on the group address, source address, outgoing interface, PIM neighbor, or a combination of these values. If the filter is removed, the join is sent after the PIM periodic join timer expires.

To filter PIM sparse mode join and prune messages at the egress interfaces, create a policy rejecting the group address, source address, outgoing interface, or PIM neighbor, and then apply the policy.

The following example filters PIM join and prune messages for group addresses 224.0.1.2 and 225.1.1.1.

1. In configuration mode, create the policy.

```
user@host# set policy-options policy-statement block-groups term t1 from route-filter
224.0.1.2/32 exact
user@host# set policy-options policy-statement block-groups term t1 from route-filter
225.1.1.1/32 exact
user@host# set policy-options policy-statement block-groups term t1 then reject
user@host# set policy-options policy-statement block-groups term last then accept
```

2. Verify the policy configuration by running the **show policy-options** command.

```
user@host# show policy-options
policy-statement block-groups {
  term t1 {
    from {
      route-filter 224.0.1.2/32 exact;
      route-filter 225.1.1.1/32 exact;
      then reject;
    }
    term last {
      then accept;
    }
  }
}
```

3. Apply the PIM join and prune message filter.

```
user@host> set protocols pim export block-groups
```

4. After the configuration is committed, use the **show pim statistics** command to verify that outgoing PIM join and prune messages are being filtered.

```
user@host> show pim statistics | grep filtered
```

RP Filtered Source	0
Rx Joins/Prunes filtered	0
Tx Joins/Prunes filtered	254

The egress filter count is shown on the **Tx Joins/Prunes filtered** line.

Filtering Incoming PIM Join Messages

Multicast scoping controls the propagation of multicast messages. Whereas multicast scoping prevents the actual multicast data packets from flowing in or out of an interface, PIM join filters prevent a state from being created in a router. A state—the (*,G) or (S,G) entries—is the information used for forwarding unicast or multicast packets. Using PIM join filters prevents the transport of multicast traffic across a network and the dropping of packets at a scope at the edge of the network. Also, PIM join filters reduce the potential for denial-of-service (DoS) attacks and PIM state explosion—large numbers of PIM join messages forwarded to each router on the rendezvous-point tree (RPT), resulting in memory consumption.

To use PIM join filters to efficiently restrict multicast traffic from certain source addresses, create and apply the routing policy across all routers in the network.

See [Table 6 on page 100](#) for a list of match conditions.

Table 6: PIM Join Filter Match Conditions

Match Condition	Matches On
interface	Router interface or interfaces specified by name or IP address
neighbor	Neighbor address (the source address in the IP header of the join and prune message)
route-filter	Multicast group address embedded in the join and prune message
source-address-filter	Multicast source address embedded in the join and prune message

The following example shows how to create a PIM join filter. The filter is composed of a route filter and a source address filter—**bad-groups** and **bad-sources**, respectively. The **bad-groups** filter prevents (*,G) or (S,G) join messages from being received for all groups listed. The **bad-sources** filter prevents (S,G) join messages from being received for all sources listed. The **bad-groups** filter and **bad-sources** filter are in two different terms. If route filters and source address filters are in the same term, they are logically ANDed.

To filter incoming PIM join messages:

1. Configure the policy.

```
[edit policy-statement pim-join-filter term bad-groups]
user@host# set from route-filter 224.0.1.2/32 exact
user@host# set from route-filter 239.0.0.0/8 orlonger
user@host# set then reject
```

```
[edit policy-statement pim-join-filter term bad-sources]
user@host# set from source-address-filter 10.0.0.0/8 orlonger
user@host# set from source-address-filter 127.0.0.0/8 orlonger
user@host# set then reject

[edit policy-statement pim-join-filter term last]
user@host# set then accept
```

2. Apply one or more policies to routes being imported into the routing table from PIM.

```
[edit protocols pim]
user@host# set import pim-join-filter
```

3. Verify the configuration by checking the output of the **show pim join** and **show policy** commands.

Configuring Register Message Filters on a PIM RP and DR

PIM register messages are sent to the rendezvous point (RP) by a designated router (DR). When a source for a group starts transmitting, the DR sends unicast PIM register packets to the RP.

Register messages have the following purposes:

- Notify the RP that a source is sending to a group.
- Deliver the initial multicast packets sent by the source to the RP for delivery down the shortest-path tree (SPT).

The PIM RP keeps track of all active sources in a single PIM sparse mode domain. In some cases, you want more control over which sources an RP discovers, or which sources a DR notifies other RPs about. A high degree of control over PIM register messages is provided by RP or DR register message filtering. Message filtering prevents unauthorized groups and sources from registering with an RP router.

You configure RP or DR register message filtering to control the number and location of multicast sources that an RP discovers. You can apply register message filters on a DR to control outgoing register messages, or apply them on an RP to control incoming register messages.

When anycast RP is configured, all RPs in the anycast RP set need to be configured with the same register message filtering policy.

You can configure message filtering globally or for a routing instance. These examples show the global configuration.

To configure an RP filter to drop the register packets for multicast group range 224.1.1.0/24 from source address 10.10.94.2:

1. On the RP, configure the policy.

```
[edit policy-options policy-statement incoming-policy-for-rp from]
user@host# set route-filter 224.1.1.0/24 orlonger
user@host# set source-address-filter 10.10.94.2/32 exact
user@host# set then reject
user@host# exit
```

2. Apply the policy to the RP.

```
[edit protocols pim rp]
user@host# set rp-register-policy incoming-policy-for-rp
user@host# set local address 10.10.10.5
user@host# exit
```

To configure a DR filter to prevent sending register packets for group range 224.1.1.0/24 and source address 10.10.10.1/32:

1. On the DR, configure the policy.

```
[edit policy-options policy-statement outgoing-policy-for-rp]
user@host# set from route-filter 224.1.1.0/24 orlonger
user@host# set from source-address-filter 10.10.10.1/32 exact
user@host# set then reject
user@host# exit
```

2. Apply the policy to the DR.

The static address is the address of the RP to which you do not want the DR to send the filtered register messages.

```
[edit protocols pim rp]
user@host# set dr-register-policy outgoing-policy-for-dr
user@host# set static 10.10.10.3
user@host# exit
```

To configure a policy expression to accept register messages for multicast group 224.1.1.5 but reject those for 224.1.1.1:

1. On the RP, configure the policies.

```
[edit policy-options policy-statement reject_224_1_1_1]
user@host# set from route-filter 224.1.1.0/24 orlonger
user@host# set from source-address-filter 10.10.94.2/32 exact
user@host# set then reject
user@host# exit

[edit policy-options policy-statement accept_224_1_1_5]
user@host# set term one from route-filter 224.1.1.5/32 exact
user@host# set term one from source-address-filter 10.10.94.2/32 exact
user@host# set term one then accept
user@host# set term two then reject
user@host# exit
```

2. Apply the policies to the RP.

```
[edit protocols pim rp]
user@host# set rp-register-policy [ reject_224_1_1_1 | accept_224_1_1_5 ]
user@host# set local address 10.10.10.5
```

To monitor the operation of the filters, run the **show pim statistics** command. The command output contains the following fields related to filtering:

- **RP Filtered Source**
- **Rx Joins/Prunes filtered**
- **Tx Joins/Prunes filtered**
- **Rx Register msgs filtering drop**
- **Tx Register msgs filtering drop**

Related Documentation

- [Configuring PIM Auto-RP on page 88](#)
- [Configuring PIM Bootstrap Router on page 84](#)
- [Configuring PIM Dense Mode on page 137](#)
- [Configuring a Designated Router for PIM on page 31](#)
- [Example: Configuring Nonstop Active Routing for PIM on page 124](#)
- [Examples: Configuring PIM RPT and SPT Cutover on page 103](#)
- [Configuring PIM Sparse-Dense Mode on page 140](#)
- [Configuring PIM and the Bidirectional Forwarding Detection \(BFD\) Protocol on page 118](#)
- [Configuring Basic PIM Settings on page 21](#)

Examples: Configuring PIM RPT and SPT Cutover

- [Understanding Multicast Rendezvous Points, Shared Trees, and Rendezvous-Point Trees on page 103](#)
- [Building an RPT Between the RP and Receivers on page 105](#)
- [PIM Sparse Mode Source Registration on page 105](#)
- [Multicast Shortest-Path Tree on page 108](#)
- [SPT Cutover on page 109](#)
- [SPT Cutover Control on page 112](#)
- [Example: Configuring the PIM Assert Timeout on page 112](#)
- [Example: Configuring the PIM SPT Threshold Policy on page 114](#)

Understanding Multicast Rendezvous Points, Shared Trees, and Rendezvous-Point Trees

In a shared tree, the root of the distribution tree is a router, not a host, and is located somewhere in the core of the network. In the primary sparse mode multicast routing protocol, Protocol Independent Multicast sparse mode (PIM SM), the core router at the root of the shared tree is the rendezvous point (RP). Packets from the upstream source and join messages from the downstream routers “rendezvous” at this core router.

In the RP model, other routers do not need to know the addresses of the sources for every multicast group. All they need to know is the IP address of the RP router. The RP router discovers the sources for all multicast groups.

The RP model shifts the burden of finding sources of multicast content from each router (the (S,G) notation) to the network (the (*,G) notation knows only the RP). Exactly how the RP finds the unicast IP address of the source varies, but there must be some method to determine the proper source for multicast content for a particular group.

Consider a set of multicast routers without any active multicast traffic for a certain group. When a router learns that an interested receiver for that group is on one of its directly connected subnets, the router attempts to join the distribution tree for that group back to the RP, not to the actual source of the content.

To join the shared tree, or *rendezvous-point tree* (RPT) as it is called in PIM sparse mode, the router must do the following:

- Determine the IP address of the RP for that group. Determining the address can be as simple as static configuration in the router, or as complex as a set of nested protocols.
- Build the shared tree for that group. The router executes an RPF check on the RP address in its routing table, which produces the interface closest to the RP. The router now detects that multicast packets from this RP for this group need to flow into the router on this RPF interface.
- Send a join message out on this interface using the proper multicast protocol (probably PIM sparse mode) to inform the upstream router that it wants to join the shared tree for that group. This message is a (*,G) join message because S is not known. Only the RP is known, and the RP is not actually the source of the multicast packets. The router receiving the (*,G) join message adds the interface on which the message was received to its outgoing interface list (OIL) for the group and also performs an RPF check on the RP address. The upstream router then sends a (*,G) join message out from the RPF interface toward the source, informing the upstream router that it also wants to join the group.

Each upstream router repeats this process, propagating join messages from the RPF interface, building the shared tree as it goes. The process stops when the join message reaches one of the following:

- The RP for the group that is being joined
- A router along the RPT that already has a multicast forwarding state for the group that is being joined

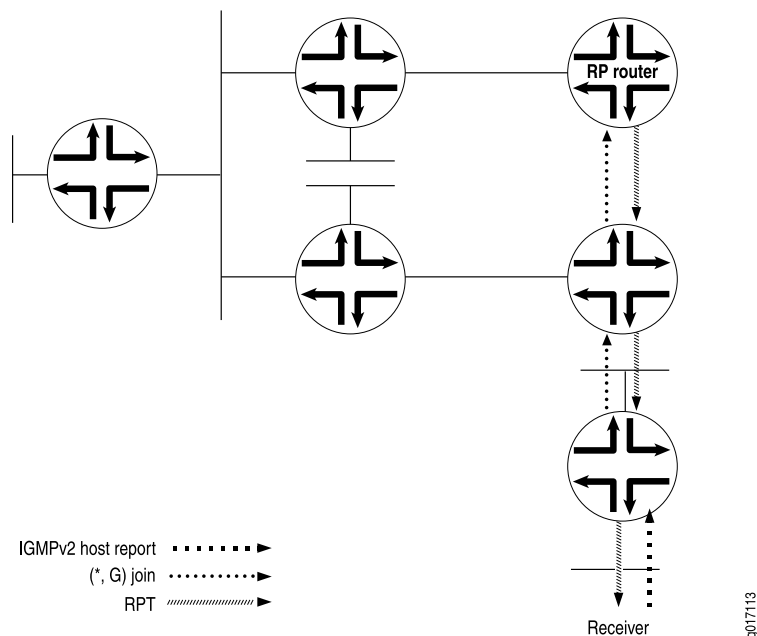
In either case, the branch is created, and packets can flow from the source to the RP and from the RP to the receiver. Note that there is no guarantee that the shared tree (RPT) is the shortest path tree to the source. Most likely it is not. However, there are ways to “migrate” a shared tree to an SPT once the flow of packets begins. In other words, the forwarding state can transition from (*,G) to (S,G). The formation of both types of tree depends heavily on the operation of the RPF check and the RPF table. For more information about the RPF table, see [“Understanding Multicast Reverse Path Forwarding” on page 155](#).

Building an RPT Between the RP and Receivers

The RPT is the path between the RP and receivers (hosts) in a multicast group (see [Figure 11 on page 105](#)). The RPT is built by means of a PIM join message from a receiver's DR:

1. A receiver sends a request to join group (G) in an Internet Group Management Protocol (IGMP) host membership report. A PIM sparse-mode router, the receiver's DR, receives the report on a directly attached subnet and creates an RPT branch for the multicast group of interest.
2. The receiver's DR sends a PIM join message to its RPF neighbor, the next-hop address in the RPF table, or the unicast routing table.
3. The PIM join message travels up the tree and is multicast to the ALL-PIM-ROUTERS group (224.0.0.13). Each router in the tree finds its RPF neighbor by using either the RPF table or the unicast routing table. This is done until the message reaches the RP and forms the RPT. Routers along the path set up the multicast forwarding state to forward requested multicast traffic back down the RPT to the receiver.

Figure 11: Building an RPT Between the RP and the Receiver



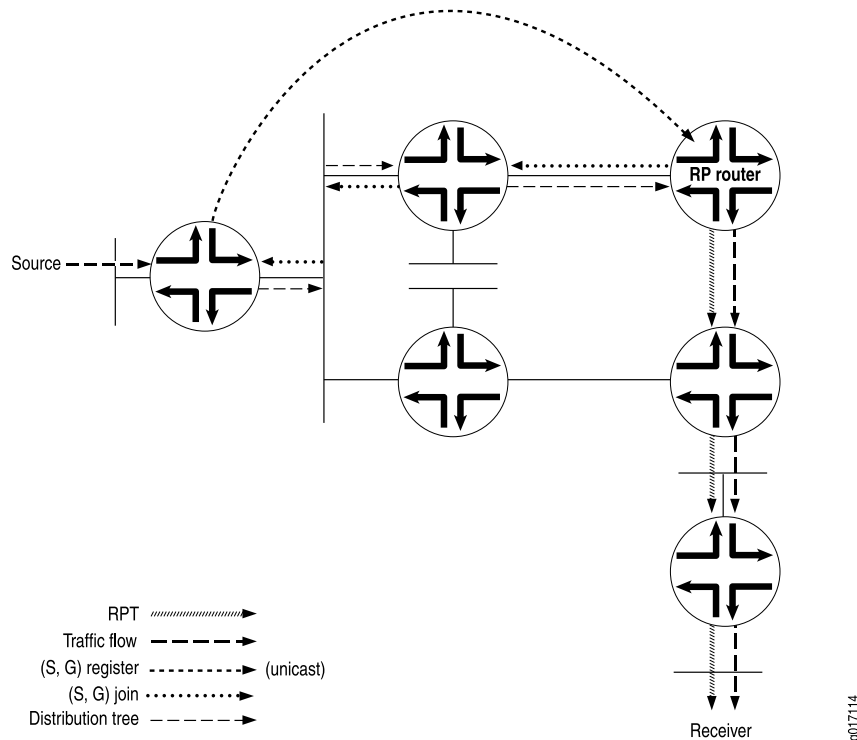
PIM Sparse Mode Source Registration

The RPT is a unidirectional tree, permitting traffic to flow down from the RP to the receiver in one direction. For multicast traffic to reach the receiver from the source, another branch of the distribution tree, called the shortest-path tree, needs to be built from the source's DR to the RP.

The shortest-path tree is created in the following way:

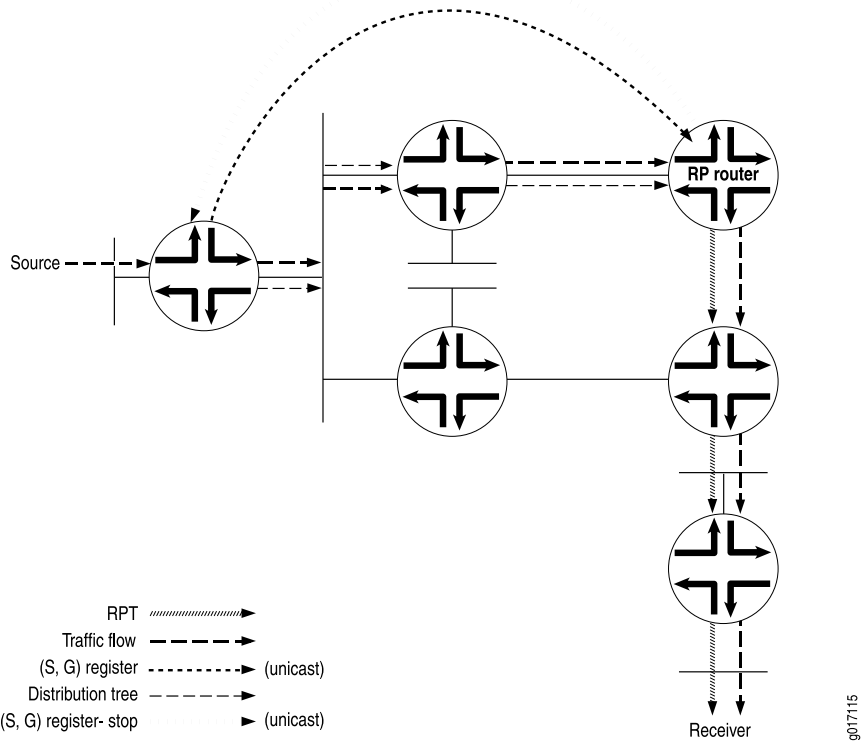
1. The source becomes active, sending out multicast packets on the LAN to which it is attached. The source's DR receives the packets and encapsulates them in a PIM register message, which it sends to the RP router (see [Figure 12 on page 106](#)).
2. When the RP router receives the PIM register message from the source, it sends a PIM join message back to the source.

Figure 12: PIM Register Message and PIM Join Message Exchanged



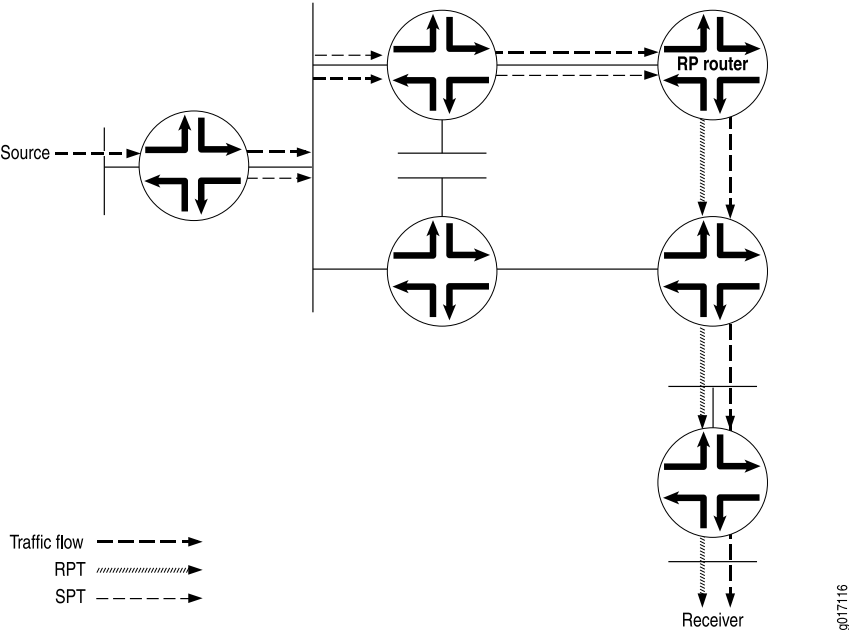
3. The source's DR receives the PIM join message and begins sending traffic down the SPT toward the RP router (see [Figure 13 on page 107](#)).
4. Once traffic is received by the RP router, it sends a register stop message to the source's DR to stop the register process.

Figure 13: Traffic Sent from the Source to the RP Router



5. The RP router sends the multicast traffic down the RPT toward the receiver (see [Figure 14 on page 107](#)).

Figure 14: Traffic Sent from the RP Router Toward the Receiver



Multicast Shortest-Path Tree

The distribution tree used for multicast is rooted at the source and is the shortest-path tree (SPT) as well. Consider a set of multicast routers without any active multicast traffic for a certain group (that is, they have no multicast forwarding state for that group). When a router learns that an interested receiver for that group is on one of its directly connected subnets, the router attempts to join the tree for that group.

To join the distribution tree, the router determines the unicast IP address of the source for that group. This address can be a simple static configuration on the router, or as complex as a set of protocols.

To build the SPT for that group, the router executes an a reverse path forwarding (RPF) check on the source address in its routing table. The RPF check produces the interface closest to the source, which is where multicast packets from this source for this group need to flow into the router.

The router next sends a join message out on this interface using the proper multicast protocol to inform the upstream router that it wants to join the distribution tree for that group. This message is an (S,G) join message because both S and G are known. The router receiving the (S,G) join message adds the interface on which the message was received to its output interface list (OIL) for the group and also performs an RPF check on the source address. The upstream router then sends an (S,G) join message out on the RPF interface toward the source, informing the upstream router that it also wants to join the group.

Each upstream router repeats this process, propagating joins out on the RPF interface, building the SPT as it goes. The process stops when the join message does one of two things:

- Reaches the router directly connected to the host that is the source.
- Reaches a router that already has multicast forwarding state for this source-group pair.

In either case, the branch is created, each of the routers has multicast forwarding state for the source-group pair, and packets can flow down the distribution tree from source to receiver. The RPF check at each router makes sure that the tree is an SPT.

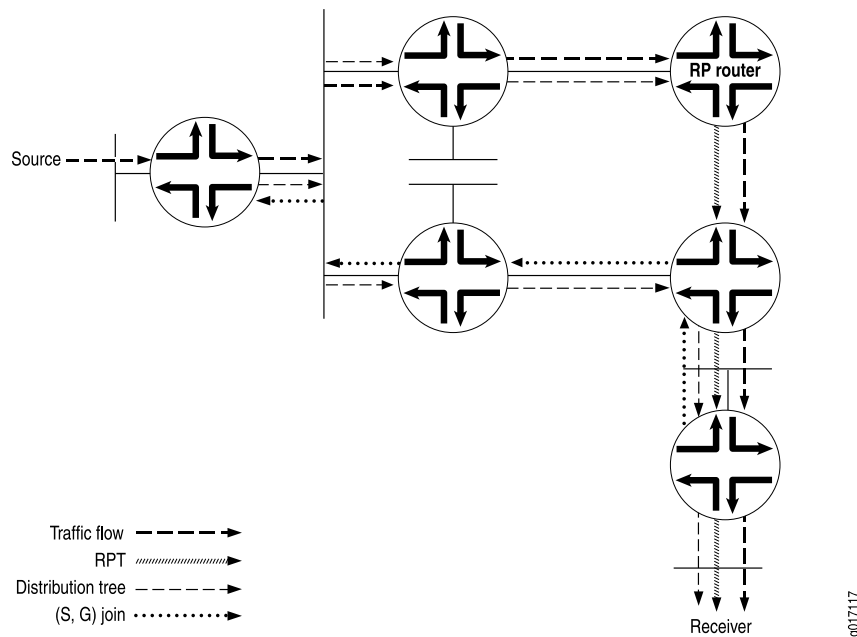
SPTs are always the shortest path, but they are not necessarily short. That is, sources and receivers tend to be on the periphery of a router network, not on the backbone, and multicast distribution trees have a tendency to sprawl across almost every router in the network. Because multicast traffic can overwhelm a slow interface, and one packet can easily become a hundred or a thousand on the opposite side of the backbone, it makes sense to provide a shared tree as a distribution tree so that the multicast source can be located more centrally in the network, on the backbone. This sharing of distribution trees with roots in the core network is accomplished by a multicast rendezvous point. For more information about RPs, see [“Understanding Multicast Rendezvous Points, Shared Trees, and Rendezvous-Point Trees”](#) on page 103.

SPT Cutover

Instead of continuing to use the SPT to the RP and the RPT toward the receiver, a direct SPT is created between the source and the receiver in the following way:

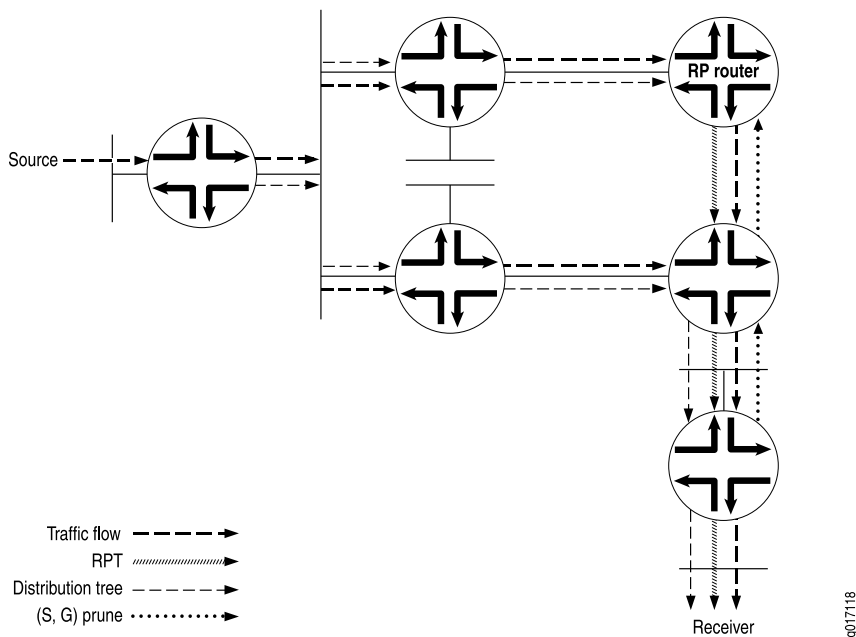
1. Once the receiver's DR receives the first multicast packet from the source, the DR sends a PIM join message to its RPF neighbor (see [Figure 15 on page 109](#)).
2. The source's DR receives the PIM join message, and an additional (S,G) state is created to form the SPT.
3. Multicast packets from that particular source begin coming from the source's DR and flowing down the new SPT to the receiver's DR. The receiver's DR is now receiving two copies of each multicast packet sent by the source—one from the RPT and one from the new SPT.

Figure 15: Receiver DR Sends a PIM Join Message to the Source



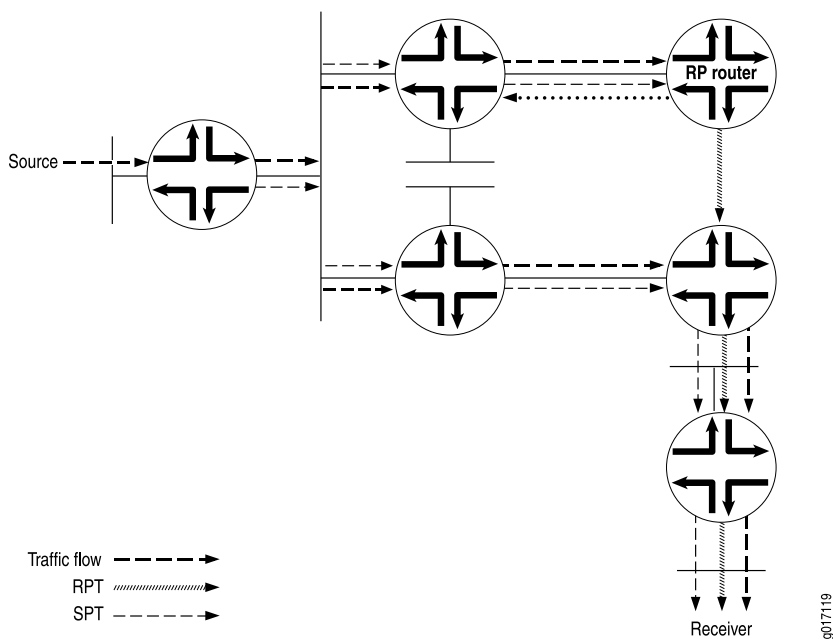
4. To stop duplicate multicast packets, the receiver's DR sends a PIM prune message toward the RP router, letting it know that the multicast packets from this particular source coming in from the RPT are no longer needed (see [Figure 16 on page 110](#)).

Figure 16: PIM Prune Message Is Sent from the Receiver's DR Toward the RP Router



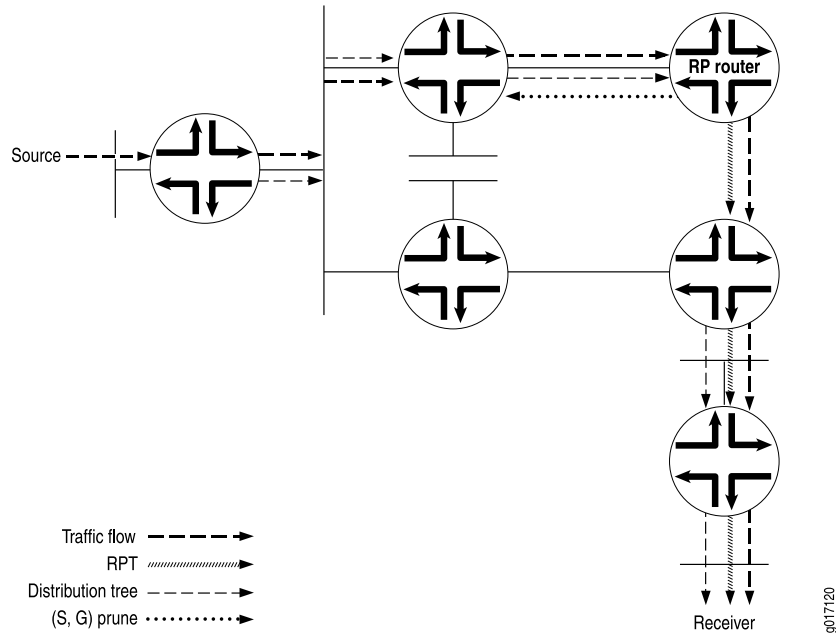
- The PIM prune message is received by the RP router, and it stops sending multicast packets down to the receiver's DR. The receiver's DR is getting multicast packets only for this particular source over the new SPT. However, multicast packets from the source are still arriving from the source's DR toward the RP router (see [Figure 17 on page 110](#)).

Figure 17: RP Router Receives PIM Prune Message



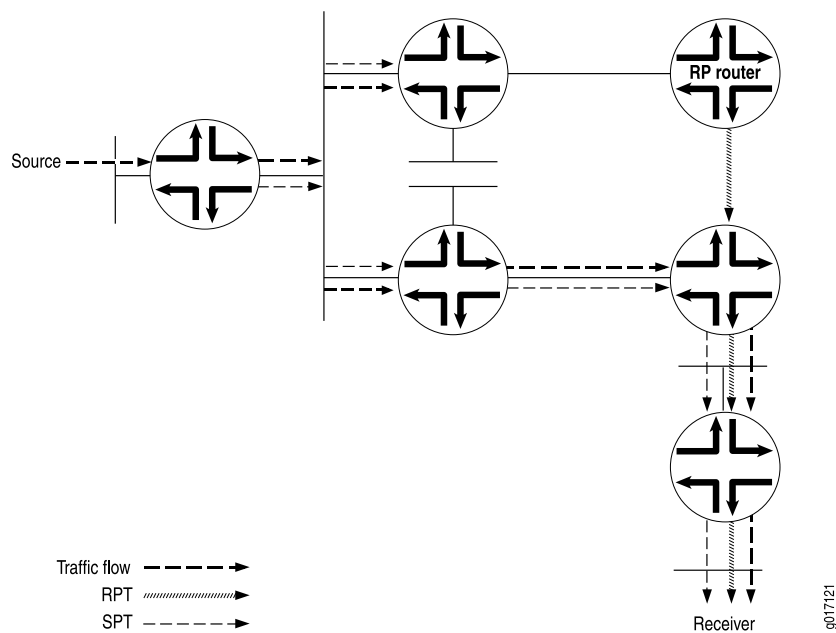
6. To stop the unneeded multicast packets from this particular source, the RP router sends a PIM prune message to the source's DR (see [Figure 18 on page 111](#)).

Figure 18: RP Router Sends a PIM Prune Message to the Source DR



7. The receiver's DR now receives multicast packets only for the particular source from the SPT (see [Figure 19 on page 111](#)).

Figure 19: Source's DR Stops Sending Duplicate Multicast Packets Toward the RP Router



SPT Cutover Control

In some cases, the last-hop router needs to stay on the shared tree to the RP and not transition to a direct SPT to the source. You might not want the last-hop router to transition when, for example, a low-bandwidth multicast stream is forwarded from the RP to a last-hop router. All routers between last hop and source must maintain and refresh the SPT state. This can become a resource-intensive activity that does not add much to the network efficiency for a particular pair of source and multicast group addresses.

In these cases, you configure an SPT threshold policy on the last-hop router to control the transition to a direct SPT. An SPT cutover threshold of infinity applied to a source-group address pair means the last-hop router will never transition to a direct SPT. For all other source-group address pairs, the last-hop router transitions immediately to a direct SPT rooted at the source DR.

Example: Configuring the PIM Assert Timeout

This example shows how to configure the timeout period for a PIM assert forwarder.

- [Requirements on page 112](#)
- [Overview on page 112](#)
- [Configuration on page 114](#)

Requirements

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure PIM Sparse Mode on the interfaces. See “[Enabling PIM Sparse Mode](#)” on [page 37](#).

Overview

The role of PIM assert messages is to determine the forwarder on a network with multiple routers. The forwarder is the router that forwards multicast packets to a network with multicast group members. The forwarder is generally the same as the PIM DR.

A router sends an assert message when it receives a multicast packet on an interface that is listed in the outgoing interface list of the matching routing entry. Receiving a message on an outgoing interface is an indication that more than one router forwards the same multicast packets to a network.

In [Figure 20 on page 113](#), both routing devices R1 and R2 forward multicast packets for the same (S,G) entry on a network. Both devices detect this situation and both devices send assert messages on the Ethernet network. An assert message contains, in addition to a source address and group address, a unicast cost metric for sending packets to the source, and a preference metric for the unicast cost. The preference metric expresses a

preference between unicast routing protocols. The routing device with the smallest preference metric becomes the forwarder (also called the assert winner). If the preference metrics are equal, the device that sent the lowest unicast cost metric becomes the forwarder. If the unicast metrics are also equal, the routing device with the highest IP address becomes the forwarder. After the transmission of assert messages, only the forwarder continues to forward messages on the network.

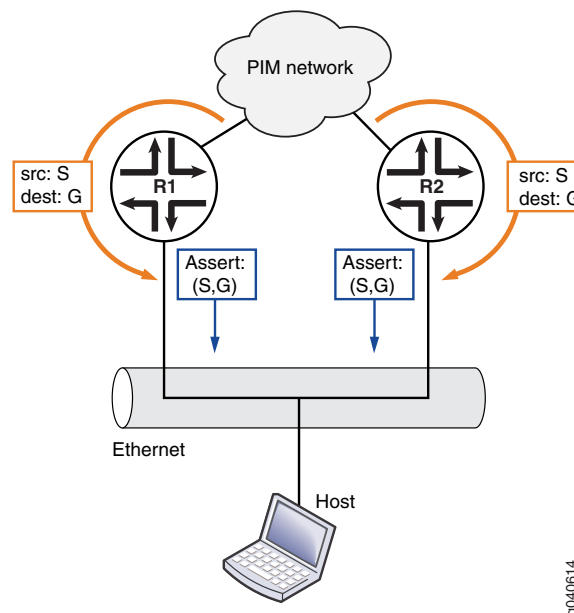
When an assert message is received and the RPF neighbor is changed to the assert winner, the assert timer is set to an assert timeout period. The assert timeout period is restarted every time a subsequent assert message for the route entry is received on the incoming interface. When the assert timer expires, the routing device resets its RPF neighbor according to its unicast routing table. Then, if multiple forwarders still exist, the forwarders reenter the assert message cycle. In effect, the assert timeout period determines how often multicast routing devices enter a PIM assert message cycle.

The range is from 5 through 210 seconds. The default is 180 seconds.

Assert messages are useful for LANs that connect multiple routing devices and no hosts.

[Figure 20 on page 113](#) shows the topology for this example.

Figure 20: PIM Assert Topology



Configuration

Step-by-Step Procedure The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure an assert timeout:

1. Configure the timeout period, in seconds.

```
[edit protocols pim]
user@host# set assert-timeout 60
```

2. (Optional) Trace assert messages.

```
[edit protocols pim]
user@host# set traceoptions file PIM.log
user@host# set traceoptions flag assert detail
```

3. If you are done configuring the device, commit the configuration.

```
user@host# commit
```

4. To verify the configuration, run the following commands:

- `show pim join`
- `show pim statistics`

Example: Configuring the PIM SPT Threshold Policy

This example shows how to apply a policy that suppresses the transition from the rendezvous-point tree (RPT) rooted at the RP to the shortest-path tree (SPT) rooted at the source.

- [Requirements on page 114](#)
- [Overview on page 115](#)
- [Configuration on page 116](#)
- [Verification on page 118](#)

Requirements

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure PIM Sparse Mode on the interfaces. See [“Enabling PIM Sparse Mode” on page 37](#).

Overview

Multicast routing devices running PIM sparse mode can forward the same stream of multicast packets onto the same LAN through an RPT rooted at the RP or through an SPT rooted at the source. In some cases, the last-hop routing device needs to stay on the shared RPT to the RP and not transition to a direct SPT to the source. Receiving the multicast data traffic on SPT is optimal but introduces more state in the network, which might not be desirable in some multicast deployments. Ideally, low-bandwidth multicast streams can be forwarded on the SPT, and high-bandwidth streams can use the SPT. This example shows how to configure such a policy.

This example includes the following settings:

- **spt-threshold**—Enables you to configure an SPT threshold policy on the last-hop routing device to control the transition to a direct SPT. When you include this statement in the main PIM instance, the PE router stays on the RPT for control traffic.
- **infinity**—Applies an SPT cutover threshold of infinity to a source-group address pair, so that the last-hop routing device never transitions to a direct SPT. For all other source-group address pairs, the last-hop routing device transitions immediately to a direct SPT rooted at the source DR. This statement must reference a properly configured policy to set the SPT cutover threshold for a particular source-group pair to infinity. The use of values other than infinity for the SPT threshold is not supported. You can configure more than one policy.
- **policy-statement**—Configures the policy. The simplest type of SPT threshold policy uses a route filter and source address filter to specify the multicast group and source addresses and to set the SPT threshold for that pair of addresses to infinity. The policy is applied to the main PIM instance.

This example sets the SPT transition value for the source-group pair 10.10.10.1 and 224.1.1.1 to infinity. When the policy is applied to the last-hop router, multicast traffic from this source-group pair never transitions to a direct SPT to the source. Traffic will continue to arrive through the RP. However, traffic for any other source-group address combination at this router transitions to a direct SPT to the source.

Note these points when configuring the SPT threshold policy:

- Configuration changes to the SPT threshold policy affect how the routing device handles the SPT transition.

Note these points when configuring the SPT threshold policy:

- Configuration changes to the SPT threshold policy affect how the routing device handles the SPT transition.

Note these points when configuring the SPT threshold policy:

- Configuration changes to the SPT threshold policy affect how the routing device handles the SPT transition.
- When the policy is configured for the first time, the routing device continues to transition to the direct SPT for the source-group address pair until the PIM-join state is cleared with the **clear pim join** command.
- If you do not clear the PIM-join state when you apply the infinity policy configuration for the first time, you must apply it before the PE router is brought up.
- When the policy is deleted for a source-group address pair for the first time, the routing device does not transition to the direct SPT for that source-group address pair until the PIM-join state is cleared with the **clear pim join** command.
- When the policy is changed for a source-group address pair for the first time, the routing device does not use the new policy until the PIM-join state is cleared with the **clear pim join** command.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
[edit]
set policy-options policy-statement spt-infinity-policy term one from route-filter
  224.1.1.1/32 exact
set policy-options policy-statement spt-infinity-policy term one from source-address-filter
  10.10.10.1/32 exact
set policy-options policy-statement spt-infinity-policy term one then accept
set policy-options policy-statement spt-infinity-policy term two then reject
set protocols pim spt-threshold infinity spt-infinity-policy
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see the *CLI User Guide*.

To configure an SPT threshold policy:

1. Apply the policy.

```
[edit]
user@host# edit protocols pim
```

```
[edit protocols pim]
user@host# set spt-threshold infinity spt-infinity-policy
[edit protocols pim]
user@host# exit
```

2. Configure the policy.

```
[edit]
user@host# edit policy-options policy-statement spt-infinity-policy
[edit policy-options policy-statement spt-infinity-policy]
user@host# set term one from route-filter 224.1.1.1/32 exact
[edit policy-options policy-statement spt-infinity-policy]
user@host# set term one from source-address-filter 10.10.10.1/32 exact
[edit policy-options policy-statement spt-infinity-policy]
user@host# set term one then accept
[edit policy-options policy-statement spt-infinity-policy]
user@host# set term two then reject
[edit policy-options policy-statement spt-infinity-policy]
user@host# exit
policy-statement {
```

3. If you are done configuring the device, commit the configuration.

```
[edit]
user@host# commit
```

4. Clear the PIM join cache to force the configuration to take effect.

```
[edit]
user@host# run clear pim join
```

Results

Confirm your configuration by entering the **show policy-options** command and the **show protocols** command from configuration mode. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show policy-options
policy-statement spt-infinity-policy {
  term one {
    from {
      route-filter 224.1.1.1/32 exact;
      source-address-filter 10.10.10.1/32 exact;
    }
    then accept;
  }
  term two {
    then reject;
  }
}

user@host# show protocols
pim {
  spt-threshold {
    infinity spt-infinity-policy;
  }
}
```

Verification

To verify the configuration, run the `show pim join` command.

Related Documentation

- [Configuring PIM Auto-RP on page 88](#)
- [Configuring PIM Bootstrap Router on page 84](#)
- [Configuring PIM Dense Mode on page 137](#)
- [Configuring a Designated Router for PIM on page 31](#)
- [Configuring PIM Filtering on page 96](#)
- [Example: Configuring Nonstop Active Routing for PIM on page 124](#)
- [Configuring PIM Sparse-Dense Mode on page 140](#)
- [Configuring PIM and the Bidirectional Forwarding Detection \(BFD\) Protocol on page 118](#)
- [Configuring Basic PIM Settings on page 21](#)

Configuring PIM and the Bidirectional Forwarding Detection (BFD) Protocol

- [Understanding Bidirectional Forwarding Detection Authentication for PIM on page 118](#)
- [Configuring BFD for PIM on page 120](#)
- [Configuring BFD Authentication for PIM on page 121](#)

Understanding Bidirectional Forwarding Detection Authentication for PIM

Bidirectional Forwarding Detection (BFD) enables rapid detection of communication failures between adjacent systems. By default, authentication for BFD sessions is disabled. However, when you run BFD over Network Layer protocols, the risk of service attacks can be significant. We strongly recommend using authentication if you are running BFD over multiple hops or through insecure tunnels. Beginning with Junos OS Release 9.6, Junos OS supports authentication for BFD sessions running over PIM. BFD authentication is only supported in the Canada and United States version of the Junos OS image and is not available in the export version.

You authenticate BFD sessions by specifying an authentication algorithm and keychain, and then associating that configuration information with a security authentication keychain using the keychain name.

The following sections describe the supported authentication algorithms, security keychains, and level of authentication that can be configured:

- [BFD Authentication Algorithms on page 119](#)
- [Security Authentication Keychains on page 119](#)
- [Strict Versus Loose Authentication on page 120](#)

BFD Authentication Algorithms

Junos OS supports the following algorithms for BFD authentication:

- **simple-password**—Plain-text password. One to 16 bytes of plain text are used to authenticate the BFD session. One or more passwords can be configured. This method is the least secure and should be used only when BFD sessions are not subject to packet interception.
- **keyed-md5**—Keyed Message Digest 5 hash algorithm for sessions with transmit and receive intervals greater than 100 ms. To authenticate the BFD session, keyed MD5 uses one or more secret keys (generated by the algorithm) and a sequence number that is updated periodically. With this method, packets are accepted at the receiving end of the session if one of the keys matches and the sequence number is greater than or equal to the last sequence number received. Although more secure than a simple password, this method is vulnerable to replay attacks. Increasing the rate at which the sequence number is updated can reduce this risk.
- **meticulous-keyed-md5**—Meticulous keyed Message Digest 5 hash algorithm. This method works in the same manner as keyed MD5, but the sequence number is updated with every packet. Although more secure than keyed MD5 and simple passwords, this method might take additional time to authenticate the session.
- **keyed-sha-1**—Keyed Secure Hash Algorithm I for sessions with transmit and receive intervals greater than 100 ms. To authenticate the BFD session, keyed SHA uses one or more secret keys (generated by the algorithm) and a sequence number that is updated periodically. The key is not carried within the packets. With this method, packets are accepted at the receiving end of the session if one of the keys matches and the sequence number is greater than the last sequence number received.
- **meticulous-keyed-sha-1**—Meticulous keyed Secure Hash Algorithm I. This method works in the same manner as keyed SHA, but the sequence number is updated with every packet. Although more secure than keyed SHA and simple passwords, this method might take additional time to authenticate the session.



NOTE: Nonstop active routing (NSR) is not supported with meticulous-keyed-md5 and meticulous-keyed-sha-1 authentication algorithms. BFD sessions using these algorithms might go down after a switchover.

Security Authentication Keychains

The security authentication keychain defines the authentication attributes used for authentication key updates. When the security authentication keychain is configured and associated with a protocol through the keychain name, authentication key updates can occur without interrupting routing and signaling protocols.

The authentication keychain contains one or more keychains. Each keychain contains one or more keys. Each key holds the secret data and the time at which the key becomes valid. The algorithm and keychain must be configured on both ends of the BFD session,

and they must match. Any mismatch in configuration prevents the BFD session from being created.

BFD allows multiple clients per session, and each client can have its own keychain and algorithm defined. To avoid confusion, we recommend specifying only one security authentication keychain.

Strict Versus Loose Authentication

By default, strict authentication is enabled, and authentication is checked at both ends of each BFD session. Optionally, to smooth migration from nonauthenticated sessions to authenticated sessions, you can configure *loose checking*. When loose checking is configured, packets are accepted without authentication being checked at each end of the session. This feature is intended for transitional periods only.

Configuring BFD for PIM

The Bidirectional Forwarding Detection (BFD) protocol is a simple hello mechanism that detects failures in a network. BFD works with a wide variety of network environments and topologies. A pair of routing devices exchanges BFD packets. Hello packets are sent at a specified, regular interval. A neighbor failure is detected when the routing device stops receiving a reply after a specified interval. The BFD failure detection timers have shorter time limits than the PIM hello hold time, so they provide faster detection.

The BFD failure detection timers are adaptive and can be adjusted to be faster or slower. The lower the BFD failure detection timer value, the faster the failure detection and vice versa. For example, the timers can adapt to a higher value if the adjacency fails (that is, the timer detects failures more slowly). Or a neighbor can negotiate a higher value for a timer than the configured value. The timers adapt to a higher value when a BFD session flap occurs more than three times in a span of 15 seconds. A back-off algorithm increases the receive (Rx) interval by two if the local BFD instance is the reason for the session flap. The transmission (Tx) interval is increased by two if the remote BFD instance is the reason for the session flap. You can use the **clear bfd adaptation** command to return BFD interval timers to their configured values. The **clear bfd adaptation** command is hitless, meaning that the command does not affect traffic flow on the routing device.

You must specify the minimum transmit and minimum receive intervals to enable BFD on PIM.

To enable failure detection:

1. Configure the interface globally or in a routing instance. This example shows the global configuration.

```
[edit protocols pim]
user@host# edit interface fe-1/0/0.0 bfd-liveness-detection
```

2. Configure the minimum transmit interval. This is the minimum interval after which the routing device transmits hello packets to a neighbor with which it has established a BFD session. Specifying an interval smaller than 300 ms can cause undesired BFD flapping.

```
[edit protocols pim interface fe-1/0/0.0 bfd-liveness-detection]
user@host# set transmit-interval 350
```


3. Configure the minimum interval after which the routing device expects to receive a reply from a neighbor with which it has established a BFD session. Specifying an interval smaller than 300 ms can cause undesired BFD flapping.

```
[edit protocols pim interface fe-1/0/0.0 bfd-liveness-detection]
user@host# set minimum-receive-interval 350
```

4. (Optional) Configure other BFD settings.

As an alternative to setting the receive and transmit intervals separately, configure one interval for both.

```
[edit protocols pim interface fe-1/0/0.0 bfd-liveness-detection]
user@host# set minimum-interval 350
```

5. Configure the threshold for the adaptation of the BFD session detection time. When the detection time adapts to a value equal to or greater than the threshold, a single trap and a single system log message are sent.

```
[edit protocols pim interface fe-1/0/0.0 bfd-liveness-detection]
user@host# set detection-time threshold 800
```

6. Configure the number of hello packets not received by a neighbor that causes the originating interface to be declared down.

```
[edit protocols pim interface fe-1/0/0.0 bfd-liveness-detection]
user@host# set multiplier 50
```

7. Configure the BFD version.

```
[edit protocols pim interface fe-1/0/0.0 bfd-liveness-detection]
user@host# set version 1
```

8. Specify that BFD sessions should not adapt to changing network conditions. We recommend that you not disable BFD adaptation unless it is preferable not to have BFD adaptation enabled in your network.

```
[edit protocols pim interface fe-1/0/0.0 bfd-liveness-detection]
user@host# set no-adaptation
```

9. Verify the configuration by checking the output of the **show bfd session** command.

Configuring BFD Authentication for PIM

Beginning with Junos OS Release 9.6, you can configure authentication for BFD sessions running over PIM. Routing instances are also supported. The following steps are needed to configure authentication on a BFD session:

1. Specify the BFD authentication algorithm for the PIM protocol.
2. Associate the authentication keychain with the PIM protocol.
3. Configure the related security authentication keychain.

The following sections provide instructions for configuring and viewing BFD authentication on PIM:

- [Configuring BFD Authentication Parameters on page 122](#)
- [Viewing Authentication Information for BFD Sessions on page 123](#)

Configuring BFD Authentication Parameters

BFD authentication is only supported in the Canada and United States version of the Junos OS image and is not available in the export version.

To configure BFD authentication:

1. Specify the algorithm (**keyed-md5**, **keyed-sha-1**, **meticulous-keyed-md5**, **meticulous-keyed-sha-1**, or **simple-password**) to use for BFD authentication on a PIM route or routing instance.

```
[edit protocols pim]
user@host# set interface if3-pim bfd-liveness-detection authentication algorithm
keyed-sha-1
```



NOTE: Nonstop active routing (NSR) is not supported with the **meticulous-keyed-md5** and **meticulous-keyed-sha-1** authentication algorithms. BFD sessions using these algorithms may go down after a switchover.

2. Specify the keychain to be used to associate BFD sessions on the specified PIM route or routing instance with the unique security authentication keychain attributes. The keychain you specify must match the keychain name configured at the **[edit security authentication key-chains]** hierarchy level.

```
[edit protocols pim]
user@host# set interface if3-pim bfd-liveness-detection authentication keychain
bfd-pim
```



NOTE: The algorithm and keychain must be configured on both ends of the BFD session, and they must match. Any mismatch in configuration prevents the BFD session from being created.

3. Specify the unique security authentication information for BFD sessions:
 - The matching keychain name as specified in Step 2.
 - At least one key, a unique integer between **0** and **63**. Creating multiple keys allows multiple clients to use the BFD session.
 - The secret data used to allow access to the session.
 - The time at which the authentication key becomes active, in the format *yyyy-mm-dd.hh:mm:ss*.

```
[edit security]
user@host# set authentication-key-chains key-chain bfd-pim key 53 secret
$9$ggaJDmPQ6/tJgF/AtREVsyPsnCtUHm start-time 2009-06-14.10:00:00
```

4. (Optional) Specify loose authentication checking if you are transitioning from nonauthenticated sessions to authenticated sessions.

```
[edit protocols pim]
```

```
user@host# set interface if3-pim bfd-liveness-detection authentication loose-check
```

5. (Optional) View your configuration using the **show bfd session detail** or **show bfd session extensive** command.
6. Repeat these steps to configure the other end of the BFD session.

Viewing Authentication Information for BFD Sessions

You can view the existing BFD authentication configuration using the **show bfd session detail** and **show bfd session extensive** commands.

The following example shows BFD authentication configured for the **if3-pim** BGP group. It specifies the keyed SHA-1 authentication algorithm and a keychain name of **bfd-pim**. The authentication keychain is configured with two keys. Key 1 contains the secret data “\$9\$ggaJDmPQ6/tJgF/AtREVsyPsnCtUHm” and a start time of June 1, 2009, at 9:46:02 AM PST. Key 2 contains the secret data “\$9\$a5jiKW9L.reP38ny.TszF2/9” and a start time of June 1, 2009, at 3:29:20 PM PST.

```
[edit protocols pim]
interface if3-pim {
  bfd-liveness-detection {
    authentication {
      algorithm keyed-sha-1;
      key-chain bfd-pim;
    }
  }
}
[edit security]
authentication key-chains {
  key-chain bfd-pim {
    key 1 {
      secret "$9$ggaJDmPQ6/tJgF/AtREVsyPsnCtUHm";
      start-time "2009-6-1.09:46:02 -0700";
    }
    key 2 {
      secret "$9$a5jiKW9L.reP38ny.TszF2/9";
      start-time "2009-6-1.15:29:20 -0700";
    }
  }
}
```

If you commit these updates to your configuration, you see output similar to the following example. In the output for the **show bfd session detail** command, **Authenticate** is displayed to indicate that BFD authentication is configured. For more information about the configuration, use the **show bfd session extensive** command. The output for this command provides the keychain name, the authentication algorithm and mode for each client in the session, and the overall BFD authentication configuration status, keychain name, and authentication algorithm and mode.

show bfd session detail

```
user@host# show bfd session detail
```

```
Detect Transmit
```

```

Address          State      Interface    Time      Interval  Multiplier
50.0.0.2         Up        ge-0/1/5.0   0.900     0.300     3
Client PIM, TX interval 0.300, RX interval 0.300, Authenticate
Session up time 3d 00:34
Local diagnostic None, remote diagnostic NbrSignal
Remote state Up, version 1
Replicated

```

show bfd session extensive

```

user@host# show bfd session extensive

Address          State      Interface    Detect      Transmit
50.0.0.2         Up        ge-0/1/5.0   Time      Interval  Multiplier
0.900           0.300     3
Client PIM, TX interval 0.300, RX interval 0.300, Authenticate
keychain bfd-pim, algo keyed-sha-1, mode strict
Session up time 00:04:42
Local diagnostic None, remote diagnostic NbrSignal
Remote state Up, version 1
Replicated
Min async interval 0.300, min slow interval 1.000
Adaptive async TX interval 0.300, RX interval 0.300
Local min TX interval 0.300, minimum RX interval 0.300, multiplier 3
Remote min TX interval 0.300, min RX interval 0.300, multiplier 3
Local discriminator 2, remote discriminator 2
Echo mode disabled/inactive
Authentication enabled/active, keychain bfd-pim, algo keyed-sha-1, mode strict

```

Related Documentation

- [Configuring PIM Auto-RP on page 88](#)
- [Configuring PIM Bootstrap Router on page 84](#)
- [Configuring PIM Dense Mode on page 137](#)
- [Configuring a Designated Router for PIM on page 31](#)
- [Configuring PIM Filtering on page 96](#)
- [Example: Configuring Nonstop Active Routing for PIM on page 124](#)
- [Examples: Configuring PIM RPT and SPT Cutover on page 103](#)
- [Configuring PIM Sparse-Dense Mode on page 140](#)
- [Configuring Basic PIM Settings on page 21](#)

Example: Configuring Nonstop Active Routing for PIM

- [Understanding Nonstop Active Routing for PIM on page 124](#)
- [Example: Configuring Nonstop Active Routing with PIM on page 125](#)
- [Configuring PIM Sparse Mode Graceful Restart on page 136](#)

Understanding Nonstop Active Routing for PIM

Nonstop active routing configurations include two Routing Engines that share information so that routing is not interrupted during Routing Engine failover. When nonstop active

routing is configured on a dual Routing Engine platform, the PIM control state is replicated on both Routing Engines.

This PIM state information includes:

- Neighbor relationships
- Join and prune information
- RP-set information
- Synchronization between routes and next hops and the forwarding state between the two Routing Engines

The PIM control state is maintained on the backup Routing Engine by the replication of state information from the master to the backup Routing Engine and having the backup Routing Engine react to route installation and modification in the `[instance].inet.1` routing table on the master Routing Engine. The backup Routing Engine does not send or receive PIM protocol packets directly. In addition, the backup Routing Engine uses the dynamic interfaces created by the master Routing Engine. These dynamic interfaces include PIM encapsulation, de-encapsulation, and multicast tunnel interfaces.



NOTE: The `clear pim join`, `clear pim register`, and `clear pim statistics` operational mode commands are not supported on the backup Routing Engine when nonstop active routing is enabled.

To enable nonstop active routing for PIM (in addition to the PIM configuration on the master Routing Engine), you must include the following statements at the `[edit]` hierarchy level:

- `chassis redundancy graceful-switchover`
- `routing-options nonstop-routing`
- `system commit synchronize`

Example: Configuring Nonstop Active Routing with PIM

This example shows how to configure nonstop active routing for PIM-based multicast IPv4 and IPv6 traffic.

- [Requirements on page 125](#)
- [Overview on page 126](#)
- [Configuration on page 127](#)
- [Verification on page 136](#)

Requirements

Before you begin:

- Configure the router interfaces. See the *Network Interfaces Configuration Guide*.
- Configure an interior gateway protocol or static routing. See the *Routing Protocols Configuration Guide*.
- Configure a multicast group membership protocol (IGMP or MLD). See “[Understanding IGMP](#)” on page 222 and “[Understanding MLD](#)” on page 247.
- For this feature to work with IPv6, the routing device must be running Junos OS Release 10.4 or above.

Overview

Junos OS supports nonstop active routing in the following PIM scenarios:

- Dense mode
- Sparse mode
- SSM
- Static RP
- Auto-RP (for IPv4 only)
- Bootstrap router
- Embedded RP on the non-RP router (for IPv6 only)
- BFD support

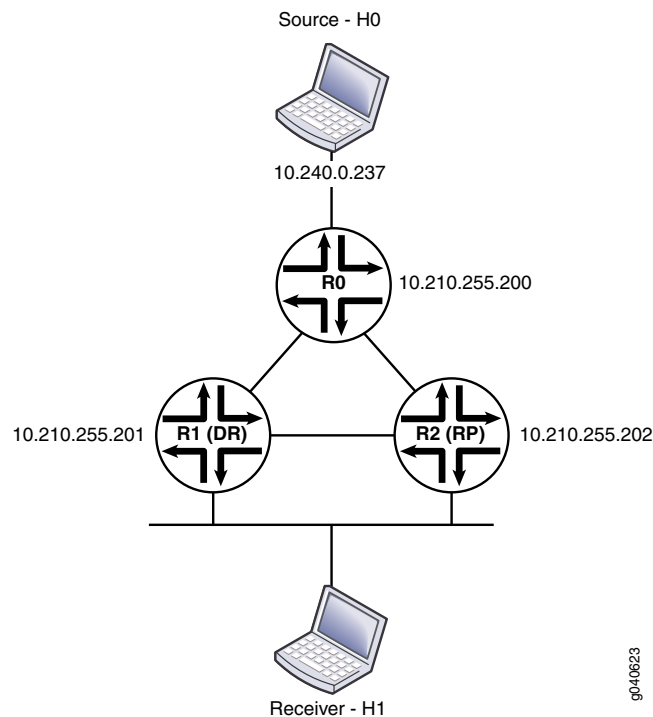


NOTE: Multicast VPNs are not supported with nonstop active routing. Policy-based features (such as neighbor policy, join policy, BSR policy, scope policy, flow maps, and RPF check policy) are not supported with nonstop active routing.

This example uses static RP. The interfaces are configured to receive both IPv4 and IPv6 traffic. R2 provides RP services as the local RP. Note that nonstop active routing is not supported on the RP router. The configuration shown in this example is on R1.

[Figure 21 on page 127](#) shows the topology used in this example.

Figure 21: Nonstop Active Routing in PIM Domain



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
R1 set system syslog archive size 10m
set system syslog file messages any info
set system commit synchronize
set chassis redundancy graceful-switchover
set interfaces traceoptions file dcd-trace
set interfaces traceoptions file size 10m
set interfaces traceoptions file files 10
set interfaces traceoptions flag all
set interfaces so-0/0/1 unit 0 description "to R0 so-0/0/1.0"
set interfaces so-0/0/1 unit 0 family inet address 10.210.1.2/30
set interfaces so-0/0/1 unit 0 family inet6 address FDCA:9E34:50CE:0001::2/126
set interfaces fe-0/1/3 unit 0 description "to R2 fe-0/1/3.0"
set interfaces fe-0/1/3 unit 0 family inet address 10.210.12.1/30
set interfaces fe-0/1/3 unit 0 family inet6 address FDCA:9E34:50CE:0012::1/126
set interfaces fe-1/1/0 unit 0 description "to H1"
set interfaces fe-1/1/0 unit 0 family inet address 10.240.0.250/30
set interfaces fe-1/1/0 unit 0 family inet6 address ::10.240.0.250/126
set interfaces lo0 unit 0 description "R1 Loopback"
set interfaces lo0 unit 0 family inet address 10.210.255.201/32 primary
set interfaces lo0 unit 0 family iso address
47.0005.80ff.f800.0000.0108.0001.0102.1025.5201.00
set interfaces lo0 unit 0 family inet6 address abcd::10:210:255:201/128
```

```
set protocols ospf traceoptions file r1-nsr-ospf2
set protocols ospf traceoptions file size 10m
set protocols ospf traceoptions file files 10
set protocols ospf traceoptions file world-readable
set protocols ospf traceoptions flag error
set protocols ospf traceoptions flag lsa-update detail
set protocols ospf traceoptions flag flooding detail
set protocols ospf traceoptions flag lsa-request detail
set protocols ospf traceoptions flag state detail
set protocols ospf traceoptions flag event detail
set protocols ospf traceoptions flag hello detail
set protocols ospf traceoptions flag nsr-synchronization detail
set protocols ospf traffic-engineering
set protocols ospf area 0.0.0.0 interface so-0/0/1.0 metric 100
set protocols ospf area 0.0.0.0 interface fe-0/1/3.0 metric 100
set protocols ospf area 0.0.0.0 interface lo0.0 passive
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface fe-1/1/0.0 passive
set protocols ospf3 traceoptions file r1-nsr-ospf3
set protocols ospf3 traceoptions file size 10m
set protocols ospf3 traceoptions file world-readable
set protocols ospf3 traceoptions flag lsa-update detail
set protocols ospf3 traceoptions flag flooding detail
set protocols ospf3 traceoptions flag lsa-request detail
set protocols ospf3 traceoptions flag state detail
set protocols ospf3 traceoptions flag event detail
set protocols ospf3 traceoptions flag hello detail
set protocols ospf3 traceoptions flag nsr-synchronization detail
set protocols ospf3 area 0.0.0.0 interface fe-1/1/0.0 passive
set protocols ospf3 area 0.0.0.0 interface fe-1/1/0.0 metric 1
set protocols ospf3 area 0.0.0.0 interface lo0.0 passive
set protocols ospf3 area 0.0.0.0 interface so-0/0/1.0 metric 1
set protocols ospf3 area 0.0.0.0 interface fe-0/1/3.0 metric 1
set protocols pim traceoptions file r1-nsr-pim
set protocols pim traceoptions file size 10m
set protocols pim traceoptions file files 10
set protocols pim traceoptions file world-readable
set protocols pim traceoptions flag mdt detail
set protocols pim traceoptions flag rp detail
set protocols pim traceoptions flag register detail
set protocols pim traceoptions flag packets detail
set protocols pim traceoptions flag autorp detail
set protocols pim traceoptions flag join detail
set protocols pim traceoptions flag hello detail
set protocols pim traceoptions flag assert detail
set protocols pim traceoptions flag normal detail
set protocols pim traceoptions flag state detail
set protocols pim traceoptions flag nsr-synchronization
set protocols pim rp static address 10.210.255.202
set protocols pim rp static address abcd::10:210:255:202
set protocols pim interface lo0.0
set protocols pim interface fe-0/1/3.0 mode sparse
set protocols pim interface fe-0/1/3.0 version 2
set protocols pim interface so-0/0/1.0 mode sparse
set protocols pim interface so-0/0/1.0 version 2
set protocols pim interface fe-1/1/0.0 mode sparse
```



```

set protocols pim interface fe-1/1/0.0 version 2
set policy-options policy-statement load-balance then load-balance per-packet
set routing-options nonstop-routing
set routing-options router-id 10.210.255.201
set routing-options forwarding-table export load-balance
set routing-options forwarding-table traceoptions file r1-nsr-krt
set routing-options forwarding-table traceoptions file size 10m
set routing-options forwarding-table traceoptions file world-readable
set routing-options forwarding-table traceoptions flag queue
set routing-options forwarding-table traceoptions flag route
set routing-options forwarding-table traceoptions flag routes
set routing-options forwarding-table traceoptions flag synchronous
set routing-options forwarding-table traceoptions flag state
set routing-options forwarding-table traceoptions flag asynchronous
set routing-options forwarding-table traceoptions flag consistency-checking
set routing-options traceoptions file r1-nsr-sync
set routing-options traceoptions file size 10m
set routing-options traceoptions flag nsr-synchronization
set routing-options traceoptions flag commit-synchronize

```

Step-by-Step Procedure The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure nonstop active routing on R1:

1. Synchronize the Routing Engines.

```

[edit]
user@host# edit system
[edit system]
user@host# set commit synchronize
user@host# exit

```

2. Enable graceful Routing Engine switchover.

```

[edit]
user@host# set chassis redundancy graceful-switchover

```

3. Configure R1's interfaces.

```

[edit]
user@host# edit interfaces
[edit interfaces]
user@host# set so-0/0/1 unit 0 description "to R0 so-0/0/1.0"
user@host# set so-0/0/1 unit 0 family inet address 10.210.1.2/30
user@host# set so-0/0/1 unit 0 family inet6 address FDCA:9E34:50CE:0001::2/126
user@host# set fe-0/1/3 unit 0 description "to R2 fe-0/1/3.0"
user@host# set fe-0/1/3 unit 0 family inet address 10.210.12.1/30
user@host# set fe-0/1/3 unit 0 family inet6 address FDCA:9E34:50CE:0012::1/126
user@host# set fe-1/1/0 unit 0 description "to H1"
user@host# set fe-1/1/0 unit 0 family inet address 10.240.0.250/30
user@host# set fe-1/1/0 unit 0 family inet6 address ::10.240.0.250/126
user@host# set lo0 unit 0 description "R1 Loopback"
user@host# set lo0 unit 0 family inet address 10.210.255.201/32 primary
user@host# set lo0 unit 0 family iso address
47.0005.80ff.f800.0000.0108.0001.0102.1025.5201.00

```

```
user@host# set lo0 unit 0 family inet6 address abcd::10:210:255:201/128
user@host# exit
```

4. Configure OSPF for IPv4 on R1.

```
[edit]
user@host# edit protocols ospf
[edit protocols ospf]
user@host# set traffic-engineering
user@host# set area 0.0.0.0 interface so-0/0/1.0 metric 100
user@host# set area 0.0.0.0 interface fe-0/1/3.0 metric 100
user@host# set area 0.0.0.0 interface lo0.0 passive
user@host# set area 0.0.0.0 interface fxp0.0 disable
user@host# set area 0.0.0.0 interface fe-1/1/0.0 passive
```

5. Configure OSPF for IPv6 on R1.

```
[edit]
user@host# edit protocols ospf3
[edit protocols ospf3]
user@host# set area 0.0.0.0 interface fe-1/1/0.0 passive
user@host# set area 0.0.0.0 interface fe-1/1/0.0 metric 1
user@host# set area 0.0.0.0 interface lo0.0 passive
user@host# set area 0.0.0.0 interface so-0/0/1.0 metric 1
user@host# set area 0.0.0.0 interface fe-0/1/3.0 metric 1
```

6. Configure PIM on R1. The PIM static address points to the RP router (R2).

```
[edit]
user@host# edit
[edit protocols pim]
user@host# set protocols pim rpstatic address 10.210.255.202
user@host# set protocols pim rp static address abcd::10:210:255:202
user@host# set protocols pim interface lo0.0
user@host# set protocols pim interface fe-0/1/3.0 mode sparse
user@host# set protocols pim interface fe-0/1/3.0 version 2
user@host# set protocols pim interface so-0/0/1.0 mode sparse
user@host# set protocols pim interface so-0/0/1.0 version 2
user@host# set protocols pim interface fe-1/1/0.0 mode sparse
user@host# set protocols pim interface fe-1/1/0.0 version 2
```

7. Configure per-packet load balancing on R1.

```
[edit]
user@host# edit policy-options policy-statement load-balance
[edit policy-options policy-statement load-balance]
user@host# set then load-balance per-packet
```

8. Apply the load-balance policy on R1.

```
[edit]
user@host# set routing-options forwarding-table export load-balance
```

9. Configure nonstop routing on R1.

```
[edit]
user@host# set routing-options nonstop-routing
user@host# set routing-options router-id 10.210.255.201
```

Step-by-Step Procedure For troubleshooting, configure system log and tracing operations.

1. Enable system log messages.

```
[edit]
user@host# set system syslog archive size 10m
user@host# set system syslog file messages any info
```
2. Trace interface operations.

```
[edit]
user@host# set interfaces traceoptions file dcd-trace
user@host# set interfaces traceoptions file size 10m
user@host# set interfaces traceoptions file files 10
user@host# set interfaces traceoptions flag all
```
3. Trace IGP operations for IPv4.

```
[edit]
user@host# set protocols ospf traceoptions file r1-nsr-ospf2
user@host# set protocols ospf traceoptions file size 10m
user@host# set protocols ospf traceoptions file files 10
user@host# set protocols ospf traceoptions file world-readable
user@host# set protocols ospf traceoptions flag error
user@host# set protocols ospf traceoptions flag lsa-update detail
user@host# set protocols ospf traceoptions flag flooding detail
user@host# set protocols ospf traceoptions flag lsa-request detail
user@host# set protocols ospf traceoptions flag state detail
user@host# set protocols ospf traceoptions flag event detail
user@host# set protocols ospf traceoptions flag hello detail
user@host# set protocols ospf traceoptions flag nsr-synchronization detail
```
4. Trace IGP operations for IPv6.

```
[edit]
user@host# set protocols ospf3 traceoptions file r1-nsr-ospf3
user@host# set protocols ospf3 traceoptions file size 10m
user@host# set protocols ospf3 traceoptions file world-readable
user@host# set protocols ospf3 traceoptions flag lsa-update detail
user@host# set protocols ospf3 traceoptions flag flooding detail
user@host# set protocols ospf3 traceoptions flag lsa-request detail
user@host# set protocols ospf3 traceoptions flag state detail
user@host# set protocols ospf3 traceoptions flag event detail
user@host# set protocols ospf3 traceoptions flag hello detail
user@host# set protocols ospf3 traceoptions flag nsr-synchronization detail
```
5. Trace PIM operations.

```
[edit]
user@host# set protocols pim traceoptions file r1-nsr-pim
user@host# set protocols pim traceoptions file size 10m
user@host# set protocols pim traceoptions file files 10
user@host# set protocols pim traceoptions file world-readable
user@host# set protocols pim traceoptions flag mdt detail
user@host# set protocols pim traceoptions flag rp detail
user@host# set protocols pim traceoptions flag register detail
user@host# set protocols pim traceoptions flag packets detail
user@host# set protocols pim traceoptions flag autorp detail
user@host# set protocols pim traceoptions flag join detail
```

```
user@host# set protocols pim traceoptions flag hello detail
user@host# set protocols pim traceoptions flag assert detail
user@host# set protocols pim traceoptions flag normal detail
user@host# set protocols pim traceoptions flag state detail
user@host# set protocols pim traceoptions flag nsr-synchronization
```

6. Trace all routing protocol functionality.

```
[edit]
user@host# set routing-options traceoptions file r1-nsr-sync
user@host# set routing-options traceoptions file size 10m
user@host# set routing-options traceoptions flag nsr-synchronization
user@host# set routing-options traceoptions flag commit-synchronize
```

7. Trace forwarding table operations.

```
[edit]
user@host# set routing-options forwarding-table traceoptions file r1-nsr-krt
user@host# set routing-options forwarding-table traceoptions file size 10m
user@host# set routing-options forwarding-table traceoptions file world-readable
user@host# set routing-options forwarding-table traceoptions flag queue
user@host# set routing-options forwarding-table traceoptions flag route
user@host# set routing-options forwarding-table traceoptions flag routes
user@host# set routing-options forwarding-table traceoptions flag synchronous
user@host# set routing-options forwarding-table traceoptions flag state
user@host# set routing-options forwarding-table traceoptions flag asynchronous
user@host# set routing-options forwarding-table traceoptions flag
consistency-checking
```

8. If you are done configuring the device, commit the configuration.

```
[edit]
user@host# commit
```

Results

From configuration mode, confirm your configuration by entering the **show chassis**, **show interfaces**, **show policy-options**, **show protocols**, **show routing-options**, and **show system** commands. If the output does not display the intended configuration, repeat the configuration instructions in this example to correct it.

```
user@host# show chassis
redundancy {
  graceful-switchover;
}

user@host# show interfaces
traceoptions {
  file dcd-trace size 10m files 10;
  flag all;
}
so-0/0/1 {
  unit 0 {
    description "to R0 so-0/0/1.0";
    family inet {
      address 10.210.1.2/30;
    }
    family inet6 {
```

```

        address FDCA:9E34:50CE:0001::2/126;
    }
}
}
fe-0/1/3 {
    unit 0 {
        description "to R2 fe-0/1/3.0";
        family inet {
            address 10.210.12.1/30;
        }
        family inet6 {
            address FDCA:9E34:50CE:0012::1/126;
        }
    }
}
fe-1/1/0 {
    unit 0 {
        description "to H1";
        family inet {
            address 10.240.0.250/30;
        }
        family inet6 {
            address ::10.240.0.250/126;
        }
    }
}
lo0 {
    unit 0 {
        description "R1 Loopback";
        family inet {
            address 10.210.255.201/32 {
                primary;
            }
        }
        family iso {
            address 47.0005.80ff.f800.0000.0108.0001.0102.1025.5201.00;
        }
        family inet6 {
            address abcd::10:210:255:201/128;
        }
    }
}

user@host# show policy-options
policy-statement load-balance {
    then {
        load-balance per-packet;
    }
}

user@host# show protocols
ospf {
    traceoptions {
        file r1-nsr-ospf2 size 10m files 10 world-readable;
        flag error;
        flag lsa-update detail;
        flag flooding detail;
    }
}

```

```
    flag lsa-request detail;
    flag state detail;
    flag event detail;
    flag hello detail;
    flag nsr-synchronization detail;
  }
  traffic-engineering;
  area 0.0.0.0 {
    interface so-0/0/1.0 {
      metric 100;
    }
    interface fe-0/1/3.0 {
      metric 100;
    }
    interface lo0.0 {
      passive;
    }
    interface fxp0.0 {
      disable;
    }
    interface fe-1/1/0.0 {
      passive;
    }
  }
}
ospf3 {
  traceoptions {
    file r1-nsr-ospf3 size 10m world-readable;
    flag lsa-update detail;
    flag flooding detail;
    flag lsa-request detail;
    flag state detail;
    flag event detail;
    flag hello detail;
    flag nsr-synchronization detail;
  }
  area 0.0.0.0 {
    interface fe-1/1/0.0 {
      passive;
      metric 1;
    }
    interface lo0.0 {
      passive;
    }
    interface so-0/0/1.0 {
      metric 1;
    }
    interface fe-0/1/3.0 {
      metric 1;
    }
  }
}
pim {
  traceoptions {
    file r1-nsr-pim size 10m files 10 world-readable;
    flag mdt detail;
```

```

    flag rp detail;
    flag register detail;
    flag packets detail;
    flag autorp detail;
    flag join detail;
    flag hello detail;
    flag assert detail;
    flag normal detail;
    flag state detail;
    flag nsr-synchronization;
}
rp {
    static {
        address 10.210.255.202;
        address abcd::10:210:255:202;
    }
}
interface lo0.0;
interface fe-0/1/3.0 {
    mode sparse;
    version 2;
}
interface so-0/0/1.0 {
    mode sparse;
    version 2;
}
interface fe-1/1/0.0 {
    mode sparse;
    version 2;
}
}

user@host# show routing-options
traceoptions {
    file r1-nsr-sync size 10m;
    flag nsr-synchronization;
    flag commit-synchronize;
}
nonstop-routing;
router-id 10.210.255.201;
forwarding-table {
    traceoptions {
        file r1-nsr-krt size 10m world-readable;
        flag queue;
        flag route;
        flag routes;
        flag synchronous;
        flag state;
        flag asynchronous;
        flag consistency-checking;
    }
    export load-balance;
}

user@host# show system
syslog {
    archive size 10m;

```

```
file messages {  
    any info;  
}  
}  
commit synchronize;
```

Verification

To verify the configuration, run the following commands:

- `show pim join extensive`
- `show pim neighbors inet detail`
- `show pim neighbors inet6 detail`
- `show pim rps inet detail`
- `show pim rps inet6 detail`
- `show multicast route inet extensive`
- `show multicast route inet6 extensive`
- `show route table inet.1 detail`
- `show route table inet6.1 detail`

Configuring PIM Sparse Mode Graceful Restart

You can configure PIM sparse mode to continue to forward existing multicast packet streams during a routing process failure and restart. Only PIM sparse mode can be configured this way. The routing platform does not forward multicast packets for protocols other than PIM during graceful restart, because all other multicast protocols must restart after a routing process failure. If you configure PIM sparse-dense mode, only sparse multicast groups benefit from a graceful restart.

The routing platform does not forward new streams until after the restart is complete. After restart, the routing platform refreshes the forwarding state with any updates that were received from neighbors during the restart period. For example, the routing platform relearns the join and prune states of neighbors during the restart, but it does not apply the changes to the forwarding table until after the restart.

When PIM sparse mode is enabled, the routing platform generates a unique 32-bit random number called a generation identifier. Generation identifiers are included by default in PIM hello messages, as specified in the Internet draft **draft-ietf-pim-sm-v2-new-10.txt**. When a routing platform receives PIM hello messages containing generation identifiers on a point-to-point interface, the Junos OS activates an algorithm that optimizes graceful restart.

Before PIM sparse mode graceful restart occurs, each routing platform creates a generation identifier and sends it to its multicast neighbors. If a routing platform with PIM sparse mode restarts, it creates a new generation identifier and sends it to neighbors. When a neighbor receives the new identifier, it resends multicast updates to the restarting

router to allow it to exit graceful restart efficiently. The restart phase is complete when the restart duration timer expires.

Multicast forwarding can be interrupted in two ways. First, if the underlying routing protocol is unstable, multicast RPF checks can fail and cause an interruption. Second, because the forwarding table is not updated during the graceful restart period, new multicast streams are not forwarded until graceful restart is complete.

You can configure graceful restart globally or for a routing instance. This example shows how to configure graceful restart globally.

To configure graceful restart for PIM sparse mode:

1. Enable graceful restart.

```
[edit protocols pim]
user@host# set graceful-restart
```

2. (Optional) Configure the amount of time the routing device waits (in seconds) to complete PIM sparse mode graceful restart. By default, the router allows 60 seconds. The range is from 30 through 300 seconds. After this restart time, the Routing Engine resumes normal multicast operation.

```
[edit protocols pim graceful-restart]
user@host# set restart-duration 120
```

3. Monitor the operation of PIM graceful restart by running the `show pim neighbors` command. In the command output, look for the **G** flag in the **Option** field. The **G** flag stands for generation identifier. Also run the `show task replication` command to verify the status of GRES and NSR.

Related Documentation

- [Configuring Basic PIM Settings on page 21](#)

Configuring PIM Dense Mode

- [Understanding PIM Dense Mode on page 137](#)
- [Configuring PIM Dense Mode Properties on page 139](#)

Understanding PIM Dense Mode

PIM dense mode is less sophisticated than PIM sparse mode. PIM dense mode is useful for multicast LAN applications, the main environment for all dense mode protocols.

PIM dense mode implements the same flood-and-prune mechanism that DVMRP and other dense mode routing protocols employ. The main difference between DVMRP and PIM dense mode is that PIM dense mode introduces the concept of protocol independence. PIM dense mode can use the routing table populated by any underlying unicast routing protocol to perform reverse-path-forwarding (RPF) checks.

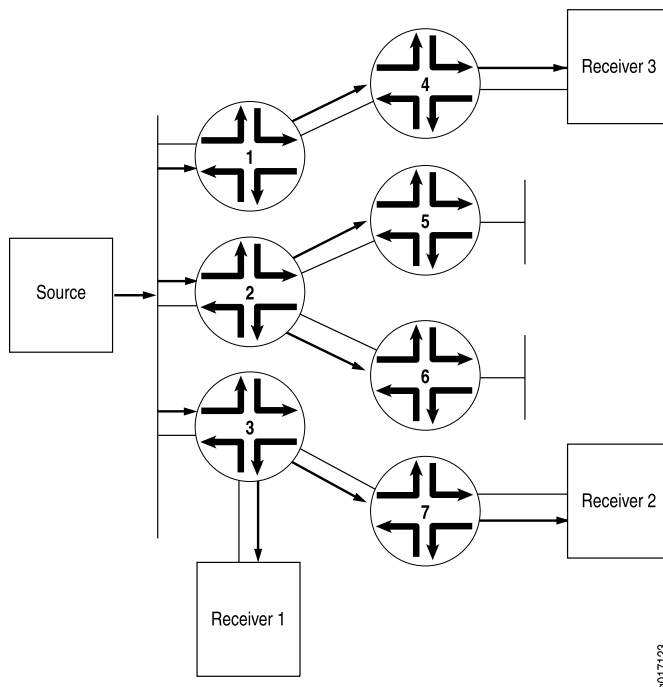
Internet service providers (ISPs) typically appreciate the ability to use any underlying unicast routing protocol with PIM dense mode because they do not need to introduce and manage a separate routing protocol just for RPF checks. While unicast routing

protocols extended as multiprotocol BGP (MBGP) and Multitopology Routing in IS-IS (M-IS-IS) were later employed to build special tables to perform RPF checks, PIM dense mode does not require them.

PIM dense mode can use the unicast routing table populated by OSPF, IS-IS, BGP, and so on, or PIM dense mode can be configured to use a special multicast RPF table populated by MBGP or M-IS-IS when performing RPF checks.

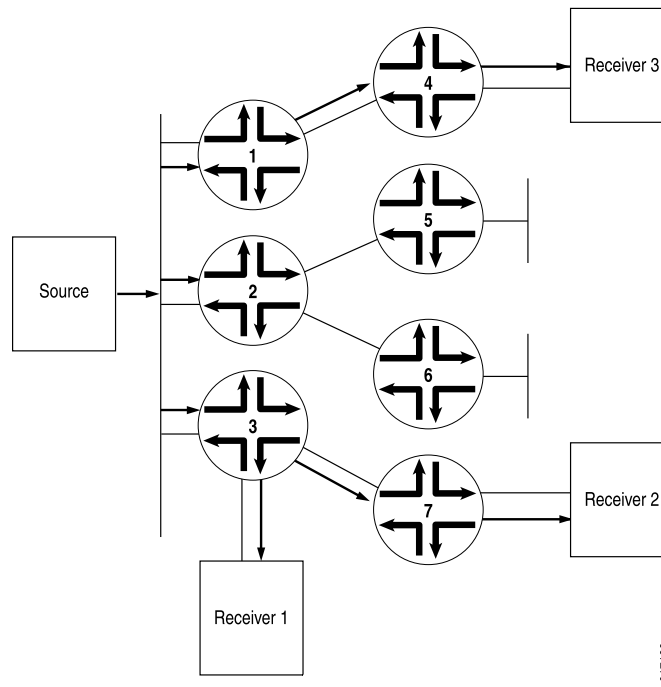
Unlike sparse mode, in which data is forwarded only to routers sending an explicit request, dense mode implements a *flood-and-prune* mechanism, similar to DVMRP. In PIM dense mode, there is no RP. A router receives the multicast data on the interface closest to the source, then forwards the traffic to all other interfaces (see [Figure 22 on page 138](#)).

Figure 22: Multicast Traffic Flooded from the Source Using PIM Dense Mode



Flooding occurs periodically. It is used to refresh state information, such as the source IP address and multicast group pair. If the router has no interested receivers for the data, and the OIL becomes empty, the router sends a prune message upstream to stop delivery of multicast traffic (see [Figure 23 on page 139](#)).

Figure 23: Prune Messages Sent Back to the Source to Stop Unwanted Multicast Traffic



Configuring PIM Dense Mode Properties

In PIM dense mode (PIM-DM), the assumption is that almost all possible subnets have at least one receiver wanting to receive the multicast traffic from a source, so the network is flooded with traffic on all possible branches, then pruned back when branches do not express an interest in receiving the packets, explicitly (by message) or implicitly (time-out silence). LANs are appropriate networks for dense-mode operation.

By default, PIM is disabled. When you enable PIM, it operates in sparse mode by default.

You can configure PIM dense mode globally or for a routing instance. This example shows how to configure the routing instance and how to specify that PIM dense mode use **inet.2** as its RPF routing table instead of **inet.0**.

To configure the router properties for PIM dense mode:

1. (Optional) Create an IPv4 routing table group so that interface routes are installed into two routing tables, **inet.0** and **inet.2**.

```
[edit routing-options rib-groups]
user@host# set pim-rg export-rib inet.0
user@host# set pim-rg import-rib [ inet.0 inet.2 ]
```

2. (Optional) Associate the routing table group with a PIM routing instance.

```
[edit routing-instances PIM.dense protocols pim]
user@host# set rib-group inet pim-rg
```

3. Configure the PIM interface. If you do not specify any interfaces, PIM is enabled on all router interfaces. Generally, you specify interface names only if you are disabling PIM on certain interfaces.

```
[edit routing-instances PIM.dense protocols pim]  
user@host# set interface fe-0/0/1.0 mode dense
```



NOTE: You cannot configure both PIM and Distance Vector Multicast Routing Protocol (DVMRP) in forwarding mode on the same interface. You can configure PIM on the same interface only if you configured DVMRP in unicast-routing mode.

4. Monitor the operation of PIM dense mode by running the **show pim interfaces**, **show pim join**, **show pim neighbors**, and **show pim statistics** commands.

**Related
Documentation**

- [Configuring PIM Sparse-Dense Mode on page 140](#)
- [Configuring Basic PIM Settings on page 21](#)

Configuring PIM Sparse-Dense Mode

- [Understanding PIM Sparse-Dense Mode on page 140](#)
- [Mixing PIM Sparse and Dense Modes on page 140](#)
- [Configuring PIM Sparse-Dense Mode Properties on page 141](#)

Understanding PIM Sparse-Dense Mode

Sparse-dense mode, as the name implies, allows the interface to operate on a per-group basis in either sparse or dense mode. A group specified as dense is not mapped to an RP. Instead, data packets destined for that group are forwarded by means of PIM dense-mode rules. A group specified as sparse is mapped to an RP, and data packets are forwarded by means of PIM sparse-mode rules.

For information about PIM sparse-mode and PIM dense-mode rules, see “[Understanding PIM Sparse Mode](#)” on page 33 and “[Understanding PIM Dense Mode](#)” on page 137.

Mixing PIM Sparse and Dense Modes

It is possible to mix PIM dense mode, PIM sparse mode, and PIM source-specific multicast (SSM) on the same network, the same router, and even the same interface. This is because modes are effectively tied to multicast groups, an IP multicast group address must be unique for a particular group's traffic, and scoping limits enforce the division between potential or actual overlaps.



NOTE: PIM sparse mode was capable of forming shortest-path trees (SPTs) already. Changes to PIM sparse mode to support PIM SSM mainly involved defining behavior in the SSM address range, because shared-tree behavior is prohibited for groups in the SSM address range.

A multicast router employing sparse-dense mode is a good example of mixing PIM modes on the same network or router or interface. Dense modes are easy to support because of the flooding, but scaling issues make dense modes inappropriate for Internet use beyond very restricted uses.

Configuring PIM Sparse-Dense Mode Properties

Sparse-dense mode allows the interface to operate on a per-group basis in either sparse or dense mode. A group specified as “dense” is not mapped to an RP. Instead, data packets destined for that group are forwarded by means of PIM dense mode rules. A group specified as “sparse” is mapped to an RP, and data packets are forwarded by means of PIM sparse-mode rules. Sparse-dense mode is useful in networks implementing auto-RP for PIM sparse mode.

By default, PIM is disabled. When you enable PIM, it operates in sparse mode by default.

You can configure PIM sparse-dense mode globally or for a routing instance. This example shows how to configure PIM sparse-dense mode globally on all interfaces, specifying that the groups 224.0.1.39 and 224.0.1.40 are using dense mode.

To configure the router properties for PIM sparse-dense mode:

1. Configure the dense-mode groups.

```
[protocols pim]
user@host# set dense-groups 224.0.1.39
user@host# set dense-groups 224.0.1.40
```

2. Configure all interfaces on the routing device to use sparse-dense mode. When configuring all interfaces, exclude the **fxp0.0** management interface by adding the **disable** statement for that interface.

```
[edit protocols pim]
user@host# set interface all mode sparse-dense
user@host# set interface fxp0.0 disable
```

3. Monitor the operation of PIM sparse-dense mode by running the **show pim interfaces**, **show pim join**, **show pim neighbors**, and **show pim statistics** commands.

Related Documentation

- [Configuring PIM Dense Mode on page 137](#)
- [Configuring Basic PIM Settings on page 21](#)

PIM Join Load Balancing on Multipath MVPN Routes Overview

A multicast virtual private network (MPVN) is a technology to deploy the multicast service in an existing MPLS/BGP VPN.

The two main MVPN services are:

- Dual PIM MVPNs (also referred to as Draft-Rosen)
- Multiprotocol BGP-based MVPNs (also referred to as next-generation)

Next-generation MVPNs constitute the next evolution after the Draft-Rosen MVPN and provide a simpler solution for administrators who want to configure multicast over Layer 3 VPNs. A Draft-Rosen MVPN uses Protocol Independent Multicast (PIM) for customer multicast (C-multicast) signaling, and a next-generation MVPN uses BGP for C-multicast signaling.

Multipath routing in an MVPN is applied to make data forwarding more robust against network failures and to minimize shared backup capacities when resilience against network failures is required.

By default, PIM join messages are sent toward a source based on the reverse path forwarding (RPF) routing table check. If there is more than one equal-cost path toward the source [S, G] or rendezvous point (RP) [*; G], then one upstream interface is used to send the join messages. The upstream path can be:

- A single active external BGP (EBGP) path when both EBGP and internal BGP (IBGP) paths are present.
- A single active IBGP path when there is no EBGP path present.

With the introduction of the multipath PIM join load-balancing feature, customer PIM (C-PIM) join messages are load-balanced in the following ways:

- In the case of a Draft-Rosen MVPN, unequal EBGP and IBGP paths are utilized.
- In the case of next-generation MVPN:
 - Available IBGP paths are utilized when no EBGP path is present.
 - Available EBGP paths are utilized when both EBGP and IBGP paths are present.

This feature is applicable to IPv4 C-PIM join messages over the Layer 3 MVPN service.

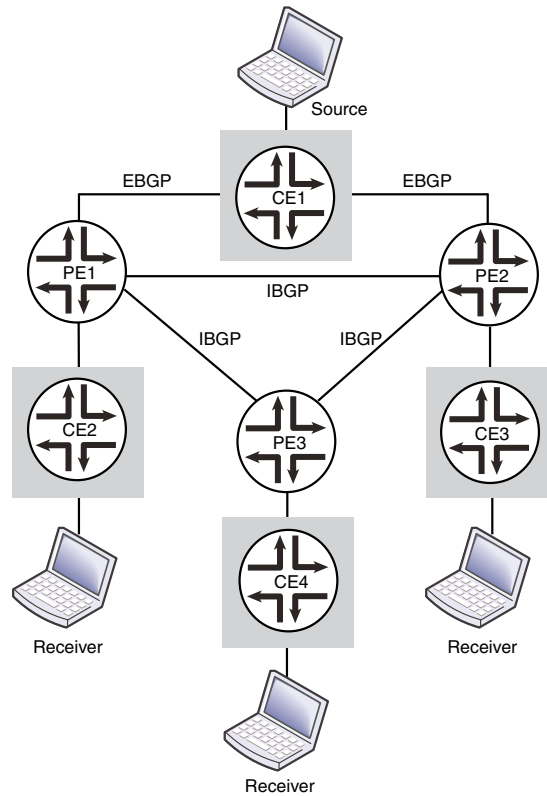
By default, a customer source (C-S) or a customer RP (C-RP) is considered remote if the active **rt_entry** is a secondary route and the primary route is present in a different routing instance. Such determination is being done without taking into consideration the (C-*;G) or (C-S,G) state for which the check is being performed. The multipath PIM join load-balancing feature determines if a source (or RP) is remote by taking into account the associated (C-*;G) or (C-S,G) state.

When the provider network does not have provider edge (PE) routers with the multipath PIM join load-balancing feature enabled, hash-based join load balancing is used. Although the decision to configure this feature does not impact PIM or overall system performance, network performance can be affected temporarily, if the feature is not enabled.

With hash-based join load balancing, adding new PE routers to the candidate upstream toward the C-S or C-RP results in C-PIM join messages being redistributed to new upstream paths. If the number of join messages is large, network performance is impacted because of join messages being sent to the new RPF neighbor and prune messages being sent to the old RPF neighbor. In next-generation MVPN, this results in BGP C-multicast data messages being withdrawn from old upstream paths and advertised on new upstream paths, impacting network performance.

In Figure 24 on page 143, PE1 and PE2 are the upstream PE routers. Router PE1 learns route Source from EGBP and IBGP peers—the customer edge CE1 router and the PE2 router, respectively.

Figure 24: PIM Join Load Balancing



- If the PE routers run the Draft-Rosen MVPN, the PE1 router distributes C-PIM join messages between the EGBP path to the CE1 router and the IBGP path to the PE2 router. The join messages on the IBGP path are sent over a multicast tunnel interface through which the PE routers establish C-PIM adjacency with each other.

If a PE router loses one or all EGBP paths toward the source (or RP), the C-PIM join messages that were previously using the EGBP path are moved to a multicast tunnel interface, and the RPF neighbor on the multicast tunnel interface is selected based on a hash mechanism.

On discovering the first EGBP path toward the source (or RP), only new join messages get load-balanced across EGBP and IBGP paths, whereas the existing join messages on the multicast tunnel interface remain unaffected.

- If the PE routers run the next-generation MVPN, the PE1 router sends C-PIM join messages directly to the CE1 router over the EGBP path. There is no C-PIM adjacency between the PE1 and PE2 routers. Router PE3 distributes the C-PIM join messages between the two IBGP paths to PE1 and PE2. The Bitwise-XOR hash algorithm is used to send the C-multicast data according to Internet draft draft-ietf-l3vpn-2547bis-mcast-bgp, *BGP Encodings and Procedures for Multicast in MPLS/BGP IP VPNs*.

Because the multipath PIM join load-balancing feature in a Draft-Rosen MVPN utilizes unequal EBGp and IBGP paths to the destination, loops can be created when forwarding unicast packets to the destination. To avoid or break such loops:

- Traffic arriving from a core or master instance should not be forwarded back to the core facing interfaces.
- A single multicast tunnel interface should either be selected as the upstream interface or the downstream interface.
- An upstream or downstream multicast tunnel interface should point to a non-multicast tunnel interface.

As a result of the loop avoidance mechanism, join messages arriving from an EBGp path get load-balanced across EIBGP paths as expected, whereas join messages from an IBGP path are constrained to choose the EBGp path only.

In [Figure 24 on page 143](#), if the CE2 host sends unicast data traffic to the CE1 host, the PE1 router could send the multicast flow to the PE2 router over the MPLS core due to traffic load balancing. A data forwarding loop is prevented by ensuring that PE2 does not forward traffic back on the MPLS core because of the load-balancing algorithm.

In the case of C-PIM join messages, assuming that both the CE2 host and the CE3 host are interested in receiving traffic from the source (S, G), and if both PE1 and PE2 choose each other as the RPF neighbor toward the source, then a multicast tree cannot be formed completely. This feature implements mechanisms to prevent such join loops in the multicast control plane in a Draft-Rosen MVPN scenario.

**NOTE:**

Disruption of multicast traffic or creation of join loops can occur, resulting in a multicast distribution tree (MDT) not being formed properly due to one of the following reasons:

- During a graceful Routing Engine switchover (GRES), the EIBGP path selection for C-PIM join messages can vary, because the upstream interface selection is performed again for the new Routing Engine based on the join messages it receives from the CE and PE neighbors. This can lead to disruption of multicast traffic depending on the number of join messages received and the load on the network at the time of the graceful restart. However, nonstop active routing (NSR) is not supported and has no impact on the multicast traffic in a Draft-Rosen MVPN scenario.
 - Any PE router in the provider network is running another vendor's implementation that does not apply the same hashing algorithm implemented in this feature.
 - The multipath PIM join load-balancing feature has not been configured properly.
-

Related Documentation

- *Example: Configuring PIM Join Load Balancing on Draft-Rosen Multicast VPN*

- [Example: Configuring PIM Join Load Balancing On Next-Generation Multicast VPN on page 145](#)

Example: Configuring PIM Join Load Balancing On Next-Generation Multicast VPN

This example shows how to configure multipath routing for external and internal virtual private network (VPN) routes with unequal interior gateway protocol (IGP) metrics and Protocol Independent Multicast (PIM) join load balancing on provider edge (PE) routers running next-generation multicast VPN (MVPN). This feature allows customer PIM (C-PIM) join messages to be load-balanced across available internal BGP (IBGP) upstream paths when there is no external BGP (EBGP) path present, and across available EBGP upstream paths when external and internal BGP (EIBGP) paths are present toward the source or rendezvous point (RP).

- [Requirements on page 145](#)
- [Overview and Topology on page 145](#)
- [Configuration on page 148](#)
- [Verification on page 152](#)

Requirements

This example uses the following hardware and software components:

- Three routers that can be a combination of M Series, MX Series, or T Series routers.
- Junos OS Release 12.1 running on all the devices.

Before you begin:

1. Configure the device interfaces.
2. Configure the following routing protocols on all PE routers:
 - OSPF
 - MPLS
 - LDP
 - PIM
 - BGP
3. Configure a multicast VPN.

Overview and Topology

Junos OS Release 12.1 and later support multipath configuration along with PIM join load balancing. This allows C-PIM join messages to be load-balanced across all available IBGP paths when there are only IBGP paths present, and across all available upstream EBGP paths when EIBGP paths are present toward the source (or RP). Unlike Draft-Rosen MVPN, next-generation MVPN does not utilize unequal EIBGP paths to send C-PIM join messages. This feature is applicable to IPv4 C-PIM join messages.

By default, only one active IBGP path is used to send the C-PIM join messages for a PE router having only IBGP paths toward the source (or RP). When there are EIBGP upstream paths present, only one active EBGp path is used to send the join messages.

In a next-generation MVPN, C-PIM join messages are translated into (or encoded as) BGP customer multicast (C-multicast) MVPN routes and advertised with the BGP MCAST-VPN address family toward the sender PE routers. A PE router originates a C-multicast MVPN route in response to receiving a C-PIM join message through its PE router to customer edge (CE) router interface. The two types of C-multicast MVPN routes are:

- Shared tree join route (C-*, C-G)
 - Originated by receiver PE routers.
 - Originated when a PE router receives a shared tree C-PIM join message through its PE-CE router interface.
- Source tree join route (C-S, C-G)
 - Originated by receiver PE routers.
 - Originated when a PE router receives a source tree C-PIM join message (C-S, C-G), or originated by the PE router that already has a shared tree join route and receives a source active autodiscovery route.

The upstream path in a next-generation MVPN is selected using the Bitwise-XOR hash algorithm as specified in Internet draft draft-ietf-l3vpn-2547bis-mcast, *Multicast in MPLS/BGP IP VPNs*. The hash algorithm is performed as follows:

1. The PE routers in the candidate set are numbered from lower to higher IP address, starting from 0.
2. A bitwise exclusive-or of all the bytes is performed on the C-root (source) and the C-G (group) address.
3. The result is taken modulo n , where n is the number of PE routers in the candidate set. The result is **N**.
4. **N** represents the IP address of the upstream PE router as numbered in Step 1.

During load balancing, if a PE router with one or more upstream IBGP paths toward the source (or RP) discovers a new IBGP path toward the same source (or RP), the C-PIM join messages distributed among previously existing IBGP paths get redistributed due to the change in the candidate PE router set.

In this example, PE1, PE2, and PE3 are the PE routers that have the multipath PIM join load-balancing feature configured. Router PE1 has two EBGp paths and one IBGP upstream path, PE2 has one EBGp path and one IBGP upstream path, and PE3 has two IBGP upstream paths toward the Source. Router CE4 is the customer edge (CE) router attached to PE3. Source and Receiver are the Free BSD hosts.

On PE routers that have EIBGP paths toward the source (or RP), such as PE1 and PE2, PIM join load balancing is performed as follows:

1. The C-PIM join messages are sent using EIBGP paths only. IBGP paths are not used to propagate the join messages.

In [Figure 25 on page 148](#), the PE1 router distributes the join messages between the two EIBGP paths to the CE1 router, and PE2 uses the EIBGP path to CE1 to send the join messages.

2. If a PE router loses one or more EIBGP paths toward the source (or RP), the RPF neighbor on the multicast tunnel interface is selected based on a hash mechanism.

On discovering the first EIBGP path, only new join messages get load-balanced across available EIBGP paths, whereas the existing join messages on the multicast tunnel interface are not redistributed.

If the EIBGP path from the PE2 router to the CE1 router goes down, PE2 sends the join messages to PE1 using the IBGP path. When the EIBGP path to CE1 is restored, only new join messages that arrive on PE2 use the restored EIBGP path, whereas join messages already sent on the IBGP path are not redistributed.

On PE routers that have only IBGP paths toward the source (or RP), such as the PE3 router, PIM join load balancing is performed as follows:

1. The C-PIM join messages from CE routers get load-balanced only as BGP C-multicast data messages among IBGP paths.

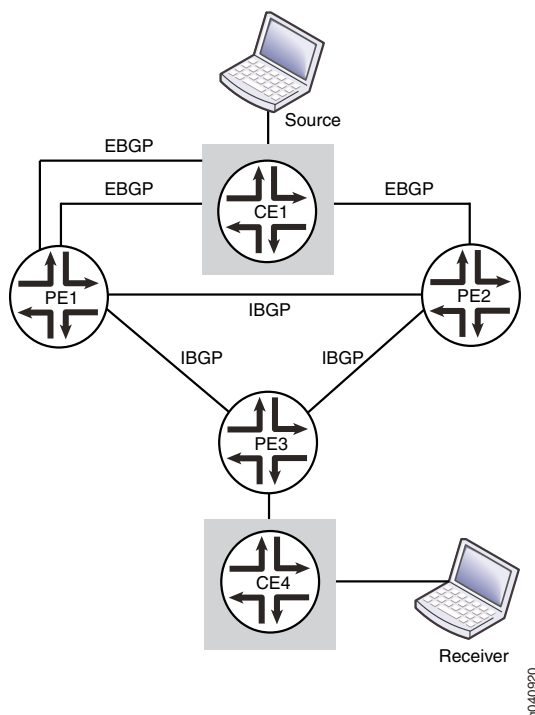
In [Figure 25 on page 148](#), assuming that the CE4 host is interested in receiving traffic from the Source, and CE4 initiates source join messages for different groups (Group 1 [C-S,C-G1] and Group 2 [C-S,C-G2]), the source join messages arrive on the PE3 router.

Router PE3 then uses the Bitwise-XOR hash algorithm to select the upstream PE router to send the C-multicast data for each group. The algorithm first numbers the upstream PE routers from lower to higher IP address starting from 0.

Assuming that Router PE1 router is numbered 0 and Router PE2 is 1, and the hash result for Group 1 and Group 2 join messages is 0 and 1, respectively, the PE3 router selects PE1 as the upstream PE router to send Group 1 join messages, and PE2 as the upstream PE router to send the Group 2 join messages to the Source.

2. The shared join messages for different groups [C-*,C-G] are also treated in a similar way to reach the destination.

Figure 25: PIM Join Load Balancing on Next-Generation MVPN



Configuration

CLI Quick Configuration To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```

PE1 set routing-instances vpn1 instance-type vrf
    set routing-instances vpn1 interface ge-3/0/1.0
    set routing-instances vpn1 interface ge-3/3/2.0
    set routing-instances vpn1 interface lo0.1
    set routing-instances vpn1 route-distinguisher 1:1
    set routing-instances vpn1 provider-tunnel rsvp-te label-switched-path-template
        default-template
    set routing-instances vpn1 vrf-target target:1:1
    set routing-instances vpn1 vrf-table-label
    set routing-instances vpn1 routing-options multipath vpn-unequal-cost
        equal-external-internal
    set routing-instances vpn1 protocols bgp export direct
    set routing-instances vpn1 protocols bgp group bgp type external
    set routing-instances vpn1 protocols bgp group bgp local-address 10.40.10.1
    set routing-instances vpn1 protocols bgp group bgp family inet unicast
    set routing-instances vpn1 protocols bgp group bgp neighbor 10.40.10.2 peer-as 3
    set routing-instances vpn1 protocols bgp group bgp1 type external
    set routing-instances vpn1 protocols bgp group bgp1 local-address 10.10.10.1
    set routing-instances vpn1 protocols bgp group bgp1 family inet unicast
  
```

```

set routing-instances vpn1 protocols bgp group bgp1 neighbor 10.10.10.2 peer-as 3
set routing-instances vpn1 protocols pim rp static address 10.255.10.119
set routing-instances vpn1 protocols pim interface all
set routing-instances vpn1 protocols pim join-load-balance
set routing-instances vpn1 protocols mvpn mvpn-mode rpt-spt
set routing-instances vpn1 protocols mvpn mvpn-join-load-balance bitwise-xor-hash

```

```

PE2  set routing-instances vpn1 instance-type vrf
      set routing-instances vpn1 interface ge-1/0/9.0
      set routing-instances vpn1 interface lo0.1
      set routing-instances vpn1 route-distinguisher 2:2
      set routing-instances vpn1 provider-tunnel rsvp-te label-switched-path-template
        default-template
      set routing-instances vpn1 vrf-target target:1:1
      set routing-instances vpn1 vrf-table-label
      set routing-instances vpn1 routing-options multipath vpn-unequal-cost
        equal-external-internal
      set routing-instances vpn1 protocols bgp export direct
      set routing-instances vpn1 protocols bgp group bgp local-address 10.50.10.2
      set routing-instances vpn1 protocols bgp group bgp family inet unicast
      set routing-instances vpn1 protocols bgp group bgp neighbor 10.50.10.1 peer-as 3
      set routing-instances vpn1 protocols pim rp static address 10.255.10.119
      set routing-instances vpn1 protocols pim interface all
      set routing-instances vpn1 protocols mvpn mvpn-mode rpt-spt
      set routing-instances vpn1 protocols mvpn mvpn-join-load-balance bitwise-xor-hash

```

```

PE3  set routing-instances vpn1 instance-type vrf
      set routing-instances vpn1 interface ge-0/0/8.0
      set routing-instances vpn1 interface lo0.1
      set routing-instances vpn1 route-distinguisher 3:3
      set routing-instances vpn1 provider-tunnel rsvp-te label-switched-path-template
        default-template
      set routing-instances vpn1 vrf-target target:1:1
      set routing-instances vpn1 vrf-table-label
      set routing-instances vpn1 routing-options multipath vpn-unequal-cost
        equal-external-internal
      set routing-instances vpn1 routing-options autonomous-system 1
      set routing-instances vpn1 protocols bgp export direct
      set routing-instances vpn1 protocols bgp group bgp type external
      set routing-instances vpn1 protocols bgp group bgp local-address 10.80.10.1
      set routing-instances vpn1 protocols bgp group bgp family inet unicast
      set routing-instances vpn1 protocols bgp group bgp neighbor 10.80.10.2 peer-as 2
      set routing-instances vpn1 protocols pim rp static address 10.255.10.119
      set routing-instances vpn1 protocols pim interface all
      set routing-instances vpn1 protocols mvpn mvpn-mode rpt-spt
      set routing-instances vpn1 protocols mvpn mvpn-join-load-balance bitwise-xor-hash

```

Step-by-Step Procedure The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode*. To configure the PE1 router:



NOTE: Repeat this procedure for every Juniper Networks router in the MVPN domain, after modifying the appropriate interface names, addresses, and any other parameters for each router.

1. Configure a VPN routing forwarding (VRF) routing instance.


```
[edit routing-instances vpn1]
user@PE1# set instance-type vrf
user@PE1# set interface ge-3/0/1.0
user@PE1# set interface ge-3/3/2.0
user@PE1# set interface lo0.1
user@PE1# set route-distinguisher 1:1
user@PE1# set provider-tunnel rsvp-te label-switched-path-template
default-template
user@PE1# set vrf-target target:1:1
user@PE1# set vrf-table-label
```
2. Enable protocol-independent load balancing for the VRF instance.


```
[edit routing-instances vpn1]
user@PE1# set routing-options multipath vpn-unequal-cost equal-external-internal
```
3. Configure BGP groups and neighbors to enable PE to CE routing.


```
[edit routing-instances vpn1 protocols]
user@PE1# set bgp export direct
user@PE1# set bgp group bgp type external
user@PE1# set bgp group bgp local-address 10.40.10.1
user@PE1# set bgp group bgp family inet unicast
user@PE1# set bgp group bgp neighbor 10.40.10.2 peer-as 3
user@PE1# set bgp group bgp1 type external
user@PE1# set bgp group bgp1 local-address 10.10.10.1
user@PE1# set bgp group bgp1 family inet unicast
user@PE1# set bgp group bgp1 neighbor 10.10.10.2 peer-as 3
```
4. Configure PIM to enable PE to CE multicast routing.


```
[edit routing-instances vpn1 protocols]
user@PE1# set pim rp static address 10.255.10.119
```
5. Enable PIM on all network interfaces.


```
[edit routing-instances vpn1 protocols]
user@PE1# set pim interface all
```
6. Enable PIM join load balancing for the VRF instance.


```
[edit routing-instances vpn1 protocols]
user@PE1# set pim join-load-balance
```
7. Configure the mode for C-PIM join messages to use rendezvous-point trees, and switch to the shortest-path tree after the source is known.

```
[edit routing-instances vpn1 protocols]
user@PE1# set mvpn mvpn-mode rpt-spt
```

8. Configure the VRF instance to use the Bytewise-XOR hash algorithm.

```
[edit routing-instances vpn1 protocols]
user@PE1# set mvpn mvpn-join-load-balance bytewise-xor-hash
```

Results

From configuration mode, confirm your configuration by entering the **show routing-instances** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@PE1# show routing-instances
routing-instances {
  vpn1 {
    instance-type vrf;
    interface ge-3/0/1.0;
    interface ge-3/3/2.0;
    interface lo0.1;
    route-distinguisher 1:1;
    provider-tunnel {
      rsvp-te {
        label-switched-path-template {
          default-template;
        }
      }
    }
    vrf-target target:1:1;
    vrf-table-label;
    routing-options {
      multipath {
        vpn-unequal-cost equal-external-internal;
      }
    }
    protocols {
      bgp {
        export direct;
        group bgp {
          type external;
          local-address 10.40.10.1;
          family inet {
            unicast;
          }
          neighbor 10.40.10.2 {
            peer-as 3;
          }
        }
        group bgp1 {
          type external;
          local-address 10.10.10.1;
          family inet {
            unicast;
          }
          neighbor 10.10.10.2 {
```

```

        peer-as 3;
    }
}
pim {
    rp {
        static {
            address 10.255.10.119;
        }
    }
    interface all;
    join-load-balance;
}
mvpn {
    mvpn-mode {
        rpt-spt;
    }
    mvpn-join-load-balance {
        bitwise-xor-hash;
    }
}
}
}

```

If you are done configuring the device, enter **commit** from configuration mode.

Verification

Confirm that the configuration is working properly.

- [Verifying MVPN C-Multicast Route Information for Different Groups of Join Messages on page 152](#)

Verifying MVPN C-Multicast Route Information for Different Groups of Join Messages

Purpose Verify MVPN C-multicast route information for different groups of join messages received on the PE3 router.

Action From operational mode, run the **show mvpn c-multicast** command.

```

user@PE3> show mvpn c-multicast
MVPN instance:
Legend for provider tunnel
I-P-tnl -- inclusive provider tunnel S-P-tnl -- selective provider tunnel
Legend for c-multicast routes properties (Pr)
DS -- derived from (*, c-g)          RM -- remote VPN route
Family : INET

Instance : vpn1
MVPN Mode : RPT-SPT
C-mcast IPv4 (S:G)          Ptnl          St
0.0.0.0/0:225.1.1.1/32      RSVP-TE P2MP:10.255.10.2, 5834,10.255.10.2
4.4.4.2/32:225.1.1.1/32    RSVP-TE P2MP:10.255.10.2, 5834,10.255.10.2
0.0.0.0/0:225.1.1.2/32      RSVP-TE P2MP:10.255.10.14, 47575,10.255.10.14
4.4.4.2/32:225.1.1.2/32    RSVP-TE P2MP:10.255.10.14, 47575,10.255.10.14

```


Meaning The output shows how the PE3 router has load-balanced the C-multicast data for the different groups.

- For source join messages (S,G):
 - 4.4.4.2/32:225.1.1.1/32 (S,G1) toward the PE1 router (10.255.10.2 is the loopback address of Router PE1).
 - 4.4.4.2/32:225.1.1.2/32 (S,G2) toward the PE2 router (10.255.10.14 is the loopback address of Router PE2).
- For shared join messages (*G):
 - 0.0.0.0/0:225.1.1.1/32 (*G1) toward the PE1 router (10.255.10.2 is the loopback address of Router PE1).
 - 0.0.0.0/0:225.1.1.2/32 (*G2) toward the PE2 router (10.255.10.14 is the loopback address of Router PE2).

- Related Documentation**
- [PIM Join Load Balancing on Multipath MVPN Routes Overview on page 141](#)
 - *Example: Configuring PIM Join Load Balancing on Draft-Rosen Multicast VPN*

CHAPTER 4

Multicast Routing Options

- [Examples: Configuring Reverse Path Forwarding on page 155](#)
- [Example: Configuring Source-Specific Multicast on page 167](#)
- [Example: Configuring SSM Maps for Different Groups to Different Sources on page 178](#)
- [Examples: Configuring Bandwidth Management on page 182](#)
- [Examples: Configuring the Multicast Forwarding Cache on page 203](#)
- [Example: Configuring Ingress PE Redundancy on page 210](#)
- [Configuring PIM-to-IGMP and PIM-to-MLD Message Translation on page 215](#)

Examples: Configuring Reverse Path Forwarding

- [Understanding Multicast Reverse Path Forwarding on page 155](#)
- [Multicast RPF Configuration Guidelines on page 157](#)
- [Example: Configuring a Dedicated PIM RPF Routing Table on page 158](#)
- [Example: Configuring RPF Policies on page 161](#)
- [Example: Configuring PIM RPF Selection on page 163](#)

Understanding Multicast Reverse Path Forwarding

Unicast forwarding decisions are typically based on the destination address of the packet arriving at a router. The unicast routing table is organized by destination subnet and mainly set up to forward the packet toward the destination.

In multicast, the router forwards the packet away from the source to make progress along the distribution tree and prevent routing loops. The router's multicast forwarding state runs more logically by organizing tables based on the reverse path, from the receiver back to the root of the distribution tree. This process is known as *reverse-path forwarding (RPF)*.

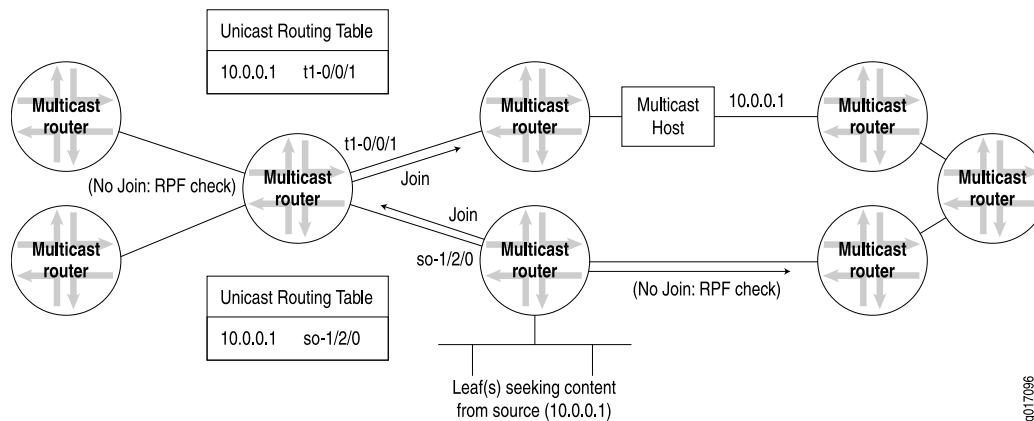
The router adds a branch to a distribution tree depending on whether the request for traffic from a multicast group passes the reverse-path-forwarding check (RPF check). Every multicast packet received must pass an RPF check before it is eligible to be replicated or forwarded on any interface.

The RPF check is essential for every router's multicast implementation. When a multicast packet is received on an interface, the router interprets the source address in the multicast IP packet as the destination address for a unicast IP packet. The source multicast address

is found in the unicast routing table, and the outgoing interface is determined. If the outgoing interface found in the unicast routing table is the same as the interface that the multicast packet was received on, the packet passes the RPF check. Multicast packets that fail the RPF check are dropped because the incoming interface is not on the *shortest path* back to the source.

Figure 26 on page 156 shows how multicast routers can use the unicast routing table to perform an RPF check and how the results obtained at each router determine where join messages are sent.

Figure 26: Multicast Routers and the RPF Check



Routers can build and maintain separate tables for RPF purposes. The router must have some way to determine its RPF interface for the group, which is the interface topologically closest to the root. For greatest efficiency, the distribution tree follows the shortest-path tree topology. The RPF check helps to construct this tree.

RPF Table

The RPF table plays the key role in the multicast router. The RPF table is consulted for every RPF check, which is performed at intervals on multicast packets entering the multicast router. Distribution trees of all types rely on the RPF table to form properly, and the multicast forwarding state also depends on the RPF table.

RPF checks are performed only on unicast addresses to find the upstream interface for the multicast source or RP.

The routing table used for RPF checks can be the same routing table used to forward unicast IP packets, or it can be a separate routing table used only for multicast RPF checks. In either case, the RPF table contains only unicast routes, because the RPF check is performed on the source address of the multicast packet, not the multicast group destination address, and a multicast address is forbidden from appearing in the source address field of an IP packet header. The unicast address can be used for RPF checks because there is only one source host for a particular stream of IP multicast content for a multicast group address, although the same content could be available from multiple sources.

If the same routing table used to forward unicast packets is also used for the RPF checks, the routing table is populated and maintained by the traditional unicast routing protocols

such as BGP, IS-IS, OSPF, and the Routing Information Protocol (RIP). If a dedicated multicast RPF table is used, this table must be populated by some other method. Some multicast routing protocols (such as the Distance Vector Multicast Routing Protocol [DVMRP]) essentially duplicate the operation of a unicast routing protocol and populate a dedicated RPF table. Others, such as PIM, do not duplicate routing protocol functions and must rely on some other routing protocol to set up this table, which is why PIM is *protocol independent*.

Some traditional routing protocols such as BGP and IS-IS now have extensions to differentiate between different sets of routing information sent between routers for unicast and multicast. For example, there is multiprotocol BGP (MBGP) and multitopology routing in IS-IS (M-IS-IS). IS-IS routes can be added to the RPF table even when special features such as traffic engineering and “shortcuts” are turned on. Multicast Open Shortest Path First (MOSPF) also extends OSPF for multicast use, but goes further than MBGP or M-IS-IS and makes MOSPF into a complete multicast routing protocol on its own. When these routing protocols are used, routes can be tagged as multicast RPF routers and used by the receiving router differently than the unicast routing information.

Using the main unicast routing table for RPF checks provides simplicity. A dedicated routing table for RPF checks allows a network administrator to set up separate paths and routing policies for unicast and multicast traffic, allowing the multicast network to function more independently of the unicast network.

Multicast RPF Configuration Guidelines

You use multicast RPF checks to prevent multicast routing loops. Routing loops are particularly debilitating in multicast applications because packets are replicated with each pass around the routing loop.

In general, a router is to forward a multicast packet only if it arrives on the interface closest (as defined by a unicast routing protocol) to the origin of the packet, whether source host or rendezvous point (RP). In other words, if a unicast packet would be sent to the “destination” (the reverse path) on the interface that the multicast packet arrived on, the packet passes the RPF check and is processed. Multicast (or unicast) packets that fail the RPF check are not forwarded (this is the default behavior). For an overview of how a Juniper Networks router implements RPF checks with tables, see [“Understanding Multicast Reverse Path Forwarding” on page 155](#).

However, there are network router configurations where multicast packets that fail the RPF check need to be forwarded. For example, when point-to-multipoint label-switched paths (LSPs) are used for distributing multicast traffic to PIM “islands” downstream from the egress router, the interface on which the multicast traffic arrives is not always the RPF interface. This is because LSPs do not follow the normal next-hop rules of independent packet routing.

In cases such as these, you can configure policies on the PE router to decide which multicast groups and sources are exempt from the default RPF check.

Example: Configuring a Dedicated PIM RPF Routing Table

This example explains how to configure a dedicated Protocol Independent Multicast (PIM) reverse path forwarding (RPF) routing table.

- [Requirements on page 158](#)
- [Overview on page 158](#)
- [Configuration on page 159](#)

Requirements

Before you begin:

- Configure the router interfaces.
- Enable PIM. See “[PIM Overview](#)” on page 13.

This example uses the following software components:

- Junos OS Release 7.4 or later

Overview

By default, PIM uses the **inet.0** routing table as its RPF routing table. PIM uses an RPF routing table to resolve its RPF neighbor for a particular multicast source address and to resolve the RPF neighbor for the rendezvous point (RP) address. PIM can optionally use **inet.2** as its RPF routing table. The **inet.2** routing table is dedicated to this purpose.

PIM uses a single routing table for its RPF check, this ensures that the route with the longest matching prefix is chosen as the RPF route.

If multicast routes are exchanged by Multiprotocol Border Gateway Protocol MP-BGP or multiprotocol IS-IS, they are placed in **inet.2** by default.

Using **inet.2** as the RPF routing table enables you to have a control plane for multicast, which is independent of the normal unicast routing table. You might want to use **inet.2** as the RPF routing table for any of the following reasons:

- If you use traffic engineering or have an interior gateway protocol (IGP) configured for shortcuts, the router has label-switched paths (LSPs) installed as the next hops in **inet.2**. By applying policy, you can have the router install the routes with non-MPLS next-hops in the **inet.2** routing table.
- If you have an MPLS network that does not support multicast traffic over LSP tunnels, you need to configure the router to use a routing table other than **inet.0**. You can have the **inet.2** routing table populated with native IGP, BGP, and interface routes that can be used for RPF.

To populate the PIM RPF table, you use rib groups. A rib group is defined with the **rib-groups** statement at the **[edit routing-options]** hierarchy level. The rib group is applied to the PIM protocol by including the **rib-group** statement at the **[edit pim]** hierarchy level. A rib group is most frequently used to place routes in multiple routing tables.

When you configure rib groups for PIM, keep the following in mind:

- The **import-rib** statement copies routes from the protocol to the routing table.
- The **export-rib** statement has no effect on PIM.
- Only the first rib routing table specified in the **import-rib** statement is used by PIM for RPF checks.

You can also configure IS-IS or OSPF to populate **inet.2** with routes that have regular IP next hops. This allows RPF to work properly even when MPLS is configured for traffic engineering, or when IS-IS or OSPF are configured to use “shortcuts” for local traffic.

You can also configure the PIM protocol to use a rib group for RPF checks under a virtual private network (VPN) routing instance. In this case the rib group is still defined at the **[edit routing-options]** hierarchy level.

Configuration

Configuring a PIM RPF Routing Table Group Using Interface Routes

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set routing-options rib-groups mcast-rpf-rib import-rib inet.2
set protocols pim rib-group mcast-rpf-rib
set rib-group inet if-rib
set routing-options interface-routes if-rib import-rib [ inet.0 inet.2 ]
```

Step-by-Step Procedure

In this example, the network administrator has decided to use the **inet.2** routing table for RPF checks. In this process, local routes are copied into this table by using an interface rib group.

To define an interface routing table group and use it to populate **inet.2** for RPF checks:

1. Use the **show multicast rpf** command to verify that the multicast RPF table is not populated with routes.

```
user@host> show multicast rpf
instance is not running
```

2. Create a multicast routing table group named **mcast-rpf-rib**.

Each routing table group must contain one or more routing tables that Junos OS uses when importing routes (specified in the **import-rib** statement).

Include the **import-rib** statement and specify the **inet.2** routing table at the **[edit routing-options rib-groups]** hierarchy level.

```
[edit routing-options rib-groups]
user@host# set mcast-rpf-rib import-rib inet.2
```

3. Configure PIM to use the **mcast-rpf-rib** rib group.

The rib group for PIM can be applied globally or in a routing instance. In this example, the global configuration is shown.

Include the **rib-group** statement and specify the **mcast-rpf-rib** rib group at the **[edit protocols pim]** hierarchy level.

```
[edit protocols pim]
user@host# set rib-group mcast-rpf-rib
```

4. Create an interface rib group named **if-rib**.

Include the **rib-group** statement and specify the **inet** address family at the **[edit routing-options interface-routes]** hierarchy level.

```
[edit routing-options interface-routes]
user@host# set rib-group inet if-rib
```

5. Configure the **if-rib** rib group to import routes from the **inet.0** and **inet.2** routing tables.

Include the **import-rib** statement and specify the **inet.0** and **inet.2** routing tables at the **[edit routing-options rib-groups]** hierarchy level.

```
[edit routing-options rib-groups]
user@host# set if-rib import-rib [ inet.0 inet.2 ]
```

6. Commit the configuration.

```
user@host# commit
```

Verifying The Multicast RPF Table

Purpose Verify that the multicast RPF table is now populated with routes.

Action Use the **show multicast rpf** command.

```
user@host> show multicast rpf
Multicast RPF table: inet.2 , 10 entries
```

```
10.0.24.12/30
  Protocol: Direct
  Interface: fe-0/1/2.0
```

```
10.0.24.13/32
  Protocol: Local
```

```
10.0.27.12/30
  Protocol: Direct
  Interface: fe-0/1/3.0
```

```
10.0.27.13/32
  Protocol: Local
```

```
10.0.224.8/30
  Protocol: Direct
  Interface: ge-1/3/3.0
```

```
10.0.224.9/32
  Protocol: Local
```



```

127.0.0.1/32
  Inactive

192.168.2.1/32
  Protocol: Direct
  Interface: lo0.0

192.168.187.0/25
  Protocol: Direct
  Interface: fxp0.0

192.168.187.12/32
  Protocol: Local

```

Meaning The first line of the sample output shows that the **inet.2** table is being used and that there are 10 routes in the table. The remainder of the sample output lists the routes that populate the **inet.2** routing table.

Example: Configuring RPF Policies

A multicast RPF policy disables RPF checks for a particular multicast (S,G) pair. You usually disable RPF checks on egress routing devices of a point-to-multipoint label-switched path (LSP), because the interface receiving the multicast traffic on a point-to-multipoint LSP egress router might not always be the RPF interface.

This example shows how to configure an RPF check policy named **disable-RPF-on-PE**. The **disable-RPF-on-PE** policy disables RPF checks on packets arriving for group 228.0.0.0/8 or from source address 196.168.25.6.

- [Requirements on page 161](#)
- [Overview on page 161](#)
- [Configuration on page 162](#)
- [Verification on page 163](#)

Requirements

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.

Overview

An RPF policy behaves like an import policy. If no policy term matches the input packet, the default action is to accept (that is, to perform the RPF check). The **route-filter** statement filters group addresses, and the **source-address-filter** statement filters source addresses.

This example shows how to configure each condition as a separate policy and references both policies in the **rpf-check-policy** statement. This allows you to associate groups in one policy and sources in the other.



NOTE: Be careful when disabling RPF checks on multicast traffic. If you disable RPF checks in some configurations, multicast loops can result.

Changes to an RPF check policy take effect immediately:

- If no policy was previously configured, the policy takes effect immediately.
- If the policy name is changed, the new policy takes effect immediately and any packets no longer filtered are subjected to the RPF check.
- If the policy is deleted, all packets formerly filtered are subjected to the RPF check.
- If the underlying policy is changed, but retains the same name, the new conditions take effect immediately and any packets no longer filtered are subjected to the RPF check.

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set policy-options policy-statement disable-RPF-from-group term first from route-filter
  228.0.0.0/8 orlonger
set policy-options policy-statement disable-RPF-from-group term first then reject
set policy-options policy-statement disable-RPF-from-source term first from
  source-address-filter 192.168.25.6/32 exact
set policy-options policy-statement disable-RPF-from-source term first then reject
set routing-options multicast rpf-check-policy [ disable-RPF-from-group
  disable-RPF-from-source ]
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure an RPF policy:

1. Configure a policy for group addresses.

```
[edit policy-options]
user@host# set policy-statement disable-RPF-for-group term first from route-filter
  228.0.0.0/8 orlonger
user@host# set policy-statement disable-RPF-for-group term first then reject
```

2. Configure a policy for a source address.

```
[edit policy-options]
user@host# set policy-statement disable-RPF-for-source term first from
  source-address-filter 192.168.25.6/32 exact
user@host# set policy-statement disable-RPF-for-source term first then reject
```

3. Apply the policies.

```
[edit routing-options]
```

```
user@host# set multicast rpf-check-policy [ disable-RPF-for-group
disable-RPF-for-source ]
```

4. If you are done configuring the device, commit the configuration.

```
user@host# commit
```

Results

Confirm your configuration by entering the **show policy-options** and **show routing-options** commands.

```
user@host# show policy-options
policy-statement disable-RPF-from-group {
  term first {
    from {
      route-filter 228.0.0.0/8 orlonger;
    }
    then reject;
  }
}
policy-statement disable-RPF-from-source {
  term first {
    from {
      source-address-filter 192.168.25.6/32 exact;
    }
    then reject;
  }
}

user@host# show routing-options
multicast {
  rpf-check-policy [ disable-RPF-from-group disable-RPF-from-source ];
}
```

Verification

To verify the configuration, run the **show multicast rpf** command.

Example: Configuring PIM RPF Selection

This example shows how to configure and verify the multicast PIM RPF next-hop neighbor selection for a group or (S,G) pair.

- [Requirements on page 163](#)
- [Overview on page 164](#)
- [Configuration on page 165](#)
- [Verification on page 167](#)

Requirements

Before you begin:

- Configure the router interfaces.

- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Make sure that the RPF next-hop neighbor you want to specify is operating.

Overview

Multicast PIM RPF neighbor selection allows you to specify the RPF neighbor (next hop) and source address for a single group or multiple groups using a prefix list. RPF neighbor selection can only be configured for VPN routing and forwarding (VRF) instances.

If you have multiple service VRFs through which a receiver VRF can learn the same source or rendezvous point (RP) address, PIM RPF checks typically choose the best path determined by the unicast protocol for all multicast flows. However, if RPF neighbor selection is configured, RPF checks are based on your configuration instead of the unicast routing protocols.

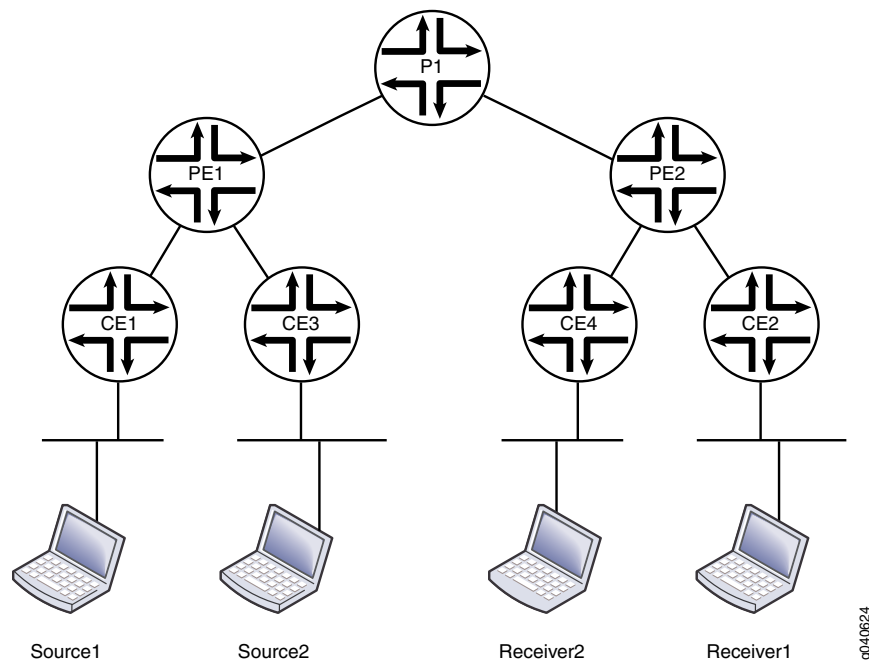
You can use this static RPF selection as a building block for particular applications. For example, an extranet. Suppose you want to split the multicast flows among parallel PIM links or assign one multicast flow to a specific PIM link. With static RPF selection configured, the router sends join and prune messages based on the configuration.

You can use wildcards to designate the source address. Whether or not you use wildcards affects how the PIM joins work:

- If you configure only a source prefix for a group, all (*,G) joins are sent to the next-hop neighbor selected by the unicast protocol, while (S,G) joins are sent to the next-hop neighbor specified for the source.
- If you configure only a wildcard source for a group, all (*,G) and (S,G) joins are sent to the upstream interface pointing to the wildcard source next-hop neighbor.
- If you configure both a source prefix and a wildcard source for a group, all (S,G) joins are sent to the next-hop neighbor defined for the source prefix, while (*,G) joins are sent to the next-hop neighbor specified for the wildcard source.

[Figure 27 on page 165](#) shows the topology used in this example.

Figure 27: PIM RPF Selection



In this example, the RPF selection is configured on the receiver provider edge router (PE2).

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set routing-instance vpn-a protocols pim rpf-selection group 225.5.0.0/16 wildcard-source
  next-hop 10.12.5.2
set routing-instance vpn-a protocols pim rpf-selection prefix-list group12 wildcard-source
  next-hop 10.12.31.2
set routing-instance vpn-a protocols pim rpf-selection prefix-list group34 source
  22.1.12.0/24 next-hop 10.12.32.2
set policy-options prefix-list group12 225.1.1.0/24
set policy-options prefix-list group12 225.2.0.0/16
set policy-options prefix-list group34 225.3.3.3/32
set policy-options prefix-list group34 225.4.4.0/24
```

Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure PIM RPF selection:

1. On PE2, configure RPF selection in a routing instance.

```
[edit routing-instance vpn-a protocols pim]
user@host# set rpf-selection group 225.5.0.0/16 wildcard-source next-hop 10.12.5.2
user@host# set rpf-selection prefix-list group12 wildcard-source next-hop 10.12.31.2
```

```
user@host# set rpf-selection prefix-list group34 source 22.1.12.0/24 next-hop
10.12.32.2
user@host# exit
```

2. On PE2, configure the policy.

```
[edit policy-options]
set prefix-list group12 225.1.1.0/24
set prefix-list group12 225.2.0.0/16
set prefix-list group34 225.3.3.3/32
set prefix-list group34 225.4.4.0/24
```

3. If you are done configuring the device, commit the configuration.

```
user@host# commit
```

Results From configuration mode, confirm your configuration by entering the **show policy-options** and **show routing-instances** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show policy-options
prefix-list group12 {
  225.1.1.0/24;
  225.2.0.0/16;
}
prefix-list group34 {
  225.3.3.3/32;
  225.4.4.0/24;
}

user@host# show routing-instances
vpn-a {
  protocols {
    pim {
      rpf-selection {
        group 225.5.0.0/16 {
          wildcard-source {
            next-hop 10.12.5.2;
          }
        }
      }
      prefix-list group12 {
        wildcard-source {
          next-hop 10.12.31.2;
        }
      }
      prefix-list group34 {
        source 22.1.12.0/24 {
          next-hop 10.12.32.2;
        }
      }
    }
  }
}
```

Verification

To verify the configuration, run the following commands, checking the upstream interface and the upstream neighbor:

- [show pim join extensive](#)
- [show multicast route](#)

Related Documentation

- [Example: Configuring Ingress PE Redundancy on page 210](#)

Example: Configuring Source-Specific Multicast

- [Understanding PIM Source-Specific Mode on page 167](#)
- [PIM SSM on page 168](#)
- [Source-Specific Multicast Groups Overview on page 170](#)
- [Example: Configuring Source-Specific Multicast Groups with Any-Source Override on page 171](#)
- [Example: Configuring an SSM-Only Domain on page 174](#)
- [Example: Configuring PIM SSM on a Network on page 175](#)
- [Example: Configuring SSM Mapping on page 176](#)

Understanding PIM Source-Specific Mode

RFC 1112, the original multicast RFC, supported both many-to-many and one-to-many models. These came to be known collectively as any-source multicast (ASM) because ASM allowed one or many sources for a multicast group's traffic. However, an ASM network must be able to determine the locations of all sources for a particular multicast group whenever there are interested listeners, no matter where the sources might be located in the network. In ASM, the key function of *source discovery* is a required function of the network itself.

Multicast source discovery appears to be an easy process, but in sparse mode it is not. In dense mode, it is simple enough to flood traffic to every router in the whole network so that every router learns the source address of the content for that multicast group. However, the flooding presents scalability and network resource use issues and is not a viable option in sparse mode.

PIM sparse mode (like any sparse mode protocol) achieves the required source discovery functionality without flooding at the cost of a considerable amount of complexity. The RP routers must be added and must know all multicast sources, and complicated shared distribution trees must be built to the RPs.

In an environment where many sources come and go, such as for a videoconferencing service, ASM is appropriate. However, by ignoring the many-to-many model and focusing attention on the one-to-many source-specific multicast (SSM) model, several commercially promising multicast applications, such as television channel distribution

over the Internet, might be brought to the Internet much more quickly and efficiently than if full ASM functionality were required of the network.

PIM SSM is simpler than PIM sparse mode because only the one-to-many model is supported. Initial commercial multicast Internet applications are likely to be available to *subscribers* (that is, receivers that issue join messages) from only a single source (a special case of SSM covers the need for a backup source). PIM SSM therefore forms a subset of PIM sparse mode. PIM SSM builds shortest-path trees (SPTs) rooted at the source immediately because in SSM, the router closest to the interested receiver host is informed of the unicast IP address of the source for the multicast traffic. That is, PIM SSM bypasses the RP connection stage through shared distribution trees, as in PIM sparse mode, and goes directly to the source-based distribution tree.

PIM SSM introduces new terms for many of the concepts in PIM sparse mode. PIM SSM can technically be used in the entire 224/4 multicast address range, although PIM SSM operation is guaranteed only in the 232/8 range (232.0.0/24 is reserved). The new SSM terms are appropriate for Internet video applications and are summarized in

[Table 7 on page 168](#).

Table 7: ASM and SSM Terminology

Term	Any-Source Multicast	Source-Specific Multicast
Address identifier	G	S,G
Address designation	group	channel
Receiver operations	join, leave	subscribe, unsubscribe
Group address range	224/4 excluding 232/8	224/4 (guaranteed only for 232/8)

Although PIM SSM describes receiver operations as *subscribe* and *unsubscribe*, the same PIM sparse mode join and leave messages are used by both forms of the protocol. The terminology change distinguishes ASM from SSM even though the receiver messages are identical.

PIM SSM

PIM source-specific multicast (SSM) uses a subset of PIM sparse mode and IGMP version 3 (IGMPv3) to allow a client to receive multicast traffic directly from the source. PIM SSM uses the PIM sparse-mode functionality to create an SPT between the receiver and the source, but builds the SPT without the help of an RP.

By default, the SSM group multicast address is limited to the IP address range from 232.0.0.0 through 232.255.255.255. However, you can extend SSM operations into another Class D range by including the **ssm-groups** statement at the **[edit routing-options multicast]** hierarchy level. The default SSM address range from 232.0.0.0 through 232.255.255.255 cannot be used in the **ssm-groups** statement. This statement is for adding other multicast addresses to the default SSM group addresses. This statement does not override the default SSM group address range.

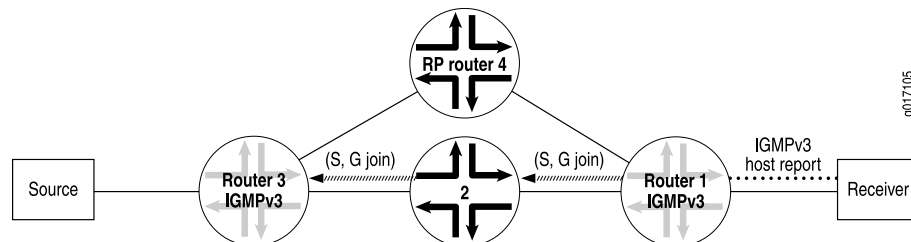
You can also configure the Junos OS to accept any-source multicast (ASM) join messages (*G) for group addresses that are within the default or configured range of source-specific multicast (SSM) groups. This allows you to support a mix of any-source and source-specific multicast groups simultaneously.

An SSM-configured network has distinct advantages over a traditionally configured PIM sparse-mode network. There is no need for shared trees or RP mapping (no RP is required), or for RP-to-RP source discovery through MSDP.

Deploying SSM is easy. You need to configure PIM sparse mode on all router interfaces and issue the necessary SSM commands, including specifying IGMPv3 on the receiver's LAN. If PIM sparse mode is not explicitly configured on both the source and group member interfaces, multicast packets are not forwarded. Source lists, supported in IGMPv3, are used in PIM SSM. As sources become active and start sending multicast packets, interested receivers in the SSM group receive the multicast packets.

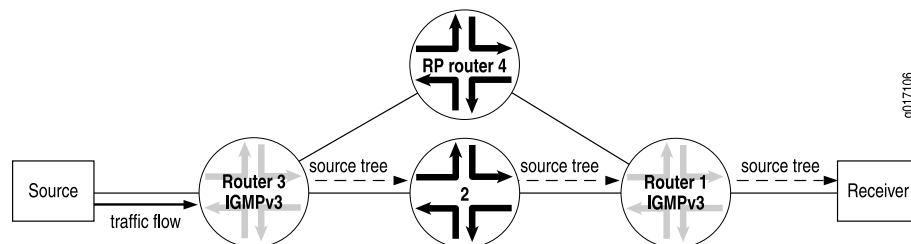
In a PIM SSM-configured network, a host subscribes to an SSM channel (by means of IGMPv3), announcing a desire to join group G and source S (see [Figure 28 on page 169](#)). The directly connected PIM sparse-mode router, the receiver's DR, sends an (S,G) join message to its RPF neighbor for the source. Notice in [Figure 28 on page 169](#) that the RP is not contacted in this process by the receiver, as would be the case in normal PIM sparse-mode operations.

Figure 28: Receiver Announces Desire to Join Group G and Source S



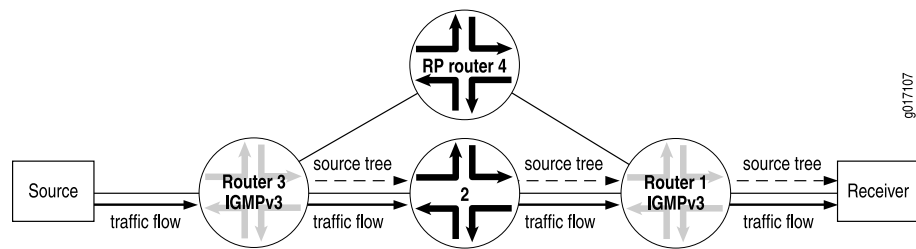
The (S,G) join message initiates the source tree and then builds it out hop by hop until it reaches the source. In [Figure 29 on page 169](#), the source tree is built across the network to Router 3, the last-hop router connected to the source.

Figure 29: Router 3 (Last-Hop Router) Joins the Source Tree



Using the source tree, multicast traffic is delivered to the subscribing host (see [Figure 30 on page 170](#)).

Figure 30: (S,G) State Is Built Between the Source and the Receiver



To configure additional SSM groups, include the **ssm-groups** statement at the **[edit routing-options multicast]** hierarchy level.

Source-Specific Multicast Groups Overview

Source-specific multicast (SSM) is a service model that identifies session traffic by both source and group address. SSM implemented in Junos OS has the efficient explicit join procedures of Protocol Independent Multicast (PIM) sparse mode but eliminates the immediate shared tree and rendezvous point (RP) procedures using (*,G) pairs. The (*) is a wildcard referring to any source sending to group G, and "G" refers to the IP multicast group. SSM builds shortest-path trees (SPTs) directly represented by (S,G) pairs. The "S" refers to the source's unicast IP address, and the "G" refers to the specific multicast group address. The SSM (S,G) pairs are called channels to differentiate them from any-source multicast (ASM) groups. Although ASM supports both one-to-many and many-to-many communications, ASM's complexity is in its method of source discovery. For example, if you click a link in a browser, the receiver is notified about the group information, but not the source information. With SSM, the client receives both source and group information.

SSM is ideal for one-to-many multicast services such as network entertainment channels. However, many-to-many multicast services might require ASM.

To deploy SSM successfully, you need an end-to-end multicast-enabled network and applications that use an Internet Group Management Protocol version 3 (IGMPv3) or Multicast Listener Discovery version 2 (MLDv2) stack, or you need to configure SSM mapping from IGMPv1 or IGMPv2 to IGMPv3. An IGMPv3 stack provides the capability of a host operating system to use the IGMPv3 protocol. IGMPv3 is available for Windows XP, Windows Vista, and most UNIX operating systems.

SSM mapping allows operators to support an SSM network without requiring all hosts to support IGMPv3. This support exists in static (S,G) configurations, but SSM mapping also supports dynamic per-source group state information, which changes as hosts join and leave the group using IGMP.

SSM is typically supported with a subset of IGMPv3 and PIM sparse mode known as *PIM SSM*. Using SSM, a client can receive multicast traffic directly from the source. PIM SSM uses the PIM sparse-mode functionality to create an SPT between the client and the source, but builds the SPT without the help of an RP.

An SSM-configured network has distinct advantages over a traditionally configured PIM sparse-mode network. There is no need for shared trees or RP mapping (no RP is required), or for RP-to-RP source discovery through the Multicast Source Discovery Protocol (MSDP).

Example: Configuring Source-Specific Multicast Groups with Any-Source Override

This example shows how to extend source-specific multicast (SSM) group operations beyond the default IP address range of 232.0.0.0 through 232.255.255.255. This example also shows how to accept any-source multicast (ASM) join messages (*G) for group addresses that are within the default or configured range of SSM groups. This allows you to support a mix of any-source and source-specific multicast groups simultaneously.

- [Requirements on page 171](#)
- [Overview on page 171](#)
- [Configuration on page 172](#)
- [Verification on page 174](#)

Requirements

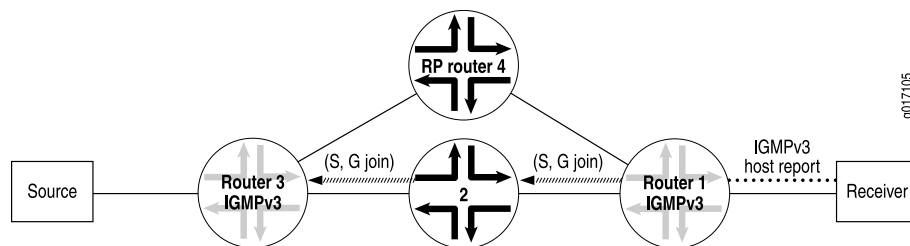
Before you begin, configure the router interfaces.

Overview

To deploy SSM, configure PIM sparse mode on all routing device interfaces and issue the necessary SSM commands, including specifying IGMPv3 or MLDv2 on the receiver's LAN. If PIM sparse mode is not explicitly configured on both the source and group members interfaces, multicast packets are not forwarded. Source lists, supported in IGMPv3 and MLDv2, are used in PIM SSM. Only sources that are specified send traffic to the SSM group.

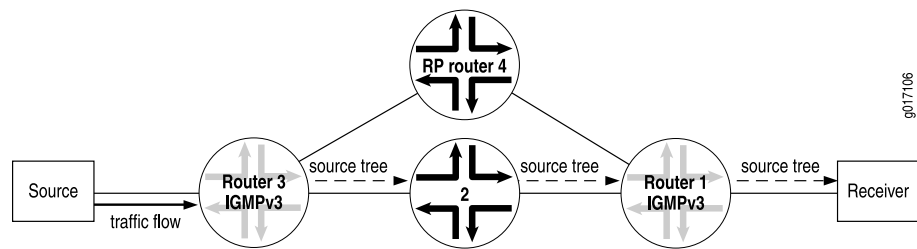
In a PIM SSM-configured network, a host subscribes to an SSM channel (by means of IGMPv3 or MLDv2) to join group G and source S (see [Figure 31 on page 171](#)). The directly connected PIM sparse-mode router, the receiver's designated router (DR), sends an (S,G) join message to its reverse-path forwarding (RPF) neighbor for the source. Notice in [Figure 31 on page 171](#) that the RP is not contacted in this process by the receiver, as would be the case in normal PIM sparse-mode operations.

Figure 31: Receiver Sends Messages to Join Group G and Source S



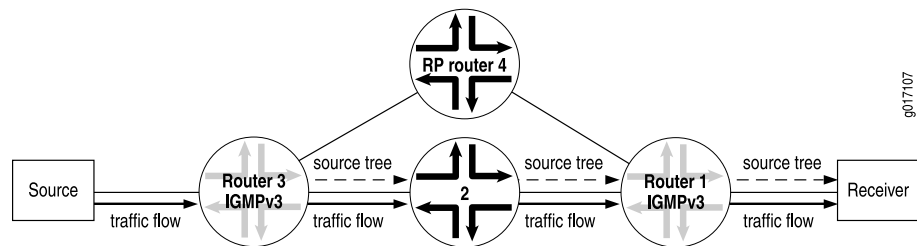
The (S,G) join message initiates the source tree and then builds it out hop by hop until it reaches the source. In [Figure 32 on page 172](#), the source tree is built across the network to Router 3, the last-hop router connected to the source.

Figure 32: Router 3 (Last-Hop Router) Joins the Source Tree



Using the source tree, multicast traffic is delivered to the subscribing host (see [Figure 33 on page 172](#)).

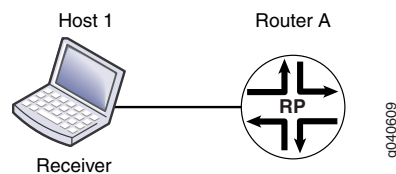
Figure 33: (S,G) State Is Built Between the Source and the Receiver



SSM can operate in include mode or in exclude mode. In exclude mode the receiver specifies a list of sources that it does not want to receive the multicast group traffic from. The routing device forwards traffic to the receiver from any source except the sources specified in the exclusion list. The receiver accepts traffic from any sources except the sources specified in the exclusion list.

This example works with the simple RPF topology shown in [Figure 34 on page 172](#).

Figure 34: Simple RPF Topology



Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set protocols ospf area 0.0.0.0 interface fxp0.0 disable
set protocols ospf area 0.0.0.0 interface all
set protocols pim rp local address 10.255.72.46
set protocols pim rp local group-ranges 239.0.0.0/24
set protocols pim interface fe-1/0/0.0 mode sparse
set protocols pim interface lo0.0 mode sparse
set routing-options multicast ssm-groups 232.0.0.0/8
```

```
set routing-options multicast ssm-groups 239.0.0.0/8
set routing-options multicast asm-override-ssm
```

Step-by-Step Procedure The following example requires that you navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure an RPF policy:

1. Configure OSPF.

```
[edit protocols ospf]
user@host# set area 0.0.0.0 interface fxp0.0 disable
user@host# set area 0.0.0.0 interface all
```

2. Configure PIM sparse mode.

```
[edit protocols pim]
user@host# set rp local address 10.255.72.46
user@host# set rp local group-ranges 239.0.0.0/24
user@host# set interface fe-1/0/0.0 mode sparse
user@host# set interface lo0.0 mode sparse
```

3. Configure additional SSM groups.

```
[edit routing-options]
user@host# set ssm-groups [ 232.0.0.0/8 239.0.0.0/8 ]
```

4. Configure the RP to accept ASM join messages for groups within the SSM address range.

```
[edit routing-options]
user@host# set multicast asm-override-ssm
```

5. If you are done configuring the device, commit the configuration.

```
user@host# commit
```

Results

Confirm your configuration by entering the **show protocols** and **show routing-options** commands.

```
user@host# show protocols
ospf {
  area 0.0.0.0 {
    interface fxp0.0 {
      disable;
    }
    interface all;
  }
}
pim {
  rp {
    local {
      address 10.255.72.46;
      group-ranges {
```

```
        239.0.0.0/24;
    }
}
interface fe-1/0/0.0 {
    mode sparse;
}
interface lo0.0 {
    mode sparse;
}
}

user@host# show routing-options
multicast {
    ssm-groups [ 232.0.0.0/8 239.0.0.0/8 ];
    asm-override-ssm;
}
```

Verification

To verify the configuration, run the following commands:

- `show igmp group`
- `show igmp statistics`
- `show pim join`

Example: Configuring an SSM-Only Domain

Deploying an SSM-only domain is much simpler than deploying an ASM domain because it only requires a few configuration steps. Enable PIM sparse mode on all interfaces by adding the **mode** statement at the **[edit protocols pim interface all]** hierarchy level. When configuring all interfaces, exclude the **fxp0.0** management interface by adding the **disable** statement for that interface. Then configure IGMPv3 on all host-facing interfaces by adding the **version** statement at the **[edit protocols igmp interface *interface-name*]** hierarchy level.

In the following example, the host-facing interface is **fe-0/1/2**:

```
[edit]
protocols {
  pim {
    interface all {
      mode sparse;
      version 2;
    }
    interface fxp0.0 {
      disable;
    }
  }
  igmp {
    interface fe-0/1/2 {
      version 3;
    }
  }
}
```

```

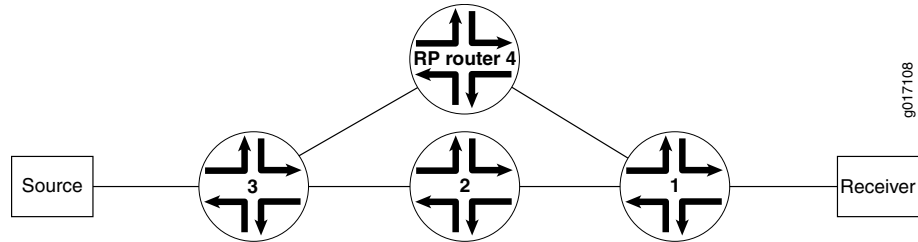
    }
  }

```

Example: Configuring PIM SSM on a Network

The following example shows how PIM SSM is configured between a receiver and a source in the network illustrated in [Figure 35 on page 175](#).

Figure 35: Network on Which to Configure PIM SSM



This example shows how to configure the IGMP version to IGMPv3 on all receiving host interfaces.

1. Enable IGMPv3 on all host-facing interfaces, and disable IGMP on the **fxp0.0** interface on Router 1.

```

user@router1# set protocols igmp interface all version 3
user@router1# set protocols igmp interface fxp0.0 disable

```



NOTE: When you configure IGMPv3 on a router, hosts on interfaces configured with IGMPv2 cannot join the source tree.

2. After the configuration is committed, use the **show configuration protocol igmp** command to verify the IGMP protocol configuration.

```

user@router1> show configuration protocol igmp

[edit protocols igmp]
interface all {
  version 3;
}
interface fxp0.0 {
  disable;
}

```

3. Use the **show igmp interface** command to verify that IGMP interfaces are configured.

```

user@router1> show igmp interface
Interface      State   Querier      Timeout  Version  Groups
fe-0/0/0.0     Up      198.58.3.245  213      3         0
fe-0/0/1.0     Up      198.58.3.241  220      3         0
fe-0/0/2.0     Up      198.58.3.237  218      3         0
Configured Parameters:
IGMP Query Interval (1/10 secs): 1250
IGMP Query Response Interval (1/10 secs): 100
IGMP Last Member Query Interval (1/10 secs): 10
IGMP Robustness Count: 2
Derived Parameters:

```

```
IGMP Membership Timeout (1/10 secs): 2600
IGMP Other Querier Present Timeout (1/10 secs): 2550
```

4. Use the **show pim join extensive** command to verify the PIM join state on Router 2 and Router 3 (the upstream routers).

```
user@router2> show pim join extensive
232.1.1.1      10.4.1.2      sparse
Upstream interface: fe-1/1/3.0
Upstream State: Local Source
Keepalive timeout: 209
Downstream Neighbors:
Interface: so-1/0/2.0
10.10.71.1      State: Join   Flags: S   Timeout: 209
```

5. Use the **show pim join extensive** command to verify the PIM join state on Router 1 (the router connected to the receiver).

```
user@router1> show pim join extensive
232.1.1.1      10.4.1.2      sparse
Upstream interface: so-1/0/2.0
Upstream State: Join to Source
Keepalive timeout: 209
Downstream Neighbors:
Interface: fe-0/2/3.0
10.3.1.1      State: Join   Flags: S   Timeout: Infinity
```

Example: Configuring SSM Mapping

SSM mapping does not require that all hosts support IGMPv3. SSM mapping translates IGMPv1 or IGMPv2 membership reports to an IGMPv3 report. This enables hosts running IGMPv1 or IGMPv2 to participate in SSM until the hosts transition to IGMPv3.

SSM mapping applies to all group addresses that match the policy, not just those that conform to SSM addressing conventions (232/8 for IPv4, ff30::/32 through ff3F::/32 for IPv6).

We recommend separate SSM maps for IPv4 and IPv6 if both address families require SSM support. If you apply an SSM map containing both IPv4 and IPv6 addresses to an interface in an IPv4 context (using IGMP), only the IPv4 addresses in the list are used. If there are no such addresses, no action is taken. Similarly, if you apply an SSM map containing both IPv4 and IPv6 addresses to an interface in an IPv6 context (using MLD), only the IPv6 addresses in the list are used. If there are no such addresses, no action is taken.

In this example, you create a policy to match the group addresses that you want to translate to IGMPv3. Then you define the SSM map that associates the policy with the source addresses where these group addresses are found. Finally, you apply the SSM map to one or more IGMP (for IPv4) or MLD (for IPv6) interfaces.

1. Create an SSM policy named **ssm-policy-example**. The policy terms match the IPv4 SSM group address 232.1.1.1/32 and the IPv6 SSM group address ff35::1/128. All other addresses are rejected.

```
user@router1# set policy-options policy-statement ssm-policy-example term A from
route-filter 232.1.1.1/32 exact
```



```

user@router1# set policy-options policy-statement ssm-policy-example term A then
accept
user@router1# set policy-options policy-statement ssm-policy-example term B from
route-filter ff35::1/128 exact
user@router1# set policy-options policy-statement ssm-policy-example term B then
accept

```

2. After the configuration is committed, use the **show configuration policy-options** command to verify the policy configuration.

```

user@host> show configuration policy-options

[edit policy-options]
policy-statement ssm-policy-example {
  term A {
    from {
      route-filter 232.1.1.1/32 exact;
    }
    then accept;
  }
  term B {
    from {
      route-filter ff35::1/128 exact;
    }
    then accept;
  }
  then reject;
}

```

The group addresses must match the configured policy for SSM mapping to occur.

3. Define two SSM maps, one called **ssm-map-ipv6-example** and one called **ssm-map-ipv4-example**, by applying the policy and configuring the source addresses as a multicast routing option.

```

user@host# set routing-options multicast ssm-map ssm-map-ipv6-example policy
ssm-policy-example
user@host# set routing-options multicast ssm-map ssm-map-ipv6-example source
fec0::1 fec0::12
user@host# set routing-options multicast ssm-map ssm-map-ipv4-example policy
ssm-policy-example
user@host# set routing-options multicast ssm-map ssm-map-ipv4-example source
10.10.10.4
user@host# set routing-options multicast ssm-map ssm-map-ipv4-example source
192.168.43.66

```

4. After the configuration is committed, use the **show configuration routing-options** command to verify the policy configuration.

```

user@host> show configuration routing-options

[edit routing-options]
multicast {
  ssm-map ssm-map-ipv6-example {
    policy ssm-policy-example;
    source [ fec0::1 fec0::12 ];
  }
  ssm-map ssm-map-ipv4-example {
    policy ssm-policy-example;
  }
}

```

```

        source [ 10.10.10.4 192.168.43.66 ];
    }
}

```

We recommend separate SSM maps for IPv4 and IPv6.

5. Apply SSM maps for IPv4-to-IGMP interfaces and SSM maps for IPv6-to-MLD interfaces:

```

user@host# set protocols igmp interface fe-0/1/0.0 ssm-map ssm-map-ipv4-example
user@host# set protocols mld interface fe-0/1/1.0 ssm-map ssm-map-ipv6-example

```

6. After the configuration is committed, use the **show configuration protocol** command to verify the IGMP and MLD protocol configuration.

```

user@router1> show configuration protocol

[edit protocols]
igmp {
  interface fe-0/1/0.0 {
    ssm-map ssm-map-ipv4-example;
  }
}
mld {
  interface fe-0/1/1.0 {
    ssm-map ssm-map-ipv6-example;
  }
}

```

7. Use the **show igmp interface** and the **show mld interface** commands to verify that the SSM maps are applied to the interfaces.

```

user@host> show igmp interface fe-0/1/0.0
Interface: fe-0/1/0.0
  Querier: 192.168.224.28
  State:      Up Timeout:      None Version:  2 Groups:  2
  SSM Map: ssm-map-ipv4-example

user@host> show mld interface fe-0/1/1.0
Interface: fe-0/1/1.0
  Querier: fec0:0:0:0:1::12
  State:      Up Timeout:      None Version:  2 Groups:  2
  SSM Map: ssm-map-ipv6-example

```

Related Documentation

- [Configuring Basic PIM Settings on page 21](#)

Example: Configuring SSM Maps for Different Groups to Different Sources

- [Multiple SSM Maps and Groups for Interfaces on page 178](#)
- [Example: Configuring Multiple SSM Maps Per Interface on page 179](#)

Multiple SSM Maps and Groups for Interfaces

You can configure multiple source-specific multicast (SSM) maps so that different groups map to different sources, which enables a single multicast group to map to different sources for different interfaces.

Example: Configuring Multiple SSM Maps Per Interface

This example shows how to assign more than one SSM map to an IGMP interface.

- [Requirements on page 179](#)
- [Overview on page 179](#)
- [Configuration on page 179](#)
- [Verification on page 181](#)

Requirements

This example requires Junos OS Release 11.4 or later.

Overview

In this example, you configure a routing policy, POLICY-ipv4-example1, that maps multicast group join messages over an IGMP logical interface to IPv4 multicast source addresses based on destination IP address as follows:

Routing Policy Name	Multicast Group Join Messages for a Route Filter at This Destination Address	Multicast Source Addresses
POLICY-ipv4-example1 term 1	232.1.1.1	10.10.10.4, 192.168.43.66
POLICY-ipv4-example1 term 2	232.1.1.2	10.10.10.5, 192.168.43.67

You apply routing policy POLICY-ipv4-example1 to IGMP logical interface fe-0/1/0.0.

Configuration

The following example requires that you navigate various levels in the configuration hierarchy. For information about navigating the CLI, see the *CLI User Guide*.

To configure this example, perform the following task:

CLI Quick Configuration

To quickly configure this example, copy the following configuration commands into a text file, remove any line breaks, and then paste the commands into the CLI at the [edit] hierarchy level.

```
set policy-options policy-statement POLICY-ipv4-example1 term 1 from route-filter 232.1.1.1/32 exact
set policy-options policy-statement POLICY-ipv4-example1 term 1 then ssm-source 10.10.10.4
set policy-options policy-statement POLICY-ipv4-example1 term 1 then ssm-source 192.168.43.66
set policy-options policy-statement POLICY-ipv4-example1 term 1 then accept
set policy-options policy-statement POLICY-ipv4-example1 term 2 from route-filter 232.1.1.2/32 exact
set policy-options policy-statement POLICY-ipv4-example1 term 2 then ssm-source 10.10.10.5
```

```

set policy-options policy-statement POLICY-ipv4-example1 term 2 then ssm-source
192.168.43.67
set policy-options policy-statement POLICY-ipv4-example1 term 2 then accept
set protocols igmp interface fe-0/1/0.0 ssm-map-policy POLICY-ipv4-example1

```

Step-by-Step Procedure

To configure multiple SSM maps per interface:

1. Configure protocol-independent routing options for route filter 232.1.1.1, and specify the multicast source addresses to which matching multicast groups are to be mapped.

```

[edit policy-options policy-statement POLICY-ipv4-example1 term 1]
user@host# set from route-filter 232.1.1/32 exact
user@host# set then ssm-source 10.10.10.4
user@host# set then ssm-source 192.168.43.66
user@host# set then accept

```

2. Configure protocol-independent routing options for route filter 232.1.1.2, and specify the multicast source addresses to which matching multicast groups are to be mapped.

```

[edit policy-options policy-statement POLICY-ipv4-example1 term 2]
user@host# set from route-filter 232.1.1.2/32 exact
user@host# set then ssm-source 10.10.10.5
user@host# set then ssm-source 192.168.43.67
user@host# set then accept

```

3. Apply the policy map POLICY-ipv4-example1 to IGMP logical interface fe-0/1/1/0.

```

[edit protocols igmp interface fe-0/1/0.0]
user@host# set ssm-map-policy POLICY-ipv4-example1

```

Results

After the configuration is committed, confirm the configuration by entering the **show policy-options** and **show protocols** configuration mode commands. If the command output does not display the intended configuration, repeat the instructions in this procedure to correct the configuration.

```

user@host# show policy-options
policy-statement POLICY-ipv4-example1 {
  term 1 {
    from {
      route-filter 232.1.1/32 exact;
    }
    then {
      ssm-source [ 10.10.10.4 192.168.43.66 ];
      accept;
    }
  }
  term 2 {
    from {
      route-filter 232.1.1.2/32 exact;
    }
    then {
      ssm-source [ 10.10.10.5 192.168.43.67 ];
      accept;
    }
  }
}

```

```

}

user@host# show protocols
igmp {
  interface fe-0/1/0.0 {
    ssm-map-policy POLICY-ipv4-example1;
  }
}

```

Verification

Confirm that the configuration is working properly.

- [Displaying Information About IGMP-Enabled Interfaces on page 181](#)
- [Displaying the PIM Groups on page 181](#)
- [Displaying the Entries in the IP Multicast Forwarding Table on page 181](#)

Displaying Information About IGMP-Enabled Interfaces

Purpose Verify that the SSM map policy POLICY-ipv4-example1 is applied to logical interface fe-0/1/0.0.

Action Use the [show igmp interface](#) operational mode command for the IGMP logical interface to which you applied the SSM map policy.

```

user@host> show igmp interface
Interface: fe-0/1/0.0
  Querier: 10.111.30.1
  State:      Up Timeout:   None Version:  2 Groups:      2
  SSM Map Policy: POLICY-ipv4-example1;

```

```

Configured Parameters:
IGMP Query Interval: 125.0
IGMP Query Response Interval: 10.0
IGMP Last Member Query Interval: 1.0
IGMP Robustness Count: 2

```

```

Derived Parameters:
IGMP Membership Timeout: 260.0
IGMP Other Querier Present Timeout: 255.0

```

The command output displays the name of the IGMP logical interface (fe-0/1/0.0), which is the address of the routing device that has been elected to send membership queries and group information.

Displaying the PIM Groups

Purpose Verify the Protocol Independent Multicast (PIM) source and group pair (S,G) entries.

Action Use the [show pim join extensive 232.1.1.1](#) operational mode command to display the PIM source and group pair (S,G) entries for the 232.1.1.1 group.

Displaying the Entries in the IP Multicast Forwarding Table

Purpose Verify that the IP multicast forwarding table displays the multicast route state.

Action Use the [show multicast route extensive](#) operational mode command to display the entries in the IP multicast forwarding table to verify that the **Route state** is active and that the **Forwarding state** is forwarding.

Related Documentation

- [Example: Configuring Source-Specific Multicast on page 167](#)
- [Example: Configuring Source-Specific Draft-Rosen 7 Multicast VPNs](#)

Examples: Configuring Bandwidth Management

- [Understanding Bandwidth Management for Multicast on page 182](#)
- [Bandwidth Management and PIM Graceful Restart on page 183](#)
- [Bandwidth Management and Source Redundancy on page 183](#)
- [Logical Systems and Bandwidth Oversubscription on page 183](#)
- [Example: Defining Interface Bandwidth Maximums on page 184](#)
- [Example: Configuring Multicast with Subscriber VLANs on page 187](#)
- [Configuring Multicast Routing Over IP Demux Interfaces on page 200](#)
- [Classifying Packets by Egress Interface on page 201](#)

Understanding Bandwidth Management for Multicast

Bandwidth management enables you to control the multicast flows that leave a multicast interface. This control enables you to better manage your multicast traffic and reduce or eliminate the chances of interface oversubscription or congestion.

Bandwidth management ensures that multicast traffic oversubscription does not occur on an interface. When managing multicast bandwidth, you define the maximum amount of multicast bandwidth that an individual interface can use as well as the bandwidth individual multicast flows use.

For example, the routing software cannot add a flow to an interface if doing so exceeds the allowed bandwidth for that interface. Under these circumstances, the interface is rejected. This rejection, however, does not prevent a multicast protocol (for example, PIM) from sending a join message upstream. Traffic continues to arrive on the router, even though the router is not sending the flow from the expected outgoing interfaces.

You can configure the flow bandwidth statically by specifying a bandwidth value for the flow in bits per second, or you can enable the flow bandwidth to be measured and adaptively changed. When using the adaptive bandwidth option, the routing software queries the statistics for the flows to be measured at 5-second intervals and calculates the bandwidth based on the queries. The routing software uses the maximum value measured within the last minute (that is, the last 12 measuring points) as the flow bandwidth.

For more information, see the following sections:

- [Bandwidth Management and PIM Graceful Restart on page 183](#)

- [Bandwidth Management and Source Redundancy on page 183](#)
- [Logical Systems and Bandwidth Oversubscription on page 183](#)

Bandwidth Management and PIM Graceful Restart

When using PIM graceful restart, after the routing process restarts on the Routing Engine, previously admitted interfaces are always readmitted and the available bandwidth is adjusted on the interfaces. When using the adaptive bandwidth option, the bandwidth measurement is initially based on the configured or default starting bandwidth, which might be inaccurate during the first minute. This means that new flows might be incorrectly rejected or admitted temporarily. You can correct this problem by issuing the **clear multicast bandwidth-admission** operational command.

If PIM graceful restart is not configured, after the routing process restarts, previously admitted or rejected interfaces might be rejected or admitted in an unpredictable manner.

Bandwidth Management and Source Redundancy

When using source redundancy, multiple sources (for example, s1 and s2) might exist for the same destination group (g). However, only one of the sources can actively transmit at any time. In this case, multiple forwarding entries—(s1,g) and (s2,g)—are created after each goes through the admission process.

With redundant sources, unlike unrelated entries, an OIF that is already admitted for one entry—for example, (s1,g)—is automatically admitted for other redundancy entries—for example, (s2,g). The remaining bandwidth on the interface is deducted each time an outbound interface is added, even though only one sender actively transmits. By measuring bandwidth, the bandwidth deducted for the inactive entries is credited back when the router detects no traffic is being transmitted.

For more information about defining redundant sources, see [“Example: Configuring a Multicast Flow Map” on page 206](#).

Logical Systems and Bandwidth Oversubscription

You can manage bandwidth at both the physical and logical interface level. However, if more than one logical system shares the same physical interface, the interface might become oversubscribed. Oversubscription occurs if the total bandwidth of all separately configured maximum bandwidth values for the interfaces on each logical system exceeds the bandwidth of the physical interface.

When displaying interface bandwidth information, a negative available bandwidth value indicates oversubscription on the interface.

Interface bandwidth can become oversubscribed when the configured maximum bandwidth decreases or when some flow bandwidths increase because of a configuration change or an actual increase in the traffic rate.

Interface bandwidth can become available again if one of the following occurs:

- The configured maximum bandwidth increases.

- Some flows are no longer transmitted from interfaces, and bandwidth reserves for them are now available to other flows.
- Some flow bandwidths decrease because of a configuration change or an actual decrease in the traffic rate.

Interfaces that are rejected for a flow because of insufficient bandwidth are not automatically readmitted, even when bandwidth becomes available again. Rejected interfaces have an opportunity to be readmitted when one of the following occurs:

- The multicast routing protocol updates the forwarding entry for the flow after receiving a join, leave, or prune message or after a topology change occurs.
- The multicast routing protocol updates the forwarding entry for the flow due to configuration changes.
- You manually reapply bandwidth management to a specific flow or to all flows using the **clear multicast bandwidth-admission** operational command.

In addition, even if previously available bandwidth is no longer available, already admitted interfaces are not removed until one of the following occurs:

- The multicast routing protocol explicitly removes the interfaces after receiving a leave or prune message or after a topology change occurs.
- You manually reapply bandwidth management to a specific flow or to all flows using the **clear multicast bandwidth-admission** operational command.

Example: Defining Interface Bandwidth Maximums

This example shows you how to configure the maximum bandwidth for a physical or logical interface.

- [Requirements on page 184](#)
- [Overview on page 185](#)
- [Configuration on page 185](#)
- [Verification on page 186](#)

Requirements

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure a multicast protocol. This feature works with the following multicast protocols:
 - DVMRP
 - PIM-DM

- PIM-SM
- PIM-SSM

Overview

The maximum bandwidth setting applies admission control either against the configured interface bandwidth or against the native speed of the underlying interface (when there is no configured bandwidth for the interface).

If you configure several logical interfaces (for example, to support VLANs or PVCs) on the same underlying physical interface, and no bandwidth is configured for the logical interfaces, it is assumed that the logical interfaces all have the same bandwidth as the underlying interface. This can cause oversubscription. To prevent oversubscription, configure bandwidth for the logical interfaces, or configure admission control at the physical interface level.

You only need to define the maximum bandwidth for an interface on which you want to apply bandwidth management. An interface that does not have a defined maximum bandwidth transmits all multicast flows as determined by the multicast protocol that is running on the interface (for example, PIM).

If you specify **maximum-bandwidth** without including a bits-per-second value, admission control is enabled based on the bandwidth configured for the interface. In the following example, admission control is enabled for logical interface unit **200**, and the maximum bandwidth is 20 Mbps. If the bandwidth is not configured on the interface, the maximum bandwidth is the link speed.

```
routing-options {
  multicast {
    interface fe-0/2/0.200 {
      maximum-bandwidth;
    }
  }
  interfaces {
    fe-0/2/0 {
      unit 200 {
        bandwidth 20m;
      }
    }
  }
}
```

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set interfaces fe-0/2/0 unit 200 bandwidth 20m
set routing-options multicast interface fe-0/2/0.200 maximum-bandwidth
set routing-options multicast interface fe-0/2/1 maximum-bandwidth 60m
set routing-options multicast interface fe-0/2/1.200 maximum-bandwidth 10m
```

Step-by-Step Procedure The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure a bandwidth maximum:

1. Configure the a logical interface bandwidth.

```
[edit interfaces]
user@host# set fe-0/2/0 unit 200 bandwidth 20m
```

2. Enable admission control on the logical interface.

```
[edit routing-options]
user@host# set multicast interface fe-0/2/0.200 maximum-bandwidth
```

3. On a physical interface, enable admission control and set the maximum bandwidth to 60 Mbps.

```
[edit routing-options]
user@host# set multicast interface fe-0/2/1 maximum-bandwidth 60m
```

4. For a logical interface on the same physical interface shown in Step 3, set a smaller maximum bandwidth.

```
[edit routing-options]
user@host# set multicast interface fe-0/2/1.200 maximum-bandwidth 10m
```

Results

Confirm your configuration by entering the **show interfaces** and **show routing-options** commands.

```
user@host# show interfaces
fe-0/2/0 {
  unit 200 {
    bandwidth 20m;
  }
}

user@host# show routing-options
multicast {
  interface fe-0/2/0.200 {
    maximum-bandwidth;
  }
  interface fe-0/2/1 {
    maximum-bandwidth 60m;
  }
  interface fe-0/2/1.200 {
    maximum-bandwidth 10m;
  }
}
```

Verification

To verify the configuration, run the **show multicast interface** command.

Example: Configuring Multicast with Subscriber VLANs

This example shows how to configure an MX Series router to function as a broadband service router (BSR).

- [Requirements on page 187](#)
- [Overview and Topology on page 187](#)
- [Configuration on page 191](#)
- [Verification on page 199](#)

Requirements

This example uses the following hardware components:

- One MX Series router or EX Series switch with a PIC that supports traffic control profile queuing
- One DSLAM

Before you begin:

- Configure an interior gateway protocol. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure PIM and IGMP or MLD on the interfaces.

Overview and Topology

When multiple BSR interfaces receive IGMP and MLD join and leave requests for the same multicast stream, the BSR sends a copy of the multicast stream on each interface. Both the multicast control packets (IGMP and MLD) and the multicast data packets flow on the same BSR interface, along with the unicast data. Because all per-customer traffic has its own interface on the BSR, per-customer accounting, call admission control (CAC), and quality-of-service (QoS) adjustment are supported. The QoS bandwidth used by multicast reduces the unicast bandwidth.

Multiple interfaces on the BSR might connect to a shared device (for example, a DSLAM). The BSR sends the same multicast stream multiple times to the shared device, thus wasting bandwidth. It is more efficient to send the multicast stream one time to the DSLAM and replicate the multicast streams in the DSLAM. There are two approaches that you can use.

The first approach is to continue to send unicast data on the per-customer interfaces, but have the DSLAM route all the per-customer IGMP and MLD join and leave requests to the BSR on a single dedicated interface (a multicast VLAN). The DSLAM receives the multicast streams from the BSR on the dedicated interface with no unnecessary replication and performs the necessary replication to the customers. Because all multicast control and data packets use only one interface, only one copy of a stream is sent even if there are multiple requests. This approach is called reverse outgoing interface (OIF) mapping. Reverse OIF mapping enables the BSR to propagate the multicast state of the shared interface to the customer interfaces, which enables per-customer accounting

and QoS adjustment to work. When a customer changes the TV channel, the router gateway (RG) sends an IGMP or MLD join and leave messages to the DSLAM. The DSLAM transparently passes the request to the BSR through the multicast VLAN. The BSR maps the IGMP or MLD request to one of the subscriber VLANs based on the IP source address or the source MAC address. When the subscriber VLAN is found, QoS adjustment and accounting are performed on that VLAN or interface.

The second approach is for the DSLAM to continue to send unicast data and all the per-customer IGMP and MLD join and leave requests to the BSR on the individual customer interfaces, but to have the multicast streams arrive on a single dedicated interface. If multiple customers request the same multicast stream, the BSR sends one copy of the data on the dedicated interface. The DSLAM receives the multicast streams from the BSR on the dedicated interface and performs the necessary replication to the customers. Because the multicast control packets use many customer interfaces, configuration on the BSR must specify how to map each customer's multicast data packets to the single dedicated output interface. QoS adjustment is supported on the customer interfaces. CAC is supported on the shared interface. This second approach is called multicast OIF mapping.

OIF mapping and reverse OIF mapping are not supported on the same customer interface or shared interface. This example shows how to configure the two different approaches. Both approaches support QoS adjustment, and both approaches support MLD/IPv6. The reverse OIF mapping example focuses on IGMP/IPv4 and enables QoS adjustment. The OIF mapping example focuses on MLD/IPv6 and disables QoS adjustment.

The first approach (reverse OIF mapping) includes the following statements:

- **flow-map**—Defines a flow map that controls the bandwidth for each flow.
- **maximum-bandwidth**—Enables CAC.
- **reverse-oif-mapping**—Enables the routing device to identify a subscriber VLAN or interface based on an IGMP or MLD join or leave request that it receives over the multicast VLAN.

After the subscriber VLAN is identified, the routing device immediately adjusts the QoS (in this case, the bandwidth) on that VLAN based on the addition or removal of a subscriber.

The routing device uses IGMP and MLD join or leave reports to obtain the subscriber VLAN information. This means that the connecting equipment (for example, the DSLAM) must forward all IGMP and MLD reports to the routing device for this feature to function properly. Using report suppression or an IGMP proxy can result in reverse OIF mapping not working properly.

- **subscriber-leave-timer**—Introduces a delay to the QoS update. After receiving an IGMP or MLD leave request, this statement defines a time delay (between 1 and 30 seconds) that the routing device waits before updating the QoS for the remaining subscriber interfaces. You might use this delay to decrease how often the routing device adjusts

the overall QoS bandwidth on the VLAN when a subscriber sends rapid leave and join messages (for example, when changing channels in an IPTV network).

- **traffic-control-profile**—Configures a shaping rate on the logical interface. The configured shaping rate must be configured as an absolute value, not as a percentage.

The second approach (OIF mapping) includes the following statements:

- **map-to-interface**—In a policy statement, enables you to build the OIF map.

The OIF map is a routing policy statement that can contain multiple terms. When creating OIF maps, keep the following in mind:

- If you specify a physical interface (for example, **ge-0/0/0**), a ".0" is appended to the interface to create a logical interface (for example, **ge-0/0/0.0**).
- Configure a routing policy for each logical system. You cannot configure routing policies dynamically.
- The interface must also have IGMP, MLD, or PIM configured.
- You cannot map to a mapped interface.
- We recommend that you configure policy statements for IGMP and MLD separately.
- Specify either a logical interface or the keyword **self**. The **self** keyword specifies that multicast data packets be sent on the same interface as the control packets and that no mapping occur. If no term matches, then no multicast data packets are sent.
- **no-qos-adjust**—Disables QoS adjustment.

QoS adjustment decreases the available bandwidth on the client interface by the amount of bandwidth consumed by the multicast streams that are mapped from the client interface to the shared interface. This action always occurs unless it is explicitly disabled.

If you disable QoS adjustment, available bandwidth is not reduced on the customer interface when multicast streams are added to the shared interface.



NOTE: You can dynamically disable QoS adjustment for IGMP and MLD interfaces using dynamic profiles.

- **oif-map**—Associate a map with an IGMP or MLD interface. The OIF map is then applied to all IGMP or MLD requests received on the configured interface. In this example, subscriber VLANs 1 and 2 have MLD configured, and each VLAN points to an OIF map that directs some traffic to **ge-2/3/9.4000**, some traffic to **ge-2/3/9.4001**, and some traffic to **self**.



NOTE: You can dynamically associate OIF maps with IGMP interfaces using dynamic profiles.

- **passive**—Defines either IGMP or MLD to use passive mode.

The OIF map interface should not typically pass IGMP or MLD control traffic and should be configured as passive. However, the OIF map implementation does support running IGMP or MLD on an interface (control and data) in addition to mapping data streams to the same interface. In this case, you should configure IGMP or MLD normally (that is, not in passive mode) on the mapped interface. In this example, the OIF map interfaces (**ge-2/3/9.4000** and **ge-2/3/9.4001**) are configured as MLD passive.

By default, specifying the **passive** statement means that no general queries, group-specific queries, or group-source-specific queries are sent over the interface and that all received control traffic is ignored by the interface. However, you can selectively activate up to two out of the three available options for the **passive** statement while keeping the other functions passive (inactive).

These options include the following:

- **send-general-query**—When specified, the interface sends general queries.
- **send-group-query**—When specified, the interface sends group-specific and group-source-specific queries.
- **allow-receive**—When specified, the interface receives control traffic.

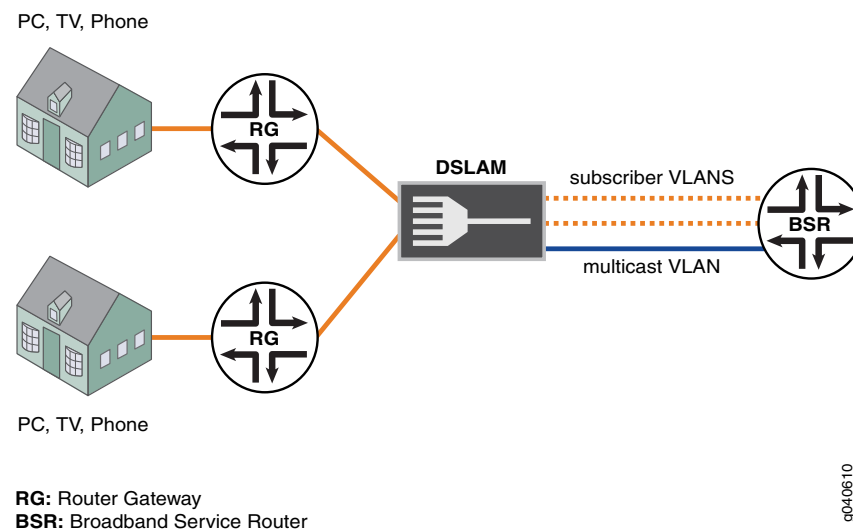
[Figure 36 on page 191](#) shows the scenario.

In both approaches, if multiple customers request the same multicast stream, the BSR sends one copy of the stream on the shared multicast VLAN interface. The DSLAM receives the multicast stream from the BSR on the shared interface and performs the necessary replication to the customers.

In the first approach (reverse OIF mapping), the DSLAM uses the per-customer subscriber VLANs for unicast data only. IGMP and MLD join and leave requests are sent on the multicast VLAN.

In the second approach (OIF mapping), the DSLAM uses the per-customer subscriber VLANs for unicast data and for IGMP and MLD join and leave requests. The multicast VLAN is used only for multicast streams, not for join and leave requests.

Figure 36: Multicast with Subscriber VLANs



Configuration

Configuring a Reverse OIF Map

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set class-of-service traffic-control-profiles tcp-iftl shaping-rate 20m
set class-of-service interfaces ge-2/2/0 shaping-rate 240m
set class-of-service interfaces ge-2/2/0 unit 50 output-traffic-control-profile tcp-iftl
set class-of-service interfaces ge-2/2/0 unit 51 output-traffic-control-profile tcp-iftl
set interfaces ge-2/0/0 unit 0 family inet address 30.0.0.2/24
set interfaces ge-2/2/0 hierarchical-scheduler
set interfaces ge-2/2/0 vlan-tagging
set interfaces ge-2/2/0 unit 10 vlan-id 10
set interfaces ge-2/2/0 unit 10 family inet address 40.0.0.2/24
set interfaces ge-2/2/0 unit 50 vlan-id 50
set interfaces ge-2/2/0 unit 50 family inet address 50.0.0.2/24
set interfaces ge-2/2/0 unit 51 vlan-id 51
set interfaces ge-2/2/0 unit 51 family inet address 50.0.1.2/24
set policy-options policy-statement all-mcast-groups from source-address-filter
30.0.0.0/8 orlonger
set policy-options policy-statement all-mcast-groups then accept
set protocols igmp interface all
set protocols igmp interface fxp0.0 disable
set protocols pim rp local address 20.0.0.2
set protocols pim interface all
set protocols pim interface fxp0.0 disable
set protocols pim interface ge-2/2/0.10 disable
set routing-options multicast flow-map map1 policy all-mcast-groups
set routing-options multicast flow-map map1 bandwidth 10m
set routing-options multicast flow-map map1 bandwidth adaptive
set routing-options multicast interface ge-2/2/0.10 maximum-bandwidth 500m
```

```
set routing-options multicast interface ge-2/2/0.10 reverse-oif-mapping
set routing-options multicast interface ge-2/2/0.10 subscriber-leave-timer 20
```

Step-by-Step Procedure The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure reverse OIF mapping:

1. Configure a logical interface for unicast data traffic.

```
[edit interfaces ge-2/0/0]
user@host# set unit 0 family inet address 30.0.0.2/24
```

2. Configure a logical interface for subscriber control traffic.

```
[edit interfaces ge-2/2/0]
user@host# set hierarchical-scheduler
user@host# set vlan-tagging
user@host# set unit 10 vlan-id 10
user@host# set unit 10 family inet address 40.0.0.2/24
```

3. Configure two logical interfaces on which QoS adjustments are made.

```
[edit interfaces ge-2/2/0]
user@host# set unit 50 vlan-id 50
user@host# set unit 50 family inet address 50.0.0.2/24
user@host# set unit 51 vlan-id 51
user@host# set unit 51 family inet address 50.0.1.2/24
```

4. Configure a policy.

```
[edit policy-options policy-statement all-mcast-groups]
user@host# set from source-address-filter 30.0.0.0/8 orlonger
user@host# set then accept
```

5. Enable a flow map that references the policy.

```
[edit routing-options multicast]
user@host# set flow-map map1 policy all-mcast-groups
user@host# set flow-map map1 bandwidth 10m adaptive
```

6. Enable OIF mapping on the logical interface that receives subscriber control traffic.

```
[edit routing-options multicast]
user@host# set interface ge-2/2/0.10 maximum-bandwidth 500m
user@host# set interface ge-2/2/0.10 reverse-oif-mapping
user@host# set interface ge-2/2/0.10 subscriber-leave-timer 20
```

7. Configure PIM and IGMP.

```
[edit protocols]
user@host# set igmp interface all
user@host# set igmp interface fxp0.0 disable
user@host# set pim rp local address 20.0.0.2
user@host# set pim interface all
user@host# set pim interface fxp0.0 disable
user@host# set pim interface ge-2/2/0.10 disable
```


8. Configure the hierarchical scheduler by configuring a shaping rate for the physical interface and a slower shaping rate for the logical interfaces on which QoS adjustments are made.

```
[edit class-of-service interfaces ge-2/2/0]
user@host# set shaping-rate 240m
user@host# set unit 50 output-traffic-control-profile tcp-ift
user@host# set unit 51 output-traffic-control-profile tcp-ift

[edit class-of-service traffic-control-profiles tcp-30m-no-smap]
user@host# set shaping-rate 20m
```

Results From configuration mode, confirm your configuration by entering the **show class-of-service**, **show interfaces**, **show policy-options**, **show protocols**, and **show routing-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show class-of-service
traffic-control-profiles {
  tcp-ift {
    shaping-rate 20m;
  }
}
interfaces {
  ge-2/2/0 {
    shaping-rate 240m;
    unit 50 {
      output-traffic-control-profile tcp-ift;
    }
    unit 51 {
      output-traffic-control-profile tcp-ift;
    }
  }
}

user@host# show interfaces
ge-2/0/0 {
  unit 0 {
    family inet {
      address 30.0.0.2/24;
    }
  }
}
ge-2/2/0 {
  hierarchical-scheduler;
  vlan-tagging;
  unit 10 {
    vlan-id 10;
    family inet {
      address 40.0.0.2/24;
    }
  }
}
unit 50 {
  vlan-id 50;
  family inet {
```

```
        address 50.0.0.2/24;
    }
}
unit 51 {
    vlan-id 51;
    family inet {
        address 50.0.1.2/24;
    }
}
}

user@host# show policy-options
policy-statement all-mcast-groups {
    from {
        source-address-filter 30.0.0.0/8 orlonger;
    }
    then accept;
}

user@host# show protocols
igmp {
    interface all;
    interface fxp0.0 {
        disable;
    }
}
pim {
    rp {
        local {
            address 20.0.0.2;
        }
    }
    interface all;
    interface fxp0.0 {
        disable;
    }
    interface ge-2/2/0.10 {
        disable;
    }
}

user@host# show routing-options
multicast {
    flow-map map1 {
        policy all-mcast-groups;
        bandwidth 10m adaptive;
    }
    interface ge-2/2/0.10 {
        maximum-bandwidth 500m;
        reverse-oif-mapping;
        subscriber-leave-timer 20;
    }
}
```

If you are done configuring the device, enter **commit** from configuration mode.

Configuring an OIF Map

CLI Quick Configuration To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```

set interfaces ge-2/3/8 unit 0 family inet6 address C300:0101::/24
set interfaces ge-2/3/9 vlan-tagging
set interfaces ge-2/3/9 unit 1 vlan-id 1
set interfaces ge-2/3/9 unit 1 family inet6 address C400:0101::/24
set interfaces ge-2/3/9 unit 2 vlan-id 2
set interfaces ge-2/3/9 unit 2 family inet6 address C400:0201::/24
set interfaces ge-2/3/9 unit 4000 vlan-id 4000
set interfaces ge-2/3/9 unit 4000 family inet6 address C40F:A001::/24
set interfaces ge-2/3/9 unit 4001 vlan-id 4001
set interfaces ge-2/3/9 unit 4001 family inet6 address C40F:A101::/24
set policy-options policy-statement g539-v6 term g539-4000 from route-filter
  FF05:0101:0000::/39 orlonger
set policy-options policy-statement g539-v6 term g539-4000 then map-to-interface
  ge-2/3/9.4000
set policy-options policy-statement g539-v6 term g539-4000 then accept
set policy-options policy-statement g539-v6 term g539-4001 from route-filter
  FF05:0101:0200::/39 orlonger
set policy-options policy-statement g539-v6 term g539-4001 then map-to-interface
  ge-2/3/9.4001
set policy-options policy-statement g539-v6 term g539-4001 then accept
set policy-options policy-statement g539-v6 term self from route-filter
  FF05:0101:0700::/40 orlonger
set policy-options policy-statement g539-v6 term self then map-to-interface self
set policy-options policy-statement g539-v6 term self then accept
set policy-options policy-statement g539-v6-all term g539 from route-filter 0::/0 orlonger
set policy-options policy-statement g539-v6-all term g539 then map-to-interface
  ge-2/3/9.4000
set policy-options policy-statement g539-v6-all term g539 then accept
set protocols mld interface fxp0.0 disable
set protocols mld interface ge-2/3/9.4000 passive
set protocols mld interface ge-2/3/9.4001 passive
set protocols mld interface ge-2/3/9.1 version 1
set protocols mld interface ge-2/3/9.1 oif-map g539-v6
set protocols mld interface ge-2/3/9.2 version 2
set protocols mld interface ge-2/3/9.2 oif-map g539-v6
set protocols pim rp local address 20.0.0.4
set protocols pim rp local family inet6 address C000::1
set protocols pim interface ge-2/3/8.0 mode sparse
set protocols pim interface ge-2/3/8.0 version 2
set routing-options multicast interface ge-2/3/9.1 no-qos-adjust
set routing-options multicast interface ge-2/3/9.2 no-qos-adjust

```

Step-by-Step Procedure The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see the *CLI User Guide*.

To configure reverse OIF mapping:

1. Configure a logical interface for unicast data traffic.

- ```
[edit interfaces ge-2/3/8]
user@host# set unit 0 family inet6 address C300:0101::/24
```
2. Configure logical interfaces for subscriber VLANs.
 

```
[edit interfaces ge-2/3/9]
user@host# set vlan-tagging
user@host# set unit 1 vlan-id 1
user@host# set unit 1 family inet6 address C400:0101::/24
user@host# set unit 2 vlan-id 2
user@host# set unit 2 family inet6 address C400:0201::/24 lo0 unit 0 family inet6
address C000::1/128
user@host# set unit 2 family inet6 address C400:0201::/24
```
  3. Configure two map-to logical interfaces.
 

```
[edit interfaces ge-2/2/0]
user@host# set unit 4000 vlan-id 4000
user@host# set unit 4000 family inet6 address C40F:A001::/24
user@host# set unit 4001 vlan-id 4001
user@host# set unit 4001 family inet6 address C40F:A101::/24
```
  4. Configure the OIF map.
 

```
[edit policy-options policy-statement g539-v6]
user@host# set term g539-4000 from route-filter FF05:0101:0000::/39 orlonger
user@host# set then map-to-interface ge-2/3/9.4000
user@host# set then accept
user@host# set term g539-4001 from route-filter FF05:0101:0200::/39 orlonger
user@host# set then map-to-interface ge-2/3/9.4001
user@host# set then accept
user@host# set term self from route-filter FF05:0101:0700::/40 orlonger
user@host# set then map-to-interface self
user@host# set then accept

[edit policy-options policy-statement g539-v6-all]
user@host# set term g539 from route-filter 0::/0 orlonger
user@host# set then map-to-interface ge-2/3/9.4000
user@host# set then accept
```
  5. Disable QoS adjustment on the subscriber VLANs.
 

```
[edit routing-options multicast]
user@host# set interface ge-2/3/9.1 no-qos-adjust
user@host# set interface ge-2/3/9.2 no-qos-adjust
```
  6. Configure PIM and MLD. Point the MLD subscriber VLANs to the OIF map.
 

```
[edit protocols]
user@host# set pim rp local address 20.0.0.4
user@host# set pim rp local family inet6 address C000::1 #C000::1 is the address
of lo0
user@host# set pim interface ge-2/3/8.0 mode sparse
user@host# set pim interface ge-2/3/8.0 version 2
user@host# set mld interface fxp0.0 disable
user@host# set interface ge-2/3/9.4000 passive
user@host# set interface ge-2/3/9.4001 passive
user@host# set interface ge-2/3/9.1 version 1
user@host# set interface ge-2/3/9.1 oif-map g539-v6
```

```

user@host# set interface ge-2/3/9.2 version 2
user@host# set interface ge-2/3/9.2 oif-map g539-v6

```

**Results** From configuration mode, confirm your configuration by entering the **show interfaces**, **show policy-options**, **show protocols**, and **show routing-options** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```

user@host# show interfaces
ge-2/3/8 {
 unit 0 {
 family inet6 {
 address C300:0101::/24;
 }
 }
}
ge-2/3/9 {
 vlan-tagging;
 unit 1 {
 vlan-id 1;
 family inet6 {
 address C400:0101::/24;
 }
 }
 unit 2 {
 vlan-id 2;
 family inet6 {
 address C400:0201::/24;
 }
 }
 unit 4000 {
 vlan-id 4000;
 family inet6 {
 address C40F:A001::/24;
 }
 }
 unit 4001 {
 vlan-id 4001;
 family inet6 {
 address C40F:A101::/24;
 }
 }
}

user@host# show policy-options
policy-statement g539-v6 {
 term g539-4000 {
 from {
 route-filter FF05:0101:0000::/39 orlonger;
 }
 then {
 map-to-interface ge-2/3/9.4000;
 accept;
 }
 }
}

```

```
term g539-4001 {
 from {
 route-filter FF05:0101:0200::/39 orlonger;
 }
 then {
 map-to-interface ge-2/3/9.4001;
 accept;
 }
}
term self {
 from {
 route-filter FF05:0101:0700::/40 orlonger;
 }
 then {
 map-to-interface self;
 accept;
 }
}
}
policy-statement g539-v6-all {
 term g539 {
 from {
 route-filter 0::/0 orlonger;
 }
 then {
 map-to-interface ge-2/3/9.4000;
 accept;
 }
 }
}

user@host# show protocols
mld {
 interface fxp0.0 {
 disable;
 }
 interface ge-2/3/9.4000 {
 passive;
 }
 interface ge-2/3/9.4001 {
 passive;
 }
 interface ge-2/3/9.1 {
 version 1;
 oif-map g539-v6;
 }
 interface ge-2/3/9.2 {
 version 2;
 oif-map g539-v6;
 }
}
pim {
 rp {
 local {
 address 20.0.0.4;
 family inet6 {
```

```
 address C000::1;
 }
}
interface ge-2/3/8.0 {
 mode sparse;
 version 2;
}
}

user@host# show routing-options
multicast {
 interface ge-2/3/9.1 no-qos-adjust;
 interface ge-2/3/9.2 no-qos-adjust;
}
```

If you are done configuring the device, enter **commit** from configuration mode.

---

### Verification

To verify the configuration, run the following commands:

- `show igmp statistics`
- `show class-of-service interface`
- `show interfaces statistics`
- `show mld statistics`
- `show multicast interface`
- `show policy`

## Configuring Multicast Routing Over IP Demux Interfaces

In a subscriber management network, fields in packets sent from IP demux interfaces are intended to correspond to a specific client that resides on the other side of an aggregation device (for example, a Multiservice Access Node [MSAN]). However, packets sent from a Broadband Services Router (BSR) to an MSAN do not identify the demux interface. Once it obtains a packet, it is up to the MSAN device to determine which client receives the packet.

Depending on the intelligence of the MSAN device, determining which client receives the packet can occur in an inefficient manner. For example, when it receives IGMP control traffic, an MSAN might forward the control traffic to all clients instead of the one intended client. In addition, once a data stream destination is established, though an MSAN can use IGMP snooping to determine which hosts reside in a particular group and limit data streams to only that group, the MSAN still must send multiple copies of the data stream to each group member, even if that data stream is intended for only one client in the group.

Various multicast features, when combined, enable you to avoid the inefficiencies mentioned above. These features include the following:

- The ability to configure the IP demux interface **family** statement to use **inet** for either the numbered or unnumbered primary interface. See *Configuring Dynamic Subscriber Interfaces Using IP Demux Interfaces in Dynamic Profiles* for details.
- The ability to configure IGMP on the primary interface to send general queries for all clients. The demux configuration prevents the primary IGMP interface from receiving any client IGMP control packets. Instead, all IGMP control packets go to the demux interfaces. However, to guarantee that no joins occur on the primary interface:
  - For static IGMP interfaces—Include the **passive send-general-query** statement in the IGMP configuration at the **[edit protocols igmp interface interface-name]** hierarchy level.
  - For dynamic IGMP demux interfaces—Include the **passive send-general-query** statement at the **[edit dynamic-profiles profile-name protocols igmp interface interface-name]** hierarchy level.
- The ability to map all multicast groups to the primary interface as follows:
  - For static IGMP interfaces—Include the **oif-map** statement at the **[edit protocols igmp interface interface-name]** hierarchy level.
  - For dynamic IGMP demux interfaces—Include the **oif-map** statement at the **[edit dynamic-profiles profile-name protocols igmp interface interface-name]** hierarchy level.



Using the **oif-map** statement, you can map the same IGMP group to the same output interface and send only one copy of the multicast stream from the interface.

- The ability to configure IGMP on each demux interface. To prevent duplicate general queries:
  - For static IGMP interfaces—Include the **passive allow-receive send-group-query** statement at the **[edit protocols igmp interface *interface-name*]** hierarchy level.
  - For dynamic demux interfaces—Include the **passive allow-receive send-group-query** statement at the **[edit dynamic-profiles *profile-name* protocols igmp interface *interface-name*]** hierarchy level.



**NOTE:** To send only one copy of each group, regardless of how many customers join, use the **oif-map** statement as previously mentioned.

## Classifying Packets by Egress Interface

For Juniper Networks M320 Multiservice Edge Routers and T Series Core Routers with the Intelligent Queuing (IQ), IQ2, Enhanced IQ (IQE), Multiservices link services intelligent queuing (LSQ) interfaces, or ATM2 PICs, you can classify unicast and multicast packets based on the egress interface. For unicast traffic, you can also use a multifield filter, but only egress interface classification applies to multicast traffic as well as unicast traffic. If you configure egress classification of an interface, you cannot perform Differentiated Services code point (DSCP) rewrites on the interface. By default, the system will not perform any classification based on the egress interface.

To enable packet classification by the egress interface, you first configure a forwarding class map and one or more queue numbers for the egress interface at the **[edit class-of-service forwarding-classes-interface-specific *forwarding-class-map-name*]** hierarchy level:

```
[edit class-of-service]
forwarding-classes-interface-specific forwarding-class-map-name {
 class class-name queue-num queue-number [restricted-queue queue-number];
}
```

For T Series routers that are restricted to only four queues, you can control the queue assignment with the **restricted-queue** option, or you can allow the system to automatically determine the queue in a modular fashion. For example, a map assigning packets to queue 6 would map to queue 2 on a four-queue system.



**NOTE:** If you configure an output forwarding class map associating a forwarding class with a queue number, this map is not supported on multiservices link services intelligent queuing (lsq-) interfaces.

Once the forwarding class map has been configured, you apply the map to the logical interface by using the **output-forwarding-class-map** statement at the **[edit class-of-service interfaces *interface-name* unit *logical-unit-number* ]** hierarchy level:

```
[edit class-of-service interfaces interface-name unit logical-unit-number]
output-forwarding-class-map forwarding-class-map-name;
```

All parameters relating to the queues and forwarding class must be configured as well. For more information about configuring forwarding classes and queues, see *Configuring Forwarding Classes*.

This example shows how to configure an interface-specific forwarding-class map named **FCMAP1** that restricts queues 5 and 6 to different queues on four-queue systems and then applies **FCMAP1** to **unit 0** of interface **ge-6/0/0**:

```
[edit class-of-service]
forwarding-classes-interface-specific FCMAP1 {
 class FC1 queue-num 6 restricted-queue 3;
 class FC2 queue-num 5 restricted-queue 2;
 class FC3 queue-num 3;
 class FC4 queue-num 0;
 class FC3 queue-num 0;
 class FC4 queue-num 1;
}

[edit class-of-service]
interfaces {
 ge-6/0/0 unit 0 {
 output-forwarding-class-map FCMAP1;
 }
}
```

Note that without the **restricted-queue** option in **FCMAP1**, the example would assign **FC1** and **FC2** to queues 2 and 1, respectively, on a system restricted to four queues.

Use the **show class-of-service forwarding-class *forwarding-class-map-name*** command to display the forwarding-class map queue configuration:

```
user@host> show class-of-service forwarding-class FCMAP2
```

| Forwarding class | ID | Queue | Restricted queue |
|------------------|----|-------|------------------|
| FC1              | 0  | 6     | 3                |
| FC2              | 1  | 5     | 2                |
| FC3              | 2  | 3     | 3                |
| FC4              | 3  | 0     | 0                |
| FC5              | 4  | 0     | 0                |
| FC6              | 5  | 1     | 1                |
| FC7              | 6  | 6     | 2                |
| FC8              | 7  | 7     | 3                |

Use the **show class-of-service interface *interface-name*** command to display the forwarding-class maps (and other information) assigned to a logical interface:

```
user@host> show class-of-service interface ge-6/0/0
```

```
Physical interface: ge-6/0/0, Index: 128
Queues supported: 8, Queues in use: 8
```

```
Scheduler map: <default>, Index: 2
Input scheduler map: <default>, Index: 3
Chassis scheduler map: <default-chassis>, Index: 4
```

```
Logical interface: ge-6/0/0.0, Index: 67
```

| Object               | Name     | Type      | Index |
|----------------------|----------|-----------|-------|
| Scheduler-map        | sch-map1 | Output    | 6998  |
| Scheduler-map        | sch-map1 | Input     | 6998  |
| Classifier           | dot1p    | ieee8021p | 4906  |
| forwarding-class-map | FCMAP1   | Output    | 1221  |

```
Logical interface: ge-6/0/0.1, Index 68
```

| Object        | Name      | Type   | Index |
|---------------|-----------|--------|-------|
| Scheduler-map | <default> | Output | 2     |
| Scheduler-map | <default> | Input  | 3     |

```
Logical interface: ge-6/0/0.32767, Index 69
```

| Object        | Name      | Type   | Index |
|---------------|-----------|--------|-------|
| Scheduler-map | <default> | Output | 2     |
| Scheduler-map | <default> | Input  | 3     |

#### Related Documentation

- [Examples: Configuring Administrative Scoping](#)
- [Examples: Configuring the Multicast Forwarding Cache on page 203](#)

## Examples: Configuring the Multicast Forwarding Cache

- [Understanding the Multicast Forwarding Cache on page 203](#)
- [Example: Configuring the Multicast Forwarding Cache on page 203](#)
- [Example: Configuring a Multicast Flow Map on page 206](#)

### Understanding the Multicast Forwarding Cache

IP multicast protocols can create numerous entries in the multicast forwarding cache. If the forwarding cache fills up with entries that prevent the addition of higher-priority entries, applications and protocols might not function properly. You can manage the multicast forwarding cache properties by limiting the size of the cache and by controlling the length of time that entries remain in the cache. By managing timeout values, you can give preference to more important forwarding cache entries while removing other less important entries.

### Example: Configuring the Multicast Forwarding Cache

When a routing device receives multicast traffic, it places the (S,G) route information in the multicast forwarding cache, **inet.1**. This example shows how to configure multicast forwarding cache limits to prevent the cache from filling up with entries.

- [Requirements on page 204](#)
- [Overview on page 204](#)
- [Configuration on page 204](#)
- [Verification on page 205](#)

## Requirements

---

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure a multicast protocol. This feature works with the following multicast protocols:
  - DVMRP
  - PIM-DM
  - PIM-SM
  - PIM-SSM

## Overview

---

This example includes the following statements:

- **forwarding-cache**—Specifies how forwarding entries are aged out and how the number of entries is controlled.
- **timeout**—Specifies an idle period after which entries are aged out and removed from **inet.1**. You can specify a timeout in the range from 1 through 720 minutes.
- **threshold**—Enables you to specify threshold values on the forwarding cache to suppress (suspend) entries from being added when the cache entries reach a certain maximum and begin adding entries to the cache when the number falls to another threshold value. By default, no threshold values are enabled on the routing device.

The suppress threshold suspends the addition of new multicast forwarding cache entries. If you do not specify a suppress value, multicast forwarding cache entries are created as necessary. If you specify a suppress threshold, you can optionally specify a reuse threshold, which sets the point at which the device resumes adding new multicast forwarding cache entries. During suspension, forwarding cache entries time out. After a certain number of entries time out, the reuse threshold is reached, and new entries are added. The range for both thresholds is from 1 through 200,000. If configured, the reuse value must be less than the suppression value. If you do not specify a reuse value, the number of multicast forwarding cache entries is limited to the suppression value. A new entry is created as soon as the number of multicast forwarding cache entries falls below the suppression value.

## Configuration

---

### CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```

set routing-options multicast forwarding-cache threshold suppress 150000
set routing-options multicast forwarding-cache threshold reuse 34
set routing-options multicast forwarding-cache timeout 60

```

**Step-by-Step Procedure** The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure the multicast forwarding cache:

1. Configure the maximum size of the forwarding cache.

```

[edit routing-options multicast forwarding-cache]
user@host# set threshold suppress 150000

```

2. Configure the amount of time (in minutes) entries can remain idle before being removed.

```

[edit routing-options multicast forwarding-cache]
user@host# set timeout 60

```

3. Configure the size of the forwarding cache when suppression stops and new entries can be added.

```

[edit routing-options multicast forwarding-cache]
user@host# set threshold reuse 70000

```

### Results

Confirm your configuration by entering the **show routing-options** command.

```

user@host# show routing-options
multicast {
 forwarding-cache {
 threshold {
 suppress 150000;
 reuse 70000;
 }
 timeout 60;
 }
}

```

### Verification

To verify the configuration, run the **show multicast route extensive** command.

```

user@host> show multicast route extensive
Family: INET
Group: 232.0.0.1
Source: 11.11.11.11/32
Upstream interface: fe-0/2/0.200
Downstream interface list:
 fe-0/2/1.210
Downstream interface list rejected by CAC:
 fe-0/2/1.220
Session description: Source specific multicast
Statistics: 0 kbps, 0 pps, 0 packets
Next-hop ID: 337

```

```
Upstream protocol: PIM
Route state: Active
Forwarding state: Forwarding
Cache lifetime/timeout: 60 minutes
Wrong incoming interface notifications: 0
```

## Example: Configuring a Multicast Flow Map

This example shows how to configure a flow map to prevent certain forwarding cache entries from aging out, thus allowing for faster failover from one source to another. Flow maps enable you to configure bandwidth variables and multicast forwarding cache timeout values for entries defined by the flow map policy.

- [Requirements on page 206](#)
- [Overview on page 206](#)
- [Configuration on page 208](#)
- [Verification on page 209](#)

### Requirements

---

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure a multicast protocol. This feature works with the following multicast protocols:
  - DVMRP
  - PIM-DM
  - PIM-SM
  - PIM-SSM

### Overview

---

Flow maps are typically used for fast multicast source failover when there are multiple sources for the same group. For example, when one video source is actively sending the traffic, the forwarding states for other video sources are timed out after a few minutes. Later, when a new source starts sending the traffic again, it takes time to install a new forwarding state for the new source if the forwarding state is not already there. This switchover delay is worsened when there are many video streams. Using flow maps with longer timeout values or permanent cache entries helps reduce this switchover delay.



**NOTE:** The permanent forwarding state must exist on all routing devices in the path for fast source switchover to function properly.

---

This example includes the following statements:

- **bandwidth**—Specifies the bandwidth for each flow that is defined by a flow map to ensure that an interface is not oversubscribed for multicast traffic. If adding one more flow would cause overall bandwidth to exceed the allowed bandwidth for the interface, the request is rejected. A rejected request means that traffic might not be delivered out of some or all of the expected outgoing interfaces. You can define the bandwidth associated with multicast flows that match a flow map by specifying a bandwidth in bits per second or by specifying that the bandwidth is measured and adaptively modified.

When you use the **adaptive** option, the bandwidth adjusts based on measurements made at 5-second intervals. The flow uses the maximum bandwidth value from the last 12 measured values (1 minute).

When you configure a bandwidth value with the **adaptive** option, the bandwidth value acts as the starting bandwidth for the flow. The bandwidth then changes based on subsequent measured bandwidth values. If you do not specify a bandwidth value with the **adaptive** option, the starting bandwidth defaults to 2 megabits per second (Mbps).

For example, the **bandwidth 2m adaptive** statement is equivalent to the **bandwidth adaptive** statement because they both use the same starting bandwidth (2 Mbps, the default). If the actual flow bandwidth is 4 Mbps, the measured flow bandwidth changes to 4 Mbps after reaching the first measuring point (5 seconds). However, if the actual flow bandwidth rate is 1 Mbps, the measured flow bandwidth remains at 2 Mbps for the first 12 measurement cycles (1 minute) and then changes to the measured 1 Mbps value.

- **flow-map**—Defines a flow map that controls the forwarding cache timeout of specified source and group addresses, controls the bandwidth for each flow, and specifies redundant sources. If a flow can match multiple flow maps, the first flow map applies.
- **forwarding-cache**—Enables you to configure the forwarding cache properties of entries defined by a flow map. You can specify a timeout of **never** to make the forwarding entries permanent, or you can specify a timeout in the range from 1 through 720 minutes. If you set the value to **never**, you can specify the **non-discard-entry-only** option to make an exception for entries that are in the pruned state. In other words, the **never non-discard-entry-only** statement allows entries in the pruned state to time out, while entries in the forwarding state never time out.
- **policy**—Specifies source and group addresses to which the flow map applies. This example creates a flow map policy called **policyForFlow1**. The policy matches the source address using the **source-address-filter** statement and matches the group address using the **prefix-list-filter** statement.



**NOTE:** The addresses must match the configured policy for flow mapping to occur.

- **redundant-sources**—Specify redundant (backup) sources for flows identified by a flow map.

Outbound interfaces that are admitted for one of the forwarding entries are automatically admitted for any other entries identified by the redundant source configuration.

In this example, forwarding entries (10.11.11.11, g1) and (10.11.11.12, g1) match the flow map **flowMap1**. In this case, if a particular outbound interface is admitted for entry (10.11.11.11, g1), it is automatically admitted for entry (10.11.11.12, g1), even if there is no longer enough remaining bandwidth available after creating entry (10.11.11.11, g1). The interface is added because only one of the two sources can send traffic at any time.

### Configuration

#### CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set policy-options prefix-list permanentEntries1 232.1.1.0/24
set policy-options policy-statement policyForFlow1 from source-address-filter 11.11.11.11/32
 exact
set policy-options policy-statement policyForFlow1 from prefix-list-filter
 permanentEntries1 orlonger
set policy-options policy-statement policyForFlow1 then accept
set routing-options multicast flow-map flowMap1 policy policyForFlow1
set routing-options multicast flow-map flowMap1 bandwidth 2m
set routing-options multicast flow-map flowMap1 bandwidth adaptive
set routing-options multicast flow-map flowMap1 redundant-sources 10.11.11.11
set routing-options multicast flow-map flowMap1 redundant-sources 10.11.11.12
set routing-options multicast flow-map flowMap1 forwarding-cache timeout never
 non-discard-entry-only
```

#### Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure a flow map:

1. Configure the flow map policy.

```
[edit policy-options]
user@host# set prefix-list permanentEntries1 232.1.1.0/24
user@host# set policy policyForFlow1 from source-address-filter 11.11.11.11/32 exact
user@host# set policy policyForFlow1 from prefix-list-filter permanentEntries1
 orlonger
user@host# set policy policyForFlow1 then accept
```

2. Apply the flow map policy.

```
[edit routing-options]
user@host# set multicast flow-map flowMap1 policy policyForFlow1
```

3. Configure permanent forwarding entries (that is, entries that never time out), and enable entries in the pruned state to time out.

```
[edit routing-options]
```



```
user@host# set multicast flow-map flowMap1 forwarding-cache timeout never
non-discard-entry-only
```

4. Configure the flow map bandwidth to be adaptive with a default starting bandwidth of 2 Mbps.

```
[edit routing-options]
user@host# set multicast flow-map flowMap1 bandwidth 2m adaptive
```

5. Specify backup sources.

```
[edit routing-options]
user@host# set multicast flow-map flowMap1 redundant-sources [10.11.11.11 10.11.11.12
]
```

6. If you are done configuring the device, commit the configuration.

```
user@host# commit
```

### Results

Confirm your configuration by entering the **show policy-options** and **show routing-options** commands.

```
user@host# show policy-options
prefix-list permanentEntries1 {
 232.1.1.0/24;
}
policy-statement policyForFlow1 {
 from {
 source-address-filter 11.11.11.11/32 exact;
 prefix-list-filter permanentEntries1 orlonger;
 }
 then accept;
}

user@host# show routing-options
multicast {
 flow-map flowMap1 {
 policy policyForFlow1;
 bandwidth 2m adaptive;
 redundant-sources [10.11.11.11 10.11.11.12];
 forwarding-cache {
 timeout never non-discard-entry-only;
 }
 }
}
```

### Verification

To verify the configuration, run the following commands:

- **show multicast flow-map**
- **show multicast route extensive**

- Related Documentation**
- [Examples: Configuring Administrative Scoping](#)
  - [Examples: Configuring Bandwidth Management on page 182](#)

---

## Example: Configuring Ingress PE Redundancy

- [Understanding Ingress PE Redundancy on page 210](#)
- [Example: Configuring Ingress PE Redundancy on page 210](#)

### Understanding Ingress PE Redundancy

In many network topologies, point-to-multipoint label-switched paths (LSPs) are used to distribute multicast traffic over a virtual private network (VPN). When traffic engineering is added to the provider edge (PE) routers, a popular deployment option has been to use traffic-engineered point-to-multipoint LSPs at the origin PE. In these network deployments, the PE is a single point of failure. Network operators have previously provided redundancy by broadcasting duplicate streams of multicast traffic from multiple PEs, a practice which at least doubles the bandwidth required for each stream.

Ingress PE redundancy eliminates the bandwidth duplication requirement by configuring one or more ingress PEs as a group. Within a group, one PE is designated as the primary PE and one or more others become backup PEs for the configured traffic stream. The solution depends on a full mesh of point-to-point (P2P) LSPs among the primary and backup PEs. Also, you must configure a full set of point-to-multipoint LSPs at the backup PEs, even though these point-to-multipoint LSPs at the backup PEs are not sending any traffic or using any bandwidth. The P2P LSPs are configured with bidirectional forwarding detection (BFD). When BFD detects a failure on the primary PE, a new designated forwarder is elected for the stream.

### Example: Configuring Ingress PE Redundancy

This example shows how to configure one PE as part of a backup PE group to enable ingress PE redundancy for multicast traffic streams.

- [Requirements on page 210](#)
- [Overview on page 211](#)
- [Configuration on page 212](#)
- [Verification on page 215](#)

---

#### Requirements

Before you begin:

- Configure the router interfaces.
- Configure a full mesh of P2P LSPs between the PEs in the backup group.

---

## Overview

---

Ingress PE redundancy provides a backup resource when point-to-multipoint LSPs are configured for multicast distribution. When point-to-multipoint LSPs are used for multicast traffic, the PE device can become a single point of failure. One way to provide redundancy is by broadcasting duplicate streams from multiple PEs, thus doubling the bandwidth requirements for each stream. This feature implements redundancy between two or more PEs by designating a primary and one or more backup PEs for each configured stream. The solution depends on the configuration of a full mesh of P2P LSPs between the primary and backup PEs. These LSPs are configured with Bidirectional Forwarding Detection (BFD) running on top of them. BFD is used on the backup PEs to detect failure on the primary PE routing device and to elect a new designated forwarder for the stream.

A full mesh is required so that each member of the group can make an independent decision about the health of the other PEs and determine the designated forwarder for the group. The key concept in a backup PE group is that of a designated PE. A designated PE is a PE that forwards data on the static route. All other PEs in the backup PE group do not forward any data on the static route. This allows you to have one designated forwarder. If the designated forwarder fails, another PE takes over as the designated forwarder, thus allowing the traffic flow to continue uninterrupted.

Each PE in the backup PE group makes its own local decision regarding the designated forwarder. Thus, there is no inter-PE communication regarding designated forwarder. A PE computes the designated forwarder based on the IP address of all PEs and the connectivity status of other PEs. Connectivity status is determined based on the state of the BFD session on the P2P LSP to a PE.

A PE chosen is as the designated forwarder if it satisfies the following conditions:

- The PE is in the UP state. Either it is the local PE, or the BFD session on the P2P LSP to that PE is in the UP state.
- The PE has the lowest IP address among all PEs that are in the UP state.

Because all PEs have P2P LSPs to each other, each PE can determine the UP state of each other PE, and all PEs converge to the same designated forwarder.

If the designated forwarder PE fails, then all other PEs lose connectivity with the designated forwarder, and their BFD session ends. Consequently, other PEs then choose another designated forwarder. The new forwarder starts forwarding traffic. Thus, the traffic loss is limited to the failure detection time, which is the BFD session detection time.

When a PE that was the designated forwarder fails and then resumes operating, all other PEs recognize this fact, rerun the designated forwarder algorithm, and choose the PE as the designated forwarder. Consequently, the backup designated forwarder stops forwarding traffic. Thus, traffic switches back to the most eligible designated forwarder.

This example includes the following statements:

- **associate-backup-pe-groups**—Monitors the health of the routing device at the other end of the LSP. You can configure multiple backup PE groups that contain the same routing device's address. Failure of this LSP indicates to all of these groups that the destination PE routing device is down. So, the **associate-backup-pe-groups** statement is not tied to any specific group but applies to all groups that are monitoring the health of the LSP to the remote address.

If there are multiple LSPs with the **associate-backup-pe-groups** statement to the same destination PE, then the local routing device picks the first LSP to that PE for detection purposes.

We do not recommend configuring multiple LSPs to the same destination. If you do, make sure that the LSP parameters (for example, liveness detection) are similar to avoid false failure notification even when the remote PE is up.

- **backup-pe-group**—Configures ingress PE redundancy for multicast traffic streams.
- **bfd-liveness-detection**—Enables BFD for each LSP.
- **label-switched-path**—Configures an LSP. You must configure a full mesh of P2P LSPs between the primary and backup PEs.



**NOTE:** We recommend that you configure the P2P LSPs with fast reroute and node link protection so that link failures do not result in the LSP failure. For the purpose of PE redundancy, a failure in the P2P LSP is treated as a PE failure. Redundancy in the inter-PE path is also encouraged.

- **p2mp-lsp-next-hop**—Enables you to associate a backup PE group with a static route.
- **static**—Applies the backup group to a static route on the PE. This ensures that the static route is active (installed in the forwarding table) when the local PE is the designated forwarder for the configured backup PE group.

### Configuration

#### CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set policy-options policy-statement no-rpf from route-filter 225.1.1.1/32 exact
set policy-options policy-statement no-rpf then reject
set protocols mpls label-switched-path backup_PE1 to 10.255.16.61
set protocols mpls label-switched-path backup_PE1 oam bfd-liveness-detection
 minimum-interval 500
set protocols mpls label-switched-path backup_PE1 oam bfd-liveness-detection multiplier
 3
set protocols mpls label-switched-path backup_PE1 associate-backup-pe-groups
set protocols mpls label-switched-path dest1 to 10.255.16.57
set protocols mpls label-switched-path dest1 p2mp p2mp-lsp
set protocols mpls label-switched-path dest2 to 10.255.16.55
set protocols mpls label-switched-path dest2 p2mp p2mp-lsp
set protocols mpls interface all
```

```

set protocols mpls interface fxp0.0 disable
set routing-options static route 1.1.1.1/32 p2mp-lsp-next-hop p2mp-lsp
set routing-options static route 1.1.1.1/32 backup-pe-group g1
set routing-options static route 225.1.1.1/32 p2mp-lsp-next-hop p2mp-lsp
set routing-options static route 225.1.1.1/32 backup-pe-group g1
set routing-options multicast rpf-check-policy no-rpf
set routing-options multicast interface fe-1/3/3.0 enable
set routing-options multicast backup-pe-group g1 backups 10.255.16.61
set routing-options multicast backup-pe-group g1 local-address 10.255.16.59

```

**Step-by-Step Procedure** The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure ingress PE redundancy:

1. Configure the multicast settings.

```

[edit routing-options multicast]
user@host# set rpf-check-policy no-rpf
user@host# set interface fe-1/3/3.0 enable

```

2. Configure the RPF policy.

```

[edit policy-options policy-statement no-rpf]
user@host# set from route-filter 225.1.1.1/32 exact
user@host# set then reject

```

3. Configure the backup PE group.

```

[edit routing-options multicast]
user@host# set backup-pe-group g1 backups 10.255.16.61
user@host# set backup-pe-group g1 local-address 10.255.16.59

```

4. Configure the static routes for the point-to-multipoint LSPs backup PE group.

```

[edit routing-options static]
user@host# set route 1.1.1.1/32 p2mp-lsp-next-hop p2mp-lsp
user@host# set route 1.1.1.1/32 backup-pe-group g1
user@host# set route 225.1.1.1/32 p2mp-lsp-next-hop p2mp-lsp
user@host# set route 225.1.1.1/32 backup-pe-group g1

```

5. Configure the MPLS interfaces.

```

[edit protocols mpls]
user@host# set interface all
user@host# set interface fxp0.0 disable

```

6. Configure the LSP to the redundant router.

```

[edit protocols mpls]
user@host# set label-switched-path backup_PE1 to 10.255.16.61
user@host# set label-switched-path backup_PE1 oam bfd-liveness-detection
minimum-interval 500
user@host# set label-switched-path backup_PE1 oam bfd-liveness-detection
multiplier 3
user@host# set label-switched-path backup_PE1 associate-backup-pe-groups

```

7. Configure LSPs to two traffic destinations.

```
[edit protocols mpls]
user@host# set label-switched-path dest1 to 10.255.16.57
user@host# set label-switched-path dest1 p2mp p2mp-lsp
user@host# set label-switched-path dest2 to 10.255.16.55
user@host# set label-switched-path dest2 p2mp p2mp-lsp
```

8. If you are done configuring the device, commit the configuration.

```
user@host# commit
```

### **Results**

Confirm your configuration by entering the **show policy**, **show protocols**, and **show routing-options** commands.

```
user@host# show policy
policy-statement no-rpf {
 from {
 route-filter 225.1.1.1/32 exact;
 }
 then reject;
}

user@host# show protocols
mpls {
 label-switched-path backup_PE1 {
 to 10.255.16.61;
 oam {
 bfd-liveness-detection {
 minimum-interval 500;
 multiplier 3;
 }
 }
 }
 associate-backup-pe-groups;
}
label-switched-path dest1 {
 to 10.255.16.57;
 p2mp p2mp-lsp;
}
label-switched-path dest2 {
 to 10.255.16.55;
 p2mp p2mp-lsp;
}
interface all;
interface fxp0.0 {
 disable;
}
}

user@host# show routing-options
static {
 route 1.1.1.1/32 {
 p2mp-lsp-next-hop p2mp-lsp;
 backup-pe-group g1;
 }
}
```

```

route 225.1.1.1/32 {
 p2mp-lsp-next-hop p2mp-lsp;
 backup-pe-group g1;
}
}
multicast {
 rpf-check-policy no-rpf;
 interface fe-1/3/3.0 enable;
 backup-pe-group g1 {
 backups 10.255.16.61;
 local-address 10.255.16.59;
 }
}

```

### Verification

To verify the configuration, run the following commands:

- `show mpls lsp`
- `show multicast backup-pe-groups`
- `show multicast rpf`

### Related Documentation

- *Examples: Configuring Administrative Scoping*
- *Examples: Configuring Bandwidth Management on page 182*
- *Examples: Configuring the Multicast Forwarding Cache on page 203*

## Configuring PIM-to-IGMP and PIM-to-MLD Message Translation

- *Understanding PIM-to-IGMP and PIM-to-MLD Message Translation on page 215*
- *Configuring PIM-to-IGMP Message Translation on page 217*
- *Configuring PIM-to-MLD Message Translation on page 218*

### Understanding PIM-to-IGMP and PIM-to-MLD Message Translation

Routing devices can translate Protocol Independent Multicast (PIM) join and prune messages into corresponding Internet Group Management Protocol (IGMP) or Multicast Listener Discovery (MLD) report or leave messages. You can use this feature to forward multicast traffic across PIM domains in certain network topologies.

In some network configurations, customers are unable to run PIM between the customer edge-facing PIM domain and the core-facing PIM domain, even though PIM is running in sparse mode within each of these domains. Because PIM is not running between the domains, customers with this configuration cannot use PIM to forward multicast traffic across the domains. Instead, they might want to use IGMP to forward IPv4 multicast traffic, or MLD to forward IPv6 multicast traffic across the domains.

To enable the use of IGMP or MLD to forward multicast traffic across the PIM domains in such topologies, you can configure the rendezvous point (RP) router that resides

between the edge domain and core domain to translate PIM join or prune messages received from PIM neighbors on downstream interfaces into corresponding IGMP or MLD report or leave messages. The router then transmits the report or leave messages by proxying them to one or two upstream interfaces that you configure on the RP router. As a result, this feature is sometimes referred to as *PIM-to-IGMP proxy* or *PIM-to-MLD proxy*.

To configure the RP router to translate PIM join or prune messages into IGMP report or leave messages, include the **pim-to-igmp-proxy** statement at the **[edit routing-options multicast]** hierarchy level. Similarly, to configure the RP router to translate PIM join or prune messages into MLD report or leave messages, include the **pim-to-mld-proxy** statement at the **[edit routing-options multicast]** hierarchy level. As part of the configuration, you must specify the full name of at least one, but not more than two, upstream interfaces on which to enable the PIM-to-IGMP proxy or PIM-to-MLD proxy feature.

The following guidelines apply when you configure PIM-to-IGMP or PIM-to-MLD message translation:

- Make sure that the router connecting the PIM edge domain and the PIM core domain is the static or elected RP router.
- Make sure that the RP router is using the PIM sparse mode (PIM-SM) multicast routing protocol.
- When you configure an upstream interface, use the full logical interface specification (for example, **ge-0/0/1.0**) and not just the physical interface specification (**ge-0/0/1**).
- When you configure two upstream interfaces, the RP router transmits the same IGMP or MLD report messages and multicast traffic on both upstream interfaces. As a result, make sure that reverse-path forwarding (RPF) is running in the PIM-SM core domain to verify that multicast packets are received on the correct incoming interface and to avoid sending duplicate packets.
- The router transmits IGMP or MLD report messages on one or both upstream interfaces only for the first PIM join message that it receives among all of the downstream interfaces. Similarly, the router transmits IGMP or MLD leave messages on one or both upstream interfaces only if it receives a PIM prune message for the last downstream interface.
- Upstream interfaces support both local sources and remote sources.
- Multicast traffic received from an upstream interface is accepted as if it came from a host.



## Configuring PIM-to-IGMP Message Translation

You can configure the rendezvous point (RP) routing device to translate PIM join or prune messages into corresponding IGMP report or leave messages. To do so, include the **pim-to-igmp-proxy** statement at the **[edit routing-options multicast]** hierarchy level:

```
[edit routing-options multicast]
pim-to-igmp-proxy {
 upstream-interface [interface-names];
}
```

Enabling the routing device to perform PIM-to-IGMP message translation, also referred to as *PIM-to-IGMP proxy*, is useful when you want to use IGMP to forward IPv4 multicast traffic between a PIM sparse mode edge domain and a PIM sparse mode core domain in certain network topologies.

Before you begin configuring PIM-to-IGMP message translation:

- Make sure that the routing device connecting the PIM edge domain and that the PIM core domain is the static or elected RP routing device.
- Make sure that the PIM sparse mode (PIM-SM) routing protocol is running on the RP routing device.
- If you plan to configure two upstream interfaces, make sure that reverse-path forwarding (RPF) is running in the PIM-SM core domain. Because the RP router transmits the same IGMP messages and multicast traffic on both upstream interfaces, you need to run RPF to verify that multicast packets are received on the correct incoming interface and to avoid sending duplicate packets.

To configure the RP routing device to translate PIM join or prune messages into corresponding IGMP report or leave messages:

1. Include the **pim-to-igmp-proxy** statement, specifying the names of one or two logical interfaces to function as the upstream interfaces on which the routing device transmits IGMP report or leave messages.

The following example configures PIM-to-IGMP message translation on a single upstream interface, **ge-0/1/0.1**.

```
[edit routing-options multicast]
user@host# set pim-to-igmp-proxy upstream-interface ge-0/1/0.1
```

The following example configures PIM-to-IGMP message translation on two upstream interfaces, **ge-0/1/0.1** and **ge-0/1/0.2**. You must include the logical interface names within square brackets ( [ ] ) when you configure a set of two upstream interfaces.

```
[edit routing-options multicast]
user@host# set pim-to-igmp-proxy upstream-interface [ge-0/1/0.1 ge-0/1/0.2]
```

2. Use the **show multicast pim-to-igmp-proxy** command to display the PIM-to-IGMP proxy state (enabled or disabled) and the name or names of the configured upstream interfaces.

```
user@host# run show multicast pim-to-igmp-proxy
```

```
Proxy state: enabled
ge-0/1/0.1
ge-0/1/0.2
```

## Configuring PIM-to-MLD Message Translation

You can configure the rendezvous point (RP) routing device to translate PIM join or prune messages into corresponding MLD report or leave messages. To do so, include the **pim-to-mld-proxy** statement at the **[edit routing-options multicast]** hierarchy level:

```
[edit routing-options multicast]
pim-to-mld-proxy {
 upstream-interface [interface-names];
}
```

Enabling the routing device to perform PIM-to-MLD message translation, also referred to as *PIM-to-MLD proxy*, is useful when you want to use MLD to forward IPv6 multicast traffic between a PIM sparse mode edge domain and a PIM sparse mode core domain in certain network topologies.

Before you begin configuring PIM-to-MLD message translation:

- Make sure that the routing device connecting the PIM edge domain and that the PIM core domain is the static or elected RP routing device.
- Make sure that the PIM sparse mode (PIM-SM) routing protocol is running on the RP routing device.
- If you plan to configure two upstream interfaces, make sure that reverse-path forwarding (RPF) is running in the PIM-SM core domain. Because the RP routing device transmits the same MLD messages and multicast traffic on both upstream interfaces, you need to run RPF to verify that multicast packets are received on the correct incoming interface and to avoid sending duplicate packets.

To configure the RP routing device to translate PIM join or prune messages into corresponding MLD report or leave messages:

1. Include the **pim-to-mld-proxy** statement, specifying the names of one or two logical interfaces to function as the upstream interfaces on which the router transmits MLD report or leave messages.

The following example configures PIM-to-MLD message translation on a single upstream interface, **ge-0/5/0.1**.

```
[edit routing-options multicast]
user@host# set pim-to-mld-proxy upstream-interface ge-0/5/0.1
```

The following example configures PIM-to-MLD message translation on two upstream interfaces, **ge-0/5/0.1** and **ge-0/5/0.2**. You must include the logical interface names within square brackets ( **[ ]** ) when you configure a set of two upstream interfaces.

```
[edit routing-options multicast]
user@host# set pim-to-mld-proxy upstream-interface [ge-0/5/0.1 ge-0/5/0.2]
```

2. Use the **show multicast pim-to-ml-d-proxy** command to display the PIM-to-MLD proxy state (enabled or disabled) and the name or names of the configured upstream interfaces.

```
user@host# run show multicast pim-to-ml-d-proxy
Proxy state: enabled
ge-0/5/0.1
ge-0/5/0.2
```

- Related Documentation**
- [Configuring IGMP on page 221](#)
  - [Examples: Configuring MLD on page 247](#)



## CHAPTER 5

# Internet Group Management Protocol

- [Configuring IGMP on page 221](#)
- [Example: Configuring SSM Maps for Different Groups to Different Sources on page 241](#)

## Configuring IGMP

---

- [Understanding Group Membership Protocols on page 221](#)
- [Understanding IGMP on page 222](#)
- [Configuring IGMP on page 223](#)
- [Enabling IGMP on page 224](#)
- [Modifying the IGMP Host-Query Message Interval on page 225](#)
- [Modifying the IGMP Query Response Interval on page 226](#)
- [Specifying Immediate-Leave Host Removal for IGMP on page 226](#)
- [Filtering Unwanted IGMP Reports at the IGMP Interface Level on page 227](#)
- [Accepting IGMP Messages from Remote Subnetworks on page 228](#)
- [Modifying the IGMP Last-Member Query Interval on page 228](#)
- [Modifying the IGMP Robustness Variable on page 229](#)
- [Limiting the Maximum IGMP Message Rate on page 230](#)
- [Changing the IGMP Version on page 230](#)
- [Enabling IGMP Static Group Membership on page 231](#)
- [Recording IGMP Join and Leave Events on page 237](#)
- [Limiting the Number of IGMP Multicast Group Joins on Logical Interfaces on page 238](#)
- [Tracing IGMP Protocol Traffic on page 239](#)
- [Disabling IGMP on page 241](#)
- [IGMP and Nonstop Active Routing on page 241](#)

## Understanding Group Membership Protocols

There is a big difference between the multicast protocols used between host and router and between the multicast routers themselves. Hosts on a given subnetwork need to inform their router only whether or not they are interested in receiving packets from a certain multicast group. The source host needs to inform its routers only that it is the

source of traffic for a particular multicast group. In other words, no detailed knowledge of the distribution tree is needed by any hosts; only a group membership protocol is needed to inform routers of their participation in a multicast group. Between adjacent routers, on the other hand, the multicast routing protocols must avoid loops as they build a detailed sense of the network topology and distribution tree from source to leaf. So, different multicast protocols are used for the host-router portion and the router-router portion of the multicast network.

Multicast group membership protocols enable a router to detect when a host on a directly attached subnet, typically a LAN, wants to receive traffic from a certain multicast group. Even if more than one host on the LAN wants to receive traffic for that multicast group, the router sends only one copy of each packet for that multicast group out on that interface, because of the inherent broadcast nature of LANs. When the multicast group membership protocol informs the router that there are no interested hosts on the subnet, the packets are withheld and that leaf is pruned from the distribution tree.

The Internet Group Management Protocol (IGMP) and the Multicast Listener Discovery (MLD) Protocol are the standard IP multicast group membership protocols: IGMP and MLD have several versions that are supported by hosts and routers:

- IGMPv1—The original protocol defined in RFC 1112. An explicit join message is sent to the router, but a timeout is used to determine when hosts leave a group. This process wastes processing cycles on the router, especially on older or smaller routers.
- IGMPv2—Defined in RFC 2236. Among other features, IGMPv2 adds an explicit leave message to the join message so that routers can more easily determine when a group has no interested listeners on a LAN.
- IGMPv3—Defined in RFC 3376. Among other features, IGMPv3 optimizes support for a single source of content for a multicast group, or *source-specific multicast (SSM)*.
- MLDv1—Defined in RFC 2710. MLDv1 is similar to IGMPv2.
- MLDv2—Defined in RFC 3810. MLDv2 is similar to IGMPv3.

The various versions of IGMP and MLD are backward compatible. It is common for a router to run multiple versions of IGMP and MLD on LAN interfaces. Backward compatibility is achieved by dropping back to the most basic of all versions run on a LAN. For example, if one host is running IGMPv1, any router attached to the LAN running IGMPv2 can drop back to IGMPv1 operation, effectively eliminating the IGMPv2 advantages. Running multiple IGMP versions ensures that both IGMPv1 and IGMPv2 hosts find peers for their versions on the router.

## Understanding IGMP

The Internet Group Management Protocol (IGMP) manages the membership of hosts and routers in multicast groups. IP hosts use IGMP to report their multicast group memberships to any immediately neighboring multicast routers. Multicast routers use IGMP to learn, for each of their attached physical networks, which groups have members.

IGMP is also used as the transport for several related multicast protocols (for example, Distance Vector Multicast Routing Protocol [DVMRP] and Protocol Independent Multicast version 1 [PIMv1]).

IGMP is an integral part of IP and must be enabled on all routers and hosts that need to receive IP multicast traffic.

For each attached network, a multicast router can be either a querier or a nonquerier. The querier router periodically sends general query messages to solicit group membership information. Hosts on the network that are members of a multicast group send report messages. When a host leaves a group, it sends a leave group message.

IGMP version 3 (IGMPv3) supports inclusion and exclusion lists. Inclusion lists enable you to specify which sources can send to a multicast group. This type of multicast group is called a source-specific multicast (SSM) group, and its multicast address is 232/8.

IGMPv3 provides support for source filtering. For example, a router can specify particular routers from which it accepts or rejects traffic. With IGMPv3, a multicast router can learn which sources are of interest to neighboring routers.

Exclusion mode works the opposite of an inclusion list. It allows any source but the ones listed to send to the SSM group.

IGMPv3 interoperates with versions 1 and 2 of the protocol. However, to remain compatible with older IGMP hosts and routers, IGMPv3 routers must also implement versions 1 and 2 of the protocol. IGMPv3 supports the following membership-report record types: mode is allowed, allow new sources, and block old sources.

For information about supported standards for IGMP, see [“Supported IP Multicast Protocol Standards” on page 17](#).

## Configuring IGMP

To configure the Internet Group Management Protocol (IGMP), include the **igmp** statement:

```
igmp {
 accounting;
 interface interface-name {
 disable;
 (accounting | no-accounting);
 group-policy [policy-names];
 immediate-leave;
 oif-map map-name;
 promiscuous-mode;
 ssm-map ssm-map-name;
 static {
 group multicast-group-address {
 exclude;
 group-count number;
 group-increment increment;
 source ip-address {
 source-count number;
 source-increment increment;
 }
 }
 }
 }
 version version;
```

```

}
query-interval seconds;
query-last-member-interval seconds;
query-response-interval seconds;
robust-count number;
traceoptions {
 file filename <files number> <size size> <world-readable | no-world-readable>;
 flag flag <flag-modifier> <disable>;
}
}

```

You can include this statement at the following hierarchy levels:

- **[edit protocols]**
- **[edit logical-systems *logical-system-name* protocols]**

By default, IGMP is enabled on all interfaces on which you configure Protocol Independent Multicast (PIM), and on all broadcast interfaces on which you configure the Distance Vector Multicast Routing Protocol (DVMRP).



**NOTE:** You can configure IGMP on an interface without configuring PIM. PIM is generally not needed on IGMP downstream interfaces. Therefore, only one “pseudo PIM interface” is created to represent all IGMP downstream (IGMP-only) interfaces on the router. This reduces the amount of router resources, such as memory, that are consumed. You must configure PIM on upstream IGMP interfaces to enable multicast routing, perform reverse-path forwarding for multicast data packets, populate the multicast forwarding table for upstream interfaces, and in the case of bidirectional PIM and PIM sparse mode, to distribute IGMP group memberships into the multicast routing domain.

## Enabling IGMP

The Internet Group Management Protocol (IGMP) manages multicast groups by establishing, maintaining, and removing groups on a subnet. Multicast routing devices use IGMP to learn which groups have members on each of their attached physical networks. IGMP must be enabled for the router to receive IPv4 multicast packets. IGMP is only needed for IPv4 networks, because multicast is handled differently in IPv6 networks. IGMP is automatically enabled on all IPv4 interfaces on which you configure PIM and on all IPv4 broadcast interfaces when you configure DVMRP.

If IGMP is not running on an interface—either because PIM and DVMRP are not configured on the interface or because IGMP is explicitly disabled on the interface—you can explicitly enable IGMP.

To explicitly enable IGMP:

1. If PIM and DVMRP are not running on the interface, explicitly enable IGMP by including the interface name.

**[edit protocols igmp]**



```
user@host# set interface fe-0/0/0.0
```

2. See if IGMP is disabled on any interfaces. In the following example, IGMP is disabled on a Gigabit Ethernet interface.

```
[edit protocols igmp]
user@host# show

interface fe-0/0/0.0;
interface ge-0/0/0.0 {
 disable;
}
```

3. Enable IGMP on the interface by deleting the **disable** statement.

```
[edit protocols igmp]
delete interface ge-0/0/0.0 disable
```

4. Verify the configuration.

```
[edit protocols igmp]
user@host# show

interface fe-0/0/0.0;
interface ge-0/0/0.0;
```

5. Verify the operation of IGMP on the interfaces by checking the output of the **show igmp interface** command.

## Modifying the IGMP Host-Query Message Interval

The objective of IGMP is to keep routers up to date with group membership of the entire subnet. Routers need not know who all the members are, only that members exist. Each host keeps track of which multicast groups are subscribed to. On each link, one router is elected the querier. The IGMP querier router periodically sends general host-query messages on each attached network to solicit membership information. The messages are sent to the all-systems multicast group address, 224.0.0.1.

The query interval, the response interval, and the robustness variable are related in that they are all variables that are used to calculate the group membership timeout. The group membership timeout is the number of seconds that must pass before a multicast router determines that no more members of a host group exist on a subnet. The group membership timeout is calculated as the (robustness variable x query-interval) + (query-response-interval). If no reports are received for a particular group before the group membership timeout has expired, the routing device stops forwarding remotely-originated multicast packets for that group onto the attached network.

By default, host-query messages are sent every 125 seconds. You can change this interval to change the number of IGMP messages sent on the subnet.

To modify the query interval:

1. Configure the interval.

```
[edit protocols igmp]
user@host# set query-interval 200
```

The value can be from 1 through 1024 seconds.

2. Verify the configuration by checking the **IGMP Query Interval** field in the output of the **show igmp interface** command.
3. Verify the operation of the query interval by checking the **Membership Query** field in the output of the **show igmp statistics** command.

## Modifying the IGMP Query Response Interval

The query response interval is the maximum amount of time that can elapse between when the querier router sends a host-query message and when it receives a response from a host. Configuring this interval allows you to adjust the burst peaks of IGMP messages on the subnet. Set a larger interval to make the traffic less bursty. Bursty traffic refers to an uneven pattern of data transmission: sometimes a very high data transmission rate, whereas at other times a very low data transmission rate.

The query response interval, the host-query interval, and the robustness variable are related in that they are all variables that are used to calculate the group membership timeout. The group membership timeout is the number of seconds that must pass before a multicast router determines that no more members of a host group exist on a subnet. The group membership timeout is calculated as the (robustness variable x query-interval) + (query-response-interval). If no reports are received for a particular group before the group membership timeout has expired, the routing device stops forwarding remotely originated multicast packets for that group onto the attached network.

The default query response interval is 10 seconds. You can configure a subsecond interval up to one digit to the right of the decimal point. The configurable range is 0.1 through 0.9, then in 1-second intervals 1 through 999,999.

To modify the query response interval:

1. Configure the interval.  

```
[edit protocols igmp]
user@host# set query-response-interval 0.4
```
2. Verify the configuration by checking the **IGMP Query Response Interval** field in the output of the **show igmp interface** command.
3. Verify the operation of the query interval by checking the **Membership Query** field in the output of the **show igmp statistics** command.

## Specifying Immediate-Leave Host Removal for IGMP

The immediate leave setting is useful for minimizing the leave latency of IGMP memberships. When this setting is enabled, the routing device leaves the multicast group immediately after the last host leaves the multicast group.

The immediate-leave setting enables host tracking, meaning that the device keeps track of the hosts that send join messages. This allows IGMP to determine when the last host sends a leave message for the multicast group.

When the immediate leave setting is enabled, the device removes an interface from the forwarding-table entry without first sending IGMP group-specific queries to the interface.

The interface is pruned from the multicast tree for the multicast group specified in the IGMP leave message. The immediate leave setting ensures optimal bandwidth management for hosts on a switched network, even when multiple multicast groups are being used simultaneously.

When immediate leave is disabled and one host sends a leave group message, the routing device first sends a group query to determine if another receiver responds. If no receiver responds, the routing device removes all hosts on the interface from the multicast group. Immediate leave is disabled by default for both IGMP version 2 and IGMP version 3.



**NOTE:** Although host tracking is enabled for IGMPv2 and MLDv1 when you enable immediate leave, use immediate leave with these versions only when there is one host on the interface. The reason is that IGMPv2 and MLDv1 use a report suppression mechanism whereby only one host on an interface sends a group join report in response to a membership query. The other interested hosts suppress their reports. The purpose of this mechanism is to avoid a flood of reports for the same group. But it also interferes with host tracking, because the router only knows about the one interested host and does not know about the others.

To enable immediate leave on an interface:

1. Configure immediate leave on the IGMP interface.

```
[edit protocols IGMP]
user@host# set interface ge-0/0/0.1 immediate-leave
```

2. Verify the configuration by checking the **Immediate Leave** field in the output of the **show IGMP interface** command.

## Filtering Unwanted IGMP Reports at the IGMP Interface Level

Suppose you need to limit the subnets that can join a certain multicast group. The **group-policy** statement enables you to filter unwanted IGMP reports at the interface level. When this statement is enabled on a router running IGMP version 2 (IGMPv2) or version 3 (IGMPv3), after the router receives an IGMP report, the router compares the group against the specified group policy and performs the action configured in that policy (for example, rejects the report if the policy matches the defined address or network).

You define the policy to match only IGMP group addresses (for IGMPv2) by using the policy's **route-filter** statement to match the group address. You define the policy to match IGMP (source, group) addresses (for IGMPv3) by using the policy's **route-filter** statement to match the group address and the policy's **source-address-filter** statement to match the source address.

To filter unwanted IGMP reports:

1. Configure an IGMPv2 policy.

```
[edit policy-statement reject_policy_v2]
user@host# set from route-filter 224.1.1/32 exact
```

```
user@host# set from route-filter 239.0.0.0/8 orlonger
user@host# set then reject
```

2. Configure an IGMPv3 policy.

```
[edit policy-statement reject_policy_v3]
user@host# set from route-filter 224.1.1.1/32 exact
user@host# set from route-filter 239.0.0.0/8 orlonger
user@host# set from source-address-filter 10.0.0.0/8 orlonger
user@host# set from source-address-filter 127.0.0.0/8 orlonger
user@host# set then reject
```

3. Apply the policies to the IGMP interfaces on which you prefer not to receive specific group or (source, group) reports. In this example, **ge-0/0/0.1** is running IGMPv2, and **ge-0/1/1.0** is running IGMPv3.

```
[edit protocols igmp]
user@host# set interface ge-0/0/0.1 group-policy reject_policy_v2
user@host# set interface ge-0/1/1.0 group-policy reject_policy_v3
```

4. Verify the operation of the filter by checking the **Rejected Report** field in the output of the **show igmp statistics** command.

## Accepting IGMP Messages from Remote Subnetworks

By default, IGMP interfaces accept IGMP messages only from the same subnet. Including the **promiscuous-mode** statement enables the routing device to accept IGMP messages from indirectly connected subnets.



**NOTE:** When you enable IGMP on an unnumbered Ethernet interface that uses a /32 loopback address as a donor address, you must configure IGMP promiscuous mode to accept the IGMP packets received on this interface.

To enable IGMP promiscuous mode on an interface:

1. Configure the IGMP interface.

```
[edit protocols igmp]
user@host# set interface ge-0/1/1.0 promiscuous-mode
```

2. Verify the configuration by checking the **Promiscuous Mode** field in the output of the **show igmp interface** command.
3. Verify the operation of the filter by checking the **Rx non-local** field in the output of the **show igmp statistics** command.

## Modifying the IGMP Last-Member Query Interval

The last-member query interval is the maximum amount of time between group-specific query messages, including those sent in response to leave-group messages. You can configure this interval to change the amount of time it takes a routing device to detect the loss of the last member of a group.

When the routing device that is serving as the querier receives a leave-group message from a host, the routing device sends multiple group-specific queries to the group being left. The querier sends a specific number of these queries at a specific interval. The number of queries sent is called the last-member query count. The interval at which the queries are sent is called the last-member query interval. Because both settings are configurable, you can adjust the leave latency. The IGMP leave latency is the time between a request to leave a multicast group and the receipt of the last byte of data for the multicast group.

The last-member query count x (times) the last-member query interval = (equals) the amount of time it takes a routing device to determine that the last member of a group has left the group and to stop forwarding group traffic.

The default last-member query interval is 1 second. You can configure a subsecond interval up to one digit to the right of the decimal point. The configurable range is 0.1 through 0.9, then in 1-second intervals 1 through 999,999.

To modify this interval:

1. Configure the time (in seconds) that the routing device waits for a report in response to a group-specific query.

```
[edit protocols igmp]
user@host# set query-last-member-interval 0.1
```

2. Verify the configuration by checking the **IGMP Last Member Query Interval** field in the output of the **show igmp interfaces** command.



**NOTE:** You can configure the last-member query count by configuring the robustness variable. The two are always equal.

## Modifying the IGMP Robustness Variable

Fine-tune the IGMP robustness variable to allow for expected packet loss on a subnet. The robust count automatically changes certain IGMP message intervals for IGMPv2 and IGMPv3. Increasing the robust count allows for more packet loss but increases the leave latency of the subnetwork.

When the query router receives an IGMP leave message on a shared network running IGMPv2, the query router must send an IGMP group query message a specified number of times. The number of IGMP group query messages sent is determined by the robust count.

The value of the robustness variable is also used in calculating the following IGMP message intervals:

- Group member interval—Amount of time that must pass before a multicast router determines that there are no more members of a group on a network. This interval is calculated as follows: (robustness variable x query-interval) + (1 x query-response-interval).

- Other querier present interval—The robust count is used to calculate the amount of time that must pass before a multicast router determines that there is no longer another multicast router that is the querier. This interval is calculated as follows: (robustness variable x query-interval) + (0.5 x query-response-interval).
- Last-member query count—Number of group-specific queries sent before the router assumes there are no local members of a group. The number of queries is equal to the value of the robustness variable.

In IGMPv3, a change of interface state causes the system to immediately transmit a state-change report from that interface. In case the state-change report is missed by one or more multicast routers, it is retransmitted. The number of times it is retransmitted is the robust count minus one. In IGMPv3, the robust count is also a factor in determining the group membership interval, the older version querier interval, and the other querier present interval.

By default, the robustness variable is set to 2. You might want to increase this value if you expect a subnet to lose packets.

The number can be from 2 through 10.

To change the value of the robustness variable:

1. Configure the robust count.

When you set the robust count, you are in effect configuring the number of times the querier retries queries on the connected subnets.

```
[edit protocols igmp]
user@host# set robust-count 5
```

2. Verify the configuration by checking the **IGMP Robustness Count** field in the output of the **show igmp interfaces** command.

## Limiting the Maximum IGMP Message Rate

This section describes how to change the limit for the maximum number of IGMP packets transmitted in 1 second by the router.

Increasing the maximum number of IGMP packets transmitted per second might be useful on a router with a large number of interfaces participating in IGMP.

To change the limit for the maximum number of IGMP packets the router can transmit in 1 second, include the **maximum-transmit-rate** statement and specify the maximum number of packets per second to be transmitted.

## Changing the IGMP Version

By default, the routing device runs IGMPv2. Routing devices running different versions of IGMP determine the lowest common version of IGMP that is supported by hosts on their subnet and operate in that version.

To enable source-specific multicast (SSM) functionality, you must configure version 3 on the host and the host's directly connected routing device. If a source address is specified in a multicast group that is statically configured, the version must be set to IGMPv3.

If a static multicast group is configured with the source address defined, and the IGMP version is configured to be version 2, the source is ignored and only the group is added. In this case, the join is treated as an IGMPv2 group join.

If you configure the IGMP version setting at the individual interface hierarchy level, it overrides the **interface all** statement.

If you have already configured the routing device to use IGMP version 1 (IGMPv1) and then configure it to use IGMPv2, the routing device continues to use IGMPv1 for up to 6 minutes and then uses IGMPv2.

To change to IGMPv3 for SSM functionality:

1. Configure the IGMP interface.

```
[edit protocols igmp]
user@host# set interface ge-0/0/0 version 3
```

2. Verify the configuration by checking the version field in the output of the **show igmp interfaces** command. The **show igmp statistics** command has version-specific output fields, such as V1 Membership Report, V2 Membership Report, and V3 Membership Report.

## Enabling IGMP Static Group Membership

You can create IGMP static group membership to test multicast forwarding without a receiver host. When you enable IGMP static group membership, data is forwarded to an interface without that interface receiving membership reports from downstream hosts. The router on which you enable static IGMP group membership must be the designated router (DR) for the subnet. Otherwise, traffic does not flow downstream.

When enabling IGMP static group membership, you cannot configure multiple groups using the **group-count**, **group-increment**, **source-count**, and **source-increment** statements if the **all** option is specified as the IGMP interface.

Class-of-service (CoS) adjustment is not supported with IGMP static group membership.

In this example, you create static group 225.1.1.1.

1. On the DR, configure the static groups to be created by including the **static** statement and **group** statement and specifying which IP multicast address of the group to be created. When creating groups individually, you must specify a unique address for each group.

```
[edit protocols igmp]
user@host# set interface fe-0/1/2 static group 225.1.1.1
```

2. After you commit the configuration, use the **show configuration protocol igmp** command to verify the IGMP protocol configuration.

```
user@host> show configuration protocol igmp
```

```
interface fe-0/1/2.0 {
 static {
 group 225.1.1.1;
 }
}
```

3. After you have committed the configuration and the source is sending traffic, use the **show igmp group** command to verify that static group 225.1.1.1 has been created.

```
user@host> show igmp group
Interface: fe-0/1/2
Group: 225.1.1.1
Source: 10.0.0.2
Last reported by: Local
Timeout: 0 Type: Static
```



**NOTE:** When you configure static IGMP group entries on point-to-point links that connect routing devices to a rendezvous point (RP), the static IGMP group entries do not generate join messages toward the RP.

When you create IGMP static group membership to test multicast forwarding on an interface on which you want to receive multicast traffic, you can specify that a number of static groups be automatically created. This is useful when you want to test forwarding to multiple receivers without having to configure each receiver separately.

In this example, you create three groups.

1. On the DR, configure the number of static groups to be created by including the **group-count** statement and specifying the number of groups to be created.

```
[edit protocols igmp]
user@host# set interface fe-0/1/2 static group 225.1.1.1 group-count 3
```

2. After you commit the configuration, use the **show configuration protocol igmp** command to verify the IGMP protocol configuration.

```
user@host> show configuration protocol igmp

interface fe-0/1/2.0 {
 static {
 group 225.1.1.1 {
 group-count 3;
 }
 }
}
```

3. After you have committed the configuration and after the source is sending traffic, use the **show igmp group** command to verify that static groups 225.1.1.1, 225.1.1.2, and 225.1.1.3 have been created.

```
user@host> show igmp group
Interface: fe-0/1/2
Group: 225.1.1.1
Source: 10.0.0.2
Last reported by: Local
Timeout: 0 Type: Static
```



```

Group: 225.1.1.2
Source: 10.0.0.2
Last reported by: Local
Timeout: 0 Type: Static
Group: 225.1.1.3
Source: 10.0.0.2
Last reported by: Local
Timeout: 0 Type: Static

```

When you create IGMP static group membership to test multicast forwarding on an interface on which you want to receive multicast traffic, you can also configure the group address to be automatically incremented for each group created. This is useful when you want to test forwarding to multiple receivers without having to configure each receiver separately and when you do not want the group addresses to be sequential.

In this example, you create three groups and increase the group address by an increment of two for each group.

1. On the DR, configure the group address increment by including the **group-increment** statement and specifying the number by which the address should be incremented for each group. The increment is specified in dotted decimal notation similar to an IPv4 address.

```
[edit protocols igmp]
```

```
user@host# set interface fe-0/1/2 static group 225.1.1.1 group-count 3 group-increment
0.0.0.2
```

2. After you commit the configuration, use the **show configuration protocol igmp** command to verify the IGMP protocol configuration.

```
user@host> show configuration protocol igmp
```

```

interface fe-0/1/2.0 {
 version 3;
 static {
 group 225.1.1.1 {
 group-increment 0.0.0.2;
 group-count 3;
 }
 }
}

```

3. After you have committed the configuration and after the source is sending traffic, use the **show igmp group** command to verify that static groups 225.1.1.1, 225.1.1.3, and 225.1.1.5 have been created.

```
user@host> show igmp group
```

```

Interface: fe-0/1/2
 Group: 225.1.1.1
 Source: 10.0.0.2
 Last reported by: Local
 Timeout: 0 Type: Static
 Group: 225.1.1.3
 Source: 10.0.0.2
 Last reported by: Local
 Timeout: 0 Type: Static
 Group: 225.1.1.5
 Source: 10.0.0.2

```

```
Last reported by: Local
Timeout: 0 Type: Static
```

When you create IGMP static group membership to test multicast forwarding on an interface on which you want to receive multicast traffic, and your network is operating in source-specific multicast (SSM) mode, you can also specify that the multicast source address be accepted. This is useful when you want to test forwarding to multicast receivers from a specific multicast source.

If you specify a group address in the SSM range, you must also specify a source.

If a source address is specified in a multicast group that is statically configured, the IGMP version on the interface must be set to IGMPv3. IGMPv2 is the default value.

In this example, you create group 225.1.1.1 and accept IP address 10.0.0.2 as the only source.

1. On the DR, configure the source address by including the **source** statement and specifying the IPv4 address of the source host.

```
[edit protocols igmp]
```

```
user@host# set interface fe-0/1/2 static group 225.1.1.1 source 10.0.0.2
```

2. After you commit the configuration, use the **show configuration protocol igmp** command to verify the IGMP protocol configuration.

```
user@host> show configuration protocol igmp
```

```
interface fe-0/1/2.0 {
 version 3;
 static {
 group 225.1.1.1 {
 source 10.0.0.2;
 }
 }
}
```

3. After you have committed the configuration and the source is sending traffic, use the **show igmp group** command to verify that static group 225.1.1.1 has been created and that source 10.0.0.2 has been accepted.

```
user@host> show igmp group
```

```
Interface: fe-0/1/2
Group: 225.1.1.1
Source: 10.0.0.2
Last reported by: Local
Timeout: 0 Type: Static
```

When you create IGMP static group membership to test multicast forwarding on an interface on which you want to receive multicast traffic, you can specify that a number of multicast sources be automatically accepted. This is useful when you want to test forwarding to multicast receivers from more than one specified multicast source.

In this example, you create group 255.1.1.1 and accept addresses 10.0.0.2, 10.0.0.3, and 10.0.0.4 as the sources.

1. On the DR, configure the number of multicast source addresses to be accepted by including the **source-count** statement and specifying the number of sources to be accepted.

```
[edit protocols igmp]
user@host# set interface fe-0/1/2 static group 225.1.1.1 source 10.0.0.2 source-count
3
```

2. After you commit the configuration, use the **show configuration protocol igmp** command to verify the IGMP protocol configuration.

```
user@host> show configuration protocol igmp

interface fe-0/1/2.0 {
 version 3;
 static {
 group 225.1.1.1 {
 source 10.0.0.2 {
 source-count 3;
 }
 }
 }
}
```

3. After you have committed the configuration and the source is sending traffic, use the **show igmp group** command to verify that static group 225.1.1.1 has been created and that sources 10.0.0.2, 10.0.0.3, and 10.0.0.4 have been accepted.

```
user@host> show igmp group
Interface: fe-0/1/2
 Group: 225.1.1.1
 Source: 10.0.0.2
 Last reported by: Local
 Timeout: 0 Type: Static
 Group: 225.1.1.3
 Source: 10.0.0.3
 Last reported by: Local
 Timeout: 0 Type: Static
 Group: 225.1.1.5
 Source: 10.0.0.4
 Last reported by: Local
 Timeout: 0 Type: Static
```

When you configure static groups on an interface on which you want to receive multicast traffic, and specify that a number of multicast sources be automatically accepted, you can also specify the number by which the address should be incremented for each source accepted. This is useful when you want to test forwarding to multiple receivers without having to configure each receiver separately and you do not want the source addresses to be sequential.

In this example, you create group 225.1.1.1 and accept addresses 10.0.0.2, 10.0.0.4, and 10.0.0.6 as the sources.

1. Configure the multicast source address increment by including the **source-increment** statement and specifying the number by which the address should be incremented for each source. The increment is specified in dotted decimal notation similar to an IPv4 address.

```
[edit protocols igmp]
```

```
user@host# set interface fe-0/1/2 static group 225.1.1.1 source 10.0.0.2 source-count 3 source-increment 0.0.0.2
```

2. After you commit the configuration, use the **show configuration protocol igmp** command to verify the IGMP protocol configuration.

```
user@host> show configuration protocol igmp
```

```
interface fe-0/1/2.0 {
 version 3;
 static {
 group 225.1.1.1 {
 source 10.0.0.2 {
 source-count 3;
 source-increment 0.0.0.2;
 }
 }
 }
}
```

3. After you have committed the configuration and after the source is sending traffic, use the **show igmp group** command to verify that static group 225.1.1.1 has been created and that sources 10.0.0.2, 10.0.0.4, and 10.0.0.6 have been accepted.

```
user@host> show igmp group
```

```
Interface: fe-0/1/2
 Group: 225.1.1.1
 Source: 10.0.0.2
 Last reported by: Local
 Timeout: 0 Type: Static
 Group: 225.1.1.1
 Source: 10.0.0.4
 Last reported by: Local
 Timeout: 0 Type: Static
 Group: 225.1.1.5
 Source: 10.0.0.6
 Last reported by: Local
 Timeout: 0 Type: Static
```

When you configure static groups on an interface on which you want to receive multicast traffic and your network is operating in source-specific multicast (SSM) mode, you can specify that certain multicast source addresses be excluded.

By default the multicast source address configured in a static group operates in include mode. In include mode the multicast traffic for the group is accepted from the source address configured. You can also configure the static group to operate in exclude mode. In exclude mode the multicast traffic for the group is accepted from any address other than the source address configured.

If a source address is specified in a multicast group that is statically configured, the IGMP version on the interface must be set to IGMPv3. IGMPv2 is the default value.

In this example, you exclude address 10.0.0.2 as a source for group 225.1.1.1.

1. On the DR, configure a multicast static group to operate in exclude mode by including the **exclude** statement and specifying which IPv4 source address to exclude.

```
[edit protocols igmp]
user@host# set interface fe-0/1/2 static group 225.1.1.1 exclude source 10.0.0.2
```

2. After you commit the configuration, use the **show configuration protocol igmp** command to verify the IGMP protocol configuration.

```
user@host> show configuration protocol igmp

interface fe-0/1/2.0 {
 version 3;
 static {
 group 225.1.1.1 {
 exclude;
 source 10.0.0.2;
 }
 }
}
```

3. After you have committed the configuration and the source is sending traffic, use the **show igmp group detail** command to verify that static group 225.1.1.1 has been created and that the static group is operating in exclude mode.

```
user@host> show igmp group detail
Interface: fe-0/1/2
 Group: 225.1.1.1
 Group mode: Exclude
 Source: 10.0.0.2
 Last reported by: Local
 Timeout: 0 Type: Static
```

## Recording IGMP Join and Leave Events

To determine whether IGMP tuning is needed in a network, you can configure the routing device to record IGMP join and leave events. You can record events globally for the routing device or for individual interfaces.

[Table 8 on page 238](#) describes the recordable IGMP events.

Table 8: IGMP Event Messages

| ERRMSG Tag                  | Definition                                                     |
|-----------------------------|----------------------------------------------------------------|
| RPD_IGMP_JOIN               | Records IGMP join events.                                      |
| RPD_IGMP_LEAVE              | Records IGMP leave events.                                     |
| RPD_IGMP_ACCOUNTING_ON      | Records when IGMP accounting is enabled on an IGMP interface.  |
| RPD_IGMP_ACCOUNTING_OFF     | Records when IGMP accounting is disabled on an IGMP interface. |
| RPD_IGMP_MEMBERSHIP_TIMEOUT | Records IGMP membership timeout events.                        |

To enable IGMP accounting:

1. Enable accounting globally or on an IGMP interface. This example shows both options.

```
[edit protocols igmp]
user@host# set accounting
user@host# set interface fe-0/1/0.2 accounting
```

2. Configure the events to be recorded and filter the events to a system log file with a descriptive filename, such as **igmp-events**.

```
[edit system syslog file igmp-events]
user@host# set any info
user@host# set match ".*RPD_IGMP_JOIN.* | .*RPD_IGMP_LEAVE.* |
.*RPD_IGMP_ACCOUNTING.* | .*RPD_IGMP_MEMBERSHIP_TIMEOUT.*"
```

3. Periodically archive the log file.

This example rotates the file size when it reaches 100 KB and keeps three files.

```
[edit system syslog file igmp-events]
user@host# set archive size 100000
user@host# set archive files 3
user@host# set archive archive-sites "ftp://user@host1//var/tmp" password
"anonymous"
user@host# set archive archive-sites "ftp://user@host2//var/tmp" password "test"
user@host# set archive transfer-interval 24
user@host# set archive start-time 2011-01-07:12:30
```

4. You can monitor the system log file as entries are added to the file by running the **monitor start** and **monitor stop** commands.

```
user@host> monitor start igmp-events

*** igmp-events ***
Apr 16 13:08:23 host mgd[16416]: UI_CMDLINE_READ_LINE: User 'user', command
'run monitor start igmp-events '
monitor
```

## Limiting the Number of IGMP Multicast Group Joins on Logical Interfaces

The **group-limit** statement enables you to limit the number of IGMP multicast group joins for logical interfaces. When this statement is enabled on a router running IGMP version 2

(IGMPv2) or version 3 (IGMPv3), the limit is applied upon receipt of the group report. Once the group limit is reached, subsequent join requests are rejected.

When configuring limits for IGMP multicast groups, keep the following in mind:

- Each any-source group (\*G) counts as one group toward the limit.
- Each source-specific group (S,G) counts as one group toward the limit.
- Groups in IGMPv3 exclude mode are counted toward the limit.
- Multiple source-specific groups count individually toward the group limit, even if they are for the same group. For example, (S1, G1) and (S2, G1) would count as two groups toward the configured limit.
- Combinations of any-source groups and source-specific groups count individually toward the group limit, even if they are for the same group. For example, (\*, G1) and (S, G1) would count as two groups toward the configured limit.
- Configuring and committing a group limit on a network that is lower than what already exists on the network results in the removal of all groups from the configuration. The groups must then request to rejoin the network (up to the newly configured group limit).
- You can dynamically limit multicast groups on IGMP logical interfaces using dynamic profiles.

To limit multicast group joins on an IGMP logical interface:

1. Access the logical interface at the IGMP protocol hierarchy level.

```
[edit]
user@host# edit protocols igmp interface interface-name
```

2. Specify the group limit for the interface.

```
[edit protocols igmp interface interface-name]
user@host# set group-limit limit
```

## Tracing IGMP Protocol Traffic

Tracing operations record detailed messages about the operation of routing protocols, such as the various types of routing protocol packets sent and received, and routing policy actions. You can specify which trace operations are logged by including specific tracing flags. The following table describes the flags that you can include.

| Flag                       | Description             |
|----------------------------|-------------------------|
| <b>all</b>                 | Trace all operations.   |
| <b>client-notification</b> | Trace notifications.    |
| <b>general</b>             | Trace general flow.     |
| <b>group</b>               | Trace group operations. |

| Flag                     | Description                                                                         |
|--------------------------|-------------------------------------------------------------------------------------|
| <b>host-notification</b> | Trace host notifications.                                                           |
| <b>leave</b>             | Trace leave group messages (IGMPv2 only).                                           |
| <b>mtrace</b>            | Trace mtrace packets. Use the <b>mtrace</b> command to troubleshoot the software.   |
| <b>normal</b>            | Trace normal events.                                                                |
| <b>packets</b>           | Trace all IGMP packets.                                                             |
| <b>policy</b>            | Trace policy processing.                                                            |
| <b>query</b>             | Trace IGMP membership query messages, including general and group-specific queries. |
| <b>report</b>            | Trace membership report messages.                                                   |
| <b>route</b>             | Trace routing information.                                                          |
| <b>state</b>             | Trace state transitions.                                                            |
| <b>task</b>              | Trace task processing.                                                              |
| <b>timer</b>             | Trace timer processing.                                                             |

In the following example, tracing is enabled for all routing protocol packets. Then tracing is narrowed to focus only on IGMP packets of a particular type. To configure tracing operations for IGMP:

- (Optional) Configure tracing at the routing options level to trace all protocol packets.  

```
[edit routing-options traceoptions]
user@host# set file all-packets-trace
user@host# set flag all
```
- Configure the filename for the IGMP trace file.  

```
[edit protocols igmp traceoptions]
user@host# set file igmp-trace
```
- (Optional) Configure the maximum number of trace files.  

```
[edit protocols igmp traceoptions]
user@host# set file files 5
```
- (Optional) Configure the maximum size of each trace file.  

```
[edit protocols igmp traceoptions]
user@host# set file size 1m
```
- (Optional) Enable unrestricted file access.



```
[edit protocols igmp traceoptions]
user@host# set file world-readable
```

6. Configure tracing flags. Suppose you are troubleshooting issues with a particular multicast group. The following example shows how to flag all events for packets associated with the group IP address.

```
[edit protocols igmp traceoptions]
user@host# set flag group | match 232.1.1.2
```

7. View the trace file.

```
user@host> file list /var/log
user@host> file show /var/log/igmp-trace
```

## Disabling IGMP

To disable IGMP on an interface, include the **disable** statement:

```
disable;
```

You can include this statement at the following hierarchy levels:

- [\[edit protocols igmp interface \*interface-name\*\]](#)
- [\[edit logical-systems \*logical-system-name\* protocols igmp interface \*interface-name\*\]](#)

## IGMP and Nonstop Active Routing

Nonstop active routing (NSR) configurations include two Routing Engines that share information so that routing is not interrupted during Routing Engine failover. These NSR configurations include passive support with IGMP in connection with PIM. The master Routing Engine uses IGMP to determine its PIM multicast state, and this IGMP-derived information is replicated on the backup Routing Engine. IGMP on the new master Routing Engine (after failover) relearns the state information quickly through IGMP operation. In the interim, the new master Routing Engine retains the IGMP-derived PIM state as received by the replication process from the old master Routing Engine. This state information times out unless refreshed by IGMP on the new master Routing Engine. No additional IGMP configuration is required.

**Related Documentation**

- [Examples: Configuring MLD on page 247](#)

## Example: Configuring SSM Maps for Different Groups to Different Sources

- [Multiple SSM Maps and Groups for Interfaces on page 241](#)
- [Example: Configuring Multiple SSM Maps Per Interface on page 242](#)

## Multiple SSM Maps and Groups for Interfaces

You can configure multiple source-specific multicast (SSM) maps so that different groups map to different sources, which enables a single multicast group to map to different sources for different interfaces.

## Example: Configuring Multiple SSM Maps Per Interface

This example shows how to assign more than one SSM map to an IGMP interface.

- [Requirements on page 242](#)
- [Overview on page 242](#)
- [Configuration on page 242](#)
- [Verification on page 244](#)

### Requirements

This example requires Junos OS Release 11.4 or later.

### Overview

In this example, you configure a routing policy, POLICY-ipv4-example1, that maps multicast group join messages over an IGMP logical interface to IPv4 multicast source addresses based on destination IP address as follows:

| Routing Policy Name         | Multicast Group Join Messages for a Route Filter at This Destination Address | Multicast Source Addresses   |
|-----------------------------|------------------------------------------------------------------------------|------------------------------|
| POLICY-ipv4-example1 term 1 | 232.1.1.1                                                                    | 10.10.10.4,<br>192.168.43.66 |
| POLICY-ipv4-example1 term 2 | 232.1.1.2                                                                    | 10.10.10.5,<br>192.168.43.67 |

You apply routing policy POLICY-ipv4-example1 to IGMP logical interface fe-0/1/0.0.

### Configuration

The following example requires that you navigate various levels in the configuration hierarchy. For information about navigating the CLI, see the *CLI User Guide*.

To configure this example, perform the following task:

#### CLI Quick Configuration

To quickly configure this example, copy the following configuration commands into a text file, remove any line breaks, and then paste the commands into the CLI at the **[edit]** hierarchy level.

```
set policy-options policy-statement POLICY-ipv4-example1 term 1 from route-filter
 232.1.1.1/32 exact
set policy-options policy-statement POLICY-ipv4-example1 term 1 then ssm-source
 10.10.10.4
set policy-options policy-statement POLICY-ipv4-example1 term 1 then ssm-source
 192.168.43.66
set policy-options policy-statement POLICY-ipv4-example1 term 1 then accept
set policy-options policy-statement POLICY-ipv4-example1 term 2 from route-filter
 232.1.1.2/32 exact
set policy-options policy-statement POLICY-ipv4-example1 term 2 then ssm-source
 10.10.10.5
```

```

set policy-options policy-statement POLICY-ipv4-example1 term 2 then ssm-source
192.168.43.67
set policy-options policy-statement POLICY-ipv4-example1 term 2 then accept
set protocols igmp interface fe-0/1/0.0 ssm-map-policy POLICY-ipv4-example1

```

### Step-by-Step Procedure

To configure multiple SSM maps per interface:

1. Configure protocol-independent routing options for route filter 232.1.1.1, and specify the multicast source addresses to which matching multicast groups are to be mapped.

```

[edit policy-options policy-statement POLICY-ipv4-example1 term 1]
user@host# set from route-filter 232.1.1/32 exact
user@host# set then ssm-source 10.10.10.4
user@host# set then ssm-source 192.168.43.66
user@host# set then accept

```

2. Configure protocol-independent routing options for route filter 232.1.1.2, and specify the multicast source addresses to which matching multicast groups are to be mapped.

```

[edit policy-options policy-statement POLICY-ipv4-example1 term 2]
user@host# set from route-filter 232.1.1.2/32 exact
user@host# set then ssm-source 10.10.10.5
user@host# set then ssm-source 192.168.43.67
user@host# set then accept

```

3. Apply the policy map POLICY-ipv4-example1 to IGMP logical interface fe-0/1/1/0.

```

[edit protocols igmp interface fe-0/1/0.0]
user@host# set ssm-map-policy POLICY-ipv4-example1

```

**Results** After the configuration is committed, confirm the configuration by entering the **show policy-options** and **show protocols** configuration mode commands. If the command output does not display the intended configuration, repeat the instructions in this procedure to correct the configuration.

```

user@host# show policy-options
policy-statement POLICY-ipv4-example1 {
 term 1 {
 from {
 route-filter 232.1.1/32 exact;
 }
 then {
 ssm-source [10.10.10.4 192.168.43.66];
 accept;
 }
 }
 term 2 {
 from {
 route-filter 232.1.1.2/32 exact;
 }
 then {
 ssm-source [10.10.10.5 192.168.43.67];
 accept;
 }
 }
}

```

```
}

user@host# show protocols
igmp {
 interface fe-0/1/0.0 {
 ssm-map-policy POLICY-ipv4-example1;
 }
}
```

---

### Verification

Confirm that the configuration is working properly.

- [Displaying Information About IGMP-Enabled Interfaces on page 244](#)
- [Displaying the PIM Groups on page 244](#)
- [Displaying the Entries in the IP Multicast Forwarding Table on page 244](#)

#### *Displaying Information About IGMP-Enabled Interfaces*

**Purpose** Verify that the SSM map policy POLICY-ipv4-example1 is applied to logical interface fe-0/1/0.0.

**Action** Use the [show igmp interface](#) operational mode command for the IGMP logical interface to which you applied the SSM map policy.

```
user@host> show igmp interface
Interface: fe-0/1/0.0
Querier: 10.111.30.1
State: Up Timeout: None Version: 2 Groups: 2
SSM Map Policy: POLICY-ipv4-example1;
```

```
Configured Parameters:
IGMP Query Interval: 125.0
IGMP Query Response Interval: 10.0
IGMP Last Member Query Interval: 1.0
IGMP Robustness Count: 2
```

```
Derived Parameters:
IGMP Membership Timeout: 260.0
IGMP Other Querier Present Timeout: 255.0
```

The command output displays the name of the IGMP logical interface (fe-0/1/0.0), which is the address of the routing device that has been elected to send membership queries and group information.

#### *Displaying the PIM Groups*

**Purpose** Verify the Protocol Independent Multicast (PIM) source and group pair (S,G) entries.

**Action** Use the [show pim join extensive 232.1.1.1](#) operational mode command to display the PIM source and group pair (S,G) entries for the 232.1.1.1 group.

#### *Displaying the Entries in the IP Multicast Forwarding Table*

**Purpose** Verify that the IP multicast forwarding table displays the multicast route state.

**Action** Use the `show multicast route extensive` operational mode command to display the entries in the IP multicast forwarding table to verify that the **Route state** is active and that the **Forwarding state** is forwarding.

**Related Documentation**

- [Example: Configuring Source-Specific Multicast on page 167](#)
- *Example: Configuring Source-Specific Draft-Rosen 7 Multicast VPNs*



## CHAPTER 6

# Multicast Listener Discovery

- [Examples: Configuring MLD on page 247](#)

## Examples: Configuring MLD

---

- [Understanding MLD on page 247](#)
- [Configuring MLD on page 250](#)
- [Enabling MLD on page 251](#)
- [Modifying the MLD Version on page 252](#)
- [Modifying the MLD Host-Query Message Interval on page 252](#)
- [Modifying the MLD Query Response Interval on page 253](#)
- [Modifying the MLD Last-Member Query Interval on page 254](#)
- [Specifying Immediate-Leave Host Removal for MLD on page 254](#)
- [Filtering Unwanted MLD Reports at the MLD Interface Level on page 255](#)
- [Example: Modifying the MLD Robustness Variable on page 256](#)
- [Limiting the Maximum MLD Message Rate on page 257](#)
- [Enabling MLD Static Group Membership on page 258](#)
- [Example: Recording MLD Join and Leave Events on page 265](#)
- [Configuring the Number of MLD Multicast Group Joins on Logical Interfaces on page 267](#)
- [Tracing MLD Protocol Traffic on page 268](#)
- [Disabling MLD on page 269](#)

## Understanding MLD

The Multicast Listener Discovery (MLD) Protocol manages the membership of hosts and routers in multicast groups. IP version 6 (IPv6) multicast routers use MLD to learn, for each of their attached physical networks, which groups have interested listeners. Each router maintains a list of host multicast addresses that have listeners for each subnetwork, as well as a timer for each address. However, the router does not need to know the address of each listener—just the address of each host. The router provides addresses to the multicast routing protocol it uses, which ensures that multicast packets are delivered to all subnetworks where there are interested listeners. In this way, MLD is used as the transport for the Protocol Independent Multicast (PIM) Protocol.

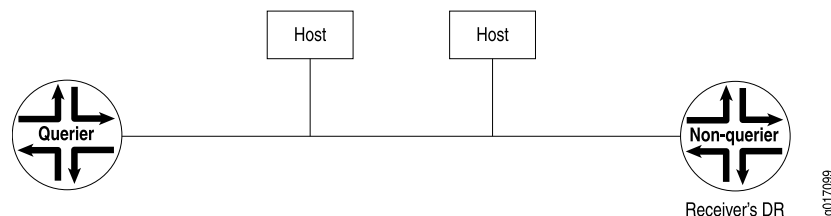
MLD is an integral part of IPv6 and must be enabled on all IPv6 routers and hosts that need to receive IP multicast traffic. The Junos OS supports MLD versions 1 and 2. Version 2 is supported for source-specific multicast (SSM) include and exclude modes.

In include mode, the receiver specifies the source or sources it is interested in receiving the multicast group traffic from. Exclude mode works the opposite of include mode. It allows the receiver to specify the source or sources it is not interested in receiving the multicast group traffic from.

For each attached network, a multicast router can be either a querier or a nonquerier. A querier router, usually one per subnet, solicits group membership information by transmitting MLD queries. When a host reports to the querier router that it has interested listeners, the querier router forwards the membership information to the rendezvous point (RP) router by means of the receiver's (host's) designated router (DR). This builds the rendezvous-point tree (RPT) connecting the host with interested listeners to the RP router. The RPT is the initial path used by the sender to transmit information to the interested listeners. Nonquerier routers do not transmit MLD queries on a subnet but can do so if the querier router fails.

All MLD-configured routers start as querier routers on each attached subnet (see [Figure 37 on page 248](#)). The querier router on the right is the receiver's DR.

**Figure 37: Routers Start Up on a Subnet**



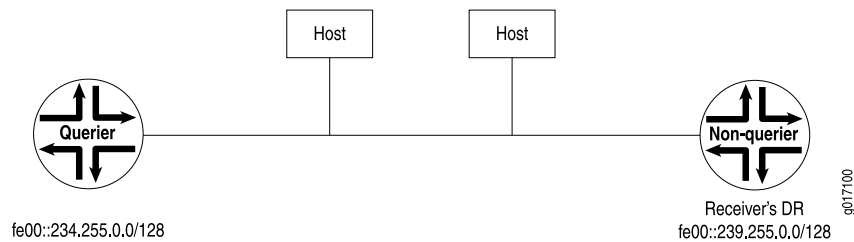
To elect the querier router, the routers exchange query messages containing their IPv6 source addresses. If a router hears a query message whose IPv6 source address is numerically lower than its own selected address, it becomes a nonquerier. In [Figure 38 on page 249](#), the router on the left has a source address numerically lower than the one on the right and therefore becomes the querier router.



**NOTE:** In the practical application of MLD, several routers on a subnet are nonqueriers. If the elected querier router fails, query messages are exchanged among the remaining routers. The router with the lowest IPv6 source address becomes the new querier router. The IPv6 Neighbor Discovery Protocol (NDP) implementation drops incoming Neighbor Announcement (NA) messages that have a broadcast or multicast address in the target link-layer address option. This behavior is recommended by RFC 2461.

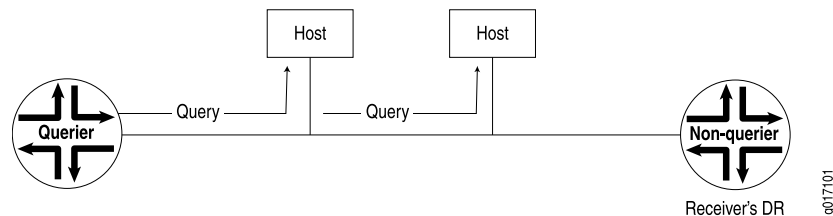


Figure 38: Querier Router Is Determined



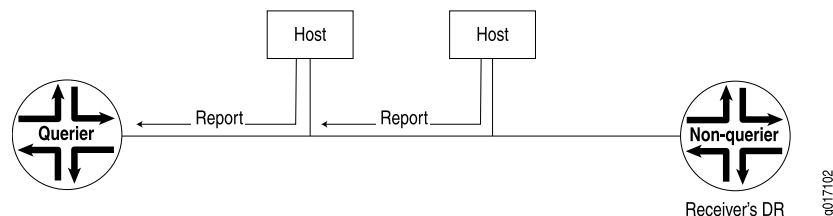
The querier router sends general MLD queries on the **link-scope all-nodes** multicast address FF02::1 at short intervals to all attached subnets to solicit group membership information (see [Figure 39 on page 249](#)). Within the query message is the *maximum response delay* value, specifying the maximum allowed delay for the host to respond with a report message.

Figure 39: General Query Message Is Issued



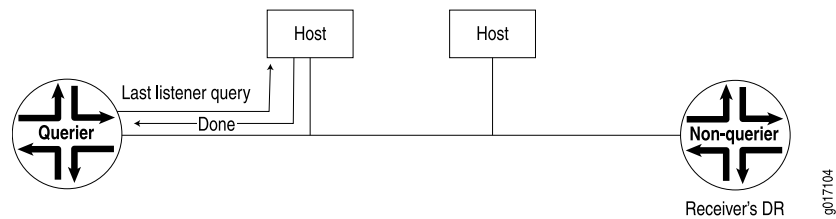
If interested listeners are attached to the host receiving the query, the host sends a report containing the host's IPv6 address to the router (see [Figure 40 on page 249](#)). If the reported address is not yet in the router's list of multicast addresses with interested listeners, the address is added to the list and a timer is set for the address. If the address is already on the list, the timer is reset. The host's address is transmitted to the RP in the PIM domain.

Figure 40: Reports Are Received by the Querier Router



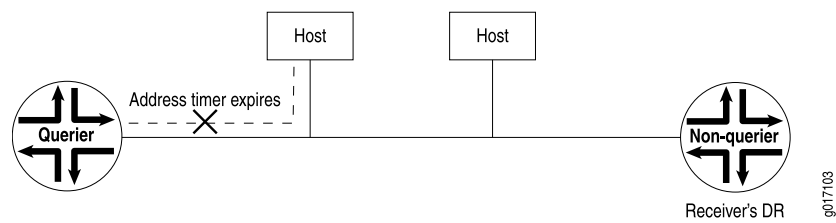
If the host has no interested multicast listeners, it sends a done message to the querier router. On receipt, the querier router issues a multicast address-specific query containing the last **listener query interval** value to the multicast address of the host. If the router does not receive a report from the multicast address, it removes the multicast address from the list and notifies the RP in the PIM domain of its removal (see [Figure 41 on page 250](#)).

**Figure 41: Host Has No Interested Receivers and Sends a Done Message to Router**



If a done message is not received by the querier router, the querier router continues to send multicast address-specific queries. If the timer set for the address on receipt of the last report expires, the querier router assumes there are no longer interested listeners on that subnet, removes the multicast address from the list, and notifies the RP in the PIM domain of its removal (see [Figure 42 on page 250](#)).

**Figure 42: Host Address Timer Expires and Address Is Removed from Multicast Address List**



## Configuring MLD

To configure the Multicast Listener Discovery (MLD) Protocol, include the **mld** statement:

```
mld {
 accounting;
 interface interface-name {
 disable;
 (accounting | no-accounting);
 group-policy [policy-names];
 immediate-leave;
 oif-map [map-names];
 passive;
 ssm-map ssm-map-name;
 static {
 group multicast-group-address {
 exclude;
 group-count number;
 group-increment increment;
 source ip-address {
 source-count number;
 source-increment increment;
 }
 }
 }
 }
 version version;
}
maximum-transmit-rate packets-per-second;
```

```

query-interval seconds;
query-last-member-interval seconds;
query-response-interval seconds;
robust-count number;
traceoptions {
 file filename <files number> <size size> <world-readable | no-world-readable>;
 flag flag <flag-modifier> <disable>;
}

```

You can include this statement at the following hierarchy levels:

- **[edit protocols]**
- **[edit logical-systems *logical-system-name* protocols]**

By default, MLD is enabled on all broadcast interfaces when you configure Protocol Independent Multicast (PIM) or the Distance Vector Multicast Routing Protocol (DVMRP).

## Enabling MLD

The Multicast Listener Discovery (MLD) Protocol manages multicast groups by establishing, maintaining, and removing groups on a subnet. Multicast routing devices use MLD to learn which groups have members on each of their attached physical networks. MLD must be enabled for the router to receive IPv6 multicast packets. MLD is only needed for IPv6 networks, because multicast is handled differently in IPv4 networks. MLD is enabled on all IPv6 interfaces on which you configure PIM and on all IPv6 broadcast interfaces when you configure DVMRP.

MLD specifies different behaviors for multicast listeners and for routers. When a router is also a listener, the router responds to its own messages. If a router has more than one interface to the same link, it needs to perform the router behavior over only one of those interfaces. Listeners, on the other hand, must perform the listener behavior on all interfaces connected to potential receivers of multicast traffic.

If MLD is not running on an interface—either because PIM and DVMRP are not configured on the interface or because MLD is explicitly disabled on the interface—you can explicitly enable MLD.

To explicitly enable MLD:

1. If PIM and DVMRP are not running on the interface, explicitly enable MLD by including the interface name.

```

[edit protocols mld]
user@host# set interface fe-0/0/0.0

```

2. Check to see if MLD is disabled on any interfaces. In the following example, MLD is disabled on a Gigabit Ethernet interface.

```

[edit protocols mld]
user@host# show

interface fe-0/0/0.0;
interface ge-0/0/0.0 {
 disable;
}

```

3. Enable MLD on the interface by deleting the **disable** statement.

```
[edit protocols mld]
delete interface ge-0/0/0.0 disable
```

4. Verify the configuration.

```
[edit protocols mld]
user@host# show

interface fe-0/0/0.0;
interface ge-0/0/0.0;
```

5. Verify the operation of MLD by checking the output of the **show mld interface** command.

## Modifying the MLD Version

By default, the router supports MLD version 1 (MLDv1). To enable the router to use MLD version 2 (MLDv2) for source-specific multicast (SSM) only, include the **version 2** statement.

If you configure the MLD version setting at the individual interface hierarchy level, it overrides configuring the IGMP version using the **interface all** statement.

If a source address is specified in a multicast group that is statically configured, the version must be set to MLDv2.

To change an MLD interface to version 2:

1. Configure the MLD interface.

```
[edit protocols mld]
user@host# set interface fe-0/0/0.0 version 2
```

2. Verify the configuration by checking the **version** field in the output of the **show mld interface** command. The **show mld statistics** command has version-specific output fields, such as the counters in the **MLD Message type** field.

## Modifying the MLD Host-Query Message Interval

The objective of MLD is to keep routers up to date with IPv6 group membership of the entire subnet. Routers need not know who all the members are, only that members exist. Each host keeps track of which multicast groups are subscribed to. On each link, one router is elected the querier. The MLD querier router periodically sends general host-query messages on each attached network to solicit membership information. These messages solicit group membership information and are sent to the **link-scope all-nodes** address **FF02::1**. A general host-query message has a maximum response time that you can set by configuring the query response interval.

The query response timeout, the query interval, and the robustness variable are related in that they are all variables that are used to calculate the multicast listener interval. The multicast listener interval is the number of seconds that must pass before a multicast router determines that no more members of a host group exist on a subnet. The multicast listener interval is calculated as the (robustness variable x query-interval) + (1 x query-response-interval). If no reports are received for a particular group before the

multicast listener interval has expired, the routing device stops forwarding remotely-originated multicast packets for that group onto the attached network.

By default, host-query messages are sent every 125 seconds. You can change this interval to change the number of MLD messages sent on the subnet.

To modify the query interval:

1. Configure the interval.

```
[edit protocols mld]
user@host# set query-interval 200
```

The value can be from 1 through 1024 seconds.

2. Verify the configuration by checking the **MLD Query Interval** field in the output of the **show mld interface** command.
3. Verify the operation of the query interval by checking the **Listener Query** field in the output of the **show mld statistics** command.

## Modifying the MLD Query Response Interval

The query response interval is the maximum amount of time that can elapse between when the querier router sends a host-query message and when it receives a response from a host. You can change this interval to adjust the burst peaks of MLD messages on the subnet. Set a larger interval to make the traffic less bursty.

The query response timeout, the query interval, and the robustness variable are related in that they are all variables that are used to calculate the multicast listener interval. The multicast listener interval is the number of seconds that must pass before a multicast router determines that no more members of a host group exist on a subnet. The multicast listener interval is calculated as the (robustness variable x query-interval) + (1 x query-response-interval). If no reports are received for a particular group before the multicast listener interval has expired, the routing device stops forwarding remotely-originated multicast packets for that group onto the attached network.

The default query response interval is 10 seconds. You can configure a subsecond interval up to one digit to the right of the decimal point. The configurable range is 0.1 through 0.9, then in 1-second intervals 1 through 999,999.

To modify the query response interval:

1. Configure the interval.

```
[edit protocols mld]
user@host# set query-response-interval 0.5
```

2. Verify the configuration by checking the **MLD Query Response Interval** field in the output of the **show mld interface** command.
3. Verify the operation of the query interval by checking the **Listener Query** field in the output of the **show mld statistics** command.

## Modifying the MLD Last-Member Query Interval

The last-member query interval (also called the last-listener query interval) is the maximum amount of time between group-specific query messages, including those sent in response to done messages sent on the **link-scope-all-routers** address FF02::2. You can lower this interval to reduce the amount of time it takes a router to detect the loss of the last member of a group.

When the routing device that is serving as the querier receives a leave-group (done) message from a host, the routing device sends multiple group-specific queries to the group. The querier sends a specific number of these queries, and it sends them at a specific interval. The number of queries sent is called the last-listener query count. The interval at which the queries are sent is called the last-listener query interval. Both settings are configurable, thus allowing you to adjust the leave latency. The IGMP leave latency is the time between a request to leave a multicast group and the receipt of the last byte of data for the multicast group.

The last-listener query count x (times) the last-listener query interval = (equals) the amount of time it takes a routing device to determine that the last member of a group has left the group and to stop forwarding group traffic.

The default last-listener query interval is 1 second. You can configure a subsecond interval up to one digit to the right of the decimal point. The configurable range is 0.1 through 0.9, then in 1-second intervals 1 through 999,999.

To modify this interval:

1. Configure the time (in seconds) that the routing device waits for a report in response to a group-specific query.

[edit protocols mld]

user@host# set query-last-member-interval 0.1

2. Verify the configuration by checking the **MLD Last Member Query Interval** field in the output of the **show igmp interfaces** command.



**NOTE:** You can configure the last-member query count by configuring the robustness variable. The two are always equal.

---

## Specifying Immediate-Leave Host Removal for MLD

The immediate leave setting is useful for minimizing the leave latency of MLD memberships. When this setting is enabled, the routing device leaves the multicast group immediately after the last host leaves the multicast group.

The immediate-leave setting enables host tracking, meaning that the device keeps track of the hosts that send join messages. This allows MLD to determine when the last host sends a leave message for the multicast group.

When the immediate leave setting is enabled, the device removes an interface from the forwarding-table entry without first sending MLD group-specific queries to the interface. The interface is pruned from the multicast tree for the multicast group specified in the MLD leave message. The immediate leave setting ensures optimal bandwidth management for hosts on a switched network, even when multiple multicast groups are being used simultaneously.

When immediate leave is disabled and one host sends a leave group message, the routing device first sends a group query to determine if another receiver responds. If no receiver responds, the routing device removes all hosts on the interface from the multicast group. Immediate leave is disabled by default for both MLD version 1 and MLD version 2.



**NOTE:** Although host tracking is enabled for IGMPv2 and MLDv1 when you enable immediate leave, use immediate leave with these versions only when there is one host on the interface. The reason is that IGMPv2 and MLDv1 use a report suppression mechanism whereby only one host on an interface sends a group join report in response to a membership query. The other interested hosts suppress their reports. The purpose of this mechanism is to avoid a flood of reports for the same group. But it also interferes with host tracking, because the router only knows about the one interested host and does not know about the others.

To enable immediate leave:

1. Configure immediate leave on the MLD interface.

```
[edit protocols mld]
user@host# set interface ge-0/0/0.1 immediate-leave
```

2. Verify the configuration by checking the **Immediate Leave** field in the output of the **show mld interface** command.

## Filtering Unwanted MLD Reports at the MLD Interface Level

Suppose you need to limit the subnets that can join a certain multicast group. The **group-policy** statement enables you to filter unwanted MLD reports at the interface level.

When the **group-policy** statement is enabled on a router, after the router receives an MLD report, the router compares the group against the specified group policy and performs the action configured in that policy (for example, rejects the report if the policy matches the defined address or network).

You define the policy to match only MLD group addresses (for MLDv1) by using the policy's **route-filter** statement to match the group address. You define the policy to match MLD (source, group) addresses (for MLDv2) by using the policy's **route-filter** statement to match the group address and the policy's **source-address-filter** statement to match the source address.

To filter unwanted MLD reports:

1. Configure an MLDv1 policy.

```
[edit policy-statement reject_policy_v1]
user@host# set from route-filter fec0:1:1:4::/64 exact
user@host# set then reject
```

2. Configure an MLDv2 policy.

```
[edit policy-statement reject_policy_v2]
user@host# set from route-filter fec0:1:1:4::/64 exact
user@host# set from source-address-filter fe80::2e0:81ff:fe05:1a8d/32 orlonger
user@host# set then reject
```

3. Apply the policies to the MLD interfaces where you prefer not to receive specific group or (source, group) reports. In this example, **ge-0/0/0.1** is running MLDv1 and **ge-0/1/1.0** is running MLDv2.

```
[edit protocols mld]
user@host# set interface ge-0/0/0.1 group-policy reject_policy_v1
user@host# set interface ge-0/1/1.0 group-policy reject_policy_v2
```

4. Verify the operation of the filter by checking the **Rejected Report** field in the output of the **show mld statistics** command.

## Example: Modifying the MLD Robustness Variable

This example shows how to configure and verify the MLD robustness variable in a multicast domain.

- [Requirements on page 256](#)
- [Overview on page 256](#)
- [Configuration on page 257](#)
- [Verification on page 257](#)

---

### Requirements

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Enable IPv6 unicast routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Enable PIM. See “[PIM Overview](#)” on page 13.

---

### Overview

The MLD robustness variable can be fine-tuned to allow for expected packet loss on a subnet. Increasing the robust count allows for more packet loss but increases the leave latency of the subnetwork.

The value of the robustness variable is used in calculating the following MLD message intervals:



- Group member interval—Amount of time that must pass before a multicast router determines that there are no more members of a group on a network. This interval is calculated as follows: (robustness variable x query-interval) + (1 x query-response-interval).
- Other querier present interval—Amount of time that must pass before a multicast router determines that there is no longer another multicast router that is the querier. This interval is calculated as follows: (robustness variable x query-interval) + (0.5 x query-response-interval).
- Last-member query count—Number of group-specific queries sent before the router assumes there are no local members of a group. The default number is the value of the robustness variable.

By default, the robustness variable is set to 2. The number can be from 2 through 10. You might want to increase this value if you expect a subnet to lose packets.

### Configuration

**CLI Quick Configuration** To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set protocols mld robust-count 5
```

**Step-by-Step Procedure** The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To change the value of the robustness variable:

1. Configure the robust count.

```
[edit protocols mld]
user@host# set robust-count 5
```

2. If you are done configuring the device, commit the configuration.

```
[edit protocols mld]
user@host# commit
```

### Verification

To verify the configuration is working properly, check the **MLD Robustness Count** field in the output of the **show mld interfaces** command.

## Limiting the Maximum MLD Message Rate

You can change the limit for the maximum number of MLD packets transmitted in 1 second by the router.

Increasing the maximum number of MLD packets transmitted per second might be useful on a router with a large number of interfaces participating in MLD.

To change the limit for the maximum number of MLD packets the router can transmit in 1 second, include the **maximum-transmit-rate** statement and specify the maximum number of packets per second to be transmitted.

## Enabling MLD Static Group Membership

You can create MLD static group membership to test multicast forwarding without a receiver host. When you enable MLD static group membership, data is forwarded to an interface without that interface receiving membership reports from downstream hosts.

Class-of-service (CoS) adjustment is not supported with MLD static group membership.

When you configure static groups on an interface on which you want to receive multicast traffic, you can specify the number of static groups to be automatically created.

In this example, you create static group ff02::1:ff05:1a8d.

1. Configure the static groups to be created by including the **static** statement and **group** statement and specifying which IPv6 multicast address of the group to be created.

[edit protocols mld]

```
user@host# set interface fe-0/1/2 static group ff02::1:ff05:1a8d
```

2. After you commit the configuration, use the **show configuration protocol mld** command to verify the MLD protocol configuration.

```
user@host> show configuration protocol mld
```

```
interface fe-0/1/2.0 {
 static {
 group ff02::1:ff05:1a8d;
 }
}
```

3. After you have committed the configuration and after the source is sending traffic, use the **show mld group** command to verify that static group ff02::1:ff05:1a8d has been created.

```
user@host> show mld group
Interface: fe-0/1/2
Group: ff02::1:ff05:1a8d
Group mode: Include
Source: fe80::2e0:81ff:fe05:1a8d
Last reported by: Local
Timeout: 0 Type: Static
```



**NOTE:** You must specify a unique address for each group.

---

When you create MLD static group membership to test multicast forwarding on an interface on which you want to receive multicast traffic, you can specify that a number of static groups be automatically created. This is useful when you want to test forwarding to multiple receivers without having to configure each receiver separately.

In this example, you create three groups.

1. Configure the number of static groups to be created by including the **group-count** statement and specifying the number of groups to be created.

```
[edit protocols mld]
user@host# set interface fe-0/1/2 static group ff02::1:ff05:1a8d group-count 3
```

2. After you commit the configuration, use the **show configuration protocol mld** command to verify the MLD protocol configuration.

```
user@host> show configuration protocol mld

interface fe-0/1/2.0 {
 static {
 group ff02::1:ff05:1a8d {
 group-count 3;
 }
 }
}
```

3. After you have committed the configuration and the source is sending traffic, use the **show mld group** command to verify that static groups ff02::1:ff05:1a8d, ff02::1:ff05:1a8e, and ff02::1:ff05:1a8f have been created.

```
user@host> show mld group

Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8d
 Source: fe80::2e0:81ff:fe05:1a8d
 Last reported by: Local
 Timeout: 0 Type: Static
Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8e
 Source: fe80::2e0:81ff:fe05:1a8d
 Last reported by: Local
 Timeout: 0 Type: Static
Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8f
 Source: fe80::2e0:81ff:fe05:1a8d
 Last reported by: Local
 Timeout: 0 Type: Static
```

When you configure static groups on an interface on which you want to receive multicast traffic and you specify the number of static groups to be automatically created, you can also configure the group address to be automatically incremented by some number of addresses.

In this example, you create three groups and increase the group address by an increment of two for each group.

1. Configure the group address increment by including the **group-increment** statement and specifying the number by which the address should be incremented for each group. The increment is specified in a format similar to an IPv6 address.

```
[edit protocols mld]
user@host# set interface fe-0/1/2 static group ff02::1:ff05:1a8d group-count 3
group-increment ::2
```

2. After you commit the configuration, use the **show configuration protocol mld** command to verify the MLD protocol configuration.

```
user@host> show configuration protocol mld

interface fe-0/1/2.0 {
 static {
 group ff02::1:ff05:1a8d {
 group-increment ::2;
 group-count 3;
 }
 }
}
```

3. After you have committed the configuration and the source is sending traffic, use the **show mld group** command to verify that static groups ff02::1:ff05:1a8d, ff02::1:ff05:1a8f, and ff02::1:ff05:1a91 have been created.

```
user@host> show mld group

Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8d
 Source: fe80::2e0:81ff:fe05:1a8d
 Last reported by: Local
 Timeout: 0 Type: Static
Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8f
 Source: fe80::2e0:81ff:fe05:1a8d
 Last reported by: Local
 Timeout: 0 Type: Static
Interface: fe-0/1/2
 Group: ff02::1:ff05:1a91
 Source: fe80::2e0:81ff:fe05:1a8d
 Last reported by: Local
 Timeout: 0 Type: Static
```

When you configure static groups on an interface on which you want to receive multicast traffic and your network is operating in source-specific multicast (SSM) mode, you can specify the multicast source address to be accepted.

If you specify a group address in the SSM range, you must also specify a source.

If a source address is specified in a multicast group that is statically configured, the MLD version must be set to MLDv2 on the interface. MLDv1 is the default value.

In this example, you create group ff02::1:ff05:1a8d and accept IPv6 address fe80::2e0:81ff:fe05:1a8d as the only source.

1. Configure the source address by including the **source** statement and specifying the IPv6 address of the source host.

```
[edit protocols mld]
user@host# set interface fe-0/1/2 static group ff02::1:ff05:1a8d source
fe80::2e0:81ff:fe05:1a8d
```

2. After you commit the configuration, use the **show configuration protocol mld** command to verify the MLD protocol configuration.

```
user@host> show configuration protocol mld

interface fe-0/1/2.0 {
 static {
 group ff02::1:ff05:1a8d {
 source fe80::2e0:81ff:fe05:1a8d;
 }
 }
}
```

3. After you have committed the configuration and the source is sending traffic, use the **show mld group** command to verify that static group ff02::1:ff05:1a8d has been created and that source fe80::2e0:81ff:fe05:1a8d has been accepted.

```
user@host> show mld group

Interface: fe-0/1/2
Group: ff02::1:ff05:1a8d
Source: fe80::2e0:81ff:fe05:1a8d
Last reported by: Local
Timeout: 0 Type: Static
```

When you configure static groups on an interface on which you want to receive multicast traffic, you can specify a number of multicast sources to be automatically accepted.

In this example, you create static group ff02::1:ff05:1a8d and accept fe80::2e0:81ff:fe05:1a8d, fe80::2e0:81ff:fe05:1a8e, and fe80::2e0:81ff:fe05:1a8f as the source addresses.

1. Configure the number of multicast source addresses to be accepted by including the **source-count** statement and specifying the number of sources to be accepted.

```
[edit protocols mld]
user@host# set interface fe-0/1/2 static group ff02::1:ff05:1a8d source
fe80::2e0:81ff:fe05:1a8d source-count 3
```

2. After you commit the configuration, use the **show configuration protocol mld** command to verify the MLD protocol configuration.

```
user@host> show configuration protocol mld

interface fe-0/1/2.0 {
 static {
 group ff02::1:ff05:1a8d {
 source fe80::2e0:81ff:fe05:1a8d {
 source-count 3;
 }
 }
 }
}
```

3. After you have committed the configuration and the source is sending traffic, use the **show mld group** command to verify that static group ff02::1:ff05:1a8d has been created and that sources fe80::2e0:81ff:fe05:1a8d, fe80::2e0:81ff:fe05:1a8e, and fe80::2e0:81ff:fe05:1a8f have been accepted.

```
user@host> show mld group

Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8d
 Source: fe80::2e0:81ff:fe05:1a8d
 Last reported by: Local
 Timeout: 0 Type: Static
Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8d
 Source: fe80::2e0:81ff:fe05:1a8e
 Last reported by: Local
 Timeout: 0 Type: Static
Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8d
 Source: fe80::2e0:81ff:fe05:1a8f
 Last reported by: Local
 Timeout: 0 Type: Static
```

When you configure static groups on an interface on which you want to receive multicast traffic, and specify a number of multicast sources to be automatically accepted, you can also specify the number by which the address should be incremented for each source accepted.

In this example, you create static group ff02::1:ff05:1a8d and accept fe80::2e0:81ff:fe05:1a8d, fe80::2e0:81ff:fe05:1a8f, and fe80::2e0:81ff:fe05:1a91 as the sources.

1. Configure the number of multicast source addresses to be accepted by including the **source-increment** statement and specifying the number of sources to be accepted.

```
[edit protocols mld]
user@host# set interface fe-0/1/2 static group ff02::1:ff05:1a8d source
fe80::2e0:81ff:fe05:1a8d source-count 3 source-increment ::2
```

2. After you commit the configuration, use the **show configuration protocol mld** command to verify the MLD protocol configuration.

```
user@host> show configuration protocol mld
```

```

interface fe-0/1/2.0 {
 static {
 group ff02::1:ff05:1a8d {
 source fe80::2e0:81ff:fe05:1a8d {
 source-count 3;
 source-increment ::2;
 }
 }
 }
}

```

3. After you have committed the configuration and the source is sending traffic, use the **show mld group** command to verify that static group ff02::1:ff05:1a8d has been created and that sources fe80::2e0:81ff:fe05:1a8d, fe80::2e0:81ff:fe05:1a8f, and fe80::2e0:81ff:fe05:1a91 have been accepted.

```
user@host> show mld group
```

```

Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8d
 Source: fe80::2e0:81ff:fe05:1a8d
 Last reported by: Local
 Timeout: 0 Type: Static
Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8d
 Source: fe80::2e0:81ff:fe05:1a8f
 Last reported by: Local
 Timeout: 0 Type: Static
Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8d
 Source: fe80::2e0:81ff:fe05:1a91
 Last reported by: Local
 Timeout: 0 Type: Static

```

```

Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8d
 Group mode: Include
 Source: fe80::2e0:81ff:fe05:1a8d
 Last reported by: Local
 Timeout: 0 Type: Static
 Group: ff02::1:ff05:1a8d
 Group mode: Include
 Source: fe80::2e0:81ff:fe05:1a8f
 Last reported by: Local
 Timeout: 0 Type: Static
 Group: ff02::1:ff05:1a8d
 Group mode: Include
 Source: fe80::2e0:81ff:fe05:1a91
 Last reported by: Local
 Timeout: 0 Type: Static

```

When you configure static groups on an interface on which you want to receive multicast traffic and your network is operating in source-specific multicast (SSM) mode, you can specify that certain multicast source addresses be excluded.

By default the multicast source address configured in a static group operates in include mode. In include mode the multicast traffic for the group is accepted from the configured source address. You can also configure the static group to operate in exclude mode. In exclude mode the multicast traffic for the group is accepted from any address other than the configured source address.

If a source address is specified in a multicast group that is statically configured, the MLD version must be set to MLDv2 on the interface. MLDv1 is the default value.

In this example, you exclude address `fe80::2e0:81ff:fe05:1a8d` as a source for group `ff02::1:ff05:1a8d`.

1. Configure a multicast static group to operate in exclude mode by including the **exclude** statement and specifying which IPv6 source address to be excluded.

[edit protocols mld]

```
user@host# set interface fe-0/1/2 static group ff02::1:ff05:1a8d exclude source
fe80::2e0:81ff:fe05:1a8d
```

2. After you commit the configuration, use the **show configuration protocol mld** command to verify the MLD protocol configuration.

```
user@host> show configuration protocol mld

interface fe-0/1/2.0 {
 static {
 group ff02::1:ff05:1a8d {
 exclude;
 source fe80::2e0:81ff:fe05:1a8d;
 }
 }
}
```

3. After you have committed the configuration and the source is sending traffic, use the **show mld group detail** command to verify that static group `ff02::1:ff05:1a8d` has been created and that the static group is operating in exclude mode.

```
user@host> show mld group detail
Interface: fe-0/1/2
 Group: ff02::1:ff05:1a8d
 Group mode: Exclude
 Source: fe80::2e0:81ff:fe05:1a8d
 Last reported by: Local
 Timeout: 0 Type: Static
```

Similar configuration is available for IPv4 multicast traffic using the IGMP protocol.



Example: Recording MLD Join and Leave Events

This example shows how to determine whether MLD tuning is needed in a network by configuring the routing device to record MLD join and leave events.

- [Requirements on page 265](#)
- [Overview on page 265](#)
- [Configuration on page 265](#)
- [Verification on page 267](#)

Requirements

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Enable IPv6 unicast routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Enable PIM. See “PIM Overview” on page 13.

Overview

Table 9 on page 265 describes the recordable MLD join and leave events.

Table 9: MLD Event Messages

| ERRMSG Tag                 | Definition                                                   |
|----------------------------|--------------------------------------------------------------|
| RPD_MLD_JOIN               | Records MLD join events.                                     |
| RPD_MLD_LEAVE              | Records MLD leave events.                                    |
| RPD_MLD_ACCOUNTING_ON      | Records when MLD accounting is enabled on an MLD interface.  |
| RPD_MLD_ACCOUNTING_OFF     | Records when MLD accounting is disabled on an MLD interface. |
| RPD_MLD_MEMBERSHIP_TIMEOUT | Records MLD membership timeout events.                       |

Configuration

CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set protocols mld interface fe-0/1/0.2 accounting
set system syslog file mld-events any info
```

```

set system syslog file mld-events match ".*RPD_MLD_JOIN.* | .*.RPD_MLD_LEAVE.* |
.*RPD_MLD_ACCOUNTING.* | .*.RPD_MLD_MEMBERSHIP_TIMEOUT.*"
set system syslog file mld-events archive size 100000
set system syslog file mld-events archive files 3
set system syslog file mld-events archive transfer-interval 1440
set system syslog file mld-events archive archive-sites "ftp://user@host1//var/tmp"
password "anonymous"
set system syslog file mld-events archive archive-sites "ftp://user@host2//var/tmp"
password "test"

```

**Step-by-Step Procedure** The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure recording of MLD join and leave events:

1. Enable accounting globally or on an MLD interface. This example shows the interface configuration.

```

[edit protocols mld]
user@host# set interface fe-0/1/0.2 accounting

```

2. Configure the events to be recorded, and filter the events to a system log file with a descriptive filename, such as **mld-events**.

```

[edit system syslog file mld-events]
user@host# set any info
[edit system syslog file mld-events]
user@host# set match ".*RPD_MLD_JOIN.* | .*.RPD_MLD_LEAVE.* |
.*RPD_MLD_ACCOUNTING.* | .*.RPD_MLD_MEMBERSHIP_TIMEOUT.*"

```

3. Periodically archive the log file.

This example rotates the file every 24 hours (1440 minutes) when it reaches 100 KB and keeps three files.

```

[edit system syslog file mld-events]
user@host# set archive size 100000
[edit system syslog file mld-events]
user@host# set archive files 3
[edit system syslog file mld-events]
user@host# set archive archive-sites "ftp://user@host1//var/tmp" password
"anonymous"
[edit system syslog file mld-events]
user@host# set archive archive-sites "ftp://user@host2//var/tmp" password "test"
[edit system syslog file mld-events]
user@host# set archive transfer-interval 1440
[edit system syslog file mld-events]
user@host# set archive start-time 2011-01-07:12:30

```

4. If you are done configuring the device, commit the configuration.

```

[edit system syslog file mld-events]]
user@host# commit

```

## Verification

You can view the system log file by running the **file show** command.

```
user@host> file show mld-events
```

You can monitor the system log file as entries are added to the file by running the **monitor start** and **monitor stop** commands.

```
user@host> monitor start mld-events
```

```
*** mld-events ***
Apr 16 13:08:23 host mgd[16416]: UI_CMDLINE_READ_LINE: User 'user', command 'run
monitor start mld-events '
monitor
```

## Configuring the Number of MLD Multicast Group Joins on Logical Interfaces

The **group-limit** statement enables you to limit the number of MLD multicast group joins for logical interfaces. When this statement is enabled on a router running MLD version 2, the limit is applied upon receipt of the group report. Once the group limit is reached, subsequent join requests are rejected.

When configuring limits for MLD multicast groups, keep the following in mind:

- Each any-source group (\*G) counts as one group toward the limit.
- Each source-specific group (S,G) counts as one group toward the limit.
- Groups in MLDv2 exclude mode are counted toward the limit.
- Multiple source-specific groups count individually toward the group limit, even if they are for the same group. For example, (S1, G1) and (S2, G1) would count as two groups toward the configured limit.
- Combinations of any-source groups and source-specific groups count individually toward the group limit, even if they are for the same group. For example, (\*, G1) and (S, G1) would count as two groups toward the configured limit.
- Configuring and committing a group limit on a network that is lower than what already exists on the network results in the removal of all groups from the configuration. The groups must then request to rejoin the network (up to the newly configured group limit).
- You can dynamically limit multicast groups on MLD logical interfaces by using dynamic profiles.

To limit multicast group joins on an MLD logical interface:

1. Access the logical interface at the MLD protocol hierarchy level.

```
[edit]
user@host# edit protocols mld interface interface-name
```

2. Specify the group limit for the interface.

```
[edit protocols mld interface interface-name]
```

```
user@host# set group-limit limit
```

## Tracing MLD Protocol Traffic

Tracing operations record detailed messages about the operation of routing protocols, such as the various types of routing protocol packets sent and received, and routing policy actions. You can specify which trace operations are logged by including specific tracing flags. The following table describes the flags that you can include.

| Flag                       | Description                                                                        |
|----------------------------|------------------------------------------------------------------------------------|
| <b>all</b>                 | Trace all operations.                                                              |
| <b>client-notification</b> | Trace notifications.                                                               |
| <b>general</b>             | Trace general flow.                                                                |
| <b>group</b>               | Trace group operations.                                                            |
| <b>host-notification</b>   | Trace host notifications.                                                          |
| <b>leave</b>               | Trace leave group messages.                                                        |
| <b>mtrace</b>              | Trace mtrace packets. Use the <b>mtrace</b> command to troubleshoot the software.  |
| <b>normal</b>              | Trace normal events.                                                               |
| <b>packets</b>             | Trace all MLD packets.                                                             |
| <b>policy</b>              | Trace policy processing.                                                           |
| <b>query</b>               | Trace MLD membership query messages, including general and group-specific queries. |
| <b>report</b>              | Trace membership report messages.                                                  |
| <b>route</b>               | Trace routing information.                                                         |
| <b>state</b>               | Trace state transitions.                                                           |
| <b>task</b>                | Trace task processing.                                                             |
| <b>timer</b>               | Trace timer processing.                                                            |

In the following example, tracing is enabled for all routing protocol packets. Then tracing is narrowed to focus only on MLD packets of a particular type. To configure tracing operations for MLD:

1. (Optional) Configure tracing at the routing options level to trace all protocol packets.

```
[edit routing-options traceoptions]
user@host# set file all-packets-trace
user@host# set flag all
```

2. Configure the filename for the MLD trace file.

```
[edit protocols mld traceoptions]
user@host# set file mld-trace
```

3. (Optional) Configure the maximum number of trace files.

```
[edit protocols mld traceoptions]
user@host# set file files 5
```

4. (Optional) Configure the maximum size of each trace file.

```
[edit protocols mld traceoptions]
user@host# set file size 1m
```

5. (Optional) Enable unrestricted file access.

```
[edit protocols mld traceoptions]
user@host# set file world-readable
```

6. Configure tracing flags. Suppose you are troubleshooting issues with a particular interface. The following example shows how to flag all events for packets associated with the interface name.

```
[edit protocols mld traceoptions]
user@host# set flag all | match fe-1/0/1.0
```

7. View the trace file.

```
user@host> file list /var/log
user@host> file show /var/log/mld-trace
```

## Disabling MLD

To disable MLD on an interface, include the **disable** statement:

```
interface interface-name {
 disable;
}
```

You can include this statement at the following hierarchy levels:

- [edit protocols **mld**]
- [edit logical-systems *logical-system-name* protocols **mld**]

Related  
Documentation

- [Configuring IGMP on page 221](#)



## CHAPTER 7

# Internet Group Management Protocol Snooping

- [Example: Configuring IGMP Snooping on page 271](#)

## Example: Configuring IGMP Snooping

---

- [Understanding Multicast Snooping on page 271](#)
- [Understanding IGMP Snooping on page 272](#)
- [IGMP Snooping Interfaces and Forwarding on page 273](#)
- [IGMP Snooping and Proxies on page 273](#)
- [Multicast-Router Interfaces and IGMP Snooping Proxy Mode on page 274](#)
- [Host-Side Interfaces and IGMP Snooping Proxy Mode on page 275](#)
- [IGMP Snooping and Bridge Domains on page 275](#)
- [Configuring IGMP Snooping on page 275](#)
- [Configuring VLAN-Specific IGMP Snooping Parameters on page 276](#)
- [Example: Configuring IGMP Snooping on page 277](#)
- [Configuring IGMP Snooping Trace Operations on page 283](#)

## Understanding Multicast Snooping

Network devices such as routers operate mainly at the packet level, or Layer 3. Other network devices such as bridges or LAN switches operate mainly at the frame level, or Layer 2. Multicasting functions mainly at the packet level, Layer 3, but there is a way to map Layer 3 IP multicast group addresses to Layer 2 MAC multicast group addresses at the frame level.

Routers can handle both Layer 2 and Layer 3 addressing information because the frame and its addresses must be processed to access the encapsulated packet inside. Routers can run Layer 3 multicast protocols such as PIM or IGMP and determine where to forward multicast content or when a host on an interface joins or leaves a group. However, bridges and LAN switches, as Layer 2 devices, are not supposed to have access to the multicast information inside the packets that their frames carry.

How then are bridges and other Layer 2 devices to determine when a device on an interface joins or leaves a multicast tree, or whether a host on an attached LAN wants to receive the content of a particular multicast group?

The answer is for the Layer 2 device to implement multicast snooping. Multicast snooping is a general term and applies to the process of a Layer 2 device “snooping” at the Layer 3 packet content to determine which actions are taken to process or forward a frame. There are more specific forms of snooping, such as IGMP snooping or PIM snooping. In all cases, snooping involves a device configured to function at Layer 2 having access to normally “forbidden” Layer 3 (packet) information. Snooping makes multicasting more efficient in these devices.

## Understanding IGMP Snooping

Snooping is a general way for Layer 2 devices, such as Juniper Networks MX Series Ethernet Services Routers, to implement a series of procedures to “snoop” at the Layer 3 packet content to determine which actions are to be taken to process or forward a frame. More specific forms of snooping, such as Internet Group Membership Protocol (IGMP) snooping or Protocol Independent Multicast (PIM) snooping, are used with multicast.

Layer 2 devices (LAN switches or bridges) handle multicast packets and the frames that contain them much in the same way the Layer 3 devices (routers) handle broadcasts. So, a Layer 2 switch processes an arriving frame having a multicast destination media access control (MAC) address by forwarding a copy of the packet (frame) onto each of the other network interfaces of the switch that are in a forwarding state.

However, this approach (sending multicast frames everywhere the device can) is not the most efficient use of network bandwidth, particularly for IPTV applications. IGMP snooping functions by “snooping” at the IGMP packets received by the switch interfaces and building a multicast database similar to that a multicast router builds in a Layer 3 network. Using this database, the switch can forward multicast traffic only onto downstream interfaces with interested receivers, and this technique allows more efficient use of network bandwidth.

You configure IGMP snooping for each bridge on the router. A bridge instance without qualified learning has just one learning domain. For a bridge instance with qualified learning, snooping will function separately within each learning domain in the bridge. That is, IGMP snooping and multicast forwarding will proceed independently in each learning domain in the bridge.

This discussion focuses on bridge instances without qualified learning (those forming one learning domain on the device). Therefore, all the interfaces mentioned are logical interfaces of the bridge or VPLS instance.

Several related concepts are important when discussing IGMP snooping:

- Bridge or VPLS instance interfaces are either multicast-router interfaces or host-side interfaces.
- IGMP snooping supports proxy mode or without-proxy mode.





**NOTE:** When integrated routing and bridging (IRB) is used, if the router is an IGMP querier, any leave message received on any Layer 2 interface will cause a group-specific query on all Layer 2 interfaces (as a result of this practice, some corresponding reports might be received on all Layer 2 interfaces). However, if some of the Layer 2 interfaces are also router (Layer 3) interfaces, reports and leaves from other Layer 2 interfaces will not be forwarded on those interfaces.

If an IRB interface is used as an outgoing interface in a multicast forwarding cache entry (as determined by the routing process), then the output interface list is expanded into a subset of the Layer 2 interface in the corresponding bridge. The subset is based on the snooped multicast membership information, according to the multicast forwarding cache entry installed by the snooping process for the bridge.

If no snooping is configured, the IRB output interface list is expanded to all Layer 2 interfaces in the bridge.

The Junos OS does not support IGMP snooping in a VPLS configuration on a virtual switch. This configuration is disallowed in the CLI.

## IGMP Snooping Interfaces and Forwarding

IGMP snooping divides the device interfaces into multicast-router interfaces and host-side interfaces. A multicast-router interface is an interface in the direction of a multicasting router. An interface on the bridge is considered a multicast-router interface if it meets at least one of the following criteria:

- It is statically configured as a multicast-router interface in the bridge instance.
- IGMP queries are being received on the interface.

All other interfaces that are not multicast-router interfaces are considered host-side interfaces.

Any multicast traffic received on a bridge interface with IGMP snooping configured will be forwarded according to following rules:

- Any IGMP packet is sent to the Routing Engine for snooping processing.
- Other multicast traffic with destination address 224.0.0/24 is flooded onto all other interfaces of the bridge.
- Other multicast traffic is sent to all the multicast-router interfaces but only to those host-side interfaces that have hosts interested in receiving that multicast group.

## IGMP Snooping and Proxies

Without a proxy arrangement, IGMP snooping does not generate or introduce queries and reports. It will only “snoop” reports received from all of its interfaces (including multicast-router interfaces) to build its state and group (S,G) database.

Without a proxy, IGMP messages are processed as follows:

- Query—All general and group-specific IGMP query messages received on a multicast-router interface are forwarded to all other interfaces (both multicast-router interfaces and host-side interfaces) on the bridge.
- Report—IGMP reports received on any interface of the bridge are forwarded toward other multicast-router interfaces. The receiving interface is added as an interface for that group if a multicast routing entry exists for this group. Also, a group timer is set for the group on that interface. If this timer expires (that is, there was no report for this group during the IGMP group timer period), then the interface is removed as an interface for that group.
- Leave—Any IGMP leave message received on any interface of the bridge. The Leave Group message reduces the time it takes for the multicast router to stop forwarding multicast traffic when there are no longer any members in the host group.

Proxy snooping reduces the number of IGMP reports sent toward an IGMP router.



**NOTE:** With proxy snooping configured, an IGMP router is not able to perform host tracking.

As proxy for its host-side interfaces, IGMP snooping in proxy mode replies to the queries it receives from an IGMP router on a multicast-router interface. On the host-side interfaces, IGMP snooping in proxy mode behaves as an IGMP router and sends general and group-specific queries on those interfaces.



**NOTE:** Only group-specific queries are generated by IGMP snooping directly. General queries received from the multicast-router interfaces are flooded to host-side interfaces.

All the queries generated by IGMP snooping are sent using 0.0.0.0 as the source address. Also, all reports generated by IGMP snooping are sent with 0.0.0.0 as the source address unless there is a configured source address to use.

Proxy mode functions differently on multicast-router interfaces than it does on host-side interfaces.

## Multicast-Router Interfaces and IGMP Snooping Proxy Mode

On multicast-router interfaces, in response to IGMP queries, IGMP snooping in proxy mode sends reports containing aggregate information on groups learned on all host-side interfaces of the bridge.

Besides replying to queries, IGMP snooping in proxy mode forwards all queries, reports, and leaves received on a multicast-router interface to other multicast-router interfaces. IGMP snooping keeps the membership information learned on this interface but does not send a group-specific query for leave messages received on this interface. It simply

times out the groups learned on this interface if there are no reports for the same group within the timer duration.



**NOTE:** For the hosts on all the multicast-router interfaces, it is the IGMP router, not the IGMP snooping proxy, that generates general and group-specific queries.

## Host-Side Interfaces and IGMP Snooping Proxy Mode

No reports are sent on host-side interfaces by IGMP snooping in proxy mode. IGMP snooping processes reports received on these interfaces and sends group-specific queries onto host-side interfaces when it receives a leave message on the interface. Host-side interfaces do not generate periodic general queries, but forwards or floods general queries received from multicast-router interfaces.

If a group is removed from a host-side interface and this was the last host-side interface for that group, a leave is sent to the multicast-router interfaces. If a group report is received on a host-side interface and this was the first host-side interface for that group, a report is sent to all multicast-router interfaces.

## IGMP Snooping and Bridge Domains

IGMP snooping on a VLAN is only allowed for the legacy **vlan-id all** case. In other cases, there is a specific bridge domain configuration that determines the VLAN-specific configuration for IGMP snooping.

## Configuring IGMP Snooping

To configure Internet Group Management Protocol (IGMP) snooping, include the **igmp-snooping** statement:

```
igmp-snooping {
 immediate-leave;
 interface interface-name {
 group-limit limit;
 host-only-interface;
 immediate-leave;
 multicast-router-interface;
 static {
 group ip-address {
 source ip-address;
 }
 }
 }
 proxy {
 source-address ip-address;
 }
 query-interval seconds;
 query-last-member-interval seconds;
 query-response-interval seconds;
 robust-count number;
 vlan vlan-id {
```

```
immediate-leave;
interface interface-name {
 group-limit limit;
 host-only-interface;
 immediate-leave;
 multicast-router-interface;
 static {
 group ip-address {
 source ip-address;
 }
 }
}
proxy {
 source-address ip-address;
}
query-interval seconds;
query-last-member-interval seconds;
query-response-interval seconds;
robust-count number;
}
```

You can include this statement at the following hierarchy levels:

- [edit bridge-domains *bridge-domain-name* protocols]
- [edit routing-instances *routing-instance-name* bridge-domains *bridge-domain-name* protocols]

By default, IGMP snooping is not enabled. Statements configured at the VLAN level apply only to that particular VLAN.

## Configuring VLAN-Specific IGMP Snooping Parameters

All of the IGMP snooping statements configured with the **igmp-snooping** statement, with the exception of the **traceoptions** statement, can be qualified with the same statement at the VLAN level. To configure IGMP snooping parameters at the VLAN level, include the **vlan** statement:

```
vlan vlan-id;
immediate-leave;
interface interface-name {
 group-limit limit;
 host-only-interface;
 multicast-router-interface;
 static {
 group ip-address {
 source ip-address;
 }
 }
}
proxy {
 source-address ip-address;
}
query-interval seconds;
query-last-member-interval seconds;
```

```

 query-response-interval seconds;
 robust-count number;
}

```

You can include this statement at the following hierarchy levels:

- [edit bridge-domains *bridge-domain-name* protocols igmp-snooping]
- [edit routing-instances *routing-instance-name* bridge-domains *bridge-domain-name* protocols igmp-snooping]

## Example: Configuring IGMP Snooping

This example shows how to configure IGMP snooping. IGMP snooping can reduce unnecessary traffic from IP multicast applications.

- [Requirements on page 277](#)
- [Overview and Topology on page 277](#)
- [Configuration on page 281](#)
- [Verification on page 283](#)

### Requirements

This example uses the following hardware components:

- One MX Series router
- One Layer 3 device functioning as a multicast router

Before you begin:

- Configure the interfaces.
- Configure an interior gateway protocol. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure a multicast protocol. This feature works with the following multicast protocols:
  - DVMRP
  - PIM-DM
  - PIM-SM
  - PIM-SSM

### Overview and Topology

IGMP snooping controls multicast traffic in a switched network. When IGMP snooping is not enabled, the Layer 2 device broadcasts multicast traffic out of all of its ports, even if the hosts on the network do not want the multicast traffic. With IGMP snooping enabled, a Layer 2 device monitors the IGMP join and leave messages sent from each connected host to a multicast router. This enables the Layer 2 device to keep track of the multicast groups and associated member ports. The Layer 2 device uses this information to make

intelligent decisions and to forward multicast traffic to only the intended destination hosts.

This example includes the following statements:

- **proxy**—Enables the Layer 2 device to actively filter IGMP packets to reduce load on the multicast router. Joins and leaves heading upstream to the multicast router are filtered so that the multicast router has a single entry for the group, regardless of how many active listeners have joined the group. When a listener leaves a group but other listeners remain in the group, the leave message is filtered because the multicast router does not need this information. The status of the group remains the same from the router's point of view.
- **immediate-leave**—When only one IGMP host is connected, the **immediate-leave** statement enables the multicast router to immediately remove the group membership from the interface and suppress the sending of any group-specific queries for the multicast group.

When you configure this feature on IGMPv2 interfaces, ensure that the IGMP interface has only one IGMP host connected. If more than one IGMPv2 host is connected to a LAN through the same interface, and one host sends a leave message, the router removes all hosts on the interface from the multicast group. The router loses contact with the hosts that properly remain in the multicast group until they send join requests in response to the next general multicast listener query from the router.

When IGMP snooping is enabled on a router running IGMP version 3 (IGMPv3) snooping, after the router receives a report with the type `BLOCK_OLD_SOURCES`, the router suppresses the sending of group-and-source queries but relies on the Junos OS host-tracking mechanism to determine whether or not it removes a particular source group membership from the interface.

- **query-interval**—Enables you to change the number of IGMP messages sent on the subnet by configuring the interval at which the IGMP querier router sends general host-query messages to solicit membership information.

By default, the query interval is 125 seconds. You can configure any value in the range 1 through 1024 seconds.

- **query-last-member-interval**—Enables you to change the amount of time it takes a device to detect the loss of the last member of a group.

The last-member query interval is the maximum amount of time between group-specific query messages, including those sent in response to leave-group messages.

By default, the last-member query interval is 1 second. You can configure any value in the range 0.1 through 0.9 seconds, and then 1-second intervals from 1 through 1024 seconds.

- **query-response-interval**—Configures how long the router waits to receive a response from its host-query messages.

By default, the query response interval is 10 seconds. You can configure any value in the range 1 through 1024 seconds. However, this interval must be less than the interval set in the **query-interval** statement.

- **robust-count**—Provides fine-tuning to allow for expected packet loss on a subnet. It is basically the number of intervals to wait before timing out a group. You can wait more intervals if subnet packet loss is high and IGMP report messages might be lost.

By default, the robust count is 2. You can configure any value in the range 2 through 10 intervals.

- **group-limit**—Configures a limit for the number of multicast groups (or [S,G] channels in IGMPv3) that can join an interface. After this limit is reached, new reports are ignored and all related flows are discarded, not flooded.

By default, there is no limit to the number of groups that can join an interface. You can configure a limit in the range 0 through a 32-bit number.

- **host-only-interface**—Configure an IGMP snooping interface to be an exclusively host-side interface. On a host-side interface, received IGMP queries are dropped.

By default, an interface can face either other multicast routers or hosts.

- **multicast-router-interface**—Configures an IGMP snooping interface to be an exclusively router-facing interface.

By default, an interface can face either other multicast routers or hosts.

- **static**—Configures an IGMP snooping interface with multicast groups statically.

By default, the router learns about multicast groups on the interface dynamically.

[Figure 43 on page 280](#) shows networks without IGMP snooping. Suppose host A is an IP multicast sender and hosts B and C are multicast receivers. The router forwards IP multicast traffic only to those segments with registered receivers (hosts B and C). However, the Layer 2 devices flood the traffic to all hosts on all interfaces.

Figure 43: Networks Without IGMP Snooping Configured

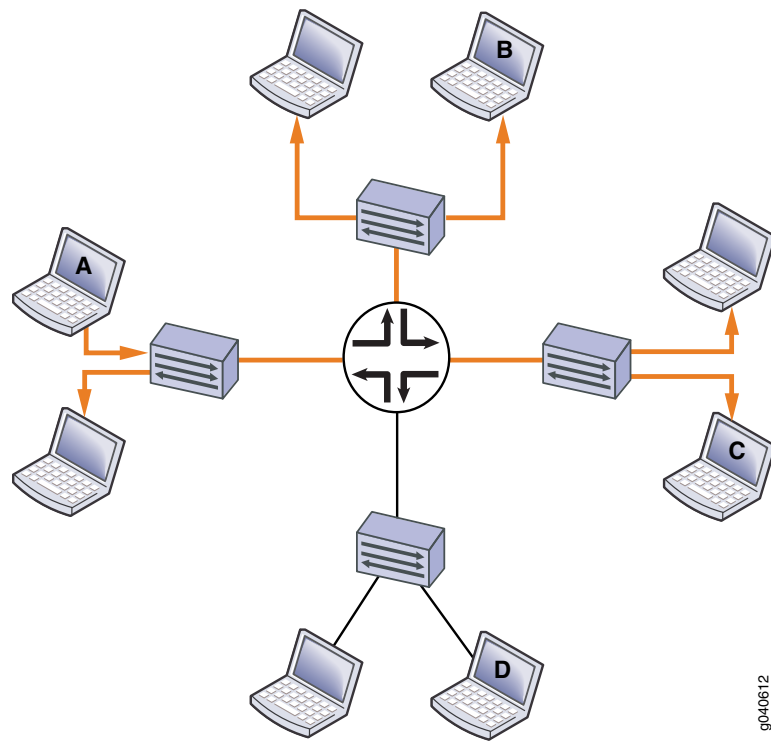
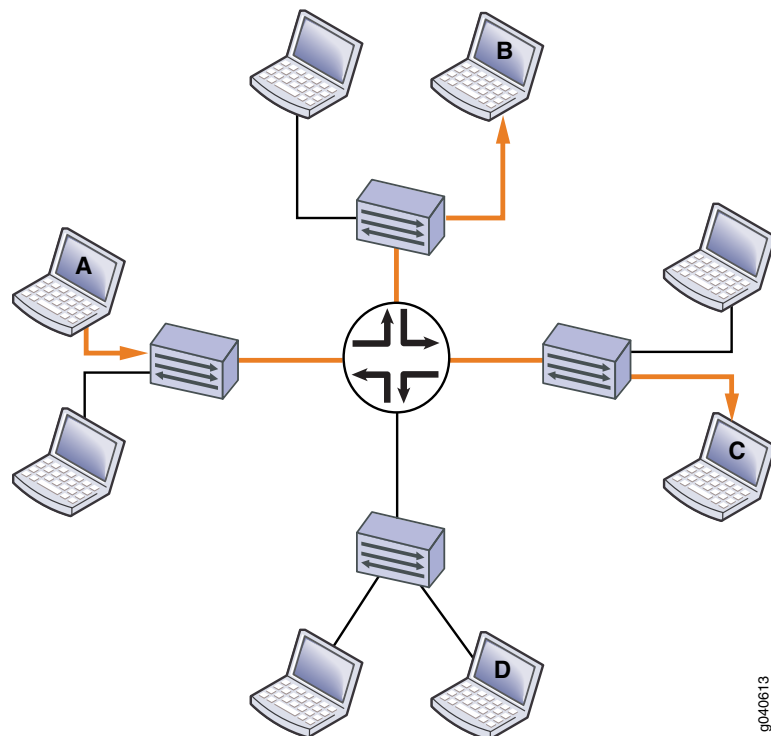


Figure 44 on page 281 shows the same networks with IGMP snooping configured. The Layer 2 devices forward multicast traffic to registered receivers only.



Figure 44: Networks With IGMP Snooping Configured



9040613

### Configuration

#### CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```

set bridge-domains domain1 domain-type bridge
set bridge-domains domain1 interface ge-0/0/1.1
set bridge-domains domain1 interface ge-0/0/2.1
set bridge-domains domain1 interface ge-0/0/3.1
set bridge-domains domain1 protocols igmp-snooping query-interval 200
set bridge-domains domain1 protocols igmp-snooping query-response-interval 0.4
set bridge-domains domain1 protocols igmp-snooping query-last-member-interval 0.1
set bridge-domains domain1 protocols igmp-snooping robust-count 4
set bridge-domains domain1 protocols igmp-snooping immediate-leave
set bridge-domains domain1 protocols igmp-snooping proxy
set bridge-domains domain1 protocols igmp-snooping interface ge-0/0/1.1
 host-only-interface
set bridge-domains domain1 protocols igmp-snooping interface ge-0/0/1.1 group-limit
 50
set bridge-domains domain1 protocols igmp-snooping interface ge-0/0/3.1 static group
 225.100.100.100
set bridge-domains domain1 protocols igmp-snooping interface ge-0/0/2.1
 multicast-router-interface

```

**Step-by-Step Procedure** The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure IGMP snooping:

1. Configure the bridge domain.

```
[edit bridge-domains domain1]
user@host# set domain-type bridge
user@host# set interface ge-0/0/1.1
user@host# set interface ge-0/0/2.1
user@host# set interface ge-0/0/3.1
```

2. Enable IGMP snooping and configure the router to serve as a proxy.

```
[edit bridge-domains domain1]
user@host# set protocols igmp-snooping proxy
```

3. Configure the limit for the number of multicast groups allowed on the **ge-0/0/1.1** interface to 50.

```
[edit bridge-domains domain1]
user@host# set protocols igmp-snooping interface ge-0/0/1.1 group-limit 50
```

4. Configure the router to immediately remove a group membership from an interface when it receives a leave message from that interface without waiting for any other IGMP messages to be exchanged.

```
[edit bridge-domains domain1]
user@host# set protocols igmp-snooping immediate-leave
```

5. Statically configure IGMP group membership on a port.

```
[edit bridge-domains domain1]
user@host# set protocols igmp-snooping interface ge-0/0/3.1 static group
225.100.100.100
```

6. Configure an interface to be an exclusively router-facing interface (to receive multicast traffic).

```
[edit bridge-domains domain1]
user@host# set protocols igmp-snooping interface ge-0/0/2.1
multicast-router-interface
```

7. Configure an interface to be an exclusively host-facing interface (to drop IGMP query messages).

```
[edit bridge-domains domain1]
user@host# set protocols igmp-snooping interface ge-0/0/1.1 host-only-interface
```

8. Configure the IGMP message intervals and robustness count.

```
[edit bridge-domains domain1]
user@host# set protocols igmp-snooping robust-count 4
user@host# set protocols igmp-snooping query-last-member-interval 0.1
user@host# set protocols igmp-snooping query-interval 200
user@host# set protocols igmp-snooping query-response-interval 0.4
```

9. If you are done configuring the device, commit the configuration.

```
user@host# commit
```

**Results** Confirm your configuration by entering the **show bridge-domains** command.

```
user@host# show bridge-domains
domain1 {
 domain-type bridge;
 interface ge-0/0/1.1;
 interface ge-0/0/2.1;
 interface ge-0/0/3.1;
 protocols {
 igmp-snooping {
 query-interval 200;
 query-response-interval 0.4;
 query-last-member-interval 0.1;
 robust-count 4;
 immediate-leave;
 proxy;
 interface ge-0/0/1.1 {
 host-only-interface;
 group-limit 50;
 }
 interface ge-0/0/3.1 {
 static {
 group 225.100.100.100;
 }
 }
 interface ge-0/0/2.1 {
 multicast-router-interface;
 }
 }
 }
}
```

### Verification

To verify the configuration, run the following commands:

- `show igmp snooping interface`
- `show igmp snooping membership`
- `show igmp snooping statistics`

## Configuring IGMP Snooping Trace Operations

Tracing operations record detailed messages about the operation of routing protocols, such as the various types of routing protocol packets sent and received, and routing policy

actions. You can specify which trace operations are logged by including specific tracing flags. The following table describes the flags that you can include.

| Flag                       | Description                               |
|----------------------------|-------------------------------------------|
| <b>all</b>                 | Trace all operations.                     |
| <b>client-notification</b> | Trace notifications.                      |
| <b>general</b>             | Trace general flow.                       |
| <b>group</b>               | Trace group operations.                   |
| <b>host-notification</b>   | Trace host notifications.                 |
| <b>leave</b>               | Trace leave group messages (IGMPv2 only). |
| <b>normal</b>              | Trace normal events.                      |
| <b>packets</b>             | Trace all IGMP packets.                   |
| <b>policy</b>              | Trace policy processing.                  |
| <b>query</b>               | Trace IGMP membership query messages.     |
| <b>report</b>              | Trace membership report messages.         |
| <b>route</b>               | Trace routing information.                |
| <b>state</b>               | Trace state transitions.                  |
| <b>task</b>                | Trace routing protocol task processing.   |
| <b>timer</b>               | Trace timer processing.                   |

You can configure tracing operations for IGMP snooping globally or in a routing instance. The following example shows the global configuration.

To configure tracing operations for IGMP snooping:

1. Configure the filename for the trace file.  

```
[edit bridge-domains domain1 protocols igmp-snooping traceoptions]
user@host# set file igmp-snoop-trace
```
2. (Optional) Configure the maximum number of trace files.  

```
[edit bridge-domains domain1 protocols igmp-snooping traceoptions]
user@host# set file files 5
```
3. (Optional) Configure the maximum size of each trace file.  

```
[edit bridge-domains domain1 protocols igmp-snooping traceoptions]
```

```
user@host# set file size 1m
```

4. (Optional) Enable unrestricted file access.

```
[edit bridge-domains domain1 protocols igmp-snooping traceoptions]
```

```
user@host# set file world-readable
```

5. Configure tracing flags. Suppose you are troubleshooting issues with a policy related to received packets on a particular logical interface with an IP address of 192.168.0.1. The following example shows how to flag all policy events for received packets associated with the IP address.

```
[edit bridge-domains domain1 protocols igmp-snooping traceoptions]
```

```
user@host# set flag policy receive | match 192.168.0.1
```

6. View the trace file.

```
user@host> file list /var/log
```

```
user@host> file show /var/log/igmp-snoop-trace
```

**Related Documentation**

- [Understanding Multicast Snooping on page 271](#)



## CHAPTER 8

# Multicast Snooping

- [Example: Configuring Multicast Snooping on page 287](#)

### Example: Configuring Multicast Snooping

---

- [Understanding Multicast Snooping on page 287](#)
- [Understanding Multicast Snooping and VPLS Root Protection on page 288](#)
- [Configuring Multicast Snooping on page 288](#)
- [Example: Configuring Multicast Snooping on page 289](#)
- [Enabling Bulk Updates for Multicast Snooping on page 294](#)
- [Enabling Multicast Snooping for Multichassis Link Aggregation Group Interfaces on page 295](#)

### Understanding Multicast Snooping

Network devices such as routers operate mainly at the packet level, or Layer 3. Other network devices such as bridges or LAN switches operate mainly at the frame level, or Layer 2. Multicasting functions mainly at the packet level, Layer 3, but there is a way to map Layer 3 IP multicast group addresses to Layer 2 MAC multicast group addresses at the frame level.

Routers can handle both Layer 2 and Layer 3 addressing information because the frame and its addresses must be processed to access the encapsulated packet inside. Routers can run Layer 3 multicast protocols such as PIM or IGMP and determine where to forward multicast content or when a host on an interface joins or leaves a group. However, bridges and LAN switches, as Layer 2 devices, are not supposed to have access to the multicast information inside the packets that their frames carry.

How then are bridges and other Layer 2 devices to determine when a device on an interface joins or leaves a multicast tree, or whether a host on an attached LAN wants to receive the content of a particular multicast group?

The answer is for the Layer 2 device to implement multicast snooping. Multicast snooping is a general term and applies to the process of a Layer 2 device “snooping” at the Layer 3 packet content to determine which actions are taken to process or forward a frame. There are more specific forms of snooping, such as IGMP snooping or PIM snooping. In all cases, snooping involves a device configured to function at Layer 2 having access to

normally “forbidden” Layer 3 (packet) information. Snooping makes multicasting more efficient in these devices.

## Understanding Multicast Snooping and VPLS Root Protection

Snooping occurs when a Layer 2 protocol such as a spanning-tree protocol is aware of the operational details of a Layer 3 protocol such as the Internet Group Management Protocol (IGMP) or other multicast protocol. Snooping is necessary when Layer 2 devices such as VLAN switches must be aware of Layer 3 information such as the media access control (MAC) addresses of members of a multicast group.

*VPLS root protection* is a spanning-tree protocol process in which only one interface in a multihomed environment is actively forwarding spanning-tree protocol frames. This protects the root of the spanning tree against bridging loops, but also prevents both devices in the multihomed topology from snooped information, such as IGMP membership reports.

For example, consider a collection of multicast-capable hosts connected to two customer edge (CE) routers (CE1 and CE2) which are connected to each other (a CE1–CE2 link is configured) and multihomed to two provider edge (PE) routers (PE1 and PE2, respectively). The active PE only receives forwarded spanning-tree protocol information on the active PE–CE link, due to root protection operation. As long as the CE1–CE2 link is operational, this is not a problem. However, if the link between CE1 and CE2 fails, and the other PE becomes the active spanning-tree protocol link, no multicast snooping information is available on the new active PE. The new active PE will not forward multicast traffic to the CE and the hosts serviced by this CE router.

The service outage is corrected once the hosts send new group membership IGMP reports to the CE routers. However, the service outage can be avoided if multicast snooping information is available to both PEs in spite of normal spanning-tree protocol root protection operation.



**NOTE:** You can configure multicast snooping to ignore messages about spanning tree topology changes for the virtual-switch routing-instance type only.

---

## Configuring Multicast Snooping

To configure the general multicast snooping parameters for MX Series routers, include the **multicast-snooping-options** statement:

```
multicast-snooping-options {
 flood-groups [ip-addresses];
 forwarding-cache {
 threshold suppress value <reuse value>;
 }
 graceful-restart <restart-duration seconds>;
 ignore-stp-topology-change;
 multichassis-lag-replicate-state;
 nexthop-hold-time milliseconds;
 traceoptions {
```



```

 file filename <files number> <size size> <world-readable | no-world-readable>;
 flag flag <flag-modifier> <disable>;
 }
}

```

You can include this statement at the following hierarchy levels:

- [edit bridge-domains *bridge-domain-name*]
- [edit routing-instances *routing-instance-name*]
- [edit routing-instances *routing-instance-name* bridge-domains *bridge-domain-name*]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name*]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* bridge-domains *bridge-domain-name*]

By default, multicast snooping is disabled. You can enable multicast snooping in VPLS or virtual switch instance types in the instance hierarchy or in one or more bridge domains.

If there are multiple bridge domains configured under a VPLS or virtual switch instance, the multicast snooping options configured at the instance level apply to all the bridge domains. Multicast snooping options configured at the bridge domain level only apply to that particular bridge domain. The options configured at the bridge domain take precedence over the options configured at the instance level.



**NOTE:** The `ignore-stp-topology-change` statement is supported for the virtual-switch routing instance type only and is not supported under the [edit logical-systems] hierarchy.



**NOTE:** The `nexthop-hold-time` statement is supported only at the [edit routing-instances *routing-instance-name*] hierarchy, and only for an instance type of virtual-switch or vpls.

## Example: Configuring Multicast Snooping

This example shows how to configure multicast snooping in a bridge or VPLS routing-instance scenario.

- [Requirements on page 289](#)
- [Overview and Topology on page 290](#)
- [Configuration on page 292](#)
- [Verification on page 294](#)

### Requirements

This example uses the following hardware components:

- One MX Series router

- One Layer 3 device functioning as a multicast router

Before you begin:

- Configure the interfaces.
- Configure an interior gateway protocol. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure a multicast protocol. This feature works with the following multicast protocols:
  - DVMRP
  - PIM-DM
  - PIM-SM
  - PIM-SSM

### Overview and Topology

---

IGMP snooping prevents Layer 2 devices from indiscriminately flooding multicast traffic out all interfaces. The settings that you configure for multicast snooping help manage the behavior of IGMP snooping.

You can configure multicast snooping options on the default master instance and on individual bridge or VPLS instances. The default master instance configuration is global and applies to all individual bridge or VPLS instances in the logical router. The configuration for the individual instances overrides the global configuration.

This example includes the following statements:

- **flood-groups**—Enables you to list multicast group addresses for which traffic must be flooded. This setting is useful for making sure that IGMP snooping does not prevent necessary multicast flooding. The block of multicast addresses from 224.0.0.1 through 224.0.0.255 is reserved for local wire use. Groups in this range are assigned for various uses, including routing protocols and local discovery mechanisms. For example, OSPF uses 224.0.0.5 for all OSPF routers.
- **forwarding-cache**—Specifies how forwarding entries are aged out and how the number of entries is controlled.

You can configure threshold values on the forwarding cache to suppress (suspend) snooping when the cache entries reach a certain maximum and reuse the cache when the number falls to another threshold value. By default, no threshold values are enabled on the router.

The suppress threshold suppresses new multicast forwarding cache entries. An optional reuse threshold specifies the point at which the router begins to create new multicast forwarding cache entries. The range for both thresholds is from 1 through 200,000. If configured, the reuse value must be less than the suppression value. The suppression value is mandatory. If you do not specify the optional reuse value, then the number of multicast forwarding cache entries is limited to the suppression value. A new entry is

created as soon as the number of multicast forwarding cache entries falls below the suppression value.

- **graceful-restart**—Configures the time after which routes learned before a restart are replaced with routes relearned. If graceful restart for multicast snooping is disabled, snooping information is lost after a Routing Engine restart.

By default, the graceful restart duration is 180 seconds (3 minutes). You can set this value between 0 and 300 seconds. If you set the duration to 0, graceful restart is effectively disabled. Set this value slightly larger than the IGMP query response interval.

- **ignore-stp-topology-change**—Configures the MX Series router to ignore messages about the spanning-tree topology state change.

By default the IGMP snooping process on an MX Series router detects interface state changes made by any of the spanning tree protocols (STPs).

In a VPLS multihoming environment where two PE routers are connected to two interconnected CE routers and STP root protection is enabled on the PE routers, one of the PE router interfaces is in forwarding state and the other is in blocking state.

If the link interconnecting the two CE routers fails, the PE router interface in blocking state transitions to the forwarding state.

The PE router interface does not wait to receive membership reports in response to the next general or group-specific query. Instead, the IGMP snooping process sends a general query message toward the CE router. The hosts connected to the CE router reply with reports for all groups they are interested in.

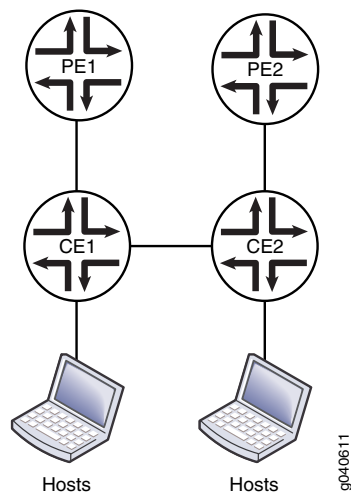
When the link interconnecting the two CE routers is restored, the original spanning-tree state on both PE routers is restored. The forwarding PE receives a spanning-tree topology change message and sends a general query message toward the CE router to immediately reconstruct the group membership state.



**NOTE:** The `ignore-stp-topology-change` statement is supported for the `virtual-switch` routing instance type only.

Figure 45 on page 292 shows a VPLS multihoming topology in which a customer network has two CE devices with a link between them. Each CE is connected to one PE.

Figure 45: VPLS Multihoming Topology



### Configuration

#### CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set bridge-domains domain1 multicast-snooping-options forwarding-cache threshold
 suppress 100
set bridge-domains domain1 multicast-snooping-options forwarding-cache threshold
 reuse 50
set bridge-domains domain1 multicast-snooping-options graceful-restart restart-duration
 120
set routing-instances ce1 instance-type virtual-switch
set routing-instances ce1 bridge-domains domain1 domain-type bridge
set routing-instances ce1 bridge-domains domain1 vlan-id 100
set routing-instances ce1 bridge-domains domain1 interface ge-0/3/9.0
set routing-instances ce1 bridge-domains domain1 interface ge-0/0/6.0
set routing-instances ce1 bridge-domains domain1 multicast-snooping-options
 flood-groups 224.0.0.5
set routing-instances ce1 bridge-domains domain1 multicast-snooping-options
 ignore-stp-topology-change
```

#### Step-by-Step Procedure

The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see the *CLI User Guide*.

To configure IGMP snooping:

1. Configure multicast snooping settings in the master routing instance.

```
[edit bridge-domains domain1]
user@host# set multicast-snooping-options forwarding-cache threshold suppress
 100 reuse 50
user@host# set multicast-snooping-options graceful-restart 120
```

2. Configure the routing instance.

```
[edit routing-instances ce1]
user@host# set instance-type virtual-switch
```

3. Configure the bridge domain in the routing instance.

```
[edit routing-instances ce1 bridge-domains domain1]
user@host# set domain-type bridge
user@host# set interface ge-0/0/6.0
user@host# set interface ge-0/3/9.0
user@host# set vlan-id 100
```

4. Configure flood groups.

```
[edit routing-instances ce1 bridge-domains domain1]
user@host# set multicast-snooping-options flood-groups 224.0.0.5
```

5. Configure the router to ignore messages about spanning-tree topology state changes.

```
[edit routing-instances ce1 bridge-domains domain1]
user@host# set multicast-snooping-options ignore-stp-topology-change
```

6. If you are done configuring the device, commit the configuration.

```
user@host# commit
```

**Results** Confirm your configuration by entering the `show bridge-domains` and `show routing-instances` commands.

```
user@host# show bridge-domains
domain1 {
 multicast-snooping-options {
 forwarding-cache {
 threshold {
 suppress 100;
 reuse 50;
 }
 }
 graceful-restart {
 restart-duration 120;
 }
 }
}

user@host# show routing-instances
ce1 {
 instance-type virtual-switch;
 bridge-domains {
 domain1 {
 domain-type bridge;
 vlan-id 100;
 interface ge-0/3/9.0; ## 'ge-0/3/9.0' is not defined
 interface ge-0/0/6.0; ## 'ge-0/0/6.0' is not defined
 multicast-snooping-options {
 flood-groups 224.0.0.5;
 ignore-stp-topology-change;
 }
 }
 }
}
```

```
 }
 }
}
```

---

### Verification

To verify the configuration, run the following commands:

- `show igmp snooping interface`
- `show igmp snooping membership`
- `show igmp snooping statistics`
- `show multicast snooping route`
- `show multicast snooping statistics`
- `show route table`

## Enabling Bulk Updates for Multicast Snooping

Whenever an individual interface joins or leaves a multicast group, a new next hop entry is installed in the routing table and the forwarding table. You can use the **nexthop-hold-time** statement to specify a time, from 1 through 1000 milliseconds (ms), during which outgoing interface changes are accumulated and then updated in bulk to the routing table and forwarding table. Bulk updating reduces the processing time and memory overhead required to process join and leave messages. This is useful for applications such as Internet Potocol television (IPTV), in which users changing channels can create thousands of interfaces joining or leaving a group in a short period. In IPTV scenarios, typically there is a relatively small and controlled number of streams and a high number of outgoing interfaces. Using bulk updates can reduce the join delay.

In this example, you configure a hold-time of 20 milliseconds for **instance-type virtual-switch**, using the **nexthop-hold-time** statement:

1. Enable the **nexthop-hold-time** statement by configuring it under **multicast-snooping-options**, using 20 milliseconds for the time value.

```
[edit routing-instances vs]
multicast-snooping-options {
 nexthop-hold-time 20;
}
```

2. Use the **show multicast snooping route** command to verify that the bulk updates feature is turned on.

```
user@host> show multicast snooping route instance vs
Nexthop Bulking: ON
Family: INET
Group: 224.0.0.0
```

You can include the **nexthop-hold-time** statement only for routing-instance types of **virtual-switch** or **vpls** at the following hierarchy level.

- [edit routing-instances *routing-instance-name* multicast-snooping-options]

If the **nexthop-hold-time** statement is deleted from the router configuration, bulk updates are disabled.

## Enabling Multicast Snooping for Multichassis Link Aggregation Group Interfaces

Include the **multichassis-lag-replicate-state** statement at the [edit **multicast-snooping-options**] hierarchy level to enable IGMP snooping and state replication for multichassis link aggregation group (MC-LAG) interfaces.

```
[edit]
multicast-snooping-options {
 multichassis-lag-replicate-state;
}
```

Replicating join and leave messages between links of a dual-link MC-LAG interface enables faster recovery of membership information for MC-LAG interfaces that experience service interruption.

Without state replication, if a dual-link MC-LAG interface experiences a service interruption (for example, if an active link switches to standby), the membership information for the interface is recovered by generating an IGMP query to the network. This method can take from 1 through 10 seconds to complete, which might be too long for some applications.

When state replication is provided for MC-LAG interfaces, IGMP join or leave messages received on an MC-LAG device are replicated from the active MC-LAG link to the standby link through an Interchassis Communication Protocol (ICCP) connection. The standby link processes the messages as if they were received from the corresponding active MC-LAG link, except it does not add itself as a next hop and it does not flood the message to the network. After a failover, the multicast membership status of the link can be recovered within a few seconds or less by retrieving the replicated messages.

This example enables state replication for MC-LAG interfaces in a bridge domain named **bridge1**:

1. Enable state replication for MC-LAG interfaces.

```
user@host# set multicast-snooping-options multichassis-lag-replicate-state
```

After you commit the configuration, multicast snooping automatically identifies the active link during initialization or after failover, and replicates data between the active and standby links without administrator intervention.

2. Use the **show igmp snooping interface** command to display the state for MC-LAG interfaces.

```
user@host> show igmp snooping interface
```

```
Instance: bridge-domain bridge1
Learning-Domain: default
Interface: ae0.1
 State: Up Groups: 1
 mc-lag state: standby
 Immediate leave: Off
```

```
Router interface: no
Interface: ge-0/1/3.100
State: Up Groups: 1
Immediate leave: Off
Router interface: no
Interface: ae1.2
State: Up Groups: 1
mc-lag state: standby
Immediate leave: Off
Router interface: no
```



**NOTE:** You can use the `show igmp snooping membership` command to display group membership information for the links of MC-LAG interfaces.

If you delete the **multicast-lag-replicate-state** statement or the configuration of IGMP snooping, replication between MC-LAG links stops within the hierarchy level from which the configuration was deleted. Then, multicast membership is recovered as needed by generating standard IGMP queries over the network.



## CHAPTER 9

# Automatic Multicast Tunneling

- [Example: Configuring Automatic IP Multicast Without Explicit Tunnels on page 297](#)

### Example: Configuring Automatic IP Multicast Without Explicit Tunnels

---

- [Understanding AMT on page 297](#)
- [AMT Applications on page 298](#)
- [AMT Operation on page 300](#)
- [Configuring the AMT Protocol on page 301](#)
- [Configuring Default IGMP Parameters for AMT Interfaces on page 303](#)
- [Example: Configuring the AMT Protocol on page 305](#)

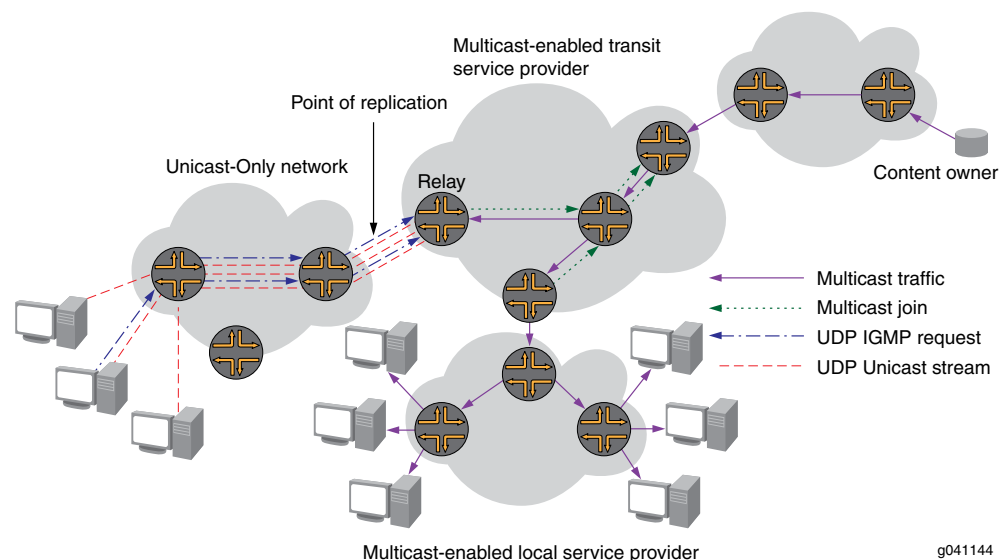
### Understanding AMT

Automatic Multicast Tunneling (AMT) facilitates dynamic multicast connectivity between multicast-enabled networks across islands of unicast-only networks. Such connectivity enables service providers, content providers, and their customers to participate in delivering multicast traffic even if they lack end-to-end multicast connectivity.

AMT is supported on MX Series Ethernet Services Routers except the MX80 router and all Modular Port Concentrators (MPCs) that use the Junos Trio chipset. AMT supports graceful restart (GR) but does not support Graceful Routing Engine switchover (GRES).

AMT dynamically establishes unicast-encapsulated tunnels between well-known multicast-enabled relay points (AMT relays) and network points reachable only through unicast (AMT gateways).

Figure 46: Automatic Multicast Tunneling Connectivity



The AMT protocol provides discovery and handshaking between relays and gateways to establish tunnels dynamically without requiring explicit per-tunnel configuration.

AMT relays are typically routers with native IP multicast connectivity that aggregate a potentially large number of AMT tunnels.

The Junos OS implementation supports the following AMT relay functions:

- IPv4 multicast traffic and IPv4 encapsulation
- Well-known sources located on the multicast network
- Prevention of denial-of-service attacks by quickly discarding multicast packets that are sourced through a gateway.
- Per-route replication to the full fan-out of all AMT tunnels desired
- The ability to collect normal interface statistics on AMT tunnels

Multicast sources located behind AMT gateways are not supported. [“Example: Configuring the AMT Protocol” on page 305](#) [“Example: Configuring the AMT Protocol” on page 305](#)

AMT supports PIM sparse mode. AMT does not support dense mode operation.

## AMT Applications

Transit service providers have a challenge in the Internet because many local service providers are not multicast-enabled. The challenge is how to entice content owners to transmit video and other multicast traffic across their backbones. The cost model for the content owners might be prohibitively high if they have to pay for unicast streams for the majority of their subscribers.

Until more local providers are multicast-enabled, there is a transition strategy proposed by the Internet Engineering Task Force (IETF) and implemented in open source software. This strategy is called Automatic IP Multicast Without Explicit Tunnels (AMT). AMT

involves setting up relays at peering points in multicast networks that can be reached from gateways installed on hosts connected to unicast networks.

Without AMT, when a user who is connected to a unicast-only network wants to receive multicast content, the content owner can allow the user to join through unicast. However, the content owner incurs an added cost because the owner needs extra bandwidth to support the unicast subscribers.

AMT allows any host to receive multicast. On the client end is an AMT gateway that is a single host. Once the gateway has located an AMT relay, which might be a host but is more typically a router, the gateway periodically sends Internet Group Management Protocol (IGMP) messages over a dynamically created UDP tunnel to the relay. AMT relays and gateways cooperate to transmit multicast traffic sourced within the multicast network to end-user sites. AMT relays receive the traffic natively and unicast-encapsulate it to gateways. This allows anyone on the Internet to create a dynamic tunnel to download multicast data streams.

With AMT, a multicast-enabled service provider can offer multicast services to a content owner. When a customer of the unicast-only local provider wants to receive the content and subscribes using an AMT join, the multicast-enabled transit provider can then efficiently transport the content to the unicast-only local provider, which sends it on to the end user.

AMT is an excellent way for transit service providers (who can get access to the content, but do not have many end users) to provide multicast service to content owners, where it would not otherwise be economically feasible. It is also a useful transition strategy for local service providers who do not yet have multicast support on all downstream equipment.

AMT is also useful for connecting two multicast-enabled service providers that are separated by a unicast-only service provider.

Similarly, AMT can be used by local service providers whose networks are multicast-enabled to tunnel multicast traffic over legacy edge devices such as digital subscriber line access multiplexers (DSLAMs) that have limited multicast capabilities.

Technical details of the implementation of AMT are as follows:

- A three-way handshake is used to join groups from unicast receivers to prevent spoofing and denial-of-service (DoS) attacks.
- An AMT relay acting as a replication server joins the multicast group and translates multicast traffic into multiple unicast streams.
- The discovery mechanism uses anycast, enabling the discovery of the relay that is closest to the gateway in the network topology.
- An AMT gateway acting as a client is a host that joins the multicast group.
- Tunnel count limits on relays can limit bandwidth usage and avoid degradation of service.

AMT is described in detail in Internet draft [draft-ietf-mboned-auto-multicast-10.txt](#), *Automatic IP Multicast Without Explicit Tunnels (AMT)*.

## AMT Operation

AMT is used to create multicast tunnels dynamically between multicast-enabled networks across islands of unicast-only networks. To do this, several steps occur sequentially.

1. The AMT relay (typically a router) advertises an anycast address prefix and route into the unicast routing infrastructure.
2. The AMT gateway (a host) sends AMT relay discovery messages to the nearest AMT relay reachable across the unicast-only infrastructure. To reduce the possibility of replay attacks or dictionary attacks, the relay discovery messages contain a cryptographic nonce. A cryptographic nonce is a random number used only once.
3. The closest relay in the topology receives the AMT relay discovery message and returns the nonce from the discovery message in an AMT relay advertisement message. This enables the gateway to learn the relay's unique IP address. The AMT relay now has an address to use for all subsequent (S,G), entries it will join.
4. The AMT gateway sends an AMT request message to the AMT relay's unique IP address to begin the process of joining the (S,G).
5. The AMT relay sends an AMT membership query back to the gateway.
6. The AMT gateway receives the AMT query message and sends an AMT membership update message containing the IGMP join messages.
7. The AMT relay sends a join message toward the source to build a native multicast tree in the native multicast infrastructure.
8. As packets are received from the source, the AMT relay replicates the packets to all interfaces in the outgoing interface list, including the AMT tunnel. The multicast traffic is then encapsulated in unicast AMT multicast data messages.
9. To maintain state in the AMT relay, the AMT gateway sends periodic AMT membership updates.
10. After the tunnel is established, the AMT tunnel state is refreshed with each membership update message sent. The timeout for the refresh messages is 240 seconds.
11. When the AMT gateway leaves the group, the AMT relay can free resources associated with the tunnel.

Note the following operational details:

- The AMT relay creates an AMT pseudo interface (tunnel interface). AMT tunnel interfaces are implemented as generic UDP encapsulation (**ud**) logical interfaces. These logical interfaces have the identifier format **ud-fpc/pic/port.unit**.
- All multicast packets (data and control) are encapsulated in unicast packets. UDP encapsulation is used for all AMT control and data packets using the IANA reserved UDP port number (2268) for AMT.

- The AMT relay maintains a receiver list for each multicast session. The relay maintains the multicast state for each gateway that has joined a particular group or (S,G) pair.

## Configuring the AMT Protocol

To configure the AMT protocol, include the **amt** statement:

```
amt {
 relay {
 family {
 inet {
 anycast-prefix ip-prefix </prefix-length>;
 local-address ip-address;
 }
 }
 secret-key-timeout minutes;
 tunnel-limit number;
 }
 traceoptions {
 file filename <files number> <size size> <world-readable | no-world-readable>;
 flag flag <flag-modifier> <disable>;
 }
}
```

You can include this statement at the following hierarchy levels:

- [edit protocols]
- [edit logical-systems *logical-system-name* protocols]
- [edit routing-instances *routing-instance-name* protocols]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols]



**NOTE:** In the following example, only the [edit protocols] hierarchy is identified.

The minimum configuration to enable AMT is to specify the AMT local address and the AMT anycast prefix.

1. To enable the MX Series router to create the UDP encapsulation (**ud**) logical interfaces, include the **bandwidth** statement and specify the bandwidth in gigabits per second.

```
[edit chassis fpc 0 pic 1]
user@host# set tunnel-services bandwidth 1g
```

2. Specify the local address by including the **local-address** statement at the [edit protocols **amt relay family inet**] hierarchy level.

```
[edit protocols amt relay family inet]
user@host# set local-address 192.168.7.1
```

The local address is used as the IP source of AMT control messages and the source of AMT data tunnel encapsulation. The local address can be configured on any active

interface. Typically, the IP address of the router's **lo0.0** loopback interface is used for configuring the AMT local address in the default routing instance, and the IP address of the router's **lo0.n** loopback interface is used for configuring the AMT local address in VPN routing instances.

3. Specify the AMT anycast address by including the **anycast-prefix** statement at the **[edit protocols amt relay family inet]** hierarchy level.

```
[edit protocols amt relay family inet]
user@host# set anycast-prefix 192.168.0.0/16
```

The AMT anycast prefix is advertised by unicast routing protocols to route AMT discovery messages to the router from nearby AMT gateways. Typically, the router's **lo0.0** interface loopback address is used for configuring the AMT anycast prefix in the default routing instance, and the router's **lo0.n** loopback address is used for configuring the AMT anycast prefix in VPN routing instances. However, the anycast address can be either the primary or secondary **lo0.0** loopback address.

Ensure that your unicast routing protocol advertises the AMT anycast prefix in the route advertisements. If the AMT anycast prefix is advertised by BGP, ensure that the local autonomous system (AS) number for the AMT relay router is in the AS path leading to the AMT anycast prefix.

4. (Optional) Specify the AMT secret key timeout by including the **secret-key-timeout** statement at the **[edit protocols amt relay]** hierarchy level. In the following example, the secret key timeout is configured to be 120 minutes.

```
[edit protocols amt relay]
user@host# set secret-key-timeout 120
```

The secret key is used to generate the AMT Message Authentication Code (MAC). Setting the secret key timeout shorter might improve security, but it consumes more CPU resources. The default is 60 minutes.

5. (Optional) Specify an AMT tunnel limit by including the **tunnel-limit** statement at the **[edit protocols amt relay]** hierarchy level. In the following example, the AMT tunnel limit is 12.

```
[edit protocols amt relay]
user@host# set tunnel-limit 12
```

The tunnel limit configures the static upper limit to the number of AMT tunnels that can be established. When the limit is reached, new AMT relay discovery messages are ignored.

6. Trace AMT protocol traffic by specifying options to the **traceoptions** statement at the **[edit protocols amt]** hierarchy level. Options applied at the AMT protocol level trace only AMT traffic. In the following example, all AMT packets are logged to the file **amt-log**.

```
[edit protocols amt]
user@host# set traceoptions file amt-log
user@host# set traceoptions flag packets
```



**NOTE:** For AMT operation, configure the PIM rendezvous point address as the primary loopback address of the AMT relay.

## Configuring Default IGMP Parameters for AMT Interfaces

You can optionally configure default IGMP parameters for all AMT tunnel interfaces. Although, typically you do not need to change the values. To configure default IGMP attributes of all AMT relay tunnels, include the **amt** statement:

```
amt {
 relay {
 defaults {
 (accounting | no-accounting);
 group-policy [policy-names];
 query-interval seconds;
 query-response-interval seconds;
 robust-count number;
 ssm-map ssm-map-name;
 version version;
 }
 }
}
```

You can include this statement at the following hierarchy levels:

- [edit protocols igmp]
- [edit logical-systems *logical-system-name* protocols igmp]
- [edit routing-instances *routing-instance-name* protocols igmp]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols igmp]

The IGMP statements included at the [edit protocols igmp amt relay defaults] hierarchy level have the same syntax and purpose as IGMP statements included at the [edit protocols igmp] or [edit protocols igmp interface *interface-name*] hierarchy levels. These statements are as follows:

- You can collect IGMP join and leave event statistics. To enable the collection of IGMP join and leave event statistics for all AMT interfaces, include the **accounting** statement:

```
user@host# set protocols igmp amt relay defaults accounting
```

- After enabling IGMP accounting, you must configure the router to filter the recorded information to a file or display it to a terminal. You can archive the events file.
- To disable the collection of IGMP join and leave event statistics for all AMT interfaces, include the **no-accounting** statement:

```
user@host# set protocols igmp amt relay defaults no-accounting
```

- You can filter unwanted IGMP reports at the interface level. To filter unwanted IGMP reports, define a policy to match only IGMP group addresses (for IGMPv2) by using the

policy's **route-filter** statement to match the group address. Define the policy to match IGMP (S,G) addresses (for IGMPv3) by using the policy's **route-filter** statement to match the group address and the policy's **source-address-filter** statement to match the source address. In the following example, the **amt\_reject** policy is created to match both the group and source addresses.

```
user@host# set policy-options policy-statement amt_reject from route-filter 224.1.1.1/32 exact
user@host# set policy-options policy-statement amt_reject from source-address-filter 192.168.0.0/16 orlonger
user@host# set policy-options policy-statement amt_reject then reject
```

- To apply the IGMP report filtering on the interface where you prefer not to receive specific group or (S,G) reports, include the **group-policy** statement. The following example applies the **amt\_reject** policy to all AMT interfaces.

```
user@host# set protocols igmp amt relay defaults group-policy amt_reject
```

- You can change the IGMP query interval for all AMT interfaces to reduce or increase the number of host query messages sent. In AMT, host query messages are sent in response to membership request messages from the gateway. The query interval configured on the relay must be compatible with the membership request timer configured on the gateway. To modify this interval, include the **query-interval** statement. The following example sets the host query interval to 250 seconds.

```
user@host# set protocols igmp amt relay defaults query-interval 250
```

The IGMP querier router periodically sends general host-query messages. These messages solicit group membership information and are sent to the all-systems multicast group address, 224.0.0.1.

- You can change the IGMP query response interval. The query response interval multiplied by the robust count is the maximum amount of time that can elapse between the sending of a host query message by the querier router and the receipt of a response from a host. Varying this interval allows you to adjust the number of IGMP messages on the AMT interfaces. To modify this interval, include the **query-response-interval** statement. The following example configures the query response interval to 20 seconds.

```
user@host# set protocols igmp amt relay defaults query-response-interval 20
```

- You can change the IGMP robust count. The robust count is used to adjust for the expected packet loss on the AMT interfaces. Increasing the robust count allows for more packet loss but increases the leave latency of the subnetwork. To modify the robust count, include the **robust-count** statement. The following example configures the robust count to 3.

```
user@host# set protocols igmp amt relay defaults robust-count 3
```

The robust count automatically changes certain IGMP message intervals for IGMPv2 and IGMPv3.

- On a shared network running IGMPv2, when the query router receives an IGMP leave message, it must send an IGMP group query message for a specified number of times. The number of IGMP group query messages sent is determined by the robust count. The interval between query messages is determined by the last member query interval. Also, the IGMPv2 query response interval is multiplied by the robust count



to determine the maximum amount of time between the sending of a host query message and receipt of a response from a host.

For more information about the IGMPv2 robust count, see RFC 2236, *Internet Group Management Protocol, Version 2*.

- In IGMPv3 a change of interface state causes the system to immediately transmit a state-change report from that interface. If the state-change report is missed by one or more multicast routers, it is retransmitted. The number of times it is retransmitted is the robust count minus one. In IGMPv3 the robust count is also a factor in determining the group membership interval, the older version querier interval, and the other querier present interval.

For more information about the IGMPv3 robust count, see RFC 3376, *Internet Group Management Protocol, Version 3*.

- You can apply a source-specific multicast (SSM) map to an AMT interface. SSM mapping translates IGMPv1 or IGMPv2 membership reports to an IGMPv3 report, which allows hosts running IGMPv1 or IGMPv2 to participate in SSM until the hosts transition to IGMPv3.

SSM mapping applies to all group addresses that match the policy, not just those that conform to SSM addressing conventions (232/8 for IPv4).

In this example, you create a policy to match the 232.1.1.1/32 group address for translation to IGMPv3. Then you define the SSM map that associates the policy with the 192.168.43.66 source address where these group addresses are found. Finally, you apply the SSM map to all AMT interfaces.

```
user@host# set policy-options policy-statement ssm-policy-example term A from
route-filter 232.1.1.1/32 exact
user@host# set policy-options policy-statement ssm-policy-example term A then
accept
user@host# set routing-options multicast ssm-map ssm-map-example policy
ssm-policy-example
user@host# set routing-options multicast ssm-map ssm-map-example source
192.168.43.66
user@host# set protocols igmp amt relay defaults ssm-map ssm-map-example
```

## Example: Configuring the AMT Protocol

This example shows how to configure the Automatic Multicast Tunneling (AMT) Protocol to facilitate dynamic multicast connectivity between multicast-enabled networks across islands of unicast-only networks.

- [Requirements on page 305](#)
- [Overview on page 306](#)
- [Configuration on page 306](#)
- [Verification on page 308](#)

### Requirements

Before you begin:

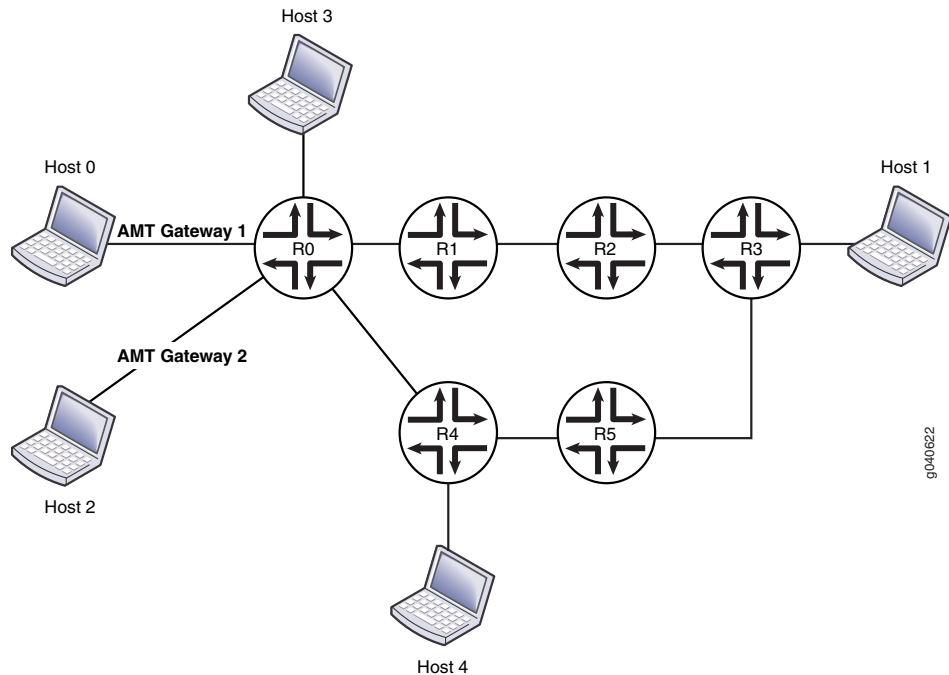
- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Configure a multicast group membership protocol (IGMP or MLD). See “[Understanding IGMP](#)” on page 222 and “[Understanding MLD](#)” on page 247.

### Overview

In this example, Host 0 and Host 2 are multicast receivers in a unicast cloud. Their default gateway devices are AMT gateways. R0 and R4 are configured with unicast protocols only. R1, R2, R3, and R5 are configured with PIM multicast. Host 1 is a source in a multicast cloud. R0 and R5 are configured to perform AMT relay. Host 3 and Host 4 are multicast receivers (or sources that are directly connected to receivers). This example shows R1 configured with an AMT relay local address and an anycast prefix as its own loopback address. The example also shows R0 configured with tunnel services enabled.

[Figure 47 on page 306](#) shows the topology used in this example.

**Figure 47: AMT Gateway Topology**



### Configuration

#### CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set protocols amt traceoptions file amt.log
set protocols amt traceoptions flag errors
```

```

set protocols amt traceoptions flag packets detail
set protocols amt traceoptions flag route detail
set protocols amt traceoptions flag state detail
set protocols amt traceoptions flag tunnels detail
set protocols amt relay family inet anycast-prefix 10.10.10.10/32
set protocols amt relay family inet local-address 10.255.112.201
set protocols amt relay tunnel-limit 10
set protocols pim interface all mode sparse-dense
set protocols pim interface all version 2
set protocols pim interface fxp0.0 disable
set chassis fpc 0 pic 0 tunnel-services bandwidth 1g

```

**Step-by-Step Procedure** The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure the AMT protocol on R1:

1. Configure AMT tracing operations.

```

[edit protocols amt traceoptions]
user@host# set file amt.log
user@host# set flag errors
user@host# set flag packets detail
user@host# set flag route detail
user@host# set flag state detail
user@host# set flag tunnels detail

```

2. Configure the AMT relay settings.

```

[edit protocols amt relay]
user@host# set relay family inet anycast-prefix 10.10.10.10/32
user@host# set family inet local-address 10.255.112.201
user@host# set tunnel-limit 10

```

3. Configure PIM on R1's interfaces.

```

[edit protocols pim]
set interface all mode sparse-dense
set interface all version 2
set interface fxp0.0 disable

```

4. Enable tunnel functionality.

```

[edit chassis]
set fpc 0 pic 0 tunnel-services bandwidth 1g

```

5. If you are done configuring the device, commit the configuration.

```

user@host# commit

```

### Results

From configuration mode, confirm your configuration by entering the **show chassis** and **show protocols** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show chassis
fpc 0 {
 pic 0 {
 tunnel-services {
 bandwidth 1g;
 }
 }
}

user@host# show protocols
amt {
 traceoptions {
 file amt.log;
 flag errors;
 flag packets detail;
 flag route detail;
 flag state detail;
 flag tunnels detail;
 }
 relay {
 family {
 inet {
 anycast-prefix 10.10.10.10/32;
 local-address 10.255.112.201;
 }
 }
 tunnel-limit 10;
 }
}
pim {
 interface all {
 mode sparse-dense;
 version 2;
 }
 interface fxp0.0 {
 disable;
 }
}
```

---

### Verification

To verify the configuration, run the following commands:

- [show amt statistics](#)
- [show amt summary](#)
- [show amt tunnel](#)

### Related Documentation

- [Understanding AMT on page 297](#)

## CHAPTER 10

# Session Announcement Protocol

- [Configuring the Session Announcement Protocol on page 309](#)

### Configuring the Session Announcement Protocol

---

The SAP and SDP protocols associate multicast session names with multicast traffic addresses. Only SAP has configuration parameters that users can change. Enabling SAP allows the router to receive announcements about multimedia and other multicast sessions.

Junos OS supports the following SAP and SDP standards:

- RFC 2327, *SDP Session Description Protocol*
- RFC 2974, *Session Announcement Protocol*

Before you begin:

1. Determine whether the router is directly attached to any multicast sources. Receivers must be able to locate these sources.
2. Determine whether the router is directly attached to any multicast group receivers. If receivers are present, IGMP is needed.
3. Determine whether to configure multicast to use sparse, dense, or sparse-dense mode. Each mode has different configuration considerations.
4. Determine the address of the RP if sparse or sparse-dense mode is used.
5. Determine whether to locate the RP with the static configuration, BSR, or auto-RP method.
6. Determine whether to configure multicast to use its own RPF routing table when configuring PIM in sparse, dense, or sparse-dense mode.

To enable SAP and the receipt of session announcements, include the **sap** statement:

```
sap {
 disable;
 listen address <port port>;
}
```

You can include this statement at the following hierarchy levels:

- **[edit protocols]**
- **[edit logical-systems *logical-system-name* protocols]**

By default, SAP listens to the address and port 224.2.127.254:9875 for session advertisements. To add other addresses or pairs of address and port, include one or more **listen** statements.

Sessions established by SDP, SAP's higher-layer protocol, time out after 60 minutes.

To monitor the operation, use the [show sap listen](#) command.

**Related  
Documentation**

- [show sap listen on page 760](#)

# Multicast Source Discovery Protocol

- [Examples: Configuring MSDP on page 311](#)

## Examples: Configuring MSDP

---

- [Configuring MSDP on page 311](#)
- [Example: Configuring MSDP in a Routing Instance on page 312](#)
- [Configuring the Interface to Accept Traffic from a Remote Source on page 320](#)
- [Example: Configuring MSDP with Active Source Limits and Mesh Groups on page 320](#)
- [Tracing MSDP Protocol Traffic on page 326](#)
- [Disabling MSDP on page 327](#)

## Configuring MSDP

To configure the Multicast Source Discovery Protocol (MSDP), include the **msdp** statement:

```
msdp {
 disable;
 active-source-limit {
 maximum number;
 threshold number;
 }
 data-encapsulation (disable | enable);
 export [policy-names];
 group group-name {
 ... group-configuration ...
 }
 import [policy-names];
 local-address address;
 peer address {
 ... peer-configuration ...
 }
 rib-group group-name;
 source ip-prefix</prefix-length> {
 active-source-limit {
 maximum number;
 threshold number;
 }
 }
}
```

```

traceoptions {
 file filename <files number> <size size> <world-readable | no-world-readable>;
 flag flag <flag-modifier> <disable>;
}
group group-name {
 disable;
 export [policy-names];
 import [policy-names];
 local-address address;
 mode (mesh-group | standard);
 peer address {
 ...same statements as at the [edit protocols msdp peer address] hierarchy level shown
 just following ...
 }
 traceoptions {
 file filename <files number> <size size> <world-readable | no-world-readable>;
 flag flag <flag-modifier> <disable>;
 }
}
peer address {
 disable;
 active-source-limit {
 maximum number;
 threshold number;
 }
 authentication-key peer-key;
 default-peer;
 export [policy-names];
 import [policy-names];
 local-address address;
 traceoptions {
 file filename <files number> <size size> <world-readable | no-world-readable>;
 flag flag <flag-modifier> <disable>;
 }
}
}

```

You can include this statement at the following hierarchy levels:

- [edit protocols]
- [edit routing-instances *routing-instance-name* protocols]
- [edit logical-systems *logical-system-name* protocols]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols]

By default, MSDP is disabled.

### Example: Configuring MSDP in a Routing Instance

This example shows how to configure MSDP in a VRF instance.

- [Requirements on page 313](#)
- [Overview on page 313](#)



- [Configuration on page 316](#)
- [Verification on page 319](#)

### Requirements

---

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Enable PIM. See [“PIM Overview” on page 13](#).

### Overview

---

You can configure MSDP in the following types of instances:

- Forwarding
- No forwarding
- Virtual router
- VPLS
- VRF

The main use of MSDP in a routing instance is to support anycast RPs in the network, which allows you to configure redundant RPs. Anycast RP addressing requires MSDP support to synchronize the active sources between RPs.

This example includes the following MSDP settings.

- **authentication-key**—By default, multicast routers accept and process any properly formatted MSDP messages from the configured peer address. This default behavior might violate the security policies in many organizations because MSDP messages by definition come from another routing domain beyond the control of the security practices of the multicast router's organization.

The router can authenticate MSDP messages using the TCP message digest 5 (MD5) signature option for MSDP peering sessions. This authentication provides protection against spoofed packets being introduced into an MSDP peering session. Two organizations implementing MSDP authentication must decide on a human-readable key on both peers. This key is included in the MD5 signature computation for each MSDP segment sent between the two peers.

You configure an MSDP authentication key on a per-peer basis, whether the MSDP peer is defined in a group or individually. If you configure different authentication keys for the same peer one in a group and one individually, the individual key is used.

The peer key can be a text string up to 16 letters and digits long. Strings can include any ASCII characters with the exception of (,), &, and [. If you include spaces in an MSDP authentication key, enclose all characters in quotation marks (" ").

Adding, removing, or changing an MSDP authentication key in a peering session resets the existing MSDP session and establishes a new session between the affected MSDP peers. This immediate session termination prevents excessive retransmissions and eventual session timeouts due to mismatched keys.

- **import** and **export**—All routing protocols use the routing table to store the routes that they learn and to determine which routes they advertise in their protocol packets. Routing policy allows you to control which routes the routing protocols store in, and retrieve from, the routing table.

You can configure routing policy globally, for a group, or for an individual peer. This example shows how to configure the policy for an individual peer.

If you configure routing policy at the group level, each peer in a group inherits the group's routing policy.

The **import** statement applies policies to source-active messages being imported into the source-active cache from MSDP. The **export** statement applies policies to source-active messages being exported from the source-active cache into MSDP. If you specify more than one policy, they are evaluated in the order specified, from first to last, and the first matching policy is applied to the route. If no match is found for the import policy, MSDP shares with the routing table only those routes that were learned from MSDP routers. If no match is found for the export policy, the default MSDP export policy is applied to entries in the source-active cache. See [Table 10 on page 314](#) for a list of match conditions.

**Table 10: MSDP Source-Active Message Filter Match Conditions**

| Match Condition  | Matches On                                                     |
|------------------|----------------------------------------------------------------|
| <b>interface</b> | Router interface or interfaces specified by name or IP address |

**Table 10: MSDP Source-Active Message Filter Match Conditions** (*continued*)

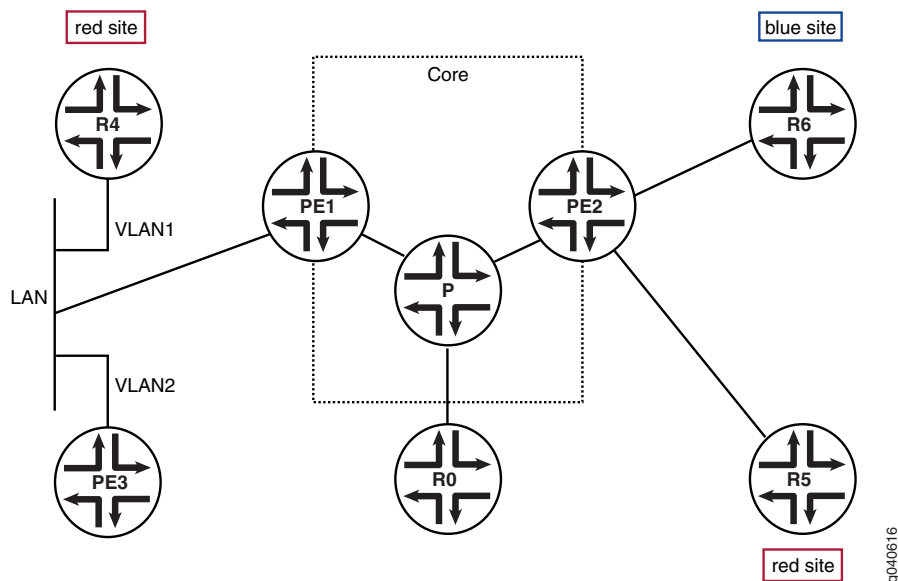
| Match Condition              | Matches On                                                                          |
|------------------------------|-------------------------------------------------------------------------------------|
| <b>neighbor</b>              | Neighbor address (the source address in the IP header of the source-active message) |
| <b>route-filter</b>          | Multicast group address embedded in the source-active message                       |
| <b>source-address-filter</b> | Multicast source address embedded in the source-active message                      |

- **local-address**—Identifies the address of the router you are configuring as an MSDP router (the local router). When you configure MSDP, the **local-address** statement is required. The router must also be a Protocol Independent Multicast (PIM) sparse-mode rendezvous point (RP).
- **peer**—An MSDP router must know which routers are its peers. You define the peer relationships explicitly by configuring the neighboring routers that are the MSDP peers of the local router. After peer relationships are established, the MSDP peers exchange messages to advertise active multicast sources. You must configure at least one peer for MSDP to function. When you configure MSDP, the **peer** statement is required. The router must also be a Protocol Independent Multicast (PIM) sparse-mode rendezvous point (RP).

You can arrange MSDP peers into groups. Each group must contain at least one peer. Arranging peers into groups is useful if you want to block sources from some peers and accept them from others, or set tracing options on one group and not others. This example shows how to configure the MSDP peers in groups. If you configure MSDP peers in a group, each peer in a group inherits all group-level options.

Figure 48 on page 316 shows the topology for this example.

Figure 48: MSDP in a VRF Instance Topology



### Configuration

#### CLI Quick Configuration

To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```

set policy-options policy-statement bgp-to-ospf term 1 from protocol bgp
set policy-options policy-statement bgp-to-ospf term 1 then accept
set policy-options policy-statement sa-filter term bad-groups from route-filter 224.0.1.2/32
 exact
set policy-options policy-statement sa-filter term bad-groups from route-filter
 224.77.0.0/16 orlonger
set policy-options policy-statement sa-filter term bad-groups then reject
set policy-options policy-statement sa-filter term bad-sources from source-address-filter
 10.0.0.0/8 orlonger
set policy-options policy-statement sa-filter term bad-sources from source-address-filter
 127.0.0.0/8 orlonger
set policy-options policy-statement sa-filter term bad-sources then reject
set policy-options policy-statement sa-filter term accept-everything-else then accept
set routing-instances VPN-100 instance-type vrf
set routing-instances VPN-100 interface ge-0/0/0.100
set routing-instances VPN-100 interface lo0.100
set routing-instances VPN-100 route-distinguisher 10.255.120.36:100
set routing-instances VPN-100 vrf-target target:100:1
set routing-instances VPN-100 protocols ospf export bgp-to-ospf
set routing-instances VPN-100 protocols ospf area 0.0.0.0 interface lo0.100
set routing-instances VPN-100 protocols ospf area 0.0.0.0 interface ge-0/0/0.100
set routing-instances VPN-100 protocols pim rp static address 11.11.47.100
set routing-instances VPN-100 protocols pim interface lo0.100 mode sparse-dense
set routing-instances VPN-100 protocols pim interface lo0.100 version 2
set routing-instances VPN-100 protocols pim interface ge-0/0/0.100 mode sparse-dense
set routing-instances VPN-100 protocols pim interface ge-0/0/0.100 version 2

```

```

set routing-instances VPN-100 protocols msdp export sa-filter
set routing-instances VPN-100 protocols msdp import sa-filter
set routing-instances VPN-100 protocols msdp group 100 local-address 10.10.47.100
set routing-instances VPN-100 protocols msdp group 100 peer 10.255.120.39
 authentication-key "New York"
set routing-instances VPN-100 protocols msdp group to_pe local-address 10.10.47.100
set routing-instances VPN-100 protocols msdp group to_pe peer 11.11.47.100

```

**Step-by-Step Procedure** The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure an MSDP routing instance:

1. Configure the BGP export policy.

```

[edit policy-options]
user@host# set policy-statement bgp-to-ospf term 1 from protocol bgp
user@host# set policy-statement bgp-to-ospf term 1 then accept

```

2. Configure a policy that filters out certain source and group addresses and accepts all other source and group addresses.

```

[edit policy-options]
user@host# set policy-statement sa-filter term bad-groups from route-filter
 224.0.1.2/32 exact
user@host# set policy-statement sa-filter term bad-groups from route-filter
 224.0.1.2/32 exact
user@host# set policy-statement sa-filter term bad-groups from route-filter
 224.77.0.0/16 orlonger
user@host# set policy-statement sa-filter term bad-groups then reject
user@host# set policy-statement sa-filter term bad-sources from
 source-address-filter 10.0.0.0/8 orlonger
user@host# set policy-statement sa-filter term bad-sources from
 source-address-filter 127.0.0.0/8 orlonger
user@host# set policy-statement sa-filter term bad-sources then reject
user@host# set policy-statement sa-filter term accept-everything-else then accept

```

3. Configure the routing instance type and interfaces.

```

[edit routing-instances]
user@host# set VPN-100 instance-type vrf
user@host# set VPN-100 interface ge-0/0/0.100
user@host# set VPN-100 interface lo0.100

```

4. Configure the routing instance route distinguisher and VRF target.

```

[edit routing-instances]
user@host# set VPN-100 route-distinguisher 10.255.120.36:100
user@host# set VPN-100 vrf-target target:100:1

```

5. Configure OSPF in the routing instance.

```

[edit routing-instances]
user@host# set VPN-100 protocols ospf export bgp-to-ospf
user@host# set VPN-100 protocols ospf area 0.0.0.0 interface lo0.100
user@host# set VPN-100 protocols ospf area 0.0.0.0 interface ge-0/0/0.100

```

6. Configure PIM in the routing instance.

```
[edit routing-instances]
user@host# set VPN-100 protocols pim rp static address 11.11.47.100
user@host# set VPN-100 protocols pim interface lo0.100 mode sparse-dense
user@host# set VPN-100 protocols pim interface lo0.100 version 2
user@host# set VPN-100 protocols pim interface ge-0/0/0.100 mode sparse-dense
user@host# set VPN-100 protocols pim interface ge-0/0/0.100 version 2
```

7. Configure MSDP in the routing instance.

```
[edit routing-instances]
user@host# set VPN-100 protocols msdp export sa-filter
user@host# set VPN-100 protocols msdp import sa-filter
user@host# set VPN-100 protocols msdp group 100 local-address 10.10.47.100
user@host# set VPN-100 protocols msdp group 100 peer 10.255.120.39
authentication-key "New York"
[edit routing-instances]
user@host# set VPN-100 protocols msdp group to_pe local-address 10.10.47.100
[edit routing-instances]
user@host# set VPN-100 protocols msdp group to_pe peer 11.11.47.100
```

8. If you are done configuring the device, commit the configuration.

```
[edit routing-instances]
user@host# commit
```

### Results

Confirm your configuration by entering the **show policy-options** command and the **show routing-instances** command from configuration mode. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show policy-options
policy-statement bgp-to-ospf {
 term 1 {
 from protocol bgp;
 then accept;
 }
}
policy-statement sa-filter {
 term bad-groups {
 from {
 route-filter 224.0.1.2/32 exact;
 route-filter 224.77.0.0/16 orlonger;
 }
 then reject;
 }
 term bad-sources {
 from {
 source-address-filter 10.0.0.0/8 orlonger;
 source-address-filter 127.0.0.0/8 orlonger;
 }
 then reject;
 }
 term accept-everything-else {
 then accept;
 }
}
```

```

user@host# show routing-instances
VPN-100 {
 instance-type vrf;
 interface ge-0/0/0.100; ## 'ge-0/0/0.100' is not defined
 interface lo0.100; ## 'lo0.100' is not defined
 route-distinguisher 10.255.120.36:100;
 vrf-target target:100:1;
 protocols {
 ospf {
 export bgp-to-ospf;
 area 0.0.0.0 {
 interface lo0.100;
 interface ge-0/0/0.100;
 }
 }
 pim {
 rp {
 static {
 address 11.11.47.100;
 }
 }
 interface lo0.100 {
 mode sparse-dense;
 version 2;
 }
 interface ge-0/0/0.100 {
 mode sparse-dense;
 version 2;
 }
 }
 msdp {
 export sa-filter;
 import sa-filter;
 group 100 {
 local-address 10.10.47.100;
 peer 10.255.120.39 {
 authentication-key "9z4l-3Ctp0B1EcF3eMW8-dDjH"; ## SECRET-DATA
 }
 }
 group to_pe {
 local-address 10.10.47.100;
 peer 11.11.47.100;
 }
 }
 }
}

```

### Verification

To verify the configuration, run the following commands:

- **show msdp instance VPN-100**
- **show msdp source-active VPN-100**

- **show multicast usage instance VPN-100**
- **show route table VPN-100.inet.4**

## Configuring the Interface to Accept Traffic from a Remote Source

You can configure an incoming interface to accept traffic from a remote source. A remote source is a source that is not on the same subnet as the incoming interface. This enables the remote source to be learned and advertised by MSDP so that receivers in other MSDP areas can join the source. You do not need to disable RPF checking, but you do need to ensure that the best path to reach the remote source is through the incoming interface.

In this sample configuration, the incoming interface (**ge-1/3/0**) is on a provider edge (PE) router on the receiver side of a multicast VPN.

To accept traffic from a remote source:

1. Edit the incoming interface.

```
[edit protocols pim interface ge-1/3/0.0]
user@host# set accept-remote-source
```

2. If the incoming interface is not the only way to reach the remote source, ensure that the best path to reach the remote source is through the incoming interface. One way to do this is to use AS path prepending on the other possible routes.

```
[edit policy-options policy-statement as-path-prepend term prepend]
user@host# set from route-filter 192.168.0.0/16 orlonger
user@host# set from route-filter 172.16.0.0/16 orlonger
user@host# set then as-path-prepend "1 1 1"
```

Another way to do this might be to configure a static route on the receiver side PE router to the source.

4. After the configuration is committed, use the **show pim statistics** and **show mdp source** commands to verify that the interface is accepting traffic from the remote source.

## Example: Configuring MSDP with Active Source Limits and Mesh Groups

This example shows how to configure MSDP to filter source-active messages and limit the flooding of source-active messages.

- [Requirements on page 320](#)
- [Overview on page 321](#)
- [Configuration on page 324](#)
- [Verification on page 325](#)

---

### Requirements

Before you begin:



- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.
- Enable PIM sparse mode. See “PIM Overview” on page 13.
- Configure the router as a PIM sparse-mode RP. See “Configuring Local PIM RPs” on page 73.

## Overview

A router interested in MSDP messages, such as an RP, might have to process a large number of MSDP messages, especially source-active messages, arriving from other routers. Because of the potential need for a router to examine, process, and create state tables for many MSDP packets, there is a possibility of an MSDP-based denial-of-service (DoS) attack on a router running MSDP. To minimize this possibility, you can configure the router to limit the number of source active messages the router accepts. Also, you can configure a threshold for applying random early detection (RED) to drop some but not all MSDP active source messages.

By default, the router accepts 25,000 source active messages before ignoring the rest. The limit can be from 1 through 1,000,000. The limit is applied to both the number of messages and the number of MSDP peers.

By default, the router accepts 24,000 source-active messages before applying the RED profile to prevent a possible DoS attack. This number can also range from 1 through 1,000,000. The next 1000 messages are screened by the RED profile and the accepted messages processed. If you configure no drop profiles (as this example does not), RED is still in effect and functions as the primary mechanism for managing congestion. In the default RED drop profile, when the packet queue fill-level is 0 percent, the drop probability is 0 percent. When the fill-level is 100 percent, the drop probability is 100 percent.



**NOTE:** The router ignores source-active messages with encapsulated TCP packets. Multicast does not use TCP; segments inside source-active messages are most likely the result of worm activity.

The number configured for the threshold must be less than the number configured for the maximum number of active MSDP sources.

You can configure an active source limit globally, for a group, or for a peer. If active source limits are configured at multiple levels of the hierarchy (as shown in this example), all are applied.

You can configure an active source limit for an address range as well as for a specific peer. A per-source active source limit uses an IP prefix and prefix length instead of a specific address. You can configure more than one per-source active source limit. The longest match determines the limit.

Per-source active source limits can be combined with active source limits at the peer, group, and global (instance) hierarchy level. Per-source limits are applied before any other type of active source limit. Limits are tested in the following order:

- Per-source
- Per-peer or group
- Per-instance

An active source message must “pass” all limits established before being accepted. For example, if a source is configured with an active source limit of 10,000 active multicast groups and the instance is configured with a limit of 5000 (and there are no other sources or limits configured), only 5000 active source messages are accepted from this source.

MSDP mesh groups are groups of peers configured in a full-mesh topology that limits the flooding of source-active messages to neighboring peers. Every mesh group member must have a peer connection with every other mesh group member. When a source-active message is received from a mesh group member, the source-active message is always accepted but is not flooded to other members of the same mesh group. However, the source-active message is flooded to non-mesh group peers or members of other mesh groups. By default, standard flooding rules apply if **mesh-group** is not specified.



**CAUTION:** When configuring MSDP mesh groups, you must configure all members the same way. If you do not configure a full mesh, excessive flooding of source-active messages can occur.

A common application for MSDP mesh groups is peer-reverse-path-forwarding (peer-RPF) check bypass. For example, if there are two MSDP peers inside an autonomous system (AS), and only one of them has an external MSDP session to another AS, the internal MSDP peer often rejects incoming source-active messages relayed by the peer with the external link. Rejection occurs because the external MSDP peer must be reachable by the internal MSDP peer through the next hop toward the source in another AS, and this next-hop condition is not certain. To prevent rejections, configure an MSDP mesh group on the internal MSDP peer so it always accepts source-active messages.



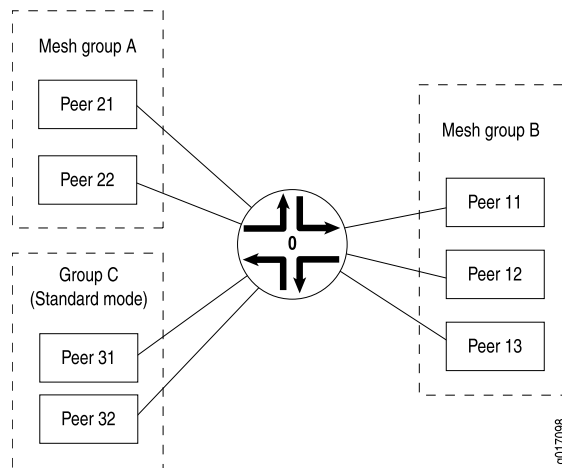
**NOTE:** An alternative way to bypass the peer-RPF check is to configure a default peer. In networks with only one MSDP peer, especially stub networks, the source-active message always needs to be accepted. An MSDP default peer is an MSDP peer from which all source-active messages are accepted without performing the peer-RPF check. You can establish a default peer at the peer or group level by including the **default-peer** statement.

Table 11 on page 323 explains how flooding is handled by peers in this example. Figure 49 on page 323 illustrates source-active message flooding between different mesh groups and peers within the same mesh group.

Table 11: Source-Active Message Flooding Explanation

| Source-Active Message Received From | Source-Active Message Flooded To                     | Source-Active Message Not Flooded To |
|-------------------------------------|------------------------------------------------------|--------------------------------------|
| Peer 21                             | Peer 11, Peer 12, Peer 13, Peer 31, Peer 32          | Peer 22                              |
| Peer 11                             | Peer 21, Peer 22, Peer 31, Peer 32                   | Peer 12, Peer 13                     |
| Peer 31                             | Peer 21, Peer 22, Peer 11, Peer 12, Peer 13, Peer 32 | —                                    |

Figure 49: Source-Active Message Flooding



This example includes the following settings:

- **active-source-limit maximum 10000**—Applies a limit of 10,000 active sources to all other peers.
- **data-encapsulation disable**—On an RP router using MSDP, disables the default encapsulation of multicast data received in MSDP register messages inside MSDP source-active messages.

MSDP data encapsulation mainly concerns bursty sources of multicast traffic. Sources that send only one packet every few minutes have trouble with the timeout of state relationships between sources and their multicast groups (S,G). Routers lose data while they attempt to reestablish (S,G) state tables. As a result, multicast register messages contain data, and this data encapsulation in MSDP source-active messages can be turned on or off through configuration.

By default, MSDP data encapsulation is enabled. An RP running MSDP takes the data packets arriving in the source's register message and encapsulates the data inside an MSDP source-active message.

However, data encapsulation creates both a multicast forwarding cache entry in the **inet.1** table (this is also the forwarding table) and a routing table entry in the **inet.4**

table. Without data encapsulation, MSDP creates only a routing table entry in the **inet.4** table. In some circumstances, such as the presence of Internet worms or other forms of DoS attack, the router's forwarding table might fill up with these entries. To prevent the forwarding table from filling up with MSDP entries, you can configure the router not to use MSDP data encapsulation. However, if you disable data encapsulation, the router ignores and discards the encapsulated data. Without data encapsulation, multicast applications with bursty sources having transmit intervals greater than about 3 minutes might not work well.

- **group MSDP-group local-address 10.1.2.3**—Specifies the address of the local router (this router).
- **group MSDP-group mode mesh-group**—Specifies that all peers belonging to the **MSDP-group** group are mesh group members.
- **group MSDP-group peer 10.10.10.10**—Prevents the sending of source-active messages to neighboring peer 10.10.10.10.
- **group MSDP-group peer 10.10.10.10 active-source-limit maximum 7500**—Applies a limit of 7500 active sources to MSDP peer 10.10.10.10 in group **MSDP-group**.
- **peer 10.0.0.1 active-source-limit maximum 5000 threshold 4000**—Applies a threshold of 4000 active sources and a limit of 5000 active sources to MSDP peer 10.0.0.1.
- **source 10.1.0.0/16 active-source-limit maximum 500**—Applies a limit of 500 active sources to any source on the 10.1.0.0/16 network.

### Configuration

**CLI Quick Configuration** To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set protocols msdp data-encapsulation disable
set protocols msdp active-source-limit maximum 10000
set protocols msdp peer 10.0.0.1 active-source-limit maximum 5000
set protocols msdp peer 10.0.0.1 active-source-limit threshold 4000
set protocols msdp source 10.1.0.0/16 active-source-limit maximum 500
set protocols msdp group MSDP-group mode mesh-group
set protocols msdp group MSDP-group local-address 10.1.2.3
set protocols msdp group MSDP-group peer 10.10.10.10 active-source-limit maximum
7500
```

**Step-by-Step Procedure** The following example requires that you navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure MSDP source active routes and mesh groups:

1. (Optional) Disable data encapsulation.

```
[edit protocols msdp]
user@host# set data-encapsulation disable
```

2. Configure the active source limits.

```
[edit protocols msdp]
user@host# set peer 10.0.0.1 active-source-limit maximum 5000 threshold 4000
user@host# set group MSDP-group peer 10.10.10.10 active-source-limit maximum
7500
user@host# set active-source-limit maximum 10000
user@host# set source 10.1.0.0/16 active-source-limit maximum 500
```

3. Configure the mesh group.

```
[edit protocols msdp]
user@host# set group MSDP-group mode mesh-group
user@host# set group MSDP-group peer 10.10.10.10
user@host# set group MSDP-group local-address 10.1.2.3
```

4. If you are done configuring the device, commit the configuration.

```
[edit routing-instances]
user@host# commit
```

### Results

Confirm your configuration by entering the **show protocols** command.

```
user@host# show protocols
msdp {
 data-encapsulation disable;
 active-source-limit {
 maximum 10000;
 }
 peer 10.0.0.1 {
 active-source-limit {
 maximum 5000;
 threshold 4000;
 }
 }
 source 10.1.0.0/16 {
 active-source-limit {
 maximum 500;
 }
 }
 group MSDP-group {
 mode mesh-group;
 local-address 10.1.2.3;
 peer 10.10.10.10 {
 active-source-limit {
 maximum 7500;
 }
 }
 }
}
```

### Verification

To verify the configuration, run the following commands:

- [show msdp source-active](#)
- [show msdp statistics](#)

## Tracing MSDP Protocol Traffic

Tracing operations record detailed messages about the operation of routing protocols, such as the various types of routing protocol packets sent and received, and routing policy actions. You can specify which trace operations are logged by including specific tracing flags. The following table describes the flags that you can include.

| Flag                          | Description                              |
|-------------------------------|------------------------------------------|
| <b>all</b>                    | Trace all operations.                    |
| <b>general</b>                | Trace general events.                    |
| <b>keepalive</b>              | Trace keepalive messages.                |
| <b>normal</b>                 | Trace normal events.                     |
| <b>packets</b>                | Trace all MSDP packets.                  |
| <b>policy</b>                 | Trace policy processing.                 |
| <b>route</b>                  | Trace MSDP changes to the routing table. |
| <b>source-active</b>          | Trace source-active packets.             |
| <b>source-active-request</b>  | Trace source-active request packets.     |
| <b>source-active-response</b> | Trace source-active response packets.    |
| <b>state</b>                  | Trace state transitions.                 |
| <b>task</b>                   | Trace task processing.                   |
| <b>timer</b>                  | Trace timer processing.                  |

You can configure MSDP tracing for all peers, for all peers in a particular group, or for a particular peer.

In the following example, tracing is enabled for all routing protocol packets. Then tracing is narrowed to focus only on MSDP peers in a particular group. To configure tracing operations for MSDP:

1. (Optional) Configure tracing by including the **traceoptions** statement at the **[edit routing-options]** hierarchy level and set the **all-packets-trace** and **all** flags to trace all protocol packets.

```
[edit routing-options traceoptions]
```

```
user@host# set file all-packets-trace
user@host# set flag all
```

2. Configure the filename for the MSDP trace file.

```
[edit protocols msdp group groupa traceoptions]
user@host# set file msdp-trace
```

3. (Optional) Configure the maximum number of trace files.

```
[edit protocols msdp group groupa traceoptions]
user@host# set file files 5
```

4. (Optional) Configure the maximum size of each trace file.

```
[edit protocols msdp group groupa traceoptions]
user@host# set file size 1m
```

5. (Optional) Enable unrestricted file access.

```
[edit protocols msdp group groupa traceoptions]
user@host# set file world-readable
```

6. Configure tracing flags. Suppose you are troubleshooting issues with the source-active cache for **groupa**. The following example shows how to trace messages associated with the group address.

```
[edit protocols msdp group groupa traceoptions]
user@host# set flag source-active | match 230.0.0.3
```

7. View the trace file.

```
user@host> file list /var/log
user@host> file show /var/log/msdp-trace
```

## Disabling MSDP

To disable MSDP on the router, include the **disable** statement:

```
disable;
```

You can disable MSDP globally for all peers, for all peers in a group, or for an individual peer.

- Globally for all MSDP peers at the following hierarchy levels:
  - [edit protocols msdp]
  - [edit logical-systems *logical-system-name* protocols msdp]
  - [edit routing-instances *routing-instance-name* protocols msdp]
  - [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols msdp]
- For all peers in a group at the following hierarchy levels:
  - [edit protocols msdp group *group-name*]
  - [edit logical-systems *logical-system-name* protocols msdp group *group-name*]

- [edit routing-instances *routing-instance-name* protocols msdp group *group-name*]
- [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols msdp group *group-name*]
- For an individual peer at the following hierarchy levels:
  - [edit protocols msdp peer *address*]
  - [edit protocols msdp group *group-name* peer *address*]
  - [edit logical-systems *logical-system-name* protocols msdp peer *address*]
  - [edit logical-systems *logical-system-name* protocols msdp group *group-name* peer *address*]
  - [edit routing-instances *routing-instance-name* protocols msdp peer *address*]
  - [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols msdp peer *address*]
  - [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols msdp group *group-name* peer *address*]

If you disable MSDP at the group level, each peer in the group is disabled.



# Pragmatic General Multicast

- [Configuring PGM on page 329](#)

## Configuring PGM

---

- [Understanding Pragmatic General Multicast on page 329](#)
- [PGM Architecture and PGM Routers on page 330](#)
- [PGM-Enabled Source on page 331](#)
- [PGM-Enabled Receivers on page 331](#)
- [PGM-Enabled Routers on page 332](#)
- [PGM Configuration Guidelines on page 333](#)

## Understanding Pragmatic General Multicast

Multicast applications often require real-time operation. These applications cannot take advantage of Transmission Control Protocol (TCP) reliability features such as sequencing, retransmission, and flow control through windowing between sender and receiver. The User Datagram Protocol (UDP), the major transport layer alternative to TCP, is not as reliable as it needs to be for multicast traffic. Pragmatic General Multicast (PGM) is a special protocol layer for multicast traffic that can be used between the IP layer and the multicast application to add reliability to multicast traffic. PGM allows a receiver to detect missing information in all cases and to request replacement information if the receiver application requires it. PGM is Internet Protocol number 113.

Although PGM mainly deals with the operation of multicast source and receiver, PGM-enabled routers (called PGM network elements) play a *router assistance* role in the initial delivery and potential replacement of multicast traffic. PGM routers are not mandatory in PGM, but they can provide the following benefits when placed anywhere between the source and receivers:

- Reduce the load on the multicast source by aggregating duplicate messages to the source. PGM routers are required to perform this function.
- Limit the flooding of repair data (replacement information) to only those downstream receivers that requested the repair data. PGM routers are required to perform this function.

- Act as designated local repairers (DLRs) by caching the repair data and resending it to receivers that request it later. DLR functions are a PGM option, and PGM routers are not required to perform this role.

PGM adds reliability to multicast traffic streams. It is not a complete multicast protocol like the Distance Vector Routing Multicast Protocol (DVMRP) or Protocol Independent Multicast (PIM). Adding PGM to a router does not enable the router to perform multicast functions. Instead, a PGM router with multicast capabilities and a preconfigured multicast protocol such as PIM can offer more reliable multicast services to PGM sources and receivers. PGM is not an alternative to multicast routing protocols, but an enhancement of the multicast capabilities already present and configured on the router.

## PGM Architecture and PGM Routers

PGM is defined in RFC 3208 and forms a reliable transport layer for multicast applications. Almost any multicast application can use PGM. Applications most suitable for PGM include stock market ticker update information, news reports, weather warnings, and other information that must reach multiple listeners in its entirety and in a timely fashion.

The basic PGM architecture consists of a multicast content source, one or more receivers, and zero or more routers between the source and receivers. All end devices must be PGM-enabled, although there can be non-PGM routers between the source and receiver. If all routers are non-PGM routers, then no routers are capable of the PGM router assistance function, and all PGM functions take place directly between the source and receiver.

PGM sources send sequenced content in sessions to receivers, using multicast protocols. Other, non-PGM protocols allow receivers to learn about a particular source, its sessions, and its location. PGM receivers listen to multicast original data (ODATA), detect missing content through the sequence numbers, and send unicast negative acknowledgments (NAKs) back to the source. NAKs are answered by multicast NAK confirmations (NCFs), which suppress any NAKs from receivers on the same subnet that have not yet sent a NAK upstream. The source sends multicast repair data (RDATA) to receivers containing the missing content. PGM routers assist in this process by making sure that the negative acknowledgments follow the same path as the outbound content upstream to the source, and by suppressing duplicate negative acknowledgments and repair information.

PGM sources must maintain a “sliding window” of retransmittable information. There is no concept of group membership in PGM, so receivers never need to communicate with the source unless they request repair data with a negative acknowledgment. However, this means that the PGM source determines the window size for each receiver, in contrast to almost all other protocols, and requires a certain processing power in each receiver. The absence of positive receiver-to-source acknowledgments also means that PGM scales well and cuts down on control message traffic that can easily overwhelm a multicast network.

PGM receivers can start receiving a PGM session from a PGM source at any time and request any missing previous information that the receiving application needs. If the session is not long enough or if the transmit window is too small so that the source does not maintain a long session history, the receiver cannot get all required information.

## PGM-Enabled Source

A PGM-enabled source of multicast content generates sequenced packets of ODATA that are multicast to receivers. Interleaved with the content packets are source path messages (SPMs), which tell PGM routers and receivers about their upstream next-hop PGM device—either another PGM router or the PGM source.

ODATA packets and SPMs are multicast from the source. A PGM router always appends its own IP address to the SPM before it is multicast on the downstream interfaces. The SPMs are sent by the source and upstream PGM routers with the router alert option set in the IP headers so that PGM routers do not have to examine every packet in the session for SPM packets.

The PGM source acknowledges a received NAK by multicasting NAK confirmations (NCFs) downstream to the next PGM device on the path to the receiver. NCFs make sure that PGM routers and receivers do not bombard sources with NAKs. Downstream PGM routers suppress all subsequent NAKs that indicate the same missing information once one NCF is received from the upstream device.

The PGM source also responds to NAKs by multicasting RDATA packets with the same sequence number as the one indicated by the NAK. RDATA packets have the router alert option set in the IP header so that PGM routers can distinguish them from ODATA packets.

PGM sources organize their packets in sessions. PGM sources are not required to retain copies of information older than the current session, although they might. Long sessions are not necessarily kept on the source in their entirety.

PGM sources identify themselves through a global source ID (GSID). This globally unique source identifier is formed from the low-order 48 bits of the Message Digest 5 (MD5) signature of the Domain Name System (DNS) name of the source.

## PGM-Enabled Receivers

The PGM architecture requires one or more PGM-enabled receivers of the multicast content generated by a PGM source. PGM receivers accept all types of downstream PGM messages: ODATA, SPMs, NCFs, and RDATA.

Receivers process the ODATA packets as they arrive from the source, constantly checking the 32-bit sequence number in the ODATA PGM header for gaps in the sequence. If the receiver detects missing information, it generates a NAK for that sequence number. The NAK is unicast upstream to the PGM next hop, which is a router or the source, as determined by the last address in the received SPM.

A receiver detects that its NAK was received by the PGM next hop when it receives an NCF in response to its NAK. If several receivers on a subnet are missing the same ODATA packet, receivers getting an NCF for the packet before sending a NAK suppress the NAK. If a receiver does not get an NCF in response to a NAK, the receiving application can send a NAK again or continue, with the certainty that information is missing.

After the NCF, PGM receivers are sent an RDATA packet with the same sequence number indicated in the NAK and a copy of the missing ODATA. NCFs and RDATA can originate

from the source or a router acting as a designated local repairer (DLR) for a subnet. The receiver now has complete information about what is missing.

PGM receivers can request almost anything from the PGM source. However, because the source determines the window size, there is no guarantee that older information is available.

## PGM-Enabled Routers

Multicast-capable routers can implement the PGM router assistance functions, although not all multicast routers must be PGM-enabled routers. Mandatory PGM router assistance functions include aggregating duplicate NAKs sent to the source to reduce the load on the multicast source, generating NCFs in response to NAKs, and flooding RDATA packets to only those downstream receivers that requested it with a NAK. Optionally, a PGM router can be a DLR, caching PGM information and cutting down on network traffic by resending RDATA packets locally.

There can be zero or more PGM-enabled network elements (routers) between the source and receiver. If there are no PGM routers between the source and receiver, then all PGM messages flow directly between the source and receiver, and no router assistance functions are possible. Both PGM and non-PGM routers can be freely mixed on a network because PGM is a transport layer protocol and is not involved with router multicast functions.

PGM routers also receive SPMs from the source or an upstream PGM router and forward them downstream, inserting the router's own downstream IP interface address into the SPM so that receivers always know their upstream PGM next hop.

When a PGM router receives unicast NAKs from a downstream PGM router or receiver, the router unicasts one NAK for each missing sequence number to the next-hop PGM device upstream toward the source. The address of the PGM next-hop device is determined by received SPMs.

The PGM router multicasts NCFs in response to received NAKs on the downstream interfaces that received the NAKs. NCFs are not multicast on interfaces that have not received NAKs.

PGM routers must multicast all ODATA and RDATA packets that they receive from upstream PGM devices. Normal multicast protocols are used to determine downstream interfaces.

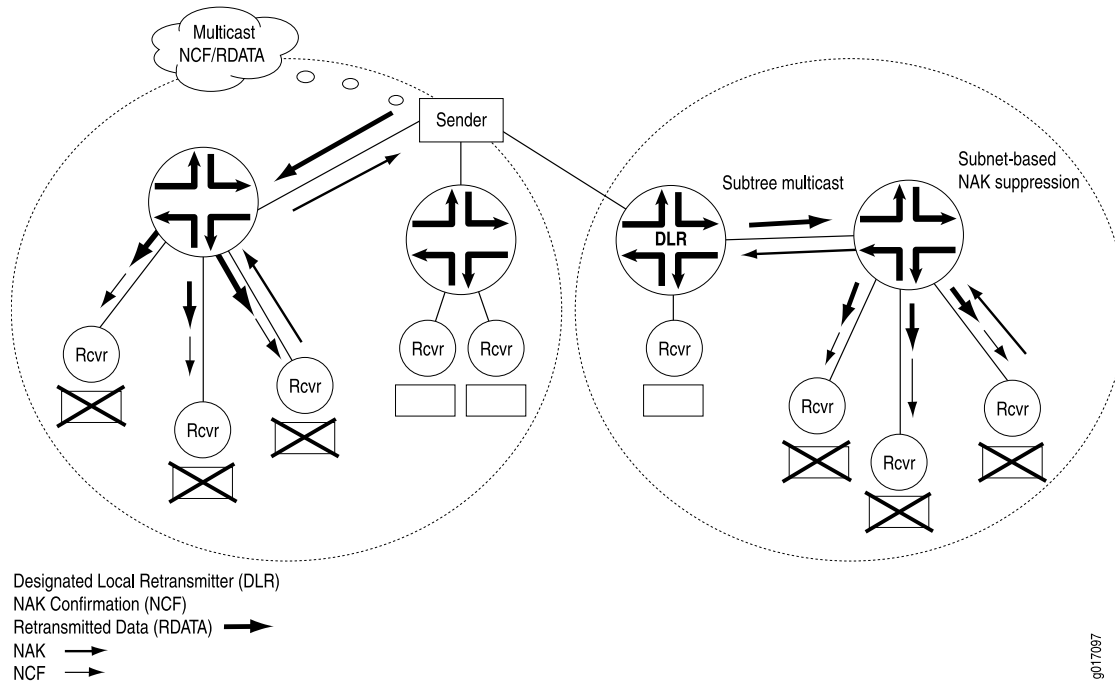
If the PGM router is a DLR, it responds to received NAKs with an NCF and with its own RDATA packet. NAKs are not forwarded upstream from a DLR.

[Figure 50 on page 333](#) shows the overall PGM architecture and the role of PGM-enabled routers.

Figure 50: PGM Architecture and General Operation

Case 1: RDATA from source in response to a NAK

Case 2: RDATA from DLR in response to a NAK



The figure shows only NAKs, NCFs, and RDATA flows. RDATA can come from either the source (left) or a DLR router (right). In both cases, unicast NAKs from a receiver are forwarded upstream by the routers, and multicast NCFs are generated downstream. Subnet NAK suppression is shown, as well as RDATA from the source or DLR sent only to the portions of the network requesting it.

## PGM Configuration Guidelines

Pragmatic General Multicast (PGM) allows the router to participate in defined PGM router assistance functions between PGM-enabled sources and receivers. Although PGM is a transport layer protocol and does not do IP packet routing, PGM must be explicitly configured on the router.

To enable PGM globally on the router, include the **pgm** statement:

```
pgm;
```

You can include this statement at the following hierarchy levels:

- [edit protocols]
- [edit logical-systems *logical-system-name* protocols]

To trace the operation of PGM, include the **traceoptions** statement:

```
traceoptions {
 flag flag <flag-modifier>;
}
```

```
}
```

You can include this statement at the following hierarchy levels:

- [edit protocols **pgm**]
- [edit logical-systems *logical-system-name* protocols **pgm**]

You can specify the following PGM-specific options in the **flag** statement:

- **all**—Trace all PGM packets.
- **init**—Trace all PGM initialization events.
- **packets**—Trace all PGM packet processing.
- **parser**—Trace all PGM parser processing.
- **route-socket**—Trace all PGM route-socket events.
- **show**—Trace all PGM **show** command servicing.
- **state**—Trace all PGM state transitions.

By default, PGM is enabled on every interface of the router, but global, explicit configuration is required. No options are available for PGM operation.

## CHAPTER 13

# Distance Vector Multicast Routing Protocol

- [Examples: Configuring DVMRP on page 335](#)

### Examples: Configuring DVMRP

---

- [Understanding DVMRP on page 335](#)
- [Configuring DVMRP on page 336](#)
- [Example: Configuring DVMRP on page 336](#)
- [Example: Configuring DVMRP to Announce Unicast Routes on page 340](#)
- [Tracing DVMRP Protocol Traffic on page 343](#)

### Understanding DVMRP

The Distance Vector Multicast Routing Protocol (DVMRP) is a distance-vector routing protocol that provides connectionless datagram delivery to a group of hosts across an internetwork. DVMRP is a distributed protocol that dynamically generates IP multicast delivery trees by using a technique called reverse-path multicasting (RPM) to forward multicast traffic to downstream interfaces. These mechanisms allow the formation of shortest-path trees, which are used to reach all group members from each network source of multicast traffic.

DVMRP is designed to be used as an interior gateway protocol (IGP) within a multicast domain.

Because not all IP routers support native multicast routing, DVMRP includes direct support for tunneling IP multicast datagrams through routers. The IP multicast datagrams are encapsulated in unicast IP packets and addressed to the routers that do support native multicast routing. DVMRP treats tunnel interfaces and physical network interfaces the same way.

DVMRP routers dynamically discover their neighbors by sending neighbor probe messages periodically to an IP multicast group address that is reserved for all DVMRP routers.

## Configuring DVMRP

Distance Vector Multicast Routing Protocol (DVMRP) is the first of the multicast routing protocols and has a number of limitations that make this method unattractive for large-scale Internet use. DVMRP is a dense-mode-only protocol, and uses the flood-and-prune or implicit join method to deliver traffic everywhere and then determine where the uninterested receivers are. DVMRP uses source-based distribution trees in the form (S,G).

To configure the Distance Vector Multicast Routing Protocol (DVMRP), include the **dvmrp** statement:

```
dvmrp {
 disable;
 export [policy-names];
 import [policy-names];
 interface interface-name {
 disable;
 hold-time seconds;
 metric metric;
 mode (forwarding | unicast-routing);
 }
 rib-group group-name;
 traceoptions {
 file filename <files number> <size size> <world-readable | no-world-readable>;
 flag flag <flag-modifier> <disable>;
 }
}
```

You can include this statement at the following hierarchy levels:

- **[edit protocols]**
- **[edit logical-systems *logical-system-name* protocols]**

By default, DVMRP is disabled.

## Example: Configuring DVMRP

This example shows how to use DVMRP to announce routes used for multicast routing as well as multicast data forwarding.

- [Requirements on page 336](#)
- [Overview on page 337](#)
- [Configuration on page 338](#)
- [Verification on page 339](#)

---

### Requirements

Before you begin:

- Configure the router interfaces.



- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.

## Overview

DVMRP is a distance vector protocol for multicast. It is similar to RIP, in that both RIP and DVMRP have issues with scalability and robustness. PIM domains are more commonly used than DVMRP domains. In some environments, you might need to configure interoperability with DVMRP.

This example includes the following DVMRP settings:

- **protocols dvmrp rib-group**—Associates the **dvmrp-rib** routing table group with the DVMRP protocol to enable multicast RPF lookup.
- **protocols dvmrp interface**—Configures the DVMRP interface. The interface of a DVMRP router can be either a physical interface to a directly attached subnetwork or a tunnel interface to another multicast-capable area of the Multicast Backbone (*MBone*). The DVMRP hold-time period is the amount of time that a neighbor is to consider the sending router (this router) to be operative (up). The default hold-time period is 35 seconds.
- **protocols dvmrp interface hold-time**—The DVMRP hold-time period is the amount of time that a neighbor is to consider the sending router (this router) to be operative (up). The default hold-time period is 35 seconds.
- **protocols dvmrp interface metric**—All interfaces can be configured with a metric specifying cost for receiving packets on a given interface. The default metric is 1.

For each source network reported, a route metric is associated with the unicast route being reported. The metric is the sum of the interface metrics between the router originating the report and the source network. A metric of 32 marks the source network as unreachable, thus limiting the breadth of the DVMRP network and placing an upper bound on the DVMRP convergence time.

- **routing-options rib-groups**—Enables DVMRP to access route information from the unicast routing table, **inet.0**, and from a separate routing table that is reserved for DVMRP. In this example, the first routing table group named **ifrg** contains local interface routes. This ensures that local interface routes get added to both the **inet.0** table for use by unicast protocols and the **inet.2** table for multicast RPF check. The second routing table group named **dvmrp-rib** contains **inet.2** routes.

DVMRP needs to access route information from the unicast routing table, **inet.0**, and from a separate routing table that is reserved for DVMRP. You need to create the routing table for DVMRP and to create groups of routing tables so that the routing protocol process imports and exports routes properly. We recommend that you use routing table **inet.2** for DVMRP routing information.

- **routing-options interface-routes**— After defining the **ifrg** routing table group, use the **interface-routes** statement to insert interface routes into the **ifrg** group—in other words,

into both **inet.0** and **inet.2**. By default, interface routes are imported into routing table **inet.0** only.

- **sap**—Enables the Session Directory Announcement Protocol (SAP) and the Session Directory Protocol (SDP). Enabling SAP allows the router to receive announcements about multimedia and other multicast sessions.

SAP always listens to the address and port 224.2.127.254:9875 for session advertisements. To add other addresses or pairs of address and port, include one or more **listen** statements.

Sessions learned by SDP, SAP's higher-layer protocol, time out after 60 minutes.

---

### Configuration

**CLI Quick Configuration** To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set routing-options interface-routes rib-group inet ifrg
set routing-options rib-groups ifrg import-rib inet.0
set routing-options rib-groups ifrg import-rib inet.2
set routing-options rib-groups dvmrp-rib export-rib inet.2
set routing-options rib-groups dvmrp-rib import-rib inet.2
set protocols sap
set protocols dvmrp rib-group dvmrp-rib
set protocols dvmrp interface ip-0/0/0.0 metric 5
set protocols dvmrp interface ip-0/0/0.0 hold-time 40
```

**Step-by-Step Procedure** The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure an MSDP routing instance:

1. Create the routing tables for DVMRP routes.

```
[edit routing-options]
user@host# set interface-routes rib-group inet ifrg
user@host# set rib-groups ifrg import-rib [inet.0 inet.2]
user@host# set rib-groups dvmrp-rib import-rib inet.2
user@host# set rib-groups dvmrp-rib export-rib inet.2
```

2. Configure SAP and SDP.

```
[edit protocols]
user@host# set sap
```

3. Enable DVMRP on the router and associate the **dvmrp-rib** routing table group with DVMRP to enable multicast RPF checks.

```
[edit protocols]
user@host# set dvmrp rib-group dvmrp-rib
```

4. Configure the DVMRP interface with a hold-time value and a metric. This example shows an IP-over-IP encapsulation tunnel interface.

```
[edit protocols]
user@host# set dvmrp interface ip-0/0/0.0
user@host# set dvmrp interface ip-0/0/0.0 hold-time 40
user@host# set dvmrp interface ip-0/0/0.0 metric 5
```

5. If you are done configuring the device, commit the configuration.

```
user@host# commit
```

### Results

Confirm your configuration by entering the **show routing-options** command and the **show protocols** command from configuration mode. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show routing-options
interface-routes {
 rib-group inet ifrg;
}
rib-groups {
 ifrg {
 import-rib [inet.0 inet.2];
 }
 dvmrp-rib {
 export-rib inet.2;
 import-rib inet.2;
 }
}

user@host# show protocols
sap;
dvmrp {
 rib-group dvmrp-rib;
 interface ip-0/0/0.0 {
 metric 5;
 hold-time 40;
 }
}
```

### Verification

To verify the configuration, run the following commands:

- **show dvmrp interfaces**
- **show dvmrp neighbors**

## Example: Configuring DVMRP to Announce Unicast Routes

This example shows how to use DVMRP to announce unicast routes used solely for multicast reverse-path forwarding (RPF) to set up the multicast control plane.

- [Requirements on page 340](#)
- [Overview on page 340](#)
- [Configuration on page 341](#)
- [Verification on page 343](#)

---

### Requirements

Before you begin:

- Configure the router interfaces.
- Configure an interior gateway protocol or static routing. See the *Junos OS Routing Protocols Library for Security Devices*.

---

### Overview

DVMRP has two modes. Forwarding mode is the default mode. In forwarding mode, DVMRP is responsible for the multicast control plane and multicast data forwarding. In the nondefault mode (which is shown in this example), DVMRP does not forward multicast data traffic. This mode is called unicast routing mode because in this mode DVMRP is only responsible for announcing unicast routes used for multicast RPF—in other words, for establishing the control plane. To forward multicast data, enable Protocol Independent Multicast (PIM) on the interface. If you have configured PIM on the interface, as shown in this example, you can configure DVMRP in unicast-routing mode only. You cannot configure PIM and DVMRP in forwarding mode at the same time.

This example includes the following settings:

- **policy-statement dvmrp-export**—Accepts static default routes.
- **protocols dvmrp export dvmrp-export**—Associates the **dvmrp-export** policy with the DVMRP protocol.

All routing protocols use the routing table to store the routes that they learn and to determine which routes they advertise in their protocol packets. Routing policy allows you to control which routes the routing protocols store in and retrieve from the routing table. Import and export policies are always from the point of view of the routing table. So the **dvmrp-export** policy exports static default routes from the routing table and accepts them into DVMRP.

- **protocols dvmrp interface all mode unicast-routing**—Enables all interfaces to announce unicast routes used solely for multicast RPF.
- **protocols dvmrp rib-group inet dvmrp-rg**—Associates the **dvmrp-rib** routing table group with the DVMRP protocol to enable multicast RPF checks.
- **protocols pim rib-group inet pim-rg**—Associates the **pim-rg** routing table group with the PIM protocol to enable multicast RPF checks.

- **routing-options rib inet.2 static route 0.0.0.0/0 discard**—Redistributes static routes to all DVMRP neighbors. The **inet.2** routing table stores unicast IPv4 routes for multicast RPF lookup. The **discard** statement silently drops packets without notice.
- **routing-options rib-groups dvmrp-rg import-rib inet.2**—Creates the routing table for DVMRP to ensure that the routing protocol process imports routes properly.
- **routing-options rib-groups dvmrp-rg export-rib inet.2**—Creates the routing table for DVMRP to ensure that the routing protocol process exports routes properly.
- **routing-options rib-groups pim-rg import-rib inet.2**—Enables access to route information from the routing table that stores unicast IPv4 routes for multicast RPF lookup. In this example, the first routing table group named **pim-rg** contains local interface routes. This ensures that local interface routes get added to the **inet.2** table.

### Configuration

**CLI Quick Configuration** To quickly configure this example, copy the following commands, paste them into a text file, remove any line breaks, change any details necessary to match your network configuration, and then copy and paste the commands into the CLI at the **[edit]** hierarchy level.

```
set policy-options policy-statement dvmrp-export term 10 from protocol static
set policy-options policy-statement dvmrp-export term 10 from route-filter 0.0.0.0/0
 exact
set policy-options policy-statement dvmrp-export term 10 then accept
set protocols dvmrp rib-group inet
set protocols dvmrp rib-group dvmrp-rg
set protocols dvmrp export dvmrp-export
set protocols dvmrp interface all mode unicast-routing
set protocols dvmrp interface fxp0.0 disable
set protocols pim rib-group inet pim-rg
set protocols pim interface all
set routing-options rib inet.2 static route 0.0.0.0/0 discard
set routing-options rib-groups pim-rg import-rib inet.2
set routing-options rib-groups dvmrp-rg export-rib inet.2
set routing-options rib-groups dvmrp-rg import-rib inet.2
```

**Step-by-Step Procedure** The following example requires you to navigate various levels in the configuration hierarchy. For information about navigating the CLI, see *Using the CLI Editor in Configuration Mode* in the *CLI User Guide*.

To configure an MSDP routing instance:

1. Configure the routing options.

```
[edit routing-options]
[edit routing -options]
user@host# set rib inet.2 static route 0.0.0.0/0 discard
user@host# set rib-groups pim-rg import-rib inet.2
user@host# set rib-groups dvmrp-rg import-rib inet.2
user@host# set rib-groups dvmrp-rg export-rib inet.2
```

2. Configure DVMRP.

- ```
[edit protocols]
user@host# set dvmrp rib-group inet dvmrp-rg
user@host# set dvmrp export dvmrp-export
user@host# set dvmrp interface all mode unicast-routing
user@host# set dvmrp interface fxp0 disable
```
3. Configure PIM so that PIM performs multicast data forwarding.


```
[edit protocols]
user@host# set pim rib-group inet pim-rg
user@host# set pim interface all
```
 4. Configure the DVMRP routing policy.


```
[edit policy-options policy-statement dvmrp-export term 10]
user@host# set from protocol static
user@host# set from route-filter 0.0.0.0/0 exact
user@host# set then accept
```
 5. If you are done configuring the device, commit the configuration.


```
user@host# commit
```

Results

Confirm your configuration by entering the **show policy-options** command, the **show protocols** command, and the **show routing-options** command from configuration mode. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@host# show policy-options
policy-statement dvmrp-export {
  term 10 {
    from {
      protocol static;
      route-filter 0.0.0.0/0 exact;
    }
    then accept;
  }
}

user@host# show protocols
dvmrp {
  rib-group inet dvmrp-rg;
  export dvmrp-export;
  interface all {
    mode unicast-routing;
  }
  interface fxp0.0 {
    disable;
  }
}
pim {
  rib-group inet pim-rg;
  interface all;
}

user@host# show routing-options
```

```

rib inet.2 {
  static {
    route 0.0.0.0/0 discard;
  }
}
rib-groups {
  pim-rg {
    import-rib inet.2;
  }
  dvmrp-rg {
    export-rib inet.2;
    import-rib inet.2;
  }
}

```

Verification

To verify the configuration, run the following commands:

- [show dvmrp interfaces](#)
- [show pim statistics](#)

Tracing DVMRP Protocol Traffic

Tracing operations record detailed messages about the operation of routing protocols, such as the various types of routing protocol packets sent and received, and routing policy actions. You can specify which trace operations are logged by including specific tracing flags. The following table describes the flags that you can include.

Flag	Description
all	Trace all operations.
general	Trace general flow.
graft	Trace graft messages.
neighbor	Trace neighbor probe packets.
normal	Trace normal events.
packets	Trace all DVMRP packets.
poison	Trace poison-route-reverse packets.
policy	Trace policy processing.
probe	Trace probe packets.
prune	Trace prune messages.

Flag	Description
report	Trace membership report messages.
route	Trace routing information.
state	Trace state transitions.
task	Trace task processing.
timer	Trace timer processing.

In the following example, tracing is enabled for all routing protocol packets. Then tracing is narrowed to focus only on DVMRP packets of a particular type. To configure tracing operations for DVMRP:

1. (Optional) Configure tracing at the routing options level to trace all protocol packets.

```
[edit routing-options traceoptions]
user@host# set file all-packets-trace
user@host# set flag all
```

2. Configure the filename for the DVMRP trace file.

```
[edit protocols dvmrp traceoptions]
user@host# set file dvmrp-trace
```

3. (Optional) Configure the maximum number of trace files.

```
[edit protocols dvmrp traceoptions]
user@host# set file files 5
```

4. (Optional) Configure the maximum size of each trace file.

```
[edit protocols dvmrp traceoptions]
user@host# set file size 1m
```

5. (Optional) Enable unrestricted file access.

```
[edit protocols dvmrp traceoptions]
user@host# set file world-readable
```

6. Configure tracing flags. Suppose you are troubleshooting issues with a particular DVMRP neighbor. The following example shows how to trace neighbor probe packets that match the neighbor's IP address.

```
[edit protocols dvmrp traceoptions]
user@host# set flag neighbor | match 192.168.1.1
```

7. View the trace file.

```
user@host> file list /var/log
user@host> file show /var/log/dvmrp-trace
```

Related Documentation

- [Understanding DVMRP on page 335](#)

PIM Configuration Statements

- [accept-remote-source](#) on page 348
- [address](#) (Anycast RPs) on page 349
- [address](#) (Bidirectional Rendezvous Points) on page 350
- [address](#) (Local RPs) on page 351
- [address](#) (Static RPs) on page 352
- [algorithm](#) on page 353
- [anycast-pim](#) on page 354
- [assert-timeout](#) on page 355
- [authentication](#) on page 356
- [auto-rp](#) on page 357
- [backoff-period](#) on page 358
- [bfd-liveness-detection](#) on page 359
- [bidirectional](#) (Interface) on page 360
- [bidirectional](#) (RP) on page 361
- [bootstrap](#) on page 362
- [bootstrap-export](#) on page 363
- [bootstrap-import](#) on page 364
- [bootstrap-priority](#) on page 365
- [dense-groups](#) on page 366
- [detection-time](#) (BFD for PIM) on page 367
- [df-election](#) on page 368
- [disable](#) (PIM Graceful Restart) on page 368
- [disable](#) (PIM) on page 369
- [dr-election-on-p2p](#) on page 370
- [dr-register-policy](#) on page 370
- [embedded-rp](#) on page 371
- [export](#) (Bootstrap) on page 372
- [export](#) (PIM) on page 372

- [family \(Bootstrap\) on page 373](#)
- [family \(Disable PIM\) on page 374](#)
- [family \(Local RP\) on page 375](#)
- [graceful-restart on page 376](#)
- [group \(RPF Selection\) on page 377](#)
- [group-ranges on page 378](#)
- [hello-interval on page 379](#)
- [hold-time \(PIM\) on page 380](#)
- [import \(Bootstrap\) on page 381](#)
- [import \(PIM\) on page 382](#)
- [infinity on page 383](#)
- [interface on page 384](#)
- [join-load-balance on page 385](#)
- [join-prune-timeout on page 386](#)
- [key-chain on page 386](#)
- [local on page 387](#)
- [local-address on page 388](#)
- [loose-check on page 389](#)
- [mapping-agent-election on page 390](#)
- [maximum-rps on page 391](#)
- [minimum-interval \(PIM BFD Liveness Detection\) on page 392](#)
- [minimum-interval \(PIM BFD Transmit Interval\) on page 393](#)
- [minimum-receive-interval on page 394](#)
- [mode on page 395](#)
- [multiplier on page 396](#)
- [neighbor-policy on page 396](#)
- [next-hop \(PIM RPF Selection\) on page 397](#)
- [no-adaptation \(PIM BFD Liveness Detection\) on page 397](#)
- [no-bidirectional-mode on page 398](#)
- [offer-period on page 399](#)
- [override \(PIM static RP\) on page 400](#)
- [override-interval on page 401](#)
- [pim on page 402](#)
- [prefix-list \(PIM RPF Selection\) on page 405](#)
- [priority \(Bootstrap\) on page 406](#)
- [priority \(PIM Interfaces\) on page 407](#)
- [priority \(PIM RPs\) on page 408](#)

- [propagation-delay on page 409](#)
- [reset-tracking-bit on page 410](#)
- [restart-duration on page 411](#)
- [rib-group on page 412](#)
- [robustness-count on page 413](#)
- [rp on page 414](#)
- [rp-register-policy on page 416](#)
- [rp-set on page 417](#)
- [rpf-selection on page 418](#)
- [source \(PIM RPF Selection\) on page 419](#)
- [spt-threshold on page 420](#)
- [static on page 421](#)
- [threshold \(PIM BFD Detection Time\) on page 422](#)
- [threshold \(PIM BFD Transmit Interval\) on page 423](#)
- [traceoptions on page 424](#)
- [transmit-interval \(PIM BFD Liveness Detection\) on page 427](#)
- [tunnel-devices on page 428](#)
- [version \(BFD\) on page 429](#)
- [version \(PIM\) on page 430](#)
- [vpn-group-address on page 431](#)
- [wildcard-source \(PIM RPF Selection\) on page 431](#)

accept-remote-source

Syntax	accept-remote-source;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim interface <i>interface-name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>], [edit protocols pim interface <i>interface-name</i>], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 9.6 for EX Series switches.
Description	Accept traffic from a remote source. A remote source is a source that is not on the same subnet as the incoming interface. This statement enables the remote source to be learned and advertised by MSDP so that receivers in other MSDP areas can join the source. You do not need to disable RPF checking, but you do need to ensure that the best path to reach the remote source is through the incoming interface.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring the Interface to Accept Traffic from a Remote Source on page 320• <i>Example: Allowing MBGP MVPN Remote Sources</i>

address (Anycast RPs)

Syntax	<code>address <i>address</i> <forward-msdp-sa>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols <code>pim rp local</code> (inet inet6) <code>anycast-pim rp-set</code>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols <code>pim rp local</code> (inet inet6) <code>anycast-pim rp-set</code>],</p> <p>[edit protocols <code>pim rp local</code> (inet inet6) <code>anycast-pim rp-set</code>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols <code>pim rp local</code> (inet inet6) <code>anycast-pim rp-set</code>]</p>
Release Information	<p>Statement introduced in Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure the anycast rendezvous point (RP) addresses in the RP set. Multiple addresses can be configured in an RP set. If the RP has peer Multicast Source Discovery Protocol (MSDP) connections, then the RP must forward MSDP source active (SA) messages.
Options	<p><i>address</i>—RP address in an RP set.</p> <p><i>forward-msdp-sa</i>—(Optional) Forward MSDP SAs to this address.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>

address (Bidirectional Rendezvous Points)

Syntax	<pre>address address { group-ranges { destination-ip-prefix </prefix-length>; } hold-time seconds; priority number; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp bidirectional], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp bidirectional], [edit protocols pim rp bidirectional], [edit routing-instances <i>routing-instance-name</i> protocols pim rp bidirectional]
Release Information	Statement introduced in Junos OS Release 12.1.
Description	Configure bidirectional rendezvous point (RP) addresses. The address can be a loopback interface address, an address of a link interface, or an address that is not assigned to an interface but belongs to a subnet that is reachable by the bidirectional PIM routers in the network.
Options	address —Bidirectional RP address. Default: 232.0.0.0/8 The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Understanding Bidirectional PIM on page 54• Example: Configuring Bidirectional PIM on page 60

address (Local RPs)

Syntax	<code>address <i>address</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols <code>pim rp local family</code> (inet inet6)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols <code>pim rp local family</code> (inet inet6)],</p> <p>[edit protocols <code>pim rp local family</code> (inet inet6)],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols <code>pim rp local family</code> (inet inet6)]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure the local rendezvous point (RP) address.
Options	<i>address</i> —Local RP address.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring Local PIM RPs on page 73

address (Static RPs)

Syntax	<pre>address address { group-ranges { destination-ip-prefix </prefix-length>; } override; version version; }</pre>
Hierarchy Level	<pre>[edit logical-systems logical-system-name protocols pim rp static], [edit logical-systems logical-system-name routing-instances routing-instance-name protocols pim rp static], [edit protocols pim static], [edit routing-instances routing-instance-name protocols pim rp static]</pre>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Configure static rendezvous point (RP) addresses. You can configure a static RP in a logical system only if the logical system is not directly connected to a source.</p> <p>For each static RP address, you can optionally specify the PIM version and the groups for which this address can be the RP. The default PIM version is version 1.</p>
Options	<p>address—Static RP address.</p> <p>Default: 224.0.0.0/4</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">• Configuring the Static PIM RP Address on the Non-RP Routing Device on page 75

algorithm

Syntax	<code>algorithm <i>algorithm-name</i>;</code>
Hierarchy Level	[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection authentication], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection authentication]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify the algorithm to use for BFD authentication.
Options	<p><i>algorithm-name</i>—Name of algorithm to use for BFD authentication:</p> <ul style="list-style-type: none"> • simple-password—Plain-text password. One to 16 bytes of plain text. One or more passwords can be configured. • keyed-md5—Keyed Message Digest 5 hash algorithm for sessions with transmit and receive rates greater than 100 ms. • meticulous-keyed-md5—Meticulous keyed Message Digest 5 hash algorithm. • keyed-sha-1—Keyed Secure Hash Algorithm I for sessions with transmit and receive rates greater than 100 ms. • meticulous-keyed-sha-1—Meticulous keyed Secure Hash Algorithm I.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Understanding Bidirectional Forwarding Detection Authentication for PIM on page 118 • Configuring BFD Authentication for PIM on page 121 • authentication on page 356

anycast-pim

Syntax	<pre>anycast-pim { rp-set { address address <forward-msdp-sa>; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp local family (inet inet6)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp local family (inet inet6)], [edit protocols pim rp local family (inet inet6)], [edit routing-instances <i>routing-instance-name</i> protocols pim rp local family (inet inet6)]
Release Information	Statement introduced in Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure properties for anycast RP using PIM. The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring PIM Anycast With or Without MSDP on page 79

assert-timeout

Syntax	<code>assert-timeout <i>seconds</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Multicast routing devices running PIM sparse mode often forward the same stream of multicast packets onto the same LAN through the rendezvous-point tree (RPT) and shortest-path tree (SPT). PIM assert messages help routing devices determine which routing device forwards the traffic and prunes the RPT for this group. By default, routing devices enter an assert cycle every 180 seconds. You can configure this assert timeout to be between 5 and 210 seconds.
Options	<i>seconds</i> —Time for routing device to wait before another assert message cycle. Range: 5 through 210 seconds Default: 180 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring the PIM Assert Timeout on page 112


authentication

Syntax	<pre>authentication { algorithm <i>algorithm-name</i>; key-chain <i>key-chain-name</i>; loose-check; }</pre>
Hierarchy Level	[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure the algorithm, security keychain, and level of authentication for BFD sessions running on PIM interfaces.
Options	The statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring BFD Authentication for PIM on page 121• Configuring BFD for PIM on page 120• Understanding Bidirectional Forwarding Detection Authentication for PIM on page 118• bfd-liveness-detection on page 359• key-chain on page 386• loose-check on page 389

auto-rp

Syntax	<pre> auto-rp { (announce discovery mapping); (mapping-agent-election no-mapping-agent-election); } </pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp], [edit protocols pim rp], [edit routing-instances <i>routing-instance-name</i> protocols pim rp]
Release Information	Statement introduced in Junos OS Release 7.5. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure automatic RP announcement and discovery.
Options	<p>announce—Configure the routing device to listen only for mapping packets and also to advertise itself if it is an RP.</p> <p>discovery—Configure the routing device to listen only for mapping packets.</p> <p>mapping—Configures the routing device to announce, listen for and generate mapping packets, and announce that the routing device is eligible to be an RP.</p> <p>The remaining statement is explained separately.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Auto-RP on page 89

backoff-period

Syntax	<code>backoff-period <i>milliseconds</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols <code>pim interface <i>interface-name</i></code> bidirectional df-election],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols <code>pim interface <i>interface-name</i></code> bidirectional df-election],</p> <p>[edit protocols <code>pim interface <i>interface-name</i></code> bidirectional df-election],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols <code>pim interface <i>interface-name</i></code> bidirectional df-election]</p>
Release Information	Statement introduced in Junos OS Release 12.1.
Description	<p>Configure the designated forwarder (DF) election backoff period for bidirectional PIM. The backoff-period statement configures the period that the acting DF waits between receiving a better DF Offer and sending the Pass message to transfer DF responsibility.</p>
<div style="display: flex; align-items: flex-start;"> <div style="flex: 1; text-align: center; margin-right: 10px;">  </div> <div> <p>NOTE: Junos OS checks rendezvous point (RP) unicast reachability before accepting incoming DF messages. DF messages for unreachable rendezvous points are ignored. This is needed to prevent the following example scenario. Routers A and B are downstream routers on the same LAN, and both are supposed to send DF election messages with an infinite metric on their upstream interfaces (reverse-path forwarding [RPF] interfaces). Router A has a higher IP address than Router B. When both routers lose the path to the RP, both send an Offer message with the infinite metric onto the LAN. Router A wins the election because it has a higher IP address, and Router B backs off as a result. After three Offer messages, according to RFC 5015, Router A looks up the RP and finds no path to the RP. As a result, Router A transitions to the Lose state and sends nothing. On the other hand, after backing off for an interval of 3 x the Offer period, Router B does not receive any messages, and resumes the DF election by sending a new Offer message. Hence, the pattern repeats indefinitely.</p> </div> </div>	
Options	<p><i>milliseconds</i>—Period that the acting DF waits between receiving a better DF Offer and sending the Pass message to transfer DF responsibility.</p> <p>Range: 100 through 65,535 milliseconds</p> <p>Default: 1000</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Understanding Bidirectional PIM on page 54 • Example: Configuring Bidirectional PIM on page 60

bfd-liveness-detection

Syntax	<pre> bfd-liveness-detection { authentication { algorithm <i>algorithm-name</i>; key-chain <i>key-chain-name</i>; loose-check; } detection-time { threshold <i>milliseconds</i>; } minimum-interval <i>milliseconds</i>; minimum-receive-interval <i>milliseconds</i>; multiplier <i>number</i>; no-adaptation; transmit-interval { minimum-interval <i>milliseconds</i>; threshold <i>milliseconds</i>; } version (0 1 automatic); } </pre>
Hierarchy Level	<p>[edit protocols pim interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 8.1.</p> <p>authentication option introduced in Junos OS Release 9.6.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	<p>Configure bidirectional forwarding detection (BFD) timers and authentication for PIM.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring BFD for PIM on page 120 • Configuring BFD Authentication for PIM on page 121

bidirectional (Interface)

Syntax	<pre>bidirectional { df-election { backoff-period <i>milliseconds</i>; offer-period <i>milliseconds</i>; robustness-count <i>number</i>; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim interface interface-name], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface interface-name], [edit protocols pim interface interface-name], [edit routing-instances <i>routing-instance-name</i> protocols pim interface interface-name]
Release Information	Statement introduced in Junos OS Release 12.1.
Description	Configure parameters for bidirectional PIM. The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Understanding Bidirectional PIM on page 54• Example: Configuring Bidirectional PIM on page 60

bidirectional (RP)

Syntax	<pre> bidirectional { address address { group-ranges { destination-ip-prefix</prefix-length>; } hold-time seconds; priority number; } } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim rp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp], [edit protocols pim rp], [edit routing-instances <i>routing-instance-name</i> protocols pim rp]</p>
Release Information	Statement introduced in Junos OS Release 12.1.
Description	<p>Configure the routing device's rendezvous-point (RP) properties for bidirectional PIM.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Understanding Bidirectional PIM on page 54 • Example: Configuring Bidirectional PIM on page 60

bootstrap

Syntax	<pre>bootstrap { family (inet inet6) { export [<i>policy-names</i>]; import [<i>policy-names</i>]; priority <i>number</i>; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp], [edit protocols pim rp], [edit routing-instances <i>routing-instance-name</i> protocols pim rp]
Release Information	Statement introduced in Junos OS Release 7.6. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure parameters to control bootstrap routers and messages. The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PIM Bootstrap Properties for IPv4 on page 85• Configuring PIM Bootstrap Properties for IPv4 or IPv6 on page 86

bootstrap-export

Syntax	<code>bootstrap-export [<i>policy-names</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim rp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp],</p> <p>[edit protocols pim rp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rp]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Apply one or more export policies to control outgoing PIM bootstrap messages.
Options	<i>policy-names</i> —Name of one or more import policies.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Bootstrap Properties for IPv4 on page 85 • Configuring PIM Bootstrap Properties for IPv4 or IPv6 on page 86 • bootstrap-import on page 364

bootstrap-import

Syntax	<code>bootstrap-import [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp], [edit protocols pim rp], [edit routing-instances <i>routing-instance-name</i> protocols pim rp]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Apply one or more import policies to control incoming PIM bootstrap messages.
Options	<i>policy-names</i> —Name of one or more import policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PIM Bootstrap Properties for IPv4 on page 85• Configuring PIM Bootstrap Properties for IPv4 or IPv6 on page 86• bootstrap-export on page 363

bootstrap-priority

Syntax	<code>bootstrap-priority <i>number</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim rp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp],</p> <p>[edit protocols pim rp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rp]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure whether this routing device is eligible to be a bootstrap router. In the case of a tie, the routing device with the highest IP address is elected to be the bootstrap router.
Options	<p><i>number</i>—Priority for becoming the bootstrap router. A value of 0 means that the routing device is not eligible to be the bootstrap router.</p> <p>Range: 0 through 255</p> <p>Default: 0</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Bootstrap Properties for IPv4 on page 85

dense-groups

Syntax	<code>dense-groups { <i>addresses</i>; }</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure which groups are operating in dense mode.
Options	<i>addresses</i> —Address of groups operating in dense mode.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PIM Sparse-Dense Mode Properties on page 141

detection-time (BFD for PIM)

Syntax	<pre> detection-time { threshold milliseconds; } </pre>
Hierarchy Level	[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection]
Release Information	<p>Statement introduced in Junos OS Release 8.2.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Support for BFD authentication introduced in Junos OS Release 9.6.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	<p>Enable BFD failure detection. The BFD failure detection timers are adaptive and can be adjusted to be faster or slower. The lower the BFD failure detection timer value, the faster the failure detection and vice versa. For example, the timers can adapt to a higher value if the adjacency fails (that is, the timer detects failures more slowly). Or a neighbor can negotiate a higher value for a timer than the configured value. The timers adapt to a higher value when a BFD session flap occurs more than three times in a span of 15 seconds. A back-off algorithm increases the receive (Rx) interval by two if the local BFD instance is the reason for the session flap. The transmission (Tx) interval is increased by two if the remote BFD instance is the reason for the session flap. You can use the clear bfd adaptation command to return BFD interval timers to their configured values. The clear bfd adaptation command is hitless, meaning that the command does not affect traffic flow on the routing device.</p> <p>The remaining statement is explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring BFD for PIM on page 120 • bfd-liveness-detection on page 359 • threshold on page 422

df-election

Syntax	<pre>df-election { backoff-period <i>milliseconds</i>; offer-period <i>milliseconds</i>; robustness-count <i>number</i>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim interface <i>interface-name</i> bidirectional], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bidirectional], [edit protocols pim interface <i>interface-name</i> bidirectional], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bidirectional]
Release Information	Statement introduced in Junos OS Release 12.1.
Description	Optionally, configure the designated forwarder (DF) election parameters for bidirectional PIM. The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Understanding Bidirectional PIM on page 54• Example: Configuring Bidirectional PIM on page 60

disable (PIM Graceful Restart)

Syntax	<pre>disable;</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim graceful-restart], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim graceful-restart], [edit protocols pim graceful-restart], [edit routing-instances <i>routing-instance-name</i> protocols pim graceful-restart]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Explicitly disable PIM sparse mode graceful restart.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PIM Sparse Mode Graceful Restart on page 136

disable (PIM)

Syntax	disable;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols pim family (inet inet6)],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols pim interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols pim rp local family (inet inet6)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp local family (inet inet6)],</p> <p>[edit protocols pim],</p> <p>[edit protocols pim family (inet inet6)],</p> <p>[edit protocols pim interface <i>interface-name</i>],</p> <p>[edit protocols pim rp local family (inet inet6)],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim family (inet inet6)],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rp local family (inet inet6)]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>disable statement extended to the [family] hierarchy level in Junos OS Release 9.6.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Explicitly disable PIM at the protocol, interface or family hierarchy levels.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Disabling PIM on page 28 • family (Disable PIM) on page 374

dr-election-on-p2p

Syntax	dr-election-on-p2p;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	Statement introduced in Junos OS Release 9.1. Statement introduced in Junos OS Release 9.1 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Enable PIM designated router (DR) election on point-to-point (P2P) links.
Default	No PIM DR election is performed on point-to-point links.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PIM Designated Router Election on Point-to-Point Links on page 32

dr-register-policy

Syntax	dr-register-policy [<i>policy-names</i>];
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp], [edit protocols pim rp], [edit routing-instances <i>routing-instance-name</i> protocols pim rp]
Release Information	Statement introduced in Junos OS Release 7.6. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Apply one or more policies to control outgoing PIM register messages.
Options	<i>policy-names</i> —Name of one or more import policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Register Message Filters on a PIM RP and DR on page 101• rp-register-policy on page 416

embedded-rp

Syntax	<pre> embedded-rp { group-ranges { destination-ip-prefix</prefix-length>; } maximum-rps limit; } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim rp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp],</p> <p>[edit protocols pim rp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rp]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Configure properties for embedded IP version 6 (IPv6) RPs.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Embedded RP for IPv6 on page 95

export (Bootstrap)

Syntax	<code>export [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp bootstrap family (inet inet6)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp bootstrap family (inet inet6)], [edit protocols pim rp bootstrap family (inet inet6)], [edit routing-instances <i>routing-instance-name</i> protocols pim rp bootstrap family (inet inet6)]
Release Information	Statement introduced in Junos OS Release 7.6. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Apply one or more export policies to control outgoing PIM bootstrap messages.
Options	<i>policy-names</i> —Name of one or more import policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PIM Bootstrap Properties for IPv4 on page 85• Configuring PIM Bootstrap Properties for IPv4 or IPv6 on page 86• import (Bootstrap) on page 381

export (PIM)

Syntax	<code>export [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Apply one or more export policies to control outgoing PIM join and prune messages. PIM join and prune filters can be applied to PIM-SM and PIM-SSM messages. PIM join and prune filters cannot be applied to PIM-DM messages.
Required Privilege Level	view-level—To view this statement in the configuration. control-level—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Filtering Outgoing PIM Join Messages on page 99

family (Bootstrap)

Syntax	<pre>family (inet inet6) { export [<i>policy-names</i>]; import [<i>policy-names</i>]; priority <i>number</i>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp bootstrap], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp bootstrap], [edit protocols pim rp bootstrap], [edit routing-instances <i>routing-instance-name</i> protocols pim rp bootstrap]
Release Information	Statement introduced in Junos OS Release 7.6. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure which IP protocol type bootstrap properties to apply.
Options	<p>inet—Apply IP version 4 (IPv4) local RP properties.</p> <p>inet6—Apply IPv6 local RP properties.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Bootstrap Properties for IPv4 on page 85 • Configuring PIM Bootstrap Properties for IPv4 or IPv6 on page 86

family (Disable PIM)

Syntax	<pre>family (inet inet6) { disable; }</pre>
Hierarchy Level	<pre>[edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> protocols pim interface <i>interface-name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>], [edit protocols pim], [edit protocols pim interface <i>interface-name</i>], [edit routing-instances <i>routing-instance-name</i> protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>]</pre>
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Disable the PIM protocol for the specified family.
Options	inet —Disable the PIM protocol for the IP version 4 (IPv4) address family. inet6 —Disable the PIM protocol for the IP version 6 (IPv6) address family.
Related Documentation	<ul style="list-style-type: none">• Disabling PIM on page 28• disable (PIM Graceful Restart) on page 368• disable (PIM) on page 369

family (Local RP)

Syntax	<pre> family (inet inet6) { disable; address address; anycast-pim { local-address address; rp-set { address address <forward-msdp-sa>; } } group-ranges { destination-ip-prefix </prefix-length>; } hold-time seconds; override; priority number; } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim rp local],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp local],</p> <p>[edit protocols pim rp local],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rp local]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure which IP protocol type local RP properties to apply.
Options	<p>inet—Apply IP version 4 (IPv4) local RP properties.</p> <p>inet6—Apply IPv6 local RP properties.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring Local PIM RPs on page 73

graceful-restart

Syntax	<pre>graceful-restart { disable; no-bidirectional-mode; restart-duration seconds; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure PIM sparse mode graceful restart. The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PIM Sparse Mode Graceful Restart on page 136

group (RPF Selection)

Syntax	<pre>group group-address{ source source-address { next-hop next-hop-address; } wildcard-source { next-hop next-hop-address; } }</pre>
Hierarchy Level	[edit routing-instances <i>routing-instance-name</i> edit protocols pim rpf-selection]
Release Information	Statement introduced in JUNOS Release 10.4. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the PIM group address for which you configure RPF selection group (RPF Selection) .
Default	By default, PIM RPF selection is not configured.
Options	group-address —PIM group address for which you configure RPF selection.
Required Privilege Level	view-level—To view this statement in the configuration. control-level—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring PIM RPF Selection on page 163

group-ranges

Syntax	<pre>group-ranges { destination-ip-prefix</prefix-length>; }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim rp bidirectional address <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols pim rp embedded-rp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>instance-name</i> protocols pim rp bidirectional address <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp embedded-rp],</p> <p>[edit protocols pim rp bidirectional address <i>address</i>],</p> <p>[edit protocols pim rp embedded-rp],</p> <p>[edit protocols pim rp local family (inet inet6)],</p> <p>[edit protocols pim rp static address <i>address</i>],</p> <p>[edit routing-instances <i>instance-name</i> protocols pim rp bidirectional address <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rp embedded-rp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rp local family (inet inet6)],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rp static address <i>address</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Support for bidirectional RP addresses introduced in Junos OS Release 12.1.</p>
Description	Configure the address ranges of the multicast groups for which this routing device can be a rendezvous point (RP).
Default	The routing device is eligible to be the RP for all IPv4 or IPv6 groups (224.0.0.0/4 or FF70::/12 to FFF0::/12).
Options	<i>destination-ip-prefix</prefix-length></i> —Addresses or address ranges for which this routing device can be an RP.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring Local PIM RPs on page 73 in the <i>Multicast Feature Guide for Security Devices</i> • Configuring PIM Embedded RP for IPv6 on page 95 in the <i>Multicast Feature Guide for Security Devices</i> • Example: Configuring Bidirectional PIM on page 60

hello-interval

Syntax	<code>hello-interval seconds;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim interface interface-name], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface interface-name], [edit protocols pim interface interface-name], [edit routing-instances <i>routing-instance-name</i> protocols pim interface interface-name]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Specify how often the routing device sends PIM hello packets out of an interface.
Options	seconds —Length of time between PIM hello packets. Range: 0 through 255 Default: 30 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • hold-time (PIM) on page 380 • Modifying the PIM Hello Interval on page 24

hold-time (PIM)

Syntax	<code>hold-time seconds;</code>
Hierarchy Level	<code>[edit logical-systems <i>logical-system-name</i> protocols pim rp bidirectional address <i>address</i>],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>instance-name</i> protocols pim</code> <code>rp bidirectional address <i>address</i>],</code> <code>[edit protocols pim rp bidirectional address <i>address</i>],</code> <code>[edit protocols pim rp local family (inet inet6)],</code> <code>[edit routing-instances <i>instance-name</i> protocols pim rp bidirectional address <i>address</i>],</code> <code>[edit routing-instances <i>routing-instance-name</i> protocols pim rp local family (inet inet6)]</code>
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series. Support for bidirectional RP addresses introduced in Junos OS Release 12.1.
Description	Specify the time period for which a neighbor is to consider the sending routing device (this routing device) to be operative (up).
Options	seconds —Hold time. Range: 0 through 255 Default: 150 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Local PIM RPs on page 73 in the <i>Multicast Feature Guide for Security Devices</i>• Example: Configuring Bidirectional PIM on page 60

import (Bootstrap)

Syntax	<code>import [<i>policy-names</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim rp bootstrap (inet inet6)],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp bootstrap (inet inet6)],</p> <p>[edit protocols pim rp bootstrap (inet inet6)],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rp bootstrap (inet inet6)]</p>
Release Information	<p>Statement introduced in Junos OS Release 7.6.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Apply one or more import policies to control incoming PIM bootstrap messages.
Options	<i>policy-names</i> —Name of one or more import policies.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Bootstrap Properties for IPv4 on page 85 • Configuring PIM Bootstrap Properties for IPv4 or IPv6 on page 86 • export (Bootstrap) on page 372

import (PIM)

Syntax	<code>import [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Apply one or more policies to routes being imported into the routing table from PIM. Use the import statement to filter PIM join messages and prevent them from entering the network.
Options	<i>policy-names</i> —Name of one or more policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Filtering Incoming PIM Join Messages on page 100

infinity

Syntax	<code>infinity [<i>policy-names</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim spt-threshold],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim spt-threshold],</p> <p>[edit protocols pim spt-threshold],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim spt-threshold]</p>
Release Information	<p>Statement introduced in Junos OS Release 8.0.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Apply one or more policies to set the SPT threshold to infinity for a source-group address pair. Use the infinity statement to prevent the last-hop routing device from transitioning from the RPT rooted at the RP to an SPT rooted at the source for that source-group address pair.
Options	<i>policy-names</i> —Name of one or more policies.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring the PIM SPT Threshold Policy on page 114

interface

Syntax	<pre> interface (all <i>interface-name</i>) { accept-remote-source; disable; bfd-liveness-detection { authentication { algorithm <i>algorithm-name</i>; key-chain <i>key-chain-name</i>; loose-check; } detection-time { threshold <i>milliseconds</i>; } minimum-interval <i>milliseconds</i>; minimum-receive-interval <i>milliseconds</i>; multiplier <i>number</i>; no-adaptation; transmit-interval { minimum-interval <i>milliseconds</i>; threshold <i>milliseconds</i>; } version (0 1 automatic); } bidirectional { df-election { backoff-period <i>milliseconds</i>; offer-period <i>milliseconds</i>; robustness-count <i>number</i>; } } family (inet inet6) { disable; } hello-interval <i>seconds</i>; mode (bidirectional-sparse bidirectional-sparse-dense dense sparse sparse-dense); neighbor-policy [<i>policy-names</i>]; override-interval <i>milliseconds</i>; priority <i>number</i>; propagation-delay <i>milliseconds</i>; reset-tracking-bit; version <i>version</i>; } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim],</p> <p>[edit protocols pim],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p>
Description	Enable PIM on an interface and configure interface-specific properties.

Options *interface-name*—Name of the interface. Specify the full interface name, including the physical and logical address components. To configure all interfaces, you can specify **all**.

The remaining statements are explained separately.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- [PIM on Aggregated Interfaces on page 26](#)

join-load-balance

Syntax join-load-balance;

Hierarchy Level [edit logical-systems *logical-system-name* protocols **pim**],
[edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols **pim**],
[edit protocols **pim**],
[edit routing-instances *routing-instance-name* protocols **pim**]

Release Information Statement introduced in Junos OS Release 9.0.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 11.3 for the QFX Series.

Description Enable load balancing of PIM join messages across interfaces and routing devices.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- [Configuring PIM Join Load Balancing on page 38](#)
- [clear pim join-distribution on page 602](#)

join-prune-timeout

Syntax	join-prune-timeout <i>seconds</i> ;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	Statement introduced in Junos OS Release 8.4. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the timeout for the join state. If the periodic join refresh message is not received before the timeout expires, the join state is removed.
Options	seconds —Number of seconds to wait for the periodic join message to arrive. Range: 210 through 240 seconds Default: 210 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Modifying the Join State Timeout on page 41

key-chain

Syntax	key-chain <i>key-chain-name</i> ;
Hierarchy Level	[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection authentication], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection authentication]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify the security keychain to use for BFD authentication.
Options	key-chain-name —Name of the security keychain to use for BFD authentication. The name is a unique integer between 0 and 63. This must match one of the keychains in the authentication-key-chains statement at the [edit security] hierarchy level.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring BFD Authentication for PIM on page 121• Understanding Bidirectional Forwarding Detection Authentication for PIM on page 118• authentication on page 356

local

Syntax	<pre> local { disable; address address; family (inet inet6) { disable; address address; anycast-pim { local-address address; rp-set { address address <forward-msdp-sa>; } } group-ranges { destination-ip-prefix</prefix-length>; } hold-time seconds; override; priority number; } group-ranges { destination-ip-prefix</prefix-length>; } hold-time seconds; override; priority number; } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim rp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp],</p> <p>[edit protocols pim rp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rp]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>The remaining statements are explained separately.</p>
Description	Configure the routing device's RP properties.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> Configuring Local PIM RPs on page 73

local-address

Syntax	<code>local-address <i>address</i>;</code>
Hierarchy Level	<code>[edit logical-systems <i>logical-system-name</i> protocols pim rp local family (inet inet6) anycast-pim],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp local family (inet inet6) anycast-pim],</code> <code>[edit protocols pim rp local family (inet inet6) anycast-pim],</code> <code>[edit routing-instances <i>routing-instance-name</i> protocols pim rp local family (inet inet6) anycast-pim]</code>
Release Information	Statement introduced in Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the routing device local address for the anycast rendezvous point (RP). If this statement is omitted, the router ID is used as this address.
Options	<i>address</i> —Anycast RP IPv4 or IPv6 address, depending on family configuration.
Required Privilege Level	<code>routing</code> —To view this statement in the configuration. <code>routing-control</code> —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring PIM Anycast With or Without MSDP on page 79

loose-check

Syntax	loose-check;
Hierarchy Level	[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection authentication], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection authentication]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	<p>Specify loose authentication checking on the BFD session. Use loose authentication for transitional periods only when authentication might not be configured at both ends of the BFD session.</p> <p>By default, strict authentication is enabled and authentication is checked at both ends of each BFD session. Optionally, to smooth migration from nonauthenticated sessions to authenticated sessions, you can configure <i>loose checking</i>. When loose checking is configured, packets are accepted without authentication being checked at each end of the session.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring BFD Authentication for PIM on page 121 • Understanding Bidirectional Forwarding Detection Authentication for PIM on page 118 • authentication on page 356

mapping-agent-election

Syntax	(mapping-agent-election no-mapping-agent-election);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp auto-rp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp auto-rp], [edit protocols pim rp auto-rp], [edit routing-instances <i>routing-instance-name</i> protocols pim rp auto-rp]
Release Information	Statement introduced in Junos OS Release 7.5. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the routing device mapping announcements as a mapping agent.
Options	mapping-agent-election —Mapping agents do not announce mappings when receiving mapping messages from a higher-addressed mapping agent. no-mapping-agent-election —Mapping agents always announce mappings and do not perform mapping agent election. Default: mapping-agent-election
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PIM Auto-RP on page 89


maximum-rps

Syntax	<code>maximum-rps <i>limit</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp embedded-rp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp embedded-rp], [edit protocols pim rp embedded-rp], [edit routing-instances <i>routing-instance-name</i> protocols pim rp embedded-rp]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Limit the number of RPs that the routing device acknowledges.
Options	<i>limit</i> —Number of RPs. Range: 1 through 500 Default: 100
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Embedded RP for IPv6 on page 95

minimum-interval (PIM BFD Liveness Detection)

Syntax	<code>minimum-interval <i>milliseconds</i>;</code>
Hierarchy Level	[edit protocols <code>pim interface interface-name bfd-liveness-detection</code>], [edit routing-instances <i>routing-instance-name</i> protocols <code>pim interface interface-name bfd-liveness-detection</code>]
Release Information	Statement introduced in Junos OS Release 8.1. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure the minimum interval after which the local routing device transmits hello packets and then expects to receive a reply from a neighbor with which it has established a BFD session. Optionally, instead of using this statement, you can specify the minimum transmit and receive intervals separately using the <code>transmit-interval</code> <code>minimum-interval</code> and <code>minimum-receive-interval</code> statements.
Options	<i>milliseconds</i> —Minimum transmit and receive interval. Range: 1 through 255,000 milliseconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring BFD for PIM on page 120

minimum-interval (PIM BFD Transmit Interval)

Syntax	<code>minimum-interval <i>milliseconds</i>;</code>
Hierarchy Level	[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection transmit-interval], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection transmit-interval]
Release Information	Statement introduced in Junos OS Release 8.2. Statement introduced in Junos OS Release 9.0 for EX Series switches. Support for BFD authentication introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure the minimum interval after which the local routing device transmits hello packets to a neighbor with which it has established a BFD session. Optionally, instead of using this statement, you can configure the minimum transmit interval using the minimum-interval statement at the [edit protocols pim interface <i>interface-name</i> bfd-liveness-detection] hierarchy level.
Options	<i>milliseconds</i> —Minimum transmit interval value. Range: 1 through 255,000
<div style="display: flex; align-items: center;">  <div> <p>NOTE: The threshold value specified in the threshold statement must be greater than the value specified in the minimum-interval statement for the transmit-interval statement.</p> </div> </div>	
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring BFD for PIM on page 120 • bfd-liveness-detection on page 359 • minimum-interval on page 392 • threshold on page 423

minimum-receive-interval

Syntax	minimum-receive-interval <i>milliseconds</i> ;
Hierarchy Level	[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection]
Release Information	Statement introduced in Junos OS Release 8.1. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure the minimum interval after which the local routing device must receive a reply from a neighbor with which it has established a BFD session. Optionally, instead of using this statement, you can configure the minimum receive interval using the minimum-interval statement at the [edit protocols pim interface <i>interface-name</i> bfd-liveness-detection] hierarchy level.
Options	milliseconds —Minimum receive interval. Range: 1 through 255,000 milliseconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring BFD for PIM on page 120

mode

Syntax	mode (bidirectional-sparse bidirectional-sparse-dense dense sparse sparse-dense);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim interface <i>interface-name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>], [edit protocols pim interface <i>interface-name</i>], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. bidirectional-sparse and bidirectional-sparse-dense options introduced in Junos OS Release 12.1.
Description	Configure the PIM mode on the interface.
Options	<p>The choice of PIM mode is closely tied to controlling how groups are mapped to PIM modes, as follows:</p> <ul style="list-style-type: none"> • bidirectional-sparse—Use if all multicast groups are operating in bidirectional, sparse, or SSM mode. • bidirectional-sparse-dense—Use if multicast groups, except those that are specified in the dense-groups statement, are operating in bidirectional, sparse, or SSM mode. • dense—Use if all multicast groups are operating in dense mode. • sparse—Use if all multicast groups are operating in sparse mode or SSM mode. • sparse-dense—Use if multicast groups, except those that are specified in the dense-groups statement, are operating in sparse mode or SSM mode. <p>Default: Sparse mode</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Dense Mode Properties on page 139 in the <i>Multicast Feature Guide for Security Devices</i> • Configuring PIM Sparse-Dense Mode Properties on page 141 in the <i>Multicast Feature Guide for Security Devices</i> • Example: Configuring Bidirectional PIM on page 60

multiplier

Syntax	<code>multiplier <i>number</i>;</code>
Hierarchy Level	[edit protocols <code>pim interface <i>interface-name</i> bfd-liveness-detection</code>], [edit routing-instances <code><i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection</code>]
Release Information	Statement introduced in Junos OS Release 8.1. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure the number of hello packets not received by a neighbor that causes the originating interface to be declared down.
Options	<i>number</i> —Number of hello packets. Range: 1 through 255 Default: 3
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring BFD for PIM on page 120

neighbor-policy

Syntax	<code>neighbor-policy [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <code><i>logical-system-name</i> protocols pim interface <i>interface-name</i></code>], [edit logical-systems <code><i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i></code>], [edit protocols <code>pim interface <i>interface-name</i></code>], [edit routing-instances <code><i>routing-instance-name</i> protocols pim interface <i>interface-name</i></code>]
Release Information	Statement introduced in Junos OS Release 8.2. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Apply a PIM interface-level policy to filter neighbor IP addresses.
Options	<i>policy-name</i> —Name of the policy that filters neighbor IP addresses.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Interface-Level PIM Neighbor Policies on page 98

next-hop (PIM RPF Selection)

Syntax	<code>next-hop <i>next-hop-address</i>;</code>
Hierarchy Level	[edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection group <i>group-address</i> source <i>source-address</i>], [edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection group <i>group-address</i> wildcard-source], [edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection prefix-list <i>prefix-list-addresses</i> source <i>source-address</i>], [edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection prefix-list <i>prefix-list-addresses</i> wildcard-source]
Release Information	Statement introduced in JUNOS Release 10.4. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the specific next-hop address for the PIM group source.
Options	<i>next-hop-address</i> —Specific next-hop address for the PIM group source.
Required Privilege Level	view-level—To view this statement in the configuration. control-level—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring PIM RPF Selection on page 163

no-adaptation (PIM BFD Liveness Detection)

Syntax	<code>no-adaptation;</code>
Hierarchy Level	[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection]
Release Information	Statement introduced in Junos OS Release 9.0 Statement introduced in Junos OS Release 9.0 for EX Series switches. Support for BFD authentication introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure BFD sessions not to adapt to changing network conditions. We recommend that you <i>do not</i> disable BFD adaptation unless it is preferable to have BFD adaptation disabled in your network.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring BFD for PIM on page 120 • bfd-liveness-detection on page 359

no-bidirectional-mode

Syntax	no-bidirectional-mode;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim graceful-restart], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim graceful-restart], [edit protocols pim graceful-restart], [edit routing-instances <i>routing-instance-name</i> protocols pim graceful-restart]
Release Information	Statement introduced in Junos OS Release 12.1.
Description	<p>Disable forwarding for bidirectional PIM routes during graceful restart recovery, both in cases of a routing protocol process (rpd) restart and graceful Routing Engine switchover.</p> <p>Bidirectional PIM accepts packets for a bidirectional route on multiple interfaces. This means that some topologies might develop multicast routing loops if all PIM neighbors are not synchronized with regard to the identity of the designated forwarder (DF) on each link. If one router is forwarding without actively participating in DF elections, particularly after unicast routing changes, multicast routing loops might occur.</p> <p>If graceful restart for PIM is enabled and the forwarding of packets on bidirectional routes is disallowed (by including the no-bidirectional-mode statement in the configuration), PIM behaves conservatively to avoid multicast routing loops during the recovery period. When the routing protocol process (rpd) restarts, all bidirectional routes are deleted. After graceful restart has completed, the routes are re-added, based on the converged unicast and bidirectional PIM state. While graceful restart is active, bidirectional multicast flows drop packets.</p>
Default	If graceful restart for PIM is enabled and the bidirectional PIM is enabled, the default graceful restart behavior is to continue forwarding packets on bidirectional routes. If the gracefully restarting router was serving as a DF for some interfaces to rendezvous points, the restarting router sends a DF Winner message with a metric of 0 on each of these RP interfaces. This ensures that a neighbor router does not become the DF due to unicast topology changes that might occur during the graceful restart period. Sending a DF Winner message with a metric of 0 prevents another PIM neighbor from assuming the DF role until after graceful restart completes. When graceful restart completes, the gracefully restarted router sends another DF Winner message with the actual converged unicast metric.



NOTE: Graceful Routing Engine switchover operates independently of the graceful restart behavior. If graceful Routing Engine switchover is configured without graceful restart, all PIM routes for all modes are deleted when the rpd process restarts. If graceful Routing Engine switchover is configured with graceful restart, the behavior is the same as described here, except that the recovery happens on the Routing Engine that assumes mastership.

Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Sparse Mode Graceful Restart on page 136 in the <i>Multicast Feature Guide for Security Devices</i> • Understanding Bidirectional PIM on page 54 • Example: Configuring Bidirectional PIM on page 60

offer-period

Syntax	<code>offer-period milliseconds;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim interface interface-name bidirectional df-election],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface interface-name bidirectional df-election],</p> <p>[edit protocols pim interface interface-name bidirectional df-election],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim interface interface-name bidirectional df-election]</p>
Release Information	Statement introduced in Junos OS Release 12.1.
Description	<p>Configure the designated forwarder (DF) election offer period for bidirectional PIM. When a DF election Offer or Winner message fails to be received, the message is retransmitted. The offer-period statement modifies the interval between repeated DF election messages. The robustness-count statement determines the minimum number of DF election messages that must fail to be received for DF election to fail. To prevent routing loops, all routers on the link must have a consistent view of the DF. When the DF election fails because DF election messages are not received, forwarding on bidirectional PIM routes is suspended.</p> <p>If a router receives from a neighbor a better offer than its own, the router stops participating in the election for a period of robustness-count * offer-period. Eventually, all routers except the best candidate stop sending Offer messages.</p>
Options	<p>milliseconds—Interval to wait before retransmitting DF Offer and Winner messages.</p> <p>Range: 100 through 10,000 milliseconds</p> <p>Default: 100</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Understanding Bidirectional PIM on page 54 • Example: Configuring Bidirectional PIM on page 60 • robustness-count on page 413

override (PIM static RP)

Syntax	override;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim rp local], [edit logical-systems <i>logical-system-name</i> protocols pim rp local family inet], [edit logical-systems <i>logical-system-name</i> protocols pim rp local family inet6], [edit logical-systems <i>logical-system-name</i> protocols pim rp static address <i>address</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>instance-name</i> protocols pim rp local], [edit logical-systems <i>logical-system-name</i> routing-instances <i>instance-name</i> protocols pim rp local family inet], [edit logical-systems <i>logical-system-name</i> routing-instances <i>instance-name</i> protocols pim rp local family inet6], [edit logical-systems <i>logical-system-name</i> routing-instances <i>instance-name</i> protocols pim rp static address <i>address</i>], [edit protocols pim rp local], [edit protocols pim rp local family inet], [edit protocols pim rp local family inet6], [edit protocols pim rp static address <i>address</i>], [edit routing-instances <i>instance-name</i> protocols pim rp local], [edit routing-instances <i>instance-name</i> protocols pim rp local family inet], [edit routing-instances <i>instance-name</i> protocols pim rp local family inet6], [edit routing-instances <i>instance-name</i> protocols pim rp static address <i>address</i>]</p>
Release Information	Statement introduced in Junos OS Release 11.4.
Description	When you configure both static RP mapping and dynamic RP mapping (such as auto-RP) in a single routing instance, allow the static mapping to take precedence for a given group range, and allow dynamic RP mapping for all other groups.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Static RP on page 72• Configuring PIM Auto-RP on page 89

override-interval

Syntax	<code>override-interval <i>milliseconds</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols pim interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>],</p> <p>[edit protocols pim],</p> <p>[edit protocols pim interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim]</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 10.1.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Set the maximum time in milliseconds to delay sending override join messages for a multicast network that has join suppression enabled. When a router or switch sees a prune message for a join it is currently suppressing, it waits for the interval specified by the override timer before it sends an override join message.
Options	<p>This is a random timer with a value in milliseconds.</p> <p>Range: 0 through maximum override value</p> <p>Default: 2000 milliseconds</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Enabling Join Suppression on page 41 • propagation-delay on page 409 • reset-tracking-bit on page 410

pim

```
Syntax  pim {
    disable;
    assert-timeout seconds;
    dense-groups {
        addresses;
    }
    dr-election-on-p2p;
    export;
    family (inet | inet6) {
        disable;
    }
    graceful-restart {
        disable;
        no-bidirectional-mode;
        restart-duration seconds;
    }
    import [ policy-names ];
    interface interface-name {
        accept-remote-source;
        disable;
        bfd-liveness-detection {
            authentication {
                algorithm algorithm-name;
                key-chain key-chain-name;
                loose-check;
            }
            detection-time {
                threshold milliseconds;
            }
            minimum-interval milliseconds;
            minimum-receive-interval milliseconds;
            multiplier number;
            no-adaptation;
            transmit-interval {
                minimum-interval milliseconds;
                threshold milliseconds;
            }
            version (0 | 1 | automatic);
        }
        bidirectional {
            df-election {
                backoff-period milliseconds;
                offer-period milliseconds;
                robustness-count number;
            }
        }
    }
    family (inet | inet6) {
        disable;
    }
    hello-interval seconds;
    mode (bidirectional-sparse | bidirectional-sparse-dense | dense | sparse | sparse-dense);
    neighbor-policy [ policy-names ];
```

```

    override-interval milliseconds;
    priority number;
    propagation-delay milliseconds;
    reset-tracking-bit;
    version version;
}
join-load-balance;
join-prune-timeout;
mvpn {
    autodiscovery {
        inet-mdt;
    }
}
nonstop-routing;
override-interval milliseconds;
propagation-delay milliseconds;
reset-tracking-bit;
rib-group group-name;
rp {
    auto-rp {
        (announce | discovery | mapping);
        (mapping-agent-election | no-mapping-agent-election);
    }
    bidirectional {
        address address {
            group-ranges {
                destination-ip-prefix </prefix-length>;
            }
            hold-time seconds;
            priority number;
        }
    }
    bootstrap {
        family (inet | inet6) {
            export [ policy-names ];
            import [ policy-names ];
            priority number;
        }
    }
    bootstrap-import [ policy-names ];
    bootstrap-export [ policy-names ];
    bootstrap-priority number;
    dr-register-policy [ policy-names ];
    embedded-rp {
        group-ranges {
            destination-ip-prefix </prefix-length>;
        }
        maximum-rps limit;
    }
    local {
        family (inet | inet6) {
            address address;
            anycast-pim {
                rp-set {
                    address address <forward-msdp-sa>;
                }
            }
        }
    }
}

```

```

        disable;
        local-address address;
    }
    group-ranges {
        destination-ip-prefix</prefix-length>;
    }
    hold-time seconds;
    override;
    priority number;
}
}
rp-register-policy [ policy-names ];
spt-threshold {
    infinity [ policy-names ];
}
static {
    address address {
        override;
        version version;
        group-ranges {
            destination-ip-prefix</prefix-length>;
        }
    }
}
}
rpf-selection {
    group group-address {
        source source-address {
            next-hop next-hop-address;
        }
        wildcard-source {
            next-hop next-hop-address;
        }
    }
    prefix-list prefix-list-addresses {
        source source-address {
            next-hop next-hop-address;
        }
        wildcard-source {
            next-hop next-hop-address;
        }
    }
    traceoptions {
        file filename <files number> <size size> <world-readable | no-world-readable>;
        flag flag <flag-modifier> <disable>;
    }
    tunnel-devices [ mt-fpc/pic/port ];
}

```

Hierarchy Level [edit logical-systems *logical-system-name* protocols],
 [edit logical-systems *logical-system-name* routing-instances *routing-instance-name* protocols],
 [edit protocols],
 [edit routing-instances *routing-instance-name* protocols]

Release Information	Statement introduced before Junos OS Release 7.4. family statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 9.0 for EX Series switches.
Description	Enable PIM on the routing device. The statements are explained separately.
Default	PIM is disabled on the routing device.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Dense Mode Properties on page 139 • Configuring PIM Sparse-Dense Mode Properties on page 141

prefix-list (PIM RPF Selection)

Syntax	<pre>prefix-list <i>prefix-list-addresses</i> { source <i>source-address</i> { next-hop <i>next-hop-address</i>; } wildcard-source { next-hop <i>next-hop-address</i>; } }</pre>
Hierarchy Level	<p>[edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection group <i>group-address</i> source <i>source-address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection group <i>group-address</i> wildcard-source],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection prefix-list <i>prefix-list-addresses</i> source <i>source-address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection prefix-list <i>prefix-list-addresses</i> wildcard-source]</p>
Release Information	Statement introduced in Junos OS Release 10.4. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	(Optional) Configure a list of prefixes (addresses) for multiple PIM groups.
Options	<p><i>prefix-list-addresses</i>—List of prefixes (addresses) for multiple PIM groups.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	view-level—To view this statement in the configuration. control-level—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring PIM RPF Selection on page 163

priority (Bootstrap)

Syntax	<code>priority <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>pim rp bootstrap</code> (inet inet6)], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols <code>pim rp bootstrap</code> (inet inet6)], [edit protocols <code>pim rp bootstrap</code> (inet inet6)], [edit routing-instances <i>routing-instance-name</i> protocols <code>pim rp bootstrap</code> (inet inet6)]
Release Information	Statement introduced in Junos OS Release 7.6. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the routing device's likelihood to be elected as the bootstrap router.
Options	<i>number</i> —Routing device's priority for becoming the bootstrap router. A higher value corresponds to a higher priority. Range: 0 through a 32-bit number Default: 0 (The routing device has the least likelihood of becoming the bootstrap router and sends packets with a priority of 0.)
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PIM Bootstrap Properties for IPv4 on page 85• Configuring PIM Bootstrap Properties for IPv4 or IPv6 on page 86• bootstrap-priority on page 365

priority (PIM Interfaces)

Syntax	<code>priority <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>pim interface <i>interface-name</i></code>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols <code>pim interface <i>interface-name</i></code>], [edit protocols <code>pim interface <i>interface-name</i></code>], [edit routing-instances <i>routing-instance-name</i> protocols <code>pim interface <i>interface-name</i></code>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the routing device's likelihood to be elected as the designated router.
Options	<p><i>number</i>—Routing device's priority for becoming the designated router. A higher value corresponds to a higher priority.</p> <p>Range: 0 through a 32-bit number</p> <p>Default: 0 (The routing device has the least likelihood of becoming the designated router.)</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring Interface Priority for the PIM Designated Router Selection on page 31

priority (PIM RPs)

Syntax	<code>priority <i>number</i>;</code>
Hierarchy Level	<code>[edit logical-systems <i>logical-system-name</i> protocols pim rp bidirectional address <i>address</i>],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>instance-name</i> protocols pim</code> <code>rp bidirectional address <i>address</i>],</code> <code>[edit protocols pim rp bidirectional address <i>address</i>],</code> <code>[edit protocols pim rp local family (inet inet6)],</code> <code>[edit routing-instances <i>instance-name</i> protocols pim rp bidirectional address <i>address</i>],</code> <code>[edit routing-instances <i>routing-instance-name</i> protocols pim rp local family (inet inet6)]</code>
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series. Support for bidirectional RP addresses introduced in Junos OS Release 12.1.
Description	For PIM-SM, configure this routing device's priority for becoming an RP. For bidirectional PIM, configure this RP address' priority for becoming an RP. The bootstrap router uses this field when selecting the list of candidate rendezvous points to send in the bootstrap message. A smaller number increases the likelihood that the routing device or RP address becomes the RP. A priority value of 0 means that bootstrap router can override the group range being advertised by the candidate RP.
Options	<i>number</i> —Priority for becoming an RP. A lower value corresponds to a higher priority. Range: 0 through 255 Default: 1
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Local PIM RPs on page 73 in the <i>Multicast Feature Guide for Security Devices</i>• Example: Configuring Bidirectional PIM on page 60

propagation-delay

Syntax	<code>propagation-delay <i>milliseconds</i>;</code>
Hierarchy Level	<p>[edit protocols pim], [edit protocols pim interface <i>interface-name</i>], [edit routing-instances <i>routing-instance-name</i> protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>], [edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> protocols pim interface <i>interface-name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 10.1.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Set a delay for implementing a PIM prune message on the upstream router on a multicast network for which join suppression has been enabled. The router waits for the prune pending period to detect whether a join message is currently being suppressed by another router.
Options	<p><i>milliseconds</i>—Interval for the prune pending timer, which is the sum of the propagation-delay value and the override-interval value.</p> <p>Range: 250 through 2000 milliseconds</p> <p>Default: 500 milliseconds</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Enabling Join Suppression on page 41 • override-interval on page 401 • reset-tracking-bit on page 410

reset-tracking-bit

Syntax	reset-tracking-bit;
Hierarchy Level	[edit protocols pim], [edit protocols pim interface interface-name], [edit routing-instances <i>routing-instance-name</i> protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim interface interface-name], [edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> protocols pim interface interface-name], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface interface-name]
Release Information	Statement introduced in Junos OS Release 10.1. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Change the value of a tracking bit (T-bit) field in the LAN prune delay hello option from the default of 1 to 0, which enables join suppression for a multicast interface. When the network starts receiving multiple identical join messages, join suppression triggers a random timer with a value of 66 through 84 milliseconds ($1.1 \times \text{periodic}$ through $1.4 \times \text{periodic}$, where periodic is 60 seconds). This creates an interval during which no identical join messages are sent. Eventually, only one of the identical messages is sent. Join suppression is triggered each time identical messages are sent for the same join.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Enabling Join Suppression on page 41• override-interval on page 401• propagation-delay on page 409

restart-duration

Syntax	<code>restart-duration <i>seconds</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim graceful-restart], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim graceful-restart], [edit protocols pim graceful-restart], [edit routing-instances <i>routing-instance-name</i> protocols pim graceful-restart]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the duration of the graceful restart interval.
Options	<i>seconds</i> —Time that the routing device waits (in seconds) to complete PIM sparse mode graceful restart. Range: 30 through 300 Default: 60
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM Sparse Mode Graceful Restart on page 136

rib-group

Syntax	<pre>rib-group { inet <i>group-name</i>; inet6 <i>group-name</i>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Associate a routing table group with PIM.
Options	<i>table-name</i> —Name of the routing table. The name must be one that you defined with the rib-groups statement at the [edit routing-options] hierarchy level.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring a Dedicated PIM RPF Routing Table on page 158

robustness-count

Syntax	<code>robustness-count <i>number</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim interface <i>interface-name</i> bidirectional df-election],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bidirectional df-election],</p> <p>[edit protocols pim interface <i>interface-name</i> bidirectional df-election],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bidirectional df-election]</p>
Release Information	Statement introduced in Junos OS Release 12.1.
Description	<p>Configure the designated forwarder (DF) election robustness count for bidirectional PIM. When a DF election Offer or Winner message fails to be received, the message is retransmitted. The robustness-count statement sets the minimum number of DF election messages that must fail to be received for DF election to fail. To prevent routing loops, all routers on the link must have a consistent view of the DF. When the DF election fails because DF election messages are not received, forwarding on bidirectional PIM routes is suspended.</p> <p>If a router receives from a neighbor a better offer than its own, the router stops participating in the election for a period of robustness-count * offer-period. Eventually, all routers except the best candidate stop sending Offer messages.</p>
Options	<p><i>number</i>—Number of transmission attempts for DF election messages.</p> <p>Range: 1 through 10</p> <p>Default: 3</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Understanding Bidirectional PIM on page 54 • Example: Configuring Bidirectional PIM on page 60

rp

```

Syntax  rp {
    auto-rp {
        (announce | discovery | mapping);
        (mapping-agent-election | no-mapping-agent-election);
    }
    bidirectional {
        address address {
            group-ranges {
                destination-ip-prefix </prefix-length>;
            }
            hold-time seconds;
            priority number;
        }
    }
    bootstrap {
        family (inet | inet6) {
            export [ policy-names ];
            import [ policy-names ];
            priority number;
        }
    }
    bootstrap-export [ policy-names ];
    bootstrap-import [ policy-names ];
    bootstrap-priority number;
    dr-register-policy [ policy-names ];
    embedded-rp {
        group-ranges {
            destination-ip-prefix </prefix-length>;
        }
        maximum-rps limit;
    }
    local {
        family (inet | inet6) {
            disable;
            address address;
            anycast-pim {
                local-address address;
                address address <forward-msdp-sa>;
                rp-set {
                }
            }
            group-ranges {
                destination-ip-prefix </prefix-length>;
            }
            hold-time seconds;
            override;
            priority number;
        }
    }
    rp-register-policy [ policy-names ];
    static {
        address address {

```

```

    override;
    version version;
    group-ranges {
        destination-ip-prefix</prefix-length>;
    }
}
}
}

```

Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim],</p> <p>[edit protocols pim],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Configure the routing device as an actual or potential RP. A routing device can be an RP for more than one group.</p> <p>The remaining statements are explained separately.</p>
Default	If you do not include the rp statement, the routing device can never become the RP.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Understanding PIM Sparse Mode on page 33

rp-register-policy

Syntax	<code>rp-register-policy [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim rp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp], [edit protocols pim rp], [edit routing-instances <i>routing-instance-name</i> protocols pim rp]
Release Information	Statement introduced in Junos OS Release 7.6. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Apply one or more policies to control incoming PIM register messages.
Options	<i>policy-names</i> —Name of one or more import policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Register Message Filters on a PIM RP and DR on page 101• dr-register-policy on page 370

rp-set

Syntax	<pre>rp-set { address address <forward-msdp-sa>; }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim local family (inet inet6) anycast-pim],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim local family (inet inet6) anycast-pim],</p> <p>[edit protocols pim local family (inet inet6) anycast-pim],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim local family (inet inet6) anycast-pim]</p>
Release Information	<p>Statement introduced in Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Configure a set of rendezvous point (RP) addresses for anycast RP. You can configure up to 15 RPs.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring PIM Anycast With or Without MSDP on page 79

rpf-selection

Syntax	<pre> rpf-selection { group group-address { source source-address { next-hop next-hop-address; } wildcard-source { next-hop next-hop-address; } } prefix-list prefix-list-addresses { source source-address { next-hop next-hop-address; } wildcard-source { next-hop next-hop-address; } } } </pre>
Hierarchy Level	[edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	<p>Statement introduced in JUNOS Release 10.4.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Configure the PIM RPF next-hop neighbor for a specific group and source for a VRF routing instance.</p> <p>The remaining statements are explained separately.</p>
Default	If you omit the rpf-selection statement, PIM RPF checks typically choose the best path determined by the unicast protocol for all multicast flows.
Options	source-address —Specific source address for the PIM group.
Required Privilege Level	<p>view-level—To view this statement in the configuration.</p> <p>control-level—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring PIM RPF Selection on page 163

source (PIM RPF Selection)

Syntax	<pre>source source-address { next-hop next-hop-address; }</pre>
Hierarchy Level	[edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection group <i>group-address</i>], [edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection prefix-list <i>prefix-list-addresses</i>]
Release Information	Statement introduced in JUNOS Release 10.4. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the source address for the PIM group.
Options	<p>source-address—Specific source address for the PIM group.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	view-level—To view this statement in the configuration. control-level—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring PIM RPF Selection on page 163


spt-threshold

Syntax	<pre>spt-threshold { infinity [<i>policy-names</i>]; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	Statement introduced in Junos OS Release 8.0. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	<p>Set the SPT threshold to infinity for a source-group address pair. Last-hop multicast routing devices running PIM sparse mode can forward the same stream of multicast packets onto the same LAN through an RPT rooted at the RP or an SPT rooted at the source. By default, last-hop routing devices transition to a direct SPT to the source. You can configure this routing device to set the SPT transition value to infinity to prevent this transition for any source-group address pair.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring the PIM SPT Threshold Policy on page 114

static

Syntax	<pre>static { address address { group-ranges { destination-ip-prefix</prefix-length>; } override; version version; } }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim rp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp], [edit protocols pim rp], [edit routing-instances <i>routing-instance-name</i> protocols pim rp]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Configure static RP addresses. The default static RP address is 224.0.0.0/4. To configure other addresses, include one or more address statements. You can configure a static RP in a logical system only if the logical system is not directly connected to a source.</p> <p>For each static RP address, you can optionally specify the PIM version and the groups for which this address can be the RP. The default PIM version is version 1.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring the Static PIM RP Address on the Non-RP Routing Device on page 75

threshold (PIM BFD Detection Time)

Syntax	<code>threshold <i>milliseconds</i>;</code>
Hierarchy Level	[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection detection-time], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection detection-time]
Release Information	Statement introduced in Junos OS Release 8.2. Statement introduced in Junos OS Release 9.0 for EX Series switches. Support for BFD authentication introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify the threshold for the adaptation of the BFD session detection time. When the detection time adapts to a value equal to or greater than the threshold, a single trap and a single system log message are sent.
<div>  <p>NOTE: The threshold value must be equal to or greater than the transmit interval.</p> <p>The threshold time must be equal to or greater than the value specified in the minimum-interval or the minimum-receive-interval statement.</p> </div>	
Options	<i>milliseconds</i> —Value for the detection time adaptation threshold. Range: 1 through 255,000
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring BFD for PIM on page 120 • bfd-liveness-detection on page 359 • detection-time on page 367 • minimum-interval on page 392 • minimum-receive-interval on page 394

threshold (PIM BFD Transmit Interval)

Syntax	<code>threshold <i>milliseconds</i>;</code>
Hierarchy Level	[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection transmit-interval], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection transmit-interval]
Release Information	Statement introduced in Junos OS Release 8.2. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify the threshold for the adaptation of the BFD session transmit interval. When the transmit interval adapts to a value greater than the threshold, a single trap and a single system message are sent.
Options	<i>milliseconds</i> —Value for the transmit interval adaptation threshold. Range: 0 through 4,294,967,295 ($2^{32} - 1$)



NOTE: The threshold value specified in the `threshold` statement must be greater than the value specified in the `minimum-interval` statement for the `transmit-interval` statement.

Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring BFD for PIM on page 120 • bfd-liveness-detection on page 359

traceoptions

Syntax	<pre>traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols pim],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim],</p> <p>[edit protocols pim],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols pim]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Configure PIM tracing options.</p> <p>To specify more than one tracing operation, include multiple flag statements.</p>
Default	The default PIM trace options are those inherited from the routing protocol's traceoptions statement included at the [edit routing-options] hierarchy level.
Options	<p>disable—(Optional) Disable the tracing operation. You can use this option to disable a single operation when you have defined a broad group of tracing operations, such as all.</p> <p>file <i>filename</i>—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. All files are placed in the directory /var/log. We recommend that you place tracing output in the pim-log file.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named trace-file reaches its maximum size, it is renamed trace-file.0, then trace-file.1, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.</p> <p>If you specify a maximum number of files, you must also include the size statement to specify the maximum file size.</p> <p>Range: 2 through 1000 files</p> <p>Default: 2 files</p> <p>flag <i>flag</i>—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements.</p> <p>PIM Tracing Flags</p> <ul style="list-style-type: none"> assert—Assert messages bidirectional-df-election—Bidirectional PIM designated-forwarder (DF) election events

- **bootstrap**—Bootstrap messages
- **cache**—Packets in the PIM sparse mode routing cache
- **graft**—Graft and graft acknowledgment messages
- **hello**—Hello packets
- **join**—Join messages
- **mt**—Multicast tunnel messages
- **nsr-synchronization**—Nonstop active routing (NSR) synchronization messages
- **packets**—All PIM packets
- **prune**—Prune messages
- **register**—Register and register stop messages
- **rp**—Candidate RP advertisements
- **all**—All tracing operations
- **general**—A combination of the **normal** and **route** trace operations
- **normal**—All normal operations

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **policy**—Policy operations and actions
- **route**—Routing table changes
- **state**—State transitions
- **task**—Interface transactions and processing
- **timer**—Timer usage

flag-modifier—(Optional) Modifier for the tracing flag. You can specify one or more of these modifiers:

- **detail**—Detailed trace information
- **receive**—Packets being received
- **send**—Packets being transmitted

no-stamp—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

Default: If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

no-world-readable—(Optional) Do not allow users to read the log file.

replace—(Optional) Replace an existing trace file if there is one.

Default: If you do not include this option, tracing output is appended to an existing trace file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches this size, it is renamed **trace-file.0**. When **trace-file** again reaches this size, **trace-file.0** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.0**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also include the **files** statement to specify the maximum number of trace files.

Syntax: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

Range: 0 KB through the maximum file size supported on your system

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level	routing and trace—To view this statement in the configuration.
	routing-control and trace-control—To add this statement to the configuration.
Related Documentation	• Configuring PIM Trace Options on page 26
	• Tracing DVMRP Protocol Traffic on page 343
	• Tracing MSDP Protocol Traffic on page 326

transmit-interval (PIM BFD Liveness Detection)

Syntax	<pre>transmit-interval { minimum-interval <i>milliseconds</i>; threshold <i>milliseconds</i>; }</pre>
Hierarchy Level	<pre>[edit protocols pim interface <i>interface-name</i> bfd-liveness-detection], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection]</pre>
Release Information	<p>Statement introduced in Junos OS Release 8.2.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Support for BFD authentication introduced in Junos OS Release 9.6.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	<p>Specify the transmit interval for the bfd-liveness-detection statement. The negotiated transmit interval for a peer is the interval between the sending of BFD packets to peers. The receive interval for a peer is the minimum interval between receiving packets sent from its peer; the receive interval is not negotiated between peers. To determine the transmit interval, each peer compares its configured minimum transmit interval with its peer's minimum receive interval. The larger of the two numbers is accepted as the transmit interval for that peer.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring BFD for PIM on page 120 • bfd-liveness-detection on page 359 • threshold on page 423 • minimum-interval on page 393 • minimum-receive-interval on page 394

tunnel-devices

Syntax	<code>tunnel-devices [<i>mt-fpc/pic/port</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>instance-name</i> protocols pim], [edit routing-instances <i>instance-name</i> protocols pim]
Release Information	Statement introduced in Junos OS Release 10.2. Statement introduced in Junos OS Release 10.2 for EX Series switches.
Description	<p>List one or more tunnel-capable PICs to be used for creating multicast tunnel (mt) interfaces. Creating a PIC list enables you to control the load-balancing implementation.</p> <p>Tunnel-capable PICs include:</p> <ul style="list-style-type: none">• Adaptive Services PIC• Multiservices PIC or Multiservices DPC• Tunnel Services PIC• On MX Series routers, a PIC created with the tunnel-services statement at the [edit chassis fpc <i>slot-number</i> pic <i>number</i>] hierarchy level. <p>The physical position of the PIC in the routing device determines the multicast tunnel interface name. For example, if you have an Adaptive Services PIC installed in FPC slot 0 and PIC slot 0, the corresponding multicast tunnel interface name is mt-0/0/0. The same is true for Tunnel Services PICs, Multiservices PICs, and Multiservices DPCs.</p>
Default	Multicast tunnel interfaces are created on all available tunnel-capable PICs, based on a round-robin algorithm.
Options	mt-fpc/pic/port —Interface that is automatically generated when a tunnel-capable PIC is installed in the routing device.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.

version (BFD)

Syntax	version (0 1 automatic);
Hierarchy Level	[edit protocols piminterface <i>interface-name</i> bfd-liveness-detection], [edit routing-instances <i>routing-instance-name</i> protocols pim interface <i>interface-name</i> bfd-liveness-detection]
Release Information	Statement introduced in Junos OS Release 8.1. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify the bidirectional forwarding detection (BFD) protocol version that you want to detect.
Options	Configure the BFD version to detect: 1 (BFD version 1) or automatic (autodetect the BFD version) Default: automatic
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring BFD for PIM on page 120

version (PIM)

Syntax	<code>version version;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pim interface interface-name], [edit logical-systems <i>logical-system-name</i> protocols pim rp static address address], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim interface interface-name], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim rp static address address], [edit protocols pim interface interface-name], [edit protocols pim rp static address address], [edit routing-instances <i>routing-instance-name</i> protocols pim interface interface-name], [edit routing-instances <i>routing-instance-name</i> protocols pim rp static address address]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Specify the version of PIM.
Options	version —PIM version number. Range: 1 or 2 Default: PIMv1 for rendezvous point (RP) mode (at the [edit protocols pim rp static address address] hierarchy level). PIMv2 for interface mode (at the [edit protocols pim interface interface-name] hierarchy level).
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Enabling PIM Sparse Mode on page 37• Configuring PIM Dense Mode Properties on page 139• Configuring PIM Sparse-Dense Mode Properties on page 141

vpn-group-address

Syntax	<code>vpn-group-address address;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols pim], [edit routing-instances <i>routing-instance-name</i> protocols pim]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Configure the group address for the Layer 3 VPN in the service provider's network.
Options	address —Address for the Layer 3 VPN in the service provider's network.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Multicast Feature Guide for Security Devices

wildcard-source (PIM RPF Selection)

Syntax	<code>wildcard-source { next-hop next-hop-address; }</code>
Hierarchy Level	[edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection group <i>group-address</i>], [edit routing-instances <i>routing-instance-name</i> protocols pim rpf-selection prefix-list <i>prefix-list-addresses</i>]
Release Information	Statement introduced in Junos OS Release 10.4. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Use a wildcard for the multicast source instead of (or in addition to) a specific multicast source. The remaining statements are explained separately.
Required Privilege Level	view-level—To view this statement in the configuration. control-level—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring PIM RPF Selection on page 163

IGMP Configuration Statements

- [accounting \(Per Interface\) on page 434](#)
- [accounting \(Protocol\) on page 434](#)
- [disable on page 435](#)
- [exclude on page 435](#)
- [group on page 436](#)
- [group-count on page 437](#)
- [group-increment on page 437](#)
- [group-limit on page 438](#)
- [group-policy on page 438](#)
- [igmp on page 439](#)
- [immediate-leave on page 441](#)
- [interface on page 442](#)
- [maximum-transmit-rate on page 443](#)
- [oif-map on page 443](#)
- [passive \(IGMP\) on page 444](#)
- [promiscuous-mode on page 445](#)
- [query-interval on page 445](#)
- [query-last-member-interval on page 446](#)
- [query-response-interval on page 447](#)
- [robust-count on page 448](#)
- [source on page 449](#)
- [source-count on page 450](#)
- [source-increment on page 450](#)
- [ssm-map on page 451](#)
- [ssm-map-policy \(IGMP\) on page 451](#)
- [static on page 452](#)
- [traceoptions on page 453](#)
- [version on page 455](#)

accounting (Per Interface)

Syntax	(accounting no-accounting);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i>], [edit protocols igmp interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 8.5. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Enable or disable the collection of IGMP join and leave event statistics for an interface.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Recording IGMP Join and Leave Events on page 237

accounting (Protocol)

Syntax	accounting;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp], [edit protocols igmp]
Release Information	Statement introduced in Junos OS Release 8.5. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Enable the collection of IGMP join and leave event statistics on the system.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Recording IGMP Join and Leave Events on page 237


disable

Syntax	disable;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i>], [edit protocols igmp interface <i>interface-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Disable IGMP on the system.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Disabling IGMP on page 241

exclude

Syntax	exclude;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i> static group <i>multicast-group-address</i>], [edit protocols igmp interface <i>interface-name</i> static group <i>multicast-group-address</i>]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	Configure the static group to operate in exclude mode. In exclude mode all sources except the address configured are accepted for the group. If this statement is not included, the group operates in include mode.
Required Privilege Level	view-level—To view this statement in the configuration. control-level—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Enabling IGMP Static Group Membership on page 231

group

Syntax	<pre>group multicast-group-address { exclude; group-count number; group-increment increment; source ip-address { source-count number; source-increment increment; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface interface-name static], [edit protocols igmp interface interface-name static]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify the IGMP multicast group address and (optionally) the source address for the multicast group being statically configured on an interface.
<hr/> <div> NOTE: You must specify a unique address for each group.</div> <hr/>	
The remaining statements are explained separately.	
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Enabling IGMP Static Group Membership on page 231

group-count

Syntax	<code>group-count <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i> static group <i>mcast-group-address</i>], [edit protocols igmp interface <i>interface-name</i> static group <i>mcast-group-address</i>]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify the number of static groups to be created.
Options	<i>number</i> —Number of static groups. Default: Range: 1 through 512
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Enabling IGMP Static Group Membership on page 231

group-increment

Syntax	<code>group-increment <i>increment</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i> static group <i>mcast-group-address</i>], [edit protocols igmp interface <i>interface-name</i> static group <i>mcast-group-address</i>]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure the number of times the address should be incremented for each static group created. The increment is specified in dotted decimal notation similar to an IPv4 address.
Options	<i>increment</i> —Number of times the address should be incremented. Default: 0.0.0.1 Range: 0.0.0.1 through 255.255.255.255
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Enabling IGMP Static Group Membership on page 231

group-limit

Syntax	<code>group-limit <i>limit</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i>], [edit protocols igmp interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 10.4. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure a limit for the number of multicast groups (or [S,G] channels in IGMPv3) allowed on an interface. After this limit is reached, new reports are ignored and all related flows are not flooded on the interface.
Default	By default, there is no limit to the number of multicast groups that can join the interface.
Options	<i>limit</i> —group limit value for the interface. Range: 1 through 32767
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Limiting the Number of IGMP Multicast Group Joins on Logical Interfaces on page 238

group-policy

Syntax	<code>group-policy [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i>], [edit protocols igmp interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 9.1. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	When this statement is enabled on a router running IGMP version 2 (IGMPv2) or version 3 (IGMPv3), after the router receives an IGMP report, the router compares the group against the specified group policy and performs the action configured in that policy (for example, rejects the report).
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Filtering Unwanted IGMP Reports at the IGMP Interface Level on page 227

igmp

```
Syntax  igmp {
    accounting;
    interface interface-name {
        disable;
        (accounting | no-accounting);
        group-limit limit;
        group-policy [ policy-names ];
        immediate-leave;
        oif-map map-name;
        passive;
        promiscuous-mode;
        ssm-map ssm-map-name;
        ssm-map-policy ssm-map-policy-name;
        static {
            group multicast-group-address {
                exclude;
                group-count number;
                group-increment increment;
                source ip-address {
                    source-count number;
                    source-increment increment;
                }
            }
        }
        version version;
    }
    query-interval seconds;
    query-last-member-interval seconds;
    query-response-interval seconds;
    robust-count number;
    traceoptions {
        file filename <files number> <size size> <world-readable | no-world-readable>;
        flag flag <flag-modifier> <disable>;
    }
}
```

Hierarchy Level [edit logical-systems *logical-system-name* protocols],
[edit protocols]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.1 for the QFX Series.


Description Enable IGMP on the router. IGMP must be enabled for the router to receive multicast packets.

The remaining statements are explained separately.

Default IGMP is disabled on the router. IGMP is automatically enabled on all broadcast interfaces when you configure Protocol Independent Multicast (PIM) or Distance Vector Multicast Routing Protocol (DVMRP).

Required Privilege	routing—To view this statement in the configuration.
Level	routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Enabling IGMP on page 224

immediate-leave

Syntax	<code>immediate-leave;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i>], [edit protocols igmp interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 8.3. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	<p>The immediate leave setting is useful for minimizing the leave latency of IGMP memberships. When this setting is enabled, the routing device leaves the multicast group immediately after the last host leaves the multicast group.</p> <p>The immediate leave setting enables host tracking, meaning that the device keeps track of the hosts that send join messages. This allows IGMP to determine when the last host sends a leave message for the multicast group.</p> <p>When the immediate leave setting is enabled, the device removes an interface from the forwarding-table entry without first sending IGMP group-specific queries to the interface. The interface is pruned from the multicast tree for the multicast group specified in the IGMP leave message. The immediate leave setting ensures optimal bandwidth management for hosts on a switched network, even when multiple multicast groups are being used simultaneously.</p> <p>When immediate leave is disabled and one host sends a leave group message, the routing device first sends a group query to determine if another receiver responds. If no receiver responds, the routing device removes all hosts on the interface from the multicast group. Immediate leave is disabled by default for both IGMP version 2 and IGMP version 3.</p> <div style="border: 1px solid #ccc; padding: 10px; margin-top: 10px;"> <p> NOTE: Although host tracking is enabled for IGMPv2 and MLDv1 when you enable immediate leave, use immediate leave with these versions only when there is one host on the interface. The reason is that IGMPv2 and MLDv1 use a report suppression mechanism whereby only one host on an interface sends a group join report in response to a membership query. The other interested hosts suppress their reports. The purpose of this mechanism is to avoid a flood of reports for the same group. But it also interferes with host tracking, because the router only knows about the one interested host and does not know about the others.</p> </div>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Specifying Immediate-Leave Host Removal for IGMP on page 226

interface

Syntax	<pre> interface <i>interface-name</i> { disable; (accounting no-accounting); group-limit <i>limit</i>; group-policy [<i>policy-names</i>]; immediate-leave; oif-map <i>map-name</i>; passive; promiscuous-mode; ssm-map <i>ssm-map-name</i>; ssm-map-policy <i>ssm-map-policy-name</i>; static { group <i>multicast-group-address</i> { exclude; group-count <i>number</i>; group-increment <i>increment</i>; source <i>ip-address</i> { source-count <i>number</i>; source-increment <i>increment</i>; } } } version <i>version</i>; } </pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp], [edit protocols igmp]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Enable IGMP on an interface and configure interface-specific properties.
Options	<p><i>interface-name</i>—Name of the interface. Specify the full interface name, including the physical and logical address components. To configure all interfaces, you can specify all.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Enabling IGMP on page 224


maximum-transmit-rate

Syntax	<code>maximum-transmit-rate <i>packets-per-second</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp], [edit protocols igmp]
Release Information	Statement introduced in Junos OS Release 9.3. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Limit the transmission rate of IGMP packets
Options	packets-per-second —Maximum number of IGMP packets transmitted in one second by the router. Range: 1 through 10000 Default: 500 packets
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Limiting the Maximum IGMP Message Rate on page 230

oif-map

Syntax	<code>oif-map <i>map-name</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i>], [edit protocols igmp interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Associates an outgoing interface (OIF) map to the IGMP interface. The OIF map is a routing policy statement that can contain multiple terms.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring Multicast with Subscriber VLANs on page 187

passive (IGMP)

Syntax	<code>passive <allow-receive> <send-general-query> <send-group-query>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i>], [edit protocols igmp interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 9.6. allow-receive , send-general-query , and send-group-query options were added in Junos OS Release 10.0. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify that IGMP run on the interface and either not send and receive control traffic or selectively send and receive control traffic such as IGMP reports, queries, and leaves.
<div> NOTE: You can selectively activate up to two out of the three available options for the passive statement while keeping the other functions passive (inactive). Activating all three options would be equivalent to not using the passive statement.</div>	
Options	allow-receive —Enables IGMP to receive control traffic on the interface. send-general-query —Enables IGMP to send general queries on the interface. send-group-query —Enables IGMP to send group-specific and group-source-specific queries on the interface.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Multicast with Subscriber VLANs on page 187• Enabling IGMP on page 224

promiscuous-mode

Syntax	<code>promiscuous-mode;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i>], [edit protocols igmp interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 8.3. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify that the interface should accept IGMP reports from hosts on any subnetwork.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Accepting IGMP Messages from Remote Subnetworks on page 228

query-interval

Syntax	<code>query-interval <i>seconds</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp], [edit protocols igmp]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify how often the querier router sends general host-query messages.
Options	seconds —Time interval. Range: 1 through 1024 Default: 125 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Modifying the IGMP Host-Query Message Interval on page 225 • query-last-member-interval on page 446 • query-response-interval on page 447

query-last-member-interval

Syntax	<code>query-last-member-interval <i>seconds</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp], [edit protocols igmp]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify how often the querier router sends group-specific query messages.
Options	<i>seconds</i> —Time interval, in fractions of a second or seconds. Range: 0.1 through 0.9, then in 1-second intervals 1 through 999999 Default: 1 second
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Modifying the IGMP Last-Member Query Interval on page 228• query-interval on page 445• query-response-interval on page 447

query-response-interval

Syntax	query-response-interval <i>seconds</i> ;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp], [edit protocols igmp]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify how long the querier router waits to receive a response to a host-query message from a host.
Options	seconds —The query response interval must be less than the query interval. Range: 1 through 1024 Default: 10 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Modifying the IGMP Query Response Interval on page 226• query-interval on page 445• query-last-member-interval on page 446

robust-count

Syntax	<code>robust-count <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp], [edit protocols igmp]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Tune the expected packet loss on a subnet. This factor is used to calculate the group member interval, other querier present interval, and last-member query count.
Options	<i>number</i> —Robustness variable. Range: 2 through 10 Default: 2
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Modifying the IGMP Robustness Variable on page 229

source

Syntax	<pre>source <i>ip-address</i> { <i>source-count</i> <i>number</i>; <i>source-increment</i> <i>increment</i>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i> static group <i>multicast-group-address</i>], [edit protocols igmp interface <i>interface-name</i> static group <i>multicast-group-address</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify the IP version 4 (IPv4) unicast source address for the multicast group being statically configured on an interface.
Options	<p><i>ip-address</i>—IPv4 unicast address.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Enabling IGMP Static Group Membership on page 231

source-count

Syntax	<code>source-count <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i> static group multicast-group-address source], [edit protocols igmp interface <i>interface-name</i> static group multicast-group-address source]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure the number of multicast source addresses that should be accepted for each static group created.
Options	<i>number</i> —Number of source addresses. Default: 1 Range: 1 through 1024
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Enabling IGMP Static Group Membership on page 231

source-increment

Syntax	<code>source-increment <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i> static group multicast-group-address source], [edit protocols igmp interface <i>interface-name</i> static group multicast-group-address source]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure the number of times the multicast source address should be incremented for each static group created. The increment is specified in dotted decimal notation similar to an IPv4 address.
Options	<i>increment</i> —Number of times the source address should be incremented. Default: 0.0.0.1 Range: 0.0.0.1 through 255.255.255.255
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Enabling IGMP Static Group Membership on page 231

ssm-map

Syntax	<code>ssm-map <i>ssm-map-name</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface interface-name], [edit protocols igmp interface interface-name]
Release Information	Statement introduced in Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Apply an SSM map to an IGMP interface.
Options	<i>ssm-map-name</i> —Name of SSM map.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring SSM Mapping on page 176

ssm-map-policy (IGMP)

Syntax	<code>ssm-map-policy <i>ssm-map-policy-name</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface interface-name], [edit protocols igmp interface interface-name]
Release Information	Statement introduced in Junos OS Release 11.4. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Apply an SSM map policy to an IGMP interface.
Options	<i>ssm-map-policy-name</i> —Name of SSM map policy.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring SSM Maps for Different Groups to Different Sources on page 178

static

Syntax

```
static {
  group multicast-group-address {
    exclude;
    group-count number;
    group-increment increment;
    source ip-address {
      source-count number;
      source-increment increment;
    }
  }
}
```

Hierarchy Level [edit logical-systems *logical-system-name* protocols **igmp interface** *interface-name*],
[edit protocols **igmp interface** *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 12.1 for the QFX Series.

Description Test multicast forwarding on an interface without a receiver host.

The **static** statement simulates IGMP joins on a routing device statically on an interface without any IGMP hosts. It is supported for both IGMPv2 and IGMPv3 joins. This statement is especially useful for testing multicast forwarding on an interface without a receiver host.



NOTE: To prevent joining too many groups accidentally, the **static** statement is not supported with the **interface all** statement.

The remaining statements are explained separately.

Required Privilege Level routing and trace—To view this statement in the configuration.
routing-control and trace-control—To add this statement to the configuration.

Related Documentation

- [Enabling IGMP Static Group Membership on page 231](#)

traceoptions

Syntax	<pre>traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp], [edit protocols igmp]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	<p>Configure IGMP tracing options.</p> <p>To specify more than one tracing operation, include multiple flag statements.</p> <p>To trace the paths of multicast packets, use the mtrace command.</p>
Default	The default IGMP trace options are those inherited from the routing protocols traceoptions statement included at the [edit routing-options] hierarchy level.
Options	<p>disable—(Optional) Disable the tracing operation. You can use this option to disable a single operation when you have defined a broad group of tracing operations, such as all.</p> <p>file <i>filename</i>—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. All files are placed in the directory /var/log. We recommend that you place tracing output in the file igmp-log.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named trace-file reaches its maximum size, it is renamed trace-file.0, then trace-file.1, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.</p> <p>If you specify a maximum number of files, you must also include the size statement to specify the maximum file size.</p> <p>Range: 2 through 1000 files</p> <p>Default: 2 files</p> <p>flag—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements.</p> <p>IGMP Tracing Flags</p> <ul style="list-style-type: none"> leave—Leave group messages (for IGMP version 2 only). mtrace—Mtrace packets. Use the mtrace command to troubleshoot the software. packets—All IGMP packets.

- **query**—IGMP membership query messages, including general and group-specific queries.
- **report**—Membership report messages.

Global Tracing Flags

- **all**—All tracing operations
- **general**—A combination of the **normal** and **route** trace operations
- **normal**—All normal operations

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **policy**—Policy operations and actions
- **route**—Routing table changes
- **state**—State transitions
- **task**—Interface transactions and processing
- **timer**—Timer usage

flag-modifier—(Optional) Modifier for the tracing flag. You can specify one or more of these modifiers:

- **detail**—Detailed trace information
- **receive**—Packets being received
- **send**—Packets being transmitted

no-stamp—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

Default: If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

no-world-readable—(Optional) Do not allow users to read the log file.

replace—(Optional) Replace an existing trace file if there is one.

Default: If you do not include this option, tracing output is appended to an existing trace file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches this size, it is renamed **trace-file.0**. When **trace-file** again reaches this size, **trace-file.0** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.0**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also include the **files** statement to specify the maximum number of trace files.

Syntax: *xk* to specify KB, *xm* to specify MB, or *xg* to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level	routing and trace—To view this statement in the configuration.
	routing-control and trace-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Tracing IGMP Protocol Traffic on page 239

version

Syntax	<code>version <i>version</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp interface <i>interface-name</i>], [edit protocols igmp interface <i>interface-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Specify the version of IGMP.
Options	<p>version—IGMP version number.</p> <p>Range: 1, 2, or 3</p> <p>Default: IGMP version 2</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Changing the IGMP Version on page 230

CHAPTER 16

MLD Configuration Statements

- [accounting \(Per Interface\) on page 458](#)
- [accounting \(Protocol\) on page 458](#)
- [disable on page 458](#)
- [exclude on page 459](#)
- [group on page 460](#)
- [group-count on page 461](#)
- [group-increment on page 461](#)
- [group-limit on page 462](#)
- [group-policy on page 462](#)
- [immediate-leave on page 463](#)
- [interface on page 464](#)
- [maximum-transmit-rate on page 465](#)
- [mld on page 466](#)
- [oif-map on page 467](#)
- [passive \(MLD\) on page 468](#)
- [query-interval on page 469](#)
- [query-last-member-interval on page 469](#)
- [query-response-interval on page 470](#)
- [robust-count on page 470](#)
- [source on page 471](#)
- [source-count on page 471](#)
- [source-increment on page 472](#)
- [ssm-map on page 472](#)
- [ssm-map-policy \(MLD\) on page 473](#)
- [static on page 474](#)
- [traceoptions on page 475](#)
- [version on page 477](#)

accounting (Per Interface)

Syntax	(accounting no-accounting);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld interface <i>interface-name</i>], [edit protocols mld interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 9.1.
Description	Enable or disable the collection of MLD join and leave event statistics for an interface.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Recording MLD Join and Leave Events on page 265

accounting (Protocol)

Syntax	accounting;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld], [edit protocols mld]
Release Information	Statement introduced in Junos OS Release 9.1.
Description	Enable the collection of MLD join and leave event statistics on the system.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Recording MLD Join and Leave Events on page 265


disable

Syntax	disable;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld interface <i>interface-name</i>], [edit protocols mld interface <i>interface-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Disable MLD on the system.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Disabling MLD on page 269

exclude

Syntax	exclude;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld interface <i>interface-name</i> static group <i>mcast-group-address</i>], [edit protocols mld interface <i>interface-name</i> static group <i>mcast-group-address</i>]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	Configure the static group to operate in exclude mode. In exclude mode all sources except the address configured are accepted for the group. By default, the group operates in include mode.
Required Privilege Level	view-level—To view this statement in the configuration. control-level—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Enabling MLD Static Group Membership on page 258

group

Syntax	<pre>group <i>multicast-group-address</i> { exclude; group-count <i>number</i>; group-increment <i>increment</i>; source <i>ip-address</i> { source-count <i>number</i>; source-increment <i>increment</i>; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld interface <i>interface-name</i> static], [edit protocols mld interface <i>interface-name</i> static]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	The MLD multicast group address and (optionally) the source address for the multicast group being statically configured on an interface.
Options	<i>multicast-group-address</i> —Address of the group.
<div> NOTE: You must specify a unique address for each group.</div> <div>The remaining statements are explained separately.</div>	
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Enabling MLD Static Group Membership on page 258

group-count

Syntax	<code>group-count <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>mld interface <i>interface-name</i> static group <i>multicast-group-address</i></code>], [edit protocols <code>mld interface <i>interface-name</i> static group <i>multicast-group-address</i></code>]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the number of static groups to be created.
Options	<i>number</i> —Number of static groups. Default: 1 Range: 1 through 512
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Enabling MLD Static Group Membership on page 258

group-increment

Syntax	<code>group-increment <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>mld interface <i>interface-name</i> static group <i>multicast-group-address</i></code>], [edit protocols <code>mld interface <i>interface-name</i> static group <i>multicast-group-address</i></code>]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the number of times the address should be incremented for each static group created. The increment is specified in a format similar to an IPv6 address.
Options	<i>increment</i> —Number of times the address should be incremented. Default: ::1 Range: ::1 through ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff:
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Enabling MLD Static Group Membership on page 258


group-limit

Syntax	<code>group-limit <i>limit</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>mld interface <i>interface-name</i></code>], [edit protocols <code>mld interface <i>interface-name</i></code>]
Release Information	Statement introduced in Junos OS Release 10.4.
Description	Configure a limit for the number of multicast groups (or [S,G] channels in MLDv2) allowed on a logical interface. After this limit is reached, new reports are ignored and all related flows are not flooded on the interface.
Default	By default, there is no limit to the number of multicast groups that can join the interface.
Options	<i>limit</i> —group value limit for the interface. Range: 1 through 32767
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.

group-policy

Syntax	<code>group-policy [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>mld interface <i>interface-name</i></code>], [edit protocols <code>mld interface <i>interface-name</i></code>]
Release Information	Statement introduced in Junos OS Release 9.1.
Description	When a router running MLD version 1 or version 2 (MLDv1 or MLDv2), receives an MLD report, the router compares the group against the specified group policy and performs the action configured in that policy (for example, rejects the report).
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Filtering Unwanted MLD Reports at the MLD Interface Level on page 255

immediate-leave

Syntax	immediate-leave;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld interface <i>interface-name</i>], [edit protocols mld interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 8.3.
Description	<p>The immediate leave setting is useful for minimizing the leave latency of MLD memberships. When this setting is enabled, the routing device leaves the multicast group immediately after the last host leaves the multicast group.</p> <p>The immediate-leave setting enables host tracking, meaning that the device keeps track of the hosts that send join messages. This allows MLD to determine when the last host sends a leave message for the multicast group.</p> <p>When the immediate leave setting is enabled, the device removes an interface from the forwarding-table entry without first sending MLD group-specific queries to the interface. The interface is pruned from the multicast tree for the multicast group specified in the MLD leave message. The immediate leave setting ensures optimal bandwidth management for hosts on a switched network, even when multiple multicast groups are being used simultaneously.</p> <p>When immediate leave is disabled and one host sends a leave group message, the routing device first sends a group query to determine if another receiver responds. If no receiver responds, the routing device removes all hosts on the interface from the multicast group. Immediate leave is disabled by default for both MLD version 1 and MLD version 2.</p>
	<div>  <p>NOTE: Although host tracking is enabled for IGMPv2 and MLDv1 when you enable immediate leave, use immediate leave with these versions only when there is one host on the interface. The reason is that IGMPv2 and MLDv1 use a report suppression mechanism whereby only one host on an interface sends a group join report in response to a membership query. The other interested hosts suppress their reports. The purpose of this mechanism is to avoid a flood of reports for the same group. But it also interferes with host tracking, because the router only knows about the one interested host and does not know about the others.</p> </div>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Specifying Immediate-Leave Host Removal for MLD on page 254

interface

Syntax	<pre> interface <i>interface-name</i> { disable; (accounting no-accounting); group-limit <i>limit</i>; group-policy [<i>policy-names</i>]; immediate-leave; oif-map [<i>map-names</i>]; passive; ssm-map <i>ssm-map-name</i>; ssm-map-policy <i>ssm-map-policy-name</i>; static { group <i>multicast-group-address</i> { exclude; group-count <i>number</i> group-increment <i>increment</i> source <i>ip-address</i> { source-count <i>number</i>; source-increment <i>increment</i>; } } } version <i>version</i>; } </pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld], [edit protocols mld]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Enable MLD on an interface and configure interface-specific properties.
Options	<p><i>interface-name</i>—Name of the interface. Specify the full interface name, including the physical and logical address components. To configure all interfaces, you can specify all.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Enabling MLD on page 251

maximum-transmit-rate

Syntax	maximum-transmit-rate <i>packets-per-second</i> ;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld], [edit protocols mld]
Release Information	Statement introduced in Junos OS Release 9.3.
Description	Limit the transmission rate of MLD packets.
Options	packets-per-second —Maximum number of MLD packets transmitted in one second by the router. Range: 1 through 10000 Default: 500 packets
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Limiting the Maximum MLD Message Rate on page 257

mld

Syntax	<pre> mld { accounting; interface <i>interface-name</i> { (accounting no-accounting); disable; group-limit <i>limit</i>; group-policy [<i>policy-names</i>]; immediate-leave; oif-map [<i>map-names</i>]; passive; ssm-map <i>ssm-map-name</i>; ssm-map-policy <i>ssm-map-policy-name</i>; static { group <i>multicast-group-address</i> { exclude; group-count <i>number</i>; group-increment <i>increment</i>; source <i>ip-address</i> { source-count <i>number</i>; source-increment <i>increment</i>; } } } version <i>version</i>; } maximum-transmit-rate <i>packets-per-second</i>; query-interval <i>seconds</i>; query-last-member-interval <i>seconds</i>; query-response-interval <i>seconds</i>; robust-count <i>number</i>; traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; } } </pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols], [edit protocols]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Enable MLD on the router. MLD must be enabled for the router to receive multicast packets.
Default	MLD is disabled on the router. MLD is automatically enabled on all broadcast interfaces when you configure Protocol Independent Multicast (PIM) or Distance Vector Multicast Routing Protocol (DVMRP).
Options	The statements are explained separately.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- [Enabling MLD on page 251](#)

oif-map

Syntax oif-map *map-name*;

Hierarchy Level [edit logical-systems *logical-system-name* protocols **mld interface** *interface-name*],
[edit protocols **mld interface** *interface-name*]

Release Information Statement introduced in Junos OS Release 9.6.


Description Associate an outgoing interface (OIF) map to an MLD logical interface. The OIF map is a routing policy statement that can contain multiple terms.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- [Example: Configuring Multicast with Subscriber VLANs on page 187](#)

passive (MLD)

Syntax	<code>passive;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>mld interface interface-name</code>], [edit protocols <code>mld interface interface-name</code>]
Release Information	Statement introduced in Junos OS Release 9.6. <code>allow-receive</code> , <code>send-general-query</code> , and <code>send-group-query</code> options added in Junos OS Release 10.0.
Description	Specify that MLD run on the interface and either not send and receive control traffic or selectively send and receive control traffic such as MLD reports, queries, and leaves.
<div> NOTE: You can selectively activate up to two out of the three available options for the <code>passive</code> statement while keeping the other functions <code>passive</code> (inactive). Activating all three options is equivalent to not using the <code>passive</code> statement.</div>	
Options	<code>allow-receive</code> —Enables IGMP to receive control traffic on the interface. <code>send-general-query</code> —Enables IGMP to send general queries on the interface. <code>send-group-query</code> —Enables IGMP to send group-specific and group-source-specific queries on the interface.
Required Privilege Level	<code>routing</code> —To view this statement in the configuration. <code>routing-control</code> —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Multicast with Subscriber VLANs on page 187

query-interval

Syntax	<code>query-interval seconds;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld], [edit protocols mld]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Specify how often the querier router sends general host-query messages.
Options	seconds —Time interval. Range: 1 through 1024 Default: 125 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Modifying the MLD Host-Query Message Interval on page 252 • query-last-member-interval on page 469 • query-response-interval on page 470

query-last-member-interval

Syntax	<code>query-last-member-interval seconds;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld], [edit protocols mld]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Specify how often the querier router sends group-specific query messages.
Options	seconds —Time interval, in fractions of a second or seconds. Range: 0.1 through 0.9, then in 1-second intervals from 1 through 1024 Default: 1 second
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Modifying the MLD Last-Member Query Interval on page 254 • query-interval on page 469 • query-response-interval on page 470

query-response-interval

Syntax	<code>query-response-interval <i>seconds</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld], [edit protocols mld]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches.
Description	Specify how long the querier router waits to receive a response to a host-query message from a host.
Options	<i>seconds</i> —Time interval. This interval must be less than the interval between general host-query messages. Range: 1 through 1024 Default: 10 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Modifying the MLD Query Response Interval on page 253• query-interval on page 469• query-last-member-interval on page 469

robust-count

Syntax	<code>robust-count <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld], [edit protocols mld]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Tune for the expected packet loss on a subnet.
Options	<i>number</i> —Time interval. This interval must be less than the interval between general host-query messages. Range: 2 through 10 Default: 2 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Modifying the MLD Robustness Variable on page 256

source

Syntax	<code>source <i>ip-address</i> { source-count <i>number</i>; source-increment <i>increment</i>; }</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>mld interface <i>interface-name</i> static group <i>multicast-group-address</i></code>], [edit protocols <code>mld interface <i>interface-name</i> static group <i>multicast-group-address</i></code>]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	IP version 6 (IPv6) unicast source address for the multicast group being statically configured on an interface.
Options	<i>ip-address</i> —One or more IPv6 unicast addresses.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Enabling MLD Static Group Membership on page 258

source-count

Syntax	<code>source-count <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>mld interface <i>interface-name</i> static group <i>multicast-group-address</i> source</code>], [edit protocols <code>mld interface <i>interface-name</i> static group <i>multicast-group-address</i> source</code>]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the number of multicast source addresses that should be accepted for each static group created.
Options	<i>number</i> —Number of source addresses. Default: 1 Range: 1 through 1024
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Enabling MLD Static Group Membership on page 258

source-increment

Syntax	<code>source-increment <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>mld interface <i>interface-name</i> static group <i>mcast-group-address</i> <i>source</i></code>], [edit protocols <code>mld interface <i>interface-name</i> static group <i>mcast-group-address</i> <i>source</i></code>]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Configure the number of times the address should be incremented for each static group created. The increment is specified in a format similar to an IPv6 address.
Options	<i>increment</i> —Number of times the source address should be incremented. Default: ::1 Range: ::1 through ffff:ffff:ffff:ffff:ffff:ffff:ffff:ffff;
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Enabling MLD Static Group Membership on page 258

ssm-map

Syntax	<code>ssm-map <i>ssm-map-name</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>mld interface <i>interface-name</i></code>], [edit protocols <code>mld interface <i>interface-name</i></code>]
Release Information	Statement introduced in Junos OS Release 7.4.
Description	Apply an SSM map to an MLD interface.
Options	<i>ssm-map-name</i> —Name of SSM map.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring SSM Mapping on page 176

ssm-map-policy (MLD)

Syntax	<code>ssm-map-policy <i>ssm-map-policy-name</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld interface <i>interface-name</i>], [edit protocols mld interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 11.4.
Description	Apply an SSM map policy to an MLD interface.
Options	<i>ssm-map-policy-name</i> —Name of SSM map policy.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring SSM Maps for Different Groups to Different Sources on page 178

static

Syntax

```
static {
  group multicast-group-address {
    exclude;
    group-count number;
    group-increment increment;
    source ip-address {
      source-count number;
      source-increment increment;
    }
  }
}
```

Hierarchy Level [edit logical-systems *logical-system-name* protocols **mld interface** *interface-name*],
[edit protocols **mld interface** *interface-name*]

Release Information Statement introduced before Junos OS Release 7.4.

Description Test multicast forwarding on an interface.

The **static** statement simulates MLD joins on a routing device statically on an interface without any MLD hosts. It is supported for both MLDv1 and MLDv2 joins. This statement is especially useful for testing multicast forwarding on an interface without a receiver host.



NOTE: To prevent joining too many groups accidentally, the **static** statement is not supported with the **interface all** statement.

The remaining statements are explained separately.

Required Privilege Level routing and trace—To view this statement in the configuration.
routing-control and trace-control—To add this statement to the configuration.

Related Documentation

- [Enabling MLD Static Group Membership on page 258](#)

traceoptions

Syntax	<pre> traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; } </pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols mld], [edit protocols mld]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	<p>Configure MLD tracing options.</p> <p>To specify more than one tracing operation, include multiple flag statements.</p> <p>To trace the paths of multicast packets, use the mtrace command.</p>
Default	The default MLD trace options are those inherited from the traceoptions statement included at the [edit routing-options] hierarchy level.
Options	<p>disable—(Optional) Disable the tracing operation. You can use this option to disable a single operation when you have defined a broad group of tracing operations, such as all.</p> <p>file <i>filename</i>—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. All files are placed in the directory /var/log. We recommend that you place tracing output in the file mld-log.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named trace-file reaches its maximum size, it is renamed trace-file.0, then trace-file.1, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.</p> <p>If you specify a maximum number of files, you must also include the size statement to specify the maximum file size.</p> <p>Range: 2 through 1000 files</p> <p>Default: 2 files</p> <p>flag—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements.</p> <p>MLD Tracing Flags</p> <ul style="list-style-type: none"> • leave—Leave group messages. • mtrace—Mtrace packets. Use the mtrace command to troubleshoot the software. • packets—All MLD packets. • query—MLD membership query messages, including general and group-specific queries.

- **report**—Membership report messages.

Global Tracing Flags

- **all**—All tracing operations
- **general**—A combination of the **normal** and **route** trace operations
- **normal**—Traces errors and significant events during normal packet processing

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **policy**—Policy operations and actions
- **route**—Routing table changes
- **state**—State transitions
- **task**—Interface transactions and processing
- **timer**—Timer usage

flag-modifier—(Optional) Modifier for the tracing flag. You can specify one or more of these modifiers:

- **detail**—Detailed trace information
- **receive**—Packets being received
- **send**—Packets being transmitted

no-stamp—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

Default: If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

no-world-readable—(Optional) Do not allow users to read the log file.

replace—(Optional) Replace an existing trace file if there is one.

Default: If you do not include this option, tracing output is appended to an existing trace file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches this size, it is renamed **trace-file.0**. When **trace-file** again reaches this size, **trace-file.0** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.0**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also include the **files** statement to specify the maximum number of trace files.

Syntax: *xk* to specify KB, *xm* to specify MB, or *xg* to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level	routing and trace—To view this statement in the configuration.
	routing-control and trace-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Tracing MLD Protocol Traffic on page 268

version

Syntax	<code>version <i>version</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols <code>mld interface <i>interface-name</i></code>], [edit protocols <code>mld interface <i>interface-name</i></code>]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Configure the MLD version explicitly. MLD version 2 (MLDv2) is used only to support source-specific multicast (SSM).
Options	<p>version—MLD version to run on the interface.</p> <p>Range: 1 or 2</p> <p>Default: 1 (MLDv1)</p>
Required Privilege Level	<p>routing and trace—To view this statement in the configuration.</p> <p>routing-control and trace-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Modifying the MLD Version on page 252

CHAPTER 17

IGMP Snooping Configuration Statements

- [group on page 480](#)
- [group-limit on page 481](#)
- [host-only-interface on page 482](#)
- [igmp-snooping on page 483](#)
- [immediate-leave on page 485](#)
- [interface on page 486](#)
- [multicast-router-interface on page 487](#)
- [proxy on page 488](#)
- [query-interval on page 489](#)
- [query-last-member-interval on page 490](#)
- [query-response-interval on page 491](#)
- [robust-count on page 492](#)
- [source on page 493](#)
- [source-address on page 493](#)
- [static on page 494](#)
- [traceoptions on page 495](#)
- [vlan on page 497](#)

group

Syntax	<code>group <i>ip-address</i> { <i>source-address</i> <i>ip-address</i>; }</code>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i> static], [edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id</i> interface <i>interface-name</i> static], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i> static], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols vlan <i>vlan-id</i> igmp-snooping interface <i>interface-name</i> static]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Configure the IGMP multicast group address that receives data on an interface and (optionally) a source address for certain packets.
Options	<i>ip-address</i> —Group address. The remaining statement is explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring IGMP Snooping on page 277

group-limit

Syntax	<code>group-limit <i>limit</i>;</code>
Hierarchy Level	<p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i>],</p> <p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols vlan <i>vlan-id</i> igmp-snooping interface <i>interface-name</i>]</p>
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Configure a limit for the number of multicast groups (or [S,G] channels in IGMPv3) allowed on an interface. After this limit is reached, new reports are ignored and all related flows are not flooded on the interface.
Default	By default, there is no limit to the number of multicast groups joining an interface.
Options	<i>limit</i> —a 32-bit number for the limit on the interface.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring IGMP Snooping on page 277

host-only-interface

Syntax	host-only-interface;
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface interface-name], [edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id</i> interface interface-name], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface interface-name], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols vlan <i>vlan-id</i> igmp-snooping interface interface-name]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Configure an interface as a host-facing interface. IGMP queries received on these interfaces are dropped.
Default	The interface can either be a host-side or multicast-router interface.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring IGMP Snooping on page 277• multicast-router-interface on page 487

igmp-snooping

Syntax	<pre> igmp-snooping { immediate-leave; interface <i>interface-name</i> { group-limit <i>limit</i>; host-only-interface; immediate-leave; multicast-router-interface; static { group <i>ip-address</i> { source <i>ip-address</i>; } } } proxy { source-address <i>ip-address</i>; } query-interval <i>seconds</i>; query-last-member-interval <i>seconds</i>; query-response-interval <i>seconds</i>; robust-count <i>number</i>; vlan <i>vlan-id</i> { immediate-leave; interface <i>interface-name</i> { group-limit <i>limit</i>; host-only-interface; immediate-leave; multicast-router-interface; static { group <i>ip-address</i> { source <i>ip-address</i>; } } } proxy { source-address <i>ip-address</i>; } query-interval <i>seconds</i>; query-last-member-interval <i>seconds</i>; query-response-interval <i>seconds</i>; robust-count <i>number</i>; } } </pre>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> protocols], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Enable IGMP snooping on the router.
Default	IGMP snooping is disabled on the router.

Options	The statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Understanding IGMP Snooping on page 272

immediate-leave

Syntax	<code>immediate-leave;</code>
Hierarchy Level	<p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping],</p> <p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i>],</p> <p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id interface</i> <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols vlan <i>vlan-id igmp-snooping interface</i> <i>interface-name</i>]</p>
Release Information	Statement introduced in Junos OS Release 8.5.
Description	<p>The immediate leave setting is useful for minimizing the leave latency of IGMP memberships. When this setting is enabled, the routing device leaves the multicast group immediately after the last host leaves the multicast group.</p> <p>The immediate-leave setting enables host tracking, meaning that the device keeps track of the hosts that send join messages. This allows IGMP to determine when the last host sends a leave message for the multicast group.</p> <p>When the immediate leave setting is enabled, the device removes an interface from the forwarding-table entry without first sending IGMP group-specific queries to the interface. The interface is pruned from the multicast tree for the multicast group specified in the IGMP leave message. The immediate leave setting ensures optimal bandwidth management for hosts on a switched network, even when multiple multicast groups are being used simultaneously.</p> <p>When immediate leave is disabled and one host sends a leave group message, the routing device first sends a group query to determine if another receiver responds. If no receiver responds, the routing device removes all hosts on the interface from the multicast group. Immediate leave is disabled by default for both IGMP version 2 and IGMP version 3.</p>



NOTE: Although host tracking is enabled for IGMPv2 and MLDv1 when you enable immediate leave, use immediate leave with these versions only when there is one host on the interface. The reason is that IGMPv2 and MLDv1 use a report suppression mechanism whereby only one host on an interface sends a group join report in response to a membership query. The other interested hosts suppress their reports. The purpose of this mechanism is to avoid a flood of reports for the same group. But it also interferes with host tracking, because the router only knows about the one interested host and does not know about the others.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- [Example: Configuring IGMP Snooping on page 277](#)

interface

Syntax

```
interface interface-name {  
    group-limit limit;  
    host-only-interface;  
    multicast-router-interface;  
    static {  
        group ip-address {  
            source ip-address;  
        }  
    }  
}
```

Hierarchy Level [edit bridge-domains *bridge-domain-name* protocols [igmp-snooping](#)],
[edit bridge-domains *bridge-domain-name* protocols [igmp-snooping](#) [vlan](#) *vlan-id*],
[edit routing-instances *routing-instance-name* bridge-domains *bridge-domain-name* protocols [igmp-snooping](#)],
[edit routing-instances *routing-instance-name* bridge-domains *bridge-domain-name* protocols [vlan](#) *vlan-id* [igmp-snooping](#)]

Release Information Statement introduced in Junos OS Release 8.5.

Description Enable IGMP snooping on an interface and configure interface-specific properties.

Options *interface-name*—Name of the interface. Specify the full interface name, including the physical and logical address components. To configure all interfaces, you can specify **all**.

The remaining statements are explained separately.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- [Example: Configuring IGMP Snooping on page 277](#)

multicast-router-interface

Syntax	multicast-router-interface;
Hierarchy Level	<p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface interface-name],</p> <p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan vlan-id interface interface-name],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface interface-name],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols vlan vlan-id igmp-snooping interface interface-name]</p>
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Configure an interface as a bridge interface toward other multicast routers.
Default	The interface can either be a host-side or multicast-router interface.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring IGMP Snooping on page 277 • host-only-interface on page 482

proxy

Syntax	<pre>proxy { source-address ip-address; }</pre>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping], [edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id</i>], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols vlan <i>vlan-id</i> igmp-snooping]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Configure proxy mode and options, including source address. All the queries generated by IGMP snooping are sent using 0.0.0.0 as the source address in order to avoid participating in IGMP querier election. Also, all reports generated by IGMP snooping are sent with 0.0.0.0 as the source address unless there is a configured source address to use.
Default	By default, IGMP snooping does not employ proxy mode. The remaining statement is explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring IGMP Snooping on page 277

query-interval

Syntax	<code>query-interval seconds;</code>
Hierarchy Level	<p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface interface-name],</p> <p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan vlan-id interface interface-name],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface interface-name],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan vlan-id interface interface-name]</p>
Release Information	Statement introduced before Junos OS Release 8.5.
Description	Configure the interval for host-query message timeouts.
Options	<p>seconds—Time interval.</p> <p>Range: 1 through 1024</p> <p>Default: 125 seconds</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring IGMP Snooping on page 277 • query-last-member-interval on page 490 • query-response-interval on page 491

query-last-member-interval

Syntax	<code>query-last-member-interval seconds;</code>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface interface-name], [edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan vlan-id interface interface-name], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface interface-name], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan vlan-id interface interface-name]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Configure the interval for group-specific query timeouts.
Options	seconds —Time interval, in fractions of a second or seconds. Range: 0.1 through 0.9, then in 1-second intervals 1 through 1024 Default: 1 second
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring IGMP Snooping on page 277• query-interval on page 489• query-response-interval on page 491

query-response-interval

Syntax	query-response-interval <i>seconds</i> ;
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface interface-name], [edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan vlan-id interface interface-name], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface interface-name], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan vlan-id interface interface-name]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Specify how long to wait to receive a response to a specific query message from a host.
Options	<i>seconds</i> —Time interval. This interval must be less than the host-query interval. Range: 1 through 1024 Default: 10 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring IGMP Snooping on page 277 • query-interval on page 489 • query-last-member-interval on page 490

robust-count

Syntax	<code>robust-count <i>number</i>;</code>
Hierarchy Level	<code>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i>],</code> <code>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id</i> interface <i>interface-name</i>],</code> <code>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i>],</code> <code>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id</i> interface <i>interface-name</i>]</code>
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Provide fine-tuning to allow for expected packet loss on a subnet. You can wait more intervals if subnet packet loss is high and IGMP report messages might be lost.
Options	<i>number</i> —Robust interval. Range: 2 through 10 Default: 2
Required Privilege Level	routing —To view this statement in the configuration. routing-control —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring IGMP Snooping on page 277

source

Syntax	<code>source ip-address;</code>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i> static group], [edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i> static group], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i> static group], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols vlan <i>vlan-id</i> igmp-snooping interface <i>interface-name</i> static group]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Statically define multicast group source addresses on an interface.
Options	<i>ip-address</i> —IP address to use as the source for the group.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring IGMP Snooping on page 277

source-address

Syntax	<code>source-address ip-address;</code>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping proxy], [edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id</i> proxy], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping proxy], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id</i> proxy]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Specify the IP address to use as the source for IGMP snooping reports in proxy mode. Reports are sent with address 0.0.0.0 as the source address unless there is a source address configured.
Options	<i>ip-address</i> —IP address to use as the source for proxy-mode IGMP snooping reports.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring IGMP Snooping on page 277

static

Syntax	<pre>static { group multicast-group-address { source ip-address; } }</pre>
Hierarchy Level	<p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i>],</p> <p>[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id</i> interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping vlan <i>vlan-id</i> interface <i>interface-name</i>]</p>
Release Information	Statement introduced in Junos OS Release 8.5.
Description	<p>Define static multicast groups on an interface.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">• Example: Configuring IGMP Snooping on page 277

traceoptions

Syntax	<pre>traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable> ; flag <i>flag</i> (detail disable receive send); }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> bridge-domains <i>domain-name</i> protocols igmp-snooping],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>instance-name</i> bridge-domains <i>domain-name</i> protocols igmp-snooping],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>instance-name</i> protocols igmp-snooping],</p> <p>[edit bridge-domains <i>domain-name</i> protocols igmp-snooping],</p> <p>[edit routing-instances <i>instance-name</i> bridge-domains <i>domain-name</i> protocols igmp-snooping],</p> <p>[edit routing-instances <i>instance-name</i> protocols igmp-snooping]</p>
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Define tracing operations for IGMP snooping.
Default	The traceoptions feature is disabled by default.
Options	<p>file <i>filename</i>—Name of the file to receive the output of the tracing operation. All files are placed in the directory /var/log.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named trace-file reaches its maximum size, it is renamed trace-file.0, then trace-file.1, and so on, until the maximum number of trace files is reached (xk to specify KB, xm to specify MB, or xg to specify gigabytes), at which point the oldest trace file is overwritten. If you specify a maximum number of files, you also must specify a maximum file size with the size option.</p> <p>Range: 2 through 1000</p> <p>Default: 3 files</p> <p>flag <i>flag</i> —Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements. You can include the following flags:</p> <ul style="list-style-type: none"> • all—All tracing operations. • client-notification—Trace notifications. • general—Trace general IGMP snooping protocol events. • group—Trace group operations. • host-notification—Trace host notifications. • leave—Trace leave group messages (IGMPv2 only). • normal—Trace normal IGMP snooping protocol events. • packets—Trace all IGMP packets.

- **policy**—Trace policy processing.
- **query**—Trace IGMP membership query messages.
- **report**—Trace membership report messages.
- **route**—Trace routing information.
- **state**—Trace IGMP state transitions.
- **task**—Trace routing protocol task processing.
- **timer**—Trace routing protocol timer processing.

no-world-readable—(Optional) Restrict file access to the user who created the file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches its maximum size, it is renamed **trace-file.0**, then **trace-file.1**, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten. If you specify a maximum number of files, you also must specify a maximum file size with the **files** option.

Syntax: *xk* to specify KB, *xm* to specify MB, or *xg* to specify gigabytes

Range: 10 KB through 1 gigabytes

Default: 128 KB

world-readable—(Optional) Enable unrestricted file access.

Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
---------------------------------	---

Related Documentation	<ul style="list-style-type: none">• Configuring IGMP Snooping Trace Operations on page 283• Configuring IGMP Snooping on page 275
------------------------------	--

vlan

Syntax	<pre> vlan <i>vlan-id</i> { immediate-leave; interface <i>interface-name</i> { group-limit <i>limit</i>; host-only-interface; multicast-router-interface; static { group <i>multicast-group-address</i> { source <i>ip-address</i>; } } } proxy { source-address <i>ip-address</i>; } query-interval <i>seconds</i>; query-last-member-interval <i>seconds</i>; query-response-interval <i>seconds</i>; robust-count <i>number</i>; } </pre>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> protocols igmp-snooping]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Configure IGMP snooping parameters for a particular VLAN.
Default	By default, IGMP snooping options apply to all VLANs.
Options	<p><i>vlan-id</i>—Apply the parameters to this VLAN.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring VLAN-Specific IGMP Snooping Parameters on page 276 • igmp-snooping on page 483

CHAPTER 18

Multicast Snooping Configuration Statements

- [flood-groups on page 500](#)
- [forwarding-cache on page 500](#)
- [graceful-restart on page 501](#)
- [ignore-stp-topology-change on page 501](#)
- [multicast-snooping-options on page 502](#)
- [multichassis-lag-replicate-state on page 503](#)
- [nexthop-hold-time on page 503](#)
- [threshold on page 504](#)
- [traceoptions on page 505](#)

flood-groups

Syntax	<code>flood-groups [<i>ip-addresses</i>];</code>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> multicast-snooping-options], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit routing-instances <i>routing-instance-name</i> multicast-snooping-options]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Establish a list of flood group addresses for multicast snooping.
Options	<i>ip-addresses</i> —List of IP addresses subject to flooding.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Multicast Snooping on page 289

forwarding-cache

Syntax	<code>forwarding-cache { threshold suppress <i>value</i> <reuse <i>value</i>>; }</code>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> multicast-snooping-options], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit routing-instances <i>routing-instance-name</i> multicast-snooping-options]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Establish multicast snooping forwarding cache parameter values.
Options	The statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Multicast Snooping on page 289

graceful-restart

Syntax	<code>graceful-restart <restart-duration seconds>;</code>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> multicast-snooping-options], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit routing-instances <i>routing-instance-name</i> multicast-snooping-options]
Release Information	Statement introduced in Junos OS Release 9.2.
Description	Establish the graceful restart duration for multicast snooping. You can set this value between 0 and 300 seconds. If you set the duration to 0, graceful restart is effectively disabled. Set this value slightly larger than the IGMP query response interval.
Default	180 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring Multicast Snooping on page 289 • query-response-interval on page 491

ignore-stp-topology-change

Syntax	<code>ignore-stp-topology-change;</code>
Hierarchy Level	[edit bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> multicast-snooping-options]
Release Information	Statement introduced in Junos OS Release 9.5.
Description	Ignore messages about spanning tree topology changes. This statement is supported for the virtual-switch routing instance type only.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring Multicast Snooping on page 289

multicast-snooping-options

Syntax	<pre>multicast-snooping-options { flood-groups [<i>ip-addresses</i>]; forwarding-cache { threshold suppress <i>value</i> <reuse <i>value</i>>; } graceful-restart <restart-duration <i>seconds</i>>; ignore-stp-topology-change; multichassis-lag-replicate-state; nexthop-hold-time <i>milliseconds</i>; traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <<i>flag-modifier</i>> <disable>; } }</pre>
Hierarchy Level	<pre>[edit bridge-domains <i>bridge-domain-name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i>], [edit routing-instances <i>routing-instance-name</i>], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i>]</pre>
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Establish multicast snooping option values.
Options	The statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Multicast Snooping on page 288• Enabling Bulk Updates for Multicast Snooping on page 294• Example: Configuring Multicast Snooping on page 289

multichassis-lag-replicate-state

Syntax	multichassis-lag-replicate-state;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> multicast-snooping-options], [edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i> multicast-snooping-options], [edit routing-instances <i>routing-instance-name</i> multicast-snooping-options]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Provide multicast snooping for multichassis link aggregation group interfaces. Replicate IGMP join and leave messages from the active link to the standby link of a dual-link multichassis link aggregation group interface, enabling faster recovery of membership information after failover.
Default	If not included, membership information is recovered using a standard IGMP network query.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring Multicast Snooping on page 288 • multicast-snooping-options on page 502

nexthop-hold-time

Syntax	nexthop-hold-time <i>milliseconds</i> ;
Hierarchy Level	[edit routing-instances <i>routing-instance-name</i> multicast-snooping-options]
Release Information	Statement introduced in Junos OS Release 10.1.
Description	Accumulate outgoing interface changes in order to perform bulk updates to the forwarding table and the routing table. Delete the statement to turn off bulk updates.
Options	milliseconds —Set the hold time duration from 1 through 1000 milliseconds. Range: 1 through 1000 milliseconds.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Enabling Bulk Updates for Multicast Snooping on page 294

threshold

Syntax	<code>threshold suppress <i>value</i> <reuse <i>value</i>>;</code>
Hierarchy Level	<code>[edit bridge-domains <i>bridge-domain-name</i> multicast-snooping-options forwarding-cache],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i></code> <code>multicast-snooping-options forwarding-cache],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i></code> <code>bridge-domains <i>bridge-domain-name</i> multicast-snooping-options forwarding-cache],</code> <code>[edit routing-instances <i>routing-instance-name</i> multicast-snooping-options</code> <code>forwarding-cache],</code> <code>[edit routing-instances <i>routing-instance-name</i> bridge-domains <i>bridge-domain-name</i></code> <code>multicast-snooping-options forwarding-cache]</code>
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Configure the suppression and reuse thresholds for multicast snooping forwarding cache limits.
Options	suppress <i>value</i> —Value to begin suppressing new multicast forwarding cache entries. This value is mandatory. This number must be greater than the reuse value. Range: 1 through 200,000 reuse <i>value</i> —(Optional) Value to begin creating new multicast forwarding cache entries. If configured, this number must be less than the suppress value. Range: 1 through 200,000
Required Privilege Level	<code>routing</code> —To view this statement in the configuration. <code>routing-control</code> —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Multicast Snooping on page 289

traceoptions

Syntax	<pre>traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <disable>; }</pre>
Hierarchy Level	[edit multicast-snooping-options]
Release Information	Statement introduced in Junos OS Release 8.5.
Description	Set multicast snooping tracing options.
Default	Tracing operations are disabled.
Options	<p>disable—(Optional) Disable the tracing operation. One use of this option is to disable a single operation when you have defined a broad group of tracing operations, such as all.</p> <p>file <i>name</i>—Name of the file to receive the output of the tracing operation. Enclose the name in quotation marks. We recommend that you place multicast snooping tracing output in the file <code>/var/log/multicast-snooping-log</code>.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named trace-file reaches its maximum size, it is renamed trace-file.0, then trace-file.1, and so on, until the maximum number of trace files is reached. Then, the oldest trace file is overwritten.</p> <p>If you specify a maximum number of files, you must also specify a maximum file size with the size option.</p> <p>Range: 2 through 1000 files</p> <p>Default: 1 trace file only</p> <p>flag—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements.</p> <p>The following are the tracing options:</p> <ul style="list-style-type: none"> • all—All tracing operations • config-internal—Trace configuration internals. • general—Trace general events. • normal—All normal events. <p>Default: If you do not specify this option, only unusual or abnormal operations are traced.</p> <ul style="list-style-type: none"> • parse—Trace configuration parsing. • policy—Trace policy operations and actions.

- **route**—Trace routing table changes.
- **state**—Trace state transitions.
- **task**—Trace protocol task processing.
- **timer**—Trace protocol task timer processing.

no-world-readable—(Optional) Prevent any user from reading the log file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB) or megabytes (MB). When a trace file named **trace-file** reaches this size, it is renamed **trace-file.0**. When the **trace-file** again reaches its maximum size, **trace-file.0** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.0**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also specify a maximum number of trace files with the **files** option.

Syntax: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
---------------------------------	---

Related Documentation	<ul style="list-style-type: none">• Configuring Multicast Snooping on page 288• Example: Configuring Multicast Snooping on page 289• Enabling Bulk Updates for Multicast Snooping on page 294• Example: Configuring Multicast Snooping on page 289
------------------------------	---

Multicast Routing Options Configuration Statements

- [asm-override-ssm on page 508](#)
- [backup-pe-group on page 509](#)
- [backups on page 510](#)
- [bandwidth on page 511](#)
- [flow-map on page 512](#)
- [forwarding-cache \(Flow Maps\) on page 513](#)
- [forwarding-cache \(Multicast\) on page 513](#)
- [interface \(Routing Options\) on page 514](#)
- [interface \(Scoping\) on page 515](#)
- [local-address on page 516](#)
- [maximum-bandwidth on page 517](#)
- [multicast on page 518](#)
- [no-qos-adjust on page 520](#)
- [pim-to-igmp-proxy on page 521](#)
- [pim-to-mld-proxy on page 522](#)
- [policy \(Flow Maps\) on page 523](#)
- [policy \(SSM Maps\) on page 523](#)
- [prefix on page 524](#)
- [redundant-sources on page 524](#)
- [reverse-oif-mapping on page 525](#)
- [rpf-check-policy on page 526](#)
- [scope on page 527](#)
- [scope-policy on page 528](#)
- [source on page 529](#)
- [ssm-groups on page 530](#)
- [ssm-map \(Multicast Routing Options\) on page 531](#)

- [subscriber-leave-timer](#) on page 532
- [threshold](#) on page 533
- [timeout \(Flow Maps\)](#) on page 534
- [timeout \(Multicast\)](#) on page 535
- [upstream-interface](#) on page 536

asm-override-ssm

Syntax	asm-override-ssm;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast], [edit logical-systems <i>logical-system-name</i> routing-options multicast], [edit routing-instances <i>routing-instance-name</i> routing-options multicast], [edit routing-options multicast]
Release Information	Statement introduced in Junos OS Release 9.4. Statement introduced in Junos OS Release 9.5 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Enable the routing device to accept any-source multicast join messages (*G) for group addresses that are within the default or configured range of source-specific multicast groups.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Source-Specific Multicast Groups with Any-Source Override on page 171

backup-pe-group

Syntax	<pre> backup-pe-group <i>group-name</i> { backups [<i>addresses</i>]; local-address <i>address</i>; } </pre>
Hierarchy Level	<pre> [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast], [edit logical-systems <i>logical-system-name</i> routing-options multicast], [edit routing-instances <i>routing-instance-name</i> routing-options multicast], [edit routing-options multicast] </pre>
Release Information	<p>Statement introduced in Junos OS Release 9.0.</p> <p>Statement introduced in Junos OS Release 9.5 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure a backup provider edge (PE) group for ingress PE redundancy when point-to-multipoint label-switched paths (LSPs) are used for multicast distribution.
Options	<p><i>group-name</i>—Name of the group for PE backups.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring Ingress PE Redundancy on page 210

backups

Syntax	<code>backups [<i>addresses</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast backup-pe-group <i>group-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options multicast backup-pe-group <i>group-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options multicast backup-pe-group <i>group-name</i>], [edit routing-options multicast backup-pe-group <i>group-name</i>]
Release Information	Statement introduced in Junos OS Release 9.0. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the address of backup PEs for ingress PE redundancy when point-to-multipoint label-switched paths (LSPs) are used for multicast distribution.
Options	<i>addresses</i> —Addresses of other PEs in the backup group.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Ingress PE Redundancy on page 210

bandwidth

Syntax	<code>bandwidth (<i>bps</i> <i>adaptive</i>);</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast flow-map], [edit logical-systems <i>logical-system-name</i> routing-options multicast flow-map], [edit routing-instances <i>routing-instance-name</i> routing-options multicast flow-map], [edit routing-options multicast flow-map]
Release Information	Statement introduced in Junos OS Release 8.3. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the bandwidth property for multicast flow maps.
Options	<p>adaptive—Specify that the bandwidth is measured for the flows that are matched by the flow map.</p> <p>bps—Bandwidth, in bits per second, for the flow map.</p> <p>Range: 0 through any amount of bandwidth</p> <p>Default: 2 Mbps</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> Example: Configuring a Multicast Flow Map on page 206

flow-map

Syntax	<pre>flow-map <i>flow-map-name</i> { bandwidth (<i>bps</i> adaptive); forwarding-cache { timeout (never non-discard-entry-only <i>minutes</i>); } policy [<i>policy-names</i>]; redundant-sources [<i>addresses</i>]; }</pre>
Hierarchy Level	<pre>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast], [edit logical-systems <i>logical-system-name</i> routing-options multicast], [edit routing-instances <i>routing-instance-name</i> routing-options multicast], [edit routing-options multicast]</pre>
Release Information	Statement introduced in Junos OS Release 8.2. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure multicast flow maps.
Options	<p><i>flow-map-name</i>—Name of the flow-map.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring a Multicast Flow Map on page 206

forwarding-cache (Flow Maps)

Syntax	forwarding-cache { timeout (minutes never non-discard-entry-only); }
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit routing-options multicast flow-map <i>flow-map-name</i>]
Release Information	Statement introduced in Junos OS Release 8.2. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure multicast forwarding cache properties for the flow map.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.

forwarding-cache (Multicast)

Syntax	forwarding-cache { threshold suppress <i>value</i> <reuse <i>value</i> >; timeout <i>minutes</i> ; }
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast], [edit logical-systems <i>logical-system-name</i> routing-options multicast], [edit routing-instances <i>routing-instance-name</i> routing-options multicast], [edit routing-options multicast]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure multicast forwarding cache properties. These properties include threshold suppression and reuse limits and timeout values. The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring the Multicast Forwarding Cache on page 203

interface (Routing Options)

Syntax	<pre>interface <i>interface-names</i> { maximum-bandwidth <i>bps</i>; no-qos-adjust; reverse-oif-mapping { no-qos-adjust; } subscriber-leave-timer <i>seconds</i>; }</pre>
Hierarchy Level	<pre>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast], [edit logical-systems <i>logical-system-name</i> routing-options multicast], [edit routing-instances <i>routing-instance-name</i> routing-options multicast], [edit routing-options multicast]</pre>
Release Information	<p>Statement introduced in Junos OS Release 8.3.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Enable multicast traffic on an interface.



TIP: You cannot enable multicast traffic on an interface by using the `routing-options multicast interface` statement and configure PIM on the interface.

Options	<p><i>interface-name</i>—Names of the physical or logical interface.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Defining Interface Bandwidth Maximums on page 184 • Example: Configuring Multicast with Subscriber VLANs on page 187

interface (Scoping)

Syntax	<code>interface [<i>interface-names</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast scope <i>scope-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast scope <i>scope-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast scope <i>scope-name</i>],</p> <p>[edit routing-options multicast scope <i>scope-name</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p>
Description	Configure the set of interfaces for multicast scoping.
Options	<p><i>interface-names</i>—Names of the interfaces to scope. Specify the full interface name, including the physical and logical address components. To configure all interfaces, you can specify all.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>Example: Creating a Named Scope for Multicast Scoping</i>

local-address

Syntax	<code>local-address <i>address</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast backup-pe-group <i>group-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options multicast backup-pe-group <i>group-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options multicast backup-pe-group <i>group-name</i>], [edit routing-options multicast backup-pe-group <i>group-name</i>]
Release Information	Statement introduced in Junos OS Release 9.0. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the address of the local PE for ingress PE redundancy when point-to-multipoint LSPs are used for multicast distribution.
Options	<i>address</i> —Address of local PEs in the backup group.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Ingress PE Redundancy on page 210

maximum-bandwidth

Syntax	<code>maximum-bandwidth <i>bps</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i>],</p> <p>[edit routing-options multicast interface <i>interface-name</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 8.3.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure the multicast bandwidth for the interface.
Options	<p><i>bps</i>—Bandwidth rate, in bits per second, for the multicast interface.</p> <p>Range: 0 through any amount of bandwidth</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Defining Interface Bandwidth Maximums on page 184

multicast

Syntax	<pre> multicast { asm-override-ssm; backup-pe-group <i>group-name</i> { backups [<i>addresses</i>]; local-address <i>address</i>; } flow-map <i>flow-map-name</i> { bandwidth (<i>bps</i> adaptive); forwarding-cache { timeout (never non-discard-entry-only <i>minutes</i>); } policy [<i>policy-names</i>]; redundant-sources [<i>addresses</i>]; } forwarding-cache { threshold suppress <i>value</i> <reuse <i>value</i>>; timeout <i>minutes</i>; } interface <i>interface-name</i> { maximum-bandwidth <i>bps</i>; no-qos-adjust; reverse-oif-mapping { no-qos-adjust; } subscriber-leave-timer <i>seconds</i>; } pim-to-igmp-proxy { upstream-interface [<i>interface-names</i>]; } pim-to-mld-proxy { upstream-interface [<i>interface-names</i>]; } rpf-check-policy [<i>policy-names</i>]; scope <i>scope-name</i> { interface [<i>interface-names</i>]; prefix <i>destination-prefix</i>; } scope-policy [<i>policy-names</i>]; ssm-groups [<i>addresses</i>]; ssm-map <i>ssm-map-name</i> { policy [<i>policy-names</i>]; source [<i>addresses</i>]; } traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <disable>; } } </pre>
Hierarchy Level	<p>[edit dynamic-profiles <i>profile-name</i> routing-options],</p> <p>[edit dynamic-profiles <i>profile-name</i> routing-instances <i>routing-instance-name</i> routing-options],</p>

```
[edit logical-systems logical-system-name routing-instances routing-instance-name
  routing-options],
[edit logical-systems logical-system-name routing-options],
[edit routing-instances routing-instance-name routing-options],
[edit routing-options]
```



NOTE: You cannot apply a scope policy to a specific routing instance. That is, all scoping policies are applied to all routing instances. However, the `scope` statement does apply individually to a specific routing instance.

Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>interface and maximum-bandwidth statements introduced in Junos OS Release 8.3.</p> <p>interface and maximum-bandwidth statements introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement added to <code>[edit dynamic-profiles routing-options]</code> and <code>[edit dynamic-profiles <i>profile-name</i> routing-instances <i>routing-instance-name</i> routing-options]</code> hierarchy levels in Junos OS Release 9.6.</p>
Description	<p>Configure multicast routing options properties.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring the Multicast Forwarding Cache on page 203 • Example: Configuring a Multicast Flow Map on page 206 • Example: Configuring Source-Specific Multicast Groups with Any-Source Override on page 171

no-qos-adjust

Syntax	no-qos-adjust;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i> reverse-oif-mapping],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast interface <i>interface-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast interface <i>interface-name</i> reverse-oif-mapping],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i> reverse-oif-mapping],</p> <p>[edit routing-options multicast interface <i>interface-name</i>],</p> <p>[edit routing-options multicast interface <i>interface-name</i> reverse-oif-mapping]</p>
Release Information	<p>Statement introduced in Junos OS Release 9.5.</p> <p>Statement introduced in Junos OS Release 9.5 for EX Series switches.</p> <p>Statement added to [edit routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i>], and [edit routing-options multicast interface <i>interface-name</i>] hierarchy levels in Junos OS Release 9.6.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Disable hierarchical bandwidth adjustment for all subscriber interfaces that are identified by their MLD or IGMP request from a specific multicast interface.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Multicast with Subscriber VLANs on page 187

pim-to-igmp-proxy

Syntax	<code>pim-to-igmp-proxy { upstream-interface [interface-names]; }</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast], [edit logical-systems <i>logical-system-name</i> routing-options multicast], [edit routing-instances <i>routing-instance-name</i> routing-options multicast], [edit routing-options multicast]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 9.6 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the rendezvous point (RP) routing device that resides between a customer edge-facing Protocol Independent Multicast (PIM) domain and a core-facing PIM domain to translate PIM join or prune messages into corresponding Internet Group Management Protocol (IGMP) report or leave messages. The routing device then transmits the report or leave messages by proxying them to one or two upstream interfaces that you configure on the RP routing device. Including the pim-to-igmp-proxy statement enables you to use IGMP to forward IPv4 multicast traffic across the PIM sparse mode domains. The remaining statement is explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM-to-IGMP Message Translation on page 217

pim-to-mld-proxy

Syntax	<pre>pim-to-mld-proxy { upstream-interface [interface-names]; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast], [edit logical-systems <i>logical-system-name</i> routing-options multicast], [edit routing-instances <i>routing-instance-name</i> routing-options multicast], [edit routing-options multicast]
Release Information	Statement introduced in Junos OS Release 9.6. Statement introduced in Junos OS Release 9.6 for EX Series switches.
Description	<p>Configure the rendezvous point (RP) routing device that resides between a customer edge-facing Protocol Independent Multicast (PIM) domain and a core-facing PIM domain to translate PIM join or prune messages into corresponding Multicast Listener Discovery (MLD) report or leave messages. The routing device then transmits the report or leave messages by proxying them to one or two upstream interfaces that you configure on the RP routing device. Including the pim-to-mld-proxy statement enables you to use MLD to forward IPv6 multicast traffic across the PIM sparse mode domains.</p> <p>The remaining statement is explained separately.</p>
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring PIM-to-MLD Message Translation on page 218

policy (Flow Maps)

Syntax	<code>policy [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit routing-options multicast flow-map <i>flow-map-name</i>]
Release Information	Statement introduced in Junos OS Release 8.2. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure a flow map policy.
Options	<i>policy-names</i> —Name of one or more policies for flow mapping.
Required Privilege Level	routing—To view this statement in the configuration.

policy (SSM Maps)

Syntax	<code>policy [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast ssm-map <i>ssm-map-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options multicast ssm-map <i>ssm-map-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options multicast ssm-map <i>ssm-map-name</i>], [edit routing-options multicast ssm-map <i>ssm-map-name</i>]
Release Information	Statement introduced in Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Apply one or more policies to an SSM map.
Options	<i>policy-names</i> —Name of one or more policies for SSM mapping.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To view this statement in the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring SSM Mapping on page 176

prefix

Syntax	<code>prefix destination-prefix;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast scope <i>scope-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options multicast scope <i>scope-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options multicast scope <i>scope-name</i>], [edit routing-options multicast scope <i>scope-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches.
Description	Configure the prefix for multicast scopes.
Options	destination-prefix —Address range for the multicast scope.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Creating a Named Scope for Multicast Scoping

redundant-sources

Syntax	<code>redundant-sources [<i>addresses</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit routing-options multicast flow-map <i>flow-map-name</i>]
Release Information	Statement introduced in Junos OS Release 8.3. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure a list of redundant sources for multicast flows defined by a flow map.
Options	addresses —List of IPv4 or IPv6 addresses for use as redundant (backup) sources for multicast flows defined by a flow map.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring a Multicast Flow Map on page 206

reverse-oif-mapping

Syntax	reverse-oif-mapping { no-qos-adjust; }
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options multicast interface <i>interface-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i>], [edit routing-options multicast interface <i>interface-name</i>]
Release Information	Statement introduced in Junos OS Release 9.2. Statement introduced in Junos OS Release 9.2 for EX Series switches. The no-qos-adjust statement added in Junos OS Release 9.5. The no-qos-adjust statement introduced in Junos OS Release 9.5 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Enable the routing device to identify a subscriber VLAN or interface based on an IGMP or MLD request it receives over the multicast VLAN. The remaining statement is explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring Multicast with Subscriber VLANs on page 187

rpf-check-policy

Syntax	<code>rpf-check-policy [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast], [edit logical-systems <i>logical-system-name</i> routing-options multicast], [edit routing-instances <i>routing-instance-name</i> routing-options multicast], [edit routing-options multicast]
Release Information	Statement introduced in Junos OS Release 8.1. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Apply policies for disabling RPF checks on arriving multicast packets. The policies must be correctly configured.
Options	<i>policy-names</i> —Name of one or more multicast RPF check policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring RPF Policies on page 161

scope

Syntax	<pre>scope scope-name { interface [interface-names]; prefix destination-prefix; }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast],</p> <p>[edit routing-options multicast]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Configure multicast scoping.
Options	<p>scope-name—Name of the multicast scope.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • <i>Example: Creating a Named Scope for Multicast Scoping</i>

scope-policy

Syntax `scope-policy [policy-names];`

Hierarchy Level `[edit logical-systems logical-system-name routing-options multicast],`
`[edit routing-options multicast]`



NOTE: You can configure a scope policy at these two hierarchy levels only. You cannot apply a scope policy to a specific routing instance, because all scoping policies are applied to all routing instances. However, you can apply the `scope` statement to a specific routing instance at the `[edit routing-instances routing-instance-name routing-options multicast]` or `[edit logical-systems logical-system-name routing-instances routing-instance-name routing-options multicast]` hierarchy level.

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 9.0 for EX Series switches.
Statement introduced in Junos OS Release 11.3 for the QFX Series.

Description Apply policies for scoping. The policy must be correctly configured at the `edit policy-options policy-statement` hierarchy level.

Options *policy-names*—Name of one or more multicast scope policies.

Required Privilege Level routing—To view this statement in the configuration.
routing-control—To add this statement to the configuration.

Related Documentation

- [scope on page 527](#)
- *Example: Using a Scope Policy for Multicast Scoping*

source

Syntax	<code>source [<i>addresses</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast ssm-map <i>ssm-map-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast ssm-map <i>ssm-map-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast ssm-map <i>ssm-map-name</i>],</p> <p>[edit routing-options multicast ssm-map <i>ssm-map-name</i>]</p>
Release Information	<p>Statement introduced in Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p>
Description	Specify IPv4 or IPv6 source addresses for an SSM map.
Options	<i>addresses</i> —IPv4 or IPv6 source addresses.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To view this statement in the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring SSM Mapping on page 176

ssm-groups

Syntax	<code>ssm-groups [<i>ip-addresses</i>];</code>
Hierarchy Level	<code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-options multicast],</code> <code>[edit routing-instances <i>routing-instance-name</i> routing-options multicast],</code> <code>[edit routing-options multicast]</code>
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	<p>Configure source-specific multicast (SSM) groups.</p> <p>By default, the SSM group multicast address is limited to the IP address range from 232.0.0.0 through 232.255.255.255. However, you can extend SSM operations into another Class D range by including the ssm-groups statement in the configuration. The default SSM address range from 232.0.0.0 through 232.255.255.255 cannot be used in the ssm-groups statement. This statement is for adding other multicast addresses to the default SSM group addresses. This statement does not override the default SSM group address range.</p>
Options	<i>ip-addresses</i> —List of one or more additional SSM group addresses separated by a space.
Required Privilege Level	<code>routing</code> —To view this statement in the configuration. <code>routing-control</code> —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Source-Specific Multicast Groups with Any-Source Override on page 171

ssm-map (Multicast Routing Options)

Syntax	<pre>ssm-map <i>ssm-map-name</i> { policy [<i>policy-names</i>]; source [<i>addresses</i>]; }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast],</p> <p>[edit routing-options multicast]</p>
Release Information	<p>Statement introduced in Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Configure SSM mapping.
Options	<p><i>ssm-map-name</i>—Name of the SSM map.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring SSM Mapping on page 176

subscriber-leave-timer

Syntax	<code>subscriber-leave-timer seconds;</code>
Hierarchy Level	<code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i>],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-options multicast interface <i>interface-name</i>],</code> <code>[edit routing-instances <i>routing-instance-name</i> routing-options multicast interface <i>interface-name</i>],</code> <code>[edit routing-options multicast interface <i>interface-name</i>]</code>
Release Information	Statement introduced in Junos OS Release 9.2. Statement introduced in Junos OS Release 9.2 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Length of time before the multicast VLAN updates QoS data (for example, available bandwidth) for subscriber interfaces after it receives an IGMP leave message.
Options	seconds —Length of time before the multicast VLAN updates QoS data (for example, available bandwidth) for subscriber interfaces after it receives an IGMP leave message. Specifying a value of 0 results in an immediate update. This is the same as if the statement were not configured. Range: 0 through 30 Default: 0 seconds
Required Privilege Level	<code>routing</code> —To view this statement in the configuration. <code>routing-control</code> —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Multicast with Subscriber VLANs on page 187

threshold

Syntax	<code>threshold suppress <i>value</i> <reuse <i>value</i>>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast forwarding-cache], [edit logical-systems <i>logical-system-name</i> routing-options multicast forwarding-cache], [edit routing-instances <i>routing-instance-name</i> routing-options multicast forwarding-cache], [edit routing-options multicast forwarding-cache]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 9.2 for EX Series switches.
Description	Configure the suppression and reuse thresholds for multicast forwarding cache limits.
Options	reuse <i>value</i> —(Optional) Value to begin creating new multicast forwarding cache entries. This value is optional. If configured, this number must be less than the suppress value. Range: 1 through 200,000 suppress <i>value</i> —Value to begin suppressing new multicast forwarding cache entries. This value is mandatory. This number must be greater than the reuse value. Range: 1 through 200,000
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring the Multicast Forwarding Cache on page 203

timeout (Flow Maps)

Syntax	timeout (never non-discard-entry-only <i>minutes</i>);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit logical-systems <i>logical-system-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit routing-instances <i>routing-instance-name</i> routing-options multicast flow-map <i>flow-map-name</i>], [edit routing-options multicast flow-map <i>flow-map-name</i>]
Release Information	Statement introduced in Junos OS Release 8.2. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the timeout value for multicast forwarding cache entries associated with the flow map.
Options	minutes —Length of time that the forwarding cache entry remains active. Range: 1 through 720 never non-discard-entry-only —Specify that the forwarding cache entry always remain active. If you omit the non-discard-entry-only option, all multicast forwarding entries, including those in forwarding and pruned states, are kept forever. If you include the non-discard-entry-only option, entries with forwarding states are kept forever, and entries with pruned states time out.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.

timeout (Multicast)

Syntax	<code>timeout <i>minutes</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast forwarding-cache], [edit logical-systems <i>logical-system-name</i> routing-options multicast forwarding-cache], [edit routing-instances <i>routing-instance-name</i> routing-options multicast forwarding-cache], [edit routing-options multicast forwarding-cache]
Release Information	Statement introduced in Junos OS Release 8.2. Statement introduced in Junos OS Release 9.0 for EX Series switches. Statement introduced in Junos OS Release 11.3 for the QFX Series.
Description	Configure the timeout value for multicast forwarding cache entries.
Options	<i>minutes</i> —Length of time that the forwarding cache limit remains active. Range: 1 through 720
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring the Multicast Forwarding Cache on page 203

upstream-interface

Syntax	<code>upstream-interface [<i>interface-names</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast pim-to-igmp-proxy],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> routing-options multicast pim-to-mld-proxy],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast pim-to-igmp-proxy],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-options multicast pim-to-mld-proxy],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast pim-to-igmp-proxy],</p> <p>[edit routing-instances <i>routing-instance-name</i> routing-options multicast pim-to-mld-proxy],</p> <p>[edit routing-options multicast pim-to-igmp-proxy],</p> <p>[edit routing-options multicast pim-to-mld-proxy]</p>
Release Information	<p>Statement introduced in Junos OS Release 9.6.</p> <p>Statement introduced in Junos OS Release 9.6 for EX Series switches.</p> <p>Statement introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	<p>Configure at least one, but not more than two, upstream interfaces on the rendezvous point (RP) routing device that resides between a customer edge-facing Protocol Independent Multicast (PIM) domain and a core-facing PIM domain. The RP routing device translates PIM join or prune messages into corresponding IGMP report or leave messages (if you include the pim-to-igmp-proxy statement), or into corresponding MLD report or leave messages (if you include the pim-to-mld-proxy statement). The routing device then proxies the IGMP or MLD report or leave messages to one or both upstream interfaces to forward IPv4 multicast traffic (for IGMP) or IPv6 multicast traffic (for MLD) across the PIM domains.</p>
Options	<p><i>interface-names</i>—Names of one or two upstream interfaces to which the RP routing device proxies IGMP or MLD report or leave messages for transmission of multicast traffic across PIM domains. You can specify a maximum of two upstream interfaces on the RP routing device. To configure a set of two upstream interfaces, specify the full interface names, including all physical and logical address components, within square brackets ([]).</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring PIM-to-IGMP Message Translation on page 217 • Configuring PIM-to-MLD Message Translation on page 218

CHAPTER 20

AMT Configuration Statements

- [accounting on page 538](#)
- [amt \(IGMP\) on page 539](#)
- [amt \(Protocols\) on page 540](#)
- [anycast-prefix on page 541](#)
- [defaults on page 542](#)
- [family on page 543](#)
- [group-policy on page 544](#)
- [inet on page 544](#)
- [local-address on page 545](#)
- [query-interval on page 546](#)
- [query-response-interval on page 547](#)
- [relay \(IGMP\) on page 548](#)
- [relay \(Protocols\) on page 549](#)
- [robust-count on page 550](#)
- [secret-key-timeout on page 551](#)
- [ssm-map on page 551](#)
- [traceoptions on page 552](#)
- [tunnel-limit on page 554](#)
- [version on page 555](#)

accounting

Syntax	(accounting no-accounting);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp amt relay defaults], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults], [edit protocols igmp amt relay defaults], [edit routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Enable or disable the collection of IGMP join and leave event statistics for an Automatic Multicast Tunneling (AMT) interface.
Default	Disabled
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Default IGMP Parameters for AMT Interfaces on page 303

amt (IGMP)

Syntax	<pre>amt { relay { defaults { (accounting no-accounting); group-policy [policy-names]; query-interval seconds; query-response-interval seconds; robust-count number; ssm-map ssm-map-name; version version; } } }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols igmp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols igmp], [edit protocols igmp], [edit routing-instances <i>routing-instance-name</i> protocols igmp]</p>
Release Information	Statement introduced in Junos OS Release 10.2.
Description	<p>Configure Automatic Multicast Tunneling (AMT) relay attributes.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring Default IGMP Parameters for AMT Interfaces on page 303

amt (Protocols)

Syntax	<pre> amt { relay { family { inet { anycast-prefix <i>ip-prefix</i> </prefix-length>; local-address <i>ip-address</i>; } } secret-key-timeout <i>minutes</i>; tunnel-limit <i>number</i>; } traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; } } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols],</p> <p>[edit protocols],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols]</p>
Release Information	Statement introduced in Junos OS Release 10.2.
Description	<p>Enable Automatic Multicast Tunneling (AMT) on the router or switch. You must also configure the local address and anycast prefix for AMT to function.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring the AMT Protocol on page 301

anycast-prefix

Syntax	<code>anycast-prefix <i>ip-prefix</i> / <<i>prefix-length</i>>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols amt relay family inet], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols amt relay family inet], [edit protocols amt relay family inet], [edit routing-instances <i>routing-instance-name</i> protocols amt relay family inet]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Specify an IP address prefix to use for the Automatic Multicast Tunneling (AMT) relay anycast address. The prefix is advertised by unicast routing protocols to route AMT discovery messages to the router from nearby AMT gateways. The IP address that the prefix is derived from can be configured on any interface in the system. Typically, the router's lo0.0 loopback address prefix is used for configuring the AMT anycast prefix in the default routing instance, and the router's lo0.n loopback address prefix is used for configuring the AMT anycast prefix in VPN routing instances. However, the anycast address can be either the primary or secondary lo0.0 loopback address.
Default	None. The anycast prefix must be configured.
Options	<i>ip-prefix</i> / < <i>prefix-length</i> >—IP address prefix.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> Configuring the AMT Protocol on page 301

defaults

Syntax	<pre>defaults { (accounting no-accounting); group-policy [policy-names]; query-interval seconds; query-response-interval seconds; robust-count number; ssm-map ssm-map-name; version version; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> statement-name protocols igmp amt relay], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> statement-name protocols igmp amt relay], [edit protocols igmp amt relay], [edit routing-instances <i>routing-instance-name</i> statement-name protocols igmp amt relay]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure default IGMP attributes for all Automatic Multicast Tunneling (AMT) interfaces. The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring the AMT Protocol on page 301

family

Syntax	<pre>family { inet { anycast-prefix <i>ip-prefix</i>/<i><prefix-length></i>; local-address <i>ip-address</i>; } }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols amt relay], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols amt relay], [edit protocols amt relay], [edit routing-instances <i>routing-instance-name</i> protocols amt relay]</p>
Release Information	Statement introduced in Junos OS Release 10.2.
Description	<p>Configure the protocol address family for Automatic Multicast Tunneling (AMT) relay functions. Only the inet family for IPv4 protocol addresses is supported.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring the AMT Protocol on page 301

group-policy

Syntax	<code>group-policy [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp amt relay defaults], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults], [edit protocols igmp amt relay defaults], [edit routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	When this statement is enabled on the Automatic Multicast Tunneling (AMT) interfaces running IGMP version 2 (IGMPv2) or version 3 (IGMPv3), after the router receives an IGMP report, the router compares the group against the specified group policy and performs the action configured in that policy (for example, rejects the report).
Options	<i>policy-names</i> —Name of the policy.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Default IGMP Parameters for AMT Interfaces on page 303

inet

Syntax	<pre>inet { anycast-prefix <i>ip-prefix</i> /<<i>prefix-length</i>>; local-address <i>ip-address</i>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols amt relay family], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols amt relay family], [edit protocols amt relay family], [edit routing-instances <i>routing-instance-name</i> protocols amt relay family]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Specify the IPv4 local address and anycast prefix for Automatic Multicast Tunneling (AMT) relay functions. The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring the AMT Protocol on page 301

local-address

Syntax	<code>local-address <i>ip-address</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols amt relay family inet], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols amt relay family inet], [edit protocols amt relay family inet], [edit routing-instances <i>routing-instance-name</i> protocols amt relay family inet]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Specify the local unique IP address to send in Automatic Multicast Tunneling (AMT) relay advertisement messages, for use as the IP source of AMT control messages, and as the source of the data tunnel encapsulation. The address can be configured on any interface in the system. Typically, the router's lo0.0 loopback address is used for configuring the AMT local address in the default routing instance, and the router's lo0.n loopback address is used for configuring the AMT local address in VPN routing instances.
Default	None. The local address must be configured.
Options	<i>ip-address</i> —Unique unicast IP address.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring the AMT Protocol on page 301

query-interval

Syntax	query-interval <i>seconds</i> ;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp amt relay defaults], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults], [edit protocols igmp amt relay defaults], [edit routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Specify how often the querier router sends IGMP general host-query messages through an Automatic Multicast Tunneling (AMT) interface.
Options	seconds —Number of seconds between sending of general host query messages. Range: 1 through 1024 Default: 125 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Default IGMP Parameters for AMT Interfaces on page 303

query-response-interval

Syntax	query-response-interval <i>seconds</i> ;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp amt relay defaults], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults], [edit protocols igmp amt relay defaults], [edit routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Specify how long the IGMP querier router waits to receive a response to a host query message from a host through an Automatic Multicast Tunneling (AMT) interface. The query response interval must be less than the query interval.
Options	<i>seconds</i> —Time to wait to receive a response to a host query message. Range: 1 through 1024 Default: 10 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring Default IGMP Parameters for AMT Interfaces on page 303

relay (IGMP)

Syntax	<pre>relay { defaults { (accounting no-accounting); group-policy [policy-names]; query-interval seconds; query-response-interval seconds; robust-count number; ssm-map ssm-map-name; version version; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> statement-name protocols igmp amt], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> statement-name protocols igmp amt], [edit protocols igmp amt], [edit routing-instances <i>routing-instance-name</i> statement-name protocols igmp amt]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure default Automatic Multicast Tunneling (AMT) interface attributes. The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Default IGMP Parameters for AMT Interfaces on page 303

relay (Protocols)

Syntax	<pre> relay { family { inet { anycast-prefix <i>ip-prefix</i> / <<i>prefix-length</i>>; local-address <i>ip-address</i>; } } secret-key-timeout <i>minutes</i>; tunnel-limit <i>number</i>; } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols amt],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols amt],</p> <p>[edit protocols amt],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols amt]</p>
Release Information	Statement introduced in Junos OS Release 10.2.
Description	<p>Configure the protocol address family, secret key timeout, and tunnel limit for Automatic Multicast Tunneling (AMT) relay functions.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Configuring the AMT Protocol on page 301

robust-count

Syntax	<code>robust-count <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp amt relay defaults], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults], [edit protocols igmp amt relay defaults], [edit routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Configure the expected IGMP packet loss on an Automatic Multicast Tunneling (AMT) tunnel. If a tunnel is expected to have packet loss, increase the robust count.
Options	<i>number</i> —Number of packets that can be lost before the AMT protocol deletes the multicast state. Range: 2 through 10 Default: 2
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring Default IGMP Parameters for AMT Interfaces on page 303

secret-key-timeout

Syntax	<code>secret-key-timeout <i>minutes</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols amt relay], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols amt relay], [edit protocols amt relay], [edit routing-instances <i>routing-instance-name</i> protocols amt relay]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Specify the period in minutes after which the local opaque secret key used in the Automatic Multicast Tunneling (AMT) Message Authentication Code (MAC) times out and is regenerated.
Default	60 minutes
Options	<i>minutes</i> —Number of minutes to wait before generating a new MAC opaque secret key.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring the AMT Protocol on page 301

ssm-map

Syntax	<code>ssm-map <i>ssm-map-name</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp amt relay defaults], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults], [edit protocols igmp amt relay defaults], [edit routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Apply a source-specific multicast (SSM) map to all Automatic Multicast Tunneling (AMT) interfaces.
Options	<i>ssm-map-name</i> —Name of the SSM map.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Configuring Default IGMP Parameters for AMT Interfaces on page 303

traceoptions

Syntax	<pre>traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols amt], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols amt], [edit protocols amt], [edit routing-instances <i>routing-instance-name</i> protocols amt]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	<p>Configure Automatic Multicast Tunneling (AMT) tracing options.</p> <p>To specify more than one tracing operation, include multiple flag statements.</p>
Options	<p>disable—(Optional) Disable the tracing operation. You can use this option to disable a single operation when you have defined a broad group of tracing operations, such as all.</p> <p>file <i>filename</i>—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. All files are placed in the directory /var/log. We recommend that you place tracing output in the file igmp-log.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named <i>trace-file</i> reaches its maximum size, it is renamed <i>trace-file.0</i>, then <i>trace-file.1</i>, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.</p> <p>If you specify a maximum number of files, you must also include the size statement to specify the maximum file size.</p> <p>Range: 2 through 1000 files</p> <p>Default: 2 files</p> <p>flag—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements.</p> <p>AMT Tracing Flags</p> <ul style="list-style-type: none">• errors—All error conditions• packets—All AMT packets• tunnels—All AMT tunnel-related information <p>Global Tracing Flags</p> <ul style="list-style-type: none">• all—All tracing operations

- **normal**—All normal operations

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **policy**—Policy operations and actions
- **route**—Routing table changes
- **state**—State transitions
- **task**—Interface transactions and processing
- **timer**—Timer usage

flag-modifier—(Optional) Modifier for the tracing flag. You can specify one or more of these modifiers:

- **detail**—Detailed trace information
- **receive**—Packets being received
- **send**—Packets being transmitted

no-stamp—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

Default: If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

no-world-readable—(Optional) Do not allow users to read the log file.

replace—(Optional) Replace an existing trace file if there is one.

Default: If you do not include this option, tracing output is appended to an existing trace file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches this size, it is renamed **trace-file.0**. When **trace-file** again reaches this size, **trace-file.0** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.0**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also include the **files** statement to specify the maximum number of trace files.

Syntax: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
---------------------------------	---

- Related Documentation**
- [Configuring the AMT Protocol on page 301](#)

tunnel-limit

Syntax	tunnel-limit <i>number</i> ;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols amt relay], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols amt relay], [edit protocols amt relay], [edit routing-instances <i>routing-instance-name</i> protocols amt relay]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Limit the number of Automatic Multicast Tunneling (AMT) data tunnels created. The system might reach a dynamic upper limit of tunnels of all types before the static AMT limit is reached.
Options	<i>number</i> —Maximum number of data AMTs that can be created on the system. Range: 0 through 4294967295 Default: 1 tunnel
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	• Configuring the AMT Protocol on page 301

version

Syntax	<code>version <i>version</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols igmp amt relay defaults], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults], [edit protocols igmp amt relay defaults], [edit routing-instances <i>routing-instance-name</i> protocols igmp amt relay defaults]
Release Information	Statement introduced in Junos OS Release 10.2.
Description	Specify the version of IGMP used through an Automatic Multicast Tunneling (AMT) interface.
Options	version —IGMP version number. Range: 1, 2, or 3 Default: IGMP version 3
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> Configuring Default IGMP Parameters for AMT Interfaces on page 303

CHAPTER 21

Session Announcement Protocol Configuration Statements

- [disable on page 557](#)
- [listen on page 558](#)
- [sap on page 559](#)

disable

Syntax	disable;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols sap], [edit protocols sap]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Explicitly disable SAP.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	• Configuring the Session Announcement Protocol on page 309

listen

Syntax	<code>listen address <port port>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols sap], [edit protocols sap]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Specify an address and optionally a port on which SAP and SDP listen, in addition to the default SAP address and port on which they always listen, 224.2.127.254:9875. To specify multiple additional addresses or pairs of address and port, include multiple listen statements.
Options	address —(Optional) Address on which SAP listens for session advertisements. Default: 224.2.127.254 port port —(Optional) Port on which SAP listens for session advertisements. Default: 9875
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring the Session Announcement Protocol on page 309

sap

Syntax	<pre>sap { disable; listen address <port port>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols], [edit protocols]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	<p>Enable the router to listen to session directory announcements for multimedia and other multicast sessions.</p> <p>SAP and SDP always listen on the default SAP address and port, 224.2.127.254:9875. To have SAP listen on additional addresses or pairs of address and port, include a listen statement for each address or pair.</p>
Options	The statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Configuring the Session Announcement Protocol on page 309• listen on page 558

CHAPTER 22

MSDP Configuration Statements

- [active-source-limit on page 562](#)
- [authentication-key on page 563](#)
- [data-encapsulation on page 564](#)
- [default-peer on page 565](#)
- [disable on page 566](#)
- [export on page 567](#)
- [group on page 568](#)
- [import on page 569](#)
- [local-address on page 570](#)
- [maximum on page 571](#)
- [mode on page 572](#)
- [msdp on page 573](#)
- [peer on page 575](#)
- [rib-group on page 576](#)
- [source on page 577](#)
- [threshold on page 578](#)
- [traceoptions on page 579](#)

active-source-limit

Syntax	<pre>active-source-limit { maximum number; threshold number; }</pre>
Hierarchy Level	<pre>[edit logical-systems logical-system-name protocols msdp], [edit logical-systems logical-system-name protocols msdp group group-name peer address], [edit logical-systems logical-system-name protocols msdp peer address], [edit logical-systems logical-system-name protocols msdp source ip-address/prefix-length], [edit logical-systems logical-system-name routing-instances instance-name protocols msdp], [edit logical-systems logical-system-name routing-instances routing-instance-name protocols msdp group group-name peer address], [edit logical-systems logical-system-name routing-instances routing-instance-name protocols msdp peer address], [edit logical-systems logical-system-name routing-instances routing-instance-name protocols msdp source ip-address/prefix-length], [edit protocols msdp], [edit protocols msdp group group-name peer address], [edit protocols msdp peer address], [edit protocols msdp source ip-address/prefix-length], [edit routing-instances routing-instance-name protocols msdp], [edit routing-instances routing-instance-name protocols msdp group group-name peer address], [edit routing-instances routing-instance-name protocols msdp peer address], [edit routing-instances routing-instance-name protocols msdp source ip-address/prefix-length]</pre>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Limit the number of active source messages the routing device accepts.
Default	If you do not include this statement, the router accepts any number of MSDP active source messages.
Options	The options are explained separately.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring MSDP with Active Source Limits and Mesh Groups on page 320

authentication-key

Syntax	<code>authentication-key <i>peer-key</i>;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols <code>msdp group <i>group-name</i> peer <i>peer address</i></code>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols <code>msdp peer <i>peer address</i></code>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols <code>msdp group <i>group-name</i> peer <i>peer address</i></code>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols <code>msdp peer <i>peer address</i></code>],</p> <p>[edit protocols <code>msdp group <i>group-name</i> peer <i>peer address</i></code>],</p> <p>[edit protocols <code>msdp peer <i>peer address</i></code>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols <code>msdp group <i>group-name</i> peer <i>peer address</i></code>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols <code>msdp peer <i>peer address</i></code>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Associate a Message Digest 5 (MD5) signature option authentication key with an MSDP peering session.
Default	If you do not include this statement, the router accepts any valid MSDP messages from the peer address.
Options	<i>peer-key</i> —MD5 authentication key. The peer key can be a text string up to 16 letters and digits long. Strings can include any ASCII characters with the exception of (,), &, and [. If you include spaces in an MSDP authentication key, enclose all characters in quotation marks (" ").
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring MSDP in a Routing Instance on page 312

data-encapsulation

Syntax	data-encapsulation (disable enable);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols msdp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp], [edit protocols msdp], [edit routing-instances <i>routing-instance-name</i> protocols msdp]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure a rendezvous point (RP) using MSDP to encapsulate multicast data received in MSDP register messages inside forwarded MSDP source-active messages.
Default	If you do not include this statement, the RP encapsulates multicast data.
Options	disable —(Optional) Do not use MSDP data encapsulation. enable —Use MSDP data encapsulation. Default: enable
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring MSDP with Active Source Limits and Mesh Groups on page 320

default-peer

Syntax	default-peer;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp peer <i>address</i>],</p> <p>[edit protocols msdp],</p> <p>[edit protocols msdp group <i>group-name</i>],</p> <p>[edit protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit protocols msdp peer <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp peer <i>address</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Establish this peer as the default MSDP peer and accept source-active messages from the peer without the usual peer-reverse-path-forwarding (peer-RPF) check.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring MSDP with Active Source Limits and Mesh Groups on page 320

disable

Syntax	disable;
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp peer <i>address</i>],</p> <p>[edit protocols msdp],</p> <p>[edit protocols msdp group <i>group-name</i>],</p> <p>[edit protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit protocols msdp peer <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp peer <i>address</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Explicitly disable MSDP.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> Disabling MSDP on page 327

export

Syntax	<code>export [<i>policy-names</i>];</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp peer <i>address</i>],</p> <p>[edit protocols msdp],</p> <p>[edit protocols msdp group <i>group-name</i>],</p> <p>[edit protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit protocols msdp peer <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp peer <i>address</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Apply one or more policies to routes being exported from the routing table into MSDP.
Options	<i>policy-names</i> —Name of one or more policies.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring MSDP in a Routing Instance on page 312 • import on page 569

group

Syntax	<pre> group <i>group-name</i> { disable; export [<i>policy-names</i>]; import [<i>policy-names</i>]; local-address <i>address</i>; mode (mesh-group standard); traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <<i>flag-modifier</i>> <disable>; } peer <i>address</i>; { disable; active-source-limit { maximum <i>number</i>; threshold <i>number</i>; } authentication-key <i>peer-key</i>; default-peer; export [<i>policy-names</i>]; import [<i>policy-names</i>]; local-address <i>address</i>; traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <<i>flag-modifier</i>> <disable>; } } } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit protocols msdp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	<p>Define an MSDP peer group. MSDP peers within groups share common tracing options, if present and not overridden for an individual peer with the peer statement. To configure multiple MSDP groups, include multiple group statements.</p> <p>By default, the group's options are identical to the global MSDP options. To override the global options, include group-specific options within the group statement.</p> <p>The group must contain at least one peer.</p>
Options	<p><i>group-name</i>—Name of the MSDP group.</p> <p>The remaining statements are explained separately.</p>

Required Privilege routing—To view this statement in the configuration.
Level routing-control—To add this statement to the configuration.

Related Documentation

- [Example: Configuring MSDP in a Routing Instance on page 312](#)

import

Syntax `import [policy-names];`

Hierarchy Level

```
[edit logical-systems logical-system-name protocols msdp],
[edit logical-systems logical-system-name protocols msdp group group-name],
[edit logical-systems logical-system-name protocols msdp group group-name peer address],
[edit logical-systems logical-system-name protocols msdp peer address],
[edit logical-systems logical-system-name routing-instances routing-instance-name protocols msdp],
[edit logical-systems logical-system-name routing-instances routing-instance-name protocols msdp group group-name],
[edit logical-systems logical-system-name routing-instances routing-instance-name protocols msdp group group-name peer address],
[edit logical-systems logical-system-name routing-instances routing-instance-name protocols msdp peer address],
[edit protocols msdp],
[edit protocols msdp group group-name],
[edit protocols msdp group group-name peer address],
[edit protocols msdp peer address],
[edit routing-instances routing-instance-name protocols msdp],
[edit routing-instances routing-instance-name protocols msdp group group-name],
[edit routing-instances routing-instance-name protocols msdp group group-name peer address],
[edit routing-instances routing-instance-name protocols msdp peer address]
```

Release Information Statement introduced before Junos OS Release 7.4.
Statement introduced in Junos OS Release 12.1 for the QFX Series.

Description Apply one or more policies to routes being imported into the routing table from MSDP.

Options *policy-names*—Name of one or more policies.

Required Privilege routing—To view this statement in the configuration.
Level routing-control—To add this statement to the configuration.

Related Documentation

- [Example: Configuring MSDP in a Routing Instance on page 312](#)
- [export on page 567](#)

local-address

Syntax	<code>local-address address;</code>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp peer <i>address</i>],</p> <p>[edit protocols msdp],</p> <p>[edit protocols msdp group <i>group-name</i>],</p> <p>[edit protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit protocols msdp peer <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp peer <i>address</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Configure the local end of an MSDP session. You must configure at least one peer for MSDP to function. When configuring a peer, you must include this statement. This address is used to accept incoming connections to the peer and to establish connections to the remote peer.
Options	address —IP address of the local end of the connection.
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring MSDP in a Routing Instance on page 312

maximum

Syntax	<code>maximum <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols msdp active-source-limit], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp active-source-limit], [edit protocols msdp active-source-limit], [edit routing-instances <i>routing-instance-name</i> protocols msdp active-source-limit]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure the maximum number of MSDP active source messages the router accepts.
Options	<i>number</i> —Maximum number of active source messages. Range: 1 through 1,000,000 Default: 25,000
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring MSDP with Active Source Limits and Mesh Groups on page 320 • threshold on page 578

mode

Syntax	mode (mesh-group standard);
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i>], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>], [edit protocols msdp group <i>group-name</i>], [edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure groups of peers in a full mesh topology to limit excessive flooding of source-active messages to neighboring peers. The default flooding mode is standard .
Default	If you do not include this statement, default flooding is applied.
Options	mesh-group —Group of peers that are mesh group members. standard —Use standard MSDP source-active flooding rules. Default: standard
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring MSDP with Active Source Limits and Mesh Groups on page 320

msdp

```

Syntax  msdp {
        disable;
        active-source-limit {
            maximum number;
            threshold number;
        }
        data-encapsulation (disable | enable);
        export [ policy-names ];
        group group-name {
            ...group-configuration ...
        }
        import [ policy-names ];
        local-address address;
        peer address {
            ...peer-configuration ...
        }
        rib-group group-name;
        source ip-prefix</prefix-length> {
            active-source-limit {
                maximum number;
                threshold number;
            }
        }
        traceoptions {
            file filename <files number> <size size> <world-readable | no-world-readable>;
            flag flag <flag-modifier> <disable>;
        }
        group group-name {
            disable;
            export [ policy-names ];
            import [ policy-names ];
            local-address address;
            mode (mesh-group | standard);
            peer address {
                ... same statements as at the [edit protocols msdp peer address] hierarchy level shown
                just following ...
            }
            traceoptions {
                file filename <files number> <size size> <world-readable | no-world-readable>;
                flag flag <flag-modifier> <disable>;
            }
        }
        peer address {
            disable;
            active-source-limit {
                maximum number;
                threshold number;
            }
            authentication-key peer-key;
            default-peer;
            export [ policy-names ];
            import [ policy-names ];

```

```
local-address address;  
traceoptions {  
    file filename <files number> <size size> <world-readable | no-world-readable>;  
    flag flag <flag-modifier> <disable>;  
}  
}
```

Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols], [edit protocols], [edit routing-instances <i>routing-instance-name</i> protocols]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Enable MSDP on the router. You must also configure at least one peer for MSDP to function.
Default	MSDP is disabled on the router.
Options	The statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring MSDP in a Routing Instance on page 312

peer

Syntax	<pre> peer address { disable; active-source-limit { maximum number; threshold number; } authentication-key peer-key; default-peer; export [policy-names]; import [policy-names]; local-address address; traceoptions { file filename <files number> <size size> <world-readable no-world-readable>; flag flag <flag-modifier> <disable>; } } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit protocols msdp],</p> <p>[edit protocols msdp group <i>group-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	<p>Define an MSDP peering relationship. An MSDP router must know which routers are its peers. You define the peer relationships explicitly by configuring the neighboring routers that are the MSDP peers of the local router. After peer relationships are established, the MSDP peers exchange messages to advertise active multicast sources. To configure multiple MSDP peers, include multiple peer statements.</p> <p>By default, the peer's options are identical to the global or group-level MSDP options. To override the global or group-level options, include peer-specific options within the peer statement.</p> <p>At least one peer must be configured for MSDP to function. You must configure address and local-address.</p>
Options	<p>address—Name of the MSDP peer.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	<p>routing—To view this statement in the configuration.</p> <p>routing-control—To add this statement to the configuration.</p>

- Related Documentation**
- [Example: Configuring MSDP in a Routing Instance on page 312](#)

rib-group

Syntax	<code>rib-group group-name;</code>
Hierarchy Level	<code>[edit logical-systems <i>logical-system-name</i> protocols msdp],</code> <code>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp],</code> <code>[edit protocols msdp],</code> <code>[edit routing-instances <i>routing-instance-name</i> protocols msdp]</code>
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Associate a routing table group with MSDP.
Options	<i>group-name</i> —Name of the routing table group. The name must be one that you defined with the <code>rib-groups</code> statement at the <code>[edit routing-options]</code> hierarchy level.
Required Privilege Level	<code>routing</code> —To view this statement in the configuration. <code>routing-control</code> —To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring MSDP in a Routing Instance on page 312

source

Syntax	<pre>source ip-address </prefix-length> { active-source-limit { maximum number; threshold number; } }</pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols msdp], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp], [edit protocols msdp], [edit routing-instances <i>routing-instance-name</i> protocols msdp]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Limit the number of active source messages the routing device accepts from sources in this address range.
Default	If you do not include this statement, the routing device accepts any number of MSDP active source messages.
Options	The other statements are explained separately.
Required Privilege Level	<p>routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring MSDP with Active Source Limits and Mesh Groups on page 320

threshold

Syntax	<code>threshold <i>number</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols msdp active-source-limit], [edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp active-source-limit], [edit protocols msdp active-source-limit], [edit routing-instances <i>routing-instance-name</i> protocols msdp active-source-limit]
Release Information	Statement introduced before Junos OS Release 7.4. Statement introduced in Junos OS Release 12.1 for the QFX Series.
Description	Configure the random early detection (RED) threshold for MSDP active source messages. This number must be less than the configured or default maximum.
Options	<i>number</i> —RED threshold for active source messages. Range: 1 through 1,000,000 Default: 24,000
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring MSDP with Active Source Limits and Mesh Groups on page 320• maximum on page 571

traceoptions

Syntax	<pre> traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; } </pre>
Hierarchy Level	<p>[edit logical-systems <i>logical-system-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> protocols msdp peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit logical-systems <i>logical-system-name</i> routing-instances <i>routing-instance-name</i> protocols msdp peer <i>address</i>],</p> <p>[edit protocols msdp],</p> <p>[edit protocols msdp group <i>group-name</i>],</p> <p>[edit protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit protocols msdp peer <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp group <i>group-name</i> peer <i>address</i>],</p> <p>[edit routing-instances <i>routing-instance-name</i> protocols msdp peer <i>address</i>]</p>
Release Information	<p>Statement introduced before Junos OS Release 7.4.</p> <p>Statement introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	<p>Configure MSDP tracing options.</p> <p>To specify more than one tracing operation, include multiple flag statements.</p>
Default	<p>The default MSDP trace options are those inherited from the routing protocol's traceoptions statement included at the [edit routing-options] hierarchy level.</p>
Options	<p>disable—(Optional) Disable the tracing operation. You can use this option to disable a single operation when you have defined a broad group of tracing operations, such as all.</p> <p>file <i>filename</i>—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. All files are placed in the directory /var/log. We recommend that you place tracing output in the msdp-log file.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named trace-file reaches its maximum size, it is renamed trace-file.0, then trace-file.1, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.</p>

If you specify a maximum number of files, you must also include the **size** statement to specify the maximum file size.

Range: 2 through 1000 files

Default: 2 files

flag *flag*—Tracing operation to perform. To specify more than one tracing operation, include multiple **flag** statements.

MSDP Tracing Flags

- **keepalive**—Keepalive messages
- **packets**—All MSDP packets
- **route**—MSDP changes to the routing table
- **source-active**—Source-active packets
- **source-active-request**—Source-active request packets
- **source-active-response**—Source-active response packets

Global Tracing Flags

- **all**—All tracing operations
- **general**—A combination of the **normal** and **route** trace operations
- **normal**—All normal operations

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **policy**—Policy operations and actions
- **route**—Routing table changes
- **state**—State transitions
- **task**—Interface transactions and processing
- **timer**—Timer usage

flag-modifier—(Optional) Modifier for the tracing flag. You can specify one or more of these modifiers:

- **detail**—Detailed trace information

- **receive**—Packets being received

- **send**—Packets being transmitted

no-stamp—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

Default: If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

no-world-readable—(Optional) Do not allow any user to read the log file.

replace—(Optional) Replace an existing trace file if there is one.

Default: If you do not include this option, tracing output is appended to an existing trace file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named **trace-file** reaches this size, it is renamed **trace-file.0**. When **trace-file** again reaches this size, **trace-file.0** is renamed **trace-file.1** and **trace-file** is renamed **trace-file.0**. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also include the **files** statement to specify the maximum number of trace files.

Syntax: **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege Level	routing and trace—To view this statement in the configuration. routing-control and trace-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Tracing MSDP Protocol Traffic on page 326

CHAPTER 23

PGM Configuration Statements

- [pgm on page 583](#)
- [traceoptions on page 584](#)

pgm

Syntax	<pre>pgm { traceoptions { flag <i>flag</i> <<i>flag-modifier</i>>; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols], [edit protocols]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	<p>Configure PGM globally and set tracing options.</p> <p>To specify more than one tracing operation, include multiple flag statements.</p> <p>The remaining statement is explained separately.</p>
Default	The default PGM trace options are inherited from the routing protocol traceoptions statement included at the [edit routing-options] hierarchy level.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	• PGM Configuration Guidelines on page 333

traceoptions

Syntax	<pre>traceoptions { flag <i>flag</i> <<i>flag-modifier</i>>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols pgm], [edit protocols pgm]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	<p>Configure PGM tracing options.</p> <p>To specify more than one tracing operation, include multiple flag statements.</p>
Default	The default PGM trace options are those inherited from the routing protocol traceoptions statement included at the [edit routing-options] hierarchy level.
Options	<p>disable—(Optional) Disable the tracing operation. You can use this option to disable a single operation when you have defined a broad group of tracing operations, such as all.</p> <p>flag <i>flag</i>—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements.</p> <p>PGM Tracing Flags</p> <ul style="list-style-type: none">• all—Trace all PGM packets.• init—Trace all PGM initialization events.• packets—Trace all PGM packet processing.• parser—Trace all PGM parser processing.• route-socket—Trace all PGM route-socket events.• show—Trace all PGM show command servicing.• state—Trace all PGM state transitions. <p>Global Tracing Flags</p> <ul style="list-style-type: none">• all—All tracing operations• general—A combination of the normal and route trace operations• normal—All normal operations <p>Default: If you do not specify this option, only unusual or abnormal operations are traced.</p> <ul style="list-style-type: none">• policy—Policy operations and actions

- **route**—Routing table changes
- **state**—State transitions
- **task**—Interface transactions and processing
- **timer**—Timer usage

flag-modifier—(Optional) Modifier for the tracing flag. You can specify one or more of the following modifiers:

- **detail**—Detailed trace information
- **receive**—Packets being received
- **send**—Packets being transmitted

Required Privilege Level	routing and trace—To view this statement in the configuration.
	routing-control and trace-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• PGM Configuration Guidelines on page 333

CHAPTER 24

DVMRP Configuration Statements

- [disable](#) on page 587
- [dvmrp](#) on page 588
- [export](#) on page 589
- [hold-time \(DVMRP\)](#) on page 589
- [import](#) on page 590
- [interface](#) on page 590
- [metric](#) on page 591
- [mode](#) on page 591
- [rib-group](#) on page 592
- [traceoptions](#) on page 593

disable

Syntax	disable;
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols dvmrp], [edit logical-systems <i>logical-system-name</i> protocols dvmrp interface <i>interface-name</i>], [edit protocols dvmrp], [edit protocols dvmrp interface <i>interface-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Explicitly disable DVMRP on the system or on an interface.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring DVMRP to Announce Unicast Routes on page 340

dvmrp

Syntax	<pre>dvmrp { disable; export [<i>policy-names</i>]; import [<i>policy-names</i>]; interface <i>interface-name</i> { disable; hold-time <i>seconds</i>; metric <i>metric</i>; mode (forwarding unicast-routing); } rib-group <i>group-name</i>; traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; } }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols], [edit protocols]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Enable DVMRP on the router.
Default	DVMRP is disabled on the router.
Options	The statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring DVMRP on page 336

export

Syntax	<code>export [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols dvmrp], [edit protocols dvmrp]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Apply one or more policies to routes being exported from the routing table into DVMRP. If you specify more than one policy, they are evaluated in the order specified, from first to last, and the first matching policy is applied to the route. If no match is found, the routing table exports into DVMRP only the routes that it learned from DVMRP and direct routes.
Options	<i>policy-names</i> —Name of one or more policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • import on page 590 • Example: Configuring DVMRP to Announce Unicast Routes on page 340

hold-time (DVMRP)

Syntax	<code>hold-time <i>seconds</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols dvmrp interface interface-name], [edit protocols dvmrp interface interface-name]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Specify the time period for which a neighbor is to consider the sending router (this router) to be operative (up).
Options	<i>seconds</i> —Hold time. Range: 1 through 255 Default: 35 seconds
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring DVMRP on page 336

import

Syntax	<code>import [<i>policy-names</i>];</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols dvmrp], [edit protocols dvmrp]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Apply one or more policies to routes being imported into the routing table from DVMRP. If you specify more than one policy, they are evaluated in the order specified, from first to last, and the first matching policy is applied to the route. If no match is found, DVMRP shares with the routing table only those routes that were learned from DVMRP routers.
Options	<i>policy-names</i> —Name of one or more policies.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• export on page 589• Example: Configuring DVMRP to Announce Unicast Routes on page 340

interface

Syntax	<code>interface <i>interface-name</i> { disable; hold-time <i>seconds</i>; metric <i>metric</i>; mode (forwarding unicast-routing); }</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols dvmrp], [edit protocols dvmrp]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Enable DVMRP on an interface and configure interface-specific properties.
Options	<i>interface-name</i> —Name of the interface. Specify the full interface name, including the physical and logical address components. To configure all interfaces, you can specify <code>all</code> . The remaining statements are explained separately.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring DVMRP on page 336

metric

Syntax	<code>metric <i>metric</i>;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols dvmrp interface <i>interface-name</i>], [edit protocols dvmrp interface <i>interface-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Define the DVMRP metric value.
Options	<i>metric</i> —Metric value. Range: 1 through 31 Default: 1
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring DVMRP on page 336

mode

Syntax	<code>mode (forwarding unicast-routing);</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols dvmrp interface <i>interface-name</i>], [edit protocols dvmrp interface <i>interface-name</i>]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Configure DVMRP for multicast traffic forwarding or unicast routing.
Options	forwarding —DVMRP performs unicast routing as well as multicast data forwarding. unicast-routing —DVMRP performs unicast routing only. To forward multicast data, you must configure Protocol Independent Multicast (PIM) on the interface.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"> • Example: Configuring DVMRP to Announce Unicast Routes on page 340

rib-group

Syntax	<code>rib-group group-name;</code>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols dvmrp], [edit protocols dvmrp]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	Associate a routing table group with DVMRP.
Options	<i>group-name</i> —Name of the routing table group. The name must be one that you defined with the rib-groups statement at the [edit routing-options] hierarchy level.
Required Privilege Level	routing—To view this statement in the configuration. routing-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Example: Configuring DVMRP on page 336

traceoptions

Syntax	<pre>traceoptions { file <i>filename</i> <files <i>number</i>> <size <i>size</i>> <world-readable no-world-readable>; flag <i>flag</i> <flag-modifier> <disable>; }</pre>
Hierarchy Level	[edit logical-systems <i>logical-system-name</i> protocols dvmrp], [edit protocols dvmrp]
Release Information	Statement introduced before Junos OS Release 7.4.
Description	<p>Configure DVMRP tracing options.</p> <p>To specify more than one tracing operation, include multiple flag statements.</p>
Default	The default DVMRP trace options are those inherited from the routing protocols traceoptions statement included at the [edit routing-options] hierarchy level.
Options	<p>disable—(Optional) Disable the tracing operation. You can use this option to disable a single operation when you have defined a broad group of tracing operations, such as all.</p> <p>file <i>filename</i>—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. All files are placed in the directory /var/log. We recommend that you place tracing output in the dvmrp-log file.</p> <p>files <i>number</i>—(Optional) Maximum number of trace files. When a trace file named trace-file reaches its maximum size, it is renamed trace-file.0, then trace-file.1, and so on, until the maximum number of trace files is reached. Then the oldest trace file is overwritten.</p> <p>If you specify a maximum number of files, you must also include the size statement to specify the maximum file size.</p> <p>Range: 2 through 1000 files</p> <p>Default: 2 files</p> <p>flag—Tracing operation to perform. To specify more than one tracing operation, include multiple flag statements.</p> <p>DVMRP Tracing Flags</p> <ul style="list-style-type: none"> • all—All tracing operations • general—A combination of the normal and route trace operations • graft—Graft messages • neighbor—Neighbor probe messages • normal—All normal operations

Default: If you do not specify this option, only unusual or abnormal operations are traced.

- **packets**—All DVMRP packets
- **poison**—Poison-route-reverse packets
- **probe**—Probe packets
- **prune**—Prune messages
- **report**—DVMRP route report packets
- **policy**—Policy operations and actions
- **route**—Routing table changes
- **state**—State transitions
- **task**—Interface transactions and processing
- **timer**—Timer usage

flag-modifier—(Optional) Modifier for the tracing flag. You can specify one or more of these modifiers:

- **detail**—Detailed trace information
- **receive**—Packets being received
- **send**—Packets being transmitted

no-stamp—(Optional) Do not place timestamp information at the beginning of each line in the trace file.

Default: If you omit this option, timestamp information is placed at the beginning of each line of the tracing output.

no-world-readable—(Optional) Do not allow users to read the log file.

replace—(Optional) Replace an existing trace file if there is one.

Default: If you do not include this option, tracing output is appended to an existing trace file.

size size—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). When a trace file named ***trace-file*** reaches this size, it is renamed ***trace-file.0***. When ***trace-file*** again reaches this size, ***trace-file.0*** is renamed ***trace-file.1*** and ***trace-file*** is renamed ***trace-file.0***. This renaming scheme continues until the maximum number of trace files is reached. Then the oldest trace file is overwritten.

If you specify a maximum file size, you must also include the **files** statement to specify the maximum number of trace files.

Syntax: *xk* to specify KB, *xm* to specify MB, or *xg* to specify GB

Range: 10 KB through the maximum file size supported on your system

Default: 1 MB

world-readable—(Optional) Allow any user to read the log file.

Required Privilege	routing and trace—To view this statement in the configuration.
Level	routing-control and trace-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none">• Tracing DVMRP Protocol Traffic on page 343

PART 3

Administration

- [PIM Operational Commands on page 599](#)
- [Multicast Routing Options Operational Commands on page 655](#)
- [IGMP Operational Commands on page 679](#)
- [MLD Operational Commands on page 699](#)
- [IGMP Snooping Operational Commands on page 715](#)
- [Multicast Snooping Operational Commands on page 729](#)
- [AMT Operational Commands on page 747](#)
- [Session Announcement Protocol Operational Commands on page 759](#)
- [MSDP Operational Commands on page 763](#)
- [PGM Operational Commands on page 785](#)
- [DVMRP Operational Commands on page 795](#)

CHAPTER 25

PIM Operational Commands

- clear pim join
- clear pim join-distribution
- clear pim register
- clear pim statistics
- request pim multicast-tunnel rebalance
- show pim bidirectional df-election
- show pim bidirectional df-election interface
- show pim bootstrap
- show pim interfaces
- show pim join
- show pim neighbors
- show pim rps
- show pim source
- show pim statistics

clear pim join

List of Syntax	Syntax on page 600 Syntax (EX Series Switch and the QFX Series) on page 600
Syntax	<pre>clear pim join <group-address> <inet inet6> <instance instance-name> <logical-system (all logical-system-name)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>clear pim join <group-address> <inet inet6> <instance instance-name></pre>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. inet6 and instance options introduced in Junos OS Release 10.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	Clear the Protocol Independent Multicast (PIM) join and prune states.
Options	<p>none—Clear the PIM join and prune states for all groups, family addresses, and instances.</p> <p>group-address—(Optional) Clear the PIM join and prune states for a group address.</p> <p>inet inet6—(Optional) Clear the PIM join and prune states for IPv4 or IPv6 family addresses, respectively.</p> <p>instance instance-name—(Optional) Clear the join and prune states for a specific PIM-enabled routing instance.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Additional Information	The clear pim join command cannot be used to clear the PIM join and prune state on a backup Routing Engine when nonstop active routing is enabled.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show pim join on page 621
List of Sample Output	clear pim join on page 601
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear pim join

```
user@host> clear pim join
```

clear pim join-distribution

Syntax	<code>clear pim join-distribution</code> <code><instance <i>instance-name</i>></code> <code><logical-system (all <i>logical-system-name</i>)></code>
Release Information	Command introduced in Junos OS Release 10.0.
Description	<p>Redistribute the Protocol Independent Multicast (PIM) join states.</p> <p>You can find out if there are multiple paths available for a source (for example, an RP) with the output of the show pim source command.</p> <p>When you include the join-load-balance statement in the configuration, the PIM join states are distributed evenly on available equal-cost multipath links. When an upstream neighbor link fails, Junos OS redistributes the PIM join states to the remaining links. However, when new links are added or the failed link is restored, the existing PIM joins are not redistributed to the new link. New flows will be distributed to the new links. However, in a network without new joins and prunes, the new link is not used for multicast traffic. The clear pim join-distribution command redistributes the existing flows to the new upstream neighbors. Redistributing the existing flows causes traffic to be disrupted, so we recommend that you run the clear pim join-distribution command during a maintenance window.</p>
Options	<p>none—Redistribute the PIM join states for the default master instance.</p> <p>instance <i>instance-name</i>—(Optional) Redistribute the join states for a specific PIM-enabled routing instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Additional Information	The clear pim join-distribution command cannot be used to redistribute the PIM join states on a backup Routing Engine when nonstop active routing is enabled.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show pim neighbors on page 630• show pim join on page 621• join-load-balance on page 385 in the <i>Multicast Protocols Configuration Guide</i>
List of Sample Output	clear pim join-distribution on page 603
Output Fields	When you enter this command, you are provided no feedback on the status of your request. You can enter the show pim join command before and after distributing the join state to verify the operation.

Sample Output

clear pim join-distribution

```
user@host> clear pim join-distribution
```

clear pim register

List of Syntax	Syntax on page 604 Syntax (EX Series Switch and the QFX Series) on page 604
Syntax	<pre>clear pim register <inet inet6> <instance <i>instance-name</i>> <interface <i>interface-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>clear pim register <inet inet6> <instance <i>instance-name</i>> <interface <i>interface-name</i>></pre>
Release Information	Command introduced in Junos OS Release 7.6. Command introduced in Junos OS Release 9.0 for EX Series switches. inet6 and instance options introduced in Junos OS Release 10.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	Clear Protocol Independent Multicast (PIM) register message counters.
Options	<p>none—Clear PIM register message counters for all family addresses, instances, and interfaces.</p> <p>inet inet6—(Optional) Clear PIM register message counters for IPv4 or IPv6 family addresses, respectively.</p> <p>instance <i>instance-name</i>—(Optional) Clear register message counters for a specific PIM-enabled routing instance.</p> <p>interface <i>interface-name</i>—(Optional) Clear PIM register message counters for a specific interface.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Additional Information	The clear pim register command cannot be used to clear the PIM register state on a backup Routing Engine when nonstop active routing is enabled.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show pim statistics on page 644
List of Sample Output	clear pim register on page 605
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear pim register

```
user@host> clear pim register
```

clear pim statistics

List of Syntax	Syntax on page 606 Syntax (EX Series Switch and the QFX Series) on page 606
Syntax	<pre>clear pim statistics <inet inet6> <instance <i>instance-name</i>> <interface <i>interface-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>clear pim statistics <inet inet6> <instance <i>instance-name</i>> <interface <i>interface-name</i>></pre>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. inet6 and instance options introduced in Junos OS Release 10.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	Clear Protocol Independent Multicast (PIM) statistics.
Options	<p>none—Clear PIM statistics for all family addresses, instances, and interfaces.</p> <p>inet inet6—(Optional) Clear PIM statistics for IPv4 or IPv6 family addresses, respectively.</p> <p>instance <i>instance-name</i>—(Optional) Clear statistics for a specific PIM-enabled routing instance.</p> <p>interface <i>interface-name</i>—(Optional) Clear PIM statistics for a specific interface.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Additional Information	The clear pim statistics command cannot be used to clear the PIM statistics on a backup Routing Engine when nonstop active routing is enabled.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show pim statistics on page 644
List of Sample Output	clear pim statistics on page 607
Output Fields	See show pim statistics for an explanation of output fields.

Sample Output

clear pim statistics

The following sample output displays PIM statistics before and after the **clear pim statistics** command is entered:

```
user@host> show pim statistics
PIM statistics on all interfaces:
PIM Message type      Received      Sent  Rx errors
Hello                  0             0       0
Register               0             0       0
Register Stop          0             0       0
Join Prune             0             0       0
Bootstrap              0             0       0
Assert                0             0       0
Graft                  0             0       0
Graft Ack              0             0       0
Candidate RP           0             0       0
V1 Query               2111          4222       0
V1 Register            0             0       0
V1 Register Stop       0             0       0
V1 Join Prune          14200         13115       0
V1 RP Reachability     0             0       0
V1 Assert              0             0       0
V1 Graft               0             0       0
V1 Graft Ack           0             0       0
PIM statistics summary for all interfaces:
Unknown type           0
V1 Unknown type        0
Unknown Version         0
Neighbor unknown       0
Bad Length              0
Bad Checksum            0
Bad Receive If         0
Rx Intf disabled       2007
Rx V1 Require V2       0
Rx Register not RP     0
RP Filtered Source     0
Unknown Reg Stop       0
Rx Join/Prune no state 1040
Rx Graft/Graft Ack no state 0
...
```

```
user@host> clear pim statistics
user@host> show pim statistics
PIM statistics on all interfaces:
PIM Message type      Received      Sent  Rx errors
Hello                  0             0       0
Register               0             0       0
Register Stop          0             0       0
Join Prune             0             0       0
Bootstrap              0             0       0
Assert                0             0       0
Graft                  0             0       0
Graft Ack              0             0       0
Candidate RP           0             0       0
V1 Query               1             0       0
V1 Register            0             0       0
...
```


request pim multicast-tunnel rebalance

List of Syntax	Syntax on page 609 Syntax (EX Series Switches) on page 609
Syntax	<pre>request pim multicast-tunnel rebalance <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switches)	<pre>request pim multicast-tunnel rebalance <instance <i>instance-name</i>></pre>
Release Information	<p>Command introduced in Junos OS Release 10.2.</p> <p>Command introduced in Junos OS Release 10.2 for EX Series switches.</p>
Description	<p>Rebalance the assignment of multicast tunnel encapsulation interfaces across available tunnel-capable PICs or across a configured list of tunnel-capable PICs. You can determine whether a rebalance is necessary by running the show pim interfaces instance <i>instance-name</i> command.</p>
Options	<p>none—Re-create and rebalance all tunnel interfaces for all routing instances.</p> <p>instance <i>instance-name</i>—Re-create and rebalance all tunnel interfaces for a specific instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	<p>maintenance</p>
Related Documentation	<ul style="list-style-type: none"> • show pim interfaces on page 618
Output Fields	<p>This command produces no output. To verify the operation of the command, run the show pim interface instance <i>instance-name</i> before and after running the request pim multicast-tunnel rebalance command.</p>

show pim bidirectional df-election

Syntax	<pre>show pim bidirectional df-election <brief detail > <inet inet6> <instance <i>instance name</i>> <logical-system (all <i>logical-system-name</i>)> <rpa <i>address</i>></pre>
Release Information	Command introduced in Junos OS Release 12.1.
Description	For bidirectional PIM, display the designated forwarder (DF) election results for each interface grouped by the rendezvous point addresses (RPAs).
Options	<p>none—Display standard information about all interfaces.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>inet inet6—(Optional) Display DF election results for IPv4 or IPv6 family addresses, respectively.</p> <p>instance <i>instance-name</i>—(Optional) Display DF election results for a specific routing instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>rpa <i>address</i>—(Optional) Display the DF election results for an RP address.</p>
Required Privilege Level	view
List of Sample Output	show pim bidirectional df-election on page 611 show pim bidirectional df-election brief on page 611
Output Fields	Table 12 on page 610 describes the output fields for the show pim bidirectional df-election command. Output fields are listed in the approximate order in which they appear.

Table 12: show pim bidirectional df-election Output Fields

Field Name	Field Description	Level of Output
Family	IPv4 address family (INET) or IPv6 address family (INET6).	All levels
Instance	Name of the routing instance.	All levels
RPA	RP address.	All levels
Group ranges	Address ranges of the multicast groups mapped to this RP address.	All levels

Table 12: show pim bidirectional df-election Output Fields (*continued*)

Field Name	Field Description	Level of Output
Interfaces	Bidirectional PIM interfaces on this router. An interface can win the DF election (Win), lose the DF election (Lose), or be the RP link (RPL). The RP link is the interface directly connected to a subnet that contains a phantom RP address. A phantom RP address is an RP address that is not assigned to a router interface.	All levels brief displays the DF election winner only.
DF	IP address of the designated forwarder.	All levels

Sample Output

show pim bidirectional df-election

```

user@host> show pim bidirectional df-election
Instance: PIM.master Family: INET

RPA: 10.10.1.3
Group ranges: 224.1.3.0/24, 225.1.3.0/24
Interfaces:
    ge-0/0/1.0    (RPL)    DF: none
    lo0.0         (Win)     DF: 10.255.179.246
    xe-4/1/0.0    (Win)     DF: 10.10.2.1

RPA: 10.10.13.2
Group ranges: 224.1.1.0/24, 225.1.1.0/24
Interfaces:
    ge-0/0/1.0    (Lose)    DF: 10.10.1.2
    lo0.0         (Win)     DF: 10.255.179.246
    xe-4/1/0.0    (Lose)    DF: 10.10.2.2

Instance: PIM.master Family: INET6

RPA: fec0::10:10:1:3
Group ranges: ff00::/8
Interfaces:
    ge-0/0/1.0    (Lose)    DF: fe80::b2c6:9aff:fe95:86fa
    lo0.0         (Win)     DF: fe80::2a0:a50f:fc64:e661
    xe-4/1/0.0    (Win)     DF: fe80::226:88ff:fec5:3c37

RPA: fec0::10:10:13:2
Group ranges: ff00::/8
Interfaces:
    ge-0/0/1.0    (Lose)    DF: fe80::b2c6:9aff:fe95:86fa
    lo0.0         (Win)     DF: fe80::2a0:a50f:fc64:e661
    xe-4/1/0.0    (Win)     DF: fe80::226:88ff:fec5:3c37

```

show pim bidirectional df-election brief

```

user@host> show pim bidirectional df-election brief
Instance: PIM.master Family: INET

RPA: 10.10.1.3
Group ranges: 224.1.3.0/24, 225.1.3.0/24
Interfaces:
    lo0.0         (Win)     DF: 10.255.179.246
    xe-4/1/0.0    (Win)     DF: 10.10.2.1

```

```
RPA: 10.10.13.2
Group ranges: 224.1.1.0/24, 225.1.1.0/24
Interfaces:
  lo0.0          (Win)      DF: 10.255.179.246
```

```
Instance: PIM.master Family: INET6
```

```
RPA: fec0::10:10:1:3
Group ranges: ff00::/8
Interfaces:
  lo0.0          (Win)      DF: fe80::2a0:a50f:fc64:e661
  xe-4/1/0.0     (Win)      DF: fe80::226:88ff:fec5:3c37
```

```
RPA: fec0::10:10:13:2
Group ranges: ff00::/8
Interfaces:
  lo0.0          (Win)      DF: fe80::2a0:a50f:fc64:e661
  xe-4/1/0.0     (Win)      DF: fe80::226:88ff:fec5:3c37
```

show pim bidirectional df-election interface

Syntax	show pim bidirectional df-election interface <inet inet6> <instance <i>instance name</i> > <interface-name> <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced in Junos OS Release 12.1.
Description	For bidirectional PIM, display the default and the configured designated forwarder (DF) election parameters for each interface.
Options	<p>none—Display standard information about all interfaces.</p> <p>inet inet6—(Optional) Display DF election parameters for IPv4 or IPv6 family addresses, respectively.</p> <p>instance <i>instance-name</i>—(Optional) Display DF election parameters for a specific routing instance.</p> <p>interface-name—(Optional) Display DF election parameters for a specific interface.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show pim bidirectional df-election interface on page 614
Output Fields	Table 13 on page 613 describes the output fields for the show pim bidirectional df-election interface command. Output fields are listed in the approximate order in which they appear.

Table 13: show pim bidirectional df-election interface Output Fields

Field Name	Field Description
Instance	Name of the routing instance.
Family	IPv4 address family (INET) or IPv6 address family (INET6).
Interface	Name of the bidirectional PIM interface.
Robustnes Count	Minimum number of DF election messages that must fail to be received for DF election to fail.
Offer Period	Interval between repeated DF election messages.
Backoff Period	Period that the acting DF waits between receiving a better DF Offer and sending the Pass message to transfer DF responsibility.

Table 13: show pim bidirectional df-election interface Output Fields (*continued*)

Field Name	Field Description
RPA	RP address.
State	For each RP address, state of each interface with respect to the DF election: Offer (when the election is in progress), Win , or Lose .
DF	IP address of the designated forwarder.

Sample Output

show pim bidirectional df-election interface

```

user@host> show pim bidirectional df-election interface
Instance: PIM.master Family: INET

Interface: ge-0/0/1.0
  Robustness Count: 3
  Offer Period: 100 ms
  Backoff Period: 1000 ms

  RPA                               State  DF
  10.10.1.3                         Offer  none
  10.10.13.2                       Lose   10.10.1.2

Interface: lo0.0
  Robustness Count: 3
  Offer Period: 100 ms
  Backoff Period: 1000 ms

  RPA                               State  DF
  10.10.1.3                         Win    10.255.179.246
  10.10.13.2                       Win    10.255.179.246

Interface: xe-4/1/0.0
  Robustness Count: 3
  Offer Period: 100 ms
  Backoff Period: 1000 ms

  RPA                               State  DF
  10.10.1.3                         Win    10.10.2.1
  10.10.13.2                       Lose   10.10.2.2

Instance: PIM.master Family: INET6

Interface: ge-0/0/1.0
  Robustness Count: 3
  Offer Period: 100 ms
  Backoff Period: 1000 ms

  RPA                               State  DF
  fec0::10:10:1:3                   Lose   fe80::b2c6:9aff:fe95:86fa
  fec0::10:10:13:2                  Lose   fe80::b2c6:9aff:fe95:86fa

Interface: lo0.0

```

Robustness Count: 3
Offer Period: 100 ms
Backoff Period: 1000 ms

RPA	State	DF
fec0::10:10:1:3	Win	fe80::2a0:a50f:fc64:e661
fec0::10:10:13:2	Win	fe80::2a0:a50f:fc64:e661

Interface: xe-4/1/0.0
Robustness Count: 3
Offer Period: 100 ms
Backoff Period: 1000 ms

RPA	State	DF
fec0::10:10:1:3	Win	fe80::226:88ff:fec5:3c37
fec0::10:10:13:2	Win	fe80::226:88ff:fec5:3c37

show pim bootstrap

List of Syntax	Syntax on page 616 Syntax (EX Series Switch and the QFX Series) on page 616
Syntax	<pre>show pim bootstrap <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show pim bootstrap <instance <i>instance-name</i>></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>instance option introduced in Junos OS Release 10.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	For sparse mode only, display information about Protocol Independent Multicast (PIM) bootstrap routers.
Options	<p>none—Display PIM bootstrap router information for all routing instances.</p> <p>instance <i>instance-name</i>—(Optional) Display information about bootstrap routers for a specific PIM-enabled routing instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show pim bootstrap on page 617 show pim bootstrap instance on page 617
Output Fields	<p>Table 14 on page 616 describes the output fields for the show pim bootstrap command. Output fields are listed in the approximate order in which they appear.</p>

Table 14: show pim bootstrap Output Fields

Field Name	Field Description
Instance	Name of the routing instance.
BSR	Bootstrap router.
Pri	Priority of the routing device as elected to be the bootstrap router.
Local address	Local routing device address.
Pri	Local routing device address priority to be elected as the bootstrap router.

Table 14: show pim bootstrap Output Fields (*continued*)

Field Name	Field Description
State	Local routing device election state: Candidate , Elected , or Ineligible .
Timeout	How long until the local routing device declares the bootstrap router to be unreachable, in seconds.

Sample Output

show pim bootstrap

```
user@host> show pim bootstrap
Instance: PIM.master
```

BSR	Pri	Local address	Pri	State	Timeout
None	0	10.255.71.46	0	InEligible	0
feco:1:1:1:1:0:aff:785c 34	feco:1:1:1:1:0:aff:7c12	0	InEligible	0	

show pim bootstrap instance

```
user@host> show pim bootstrap instance VPN-A
Instance: PIM.VPN-A
```

BSR	Pri	Local address	Pri	State	Timeout
None	0	192.168.196.105	0	InEligible	0

show pim interfaces

List of Syntax [Syntax on page 618](#)
[Syntax \(EX Series Switch and the QFX Series\) on page 618](#)

Syntax show pim interfaces
 <inet | inet6>
 <instance *instance-name*>
 <logical-system (all | *logical-system-name*)>

Syntax (EX Series Switch and the QFX Series) show pim interfaces
 <inet | inet6>
 <instance *instance-name*>

Release Information Command introduced before Junos OS Release 7.4.
 Command introduced in Junos OS Release 9.0 for EX Series switches.
inet6 and **instance** options introduced in Junos OS Release 10.0 for EX Series switches.
 Command introduced in Junos OS Release 11.3 for the QFX Series.
 Support for bidirectional PIM added in Junos OS Release 12.1.

Description Display information about the interfaces on which Protocol Independent Multicast (PIM) is configured.

Options **none**—Display interface information for all family addresses for all routing instances.

inet | inet6—(Optional) Display interface information for IPv4 or IPv6 family addresses, respectively.

instance *instance-name*—(Optional) Display information about interfaces for a specific PIM-enabled routing instance.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

Required Privilege Level view

List of Sample Output [show pim interfaces on page 619](#)

Output Fields [Table 15 on page 618](#) describes the output fields for the **show pim interfaces** command. Output fields are listed in the approximate order in which they appear.

Table 15: show pim interfaces Output Fields

Field Name	Field Description
Instance	Name of the routing instance.
Name	Interface name.
State	State of the interface. The state also is displayed in the show interfaces command.

Table 15: show pim interfaces Output Fields (*continued*)

Field Name	Field Description
Mode	<p>PIM mode running on the interface:</p> <ul style="list-style-type: none"> • B—In bidirectional mode, multicast groups are carried across the network over bidirectional shared trees. This type of tree minimizes PIM routing state, which is especially important in networks with numerous and dispersed senders and receivers. • S—In sparse mode, routing devices must join and leave multicast groups explicitly. Upstream routing devices do not forward multicast traffic to this routing device unless this device has sent an explicit request (using a join message) to receive multicast traffic. • Dense—Unlike sparse mode, where data is forwarded only to routing devices sending an explicit request, dense mode implements a flood-and-prune mechanism, similar to DVMRP (the first multicast protocol used to support the multicast backbone). (Not supported on QFX Series.) • Sparse-Dense—Sparse-dense mode allows the interface to operate on a per-group basis in either sparse or dense mode. A group specified as dense is not mapped to a rendezvous point (RP). Instead, data packets destined for that group are forwarded using PIM-Dense Mode (PIM-DM) rules. A group specified as sparse is mapped to an RP, and data packets are forwarded using PIM-Sparse Mode (PIM-SM) rules. (Not supported on QFX Series.) <p>When sparse-dense mode is configured, the output includes both S and D. When bidirectional-sparse mode is configured, the output includes S and B. When bidirectional-sparse-dense mode is configured, the output includes B, S, and D.</p>
IP	Version number of the address family on the interface: 4 (IPv4) or 6 (IPv6).
V	PIM version running on the interface: 1 or 2.
State	<p>State of PIM on the interface:</p> <ul style="list-style-type: none"> • Active—Bidirectional mode is enabled on the interface and on all PIM neighbors. • DR—Designated router. • NotCap—Bidirectional mode is not enabled on the interface. This can happen when bidirectional PIM is not configured locally, when one of the neighbors is not configured for bidirectional PIM, or when one of the neighbors has not implemented the bidirectional PIM protocol. • NotDR—Not the designated router. • P2P—Point to point.
NbrCnt	Number of neighbors that have been seen on the interface.
JoinCnt(sg)	Number of (s,g) join messages that have been seen on the interface.
JointCnt(*g)	Number of (*g) join messages that have been seen on the interface.
DR address	Address of the designated router.

Sample Output

show pim interfaces

```

user@host> show pim interfaces
Stat = Status, V = Version, NbrCnt = Neighbor Count,
S = Sparse, D = Dense, B = Bidirectional,
DR = Designated Router, P2P = Point-to-point link,

```

Active = Bidirectional is active, NotCap = Not Bidirectional Capable

Name	Stat	Mode	IP	V	State	NbrCnt	JoinCnt(sg/*g)	DR address
ge-0/3/0.0	Up	S	4	2	NotDR,NotCap	1	0/0	40.0.0.3
ge-0/3/3.50	Up	S	4	2	DR,NotCap	1	9901/100	50.0.0.2
ge-0/3/3.51	Up	S	4	2	DR,NotCap	1	0/0	51.0.0.2
pe-1/2/0.32769	Up	S	4	2	P2P,NotCap	0	0/0	

show pim join

List of Syntax [Syntax on page 621](#)
 [Syntax \(EX Series Switch and the QFX Series\) on page 621](#)

Syntax show pim join
 <brief | detail | extensive | summary>
 <inet | inet6>
 <instance *instance-name*>
 <logical-system (all | *logical-system-name*)>
 <range>

Syntax (EX Series Switch and the QFX Series) show pim join
 <brief | detail | extensive | summary>
 <inet | inet6>
 <instance *instance-name*>
 <range>

Release Information Command introduced before Junos OS Release 7.4.
 Command introduced in Junos OS Release 9.0 for EX Series switches.
 summary option introduced in Junos OS Release 9.6.
 inet6 and **instance** options introduced in Junos OS Release 10.0 for EX Series switches.
 Support for bidirectional PIM added in Junos OS Release 12.1.
 Command introduced in Junos OS Release 11.3 for the QFX Series.

Description Display information about Protocol Independent Multicast (PIM) groups for all PIM modes.

For bidirectional PIM, display information about PIM group ranges (*G-range) for each active bidirectional RP group range, in addition to each of the joined (*G) routes.

Options **none**—Display the standard information about PIM groups for all supported family addresses for all routing instances.

brief | detail | extensive | summary—(Optional) Display the specified level of output.

inet | inet6—(Optional) Display PIM group information for IPv4 or IPv6 family addresses, respectively.

instance *instance-name*—(Optional) Display information about groups for the specified PIM-enabled routing instance only.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

range—(Optional) Address range of the group, specified as *prefix/prefix-length*.

Required Privilege Level view

Related Documentation • [clear pim join on page 600](#)

List of Sample Output

- [show pim join summary on page 624](#)
- [show pim join \(PIM Sparse Mode\) on page 625](#)
- [show pim join \(Bidirectional PIM\) on page 625](#)
- [show pim join instance <instance-name> on page 626](#)
- [show pim join detail on page 626](#)
- [show pim join extensive \(PIM Sparse Mode\) on page 627](#)
- [show pim join extensive \(Bidirectional PIM\) on page 628](#)
- [show pim join extensive \(Bidirectional PIM with a Directly Connected Phantom RP\) on page 628](#)
- [show pim join instance <instance-name> extensive on page 629](#)

Output Fields [Table 16 on page 622](#) describes the output fields for the **show pim join** command. Output fields are listed in the approximate order in which they appear.

Table 16: show pim join Output Fields

Field Name	Field Description	Level of Output
Instance	Name of the routing instance.	brief detail extensive summary none
Family	Name of the address family: inet (IPv4) or inet6 (IPv6).	brief detail extensive summary none
Route type	Type of multicast route: (S,G) or (*,G).	summary
Route count	Number of (S,G) routes and number of (*,G) routes.	summary
R	Rendezvous Point Tree.	brief detail extensive none
S	Sparse.	brief detail extensive none
W	Wildcard.	brief detail extensive none
Group	Group address.	brief detail extensive none
Bidirectional group prefix length	For bidirectional PIM, length of the IP prefix for RP group ranges.	All levels
Source	Multicast source: <ul style="list-style-type: none"> • * (wildcard value) • <i>ipv4-address</i> • <i>ipv6-address</i> 	brief detail extensive none
RP	Rendezvous point for the PIM group.	brief detail extensive none

Table 16: show pim join Output Fields (*continued*)

Field Name	Field Description	Level of Output
Flags	PIM flags: <ul style="list-style-type: none"> • bidirectional—Bidirectional mode entry. • dense—Dense mode entry. • rptree—Entry is on the rendezvous point tree. • sparse—Sparse mode entry. • spt—Entry is on the shortest-path tree for the source. • wildcard—Entry is on the shared tree. 	brief detail extensive none
Upstream interface	RPF interface toward the source address for the source-specific state (S,G) or toward the rendezvous point (RP) address for the non-source-specific state (*,G). For bidirectional PIM, RP Link means that the interface is directly connected to a subnet that contains a phantom RP address.	brief detail extensive none
Upstream neighbor	Information about the upstream neighbor: Direct , Local , Unknown , or a specific IP address. For bidirectional PIM, Direct means that the interface is directly connected to a subnet that contains a phantom RP address.	extensive
Upstream state	Information about the upstream interface: <ul style="list-style-type: none"> • Join to RP—Sending a join to the rendezvous point. • Join to Source—Sending a join to the source. • Local RP—Sending neither join messages nor prune messages toward the RP, because this router is the rendezvous point. • Local Source—Sending neither join messages nor prune messages toward the source, because the source is locally attached to this routing device. • Prune to RP—Sending a prune to the rendezvous point. • Prune to Source—Sending a prune to the source. <p>NOTE: RP group range entries have None in the Upstream state field because RP group ranges do not trigger actual PIM join messages between routers.</p>	extensive

Table 16: show pim join Output Fields (*continued*)

Field Name	Field Description	Level of Output
Downstream neighbors	<p>Information about downstream interfaces:</p> <ul style="list-style-type: none"> • Interface—Interface name for the downstream neighbor. <p>NOTE: A pseudo PIM-SM interface appears for all IGMP-only interfaces.</p> <ul style="list-style-type: none"> • Interface address—Address of the downstream neighbor. • State—Information about the downstream neighbor: join or prune. • Flags—PIM join flags: R (RPtree), S (Sparse), W (Wildcard), or zero. • Uptime—Time since the downstream interface joined the group. • Time since last Join—Time since the last join message was received from the downstream interface. • Time since last Prune—Time since the last prune message was received from the downstream interface. 	extensive
Assert Timeout	Length of time between assert cycles on the downstream interface. Not displayed if the assert timer is null.	extensive
Keepalive timeout	Time remaining until the downstream join state is updated (in seconds). If the downstream join state is not updated before this keepalive timer reaches zero, the entry is deleted. If there is a directly connected host, Keepalive timeout is Infinity .	extensive
Uptime	Time since the creation of (S,G) or (*G) state. The uptime is not refreshed every time a PIM join message is received for an existing (S,G) or (*G) state.	extensive
Bidirectional accepting interfaces	<p>Interfaces on the router that forward bidirectional PIM traffic.</p> <p>The reasons for forwarding bidirectional PIM traffic are that the interface is the winner of the designated forwarder election (DF Winner), or the interface is the reverse path forwarding (RPF) interface toward the RP (RPF).</p>	extensive

Sample Output

show pim join summary

```
user@host> show pim join summary
```


Instance: PIM.master Family: INET

Route type	Route count
(s,g)	2
(*,g)	1

Instance: PIM.master Family: INET6

show pim join (PIM Sparse Mode)

```

user@host> show pim join
Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

Group: 239.1.1.1
  Source: *
  RP: 10.255.14.144
  Flags: sparse,rptree,wildcard
  Upstream interface: Local

Group: 239.1.1.1
  Source: 10.255.14.144
  Flags: sparse,spt
  Upstream interface: Local

Group: 239.1.1.1
  Source: 10.255.70.15
  Flags: sparse,spt
  Upstream interface: so-1/0/0.0

Instance: PIM.master Family: INET6
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

```

show pim join (Bidirectional PIM)

```

user@host> show pim join
Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

Group: 224.1.1.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.13.2
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0

Group: 224.1.3.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.1.3
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0 (RP Link)

Group: 225.1.1.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.13.2
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0

Group: 225.1.3.0

```

```
Bidirectional group prefix length: 24
Source: *
RP: 10.10.1.3
Flags: bidirectional,rptree,wildcard
Upstream interface: ge-0/0/1.0 (RP Link)
```

```
Instance: PIM.master Family: INET6
R = Rendezvous Point Tree, S = Sparse, W = Wildcard
```

show pim join instance <instance-name>

```
user@host> show pim join instance VPN-A
Instance: PIM.VPN-A Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard
```

```
Group: 235.1.1.2
Source: *
RP: 10.10.47.100
Flags: sparse,rptree,wildcard
Upstream interface: Local
```

```
Group: 235.1.1.2
Source: 192.168.195.74
Flags: sparse,spt
Upstream interface: at-0/3/1.0
```

```
Group: 235.1.1.2
Source: 192.168.195.169
Flags: sparse
Upstream interface: so-1/0/1.0
```

```
Instance: PIM.VPN-A Family: INET6
R = Rendezvous Point Tree, S = Sparse, W = Wildcard
```

show pim join detail

```
user@host> show pim join detail
Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard
```

```
Group: 239.1.1.1
Source: *
RP: 10.255.14.144
Flags: sparse,rptree,wildcard
Upstream interface: Local
```

```
Group: 239.1.1.1
Source: 10.255.14.144
Flags: sparse,spt
Upstream interface: Local
```

```
Group: 239.1.1.1
Source: 10.255.70.15
Flags: sparse,spt
Upstream interface: so-1/0/0.0
```

```
Instance: PIM.master Family: INET6
R = Rendezvous Point Tree, S = Sparse, W = Wildcard
```

show pim join extensive (PIM Sparse Mode)

```

user@host> show pim join extensive
Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

Group: 239.1.1.1
Source: *
RP: 10.255.14.144
Flags: sparse,rptree,wildcard
Upstream interface: Local
Upstream neighbor: Local
Upstream state: Local RP
Uptime: 00:03:49
Downstream neighbors:
  Interface: so-1/0/0.0
    10.111.10.2 State: Join Flags: SRW Timeout: 174
    Uptime: 00:03:49 Time since last Join: 00:01:49
  Interface: mt-1/1/0.32768
    10.10.47.100 State: Join Flags: SRW Timeout: Infinity
    Uptime: 00:03:49 Time since last Join: 00:01:49

Group: 239.1.1.1
Source: 10.255.14.144
Flags: sparse,spt
Upstream interface: Local
Upstream neighbor: Local
Upstream state: Local Source, Local RP
Keepalive timeout: 344
Uptime: 00:03:49
Downstream neighbors:
  Interface: so-1/0/0.0
    10.111.10.2 State: Join Flags: S Timeout: 174
    Uptime: 00:03:49 Time since last Prune: 00:01:49
  Interface: mt-1/1/0.32768
    10.10.47.100 State: Join Flags: S Timeout: Infinity
    Uptime: 00:03:49 Time since last Prune: 00:01:49

Group: 239.1.1.1
Source: 10.255.70.15
Flags: sparse,spt
Upstream interface: so-1/0/0.0
Upstream neighbor: 10.111.10.2
Upstream state: Local RP, Join to Source
Keepalive timeout: 344
Uptime: 00:03:49
Downstream neighbors:
  Interface: Pseudo-GMP
    fe-0/0/0.0 fe-0/0/1.0 fe-0/0/3.0
  Interface: so-1/0/0.0 (pruned)
    10.111.10.2 State: Prune Flags: SR Timeout: 174
    Uptime: 00:03:49 Time since last Prune: 00:01:49
  Interface: mt-1/1/0.32768
    10.10.47.100 State: Join Flags: S Timeout: Infinity
    Uptime: 00:03:49 Time since last Prune: 00:01:49

Instance: PIM.master Family: INET6
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

```

show pim join extensive (Bidirectional PIM)

```
user@host> show pim join extensive
Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard
```

```
Group: 224.1.1.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.13.2
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0
  Upstream neighbor: 10.10.1.2
  Upstream state: None
  Uptime: 00:03:49
  Bidirectional accepting interfaces:
    Interface: ge-0/0/1.0      (RPF)
    Interface: lo0.0           (DF Winner)
```

```
Group: 225.1.1.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.13.2
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0
  Upstream neighbor: 10.10.1.2
  Upstream state: None
  Uptime: 00:03:49
  Bidirectional accepting interfaces:
    Interface: ge-0/0/1.0      (RPF)
    Interface: lo0.0           (DF Winner)
```

```
Group: 225.1.3.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.1.3
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0 (RP Link)
  Upstream neighbor: Direct
  Upstream state: Local RP
  Uptime: 00:03:49
  Bidirectional accepting interfaces:
    Interface: ge-0/0/1.0      (RPF)
    Interface: lo0.0           (DF Winner)
    Interface: xe-4/1/0.0      (DF Winner)
```

```
Instance: PIM.master Family: INET6
R = Rendezvous Point Tree, S = Sparse, W = Wildcard
```

show pim join extensive (Bidirectional PIM with a Directly Connected Phantom RP)

```
user@host> show pim join extensive
Instance: PIM.master Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard
```

```
Group: 224.1.3.0
  Bidirectional group prefix length: 24
  Source: *
  RP: 10.10.1.3
  Flags: bidirectional,rptree,wildcard
  Upstream interface: ge-0/0/1.0 (RP Link)
```

```

Upstream neighbor: Direct
Upstream state: Local RP
Uptime: 00:03:49
Bidirectional accepting interfaces:
  Interface: ge-0/0/1.0    (RPF)
  Interface: lo0.0        (DF Winner)
  Interface: xe-4/1/0.0    (DF Winner)

```

show pim join instance <instance-name> extensive

```

user@host> show pim join instance VPN-A extensive
Instance: PIM.VPN-A Family: INET
R = Rendezvous Point Tree, S = Sparse, W = Wildcard

Group: 235.1.1.2
  Source: *
  RP: 10.10.47.100
  Flags: sparse,rptree,wildcard
  Upstream interface: Local
  Upstream neighbor: Local
  Upstream state: Local RP
  Uptime: 00:03:49
  Downstream neighbors:
    Interface: mt-1/1/0.32768
      10.10.47.101 State: Join Flags: SRW Timeout: 156
      Uptime: 00:03:49 Time since last Join: 00:01:49

Group: 235.1.1.2
  Source: 192.168.195.74
  Flags: sparse,spt
  Upstream interface: at-0/3/1.0
  Upstream neighbor: 10.111.30.2
  Upstream state: Local RP, Join to Source
  Keepalive timeout: 156
  Uptime: 00:14:52

Group: 235.1.1.2
  Source: 192.168.195.169
  Flags: sparse
  Upstream interface: so-1/0/1.0
  Upstream neighbor: 10.111.20.2
  Upstream state: Local RP, Join to Source
  Keepalive timeout: 156
  Uptime: 00:14:52

```

show pim neighbors

List of Syntax	Syntax on page 630 Syntax (EX Series Switch and the QFX Series) on page 630
Syntax	<pre>show pim neighbors <brief detail> <inet inet6> <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show pim neighbors <brief detail> <inet inet6> <instance <i>instance-name</i>></pre>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. inet6 and instance options introduced in Junos OS Release 10.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series. Support for bidirectional PIM added in Junos OS Release 12.1.
Description	Display information about Protocol Independent Multicast (PIM) neighbors.
Options	<p>none—(Same as brief) Display standard information about PIM neighbors for all supported family addresses for all routing instances.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>inet inet6—(Optional) Display information about PIM neighbors for IPv4 or IPv6 family addresses, respectively.</p> <p>instance <i>instance-name</i>—(Optional) Display information about neighbors for the specified PIM-enabled routing instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show pim neighbors on page 632 show pim neighbors brief on page 632 show pim neighbors instance on page 632 show pim neighbors detail on page 632 show pim neighbors detail (With BFD) on page 633
Output Fields	Table 17 on page 631 describes the output fields for the show pim neighbors command. Output fields are listed in the approximate order in which they appear.

Table 17: show pim neighbors Output Fields

Field Name	Field Description	Level of Output
Instance	Name of the routing instance.	All levels
Interface	Interface through which the neighbor is reachable.	All levels
Neighbor addr	Address of the neighboring PIM routing device.	All levels
IP	IP version: 4 or 6.	All levels
V	PIM version running on the neighbor: 1 or 2.	All levels
Mode	PIM mode of the neighbor: Sparse , Dense , SparseDense , or Unknown . When the neighbor is running PIM version 2, this mode is always Unknown .	All levels
Option	Can be one or more of the following: <ul style="list-style-type: none"> • B—Bidirectional Capable. • H—Hello Option Holdtime. • G—Generation Identifier. • P—Hello Option DR Priority. • L—Hello Option LAN Prune Delay. 	brief none
Uptime	Time the neighbor has been operational since the PIM process was last initialized, in the format dd:hh:mm:ss ago for less than a week and nwnd:hh:mm:ss ago for more than a week.	All levels
Address	Address of the neighboring PIM router.	detail
BFD	Status and operational state of the Bidirectional Forwarding Detection (BFD) protocol on the interface: Enabled , Operational state is up , or Disabled .	detail
Hello Option Holdtime	Time for which the neighbor is available, in seconds. The range of values is 0 through 65,535.	detail
Hello Default Holdtime	Default holdtime and the time remaining if the holdtime option is not in the received hello message.	detail
Hello Option DR Priority	Designated router election priority. The range of values is 0 through 255.	detail
Hello Option Generation ID	9-digit or 10-digit number used to tag hello messages.	detail
Hello Option Bi-Directional PIM supported	Neighbor can process bidirectional PIM messages.	detail
Hello Option LAN Prune Delay	Time to wait before the neighbor receives prune messages, in the format delay nnn ms override nnnn ms .	detail

Table 17: show pim neighbors Output Fields (*continued*)

Field Name	Field Description	Level of Output
Join Suppression supported	Neighbor is capable of join suppression.	detail
Rx Join	Information about joins received from the neighbor. <ul style="list-style-type: none"> • Group—Group addresses in the join message. • Source—Address of the source in the join message. • Timeout—Time for which the join is valid. 	detail

Sample Output

show pim neighbors

```

user@host> show pim neighbors
Instance: PIM.master
B = Bidirectional Capable, G = Generation Identifier,
H = Hello Option Holdtime, L = Hello Option LAN Prune Delay,
P = Hello Option DR Priority

Interface      IP V Mode      Option      Uptime Neighbor addr
so-1/0/0.0      4 2            HPLG        00:07:10 10.111.10.2

```

show pim neighbors brief

The output for the **show pim neighbors brief** command is identical to that for the **show pim neighbors** command. For sample output, see [show pim neighbors on page 632](#).

show pim neighbors instance

```

user@host> show pim neighbors instance VPN-A
Instance: PIM.VPN-A
B = Bidirectional Capable, G = Generation Identifier,
H = Hello Option Holdtime, L = Hello Option LAN Prune Delay,
P = Hello Option DR Priority

Interface      IP V Mode      Option      Uptime Neighbor addr
at-0/3/1.0      4 2            HPLG        00:07:54 10.111.30.2
mt-1/1/0.32768  4 2            HPLG        00:07:22 10.10.47.101
so-1/0/1.0      4 2            HPLG        00:07:50 10.111.20.2

```

show pim neighbors detail

```

user@host> show pim neighbors detail
Instance: PIM.master
Interface: ge-0/0/1.0

Address: 10.10.1.1, IPv4, PIM v2, Mode: SparseDense, sg Join Count: 0, ts
Join Count: 2
Hello Option Holdtime: 65535 seconds
Hello Option DR Priority: 1
Hello Option Generation ID: 2053759302
Hello Option Bi-Directional PIM supported
Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
Join Suppression supported

```



```

Address: 10.10.1.2, IPv4, PIM v2, sg Join Count: 0, tsg Join Count: 2
  BFD: Disabled
  Hello Option Holdtime: 105 seconds 93 remaining
  Hello Option DR Priority: 1
  Hello Option Generation ID: 1734018161
  Hello Option Bi-Directional PIM supported
  Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
                                Join Suppression supported

```

Interface: lo0.0

```

Address: 10.255.179.246, IPv4, PIM v2, Mode: SparseDense, sg Join Count:
0, tsg Join Count: 0
  Hello Option Holdtime: 65535 seconds
  Hello Option DR Priority: 1
  Hello Option Generation ID: 1997462267
  Hello Option Bi-Directional PIM supported
  Hello Option LAN Prune Delay: delay 500 ms override 2000 ms
                                Join Suppression supported

```

show pim neighbors detail (With BFD)

```
user@host> show pim neighbors detail
```

Instance: PIM.master

Interface: fe-1/0/0.0

```

Address: 192.168.11.1, IPv4, PIM v2, Mode: Sparse
  Hello Option Holdtime: 65535 seconds
  Hello Option DR Priority: 1
  Hello Option Generation ID: 836607909
  Hello Option LAN Prune Delay: delay 500 ms override 2000 ms

```

```

Address: 192.168.11.2, IPv4, PIM v2
  BFD: Enabled, Operational state is up
  Hello Default Holdtime: 105 seconds 104 remaining
  Hello Option DR Priority: 1
  Hello Option Generation ID: 1907549685
  Hello Option LAN Prune Delay: delay 500 ms override 2000 ms

```

Interface: fe-1/0/1.0

```

Address: 192.168.12.1, IPv4, PIM v2
  BFD: Disabled
  Hello Default Holdtime: 105 seconds 80 remaining
  Hello Option DR Priority: 1
  Hello Option Generation ID: 1971554705
  Hello Option LAN Prune Delay: delay 500 ms override 2000 ms

```

show pim rps

List of Syntax	Syntax on page 634 Syntax (EX Series Switch and the QFX Series) on page 634
Syntax	<pre>show pim rps <brief detail extensive> <group-address> <inet inet6> <instance instance-name> <logical-system (all logical-system-name)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show pim rps <brief detail extensive> <group-address> <inet inet6> <instance instance-name></pre>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. inet6 and instance options introduced in Junos OS Release 10.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series. Support for bidirectional PIM added in Junos OS Release 12.1.
Description	Display information about Protocol Independent Multicast (PIM) rendezvous points (RPs).
Options	<p>none—Display standard information about PIM RPs for all groups and family addresses for all routing instances.</p> <p>brief detail extensive—(Optional) Display the specified level of output.</p> <p>group-address—(Optional) Display the RPs for a particular group. If you specify a group address, the output lists the routing device that is the RP for that group.</p> <p>inet inet6—(Optional) Display information for IPv4 or IPv6 family addresses, respectively.</p> <p>instance instance-name—(Optional) Display information about RPs for a specific PIM-enabled routing instance.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none">• Example: Configuring Bidirectional PIM on page 54
List of Sample Output	show pim rps on page 637 show pim rps brief on page 637 show pim rps <group-address> (Bidirectional PIM) on page 637

[show pim rps <group-address> \(PIM Dense Mode\) on page 637](#)
[show pim rps <group-address> \(SSM Range Without asm-override-ssm Configured\) on page 637](#)
[show pim rps <group-address> \(SSM Range With asm-override-ssm Configured and a Sparse-Mode RP\) on page 638](#)
[show pim rps <group-address> \(SSM Range With asm-override-ssm Configured and a Bidirectional RP\) on page 638](#)
[show pim rps instance on page 638](#)
[show pim rps extensive \(PIM Sparse Mode\) on page 638](#)
[show pim rps extensive \(Bidirectional PIM\) on page 639](#)
[show pim rps extensive \(PIM Anycast RP in Use\) on page 639](#)

Output Fields [Table 18 on page 635](#) describes the output fields for the **show pim rps** command. Output fields are listed in the approximate order in which they appear.

Table 18: show pim rps Output Fields

Field Name	Field Description	Level of Output
Instance	Name of the routing instance.	All levels
Family or Address family	Name of the address family: inet (IPv4) or inet6 (IPv6).	All levels
RP address	Address of the rendezvous point.	All levels
Type	Type of RP: <ul style="list-style-type: none"> • auto-rp—Address of the RP known through the Auto-RP protocol. • bootstrap—Address of the RP known through the bootstrap router protocol (BSR). • embedded—Address of the RP known through an embedded RP (IPv6). • static—Address of RP known through static configuration. 	brief none
Holdtime	How long to keep the RP active, with time remaining, in seconds.	All levels
Timeout	How long until the local routing device determines the RP to be unreachable, in seconds.	All levels
Groups	Number of groups currently using this RP.	All levels
Group prefixes	Addresses of groups that this RP can span.	brief none
Learned via	Address and method by which the RP was learned.	detail extensive
Mode	The PIM mode of the RP: bidirectional or sparse. If a sparse and bidirectional RPs are configured with the same RP address, they appear as separate entries in both formats.	All levels
Time Active	How long the RP has been active, in the format hh:mm:ss .	detail extensive

Table 18: show pim rps Output Fields (*continued*)

Field Name	Field Description	Level of Output
Device Index	Index value of the order in which Junos OS finds and initializes the interface. For bidirectional RPs, the Device Index output field is omitted because bidirectional RPs do not require encapsulation and de-encapsulation interfaces.	detail extensive
Subunit	Logical unit number of the interface. For bidirectional RPs, the Subunit output field is omitted because bidirectional RPs do not require encapsulation and de-encapsulation interfaces.	detail extensive
Interface	Either the encapsulation or the de-encapsulation logical interface, depending on whether this routing device is a designated router (DR) facing an RP router, or is the local RP, respectively. For bidirectional RPs, the Interface output field is omitted because bidirectional RPs do not require encapsulation and de-encapsulation interfaces.	detail extensive
Group Ranges	Addresses of groups that this RP spans.	detail extensive <i>group-address</i>
Active groups using RP	Number of groups currently using this RP.	detail extensive
total	Total number of active groups for this RP.	detail extensive
Register State for RP	Current register state for each group: <ul style="list-style-type: none"> • Group—Multicast group address. • Source—Multicast source address for which the PIM register is sent or received, depending on whether this router is a designated router facing an RP router, or is the local RP, respectively: • First Hop—PIM-designated routing device that sent the Register message (the source address in the IP header). • RP Address—RP to which the Register message was sent (the destination address in the IP header). • State: On the designated router: <ul style="list-style-type: none"> • Send—Sending Register messages. • Probe—Sent a null register. If a Register-Stop message does not arrive in 5 seconds, the designated router resumes sending Register messages. • Suppress—Received a Register-Stop message. The designated router is waiting for the timer to resume before changing to Probe state. • On the RP: <ul style="list-style-type: none"> • Receive—Receiving Register messages. 	extensive
Anycast-PIM rpset	If anycast RP is configured, the addresses of the RPs in the set.	extensive
Anycast-PIM local address used	If anycast RP is configured, the local address used by the RP.	extensive

Table 18: show pim rps Output Fields (*continued*)

Field Name	Field Description	Level of Output
Anycast-PIM Register State	<p>If anycast RP is configured, the current register state for each group:</p> <ul style="list-style-type: none"> • Group—Multicast group address. • Source—Multicast source address for which the PIM register is sent or received, depending on whether this routing device is a designated router facing an RP router, or is the local RP, respectively. • Origin—How the information was obtained: <ul style="list-style-type: none"> • DIRECT—From a local attachment • MSDP—From the Multicast Source Discovery Protocol (MSDP) • DR—From the designated router 	extensive
RP selected	For sparse mode and bidirectional mode, the identity of the RP for the specified group address.	<i>group-address</i>

Sample Output

show pim rps

```

user@host> show pim rps
Instance: PIM.master
Address family INET
RP address      Type      Mode   Holdtime Timeout Groups  Group prefixes
10.10.1.3       static   bidir   150     None     2  224.1.3.0/24
                225.1.3.0/24
10.10.13.2      static   bidir   150     None     2  224.1.1.0/24
                225.1.1.0/24

```

show pim rps brief

The output for the **show pim rps brief** command is identical to that for the **show pim rps** command. For sample output, see [show pim rps on page 637](#).

show pim rps <group-address> (Bidirectional PIM)

```

user@host> show pim rps 224.1.1.1
Instance: PIM.master

224.1.0.0/16
  11.4.12.75 (Bidirectional)

RP selected: 11.4.12.75

```

show pim rps <group-address> (PIM Dense Mode)

```

user@host> show pim rps 224.1.1.1
Instance: PIM.master

Dense Mode active for group 224.1.1.1

```

show pim rps <group-address> (SSM Range Without asm-override-ssm Configured)

```

user@host> show pim rps 224.1.1.1

```

Instance: PIM.master

Source-specific Mode (SSM) active for group 224.1.1.1

show pim rps <group-address> (SSM Range With asm-override-ssm Configured and a Sparse-Mode RP)

user@host> show pim rps 224.1.1.1

Instance: PIM.master

Source-specific Mode (SSM) active with Sparse Mode ASM override for group 224.1.1.1

224.1.0.0/16
11.4.12.75

RP selected: 11.4.12.75

show pim rps <group-address> (SSM Range With asm-override-ssm Configured and a Bidirectional RP)

user@host> show pim rps 224.1.1.1

Instance: PIM.master

Source-specific Mode (SSM) active with Sparse Mode ASM override for group 224.1.1.1

224.1.0.0/16
11.4.12.75 (Bidirectional)

RP selected: (null)

show pim rps instance

user@host> show pim rps instance VPN-A

Instance: PIM.VPN-A

Address family INET

RP address	Type	Holdtime	Timeout	Groups	Group prefixes
10.10.47.100	static	0	None	1	224.0.0.0/4

Address family INET6

show pim rps extensive (PIM Sparse Mode)

user@host> show pim rps extensive

Instance: PIM.master

Family: INET

RP: 10.255.245.91

Learned via: static configuration

Time Active: 00:05:48

Holdtime: 45 with 36 remaining

Device Index: 122

Subunit: 32768

Interface: pd-6/0/0.32768

Group Ranges:

224.0.0.0/4, 36s remaining

Active groups using RP:

225.1.1.1

total 1 groups active

Register State for RP:

Group	Source	FirstHop	RP Address	State	Timeout
225.1.1.1	192.168.195.78	10.255.14.132	10.255.245.91	Receive	0

show pim rps extensive (Bidirectional PIM)

```

user@host> show pim rps extensive
Instance: PIM.master
Address family INET

RP: 10.10.1.3
Learned via: static configuration
Mode: Bidirectional
Time Active: 01:58:07
Holdtime: 150
Group Ranges:
    224.1.3.0/24
    225.1.3.0/24

RP: 10.10.13.2
Learned via: static configuration
Mode: Bidirectional
Time Active: 01:58:07
Holdtime: 150
Group Ranges:
    224.1.1.0/24
    225.1.1.0/24

```

show pim rps extensive (PIM Anycast RP in Use)

```

user@host> show pim rps extensive
Instance: PIM.master

Family: INET
RP: 10.10.10.2
Learned via: static configuration
Time Active: 00:54:52
Holdtime: 0
Device Index: 130
Subunit: 32769
Interface: pimd.32769
Group Ranges:
    224.0.0.0/4
Active groups using RP:
    224.10.10.10

    total 1 groups active

Anycast-PIM rpset:
    10.100.111.34
    10.100.111.17
    10.100.111.55

Anycast-PIM local address used: 10.100.111.1
Anycast-PIM Register State:

```

Group	Source	Origin
224.1.1.1	10.10.95.2	DIRECT
224.1.1.2	10.10.95.2	DIRECT
224.10.10.10	10.10.70.1	MSDP
224.10.10.11	10.10.70.1	MSDP
224.20.20.1	10.10.71.1	DR

```

Address family INET6

Anycast-PIM rpset:

```

```

                ab::1
                ab::2
Anycast-PIM local address used: cd::1

```

Anycast-PIM Register State:

Group	Source	Origin
::224.1.1.1	::10.10.95.2	DIRECT
::224.1.1.2	::10.10.95.2	DIRECT
::224.20.20.1	::10.10.71.1	DR

show pim source

List of Syntax	Syntax on page 641 Syntax (EX Series Switch and the QFX Series) on page 641
Syntax	<pre>show pim source <brief detail> <inet inet6> <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)> <source-prefix></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show pim source <brief detail> <inet inet6> <instance <i>instance-name</i>> <source-prefix></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>inet6 and instance options introduced in Junos OS Release 10.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Display information about the Protocol Independent Multicast (PIM) source reverse path forwarding (RPF) state.
Options	<p>none—Display standard information about the PIM RPF state for all supported family addresses for all routing instances.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>inet inet6—(Optional) Display information for IPv4 or IPv6 family addresses, respectively.</p> <p>instance <i>instance-name</i>—(Optional) Display information about the RPF state for a specific PIM-enabled routing instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p><i>source-prefix</i>—(Optional) Display the state for source RPF states in the given range.</p>
Required Privilege Level	view
List of Sample Output	show pim source on page 642 show pim source brief on page 642 show pim source detail on page 642
Output Fields	<p>Table 19 on page 642 describes the output fields for the show pim source command. Output fields are listed in the approximate order in which they appear.</p>

Table 19: show pim source Output Fields

Field Name	Field Description
Instance	Name of the routing instance.
Source	Address of the source or reverse path.
Prefix/length	Prefix and prefix length for the route used to reach the RPF address.
Upstream interface	RPF interface toward the source address.
Upstream Neighbor	Address of the RPF neighbor used to reach the source address.

Sample Output

show pim source

```

user@host> show pim source
Instance: PIM.master Family: INET

Source 10.255.14.144
  Prefix 10.255.14.144/32
  Upstream interface Local
  Upstream neighbor Local

Source 10.255.70.15
  Prefix 10.255.70.15/32
  Upstream interface so-1/0/0.0
  Upstream neighbor 10.111.10.2

Instance: PIM.master Family: INET6

```

show pim source brief

The output for the **show pim source brief** command is identical to that for the **show pim source** command. For sample output, see [show pim source on page 642](#).

show pim source detail

```

user@host> show pim source detail
Instance: PIM.master Family: INET

Source 10.255.14.144
  Prefix 10.255.14.144/32
  Upstream interface Local
  Upstream neighbor Local
  Active groups:228.0.0.0
    239.1.1.1
    239.1.1.1

Source 10.255.70.15
  Prefix 10.255.70.15/32
  Upstream interface so-1/0/0.0
  Upstream neighbor 10.111.10.2
  Active groups:239.1.1.1

```

Instance: PIM.master Family: INET6

show pim statistics

List of Syntax	Syntax on page 644 Syntax (EX Series Switch and the QFX Series) on page 644
Syntax	<pre>show pim statistics <inet inet6> <instance <i>instance-name</i>> <interface <i>interface-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show pim statistics <inet inet6> <instance <i>instance-name</i>> <interface <i>interface-name</i>></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>inet6 and instance options introduced in Junos OS Release 10.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.3 for the QFX Series.</p> <p>Support for bidirectional PIM added in Junos OS Release 12.1.</p>
Description	Display Protocol Independent Multicast (PIM) statistics.
Options	<p>none—Display PIM statistics.</p> <p>inet inet6—(Optional) Display IPv4 or IPv6 PIM statistics, respectively.</p> <p>instance <i>instance-name</i>—(Optional) Display statistics for a specific routing instance enabled by Protocol Independent Multicast (PIM).</p> <p>interface <i>interface-name</i>—(Optional) Display statistics about the specified interface.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none">• clear pim statistics on page 606
List of Sample Output	<p>show pim statistics on page 650</p> <p>show pim statistics inet interface <interface-name> on page 651</p> <p>show pim statistics inet6 interface <interface-name> on page 652</p> <p>show pim statistics interface <interface-name> on page 652</p>
Output Fields	<p>Table 20 on page 645 describes the output fields for the show pim statistics command. Output fields are listed in the approximate order in which they appear.</p>

Table 20: show pim statistics Output Fields

Field Name	Field Description
Instance	<p>Name of the routing instance.</p> <p>This field only appears if you specify an interface, for example:</p> <ul style="list-style-type: none"> • inet interface <i>interface-name</i> • inet6 interface <i>interface-name</i> • interface <i>interface-name</i>
Family	<p>Output is for IPv4 or IPv6 PIM statistics. INET indicates IPv4 statistics, and INET6 indicates IPv6 statistics.</p> <p>This field only appears if you specify an interface, for example:</p> <ul style="list-style-type: none"> • inet interface <i>interface-name</i> • inet6 interface <i>interface-name</i> • interface <i>interface-name</i>
PIM statistics	PIM statistics for all interfaces or for the specified interface.
PIM message type	Message type for which statistics are displayed.
Received	Number of received statistics.
Sent	Number of messages sent of a certain type.
Rx errors	Number of received packets that contained errors.
V2 Hello	PIM version 2 hello packets.
V2 Register	PIM version 2 register packets.
V2 Register Stop	PIM version 2 register stop packets.
V2 Join Prune	PIM version 2 join and prune packets.
V2 Bootstrap	PIM version 2 bootstrap packets.
V2 Assert	PIM version 2 assert packets.
V2 Graft	PIM version 2 graft packets.
V2 Graft Ack	PIM version 2 graft acknowledgment packets.
V2 Candidate RP	PIM version 2 candidate RP packets.

Table 20: show pim statistics Output Fields (*continued*)

Field Name	Field Description
V2 State Refresh	PIM version 2 control messages related to PIM dense mode (PIM-DM) state refresh. State refresh is an extension to PIM-DM. It not supported in Junos OS.
V2 DF Election	PIM version 2 send and receive messages associated with bidirectional PIM designated forwarder election.
V1 Query	PIM version 1 query packets.
V1 Register	PIM version 1 register packets.
V1 Register Stop	PIM version 1 register stop packets.
V1 Join Prune	PIM version 1 join and prune packets.
V1 RP Reachability	PIM version 1 RP reachability packets.
V1 Assert	PIM version 1 assert packets.
V1 Graft	PIM version 1 graft packets.
V1 Graft Ack	PIM version 1 graft acknowledgment packets.
AutoRP Announce	Auto-RP announce packets.
AutoRP Mapping	Auto-RP mapping packets.
AutoRP Unknown type	Auto-RP packets with an unknown type.
Anycast Register	Auto-RP announce packets.
Anycast Register Stop	Auto-RP announce packets.
Global Statistics	Summary of PIM statistics for all interfaces.
Hello dropped on neighbor policy	Number of hello packets dropped because of a configured neighbor policy.
Unknown type	Number of PIM control packets received with an unknown type.
V1 Unknown type	Number of PIM version 1 control packets received with an unknown type.
Unknown Version	Number of PIM control packets received with an unknown version. The version is not version 1 or version 2.

Table 20: show pim statistics Output Fields (*continued*)

Field Name	Field Description
Neighbor unknown	Number of PIM control packets received (excluding PIM hello) without first receiving the hello packet.
Bad Length	Number of PIM control packets received for which the packet size does not match the PIM length field in the packet.
Bad Checksum	Number of PIM control packets received for which the calculated checksum does not match the checksum field in the packet.
Bad Receive If	Number of PIM control packets received on an interface that does not have PIM configured.
Rx Bad Data	Number of PIM control packets received that contain data for TCP Bad register packets.
Rx Intf disabled	Number of PIM control packets received on an interface that has PIM disabled.
Rx V1 Require V2	Number of PIM version 1 control packets received on an interface configured for PIM version 2.
Rx V2 Require V1	Number of PIM version 2 control packets received on an interface configured for PIM version 1.
Rx Register not RP	Number of PIM register packets received when the router is not the RP for the group.
Rx Register no route	Number of PIM register packets received when the RP does not have a unicast route back to the source.
Rx Register no decap if	Number of PIM register packets received when the RP does not have a de-encapsulation interface.
Null Register Timeout	Number of NULL register timeout packets.
RP Filtered Source	Number of PIM packets received when the router has a source address filter configured for the RP.
Rx Unknown Reg Stop	Number of register stop messages received with an unknown type.
Rx Join/Prune no state	Number of join and prune messages received for which the router has no state.
Rx Join/Prune on upstream if	Number of join and prune messages received on the interface used to reach the upstream router, toward the RP.
Rx Join/Prune for invalid group	Number of join or prune messages received for invalid multicast group addresses.

Table 20: show pim statistics Output Fields (*continued*)

Field Name	Field Description
Rx Join/Prune messages dropped	Number of join and prune messages received and dropped.
Rx sparse join for dense group	Number of PIM sparse mode join messages received for a group that is configured for dense mode.
Rx Graft/Graft Ack no state	Number of graft and graft acknowledgment messages received for which the router or switch has no state.
Rx Graft on upstream if	Number of graft messages received on the interface used to reach the upstream router, toward the RP.
Rx CRP not BSR	Number of BSR messages received in which the PIM message type is Candidate-RP-Advertisement, not Bootstrap.
Rx BSR when BSR	Number of BSR messages received in which the PIM message type is Bootstrap.
Rx BSR not RPF if	Number of BSR messages received on an interface that is not the RPF interface.
Rx unknown hello opt	Number of PIM hello packets received with options that Junos OS does not support.
Rx data no state	Number of PIM control packets received for which the router has no state for the data type.
Rx RP no state	Number of PIM control packets received for which the router has no state for the RP.
Rx aggregate	Number of PIM aggregate MDT packets received.
Rx malformed packet	Number of PIM control packets received with a malformed IP unicast or multicast address family.
No RP	Number of PIM control packets received with no RP address.
No register encaps if	Number of PIM register packets received when the first-hop router does not have an encapsulation interface.
No route upstream	Number of PIM control packets received when the router does not have a unicast route to the the interface used to reach the upstream router, toward the RP.
Nexthop Unusable	Number of PIM control packets with an unusable nexthop. A path can be unusable if the route is hidden or the link is down.
RP mismatch	Number of PIM control packets received for which the router has an RP mismatch.

Table 20: show pim statistics Output Fields (*continued*)

Field Name	Field Description
RP mode mismatch	RP mode (sparse or bidirectional) mismatches encountered when processing join and prune messages.
RPF neighbor unknown	Number of PIM control packets received for which the router has an unknown RPF neighbor for the source.
Rx Joins/Prunes filtered	The number of join and prune messages filtered because of configured route filters and source address filters.
Tx Joins/Prunes filtered	The number of join and prune messages filtered because of configured route filters and source address filters.
Embedded-RP invalid addr	Number of packets received with an invalid embedded RP address in PIM join messages and other types of messages sent between routing domains.
Embedded-RP limit exceed	Number of times the limit configured with the maximum-rps statement is exceeded. The maximum-rps statement limits the number of embedded RPs created in a specific routing instance. The range is from 1 through 500. The default is 100.
Embedded-RP added	<p>Number of packets in which the embedded RP for IPv6 is added.</p> <p>The following receive events trigger extraction of an IPv6 embedded RP address on the router:</p> <ul style="list-style-type: none"> • Multicast Listener Discovery (MLD) report for an embedded RP multicast group address • PIM join message with an embedded RP multicast group address • Static embedded RP multicast group address associated with an interface • Packets sent to an embedded RP multicast group address received on the DR <p>An embedded RP node discovered through these receive events is added if it does not already exist on the routing platform.</p>
Embedded-RP removed	Number of packets in which the embedded RP for IPv6 is removed. The embedded RP is removed whenever all PIM join states using this RP are removed or the configuration changes to remove the embedded RP feature.
Rx Register msgs filtering drop	Number of received register messages dropped because of a filter configured for PIM register messages.
Tx Register msgs filtering drop	Number of register messages dropped because of a filter configured for PIM register messages.
Rx Bidir Join/Prune on non-Bidir if	Error counter for join and prune messages received on non-bidirectional PIM interfaces.

Table 20: show pim statistics Output Fields (*continued*)

Field Name	Field Description
Rx Bidir Join/Prune on non-DF if	Error counter for join and prune messages received on non-designated forwarder interfaces.

Sample Output

show pim statistics

```

user@host> show pim statistics
PIM Message type      Received      Sent      Rx errors
V2 Hello               15           32         0
V2 Register            0           362        0
V2 Register Stop       483          0         0
V2 Join Prune          18          518        0
V2 Bootstrap           0            0         0
V2 Assert              0            0         0
V2 Graft               0            0         0
V2 Graft Ack           0            0         0
V2 Candidate RP        0            0         0
V2 State Refresh       0            0         0
V2 DF Election         0            0         0
V1 Query               0            0         0
V1 Register            0            0         0
V1 Register Stop       0            0         0
V1 Join Prune          0            0         0
V1 RP Reachability     0            0         0
V1 Assert              0            0         0
V1 Graft               0            0         0
V1 Graft Ack           0            0         0
AutoRP Announce        0            0         0
AutoRP Mapping         0            0         0
AutoRP Unknown type    0            0         0
Anycast Register       0            0         0
Anycast Register Stop  0            0         0

```

Global Statistics

```

Hello dropped on neighbor policy    0
Unknown type                        0
V1 Unknown type                     0
Unknown Version                     0
Neighbor unknown                    0
Bad Length                          0
Bad Checksum                        0
Bad Receive If                      0
Rx Bad Data                         0
Rx Intf disabled                     0
Rx V1 Require V2                     0
Rx V2 Require V1                     0
Rx Register not RP                   0
Rx Register no route                 0
Rx Register no decap if              0
Null Register Timeout                0
RP Filtered Source                   0
Rx Unknown Reg Stop                  0
Rx Join/Prune no state                0

```

Rx Join/Prune on upstream if	0
Rx Join/Prune for invalid group	5
Rx Join/Prune messages dropped	0
Rx sparse join for dense group	0
Rx Graft/Graft Ack no state	0
Rx Graft on upstream if	0
Rx CRP not BSR	0
Rx BSR when BSR	0
Rx BSR not RPF if	0
Rx unknown hello opt	0
Rx data no state	0
Rx RP no state	0
Rx aggregate	0
Rx malformed packet	0
Rx illegal TTL	0
Rx illegal destination address	0
No RP	0
No register encap if	0
No route upstream	0
Nexthop Unusable	0
RP mismatch	0
RP mode mismatch	0
RPF neighbor unknown	0
Rx Joins/Prunes filtered	0
Tx Joins/Prunes filtered	0
Embedded-RP invalid addr	0
Embedded-RP limit exceed	0
Embedded-RP added	0
Embedded-RP removed	0
Rx Register msgs filtering drop	0
Tx Register msgs filtering drop	0
Rx Bidir Join/Prune on non-Bidir if	0
Rx Bidir Join/Prune on non-DF if	0

Sample Output

show pim statistics inet interface <interface-name>

```
user@host> show pim statistics inet interface ge-0/3/0.0
Instance: PIM.master Family: INET
```

PIM Interface statistics for ge-0/3/0.0

PIM Message type	Received	Sent	Rx errors
V2 Hello	0	4	0
V2 Register	0	0	0
V2 Register Stop	0	0	0
V2 Join Prune	0	0	0
V2 Bootstrap	0	0	0
V2 Assert	0	0	0
V2 Graft	0	0	0
V2 Graft Ack	0	0	0
V2 Candidate RP	0	0	0
V1 Query	0	0	0
V1 Register	0	0	0
V1 Register Stop	0	0	0
V1 Join Prune	0	0	0
V1 RP Reachability	0	0	0
V1 Assert	0	0	0
V1 Graft	0	0	0
V1 Graft Ack	0	0	0

AutoRP Announce	0	0	0
AutoRP Mapping	0	0	0
AutoRP Unknown type	0		
Anycast Register	0	0	0
Anycast Register Stop	0	0	0

Sample Output

show pim statistics inet6 interface <interface-name>

```
user@host> show pim statistics inet6 interface ge-0/3/0.0
Instance: PIM.master Family: INET6
```

PIM Interface statistics for ge-0/3/0.0

PIM Message type	Received	Sent	Rx errors
V2 Hello	0	4	0
V2 Register	0	0	0
V2 Register Stop	0	0	0
V2 Join Prune	0	0	0
V2 Bootstrap	0	0	0
V2 Assert	0	0	0
V2 Graft	0	0	0
V2 Graft Ack	0	0	0
V2 Candidate RP	0	0	0
Anycast Register	0	0	0
Anycast Register Stop	0	0	0

Sample Output

show pim statistics interface <interface-name>

```
user@host> show pim statistics interface ge-0/3/0.0
Instance: PIM.master Family: INET
```

PIM Interface statistics for ge-0/3/0.0

PIM Message type	Received	Sent	Rx errors
V2 Hello	0	3	0
V2 Register	0	0	0
V2 Register Stop	0	0	0
V2 Join Prune	0	0	0
V2 Bootstrap	0	0	0
V2 Assert	0	0	0
V2 Graft	0	0	0
V2 Graft Ack	0	0	0
V2 Candidate RP	0	0	0
V1 Query	0	0	0
V1 Register	0	0	0
V1 Register Stop	0	0	0
V1 Join Prune	0	0	0
V1 RP Reachability	0	0	0
V1 Assert	0	0	0
V1 Graft	0	0	0
V1 Graft Ack	0	0	0
AutoRP Announce	0	0	0
AutoRP Mapping	0	0	0
AutoRP Unknown type	0		
Anycast Register	0	0	0
Anycast Register Stop	0	0	0

Instance: PIM.master Family: INET6

PIM Interface statistics for ge-0/3/0.0

PIM Message type	Received	Sent	Rx errors
V2 Hello	0	3	0
V2 Register	0	0	0
V2 Register Stop	0	0	0
V2 Join Prune	0	0	0
V2 Bootstrap	0	0	0
V2 Assert	0	0	0
V2 Graft	0	0	0
V2 Graft Ack	0	0	0
V2 Candidate RP	0	0	0
Anycast Register	0	0	0
Anycast Register Stop	0	0	0

CHAPTER 26

Multicast Routing Options Operational Commands

- `show multicast backup-pe-groups`
- `show multicast flow-map`
- `show multicast interface`
- `show multicast route`
- `show multicast rpf`
- `show multicast scope`
- `show multicast sessions`
- `show policy`

show multicast backup-pe-groups

Syntax	show multicast backup-pe-groups <address <i>pe-address</i> > <group <i>group-name</i> > <instance <i>instance-name</i> > <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced in Junos OS Release 9.0.
Description	Display backup PE router group information when ingress PE redundancy is configured. Ingress PE redundancy provides a backup resource when point-to-multipoint LSPs are configured for multicast distribution.
Options	<p>none—Display standard information about all backup PE groups.</p> <p>address <i>pe-address</i>—(Optional) Display the groups that a PE address is associated with.</p> <p>group <i>group</i>—(Optional) Display the backup PE group information for a particular group.</p> <p>instance <i>instance-name</i>—(Optional) Display backup PE group information for a specific multicast instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show multicast backup-pe-groups on page 657
Output Fields	Table 21 on page 656 describes the output fields for the show multicast backup-pe-groups command. Output fields are listed in the approximate order in which they appear.

Table 21: show multicast backup-pe-groups Output Fields

Field Name	Field Description
Backup PE Group	Group name.
Designated PE	Primary PE router. Address of the PE router that is currently forwarding traffic on the static route.
Transitions	Number of times that the designated PE router has transitioned from the most eligible PE router to a backup PE router and back again to the most eligible PE router.
Last Transition	Time of the most recent transition.
Local Address	Address of the local PE router.
Backup PE List	List of PE routers that are configured to be backups for the group.

Sample Output

show multicast backup-pe-groups

```
user@host> show multicast backup-pe-groups
Instance: master

Backup PE group: b1
  Designated PE: 10.255.165.7
  Transitions: 1
  Last Transition: 03:15:01
  Local Address: 10.255.165.7
  Backup PE List:
    10.255.165.8

Backup PE group: b2
  Designated PE: 10.255.165.7
  Transitions: 2
  Last Transition: 02:58:20
  Local Address: 10.255.165.7
  Backup PE List:
    10.255.165.9
    10.255.165.8
```

show multicast flow-map

List of Syntax	Syntax on page 658 Syntax (EX Series Switch and the QFX Series) on page 658
Syntax	show multicast flow-map <brief detail> <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switch and the QFX Series)	show multicast flow-map <brief detail>
Release Information	Command introduced in Junos OS Release 8.2. Command introduced in Junos OS Release 9.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	Display configuration information about IP multicast flow maps.
Options	none —Display configuration information about IP multicast flow maps on all systems. brief detail —(Optional) Display the specified level of output. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
List of Sample Output	show multicast flow-map on page 659 show multicast flow-map detail on page 659
Output Fields	Table 22 on page 658 describes the output fields for the show multicast flow-map command. Output fields are listed in the approximate order in which they appear.

Table 22: show multicast flow-map Output Fields

Field Name	Field Description	Levels of Output
Name	Name of the flow map.	All levels
Policy	Name of the policy associated with the flow map.	All levels
Cache-timeout	Cache timeout value assigned to the flow map.	All levels
Bandwidth	Bandwidth setting associated with the flow map.	All levels
Adaptive	Whether or not adaptive mode is enabled for the flow map.	none
Flow-map	Name of the flow map.	detail

Table 22: show multicast flow-map Output Fields (*continued*)

Field Name	Field Description	Levels of Output
Adaptive Bandwidth	Whether or not adaptive mode is enabled for the flow map.	detail
Redundant Sources	Redundant sources defined for the same destination group.	detail

Sample Output

show multicast flow-map

```

user@host> show multicast flow-map
Instance: master
Name          Policy          Cache timeout    Bandwidth Adaptive
map2          policy2         never            2000000 no
map1          policy1         60 seconds      2000000 no

```

Sample Output

show multicast flow-map detail

```

user@host> show multicast flow-map detail
Instance: master
Flow-map: map1
  Policy:          policy1
  Cache Timeout:   600 seconds
  Bandwidth:       2000000
  Adaptive Bandwidth: yes
  Redundant Sources: 11.11.11.11
  Redundant Sources: 11.11.11.12
  Redundant Sources: 11.11.11.13

```

show multicast interface

List of Syntax	Syntax on page 660 Syntax (EX Series Switch and the QFX Series) on page 660
Syntax	show multicast interface <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switch and the QFX Series)	show multicast interface
Release Information	Command introduced in Junos OS Release 8.3. Command introduced in Junos OS Release 9.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	Display bandwidth information about IP multicast interfaces.
Options	none —Display all interfaces that have multicast configured. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
List of Sample Output	show multicast interface on page 661
Output Fields	Table 23 on page 660 describes the output fields for the show multicast interface command. Output fields are listed in the approximate order in which they appear.

Table 23: show multicast interface Output Fields

Field Name	Field Description
Interface	Name of the multicast interface.
Maximum bandwidth (bps)	Maximum bandwidth setting, in bits per second, for this interface.
Remaining bandwidth (bps)	Amount of bandwidth, in bits per second, remaining on the interface.
Mapped bandwidth deduction (bps)	Amount of bandwidth, in bits per second, used by any flows that are mapped to the interface. NOTE: Adding the mapped bandwidth deduction value to the local bandwidth deduction value results in the total deduction value for the interface. This field does not appear in the output when the no QoS adjustment feature is disabled.

Table 23: show multicast interface Output Fields (*continued*)

Field Name	Field Description
Local bandwidth deduction (bps)	<p>Amount of bandwidth, in bits per second, used by any mapped flows that are traversing the interface.</p> <p>NOTE: Adding the mapped bandwidth deduction value to the local bandwidth deduction value results in the total deduction value for the interface.</p> <p>This field does not appear in the output when the no QoS adjustment feature is disabled.</p>
Reverse OIF mapping	<p>State of the reverse OIF mapping feature (on or off).</p> <p>NOTE: This field does not appear in the output when the no QoS adjustment feature is disabled.</p>
Reverse OIF mapping no QoS adjustment	<p>State of the no QoS adjustment feature (on or off) for interfaces that are using reverse OIF mapping.</p> <p>NOTE: This field does not appear in the output when the no QoS adjustment feature is disabled.</p>
Leave timer	<p>Amount of time a mapped interface remains active after the last mapping ends.</p> <p>NOTE: This field does not appear in the output when the no QoS adjustment feature is disabled.</p>
No QoS adjustment	<p>State (on) of the no QoS adjustment feature when this feature is enabled.</p> <p>NOTE: This field does not appear in the output when the no QoS adjustment feature is disabled.</p>

Sample Output

show multicast interface

```

user@host> show multicast interface
Interface           Maximum bandwidth (bps) Remaining bandwidth (bps)
fe-0/0/3            10000000                0
fe-0/0/3.210        10000000                -2000000
fe-0/0/3.220        100000000               100000000
fe-0/0/3.230        20000000                18000000
fe-0/0/2.200        100000000               100000000

```

show multicast route

List of Syntax [Syntax on page 662](#)
 [Syntax \(EX Series Switch and the QFX Series\) on page 662](#)

Syntax show multicast route
 <brief | detail | extensive | summary>
 <active | all | inactive>
 <group *group*>
 <inet | inet6>
 <instance *instance name*>
 <logical-system (all | *logical-system-name*)>
 <*regular-expression*>
 <source-prefix *source-prefix*>

Syntax (EX Series Switch and the QFX Series) show multicast route
 <brief | detail | extensive | summary>
 <active | all | inactive>
 <group *group*>
 <inet | inet6>
 <instance *instance name*>
 <*regular-expression*>
 <source-prefix *source-prefix*>

Release Information Command introduced before Junos OS Release 7.4.
 Command introduced in Junos OS Release 9.0 for EX Series switches.
 inet6 and **instance** options introduced in Junos OS Release 10.0 for EX Series switches.
 Command introduced in Junos OS Release 11.3 for the QFX Series.
 Support for bidirectional PIM added in Junos OS Release 12.1.

Description Display the entries in the IP multicast forwarding table. You can display similar information with the **show route table inet.1** command.

Options **none**—Display standard information about all entries in the multicast forwarding table for all routing instances.

brief | detail | extensive | summary—(Optional) Display the specified level of output.

active | all | inactive—(Optional) Display all active entries, all entries, or all inactive entries, respectively, in the multicast forwarding table.

group *group*—(Optional) Display the cache entries for a particular group.

inet | inet6—(Optional) Display multicast forwarding table entries for IPv4 or IPv6 family addresses, respectively.

instance *instance-name*—(Optional) Display entries in the multicast forwarding table for a specific multicast instance.

logical-system (all | *logical-system-name*)—(Optional) Perform this operation on all logical systems or on a particular logical system.

regular-expression—(Optional) Display information about the multicast forwarding table entries that match a UNIX OS-style regular expression.

source-prefix *source-prefix*—(Optional) Display the cache entries for a particular source prefix.

Required Privilege Level view

List of Sample Output [show multicast route on page 664](#)
[show multicast route \(Bidirectional PIM\) on page 665](#)
[show multicast route brief on page 665](#)
[show multicast route detail on page 665](#)
[show multicast route extensive \(Bidirectional PIM\) on page 666](#)
[show multicast route instance <instance-name> extensive on page 666](#)
[show multicast route summary on page 667](#)

Output Fields [Table 24 on page 663](#) describes the output fields for the **show multicast route** command. Output fields are listed in the approximate order in which they appear.

Table 24: show multicast route Output Fields

Field Name	Field Description	Level of Output
family	IPv4 address family (INET) or IPv6 address family (INET6).	All levels
Group	Group address. For any-source multicast routes, for example for bidirectional PIM, the group address includes the prefix length.	All levels
Source	Prefix and length of the source as it is in the multicast forwarding table.	All levels
Incoming interface list	List of interfaces that accept incoming traffic. Only shown for routes that do not use strict RPF-based forwarding, for example for bidirectional PIM.	All levels
Upstream interface	Name of the interface on which the packet with this source prefix is expected to arrive.	All levels
Downstream interface list	List of interface names to which the packet with this source prefix is forwarded.	All levels
Session description	Name of the multicast session.	detail extensive
Statistics	Rate at which packets are being forwarded for this source and group entry (in Kbps and pps), and number of packets that have been forwarded to this prefix. If one or more of the kilobits per second packet forwarding statistic queries fails or times out, the statistics field displays Forwarding statistics are not available . NOTE: On QFX Series switches, this field does not report valid statistics.	detail extensive
Next-hop ID	Next-hop identifier of the prefix. The identifier is returned by the routing device's Packet Forwarding Engine and is also displayed in the output of the show multicast nexthops command.	detail extensive

Table 24: show multicast route Output Fields (*continued*)

Field Name	Field Description	Level of Output
Incoming interface list ID	For bidirectional PIM, incoming interface list identifier. Identifiers for interfaces that accept incoming traffic. Only shown for routes that do not use strict RPF-based forwarding, for example for bidirectional PIM.	detail extensive
Upstream protocol	Protocol running on the interface on which the packet with this source prefix is expected to arrive.	detail extensive
Route type	Type of multicast route. Values can be (S,G) or (*,G).	summary
Route state	Whether the group is Active or Inactive .	summary extensive
Route count	Number of multicast routes.	summary
Forwarding state	Whether the prefix is pruned or forwarding.	extensive
Cache lifetime/timeout	Number of seconds until the prefix is removed from the multicast forwarding table. A value of never indicates a permanent forwarding entry. A value of forever indicates routes that do not have keepalive times.	extensive
Wrong incoming interface notifications	Number of times that the upstream interface was not available.	extensive
Uptime	Time since the creation of a multicast route.	extensive

Sample Output

show multicast route

```

user@host> show multicast route
Family: INET

Group: 228.0.0.0
Source: 10.255.14.144/32
Upstream interface: local
Downstream interface list:
so-1/0/0.0

Group: 239.1.1.1
Source: 10.255.14.144/32
Upstream interface: local
Downstream interface list:
so-1/0/0.0

Group: 239.1.1.1
Source: 10.255.70.15/32
Upstream interface: so-1/0/0.0
Downstream interface list:
mt-1/1/0.49152

Family: INET6

```


show multicast route (Bidirectional PIM)

```

user@host> show multicast route
Family: INET

Group: 224.1.1.0/24
Source: *
Incoming interface list:
  lo0.0 ge-0/0/1.0
Downstream interface list:
  ge-0/0/1.0

Group: 224.1.3.0/24
Source: *
Incoming interface list:
  lo0.0 ge-0/0/1.0 xe-4/1/0.0
Downstream interface list:
  ge-0/0/1.0

Group: 225.1.1.0/24
Source: *
Incoming interface list:
  lo0.0 ge-0/0/1.0
Downstream interface list:
  ge-0/0/1.0

Group: 225.1.3.0/24
Source: *
Incoming interface list:
  lo0.0 ge-0/0/1.0 xe-4/1/0.0
Downstream interface list:
  ge-0/0/1.0
Family: INET6

```

show multicast route brief

The output for the **show multicast route brief** command is identical to that for the **show multicast route** command. For sample output, see [show multicast route on page 664](#) or [show multicast route \(Bidirectional PIM\) on page 665](#).

show multicast route detail

```

user@host> show multicast route detail
Family: INET

Group: 228.0.0.0
Source: 10.255.14.144/32
Upstream interface: local
Downstream interface list:
  so-1/0/0.0
Session description: Unknown
Statistics: 8 kbps, 100 pps, 45272 packets
Next-hop ID: 262142
Upstream protocol: PIM

Group: 239.1.1.1
Source: 10.255.14.144/32
Upstream interface: local
Downstream interface list:
  so-1/0/0.0

```

Session description: Administratively Scoped
Statistics: 0 kbps, 0 pps, 13404 packets
Next-hop ID: 262142
Upstream protocol: PIM

Group: 239.1.1.1
Source: 10.255.70.15/32
Upstream interface: so-1/0/0.0
Downstream interface list:
 mt-1/1/0.49152
Session description: Administratively Scoped
Statistics: 46 kbps, 1000 pps, 921077 packets

Next-hop ID: 262143
Upstream protocol: PIM

Family: INET6

show multicast route extensive (Bidirectional PIM)

user@host> show multicast route extensive
Family: INET

Group: 224.1.1.0/24
Source: *
Incoming interface list:
 lo0.0 ge-0/0/1.0
Downstream interface list:
 ge-0/0/1.0
Session description: NOB Cross media facilities
Statistics: 0 kbps, 0 pps, 0 packets
Next-hop ID: 2097153
Incoming interface list ID: 585
Upstream protocol: PIM
Route state: Active
Forwarding state: Forwarding
Cache lifetime/timeout: forever
Wrong incoming interface notifications: 0

Group: 224.1.3.0/24
Source: *
Incoming interface list:
 lo0.0 ge-0/0/1.0 xe-4/1/0.0
Downstream interface list:
 ge-0/0/1.0
Session description: NOB Cross media facilities
Statistics: 0 kbps, 0 pps, 0 packets
Next-hop ID: 2097153
Incoming interface list ID: 589
Upstream protocol: PIM
Route state: Active
Forwarding state: Forwarding
Cache lifetime/timeout: forever
Wrong incoming interface notifications: 0

Family: INET6

show multicast route instance <instance-name> extensive

user@host> show multicast route instance mvpn extensive

```

Family: INET

Group: 239.10.10.10
  Source: 2.0.0.2/32
  Upstream interface: xe-0/0/0.102
  Downstream interface list:
    xe-10/3/0.0 xe-0/3/0.0 xe-0/0/0.106 xe-0/0/0.105
    xe-0/0/0.103 xe-0/0/0.104 xe-0/0/0.107 xe-0/0/0.108
  Session description: Administratively Scoped
  Statistics: 256 kbps, 3998 pps, 670150 packets
  Next-hop ID: 1048579
  Upstream protocol: MVPN
  Route state: Active
  Forwarding state: Forwarding
  Cache lifetime/timeout: forever
  Wrong incoming interface notifications: 58
  Uptime: 00:00:04

```

show multicast route summary

```

user@host>show multicast route summary
Instance: master Family: INET

Route type   Route state   Route count
(S,G)        Active        2
(S,G)        Inactive      3

Instance: master Family: INET6

```

show multicast rpf

List of Syntax	Syntax on page 668 Syntax (EX Series Switch and the QFX Series) on page 668
Syntax	<pre>show multicast rpf <inet inet6> <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)> <prefix> <summary></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show multicast rpf <inet inet6> <instance <i>instance-name</i>> <prefix> <summary></pre>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. inet6 and instance options introduced in Junos OS Release 10.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	Display information about multicast reverse-path-forwarding (RPF) calculations.
Options	<p>none—Display RPF calculation information for all supported address families.</p> <p>inet inet6—(Optional) Display the RPF calculation information for IPv4 or IPv6 family addresses, respectively.</p> <p>instance <i>instance-name</i>—(Optional) Display information about multicast RPF calculations for a specific multicast instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>prefix—(Optional) Display the RPF calculation information for the specified prefix.</p> <p>summary—(Optional) Display a summary of all multicast RPF information.</p>
Required Privilege Level	view
List of Sample Output	show multicast rpf on page 669 show multicast rpf inet6 on page 670 show multicast rpf prefix on page 671 show multicast rpf summary on page 671

Output Fields Table 25 on page 669 describes the output fields for the **show multicast rpf** command. Output fields are listed in the approximate order in which they appear.

Table 25: show multicast rpf Output Fields

Field Name	Field Description
Instance	Name of the routing instance. (Displayed when multicast is configured within a routing instance.)
Source prefix	Prefix and length of the source as it exists in the multicast forwarding table.
Protocol	How the route was learned.
Interface	Upstream RPF interface. NOTE: The displayed interface information does not apply to bidirectional PIM RP addresses. This is because the show multicast rpf command does not take into account equal-cost paths or the designated forwarder. For accurate upstream RPF interface information, always use the show pim join extensive command when bidirectional PIM is configured.
Neighbor	Upstream RPF neighbor. NOTE: The displayed neighbor information does not apply to bidirectional PIM. This is because the show multicast rpf command does not take into account equal-cost paths or the designated forwarder. For accurate upstream RPF neighbor information, always use the show pim join extensive command when bidirectional PIM is configured.

Sample Output

show multicast rpf

```

user@host> show multicast rpf

Multicast RPF table: inet.0, 12 entries

0.0.0.0/0
  Protocol: Static

10.255.14.132/32
  Protocol: Direct
  Interface: lo0.0

10.255.245.91/32
  Protocol: IS-IS
  Interface: so-1/1/1.0
  Neighbor: 192.168.195.21

127.0.0.1/32
Inactive172.16.0.0/12
Protocol: Static
Interface: fxp0.0

```

```
Neighbor: 192.168.14.254

192.168.0.0/16
Protocol: Static
Interface: fxp0.0
Neighbor: 192.168.14.254

192.168.14.0/24
Protocol: Direct
Interface: fxp0.0

192.168.14.132/32
Protocol: Local

192.168.195.20/30
Protocol: Direct
Interface: so-1/1/1.0

192.168.195.22/32
Protocol: Local

192.168.195.36/30
Protocol: IS-IS
Interface: so-1/1/1.0
Neighbor: 192.168.195.21
```

show multicast rpf inet6

```
user@host> show multicast rpf inet6

Multicast RPF table: inet6.0, 12 entries

::10.255.14.132/128
  Protocol: Direct
  Interface: lo0.0

::10.255.245.91/128
  Protocol: IS-IS
  Interface: so-1/1/1.0
  Neighbor: fe80::2a0:a5ff:fe28:2e8c

::192.168.195.20/126
  Protocol: Direct
  Interface: so-1/1/1.0

::192.168.195.22/128
  Protocol: Local

::192.168.195.36/126
  Protocol: IS-IS
  Interface: so-1/1/1.0
  Neighbor: fe80::2a0:a5ff:fe28:2e8c

::192.168.195.76/126
  Protocol: Direct
  Interface: fe-2/2/0.0

::192.168.195.77/128
  Protocol: Local
```

```
fe80::/64
Protocol: Direct
Interface: so-1/1/1.0

fe80::290:69ff:fe0c:993a/128
Protocol: Local

fe80::2a0:a5ff:fe12:84f/128
Protocol: Direct
Interface: lo0.0

ff02::2/128
Protocol: PIM

ff02::d/128
Protocol: PIM
```

show multicast rpf prefix

```
user@host> show multicast rpf ff02::/16

Multicast RPF table: inet6.0, 13 entries

ff02::2/128
    Protocol: PIM

ff02::d/128
    Protocol: PIM

...
```

show multicast rpf summary

```
user@host> show multicast rpf summary

Multicast RPF table: inet.0, 16 entries
Multicast RPF table: inet6.0, 12 entries
```

show multicast scope

List of Syntax	Syntax on page 672 Syntax (EX Series Switch and the QFX Series) on page 672
Syntax	<pre>show multicast scope <inet inet6> <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show multicast scope <inet inet6> <instance <i>instance-name</i>></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>inet6 and instance options introduced in Junos OS Release 10.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Display administratively scoped IP multicast information.
Options	<p>none—Display standard information about administratively scoped multicast information for all supported address families in all routing instances.</p> <p>inet inet6—(Optional) Display scoped multicast information for IPv4 or IPv6 family addresses, respectively.</p> <p>instance <i>instance-name</i>—(Optional) Display administratively scoped information for a specific multicast instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show multicast scope on page 673 show multicast scope inet on page 673 show multicast scope inet6 on page 673
Output Fields	<p>Table 26 on page 672 describes the output fields for the show multicast scope command. Output fields are listed in the approximate order in which they appear.</p>

Table 26: show multicast scope Output Fields

Field Name	Field Description
Scope name	Name of the multicast scope.
Group Prefix	Range of multicast groups that are scoped.
Interface	Interface that is the boundary of the administrative scope.

Table 26: show multicast scope Output Fields (*continued*)

Field Name	Field Description
Resolve Rejects	Number of kernel resolve rejects.

Sample Output

show multicast scope

```
user@host> show multicast scope
```

Scope name	Group Prefix	Interface	Resolve Rejects
232-net	232.232.0.0/16	fe-0/0/0.1	0
local	239.255.0.0/16	fe-0/0/0.1	0
local	ff05::/16	fe-0/0/0.1	0
larry	ff05::1234/128	fe-0/0/0.1	0

show multicast scope inet

```
user@host> show multicast scope inet
```

Scope name	Group Prefix	Interface	Resolve Rejects
232-net	232.232.0.0/16	fe-0/0/0.1	0
local	239.255.0.0/16	fe-0/0/0.1	0

show multicast scope inet6

```
user@host> show multicast scope inet6
```

Scope name	Group Prefix	Interface	Resolve Rejects
local	ff05::/16	fe-0/0/0.1	0
larry	ff05::1234/128	fe-0/0/0.1	0

show multicast sessions

List of Syntax	Syntax on page 674 Syntax (EX Series Switch and the QFX Series) on page 674
Syntax	show multicast sessions <brief detail extensive> <logical-system (all <i>logical-system-name</i>)> < <i>regular-expression</i> >
Syntax (EX Series Switch and the QFX Series)	show multicast sessions <brief detail extensive> < <i>regular-expression</i> >
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	Display information about announced IP multicast sessions.
Options	none —Display standard information about all multicast sessions for all routing instances. brief detail extensive —(Optional) Display the specified level of output. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system. <i>regular-expression</i> —(Optional) Display information about announced sessions that match a UNIX-style regular expression.
Required Privilege Level	view
List of Sample Output	show multicast sessions on page 675 show multicast sessions regular-expression detail on page 675
Output Fields	Table 27 on page 674 describes the output fields for the show multicast sessions command. Output fields are listed in the approximate order in which they appear.

Table 27: show multicast sessions Output Fields

Field Name	Field Description
<i>session-name</i>	Name of the known announced multicast sessions.

Sample Output

show multicast sessions

```

user@host> show multicast sessions
1-Department of Biological Sciences, LSU
...
Monterey Bay - DockCam
Monterey Bay - JettyCam
Monterey Bay - StandCam
Monterey DockCam
Monterey DockCam / ROV cam
...
NASA TV (MPEG-1)
...
UO Broadcast - NASA Videos - 25 Years of Progress
UO Broadcast - NASA Videos - Journey through the Solar System
UO Broadcast - NASA Videos - Life in the Universe
UO Broadcast - NASA Videos - Nasa and the Airplane
UO Broadcasts OPB's Oregon Story
UO DOD News Clips
UO Medical Management of Biological Casualties (1)
UO Medical Management of Biological Casualties (2)
UO Medical Management of Biological Casualties (3)
...
376 active sessions.

```

show multicast sessions regular-expression detail

```

user@host> show multicast sessions "NASA TV" detail
SDP Version: 0  Originated by: -@128.223.83.33
Session: NASA TV (MPEG-1)
Description: NASA television in MPEG-1 format, provided by Private University.
Please contact the UO if you have problems with this feed.
Email: Your Name Here <multicast@lists.private.edu>
Phone: Your Name Here <888/555-1212>
Bandwidth: AS:1000
Start time: permanent
Stop time: none
Attribute: type:broadcast
Attribute: tool:IP/TV Content Manager 3.4.14
Attribute: live:capture:1
Attribute: x-iptv-capture:mp1s
Media: video 54302 RTP/AVP 32 31 96 97
Connection Data: 224.2.231.45 ttl 127
Attribute: quality:8
Attribute: framerate:30
Attribute: rtpmap:96 WBIH/90000
Attribute: rtpmap:97 MP4V-ES/90000
Attribute: x-iptv-svr:video 128.223.91.191 live
Attribute: fmtp:32 type=mpeg1
Media: audio 28848 RTP/AVP 14 0 96 3 5 97 98 99 100 101 102 10 11 103 104 105 106
Connection Data: 224.2.145.37 ttl 127
Attribute: rtpmap:96 X-WAVE/8000
Attribute: rtpmap:97 L8/8000/2
Attribute: rtpmap:98 L8/8000
Attribute: rtpmap:99 L8/22050/2
Attribute: rtpmap:100 L8/22050
Attribute: rtpmap:101 L8/11025/2
Attribute: rtpmap:102 L8/11025
Attribute: rtpmap:103 L16/22050/2

```

Attribute: rtpmap:104 L16/22050

1 matching sessions.

show policy

List of Syntax	Syntax on page 677 Syntax (EX Series Switches) on page 677
Syntax	<pre>show policy <logical-system (all <i>logical-system-name</i>)> <<i>policy-name</i>></pre>
Syntax (EX Series Switches)	<pre>show policy <<i>policy-name</i>></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p>
Description	Display information about configured routing policies.
Options	<p>none—List the names of all configured routing policies.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p><i>policy-name</i>—(Optional) Show the contents of the specified policy.</p>
Required Privilege Level	view
List of Sample Output	show policy on page 677 show policy policy-name on page 678 show policy (Multicast Scoping) on page 678
Output Fields	<p>Table 28 on page 677 lists the output fields for the show policy command. Output fields are listed in the approximate order in which they appear.</p>

Table 28: show policy Output Fields

Field Name	Field Description
<i>policy-name</i>	Name of the policy listed.
<i>term</i>	Policy term listed.
<i>from</i>	Match condition for the policy.
<i>then</i>	Action for the policy.

Sample Output

show policy

```
user@host> show policy
```

```
Configured policies:
__vrf-export-red-internal__
__vrf-import-red-internal__
red-export
all_routes
```

show policy policy-name

```
user@host> show policy test-statics
Policy test-statics:
  from
    3.0.0.0/8  accept
    3.1.0.0/16  accept
  then reject
```

show policy (Multicast Scoping)

```
user@host> show policy test-statics
Policy test-statics:
  from
    multicast-scoping == 8
```

CHAPTER 27

IGMP Operational Commands

- `clear igmp membership`
- `clear igmp statistics`
- `show igmp group`
- `show igmp interface`
- `show multicast pim-to-igmp-proxy`
- `show igmp statistics`

clear igmp membership

List of Syntax	Syntax on page 680 Syntax (EX Series Switch and the QFX Series) on page 680
Syntax	<pre>clear igmp membership <group address-range> <interface interface-name> <logical-system (all logical-system-name)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>clear igmp membership <group address-range> <interface interface-name></pre>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	Clear Internet Group Management Protocol (IGMP) group members.
Options	<p>none—Clear all IGMP members on all interfaces and for all address ranges.</p> <p>group address-range—(Optional) Clear all IGMP members that are in a particular address range. An example of a range is 224.2/16. If you omit the destination prefix length, the default is /32.</p> <p>interface interface-name—(Optional) Clear all IGMP group members on an interface.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show igmp group on page 685• show igmp interface on page 689
List of Sample Output	clear igmp membership on page 680 clear igmp membership interface on page 681 clear igmp membership group on page 682
Output Fields	See show igmp group for an explanation of output fields.

Sample Output

clear igmp membership

The following sample output displays IGMP group information before and after the **clear igmp membership** command is entered:

```
user@host> show igmp group
```


Interface	Group	Last Reported	Timeout
so-0/0/0	224.2.127.253	10.1.128.1	186
so-0/0/0	224.2.127.254	10.1.128.1	186
so-0/0/0	239.255.255.255	10.1.128.1	187
so-0/0/0	224.1.127.255	10.1.128.1	188
local	224.0.0.6	(null)	0
local	224.0.0.5	(null)	0
local	224.2.127.254	(null)	0
local	239.255.255.255	(null)	0
local	224.0.0.2	(null)	0
local	224.0.0.13	(null)	0

```

user@host> clear igmp membership
Clearing Group Membership Info for so-0/0/0
Clearing Group Membership Info for so-1/0/0
Clearing Group Membership Info for so-2/0/0

```

```
user@host> show igmp group
```

Interface	Group	Last Reported	Timeout
local	224.0.0.6	(null)	0
local	224.0.0.5	(null)	0
local	224.2.127.254	(null)	0
local	239.255.255.255	(null)	0
local	224.0.0.2	(null)	0
local	224.0.0.13	(null)	0

clear igmp membership interface

The following sample output displays IGMP group information before and after the **clear igmp membership interface** command is issued:

```
user@host> show igmp group
```

Interface	Group	Last Reported	Timeout
so-0/0/0	224.2.127.253	10.1.128.1	210
so-0/0/0	239.255.255.255	10.1.128.1	210
so-0/0/0	224.1.127.255	10.1.128.1	215
so-0/0/0	224.2.127.254	10.1.128.1	216
local	224.0.0.6	(null)	0
local	224.0.0.5	(null)	0
local	224.2.127.254	(null)	0
local	239.255.255.255	(null)	0
local	224.0.0.2	(null)	0
local	224.0.0.13	(null)	0

```

user@host> clear igmp membership interface so-0/0/0
Clearing Group Membership Info for so-0/0/0

```

```
user@host> show igmp group
```

Interface	Group	Last Reported	Timeout
local	224.0.0.6	(null)	0
local	224.0.0.5	(null)	0
local	224.2.127.254	(null)	0
local	239.255.255.255	(null)	0
local	224.0.0.2	(null)	0
local	224.0.0.13	(null)	0

clear igmp membership group

The following sample output displays IGMP group information before and after the **clear igmp membership group** command is entered:

```
user@host> show igmp group
```

Interface	Group	Last Reported	Timeout
so-0/0/0	224.2.127.253	10.1.128.1	210
so-0/0/0	239.255.255.255	10.1.128.1	210
so-0/0/0	224.1.127.255	10.1.128.1	215
so-0/0/0	224.2.127.254	10.1.128.1	216
local	224.0.0.6	(null)	0
local	224.0.0.5	(null)	0
local	224.2.127.254	(null)	0
local	239.255.255.255	(null)	0
local	224.0.0.2	(null)	0
local	224.0.0.13	(null)	0

```
user@host> clear igmp membership group 239.225/16
```

```
Clearing Group Membership Range 239.225.0.0/16 on so-0/0/0
```

```
Clearing Group Membership Range 239.225.0.0/16 on so-1/0/0
```

```
Clearing Group Membership Range 239.225.0.0/16 on so-2/0/0
```

```
user@host> show igmp group
```

Interface	Group	Last Reported	Timeout
so-0/0/0	224.1.127.255	10.1.128.1	231
so-0/0/0	224.2.127.254	10.1.128.1	233
so-0/0/0	224.2.127.253	10.1.128.1	236
local	224.0.0.6	(null)	0
local	224.0.0.5	(null)	0
local	224.2.127.254	(null)	0
local	239.255.255.255	(null)	0
local	224.0.0.2	(null)	0
local	224.0.0.13	(null)	0

clear igmp statistics

List of Syntax	Syntax on page 683 Syntax (EX Series Switches) on page 683
Syntax	clear igmp statistics <interface <i>interface-name</i> > <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	clear igmp statistics <interface <i>interface-name</i> >
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	Clear Internet Group Management Protocol (IGMP) statistics.
Options	none —Clear IGMP statistics on all interfaces. interface <i>interface-name</i> —(Optional) Clear IGMP statistics for the specified interface only. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	clear
List of Sample Output	clear igmp statistics on page 683
Output Fields	See show igmp statistics for an explanation of output fields.

Sample Output

clear igmp statistics

The following sample output displays IGMP statistics information before and after the **clear igmp statistics** command is entered:

```

user@host> show igmp statistics
IGMP packet statistics for all interfaces
IGMP Message type      Received      Sent  Rx errors
Membership Query        8883         459      0
V1 Membership Report    0            0        0
DVMRP                   19784        35476    0
PIM V1                  18310         0        0
Cisco Trace             0            0        0
V2 Membership Report    0            0        0
Group Leave             0            0        0
Mtrace Response         0            0        0
Mtrace Request          0            0        0
Domain Wide Report      0            0        0
V3 Membership Report    0            0        0
Other Unknown types     0            0        0

```

IGMP v3 unsupported type	0
IGMP v3 source required for SSM	0
IGMP v3 mode not applicable for SSM	0

IGMP Global Statistics	
Bad Length	0
Bad Checksum	0
Bad Receive If	0
Rx non-local	1227

user@host> clear igmp statistics

user@host> show igmp statistics

IGMP packet statistics for all interfaces

IGMP Message type	Received	Sent	Rx errors
Membership Query	0	0	0
V1 Membership Report	0	0	0
DVMRP	0	0	0
PIM V1	0	0	0
Cisco Trace	0	0	0
V2 Membership Report	0	0	0
Group Leave	0	0	0
Mtrace Response	0	0	0
Mtrace Request	0	0	0
Domain Wide Report	0	0	0
V3 Membership Report	0	0	0
Other Unknown types			0
IGMP v3 unsupported type			0
IGMP v3 source required for SSM			0
IGMP v3 mode not applicable for SSM			0
IGMP Global Statistics			
Bad Length	0		
Bad Checksum	0		
Bad Receive If	0		
Rx non-local	0		

show igmp group

List of Syntax	Syntax on page 685 Syntax (EX Series Switch and the QFX Series) on page 685
Syntax	<pre>show igmp group <brief detail> <group-name> <logical-system (all logical-system-name)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show igmp group <brief detail> <group-name></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Display Internet Group Management Protocol (IGMP) group membership information.
Options	<p>none—Display standard information about membership for all IGMP groups.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>group-name—(Optional) Display group membership for the specified IP address only.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show igmp group (Include Mode) on page 686 show igmp group (Exclude Mode) on page 687 show igmp group brief on page 687 show igmp group detail on page 687
Output Fields	<p>Table 29 on page 685 describes the output fields for the show igmp group command. Output fields are listed in the approximate order in which they appear.</p>

Table 29: show igmp group Output Fields

Field Name	Field Description	Level of Output
Interface	Name of the interface that received the IGMP membership report. A name of local indicates that the local routing device joined the group itself.	All levels
Group	Group address.	All levels
Group Mode	Mode the SSM group is operating in: Include or Exclude .	All levels
Source	Source address.	All levels

Table 29: show igmp group Output Fields (*continued*)

Field Name	Field Description	Level of Output
Source timeout	Time remaining until the group traffic is no longer forwarded. The timer is refreshed when a listener in include mode sends a report. A group in exclude mode or configured as a static group displays a zero timer.	detail
Last reported by	Address of the host that last reported membership in this group.	All levels
Timeout	Time remaining until the group membership is removed.	brief none
Group timeout	Time remaining until a group in exclude mode moves to include mode. The timer is refreshed when a listener in exclude mode sends a report. A group in include mode or configured as a static group displays a zero timer.	detail
Type	Type of group membership: <ul style="list-style-type: none"> • Dynamic—Host reported the membership. • Static—Membership is configured. 	All levels

Sample Output

show igmp group (Include Mode)

```

user@host> show igmp group
Interface: t1-0/1/0.0
  Group: 232.1.1.1
    Group mode: Include
    Source: 10.0.0.2
    Last reported by: 10.9.5.2
    Timeout:      24 Type: Dynamic
  Group: 232.1.1.1
    Group mode: Include
    Source: 10.0.0.3
    Last reported by: 10.9.5.2
    Timeout:      24 Type: Dynamic
  Group: 232.1.1.1
    Group mode: Include
    Source: 10.0.0.4
    Last reported by: 10.9.5.2
    Timeout:      24 Type: Dynamic
  Group: 232.1.1.2
    Group mode: Include
    Source: 10.0.0.4
    Last reported by: 10.9.5.2
    Timeout:      24 Type: Dynamic
Interface: t1-0/1/1.0
Interface: ge-0/2/2.0
Interface: ge-0/2/0.0
Interface: local
  Group: 224.0.0.2
    Source: 0.0.0.0
    Last reported by: Local
    Timeout:      0 Type: Dynamic
  Group: 224.0.0.22
    Source: 0.0.0.0

```

```

Last reported by: Local
Timeout:          0 Type: Dynamic

```

show igmp group (Exclude Mode)

```

user@host> show igmp group
Interface: t1-0/1/0.0
Interface: t1-0/1/1.0
Interface: ge-0/2/2.0
Interface: ge-0/2/0.0
Interface: local
  Group: 224.0.0.2
    Source: 0.0.0.0
    Last reported by: Local
    Timeout:          0 Type: Dynamic
  Group: 224.0.0.22
    Source: 0.0.0.0
    Last reported by: Local
    Timeout:          0 Type: Dynamic

```

show igmp group brief

The output for the **show igmp group brief** command is identical to that for the **show igmp group** command.

show igmp group detail

```

user@host> show igmp group detail
Interface: t1-0/1/0.0
  Group: 232.1.1.1
    Group mode: Include
    Source: 10.0.0.2
    Source timeout: 12
    Last reported by: 10.9.5.2
    Group timeout:          0 Type: Dynamic
  Group: 232.1.1.1
    Group mode: Include
    Source: 10.0.0.3
    Source timeout: 12
    Last reported by: 10.9.5.2
    Group timeout:          0 Type: Dynamic
  Group: 232.1.1.1
    Group mode: Include
    Source: 10.0.0.4
    Source timeout: 12
    Last reported by: 10.9.5.2
    Group timeout:          0 Type: Dynamic
  Group: 232.1.1.2
    Group mode: Include
    Source: 10.0.0.4
    Source timeout: 12
    Last reported by: 10.9.5.2
    Group timeout:          0 Type: Dynamic
Interface: t1-0/1/1.0
Interface: ge-0/2/2.0
Interface: ge-0/2/0.0
Interface: local
  Group: 224.0.0.2
    Group mode: Exclude
    Source: 0.0.0.0
    Source timeout: 0

```

```
      Last reported by: Local
      Group timeout:      0 Type: Dynamic
Group: 224.0.0.22
      Group mode: Exclude
      Source: 0.0.0.0
      Source timeout: 0
      Last reported by: Local
      Group timeout:      0 Type: Dynamic
```


show igmp interface

List of Syntax	Syntax on page 689 Syntax (EX Series Switch and the QFX Series) on page 689
Syntax	<pre>show igmp interface <brief detail> <interface-name> <logical-system (all logical-system-name)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show igmp interface <brief detail> <interface-name></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Display information about Internet Group Management Protocol (IGMP)-enabled interfaces.
Options	<p>none—Display standard information about all IGMP-enabled interfaces.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>interface-name—(Optional) Display information about the specified IGMP-enabled interface only.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • clear igmp membership on page 680
List of Sample Output	show igmp interface on page 691 show igmp interface brief on page 691 show igmp interface detail on page 692
Output Fields	<p>Table 30 on page 689 describes the output fields for the show igmp interface command. Output fields are listed in the approximate order in which they appear.</p>

Table 30: show igmp interface Output Fields

Field Name	Field Description	Level of Output
Interface	Name of the interface.	All levels
Querier	Address of the routing device that has been elected to send membership queries.	All levels

Table 30: show igmp interface Output Fields (*continued*)

Field Name	Field Description	Level of Output
State	State of the interface: Up or Down .	All levels
SSM Map Policy	Name of the source-specific multicast (SSM) map policy that has been applied to the IGMP interface.	All levels
Timeout	How long until the IGMP querier is declared to be unreachable, in seconds.	All levels
Version	IGMP version being used on the interface: 1 , 2 , or 3 .	All levels
Groups	Number of groups on the interface.	All levels
Immediate Leave	State of the immediate leave option: <ul style="list-style-type: none"> • On—Indicates that the router removes a host from the multicast group as soon as the router receives a leave group message from a host associated with the interface. • Off—Indicates that after receiving a leave group message, instead of removing a host from the multicast group immediately, the router sends a group query to determine if another receiver responds. 	All levels
Promiscuous Mode	State of the promiscuous mode option: <ul style="list-style-type: none"> • On—Indicates that the router can accept IGMP reports from subnetworks that are not associated with its interfaces. • Off—Indicates that the router can accept IGMP reports only from subnetworks that are associated with its interfaces. 	All levels
Passive	State of the passive mode option: <ul style="list-style-type: none"> • On—Indicates that the router can run IGMP on the interface but not send or receive control traffic such as IGMP reports, queries, and leaves. • Off—Indicates that the router can run IGMP on the interface and send or receive control traffic such as IGMP reports, queries, and leaves. <p>The passive statement enables you to selectively activate up to two out of a possible three available query or control traffic options. When enabled, the following options appear after the on state declaration:</p> <ul style="list-style-type: none"> • send-general-query—The interface sends general queries. • send-group-query—The interface sends group-specific and group-source-specific queries. • allow-receive—The interface receives control traffic. 	All levels
OIF map	Name of the OIF map (if configured) associated with the interface.	All levels
SSM map	Name of the source-specific multicast (SSM) map (if configured) used on the interface.	All levels

Table 30: show igmp interface Output Fields (*continued*)

Field Name	Field Description	Level of Output
Configured Parameters	Information configured by the user: <ul style="list-style-type: none"> IGMP Query Interval—Interval (in seconds) at which this router sends membership queries when it is the querier. IGMP Query Response Interval—Time (in seconds) that the router waits for a report in response to a general query. IGMP Last Member Query Interval—Time (in seconds) that the router waits for a report in response to a group-specific query. IGMP Robustness Count—Number of times the router retries a query. 	All levels
Derived Parameters	Derived information: <ul style="list-style-type: none"> IGMP Membership Timeout—Timeout period (in seconds) for group membership. If no report is received for these groups before the timeout expires, the group membership is removed. IGMP Other Querier Present Timeout—Time (in seconds) that the router waits for the IGMP querier to send a query. 	All levels

Sample Output

show igmp interface

```

user@host> show igmp interface
Interface: at-0/3/1.0
  Querier: 10.111.30.1
  State:      Up Timeout:  None Version:  2 Groups:    4
  SSM Map Policy: ssm-policy-A
Interface: so-1/0/0.0
  Querier: 10.111.10.1
  State:      Up Timeout:  None Version:  2 Groups:    2
  SSM Map Policy: ssm-policy-B
Interface: so-1/0/1.0
  Querier: 10.111.20.1
  State:      Up Timeout:  None Version:  2 Groups:    4
  SSM Map Policy: ssm-policy-C
Immediate Leave: On
Promiscuous Mode: Off

Configured Parameters:
IGMP Query Interval: 125.0
IGMP Query Response Interval: 10.0
IGMP Last Member Query Interval: 1.0
IGMP Robustness Count: 2

Derived Parameters:
IGMP Membership Timeout: 260.0
IGMP Other Querier Present Timeout: 255.0

```

show igmp interface brief

The output for the **show igmp interface brief** command is identical to that for the **show igmp interface** command. For sample output, see [show igmp interface on page 691](#).

[show igmp interface detail](#)

The output for the **show igmp interface detail** command is identical to that for the **show igmp interface** command. For sample output, see [show igmp interface on page 691](#).

show multicast pim-to-igmp-proxy

List of Syntax	Syntax on page 693 Syntax (EX Series Switch and the QFX Series) on page 693
Syntax	<pre>show multicast pim-to-igmp-proxy <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show multicast pim-to-igmp-proxy <instance <i>instance-name</i>></pre>
Release Information	<p>Command introduced in Junos OS Release 9.6.</p> <p>Command introduced in Junos OS Release 9.6 for EX Series switches.</p> <p>instance option introduced in Junos OS Release 10.0.</p> <p>instance option introduced in Junos OS Release 10.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Display configuration information about PIM-to-IGMP message translation, also known as PIM-to-IGMP proxy.
Options	<p>none—Display configuration information about PIM-to-IGMP message translation for all routing instances.</p> <p>instance <i>instance-name</i>—(Optional) Display configuration information about PIM-to-IGMP message translation for a specific multicast instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show multicast pim-to-igmp-proxy on page 694 show multicast pim-to-igmp-proxy instance on page 694
Output Fields	Table 31 on page 693 describes the output fields for the show multicast pim-to-igmp-proxy command. Output fields are listed in the order in which they appear.

Table 31: show multicast pim-to-igmp-proxy Output Fields

Field Name	Field Description
Instance	Routing instance. Default instance is master (inet.0 routing table).
Proxy state	State of PIM-to-IGMP message translation, also known as PIM-to-IGMP proxy, on the configured upstream interfaces: enabled or disabled .
<i>interface-name</i>	Name of upstream interface (no more than two allowed) on which PIM-to-IGMP message translation is configured.

Sample Output

show multicast pim-to-igmp-proxy

```
user@host> show multicast pim-to-igmp-proxy
Instance: master Proxy state: enabled
ge-0/1/0.1
ge-0/1/0.2
```

show multicast pim-to-igmp-proxy instance

```
user@host> show multicast pim-to-igmp-proxy instance VPN-A
Instance: VPN-A Proxy state: enabled
ge-0/1/0.1
```

show igmp statistics

List of Syntax	Syntax on page 695 Syntax (EX Series Switch and the QFX Series) on page 695
Syntax	<pre>show igmp statistics <brief detail> <interface <i>interface-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show igmp statistics <brief detail> <interface <i>interface-name</i>></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 9.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Display Internet Group Management Protocol (IGMP) statistics.
Options	<p>none—Display IGMP statistics for all interfaces.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>interface <i>interface-name</i>—(Optional) Display IGMP statistics about the specified interface only.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • clear igmp statistics on page 683
List of Sample Output	show igmp statistics on page 696 show igmp statistics interface on page 697
Output Fields	<p>Table 32 on page 695 describes the output fields for the show igmp statistics command. Output fields are listed in the approximate order in which they appear.</p>

Table 32: show igmp statistics Output Fields

Field Name	Field Description
IGMP packet statistics	Heading for IGMP packet statistics for all interfaces or for the specified interface name.

Table 32: show igmp statistics Output Fields (*continued*)

Field Name	Field Description
IGMP Message type	<p>Summary of IGMP statistics:</p> <ul style="list-style-type: none"> • Membership Query—Number of membership queries sent and received. • V1 Membership Report—Number of version 1 membership reports sent and received. • DVMRP—Number of DVMRP messages sent or received. • PIM V1—Number of PIM version 1 messages sent or received. • Cisco Trace—Number of Cisco trace messages sent or received. • V2 Membership Report—Number of version 2 membership reports sent or received. • Group Leave—Number of group leave messages sent or received. • Mtrace Response—Number of Mtrace response messages sent or received. • Mtrace Request—Number of Mtrace request messages sent or received. • Domain Wide Report—Number of domain-wide reports sent or received. • V3 Membership Report—Number of version 3 membership reports sent or received. • Other Unknown types—Number of unknown message types received. • IGMP v3 unsupported type—Number of messages received with unknown and unsupported IGMP version 3 message types. • IGMP v3 source required for SSM—Number of IGMP version 3 messages received that contained no source. • IGMP v3 mode not applicable for SSM—Number of IGMP version 3 messages received that did not contain a mode applicable for source-specific multicast (SSM).
Received	Number of messages received.
Sent	Number of messages sent.
Rx errors	Number of received packets that contained errors.
IGMP Global Statistics	<p>Summary of IGMP statistics for all interfaces.</p> <ul style="list-style-type: none"> • Bad Length—Number of messages received with length errors so severe that further classification could not occur. • Bad Checksum—Number of messages received with a bad IP checksum. No further classification was performed. • Bad Receive If—Number of messages received on an interface not enabled for IGMP. • Rx non-local—Number of messages received from senders that are not local. • Timed out—Number of groups that timed out as a result of not receiving an explicit leave message. • Rejected Report—Number of reports dropped because of the IGMP group policy. • Total Interfaces—Number of interfaces configured to support IGMP.

Sample Output

show igmp statistics

```

user@host> show igmp statistics
IGMP packet statistics for all interfaces
IGMP Message type      Received      Sent  Rx errors
Membership Query        8883         459      0
V1 Membership Report     0            0        0

```


DVMRP	0	0	0
PIM V1	0	0	0
Cisco Trace	0	0	0
V2 Membership Report	0	0	0
Group Leave	0	0	0
Mtrace Response	0	0	0
Mtrace Request	0	0	0
Domain Wide Report	0	0	0
V3 Membership Report	0	0	0
Other Unknown types			0
IGMP v3 unsupported type			0
IGMP v3 source required for SSM			0
IGMP v3 mode not applicable for SSM			0
IGMP Global Statistics			
Bad Length	0		
Bad Checksum	0		
Bad Receive If	0		
Rx non-local	1227		
Timed out	0		
Rejected Report	0		
Total Interfaces	2		

show igmp statistics interface

```

user@host> show igmp statistics interface fe-1/0/1.0
IGMP interface packet statistics for fe-1/0/1.0
IGMP Message type      Received      Sent  Rx errors
Membership Query        0           230      0
V1 Membership Report    0           0        0

```


CHAPTER 28

MLD Operational Commands

- clear mld membership
- clear mld statistics
- show mld group
- show mld interface
- show mld statistics
- show multicast pim-to-mld-proxy

clear mld membership

Syntax	<code>clear mld membership</code> <code><group <i>group-name</i>> <interface <i>interface-name</i>></code> <code><logical-system (all <i>logical-system-name</i>)></code>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Clear Multicast Listener Discovery (MLD) group membership.
Options	none —Clear all MLD memberships. group <i>group-name</i> —(Optional) Clear MLD membership for the specified group. interface <i>interface-name</i> —(Optional) Clear MLD group membership for the specified interface. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none">• show mld group on page 702
List of Sample Output	clear mld membership on page 700
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear mld membership

```
user@host> clear mld membership
```

clear mld statistics

Syntax	clear mld statistics <interface <i>interface-name</i> > <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Clear Multicast Listener Discovery (MLD) statistics.
Options	<p>none—(Same as logical-system all) Clear MLD statistics for all interfaces.</p> <p>interface <i>interface-name</i>—(Optional) Clear MLD statistics for the specified interface.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none"> • show mld statistics on page 709
List of Sample Output	clear mld statistics on page 701
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear mld statistics

```
user@host> clear mld statistics
```

show mld group

Syntax	show mld group <brief detail> <group-name> <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display information about Multicast Listener Discovery (MLD) group membership.
Options	<p>none—Display standard information about all MLD groups.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>group-name—(Optional) Display MLD information about the specified group.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> clear mld membership on page 700
List of Sample Output	show mld group (Include Mode) on page 703 show mld group (Exclude Mode) on page 704 show mld group brief on page 704 show mld group detail (Include Mode) on page 704 show mld group detail (Exclude Mode) on page 705
Output Fields	Table 33 on page 702 describes the output fields for the show mld group command. Output fields are listed in the approximate order in which they appear.

Table 33: show mld group Output Fields

Field Name	Field Description	Level of Output
Interface	Name of the interface that received the MLD membership report; local means that the local router joined the group itself.	All levels
Group	Group address.	All levels
Source	Source address.	All levels
Group Mode	Mode the SSM group is operating in: Include or Exclude .	All levels
Last reported by	Address of the host that last reported membership in this group.	All levels

Table 33: show mld group Output Fields (*continued*)

Field Name	Field Description	Level of Output
Source timeout	Time remaining until the group traffic is no longer forwarded. The timer is refreshed when a listener in include mode sends a report. A group in exclude mode or configured as a static group displays a zero timer.	detail
Timeout	Time remaining until the group membership is removed.	brief none
Group timeout	Time remaining until a group in exclude mode moves to include mode. The timer is refreshed when a listener in exclude mode sends a report. A group in include mode or configured as a static group displays a zero timer.	detail
Type	Type of group membership: <ul style="list-style-type: none"> • Dynamic—Host reported the membership. • Static—Membership is configured. 	All levels

Sample Output

show mld group (Include Mode)

```

user@host> show mld group
Interface: fe-0/1/2.0
  Group: ff02::1:ff05:1a67
    Group mode: Include
    Source: ::
    Last reported by: fe80::2e0:81ff:fe05:1a67
    Timeout:      245 Type: Dynamic
  Group: ff02::1:ffa8:c35e
    Group mode: Include
    Source: ::
    Last reported by: fe80::2e0:81ff:fe05:1a67
    Timeout:      241 Type: Dynamic
  Group: ff02::2:43e:d7f6
    Group mode: Include
    Source: ::
    Last reported by: fe80::2e0:81ff:fe05:1a67
    Timeout:      244 Type: Dynamic
  Group: ff05::2
    Group mode: Include
    Source: ::
    Last reported by: fe80::2e0:81ff:fe05:1a67
    Timeout:      244 Type: Dynamic
Interface: local
  Group: ff02::2
    Source: ::
    Last reported by: Local
    Timeout:      0 Type: Dynamic
  Group: ff02::16
    Source: ::
    Last reported by: Local
    Timeout:      0 Type: Dynamic

```

show mld group (Exclude Mode)

```
user@host> show mld group
Interface: ge-0/2/2.0
Interface: ge-0/2/0.0
  Group: ff02::6
    Source: ::
    Last reported by: fe80::21f:12ff:feb6:4b3a
    Timeout:      245 Type: Dynamic
  Group: ff02::16
    Source: ::
    Last reported by: fe80::21f:12ff:feb6:4b3a
    Timeout:      28 Type: Dynamic
Interface: local
  Group: ff02::2
    Source: ::
    Last reported by: Local
    Timeout:      0 Type: Dynamic
  Group: ff02::16
    Source: ::
    Last reported by: Local
    Timeout:      0 Type: Dynamic
```

show mld group brief

The output for the **show mld group brief** command is identical to that for the **show mld group** command. For sample output, see [show mld group \(Include Mode\) on page 703](#) and [show mld group \(Exclude Mode\) on page 704](#).

show mld group detail (Include Mode)

```
user@host> show mld group detail
Interface: fe-0/1/2.0
  Group: ff02::1:ff05:1a67
    Group mode: Include
    Source: ::
    Last reported by: fe80::2e0:81ff:fe05:1a67
    Timeout:      224 Type: Dynamic
  Group: ff02::1:ffa8:c35e
    Group mode: Include
    Source: ::
    Last reported by: fe80::2e0:81ff:fe05:1a67
    Timeout:      220 Type: Dynamic
  Group: ff02::2:43e:d7f6
    Group mode: Include
    Source: ::
    Last reported by: fe80::2e0:81ff:fe05:1a67
    Timeout:      223 Type: Dynamic
  Group: ff05::2
    Group mode: Include
    Source: ::
    Last reported by: fe80::2e0:81ff:fe05:1a67
    Timeout:      223 Type: Dynamic
Interface: so-1/0/1.0
  Group: ff02::2
    Group mode: Include
    Source: ::
    Last reported by: fe80::280:42ff:fe15:f445
    Timeout:      258 Type: Dynamic
Interface: local
```



```

Group: ff02::2
  Group mode: Include
  Source: ::
  Last reported by: Local
  Timeout:      0 Type: Dynamic
Group: ff02::16
  Source: ::
  Last reported by: Local
  Timeout:      0 Type: Dynamic

```

show mld group detail (Exclude Mode)

```

user@host> show mld group detail
Interface: ge-0/2/2.0
Interface: ge-0/2/0.0
  Group: ff02::6
    Group mode: Exclude
    Source: ::
    Source timeout: 0
    Last reported by: fe80::21f:12ff:feb6:4b3a
    Group timeout:   226 Type: Dynamic
  Group: ff02::16
    Group mode: Exclude
    Source: ::
    Source timeout: 0
    Last reported by: fe80::21f:12ff:feb6:4b3a
    Group timeout:   246 Type: Dynamic
Interface: local
  Group: ff02::2
    Group mode: Exclude
    Source: ::
    Source timeout: 0
    Last reported by: Local
    Group timeout:   0 Type: Dynamic
  Group: ff02::16
    Group mode: Exclude
    Source: ::
    Source timeout: 0
    Last reported by: Local
    Group timeout:   0 Type: Dynamic

```

show mld interface

Syntax	<pre>show mld interface <brief detail> <interface-name> <logical-system (all logical-system-name)></pre>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display information about Multicast Listener Discovery (MLD)-enabled interfaces.
Options	<p>none—Display standard information about all MLD-enabled interfaces.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>interface-name—(Optional) Display information about the specified interface.</p> <p>logical-system (all logical-system-name)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> clear mld membership on page 700
List of Sample Output	show mld interface on page 708 show mld interface brief on page 708 show mld interface detail on page 708
Output Fields	<p>Table 34 on page 706 describes the output fields for the show mld interface command. Output fields are listed in the approximate order in which they appear.</p>

Table 34: show mld interface Output Fields

Field Name	Field Description	Level of Output
Interface	Name of the interface.	All levels
Querier	Address of the router that has been elected to send membership queries.	All levels
State	State of the interface: Up or Down .	All levels
SSM Map Policy	Name of the source-specific multicast (SSM) map policy that has been applied to the interface.	All levels
SSM Map Policy	Name of the source-specific multicast (SSM) map policy at the MLD interface.	All levels
Timeout	How long until the MLD querier is declared to be unreachable, in seconds.	All levels
Version	MLD version being used on the interface: 1 or 2.	All levels

Table 34: show mld interface Output Fields (*continued*)

Field Name	Field Description	Level of Output
Groups	Number of groups on the interface.	All levels
Passive	<p>State of the passive mode option:</p> <ul style="list-style-type: none"> • On—Indicates that the router can run IGMP or MLD on the interface but not send or receive control traffic such as IGMP or MLD reports, queries, and leaves. • Off—Indicates that the router can run IGMP or MLD on the interface and send or receive control traffic such as IGMP or MLD reports, queries, and leaves. <p>The passive statement enables you to selectively activate up to two out of a possible three available query or control traffic options. When enabled, the following options appear after the on state declaration:</p> <ul style="list-style-type: none"> • send-general-query—The interface sends general queries. • send-group-query—The interface sends group-specific and group-source-specific queries. • allow-receive—The interface receives control traffic 	All levels
OIF map	Name of the OIF map associated to the interface.	All levels
SSM map	Name of the source-specific multicast (SSM) map used on the interface, if configured.	All levels
Immediate Leave	<p>State of the immediate leave option:</p> <ul style="list-style-type: none"> • On—Indicates that the router removes a host from the multicast group as soon as the router receives a multicast listener done message from a host associated with the interface. • Off—Indicates that after receiving a multicast listener done message, instead of removing a host from the multicast group immediately, the router sends a group query to determine if another receiver responds. 	All levels
Configured Parameters	<p>Information configured by the user.</p> <ul style="list-style-type: none"> • MLD Query Interval (.1 secs)—Interval at which this router sends membership queries when it is the querier. • MLD Query Response Interval (.1 secs)—Time that the router waits for a report in response to a general query. • MLD Last Member Query Interval (.1 secs)—Time that the router waits for a report in response to a group-specific query. • MLD Robustness Count—Number of times the router retries a query. 	All levels
Derived Parameters	<p>Derived information.</p> <ul style="list-style-type: none"> • MLD Membership Timeout (.1 secs)—Timeout period for group membership. If no report is received for these groups before the timeout expires, the group membership will be removed. • MLD Other Querier Present Timeout (.1 secs)—Time that the router waits for the IGMP querier to send a query. 	All levels

Sample Output

show mld interface

```
user@host> show mld interface
Interface: fe-0/0/0
  Querier: None
  State: Up      Timeout:      0    Version:  1    Groups:    0
  SSM Map Policy: ssm-policy-A
Interface: at-0/3/1.0
  Querier: 8038::c0a8:c345
  State: Up      Timeout:    None   Version:  1    Groups:    0
  SSM Map Policy: ssm-policy-B
Interface: fe-1/0/1.0
  Querier: ::192.168.195.73
  State: Up      Timeout:    None   Version:  1    Groups:    3
  SSM Map Policy: ssm-policy-C
  SSM map: ipv6map1
Immediate Leave: On

Configured Parameters:
MLD Query Interval (.1 secs): 1250
MLD Query Response Interval (.1 secs): 100
MLD Last Member Query Interval (.1 secs): 10
MLD Robustness Count: 2

Derived Parameters:
MLD Membership Timeout (.1secs): 2600
MLD Other Querier Present Timeout (.1 secs): 2550
```

show mld interface brief

The output for the **show mld interface brief** command is identical to that for the **show mld interface** command. For sample output, see [show mld interface on page 708](#).

show mld interface detail

The output for the **show mld interface detail** command is identical to that for the **show mld interface** command. For sample output, see [show mld interface on page 708](#).

show mld statistics

Syntax	show mld statistics <interface <i>interface-name</i> > <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display information about Multicast Listener Discovery (MLD) statistics.
Options	<p>none—Display MLD statistics for all interfaces.</p> <p>interface <i>interface-name</i>—(Optional) Display statistics about the specified interface.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • clear mld statistics on page 701
List of Sample Output	show mld statistics on page 710 show mld statistics interface on page 711
Output Fields	<p>Table 35 on page 709 describes the output fields for the show mld statistics command. Output fields are listed in the approximate order in which they appear.</p>

Table 35: show mld statistics Output Fields

Field Name	Field Description
Received	Number of received packets.
Sent	Number of transmitted packets.
Rx errors	Number of received packets that contained errors.

Table 35: show mld statistics Output Fields (*continued*)

Field Name	Field Description
MLD Message type	Summary of MLD statistics. <ul style="list-style-type: none"> • Listener Query (v1/v2)—Number of membership queries sent and received. • Listener Report (v1)—Number of version 1 membership reports sent and received. • Listener Done (v1/v2)—Number of Listener Done messages sent and received. • Listener Report (v2)—Number of version 2 membership reports sent and received. • Other Unknown types—Number of unknown message types received. • MLD v2 source required for SSM—Number of MLD version 2 messages received that contained no source. • MLD v2 mode not applicable for SSM—Number of MLD version 2 messages received that did not contain a mode applicable for source-specific multicast (SSM).
MLD Global Statistics	Summary of MLD statistics for all interfaces. <ul style="list-style-type: none"> • Bad Length—Number of messages received with length errors so severe that further classification could not occur. • Bad Checksum—Number of messages received with an invalid IP checksum. No further classification was performed. • Bad Receive If—Number of messages received on an interface not enabled for MLD. • Rx non-local—Number of messages received from nonlocal senders. • Timed out—Number of groups that timed out as a result of not receiving an explicit leave message. • Rejected Report—Number of reports dropped because of the MLD group policy. • Total Interfaces—Number of interfaces configured to support IGMP.

Sample Output

show mld statistics

```

user@host> show mld statistics
MLD packet statistics for all interfaces
MLD Message type      Received      Sent  Rx errors
Listener Query (v1/v2)    0            2      0
Listener Report (v1)      0            0      0
Listener Done (v1/v2)     0            0      0
Listener Report (v2)      0            0      0
Other Unknown types       0            0      0
MLD v2 source required for SSM  2
MLD v2 mode not applicable for SSM 0

MLD Global Statistics
Bad Length                0
Bad Checksum              0
Bad Receive If            0
Rx non-local              0
Timed out                 0

```

Rejected Report	0
Total Interfaces	2

show mld statistics interface

```
user@host> show mld statistics interface fe-1/0/1.0
MLD interface packet statistics for fe-1/0/1.0
MLD Message type      Received      Sent  Rx errors
Listener Query (v1/v2)    0            2      0
Listener Report (v1)      0            0      0
Listener Done (v1/v2)     0            0      0
Listener Report (v2)      0            0      0
Other Unknown types              0      0
MLD v2 source required for SSM    2
MLD v2 mode not applicable for SSM 0

MLD Global Statistics
Bad Length                0
Bad Checksum              0
Bad Receive If            0
Rx non-local              0
Timed out                 0
Rejected Report           0
Total Interfaces          2
```

show multicast pim-to-mld-proxy

List of Syntax	Syntax on page 712 Syntax (EX Series Switch and the QFX Series) on page 712
Syntax	<pre>show multicast pim-to-mld-proxy <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show multicast pim-to-mld-proxy <instance <i>instance-name</i>></pre>
Release Information	<p>Command introduced in Junos OS Release 9.6.</p> <p>Command introduced in Junos OS Release 9.6 for EX Series switches.</p> <p>instance option introduced in Junos OS Release 10.0.</p> <p>instance option introduced in Junos OS Release 10.0 for EX Series switches.</p> <p>Command introduced in Junos OS Release 11.3 for the QFX Series.</p>
Description	Display configuration information about PIM-to-MLD message translation, also known as PIM-to-MLD proxy.
Options	<p>none—Display configuration information about PIM-to-MLD message translation for all routing instances.</p> <p>instance <i>instance-name</i>—(Optional) Display configuration information about PIM-to-MLD message translation for a specific multicast instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show multicast pim-to-mld-proxy on page 713 show multicast pim-to-mld-proxy instance on page 713
Output Fields	Table 36 on page 712 describes the output fields for the show multicast pim-to-mld-proxy command. Output fields are listed in the order in which they appear.

Table 36: show multicast pim-to-mld-proxy Output Fields

Field Name	Field Description
Proxy state	State of PIM-to-MLD message translation, also known as PIM-to-MLD proxy, on the configured upstream interfaces: enabled or disabled .
<i>interface-name</i>	Name of upstream interface (no more than two allowed) on which PIM-to-MLD message translation is configured.

Sample Output

show multicast pim-to-mld-proxy

```
user@host> show multicast pim-to-mld-proxy
Instance: master Proxy state: enabled
ge-0/5/0.1
ge-0/5/0.2
```

show multicast pim-to-mld-proxy instance

```
user@host> show multicast pim-to-mld-proxy instance VPN-A
Instance: VPN-A Proxy state: enabled
ge-0/5/0.1
```


CHAPTER 29

IGMP Snooping Operational Commands

- clear igmp snooping membership
- clear igmp snooping statistics
- show igmp snooping interface
- show igmp snooping membership
- show igmp snooping statistics

clear igmp snooping membership

Syntax	<code>clear igmp snooping membership</code> <code><group source address></code> <code><instance <i>instance-name</i>></code> <code><interface <i>interface-name</i>></code> <code><learning-domain <i>learning-domain-name</i>></code> <code><vlan-id <i>vlan-identifier</i>></code>
Release Information	Command introduced in Junos OS Release 8.5.
Description	Clear IP IGMP snooping membership information.
Options	<p>none—Clear IGMP snooping membership for all supported address families on all interfaces.</p> <p>group source address—(Optional) Clear IGMP snooping membership for the specified multicast group or source address.</p> <p>instance <i>instance-name</i>—(Optional) Clear IGMP snooping membership for the specified instance.</p> <p>interface <i>interface-name</i>—(Optional) Clear IGMP snooping membership on a specific interface.</p> <p>learning-domain <i>learning-domain-name</i>—(Optional) Perform this operation on all learning domains or on a particular learning domain.</p> <p>vlan-id <i>vlan-identifier</i>—(Optional) Perform this operation on a particular VLAN.</p>
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show igmp snooping membership on page 721
List of Sample Output	clear igmp snooping membership on page 716
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear igmp snooping membership

```
user@host> clear igmp snooping membership
```

clear igmp snooping statistics

Syntax	clear igmp snooping statistics <instance <i>instance-name</i> > <interface <i>interface-name</i> > <learning-domain (all <i>learning-domain-name</i>)> <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced in Junos OS Release 8.5.
Description	Clear IP IGMP snooping statistics.
Options	<p>none—Clear IGMP snooping statistics for all supported address families on all interfaces.</p> <p>instance <i>instance-name</i>—(Optional) Clear IGMP snooping statistics for the specified instance.</p> <p>interface <i>interface-name</i>—(Optional) Clear IGMP snooping statistics on a specific interface.</p> <p>learning-domain (all <i>learning-domain-name</i>)—(Optional) Perform this operation on all learning domains or on a particular learning domain.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none"> • show igmp snooping statistics on page 725
List of Sample Output	clear igmp snooping statistics on page 717
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear igmp snooping statistics

```
user@host> clear igmp snooping statistics
```

show igmp snooping interface

Syntax	show igmp snooping interface <i>interface-name</i> <brief detail> <bridge-domain <i>bridge-domain-name</i> > <virtual-switch <i>virtual-switch-name</i> > <vlan-id <i>vlan-identifier</i> >
Release Information	Command introduced in Junos OS Release 8.5.
Description	Display IGMP snooping interface information.
Options	<p>none—Display detailed information.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>bridge-domain <i>bridge-domain-name</i>—(Optional) Display information about a particular bridge domain.</p> <p>virtual-switch <i>virtual-switch-name</i>—(Optional) Display information about a particular virtual switch.</p> <p>vlan-id <i>vlan-identifier</i>—(Optional) Display information about a particular VLAN.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show igmp snooping membership on page 721 • show igmp snooping statistics on page 725
List of Sample Output	<p>show igmp snooping interface on page 719</p> <p>show igmp snooping interface (Group Limit Configured) on page 720</p>
Output Fields	Table 37 on page 718 lists the output fields for the show igmp snooping interface command. Output fields are listed in the approximate order in which they appear.

Table 37: show igmp snooping interface Output Fields

Field Name	Field Description	Level of Output
Routing-instance	Routing instance for IGMP snooping.	All levels
Learning Domain	Learning domain for snooping.	All levels
IGMP Query Interval	Frequency (in seconds) with which this router sends membership queries when it is the querier.	detail
IGMP Query Response Interval	Time (in seconds) that the router waits for a response to a general query.	detail

Table 37: show igmp snooping interface Output Fields (*continued*)

Field Name	Field Description	Level of Output
IGMP Last Member Query Interval	Time (in seconds) that the router waits for a report in response to a group-specific query.	detail
IGMP Robustness Count	Number of times the router retries a query.	detail
immediate-leave	State of immediate leave: On or Off .	All levels
router-interface	Router interfaces that are part of this learning domain.	All levels
Group limit	Maximum number of (source,group) pairs allowed per interface. When a group limit is not configured, this field is not shown.	All levels
interface	Interfaces that are being snooped in this learning domain.	All levels
Groups	Number of groups on the interface.	none
State	State of the interface: Up or Down .	none
Up Groups	Number of active multicast groups attached to the logical interface.	All levels
IGMP Membership Timeout	Timeout for group membership. If no report is received for these groups before the timeout expires, the group membership is removed.	none
IGMP Other Querier Present Timeout	Time that the router waits for the IGMP querier to send a query.	none

Sample Output

show igmp snooping interface

```

user@host> show igmp snooping interface
Instance: bridge-domain bar

Learning-Domain: default
Interface: ge-0/1/0.200
  State:          Up Groups:      0
  Immediate leave: Off
  Router interface: yes
Interface: ge-0/1/2.200
  State:          Up Groups:      2
  Immediate leave: On
  Router interface: no
Interface: ge-0/1/3.200
  State:          Up Groups:      1
  Immediate leave: Off
  Router interface: no

Configured Parameters:
IGMP Query Interval: 130.0
IGMP Query Response Interval: 15.0

```

```
IGMP Last Member Query Interval: 2.0
IGMP Robustness Count: 3

Derived Parameters:
IGMP Membership Timeout: 405.0
IGMP Other Querier Present Timeout: 397.500
```

Sample Output

show igmp snooping interface (Group Limit Configured)

```
user@host> show igmp snooping interface instance vpls1
Instance: vpls1

Learning-Domain: default
Interface: ge-1/3/9.0
  State:          Up Groups:      0
  Immediate leave: Off
  Router interface: yes
Interface: ge-1/3/8.0
  State:          Up Groups:      0
  Immediate leave: Off
  Router interface: yes
  Group limit:    1000

Configured Parameters:
IGMP Query Interval: 125.0
IGMP Query Response Interval: 10.0
IGMP Last Member Query Interval: 1.0
IGMP Robustness Count: 2
```


show igmp snooping membership

Syntax	show igmp snooping membership <brief detail> <bridge-domain <i>bridge-domain-name</i> > <group <i>group-name</i> > <virtual-switch <i>virtual-switch-name</i> > <vlan-id <i>vlan-identifier</i> >
Release Information	Command introduced in Junos OS Release 8.5.
Description	Display IGMP snooping membership information.
Options	<p>none—Display detailed information.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>bridge-domain <i>bridge-domain-name</i>—(Optional) Display information about a particular bridge domain.</p> <p>group <i>group-name</i> —(Optional) Display information about this group address.</p> <p>virtual-switch <i>virtual-switch-name</i>—(Optional) Display information about a particular virtual switch.</p> <p>vlan-id <i>vlan-identifier</i>—(Optional) Display information about a particular VLAN.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show igmp snooping interface on page 718 • show igmp snooping statistics on page 725 • clear igmp snooping membership on page 716
List of Sample Output	show igmp snooping membership on page 722 show igmp snooping membership (Exclude Mode) on page 723 show igmp snooping membership interface ge-0/1/2.200 on page 723 show igmp snooping membership vlan-id 1 on page 723
Output Fields	Table 38 on page 721 lists the output fields for the show igmp snooping membership command. Output fields are listed in the approximate order in which they appear.

Table 38: show igmp snooping membership Output Fields

Field Name	Field Description	Level of Output
Instance	Routing instance for IGMP snooping.	All levels
Learning Domain	Learning domain for snooping.	All levels

Table 38: show igmp snooping membership Output Fields (*continued*)

Field Name	Field Description	Level of Output
Interface	Interface on which this router is a proxy.	detail
Up Groups	Number of active multicast groups attached to the logical interface.	All levels
Group	Multicast group address in the membership database.	All levels
Group Mode	Mode the SSM group is operating in: Include or Exclude .	All levels
Source	Source address used on queries.	detail
Last reported by	Address of source last replying to the query.	detail
Group Timeout	Time remaining until a group in exclude mode moves to include mode. The timer is refreshed when a listener in exclude mode sends a report. A group in include mode or configured as a static group displays a zero timer.	All levels
Timeout	Length of time (in seconds) left until the entry is purged.	detail
Type	Way that the group membership information was learned: <ul style="list-style-type: none"> • Dynamic—Group membership was learned by the IGMP protocol. • Static—Group membership was learned by configuration. 	detail
Include receiver	Source address of receiver included in membership with timeout (in seconds).	detail

Sample Output

show igmp snooping membership

```

user@host> show igmp snooping membership
Instance: vpls2

Learning-Domain: vlan-id 2
Interface: ge-3/0/0.2
Up Groups:      0
Interface: ge-3/1/0.2
Up Groups:      0
Interface: ge-3/1/5.2
Up Groups:      0

Instance: vpls1

Learning-Domain: vlan-id 1
Interface: ge-3/0/0.1
Up Groups:      0
Interface: ge-3/1/0.1
Up Groups:      0
Interface: ge-3/1/5.1
Up Groups:      1
  Group: 225.10.10.1
    Group mode: Exclude
    Source: 0.0.0.0

```

```

Last reported by: 100.6.85.2
Group timeout:    173 Type: Dynamic

```

show igmp snooping membership (Exclude Mode)

```

user@host> show igmp snooping membership
Instance: vpls2

Learning-Domain: vlan-id 2
Interface: ge-3/0/0.2
Up Groups:      0
Interface: ge-3/1/0.2
Up Groups:      0
Interface: ge-3/1/5.2
Up Groups:      0

Instance: vpls1

Learning-Domain: vlan-id 1
Interface: ge-3/0/0.1
Up Groups:      0
Interface: ge-3/1/0.1
Up Groups:      0
Interface: ge-3/1/5.1
Up Groups:      1
  Group: 225.10.10.1
    Group mode: Exclude
    Source: 0.0.0.0
    Last reported by: 100.6.85.2
    Group timeout:    173 Type: Dynamic

```

show igmp snooping membership interface ge-0/1/2.200

```

user@host> show igmp snooping membership interface ge-0/1/2.200
Instance: bridge-domain bar

Learning-Domain: default
Interface: ge-0/1/2.200
  Group: 225.1.1.1
    Source: 0.0.0.0
    Timeout: 391 Type: Static
  Group: 232.1.1.1
    Source: 192.168.1.1
    Timeout: 0 Type: Static

```

show igmp snooping membership vlan-id 1

```

user@host> show igmp snooping membership vlan-id 1
Instance: vpls2

Instance: vpls1

Learning-Domain: vlan-id 1
Interface: ge-3/0/0.1
Up Groups:      0
Interface: ge-3/1/0.1
Up Groups:      0
Interface: ge-3/1/5.1
Up Groups:      1
  Group: 225.10.10.1
    Group mode: Exclude
    Source: 0.0.0.0

```

Last reported by: 100.6.85.2
Group timeout: 209 Type: Dynamic

show igmp snooping statistics

Syntax	show igmp snooping statistics <brief detail> <bridge-domain <i>bridge-domain-name</i> > <virtual-switch <i>virtual-switch-name</i> > <vlan-id <i>vlan-identifier</i> >
Release Information	Command introduced in Junos OS Release 8.5.
Description	Display IGMP snooping statistics.
Options	<p>none—(Optional) Display detailed information.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>bridge-domain <i>bridge-domain-name</i>—(Optional) Display information about a particular bridge domain.</p> <p>virtual-switch <i>virtual-switch-name</i>—(Optional) Display information about a particular virtual switch.</p> <p>vlan-id <i>vlan-identifier</i>—(Optional) Display information about a particular VLAN.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show igmp snooping interface on page 718 • show igmp snooping membership on page 721 • clear igmp snooping statistics on page 717
List of Sample Output	show igmp snooping statistics on page 726
Output Fields	Table 39 on page 725 lists the output fields for the show igmp snooping statistics command. Output fields are listed in the approximate order in which they appear.

Table 39: show igmp snooping statistics Output Fields

Field Name	Field Description	Level of Output
Routing-instance	Routing instance for IGMP snooping.	All levels
IGMP packet statistics	Heading for IGMP snooping statistics for all interfaces or for the specified interface.	All levels
learning-domain	Appears at end of “IGMP packets statistics” line.	All levels

Table 39: show igmp snooping statistics Output Fields (*continued*)

Field Name	Field Description	Level of Output
IGMP Message type	Summary of IGMP statistics: <ul style="list-style-type: none"> • Membership Query—Number of membership queries sent and received. • V1 Membership Report—Number of version 1 membership reports sent and received. • DVMRP—Number of DVMRP messages sent or received. • PIM V1—Number of PIM version 1 messages sent or received. • Cisco Trace—Number of Cisco trace messages sent or received. • V2 Membership Report—Number of version 2 membership reports sent or received. • Group Leave—Number of group leave messages sent or received. • Domain Wide Report—Number of domain-wide reports sent or received. • V3 Membership Report—Number of version 3 membership reports sent or received. • Other Unknown types—Number of unknown message types received. • IGMP v3 unsupported type—Number of messages received with unknown and unsupported IGMP version 3 message types. • IGMP v3 source required for SSM—Number of IGMP version 3 messages received that contained no source. • IGMP v3 mode not applicable for SSM—Number of IGMP version 3 messages received that did not contain a mode applicable for source-specific multicast (SSM). 	All levels
Received	Number of messages received.	All levels
Sent	Number of messages sent.	All levels
Rx errors	Number of received packets that contained errors.	All levels
IGMP Global Statistics	Summary of IGMP snooping statistics for all interfaces. <ul style="list-style-type: none"> • Bad Length—Number of messages received with length errors so severe that further classification could not occur. • Bad Checksum—Number of messages received with a bad IP checksum. No further classification was performed. • Rx non-local—Number of messages received from senders that are not local. 	All levels

Sample Output

show igmp snooping statistics

```
user@host> show igmp snooping statistics
Routing-instance foo
```

```
IGMP packet statistics for all interfaces in learning-domain vlan-100
```

IGMP Message type	Received	Sent	Rx errors
Membership Query	89	51	0
V1 Membership Report	0	0	0
DVMRP	0	0	0

PIM V1	0	0	0
Cisco Trace	0	0	0
V2 Membership Report	139	0	0
Group Leave	0	0	0
Domain Wide Report	0	0	0
V3 Membership Report	136	0	0
Other Unknown types			0
IGMP v3 unsupported type			0
IGMP v3 source required for SSM			23
IGMP v3 mode not applicable for SSM			0

IGMP Global Statistics

Bad Length	0
Bad Checksum	0
Rx non-local	0

Routing-instance bar

IGMP packet statistics for all interfaces in learning-domain vlan-100

IGMP Message type	Received	Sent	Rx errors
Membership Query	89	51	0
V1 Membership Report	0	0	0
DVMRP	0	0	0
PIM V1	0	0	0
Cisco Trace	0	0	0
V2 Membership Report	139	0	0
Group Leave	0	0	0
Domain Wide Report	0	0	0
V3 Membership Report	136	0	0
Other Unknown types			0
IGMP v3 unsupported type			0
IGMP v3 source required for SSM			23
IGMP v3 mode not applicable for SSM			0

IGMP Global Statistics

Bad Length	0
Bad Checksum	0
Rx non-local	0

CHAPTER 30

Multicast Snooping Operational Commands

- clear multicast snooping statistics
- show multicast snooping route
- show multicast snooping statistics
- show route table

clear multicast snooping statistics

Syntax	clear multicast snooping statistics <instance <i>instance-name</i> > <interface <i>interface-name</i> > <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced in Junos OS Release 8.5.
Description	Clear IP multicast snooping statistics.
Options	<p>none—Clear multicast snooping statistics for all supported address families on all interfaces.</p> <p>instance <i>instance-name</i>—(Optional) Clear multicast snooping statistics for the specified instance.</p> <p>interface <i>interface-name</i>—(Optional) Clear multicast snooping statistics on a specific interface.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show multicast snooping statistics on page 734
List of Sample Output	clear multicast snooping statistics on page 730
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear multicast snooping statistics

```
user@host> clear multicast snooping statistics
```

show multicast snooping route

Syntax	<pre>show multicast snooping route <brief detail extensive> <active all inactive> <bridge-domain <i>bridge-domain-name</i>> <group <i>group</i>> <instance <i>instance-name</i>> <mesh-group <i>mesh-group-name</i>> <<i>regular-expression</i>> <source-prefix <i>source-prefix</i>></pre>
Release Information	Command introduced in Junos OS Release 8.5.
Description	Display the entries in the IP multicast snooping forwarding table. You can display some of this information with the show route table inet.1 command.
Options	<p>none—Display standard information about all entries in the multicast snooping table for all virtual switches and all bridge domains.</p> <p>brief detail extensive—(Optional) Display the specified level of output.</p> <p>active all inactive—(Optional) Display all active entries, all entries, or all inactive entries, respectively, in the multicast snooping table.</p> <p>bridge-domain <i>bridge-domain</i>—(Optional) Display the entries for a particular bridge domain.</p> <p>group <i>group</i>—(Optional) Display the entries for a particular group.</p> <p>instance <i>instance-name</i>—(Optional) Display the entries for a multicast instance.</p> <p>mesh-group <i>mesh-group-name</i>—(Optional) Display the entries for a particular mesh group.</p> <p><i>regular-expression</i>—(Optional) Display information about the multicast forwarding table entries that match a UNIX-style regular expression.</p> <p>source-prefix <i>source-prefix</i>—(Optional) Display the entries for a particular source prefix.</p>
Required Privilege Level	view
List of Sample Output	<p>show multicast snooping route bridge-domain on page 732</p> <p>show multicast snooping route instance vs on page 732</p>
Output Fields	Table 40 on page 732 describes the output fields for the show multicast snooping route command. Output fields are listed in the approximate order in which they appear.

Table 40: show multicast snooping route Output Fields

Field Name	Field Description	Level of Output
Nexthop Bulking	Displays whether next-hop bulk updating is ON or OFF (only for routing-instance type of virtual switch or vpls).	All levels
Family	IPv4 address family (INET) or IPv6 address family (INET6).	All levels
Group	Group address.	All levels
Source	Prefix and length of the source as it is in the multicast forwarding table.	All levels
Routing-instance	Name of the routing instance to which this routing information applies. (Displayed when multicast is configured within a routing instance.)	All levels
Learning Domain	Name of the learning domain to which this routing information applies.	detail extensive
Statistics	Rate at which packets are being forwarded for this source and group entry (in Kbps and pps), and number of packets that have been forwarded to this prefix.	detail extensive
Next-hop ID	Next-hop identifier of the prefix. The identifier is returned by the router's Packet Forwarding Engine and is also displayed in the output of the show multicast nexthops command.	detail extensive
Route state	Whether the group is Active or Inactive .	extensive
Forwarding state	Whether the prefix is Pruned or Forwarding .	extensive
Cache lifetime/timeout	Number of seconds until the prefix is removed from the multicast forwarding table. A value of never indicates a permanent forwarding entry.	extensive

Sample Output

show multicast snooping route bridge-domain

```

user@host> show multicast snooping route bridge-domain br-dom-1 extensive
Family: INET

Group: 232.1.1.1
Source: 192.168.3.100/32
Downstream interface list:
    ge-0/1/0.200
Statistics: 0 kbps, 0 pps, 1 packets
Next-hop ID: 1048577
Route state: Active
Forwarding state: Forwarding
Cache lifetime/timeout: 240 seconds

```

show multicast snooping route instance vs

```

user@host> show multicast snooping route instance vs
Nexthop Bulking: ON

Family: INET

```

```
Group: 224.0.0.0
  Bridge-domain: vsid500

Group: 225.1.0.1
  Bridge-domain: vsid500
  Downstream interface list: vsid500
    ge-0/3/8.500 ge-1/1/9.500 ge1/2/5.500
```

show multicast snooping statistics

Syntax	show multicast snooping statistics <instance <i>instance-name</i> > <interface <i>interface-name</i> > <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced in Junos OS Release 8.5.
Description	Display IP multicast snooping statistics.
Options	<p>none—Display multicast snooping statistics for all supported address families for all routing instances.</p> <p>instance <i>instance-name</i>—(Optional) Display statistics for a specific routing instance.</p> <p>interface <i>interface-name</i>—(Optional) Display statistics for a specific interface.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Additional Information	The input and output interface multicast snooping statistics are consistent, but not timely. They are constructed from the forwarding statistics, which are gathered at 30-second intervals. Therefore, the output from this command always lags the true count by up to 30 seconds.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> clear multicast snooping statistics on page 730
List of Sample Output	show multicast snooping statistics on page 736
Output Fields	Table 41 on page 734 describes the output fields for the show multicast snooping statistics command. Output fields are listed in the approximate order in which they appear.

Table 41: show multicast snooping statistics Output Fields

Field Name	Field Description
Routing-instance	Name of the routing instance. (Displayed when multicast is configured within a routing instance.)
Family	Protocol family for which multicast statistics are displayed: INET or INET6 .
Interface	Name of the interface for which statistics are being reported.
Routing Protocol	Primary multicast protocol on the interface: PIM , DVMRP for INET , or PIM for INET6 .
Mismatch	Number of multicast packets that did not arrive on the correct upstream interface.

Table 41: show multicast snooping statistics Output Fields (*continued*)

Field Name	Field Description
Kernel Resolve	Number of resolve requests processed by the primary multicast protocol on the interface.
Resolve No Route	Number of resolve requests that were ignored because there was no route to the source.
In Kbytes	Total accumulated incoming packets (in KB) since the last time the clear multicast snooping statistics command was issued.
Out Kbytes	Total accumulated outgoing packets (in KB) since the last time the clear multicast snooping statistics command was issued.
Mismatch error	Number of mismatches that were ignored because of internal errors.
Mismatch No Route	Number of mismatches that were ignored because there was no route to the source.
Routing Notify	Number of times that the multicast routing system has been notified of a new multicast source by a multicast routing protocol.
Resolve Error	Number of resolve requests that were ignored because of internal errors.
In packets	Total number of incoming packets since the last time the clear multicast snooping statistics command was issued.
Out packets	Total number of outgoing packets since the last time the clear multicast snooping statistics command was issued.

Sample Output

show multicast snooping statistics

```
user@host> show multicast snooping statistics
Routing-instance: foo
Family: INET
Interface: fe-0/0/2.200
  Routing protocol: PIM Mismatch error: 0
  Mismatch: 0 Mismatch no route: 0
  Kernel resolve: 22 Routing notify: 0
  Resolve no route: 0 Resolve error: 0
  Resolve filtered: 0 Notify filtered: 0
  In kbytes: 0 In packets: 0
  Out kbytes: 0 Out packets: 0

Routing-instance: bar
Family: INET
Interface: fe-0/1/2.200
  Routing protocol: PIM Mismatch error: 0
  Mismatch: 0 Mismatch no route: 0
  Kernel resolve: 22 Routing notify: 0
  Resolve no route: 0 Resolve error: 0
  Resolve filtered: 0 Notify filtered: 0
  In kbytes: 0 In packets: 0
  Out kbytes: 0 Out packets: 0
```


show route table

List of Syntax	Syntax on page 737 Syntax (EX Series Switches) on page 737
Syntax	show route table <i>routing-table-name</i> <brief detail extensive terse> <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	show route table <i>routing-table-name</i> <brief detail extensive terse>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches.
Description	Display the route entries in a particular routing table.
Options	<p>brief detail extensive terse—(Optional) Display the specified level of output.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p><i>routing-table-name</i>—Display route entries for all routing tables whose name begins with this string (for example, inet.0 and inet6.0 are both displayed when you run the show route table inet command).</p>
Required Privilege Level	view
List of Sample Output	show route table bgp.l2.vpn on page 738 show route table bgp.l3vpn.0 on page 738 show route table bgp.l3vpn.0 detail on page 738 show route table inet.0 on page 739 show route table inet6.0 on page 740 show route table inet6.3 on page 740 show route table l2circuit.0 on page 740 show route table mpls on page 741 show route table mpls extensive on page 741 show route table mpls.0 on page 741 show route table mpls.0 (RSVP Route—Transit LSP) on page 742 show route table vpls_1 detail on page 742 show route table vpn-a on page 743 show route table vpn-a.mdt.0 on page 743 show route table VPN-AB.inet.0 on page 743 show route table VPN_blue.mvpn-inet6.0 on page 744 show route table VPN-A detail on page 744 show route table inetflow detail on page 745
Output Fields	For information about output fields, see the output field tables for the show route command, the show route detail command, the show route extensive command, or the show route terse command.

Sample Output

show route table bgp.l2vpn

```
user@host> show route table bgp.l2vpn
bgp.l2vpn.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.24.1:1:4:1/96
    *[BGP/170] 01:08:58, localpref 100, from 192.168.24.1
    AS path: I
    > to 10.0.16.2 via fe-0/0/1.0, label-switched-path am
```

show route table bgp.l3vpn.0

```
user@host> show route table bgp.l3vpn.0
bgp.l3vpn.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.255.71.15:100:10.255.71.17/32
    *[BGP/170] 00:03:59, MED 1, localpref 100, from
10.255.71.15
    AS path: I
    > via so-2/1/0.0, Push 100020, Push 100011(top)
10.255.71.15:200:10.255.71.18/32
    *[BGP/170] 00:03:59, MED 1, localpref 100, from
10.255.71.15
    AS path: I
    > via so-2/1/0.0, Push 100021, Push 100011(top)
```

show route table bgp.l3vpn.0 detail

```
user@host> show route table bgp.l3vpn.0 detail
bgp.l3vpn.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)

10.255.245.12:1:4.0.0.0/8 (1 entry, 1 announced)
  *BGP Preference: 170/-101
    Route Distinguisher: 10.255.245.12:1
    Source: 10.255.245.12
    Next hop: 192.168.208.66 via fe-0/0/0.0, selected
    Label operation: Push 182449
    Protocol next hop: 10.255.245.12
    Push 182449
    Indirect next hop: 863a630 297
    State: <Active Int Ext>
    Local AS: 35 Peer AS: 35
    Age: 12:19 Metric2: 1
    Task: BGP_35.10.255.245.12+179
    Announcement bits (1): 0-BGP.0.0.0.0+179
    AS path: 30 10458 14203 2914 3356 I (Atomic) Aggregator: 3356 4.68.0.11

    Communities: 2914:420 target:11111:1 origin:56:78
    VPN Label: 182449
    Localpref: 100
    Router ID: 10.255.245.12

10.255.245.12:1:4.17.225.0/24 (1 entry, 1 announced)
  *BGP Preference: 170/-101
    Route Distinguisher: 10.255.245.12:1
    Source: 10.255.245.12
    Next hop: 192.168.208.66 via fe-0/0/0.0, selected
```

```

Label operation: Push 182465
Protocol next hop: 10.255.245.12
Push 182465
Indirect next hop: 863a8f0 305
State: <Active Int Ext>
Local AS: 35 Peer AS: 35
Age: 12:19 Metric2: 1
Task: BGP_35.10.255.245.12+179
Announcement bits (1): 0-BGP.0.0.0.0+179
AS path: 30 10458 14203 2914 11853 11853 11853 6496 6496 6496 6496 6496 6496 I
Communities: 2914:410 target:12:34 target:11111:1 origin:12:34
VPN Label: 182465
Localpref: 100
Router ID: 10.255.245.12

10.255.245.12:1:4.17.226.0/23 (1 entry, 1 announced)
*BGP Preference: 170/-101
Route Distinguisher: 10.255.245.12:1
Source: 10.255.245.12
Next hop: 192.168.208.66 via fe-0/0/0.0, selected
Label operation: Push 182465
Protocol next hop: 10.255.245.12
Push 182465
Indirect next hop: 86bd210 330
State: <Active Int Ext>
Local AS: 35 Peer AS: 35
Age: 12:19 Metric2: 1
Task: BGP_35.10.255.245.12+179
Announcement bits (1): 0-BGP.0.0.0.0+179
AS path: 30 10458 14203 2914 11853 11853 11853 6496 6496 6496 6496 6496
6496 I
Communities: 2914:410 target:12:34 target:11111:1 origin:12:34
VPN Label: 182465
Localpref: 100
Router ID: 10.255.245.12

10.255.245.12:1:4.17.251.0/24 (1 entry, 1 announced)
*BGP Preference: 170/-101
Route Distinguisher: 10.255.245.12:1
Source: 10.255.245.12
Next hop: 192.168.208.66 via fe-0/0/0.0, selected
Label operation: Push 182465
Protocol next hop: 10.255.245.12
Push 182465
Indirect next hop: 86bd210 330
State: <Active Int Ext>
Local AS: 35 Peer AS: 35
Age: 12:19 Metric2: 1
Task: BGP_35.10.255.245.12+179
Announcement bits (1): 0-BGP.0.0.0.0+179
AS path: 30 10458 14203 2914 11853 11853 11853 6496 6496 6496 6496 6496
6496 I
Communities: 2914:410 target:12:34 target:11111:1 origin:12:34
VPN Label: 182465
Localpref: 100

```

show route table inet.0

user@host> show route table inet.0

```

inet.0: 12 destinations, 12 routes (11 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

0.0.0.0/0      *[Static/5] 00:51:57
               > to 111.222.5.254 via fxp0.0
1.0.0.1/32    *[Direct/0] 00:51:58
               > via at-5/3/0.0
1.0.0.2/32    *[Local/0] 00:51:58
               Local
12.12.12.21/32 *[Local/0] 00:51:57
               Reject
13.13.13.13/32 *[Direct/0] 00:51:58
               > via t3-5/2/1.0
13.13.13.14/32 *[Local/0] 00:51:58
               Local
13.13.13.21/32 *[Local/0] 00:51:58
               Local
13.13.13.22/32 *[Direct/0] 00:33:59
               > via t3-5/2/0.0
127.0.0.1/32  [Direct/0] 00:51:58
               > via lo0.0
111.222.5.0/24 *[Direct/0] 00:51:58
               > via fxp0.0
111.222.5.81/32 *[Local/0] 00:51:58
               Local

```

show route table inet6.0

```

user@host> show route table inet6.0
inet6.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Route, * = Both

fec0:0:0:3::/64 *[Direct/0] 00:01:34
>via fe-0/1/0.0

fec0:0:0:3::/128 *[Local/0] 00:01:34
>Local

fec0:0:0:4::/64 *[Static/5] 00:01:34
>to fec0:0:0:3::ffff via fe-0/1/0.0

```

show route table inet6.3

```

user@router> show route table inet6.3
inet6.3: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

::10.255.245.195/128
               *[LDP/9] 00:00:22, metric 1
               > via so-1/0/0.0
::10.255.245.196/128
               *[LDP/9] 00:00:08, metric 1
               > via so-1/0/0.0, Push 100008

```

show route table l2circuit.0

```

user@host> show route table l2circuit.0
l2circuit.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.1.1.195:NoCtrlWord:1:1:Local/96
               *[L2CKT/7] 00:50:47

```

```

> via so-0/1/2.0, Push 100049
  via so-0/1/3.0, Push 100049
10.1.1.195:NoCtrlWord:1:1:Remote/96
  *[LDP/9] 00:50:14
  Discard
10.1.1.195:CtrlWord:1:2:Local/96
  *[L2CKT/7] 00:50:47
  > via so-0/1/2.0, Push 100049
    via so-0/1/3.0, Push 100049
10.1.1.195:CtrlWord:1:2:Remote/96
  *[LDP/9] 00:50:14
  Discard

```

show route table mpls

```

user@host> show route table mpls
mpls.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

0          *[MPLS/0] 00:13:55, metric 1
           Receive
1          *[MPLS/0] 00:13:55, metric 1
           Receive
2          *[MPLS/0] 00:13:55, metric 1
           Receive
1024       *[VPN/0] 00:04:18
           to table red.inet.0, Pop

```

show route table mpls extensive

```

user@host> show route table mpls extensive
100000 (1 entry, 1 announced)
TSI:
KRT in-kernel 100000 /36 -> {so-1/0/0.0}
  *LDP Preference: 9
  Next hop: via so-1/0/0.0, selected
  Pop
  State: <Active Int>
  Age: 29:50 Metric: 1
  Task: LDP
  Announcement bits (1): 0-KRT
  AS path: I
  Prefixes bound to route: 10.0.0.194/32

```

show route table mpls.0

```

user@host> show route table mpls.0
mpls.0: 11 destinations, 11 routes (11 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

0          *[MPLS/0] 00:45:09, metric 1
           Receive
1          *[MPLS/0] 00:45:09, metric 1
           Receive
2          *[MPLS/0] 00:45:09, metric 1
           Receive
100000     *[L2VPN/7] 00:43:04
           > via so-0/1/0.1, Pop
100001     *[L2VPN/7] 00:43:03
           > via so-0/1/0.2, Pop      Offset: 4
100002     *[LDP/9] 00:43:22, metric 1
           via so-0/1/2.0, Pop

```

```

100002(S=0)      > via so-0/1/3.0, Pop
                  *[LDP/9] 00:43:22, metric 1
                  via so-0/1/2.0, Pop
100003           > via so-0/1/3.0, Pop
                  *[LDP/9] 00:43:22, metric 1
                  > via so-0/1/2.0, Swap 100002
                  via so-0/1/3.0, Swap 100002
100004           *[LDP/9] 00:43:16, metric 1
                  via so-0/1/2.0, Swap 100049
                  > via so-0/1/3.0, Swap 100049
so-0/1/0.1       *[L2VPN/7] 00:43:04
                  > via so-0/1/2.0, Push 100001, Push 100049(top)
                  via so-0/1/3.0, Push 100001, Push 100049(top)
so-0/1/0.2       *[L2VPN/7] 00:43:03
                  via so-0/1/2.0, Push 100000, Push 100049(top) Offset: -4
                  > via so-0/1/3.0, Push 100000, Push 100049(top) Offset: -4

```

show route table mpls.0 (RSVP Route—Transit LSP)

```
user@host> show route table mpls.0
```

```
mpls.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
```

```

0                *[MPLS/0] 00:37:31, metric 1
                  Receive
1                *[MPLS/0] 00:37:31, metric 1
                  Receive
2                *[MPLS/0] 00:37:31, metric 1
                  Receive
13               *[MPLS/0] 00:37:31, metric 1
                  Receive
300352           *[RSVP/7/1] 00:08:00, metric 1
                  > to 8.64.0.106 via ge-1/0/1.0, label-switched-path lsp1_p2p
300352(S=0)      *[RSVP/7/1] 00:08:00, metric 1
                  > to 8.64.0.106 via ge-1/0/1.0, label-switched-path lsp1_p2p
300384           *[RSVP/7/2] 00:05:20, metric 1
                  > to 8.64.1.106 via ge-1/0/0.0, Pop
300384(S=0)      *[RSVP/7/2] 00:05:20, metric 1
                  > to 8.64.1.106 via ge-1/0/0.0, Pop

```

show route table vpls_1 detail

```
user@host> show route table vpls_1 detail
```

```
vpls_1.l2vpn.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
Restart Complete
```

```

1.1.1.11:1000:1:1/96 (1 entry, 1 announced)
*L2VPN Preference: 170/-1
Receive table: vpls_1.l2vpn.0
Next-hop reference count: 2
State: <Active Int Ext>
Age: 4:29:47 Metric2: 1
Task: vpls_1-l2vpn
Announcement bits (1): 1-BGP.0.0.0.0+179
AS path: I
Communities: Layer2-info: encaps:VPLS, control flags:Site-Down
Label-base: 800000, range: 8, status-vector: 0xFF

```

show route table vpn-a

```

user@host> show route table vpn-a
vpn-a.12vpn.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)

+ = Active Route, - = Last Active, * = Both
192.168.16.1:1:1:1/96
    *[VPN/7] 05:48:27
    Discard
192.168.24.1:1:2:1/96
    *[BGP/170] 00:02:53, localpref 100, from 192.168.24.1
    AS path: I
    > to 10.0.16.2 via fe-0/0/1.0, label-switched-path am
192.168.24.1:1:3:1/96
    *[BGP/170] 00:02:53, localpref 100, from 192.168.24.1
    AS path: I
    > to 10.0.16.2 via fe-0/0/1.0, label-switched-path am

```

show route table vpn-a.mdt.0

```

user@host> show route table vpn-a.mdt.0
vpn-a.mdt.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

1:1:0:10.255.14.216:232.1.1.1/144
    *[MVPN/70] 01:23:05, metric2 1
    Indirect
1:1:1:10.255.14.218:232.1.1.1/144
    *[BGP/170] 00:57:49, localpref 100, from 10.255.14.218
    AS path: I
    > via so-0/0/0.0, label-switched-path r0e-to-r1
1:1:2:10.255.14.217:232.1.1.1/144
    *[BGP/170] 00:57:49, localpref 100, from 10.255.14.217
    AS path: I
    > via so-0/0/1.0, label-switched-path r0-to-r2

```

show route table VPN-AB.inet.0

```

user@host> show route table VPN-AB.inet.0
VPN-AB.inet.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.39.1.0/30      *[OSPF/10] 00:07:24, metric 1
                  > via so-7/3/1.0
10.39.1.4/30      *[Direct/0] 00:08:42
                  > via so-5/1/0.0
10.39.1.6/32      *[Local/0] 00:08:46
                  Local
10.255.71.16/32   *[Static/5] 00:07:24
                  > via so-2/0/0.0
10.255.71.17/32   *[BGP/170] 00:07:24, MED 1, localpref 100, from
10.255.71.15
                  AS path: I
                  > via so-2/1/0.0, Push 100020, Push 100011(top)
10.255.71.18/32   *[BGP/170] 00:07:24, MED 1, localpref 100, from
10.255.71.15
                  AS path: I
                  > via so-2/1/0.0, Push 100021, Push 100011(top)
10.255.245.245/32 *[BGP/170] 00:08:35, localpref 100
                  AS path: 2 I
                  > to 10.39.1.5 via so-5/1/0.0

```

```
10.255.245.246/32 *[OSPF/10] 00:07:24, metric 1
> via so-7/3/1.0
```

show route table VPN_blue.mvpn-inet6.0

```
user@host> show route table VPN_blue.mvpn-inet6.0
vpn_blue.mvpn-inet6.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

1:10.255.2.202:65535:10.255.2.202/432
    *[BGP/170] 00:02:37, localpref 100, from 10.255.2.202
    AS path: I
    > via so-0/1/3.0
1:10.255.2.203:65535:10.255.2.203/432
    *[BGP/170] 00:02:37, localpref 100, from 10.255.2.203
    AS path: I
    > via so-0/1/0.0
1:10.255.2.204:65535:10.255.2.204/432
    *[MVPN/70] 00:57:23, metric2 1
    Indirect
5:10.255.2.202:65535:128::192.168.90.2:128:ffff::1/432
    *[BGP/170] 00:02:37, localpref 100, from 10.255.2.202
    AS path: I
    > via so-0/1/3.0
6:10.255.2.203:65535:65000:128::10.12.53.12:128:ffff::1/432
    *[PIM/105] 00:02:37
    Multicast (IPv6)
7:10.255.2.202:65535:65000:128::192.168.90.2:128:ffff::1/432
    *[MVPN/70] 00:02:37, metric2 1
    Indirect
```

show route table VPN-A detail

```
user@host> show route table VPN-A detail
VPN-AB.inet.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
10.255.179.9/32 (1 entry, 1 announced)
    *BGP Preference: 170/-101
    Route Distinguisher: 10.255.179.13:200
    Next hop type: Indirect
    Next-hop reference count: 5
    Source: 10.255.179.13
    Next hop type: Router, Next hop index: 732
    Next hop: 10.39.1.14 via fe-0/3/0.0, selected
    Label operation: Push 299824, Push 299824(top)
    Protocol next hop: 10.255.179.13
    Push 299824
    Indirect next hop: 8f275a0 1048574
    State: (Secondary Active Int Ext)
    Local AS: 1 Peer AS: 1
    Age: 3:41:06 Metric: 1 Metric2: 1
    Task: BGP_1.10.255.179.13+64309
    Announcement bits (2): 0-KRT 1-BGP RT Background
    AS path: I
    Communities: target:1:200 rte-type:0.0.0.0:1:0
    Import Accepted
    VPN Label: 299824 TTL Action: vrf-ttl-propagate
    Localpref: 100
    Router ID: 10.255.179.13
    Primary Routing Table bgp.13vpn.0
```


show route table inetflow detail

```
user@host> show route table inetflow detail
inetflow.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
10.12.44.1,*/48 (1 entry, 1 announced)
    *BGP    Preference: 170/-101
            Next-hop reference count: 2
            State: **Active Ext>
            Local AS: 65002 Peer AS: 65000
            Age: 4
            Task: BGP_65000.10.12.99.5+3792
            Announcement bits (1): 0-Flow
            AS path: 65000 I
            Communities: traffic-rate:0:0
            Validation state: Accept, Originator: 10.12.99.5
            Via: 10.12.44.0/24, Active
            Localpref: 100
            Router ID: 10.255.71.161

10.12.56.1,*/48 (1 entry, 1 announced)
    *Flow    Preference: 5
            Next-hop reference count: 2
            State: **Active>
            Local AS: 65002
            Age: 6:30
            Task: RT Flow
            Announcement bits (2): 0-Flow 1-BGP.0.0.0.0+179
            AS path: I
            Communities: 1:1
```


CHAPTER 31

AMT Operational Commands

- clear amt statistics
- clear amt tunnel
- show amt statistics
- show amt summary
- show amt tunnel

clear amt statistics

Syntax	<code>clear amt statistics</code> <code><instance <i>instance-name</i>></code> <code><logical-system (all <i>logical-system-name</i>)></code>
Release Information	Command introduced in JUNOS Release 10.2.
Description	Clear Automatic Multicast Tunneling (AMT) statistics.
Options	none —Clear the multicast statistics for all AMT tunnel interfaces. instance <i>instance-name</i> —(Optional) Clear AMT multicast statistics for the specified instance. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show amt statistics on page 750
List of Sample Output	clear amt statistics on page 748
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear amt statistics

```
user@host> clear amt statistics
```

clear amt tunnel

Syntax	<pre>clear amt tunnel <gateway <i>gateway-ip-addr</i>> <port <i>port-number</i>> <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)> <statistics> <tunnel-interface <i>interface-name</i>></pre>
Release Information	Command introduced in JUNOS Release 10.2.
Description	Clear the Automatic Multicast Tunneling (AMT) multicast state. Optionally, clear AMT protocol statistics.
Options	<p>none—Clear multicast state for all AMT tunnel interfaces.</p> <p>gateway <i>gateway-ip-addr</i> port <i>port-number</i>—(Optional) Clear the AMT multicast state for the specified gateway address. If no port is specified, clear the AMT multicast state for all AMT gateways with the given IP address.</p> <p>instance <i>instance-name</i>—(Optional) Clear the AMT multicast state for the specified instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>statistics—(Optional) Clear multicast statistics for all AMT tunnels or for specified tunnels.</p> <p>tunnel-interface <i>interface-name</i>—(Optional) Clear the AMT multicast state for the specified AMT tunnel interface.</p>
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none"> • show amt tunnel on page 755
List of Sample Output	clear amt tunnel on page 749 clear amt tunnel statistics gateway-address on page 749
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear amt tunnel

```
user@host> clear amt tunnel
```

clear amt tunnel statistics gateway-address

```
user@host> clear amt tunnel statistics gateway-address 100.31.1.21 port 4000
```

show amt statistics

Syntax	show amt statistics <instance <i>instance-name</i> > <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced in JUNOS Release 10.2.
Description	Display information about the Automatic Multicast Tunneling (AMT) protocol tunnel statistics.
Options	<p>none—Display summary information about all AMT Protocol tunnels.</p> <p>instance <i>instance-name</i>—(Optional) Display information for the specified instance only.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • clear amt statistics on page 748 • show amt summary on page 753 • show amt tunnel on page 755
List of Sample Output	show amt statistics on page 751
Output Fields	Table 42 on page 750 describes the output fields for the show amt statistics command. Output fields are listed in the approximate order in which they appear.

Table 42: show amt statistics Output Fields

Field Name	Field Description
AMT receive message count	<p>Summary of AMT statistics for messages received on all interfaces.</p> <ul style="list-style-type: none"> • AMT relay discovery—Number of AMT relay discovery messages received. • AMT membership request—Number of AMT membership request messages received. • AMT membership update—Number of AMT membership update messages received.
AMT send message count	<p>Summary of AMT statistics for messages sent on all interfaces.</p> <ul style="list-style-type: none"> • AMT relay advertisement—Number of AMT relay advertisement messages sent. • AMT membership query—Number of AMT membership query messages sent.

Table 42: show amt statistics Output Fields (*continued*)

Field Name	Field Description
AMT error message count	<p>Summary of AMT statistics for error messages received on all interfaces.</p> <ul style="list-style-type: none"> • AMT incomplete packet—Number of messages received with length errors so severe that further classification could not occur. • AMT invalid mac—Number of messages received with an invalid message authentication code (MAC). • AMT unexpected type—Number of messages received with an unknown message type specified. • AMT invalid relay discovery address—Number of AMT relay discovery messages received with an address other than the configured anycast address. • AMT invalid membership request address—Number of AMT membership request messages received with an address other than the configured AMT local address. • AMT invalid membership update address—Number of AMT membership update messages received with an address other than the configured AMT local address. • AMT incomplete relay discovery messages—Number of AMT relay discovery messages received that are not fully formed. • AMT incomplete membership request messages—Number of AMT membership request messages received that are not fully formed. • AMT incomplete membership update messages—Number of AMT membership update messages received that are not fully formed. • AMT no active gateway—Number of AMT membership update messages received for a tunnel that does not exist for the gateway that sent the message. • AMT invalid inner header checksum—Number of AMT membership update messages received with an invalid IP checksum. • AMT gateways timed out—Number of gateways that timed out because of inactivity.

Sample Output

show amt statistics

```
user@host> show amt statistics
```

```

AMT receive message count
AMT relay advertisement           :           2
AMT membership request           :           5
AMT membership update            :           5

AMT send message count
AMT relay advertisement           :           2
AMT membership query              :           5

AMT error message count
AMT incomplete packet             :           0
AMT invalid mac                   :           0
AMT unexpected type               :           0
AMT invalid relay discovery address :           0
AMT invalid membership request address :           0
AMT invalid membership update address :           0
AMT incomplete relay discovery messages :           0
AMT incomplete membership request messages :           0
AMT incomplete membership update messages :           0
AMT no active gateway             :           0

```

AMT invalid inner header checksum	:	0
AMT gateways timed out	:	0

show amt summary

Syntax	show amt summary <instance <i>instance-name</i> > <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced in JUNOS Release 10.2.
Description	Display summary information about the Automatic Multicast Tunneling (AMT) protocol.
Options	<p>none—Display summary information about all AMT protocol instances.</p> <p>instance <i>instance-name</i>—(Optional) Display information for the specified instance only.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • clear amt tunnel on page 749 • show amt statistics on page 750 • show amt tunnel on page 755
List of Sample Output	show amt summary on page 754
Output Fields	<p>Table 43 on page 753 describes the output fields for the show amt summary command. Output fields are listed in the approximate order in which they appear.</p>

Table 43: show amt summary Output Fields

Field Name	Field Description	Level of Output
AMT anycast prefix	Prefix advertised by unicast routing protocols to route AMT discovery messages to the router from nearby AMT gateways.	All levels
AMT anycast address	Anycast address configured from which the anycast prefix is derived.	All levels
AMT local address	Local unique AMT relay IP address configured. Used to send AMT relay advertisement messages, it is the IP source address of AMT control messages and the source address of the data tunnel encapsulation.	All levels
AMT tunnel limit	Maximum number of AMT tunnels that can be created.	All levels
active tunnels	Number of active AMT tunnel interfaces.	All levels

Sample Output

show amt summary

```
user@host> show amt summary
  AMT anycast prefix : 20.0.0.4/32
  AMT anycast address : 20.0.0.4
  AMT local address : 20.0.0.4
  AMT tunnel limit : 1000, active tunnels : 2
```

show amt tunnel

Syntax	<pre>show amt tunnel <brief detail> <gateway-address <i>gateway-ip-address</i>> <port <i>port-number</i>> <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)> <tunnel-interface <i>interface-name</i>></pre>	
Release Information	Command introduced in JUNOS Release 10.2.	
Description	Display information about the Automatic Multicast Tunneling (AMT) dynamic tunnels.	
Options	<p>none—Display summary information about all AMT protocol instances.</p> <p>brief detail—(Optional) Display the specified level of detail.</p> <p>gateway-address <i>gateway-ip-address</i> port <i>port-number</i>—(Optional) Display information for the specified AMT gateway only. If no port is specified, display information for all AMT gateways with the given IP address.</p> <p>instance <i>instance-name</i>—(Optional) Display information for the specified instance only.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>tunnel-interface <i>interface-name</i>—(Optional) Display information for the specified AMT tunnel interface only.</p>	
Required Privilege Level	view	
Related Documentation	<ul style="list-style-type: none"> • clear amt tunnel on page 749 • show amt statistics on page 750 • show amt summary on page 753 	
List of Sample Output	show amt tunnel on page 756 show amt tunnel detail on page 756 show amt tunnel tunnel-interface on page 757 show amt tunnel gateway-address on page 757 show amt tunnel gateway-address detail on page 757	
Output Fields	<p>Table 44 on page 755 describes the output fields for the show amt tunnel command. Output fields are listed in the approximate order in which they appear.</p>	

Table 44: show amt tunnel Output Fields

Field Name	Field Description	Level of Output
AMT gateway address	Address of the AMT gateway that is being connected by the AMT tunnel.	All levels

Table 44: show amt tunnel Output Fields (*continued*)

Field Name	Field Description	Level of Output
port	Client port used by the AMT tunnel.	All levels
AMT tunnel interface	Dynamically created AMT logical interfaces used by the AMT tunnel in the format ud-FPC/PIC/Port.unit .	All levels
AMT tunnel state	State of the AMT tunnel. The state is normally Active . <ul style="list-style-type: none"> Active—The tunnel is active. Pending—The tunnel creation is pending. This is a transient state. Down—The tunnel is in the down state. Graceful restart pending—Graceful restart is in progress. Reviving—The routing protocol daemon or Routing Engine was restarted (not gracefully). The tunnel remains in the reviving state until the AMT gateway sends a control message. When the message is received the tunnel is moved to the Active state. If no message is received before the AMT tunnel inactivity timer expires, the tunnel is deleted. 	All levels
AMT tunnel inactivity timeout	Number of seconds since the most recent control message was received from an AMT gateway. If no message is received before the AMT tunnel inactivity timer expires, the tunnel is deleted.	All levels
Number of groups	Number of multicast groups using the tunnel.	All levels
Group	Multicast group address or addresses using the tunnel.	detail
Include Source	Multicast source address for each IGMPv3 group using the tunnel.	detail
AMT message count	Statistics for AMT messages: <ul style="list-style-type: none"> AMT Request—Number of AMT relay tunnel request messages received. AMT membership update—Number of AMT membership update messages received. 	All levels

Sample Output

show amt tunnel

```

user@host> show amt tunnel
AMT gateway address : 11.11.11.2, port : 2268
AMT tunnel interface : ud-5/1/10.1120256
AMT tunnel state : Active
AMT tunnel inactivity timeout : 15
Number of groups : 1

AMT message count:
AMT Request      AMT membership update
2                2

```

show amt tunnel detail

```

user@host> show amt tunnel detail
AMT gateway address : 11.11.11.2, port : 2268
AMT tunnel interface : ud-5/3/10.1120512

```

```

AMT tunnel state : Active
AMT tunnel inactivity timeout : 62
Number of groups : 1
Group: 226.2.3.2

AMT message count:
AMT Request      AMT membership update
2                2

AMT gateway address : 11.11.11.3, port : 2268
AMT tunnel interface : ud-5/2/10.1120513
AMT tunnel state : Active
AMT tunnel inactivity timeout : 214
Number of groups : 1
Group: 226.2.3.3

AMT message count:
AMT Request      AMT membership update
2                2

```

show amt tunnel tunnel-interface

```

user@host> show amt tunnel tunnel-interface ud-5/3/10.1120512
AMT gateway address : 11.11.11.2, port : 2268
AMT tunnel interface : ud-5/3/10.1120512
AMT tunnel state : Active
AMT tunnel inactivity timeout : 145
Number of groups : 1

AMT message count:
AMT Request      AMT membership update
2                2

```

show amt tunnel gateway-address

```

user@host> show amt tunnel gateway-address 11.11.11.3 port 2268
AMT gateway address : 11.11.11.3, port : 2268
AMT tunnel interface : ud-5/2/10.1120513
AMT tunnel state : Active
AMT tunnel inactivity timeout : 214
Number of groups : 1
Group: 226.2.3.3

AMT message count:
AMT Request      AMT membership update
2                2

```

show amt tunnel gateway-address detail

```

user@host> show amt tunnel gateway-address 11.11.11.2 detail
AMT gateway address : 11.11.11.2, port : 2268
AMT tunnel interface : ud-5/3/10.1120512
AMT tunnel state : Active
AMT tunnel inactivity timeout : 234
Number of groups : 1
Group: 226.2.3.2

AMT message count:
AMT Request      AMT membership update
2                2

```


CHAPTER 32

Session Announcement Protocol Operational Commands

- `show sap listen`

show sap listen

Syntax	show sap listen <brief detail> <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display the addresses that the router is listening to in order to receive multicast Session Announcement Protocol (SAP) session announcements.
Options	<p>none—Display standard information about the addresses that the router is listening to in order to receive multicast SAP session announcements.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show sap listen on page 760 show sap listen brief on page 760 show sap listen detail on page 761
Output Fields	Table 45 on page 760 describes the output fields for the show sap listen command. Output fields are listed in the approximate order in which they appear.

Table 45: show sap listen Output Fields

Field Name	Field Description
Group address	Address of the group that the local router is listening to for SAP messages.
Port	UDP port number used for SAP.

Sample Output

show sap listen

```
user@host> show sap listen
Group address  Port
224.2.127.254  9875
239.255.255.255 9875
```

show sap listen brief

The output for the **show sap listen brief** command is identical to that for the **show sap listen** command. For sample output, see [show sap listen on page 760](#).

show sap listen detail

The output for the **show sap listen detail** command is identical to that for the **show sap listen** command. For sample output, see [show sap listen on page 760](#).

CHAPTER 33

MSDP Operational Commands

- `show msdp`
- `show msdp source`
- `show msdp source-active`
- `show msdp statistics`
- `show multicast usage`
- `show route table`

show msdp

Syntax	<pre>show msdp <brief detail> <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)> <peer <i>peer-address</i>></pre>
Release Information	<p>Command introduced before Junos OS Release 7.4.</p> <p>Command introduced in Junos OS Release 12.1 for the QFX Series.</p>
Description	Display Multicast Source Discovery Protocol (MSDP) information.
Options	<p>none—Display standard MSDP information for all routing instances.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>instance <i>instance-name</i>—(Optional) Display information for the specified instance only.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>peer <i>peer-address</i>—(Optional) Display information about the specified peer only.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none"> • show msdp source on page 766 • show msdp source-active on page 768 • show msdp statistics on page 770
List of Sample Output	<p>show msdp on page 765</p> <p>show msdp brief on page 765</p> <p>show msdp detail on page 765</p>
Output Fields	Table 46 on page 764 describes the output fields for the show msdp command. Output fields are listed in the approximate order in which they appear.

Table 46: show msdp Output Fields

Field Name	Field Description	Level of Output
Peer address	IP address of the peer.	All levels
Local address	Local address of the peer.	All levels
State	Status of the MSDP connection: Listen , Established , or Inactive .	All levels
Last up/down	Time at which the most recent peer-state change occurred.	All levels

Table 46: show msdp Output Fields (*continued*)

Field Name	Field Description	Level of Output
Peer-Group	Peer group name.	All levels
SA Count	Number of source-active cache entries advertised by each peer that were accepted, compared to the number that were received, in the format <i>number-accepted/number-received</i> .	All levels
Peer Connect Retries	Number of peer connection retries.	detail
State timer expires	Number of seconds before another message is sent to a peer.	detail
Peer Times out	Number of seconds to wait for a response from the peer before the peer is declared unavailable.	detail
SA accepted	Number of entries in the source-active cache accepted from the peer.	detail
SA received	Number of entries in the source-active cache received by the peer.	detail

Sample Output

show msdp

```

user@host> show msdp
Peer address    Local address  State      Last up/down Peer-Group SA Count
198.32.8.193    198.32.8.195  Established 5d 19:25:44 North23 120/150
198.32.8.194    198.32.8.195  Established 3d 19:27:27 North23 300/345
198.32.8.196    198.32.8.195  Established 5d 19:39:36 North23 10/13
198.32.8.197    198.32.8.195  Established 5d 19:32:27 North23 5/6
198.32.8.198    198.32.8.195  Established 3d 19:33:04 North23 2305/3000

```

show msdp brief

The output for the **show msdp brief** command is identical to that for the **show msdp** command. For sample output, see [show msdp on page 765](#).

show msdp detail

```

user@host> show msdp detail
Peer: 10.255.70.15
Local address: 10.255.70.19
State: Established
Peer Connect Retries: 0
State timer expires: 22
Peer Times out: 49
SA accepted: 0
SA received: 0

```

show msdp source

Syntax	<code>show msdp source</code> <code><instance <i>instance-name</i>></code> <code><logical-system (all <i>logical-system-name</i>)></code> <code><source-address></code>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 12.1 for the QFX Series.
Description	Display multicast sources learned from Multicast Source Discovery Protocol (MSDP).
Options	none —Display standard MSDP source information for all routing instances. instance <i>instance-name</i> —(Optional) Display information for the specified instance only. logical-system (all <i>logical-system-name</i>) —(Optional) Perform this operation on all logical systems or on a particular logical system. source-address —(Optional) IP address and optional prefix length. Display information for the specified source address only.
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none">• show msdp on page 764• show msdp source-active on page 768• show msdp statistics on page 770
List of Sample Output	show msdp source on page 767

Output Fields Table 47 on page 767 describes the output fields for the **show msdp source** command. Output fields are listed in the approximate order in which they appear.

Table 47: show msdp source Output Fields

Field Name	Field Description
Source address	IP address of the source.
/Len	Length of the prefix for this IP address.
Type	Discovery method for this multicast source: <ul style="list-style-type: none"> • Configured—Source-active limit explicitly configured for this source. • Dynamic—Source-active limit established when this source was discovered.
Maximum	Source-active limit applied to this source.
Threshold	Source-active threshold applied to this source.
Exceeded	Number of source-active messages received from this source exceeding the established maximum.

Sample Output

show msdp source

```

user@host> show msdp source
Source address /Len  Type      Maximum  Threshold  Exceeded
0.0.0.0       /0    Configured    5         none        0
10.1.0.0      /16   Configured    500       none        0
10.1.1.1      /32   Configured    10000     none        0
10.1.1.2      /32   Dynamic       6936     none        0
10.1.5.5      /32   Dynamic       500       none        123
10.2.1.1      /32   Dynamic        2         none        0

```

show msdp source-active

Syntax	<pre>show msdp source-active <brief detail> <group <i>group</i>> <instance <i>instance-name</i>> <local> <logical-system (all <i>logical-system-name</i>)> <originator <i>originator</i>> <peer <i>peer-address</i>> <source <i>source-address</i>></pre>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 12.1 for the QFX Series.
Description	Display the Multicast Source Discovery Protocol (MSDP) source-active cache.
Options	<p>none—Display standard MSDP source-active cache information for all routing instances.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>group <i>group</i>—(Optional) Display source-active cache information for the specified group.</p> <p>instance <i>instance-name</i>—(Optional) Display information for the specified instance.</p> <p>local—(Optional) Display all source-active caches originated by this router.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>originator <i>originator</i>—(Optional) Display information about the peer that originated the source-active cache entries.</p> <p>peer <i>peer-address</i>—(Optional) Display the source-active cache of the specified peer.</p> <p>source <i>source-address</i>—(Optional) Display the source-active cache of the specified source.</p>
Required Privilege Level	view
Related Documentation	<ul style="list-style-type: none">• show msdp on page 764• show msdp source on page 766• show msdp statistics on page 770
List of Sample Output	show msdp source-active on page 769 show msdp source-active brief on page 769 show msdp source-active detail on page 769
Output Fields	Table 48 on page 769 describes the output fields for the show msdp source-active command. Output fields are listed in the approximate order in which they appear.

Table 48: show msdp source-active Output Fields

Field Name	Field Description
Group address	Multicast address of the group.
Source address	IP address of the source.
Peer address	IP address of the peer.
Originator	Address of the rendezvous point (RP) that originated the message.
Flags	Flags: Accept, Reject, or Filtered.

Sample Output

show msdp source-active

```

user@host> show msdp source-active
Group address  Source address  Peer address  Originator  Flags
230.0.0.0     192.168.195.46  local        10.255.14.30  Accept
230.0.0.1     192.168.195.46  local        10.255.14.30  Accept
230.0.0.2     192.168.195.46  local        10.255.14.30  Accept
230.0.0.3     192.168.195.46  local        10.255.14.30  Accept
230.0.0.4     192.168.195.46  local        10.255.14.30  Accept

```

show msdp source-active brief

The output for the **show msdp source-active brief** command is identical to that for the **show msdp source-active** command. For sample output, see [show msdp source-active on page 769](#).

show msdp source-active detail

The output for the **show msdp source-active detail** command is identical to that for the **show msdp source-active** command. For sample output, see [show msdp source-active on page 769](#).

show msdp statistics

Syntax	show msdp statistics <instance <i>instance-name</i> > <logical-system (all <i>logical-system-name</i>)> <peer <i>peer-address</i> >
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 12.1 for the QFX Series.
Description	Display statistics about Multicast Source Discovery Protocol (MSDP) peers.
Options	<p>none—Display statistics about all MSDP peers for all routing instances.</p> <p>instance <i>instance-name</i>—(Optional) Display statistics about a specific MSDP instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>peer <i>peer-address</i>—(Optional) Display statistics about a particular MSDP peer.</p>
Required Privilege Level	view
List of Sample Output	show msdp statistics on page 771
Output Fields	Table 49 on page 770 describes the output fields for the show msdp statistics command. Output fields are listed in the approximate order in which they appear.

Table 49: show msdp statistics Output Fields

Field Name	Field Description
Global active source limit exceeded	Number of times all peers have exceeded configured active source limits.
Peer	Address of peer.
Last State Change	How long ago the peer state changed.
Last message received from the peer	How long ago the last message was received from the peer.
RPF Failures	Number of reverse path forwarding (RPF) failures.
Remote Closes	Number of times the remote peer closed.
Peer Timeouts	Number of peer timeouts.
SA messages sent	Number of source-active messages sent.
SA messages received	Number of source-active messages received.

Table 49: show msdp statistics Output Fields (*continued*)

Field Name	Field Description
SA request messages sent	Number of source-active request messages sent.
SA request messages received	Number of source-active request messages received.
SA response messages sent	Number of source-active response messages sent.
SA response messages received	Number of source-active response messages received.
Active source exceeded	Number of times this peer has exceeded configured source-active limits.
Keepalive messages sent	Number of keepalive messages sent.
Keepalive messages received	Number of keepalive messages received.
Unknown messages received	Number of unknown messages received.
Error messages received	Number of error messages received.

Sample Output

show msdp statistics

```

user@host> show msdp statistics
Global active source exceeded: 0

Peer: 10.255.245.39
Last State Change: 11:54:49 (00:24:59)
Last message received from peer: 11:53:32 (00:26:16)
RPF Failures: 0
Remote Closes: 0
Peer Timeouts: 0
SA messages sent: 376
SA messages received: 459
SA request messages sent: 0
SA request messages received: 0
SA response messages sent: 0
SA response messages received: 0
Active source exceeded: 0
Keepalive messages sent: 17
Keepalive messages received: 19
Unknown messages received: 0
Error messages received: 0

```

show multicast usage

List of Syntax	Syntax on page 772 Syntax (EX Series Switch and the QFX Series) on page 772
Syntax	<pre>show multicast usage <brief detail> <inet inet6> <instance <i>instance-name</i>> <logical-system (all <i>logical-system-name</i>)></pre>
Syntax (EX Series Switch and the QFX Series)	<pre>show multicast usage <brief detail> <inet inet6> <instance <i>instance-name</i>></pre>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches. inet6 and instance options introduced in Junos OS Release 10.0 for EX Series switches. Command introduced in Junos OS Release 11.3 for the QFX Series.
Description	Display usage information about the 10 most active Distance Vector Multicast Routing Protocol (DVMRP) or Protocol Independent Multicast (PIM) groups.
Options	<p>none—Display multicast usage information for all supported address families for all routing instances.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>inet inet6—(Optional) Display usage information for IPv4 or IPv6 family addresses, respectively.</p> <p>instance <i>instance-name</i>—(Optional) Display information about the most active DVMRP or PIM groups for a specific multicast instance.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show multicast usage on page 773 show multicast usage brief on page 773 show multicast usage instance on page 773 show multicast usage detail on page 774
Output Fields	Table 50 on page 773 describes the output fields for the show multicast usage command. Output fields are listed in the approximate order in which they appear.

Table 50: show multicast usage Output Fields

Field Name	Field Description
Instance	Name of the routing instance. (Displayed when multicast is configured within a routing instance.)
Group	Group address.
Sources	Number of sources.
Packets	Number of packets that have been forwarded to this prefix. If one or more of the packets forwarded statistic queries fails or times out, the packets field displays unavailable .
Bytes	Number of bytes that have been forwarded to this prefix. If one or more of the packets forwarded statistic queries fails or times out, the bytes field displays unavailable .
Prefix	IP address.
/len	Prefix length.
Groups	Number of multicast groups.

Sample Output

show multicast usage

```

user@host> show multicast usage
Group          Sources  Packets      Bytes
228.0.0.0      1        52847      4439148
239.1.1.1      2        13450      1125530

Prefix         /len  Groups  Packets      Bytes
10.255.14.144 /32   2        66254      5561304
10.255.70.15  /32   1         43        3374...
```

show multicast usage brief

The output for the **show multicast usage brief** command is identical to that for the **show multicast usage** command. For sample output, see [show multicast usage on page 773](#).

show multicast usage instance

```

user@host> show multicast usage instance VPN-A
Group          Sources  Packets      Bytes
224.2.127.254  1        5538      509496
224.0.1.39     1         13         624
224.0.1.40     1         13         624

Prefix         /len  Groups  Packets      Bytes
192.168.195.34 /32   1        5538      509496
10.255.14.30   /32   1         13         624
```

```
10.255.245.91 /32 1 13 624
...
```

show multicast usage detail

```
user@host> show multicast usage detail
Group          Sources Packets          Bytes
228.0.0.0      1        53159          4465356
  Source: 10.255.14.144 /32 Packets: 53159 Bytes: 4465356
239.1.1.1      2        13450          1125530
  Source: 10.255.14.144 /32 Packets: 13407 Bytes: 1122156
  Source: 10.255.70.15  /32 Packets: 43 Bytes: 3374
```

```
Prefix        /len Groups Packets          Bytes
10.255.14.144 /32 2        66566          5587512
  Group: 228.0.0.0      Packets: 53159 Bytes: 4465356
  Group: 239.1.1.1      Packets: 13407 Bytes: 1122156
10.255.70.15  /32 1         43            3374
  Group: 239.1.1.1      Packets: 43 Bytes: 3374
```

show route table

List of Syntax	Syntax on page 775 Syntax (EX Series Switches) on page 775
Syntax	show route table <i>routing-table-name</i> <brief detail extensive terse> <logical-system (all <i>logical-system-name</i>)>
Syntax (EX Series Switches)	show route table <i>routing-table-name</i> <brief detail extensive terse>
Release Information	Command introduced before Junos OS Release 7.4. Command introduced in Junos OS Release 9.0 for EX Series switches.
Description	Display the route entries in a particular routing table.
Options	<p>brief detail extensive terse—(Optional) Display the specified level of output.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p><i>routing-table-name</i>—Display route entries for all routing tables whose name begins with this string (for example, inet.0 and inet6.0 are both displayed when you run the show route table inet command).</p>
Required Privilege Level	view
List of Sample Output	show route table bgp.l2.vpn on page 776 show route table bgp.l3vpn.0 on page 776 show route table bgp.l3vpn.0 detail on page 776 show route table inet.0 on page 777 show route table inet6.0 on page 778 show route table inet6.3 on page 778 show route table l2circuit.0 on page 778 show route table mpls on page 779 show route table mpls extensive on page 779 show route table mpls.0 on page 779 show route table mpls.0 (RSVP Route—Transit LSP) on page 780 show route table vpls_1 detail on page 780 show route table vpn-a on page 781 show route table vpn-a.mdt.0 on page 781 show route table VPN-AB.inet.0 on page 781 show route table VPN_blue.mvpn-inet6.0 on page 782 show route table VPN-A detail on page 782 show route table inetflow detail on page 783
Output Fields	For information about output fields, see the output field tables for the show route command, the show route detail command, the show route extensive command, or the show route terse command.

Sample Output

show route table bgp.l2vpn

```
user@host> show route table bgp.l2vpn
bgp.l2vpn.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

192.168.24.1:1:4:1/96
    *[BGP/170] 01:08:58, localpref 100, from 192.168.24.1
    AS path: I
    > to 10.0.16.2 via fe-0/0/1.0, label-switched-path am
```

show route table bgp.l3vpn.0

```
user@host> show route table bgp.l3vpn.0
bgp.l3vpn.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.255.71.15:100:10.255.71.17/32
    *[BGP/170] 00:03:59, MED 1, localpref 100, from
10.255.71.15
    AS path: I
    > via so-2/1/0.0, Push 100020, Push 100011(top)
10.255.71.15:200:10.255.71.18/32
    *[BGP/170] 00:03:59, MED 1, localpref 100, from
10.255.71.15
    AS path: I
    > via so-2/1/0.0, Push 100021, Push 100011(top)
```

show route table bgp.l3vpn.0 detail

```
user@host> show route table bgp.l3vpn.0 detail
bgp.l3vpn.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)

10.255.245.12:1:4.0.0.0/8 (1 entry, 1 announced)
  *BGP Preference: 170/-101
    Route Distinguisher: 10.255.245.12:1
    Source: 10.255.245.12
    Next hop: 192.168.208.66 via fe-0/0/0.0, selected
    Label operation: Push 182449
    Protocol next hop: 10.255.245.12
    Push 182449
    Indirect next hop: 863a630 297
    State: <Active Int Ext>
    Local AS: 35 Peer AS: 35
    Age: 12:19 Metric2: 1
    Task: BGP_35.10.255.245.12+179
    Announcement bits (1): 0-BGP.0.0.0.0+179
    AS path: 30 10458 14203 2914 3356 I (Atomic) Aggregator: 3356 4.68.0.11

    Communities: 2914:420 target:11111:1 origin:56:78
    VPN Label: 182449
    Localpref: 100
    Router ID: 10.255.245.12

10.255.245.12:1:4.17.225.0/24 (1 entry, 1 announced)
  *BGP Preference: 170/-101
    Route Distinguisher: 10.255.245.12:1
    Source: 10.255.245.12
    Next hop: 192.168.208.66 via fe-0/0/0.0, selected
```



```

Label operation: Push 182465
Protocol next hop: 10.255.245.12
Push 182465
Indirect next hop: 863a8f0 305
State: <Active Int Ext>
Local AS: 35 Peer AS: 35
Age: 12:19 Metric2: 1
Task: BGP_35.10.255.245.12+179
Announcement bits (1): 0-BGP.0.0.0.0+179
AS path: 30 10458 14203 2914 11853 11853 11853 6496 6496 6496 6496 6496 6496 I
Communities: 2914:410 target:12:34 target:11111:1 origin:12:34
VPN Label: 182465
Localpref: 100
Router ID: 10.255.245.12

10.255.245.12:1:4.17.226.0/23 (1 entry, 1 announced)
*BGP Preference: 170/-101
Route Distinguisher: 10.255.245.12:1
Source: 10.255.245.12
Next hop: 192.168.208.66 via fe-0/0/0.0, selected
Label operation: Push 182465
Protocol next hop: 10.255.245.12
Push 182465
Indirect next hop: 86bd210 330
State: <Active Int Ext>
Local AS: 35 Peer AS: 35
Age: 12:19 Metric2: 1
Task: BGP_35.10.255.245.12+179
Announcement bits (1): 0-BGP.0.0.0.0+179
AS path: 30 10458 14203 2914 11853 11853 11853 6496 6496 6496 6496 6496
6496 I
Communities: 2914:410 target:12:34 target:11111:1 origin:12:34
VPN Label: 182465
Localpref: 100
Router ID: 10.255.245.12

10.255.245.12:1:4.17.251.0/24 (1 entry, 1 announced)
*BGP Preference: 170/-101
Route Distinguisher: 10.255.245.12:1
Source: 10.255.245.12
Next hop: 192.168.208.66 via fe-0/0/0.0, selected
Label operation: Push 182465
Protocol next hop: 10.255.245.12
Push 182465
Indirect next hop: 86bd210 330
State: <Active Int Ext>
Local AS: 35 Peer AS: 35
Age: 12:19 Metric2: 1
Task: BGP_35.10.255.245.12+179
Announcement bits (1): 0-BGP.0.0.0.0+179
AS path: 30 10458 14203 2914 11853 11853 11853 6496 6496 6496 6496 6496
6496 I
Communities: 2914:410 target:12:34 target:11111:1 origin:12:34
VPN Label: 182465
Localpref: 100

```

show route table inet.0

user@host> show route table inet.0

```

inet.0: 12 destinations, 12 routes (11 active, 0 holddown, 1 hidden)
+ = Active Route, - = Last Active, * = Both

0.0.0.0/0      *[Static/5] 00:51:57
               > to 111.222.5.254 via fxp0.0
1.0.0.1/32    *[Direct/0] 00:51:58
               > via at-5/3/0.0
1.0.0.2/32    *[Local/0] 00:51:58
               Local
12.12.12.21/32 *[Local/0] 00:51:57
               Reject
13.13.13.13/32 *[Direct/0] 00:51:58
               > via t3-5/2/1.0
13.13.13.14/32 *[Local/0] 00:51:58
               Local
13.13.13.21/32 *[Local/0] 00:51:58
               Local
13.13.13.22/32 *[Direct/0] 00:33:59
               > via t3-5/2/0.0
127.0.0.1/32  [Direct/0] 00:51:58
               > via lo0.0
111.222.5.0/24 *[Direct/0] 00:51:58
               > via fxp0.0
111.222.5.81/32 *[Local/0] 00:51:58
               Local

```

show route table inet6.0

```

user@host> show route table inet6.0
inet6.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Route, * = Both

fec0:0:0:3::/64 *[Direct/0] 00:01:34
>via fe-0/1/0.0

fec0:0:0:3::/128 *[Local/0] 00:01:34
>Local

fec0:0:0:4::/64 *[Static/5] 00:01:34
>to fec0:0:0:3::ffff via fe-0/1/0.0

```

show route table inet6.3

```

user@router> show route table inet6.3
inet6.3: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

::10.255.245.195/128
               *[LDP/9] 00:00:22, metric 1
               > via so-1/0/0.0
::10.255.245.196/128
               *[LDP/9] 00:00:08, metric 1
               > via so-1/0/0.0, Push 100008

```

show route table l2circuit.0

```

user@host> show route table l2circuit.0
l2circuit.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.1.1.195:NoCtrlWord:1:1:Local/96
               *[L2CKT/7] 00:50:47

```

```

> via so-0/1/2.0, Push 100049
  via so-0/1/3.0, Push 100049
10.1.1.195:NoCtrlWord:1:1:Remote/96
  *[LDP/9] 00:50:14
  Discard
10.1.1.195:CtrlWord:1:2:Local/96
  *[L2CKT/7] 00:50:47
  > via so-0/1/2.0, Push 100049
    via so-0/1/3.0, Push 100049
10.1.1.195:CtrlWord:1:2:Remote/96
  *[LDP/9] 00:50:14
  Discard

```

show route table mpls

```

user@host> show route table mpls
mpls.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

0          *[MPLS/0] 00:13:55, metric 1
           Receive
1          *[MPLS/0] 00:13:55, metric 1
           Receive
2          *[MPLS/0] 00:13:55, metric 1
           Receive
1024       *[VPN/0] 00:04:18
           to table red.inet.0, Pop

```

show route table mpls extensive

```

user@host> show route table mpls extensive
100000 (1 entry, 1 announced)
TSI:
KRT in-kernel 100000 /36 -> {so-1/0/0.0}
  *LDP Preference: 9
  Next hop: via so-1/0/0.0, selected
  Pop
  State: <Active Int>
  Age: 29:50 Metric: 1
  Task: LDP
  Announcement bits (1): 0-KRT
  AS path: I
  Prefixes bound to route: 10.0.0.194/32

```

show route table mpls.0

```

user@host> show route table mpls.0
mpls.0: 11 destinations, 11 routes (11 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

0          *[MPLS/0] 00:45:09, metric 1
           Receive
1          *[MPLS/0] 00:45:09, metric 1
           Receive
2          *[MPLS/0] 00:45:09, metric 1
           Receive
100000     *[L2VPN/7] 00:43:04
           > via so-0/1/0.1, Pop
100001     *[L2VPN/7] 00:43:03
           > via so-0/1/0.2, Pop      Offset: 4
100002     *[LDP/9] 00:43:22, metric 1
           via so-0/1/2.0, Pop

```

```

100002(S=0)      > via so-0/1/3.0, Pop
                  *[LDP/9] 00:43:22, metric 1
                  via so-0/1/2.0, Pop
100003           > via so-0/1/3.0, Pop
                  *[LDP/9] 00:43:22, metric 1
                  > via so-0/1/2.0, Swap 100002
                  via so-0/1/3.0, Swap 100002
100004           *[LDP/9] 00:43:16, metric 1
                  via so-0/1/2.0, Swap 100049
                  > via so-0/1/3.0, Swap 100049
so-0/1/0.1       *[L2VPN/7] 00:43:04
                  > via so-0/1/2.0, Push 100001, Push 100049(top)
                  via so-0/1/3.0, Push 100001, Push 100049(top)
so-0/1/0.2       *[L2VPN/7] 00:43:03
                  via so-0/1/2.0, Push 100000, Push 100049(top) Offset: -4
                  > via so-0/1/3.0, Push 100000, Push 100049(top) Offset: -4

```

show route table mpls.0 (RSVP Route—Transit LSP)

```
user@host> show route table mpls.0
```

```
mpls.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both
```

```

0                *[MPLS/0] 00:37:31, metric 1
                  Receive
1                *[MPLS/0] 00:37:31, metric 1
                  Receive
2                *[MPLS/0] 00:37:31, metric 1
                  Receive
13               *[MPLS/0] 00:37:31, metric 1
                  Receive
300352           *[RSVP/7/1] 00:08:00, metric 1
                  > to 8.64.0.106 via ge-1/0/1.0, label-switched-path lsp1_p2p
300352(S=0)       *[RSVP/7/1] 00:08:00, metric 1
                  > to 8.64.0.106 via ge-1/0/1.0, label-switched-path lsp1_p2p
300384           *[RSVP/7/2] 00:05:20, metric 1
                  > to 8.64.1.106 via ge-1/0/0.0, Pop
300384(S=0)       *[RSVP/7/2] 00:05:20, metric 1
                  > to 8.64.1.106 via ge-1/0/0.0, Pop

```

show route table vpls_1 detail

```
user@host> show route table vpls_1 detail
```

```
vpls_1.l2vpn.0: 1 destinations, 1 routes (1 active, 0 holddown, 0 hidden)
Restart Complete
```

```

1.1.1.11:1000:1:1/96 (1 entry, 1 announced)
*L2VPN Preference: 170/-1
Receive table: vpls_1.l2vpn.0
Next-hop reference count: 2
State: <Active Int Ext>
Age: 4:29:47 Metric2: 1
Task: vpls_1-l2vpn
Announcement bits (1): 1-BGP.0.0.0.0+179
AS path: I
Communities: Layer2-info: encaps:VPLS, control flags:Site-Down
Label-base: 800000, range: 8, status-vector: 0xFF

```

show route table vpn-a

```

user@host> show route table vpn-a
vpn-a.12vpn.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)

+ = Active Route, - = Last Active, * = Both
192.168.16.1:1:1:1/96
    *[VPN/7] 05:48:27
    Discard
192.168.24.1:1:2:1/96
    *[BGP/170] 00:02:53, localpref 100, from 192.168.24.1
    AS path: I
    > to 10.0.16.2 via fe-0/0/1.0, label-switched-path am
192.168.24.1:1:3:1/96
    *[BGP/170] 00:02:53, localpref 100, from 192.168.24.1
    AS path: I
    > to 10.0.16.2 via fe-0/0/1.0, label-switched-path am

```

show route table vpn-a.mdt.0

```

user@host> show route table vpn-a.mdt.0
vpn-a.mdt.0: 3 destinations, 3 routes (3 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

1:1:0:10.255.14.216:232.1.1.1/144
    *[MVPN/70] 01:23:05, metric2 1
    Indirect
1:1:1:10.255.14.218:232.1.1.1/144
    *[BGP/170] 00:57:49, localpref 100, from 10.255.14.218
    AS path: I
    > via so-0/0/0.0, label-switched-path r0e-to-r1
1:1:2:10.255.14.217:232.1.1.1/144
    *[BGP/170] 00:57:49, localpref 100, from 10.255.14.217
    AS path: I
    > via so-0/0/1.0, label-switched-path r0-to-r2

```

show route table VPN-AB.inet.0

```

user@host> show route table VPN-AB.inet.0
VPN-AB.inet.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

10.39.1.0/30      *[OSPF/10] 00:07:24, metric 1
                  > via so-7/3/1.0
10.39.1.4/30      *[Direct/0] 00:08:42
                  > via so-5/1/0.0
10.39.1.6/32      *[Local/0] 00:08:46
                  Local
10.255.71.16/32   *[Static/5] 00:07:24
                  > via so-2/0/0.0
10.255.71.17/32   *[BGP/170] 00:07:24, MED 1, localpref 100, from
10.255.71.15
                  AS path: I
                  > via so-2/1/0.0, Push 100020, Push 100011(top)
10.255.71.18/32   *[BGP/170] 00:07:24, MED 1, localpref 100, from
10.255.71.15
                  AS path: I
                  > via so-2/1/0.0, Push 100021, Push 100011(top)
10.255.245.245/32 *[BGP/170] 00:08:35, localpref 100
                  AS path: 2 I
                  > to 10.39.1.5 via so-5/1/0.0

```

```
10.255.245.246/32 *[OSPF/10] 00:07:24, metric 1
> via so-7/3/1.0
```

show route table VPN_blue.mvpn-inet6.0

```
user@host> show route table VPN_blue.mvpn-inet6.0
vpn_blue.mvpn-inet6.0: 6 destinations, 6 routes (6 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

1:10.255.2.202:65535:10.255.2.202/432
    *[BGP/170] 00:02:37, localpref 100, from 10.255.2.202
    AS path: I
    > via so-0/1/3.0
1:10.255.2.203:65535:10.255.2.203/432
    *[BGP/170] 00:02:37, localpref 100, from 10.255.2.203
    AS path: I
    > via so-0/1/0.0
1:10.255.2.204:65535:10.255.2.204/432
    *[MVPN/70] 00:57:23, metric2 1
    Indirect
5:10.255.2.202:65535:128::192.168.90.2:128:ffff::1/432
    *[BGP/170] 00:02:37, localpref 100, from 10.255.2.202
    AS path: I
    > via so-0/1/3.0
6:10.255.2.203:65535:65000:128::10.12.53.12:128:ffff::1/432
    *[PIM/105] 00:02:37
    Multicast (IPv6)
7:10.255.2.202:65535:65000:128::192.168.90.2:128:ffff::1/432
    *[MVPN/70] 00:02:37, metric2 1
    Indirect
```

show route table VPN-A detail

```
user@host> show route table VPN-A detail
VPN-AB.inet.0: 8 destinations, 8 routes (8 active, 0 holddown, 0 hidden)
10.255.179.9/32 (1 entry, 1 announced)
    *BGP Preference: 170/-101
    Route Distinguisher: 10.255.179.13:200
    Next hop type: Indirect
    Next-hop reference count: 5
    Source: 10.255.179.13
    Next hop type: Router, Next hop index: 732
    Next hop: 10.39.1.14 via fe-0/3/0.0, selected
    Label operation: Push 299824, Push 299824(top)
    Protocol next hop: 10.255.179.13
    Push 299824
    Indirect next hop: 8f275a0 1048574
    State: (Secondary Active Int Ext)
    Local AS: 1 Peer AS: 1
    Age: 3:41:06 Metric: 1 Metric2: 1
    Task: BGP_1.10.255.179.13+64309
    Announcement bits (2): 0-KRT 1-BGP RT Background
    AS path: I
    Communities: target:1:200 rte-type:0.0.0.0:1:0
    Import Accepted
    VPN Label: 299824 TTL Action: vrf-ttl-propagate
    Localpref: 100
    Router ID: 10.255.179.13
    Primary Routing Table bgp.13vpn.0
```

show route table inetflow detail

```
user@host> show route table inetflow detail
inetflow.0: 2 destinations, 2 routes (2 active, 0 holddown, 0 hidden)
10.12.44.1,*/48 (1 entry, 1 announced)
    *BGP    Preference: 170/-101
            Next-hop reference count: 2
            State: **Active Ext>
            Local AS: 65002 Peer AS: 65000
            Age: 4
            Task: BGP_65000.10.12.99.5+3792
            Announcement bits (1): 0-Flow
            AS path: 65000 I
            Communities: traffic-rate:0:0
            Validation state: Accept, Originator: 10.12.99.5
            Via: 10.12.44.0/24, Active
            Localpref: 100
            Router ID: 10.255.71.161

10.12.56.1,*/48 (1 entry, 1 announced)
    *Flow    Preference: 5
            Next-hop reference count: 2
            State: **Active>
            Local AS: 65002
            Age: 6:30
            Task: RT Flow
            Announcement bits (2): 0-Flow 1-BGP.0.0.0.0+179
            AS path: I
            Communities: 1:1
```


CHAPTER 34

PGM Operational Commands

- clear pgm negative-acknowledgments
- clear pgm source-path-messages
- clear pgm statistics
- show pgm negative-acknowledgments
- show pgm source-path-messages
- show pgm statistics

clear pgm negative-acknowledgments

Syntax	clear pgm negative-acknowledgments
Release Information	Command introduced before Junos OS Release 7.4.
Description	Clear the Pragmatic General Multicast (PGM) negative acknowledgment (NAK) state received.
Options	This command has no options.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show pgm negative-acknowledgments on page 789
List of Sample Output	clear pgm negative-acknowledgments on page 786
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear pgm negative-
acknowledgments

```
user@host> clear pgm negative-acknowledgments
```

clear pgm source-path-messages

Syntax	clear pgm source-path-messages
Release Information	Command introduced before Junos OS Release 7.4.
Description	Clear Pragmatic General Multicast (PGM) source-path messages.
Options	This command has no options.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show pgm source-path-messages on page 791
List of Sample Output	clear pgm source-path-messages on page 787
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear pgm source-path-messages

```
user@host> clear pgm source-path-messages
```

clear pgm statistics

Syntax	clear pgm statistics
Release Information	Command introduced before Junos OS Release 7.4.
Description	Clear Pragmatic General Multicast (PGM) statistics.
Options	This command has no options.
Required Privilege Level	clear
Related Documentation	<ul style="list-style-type: none">• show pgm statistics on page 792
List of Sample Output	clear pgm statistics on page 788
Output Fields	When you enter this command, you are provided feedback on the status of your request.

Sample Output

clear pgm statistics

```
user@host> clear pgm statistics
```

show pgm negative-acknowledgments

Syntax	show pgm negative-acknowledgments
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display the sent or received Pragmatic General Multicast (PGM) negative acknowledgments (NAKs), the source-path message (SPM) sequence number being negatively acknowledged, and the current state of repair.
Options	This command has no options.
Required Privilege Level	view
List of Sample Output	show pgm negative-acknowledgments on page 790
Output Fields	Table 51 on page 789 describes the output fields for the show pgm negative-acknowledgments command. Output fields are listed in the approximate order in which they appear.

Table 51: show pgm negative-acknowledgments Output Fields

Field Name	Field Description
Global source id	Global source identifier (GSI), which combines with the source port to determine the transport session identifier (TSI).
Network layer address	Network layer address of the local system.
Source port	Source port number, which is combined with the GSI to determine the TSI.
SPM sequence number	Numeric sequence identifier of the source-path message.
Window (trailing/leading sequence)	Range of sequence numbers used by the source for sequentially numbering and transmitting the most recent packets. The trailing (or left) edge of the transmit window is the sequence number of the oldest data packet available for repair from a source. The leading (or right) edge of the transmit window is defined as the sequence number of the most recent data packet a source has transmitted.
Outstanding NAKS	<p>Total number of outstanding negative acknowledgments sent or received by the local system. NAK packets indicate that a packet in the expected original data sequence has been detected as missing.</p> <ul style="list-style-type: none"> • Sequence number—Numeric sequence identifier of the source-path message. • Group—Group address. • Source—Multicast source. • Interface—Interface name. • Receiver—IP address receiving the multicast.

Sample Output

`show pgm negative-
acknowledgments`

```
user@host> show pgm negative-acknowledgments
Global source ID: 010203040506 Source port: 1111
  Network layer address: 10.38.0.1
  SPM sequence number: 1
  Window (trailing/leading sequence): 0/1
  Outstanding NAKs:
    Sequence number: 1
    Group: 225.1.1.1
    Source: 192.168.195.121
    Interface: t3-0/2/0:0 Receiver: 10.38.0.10
```

show pgm source-path-messages

Syntax	show pgm source-path-messages
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display the Pragmatic General Multicast (PGM) source-path messages received.
Options	This command has no options.
Required Privilege Level	view
List of Sample Output	show pgm source-path-messages on page 791
Output Fields	Table 52 on page 791 describes the output fields for the show pgm source-path-messages command. Output fields are listed in the approximate order in which they appear.

Table 52: show pgm source-path-messages Output Fields

Field Name	Field Description
Global source ID	Global source identifier (GSI), which combines with the source port to determine the transport session identifier (TSI).
Port	Source port number, which combines with the GSI to determine the TSI.
SPM number	Numeric sequence identifier of the source-path message.
Trail number	Sequence number of the oldest data packet available for repair from a source.
Lead number	Sequence number of the most recent data packet a source has transmitted.
Network layer address	Network layer address of the local system.

Sample Output

show pgm source-path-messages

```

user@host> show pgm source-path-messages
Global source ID  Port  SPM number  Trail number  Lead number  Network layer address
010203040506     1111         1           0             1    10.38.0.1

```

show pgm statistics

Syntax	show pgm statistics
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display Pragmatic General Multicast (PGM) packet statistics, including general loss and repair statistics.
Options	This command has no options.
Required Privilege Level	view
List of Sample Output	show pgm statistics on page 794
Output Fields	Table 53 on page 792 describes the output fields for the show pgm statistics command. Output fields are listed in the approximate order in which they appear.

Table 53: show pgm statistics Output Fields

Field Name	Field Description
PGM type, # received, # sent	<p>Number of packets received and sent for the following PGM packet types:</p> <ul style="list-style-type: none"> SPM—Number of total source path messages received and sent by the local system. Source path messages (SPMs) are sent by a source to establish the source path state in network elements and to provide the transmit-window state to receivers. POLL—Total number of poll requests received and sent by the local system. POLR—Total number of poll responses received and sent by the local system. ODATA—Total number of original data packets received and sent by the local system. RDATA—Total number of repair data packets received and sent by the local system. RDATA packets are generated in response to negative acknowledgments (NAKs), which indicate a missing packet from the original data sequence. NAK—Total number of negative acknowledgments received and sent by the local system. NAK packets indicate that a packet in the expected original data sequence has been detected as missing. NULLNAK—Total number of null negative acknowledgments received and sent by the local system. NULLNAKs are transmitted by a designated local repairer that receives NAKs redirected to it by either receivers or network elements to provide flow-control feedback to a source. NCF—Total number of NAK confirmations received and sent by the local system. NAK confirmations are generated in response to NAK packets that are received. SPMR—Total number of source path message requests (SPMRs) received and sent by the local system. SPMRs are used to solicit a source path message from a source in a nonimplosive way. The typical application is for late-joining receivers to solicit source path messages directly from a source in order to be able to send NAKs for missing packets, without having to wait for a regularly scheduled source path message from that source. OTHER—Total number of other PGM packets received and sent by the local system.
packets shorter than minimum PGM header length	Total number of packets received with headers that are shorter than the minimum required PGM header length.

Table 53: show pgm statistics Output Fields (*continued*)

Field Name	Field Description
packets received with incorrect check sum	Total number of packets received with an incorrect checksum. The checksum field is the 1's complement of the 1's complement sum of the entire PGM packet, including the header.
packets received with zero check sum	Total number of packets received with a zero checksum. If the computed checksum is zero, it is transmitted as all ones. A value of zero in this field means that the transmitter generated no checksum.
packets received with TSDU length incorrect	Total number of packets received with an incorrect Transport Service Data Unit (TSDU) length (16 bits).
packets received with SPM length incorrect	Total number of packets received with an incorrect source path message length.
packets received with unknown SPM address family	Total number of packets received with an unknown source path message address family indicator (AFI).
packets received with NAK length incorrect	Total number of packets received with an incorrect NAK length.
packets received with unknown NAK address family	Total number of packets received with an unknown NAK address family indicator (AFI).
packets received with NAK for unknown TSI	Total number of NAK packets received with an unknown transport session identifier (TSI).
packets received when NAK throttled	Total number of packets received when NAK is throttled.
packets received with NCF length incorrect	Total number of packets received with an incorrect NAK confirmation length.
packets received with unknown NCF address family	Total number of packets received with an unknown NAK confirmation address family indicator (AFI).
packets received with NCF for unknown TSI	Total number of NAK confirmation packets received with an unknown transport session identifier (TSI).
packets received with RDATA length incorrect	Total number of packets received with an incorrect RDATA length.
packets received with RDATA for unknown TSI	Total number of RDATA packets received with an unknown transport session identifier (TSI).

Sample Output

show pgm statistics

```
user@host> show pgm statistics
PGM type      # received    # sent
SPM            0            0
POLL           0            0
POLR           0            0
ODATA          0            0
RDATA          0            0
NAK            0            0
NULLNAK        0            0
NCF            0            0
SPMR           0            0
OTHER          0            0

packets shorter than minimum PGM header length :      0
packets received with incorrect check sum       :      0
packets received with zero check sum            :      0
packets received with TSDU length incorrect     :      0
packets received with SPM length incorrect      :      0
packets received with unknown SPM address family:      0
packets received with NAK length incorrect      :      0
packets received with unknown NAK address family:      0
packets received with NAK for unknown TSI       :      0
packets received when NAK throttled             :      0
packets received with NCF length incorrect      :      0
packets received with unknown NCF address family:      0
packets received with NCF for unknown TSI       :      0
packets received with RDATA length incorrect    :      0
packets received with RDATA for unknown TSI     :      0
```

CHAPTER 35

DVMRP Operational Commands

- `show dvmrp interfaces`
- `show dvmrp neighbors`
- `show dvmrp prefix`
- `show dvmrp prunes`

show dvmrp interfaces

Syntax	show dvmrp interfaces <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display information about Distance Vector Multicast Routing Protocol (DVMRP)–enabled interfaces.
Options	<p>none—(Same as logical-system all) Display information about DVMRP-enabled interfaces.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show dvmrp interfaces on page 797
Output Fields	Table 54 on page 796 describes the output fields for the show dvmrp interfaces command. Output fields are listed in the approximate order in which they appear.

Table 54: show dvmrp interfaces Output Fields

Field Name	Field Description
Interface	Name of the interface.
State	State of the interface: up or down .
Leaf	Whether the interface is a leaf (that is, whether it has no neighbors) or whether it has neighbors.
Metric	Interface metric: a value from 1 through 31.
Announce	Number of routes the interface is announcing.
Mode	DVMRP mode: <ul style="list-style-type: none"> • Forwarding—DVMRP does both the routing and the multicast data forwarding. • Unicast-routing—DVMRP does only the routing. Forwarding of the multicast data packets can be done by enabling PIM on the interface.

Sample Output

show dvmrp interfaces

```
user@host> show dvmrp interfaces
Interface State Leaf Metric Announce Mode
fxp0.0    Up    N    1    4 Forwarding
fxp1.0    Up    N    1    4 Forwarding
fxp2.0    Up    N    1    3 Forwarding
lo0.0     Up    Y    1    0 Unicast-routing
```

show dvmrp neighbors

Syntax	show dvmrp neighbors <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display information about Distance Vector Multicast Routing Protocol (DVMRP) neighbors.
Options	<p>none—(Same as logical-system all) Display information about DVMRP neighbors.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show dvmrp neighbors on page 799
Output Fields	Table 55 on page 798 describes the output fields for the show dvmrp neighbors command. Output fields are listed in the approximate order in which they appear.

Table 55: show dvmrp neighbors Output Fields

Field Name	Field Description
Neighbor	Address of the neighboring DVMRP router.
Interface	Interface through which the neighbor is reachable.
Version	Version of DVMRP that the neighbor is running, in the format <i>majorminor</i> .
Flags	<p>Information about the neighbor:</p> <ul style="list-style-type: none"> 1—One way. The local router has seen the neighbor, but the neighbor has not seen the local router. G—Neighbor supports generation ID. L—Neighbor is a leaf router. M—Neighbor supports mtrace. N—Neighbor supports netmask in prune messages and graft messages. P—Neighbor supports pruning. S—Neighbor supports SNMP.
Routes	Number of routes learned from the neighbor.
Timeout	How long until the DVMRP neighbor information times out, in seconds.
Transitions	Number of generation ID changes that have occurred since the local router learned about the neighbor.

Sample Output

show dvmrp neighbors

```
user@host> show dvmrp neighbors
Neighbor      Interface      Version  Flags    Routes  Timeout  Transitions
192.168.1.1   ipip.0         3.255    PGM      3       28       1
```

show dvmrp prefix

Syntax	show dvmrp prefix <brief detail> <logical-system (all <i>logical-system-name</i>)> <prefix>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display information about Distance Vector Multicast Routing Protocol (DVMRP) prefixes.
Options	<p>none—Display standard information about all DVMRP prefixes.</p> <p>brief detail—(Optional) Display the specified level of output.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p> <p>prefix—(Optional) Display information about specific prefixes.</p>
Required Privilege Level	view
List of Sample Output	show dvmrp prefix on page 801 show dvmrp prefix brief on page 801 show dvmrp prefix detail on page 801
Output Fields	Table 56 on page 800 describes the output fields for the show dvmrp prefix command. Output fields are listed in the approximate order in which they appear.

Table 56: show dvmrp prefix Output Fields

Field Name	Field Description	Level of Output
Prefix	DVMRP route.	All levels
Next hop	Next hop from which the route was learned.	All levels
Age	Last time that the route was refreshed.	All levels
<i>multicast-group</i>	Multicast group address.	detail
Prunes sent	Number of prune messages sent to the multicast group.	detail
Grafts sent	Number of grafts sent to the multicast group.	detail
Cache lifetime	Lifetime of the group in the multicast cache, in seconds.	detail
Prune lifetime	Lifetime remaining and total lifetime of prune messages, in seconds.	detail

Sample Output

show dvmrp prefix

```
user@host> show dvmrp prefix
Prefix           Next hop        Age
10.38.0.0        /30 10.38.0.1   00:06:17
10.38.0.4        /30 10.38.0.5   00:06:13
10.38.0.8        /30 10.38.0.2   00:00:04
10.38.0.12       /30 10.38.0.6   00:00:04
10.255.14.114    /32 10.255.14.114 00:06:17
10.255.14.142    /32 10.38.0.2   00:00:04
10.255.14.144    /32 10.38.0.2   00:00:04
10.255.70.15     /32 10.38.0.6   00:00:04
192.168.14.0     /24 192.168.14.114 00:06:17
192.168.195.40   /30 192.168.195.41 00:06:17
192.168.195.92   /30 10.38.0.2   00:00:04
```

show dvmrp prefix brief

The output for the **show dvmrp prefix brief** command is identical to that for the **show dvmrp prefix** command.

show dvmrp prefix detail

```
user@host> show dvmrp prefix detail
Prefix           Next hop        Age
10.38.0.0        /30 10.38.0.1   00:06:28
10.38.0.4        /30 10.38.0.5   00:06:24
10.38.0.8        /30 10.38.0.2   00:00:15
10.38.0.12       /30 10.38.0.6   00:00:15
10.255.14.114    /32 10.255.14.114 00:06:28
10.255.14.142    /32 10.38.0.2   00:00:15
10.255.14.144    /32 10.38.0.2   00:00:15
10.255.70.15     /32 10.38.0.6   00:00:15
192.168.14.0     /24 192.168.14.114 00:06:28
192.168.195.40   /30 192.168.195.41 00:06:28
192.168.195.92   /30 10.38.0.2   00:00:15
```

show dvmrp prunes

Syntax	show dvmrp prunes <all rx tx> <logical-system (all <i>logical-system-name</i>)>
Release Information	Command introduced before Junos OS Release 7.4.
Description	Display information about active Distance Vector Multicast Routing Protocol (DVMRP) prune messages.
Options	<p>none—Display received and transmitted DVMRP prune information.</p> <p>all—(Optional) Display information about all received and transmitted prune messages.</p> <p>rx—(Optional) Display information about received prune messages.</p> <p>tx—(Optional) Display information about transmitted prune messages.</p> <p>logical-system (all <i>logical-system-name</i>)—(Optional) Perform this operation on all logical systems or on a particular logical system.</p>
Required Privilege Level	view
List of Sample Output	show dvmrp prunes on page 802
Output Fields	Table 57 on page 802 describes the output fields for the show dvmrp prunes command. Output fields are listed in the approximate order in which they appear.

Table 57: show dvmrp prunes Output Fields

Field Name	Field Description
Group	Group address.
Source prefix	Prefix for the prune.
Timeout	How long until the prune message expires, in seconds.
Neighbor	Neighbor to which the prune was sent or from which the prune was received.

Sample Output

show dvmrp prunes

```

user@host> show dvmrp prunes
Group           Source prefix      Timeout Neighbor
224.0.1.1       128.112.0.0       /12    7077 192.168.1.1
224.0.1.32      160.0.0.0         /3     7087 192.168.1.1
224.2.123.4     136.0.0.0         /5     6955 192.168.1.1
224.2.127.1     129.0.0.0         /8     7046 192.168.1.1

```

```
224.2.135.86 128.102.128.0 /17 7071 192.168.1.1
224.2.135.86 129.0.0.0 /8 7074 192.168.1.1
224.2.135.86 130.0.0.0 /7 7071 192.168.1.1
...
```


PART 4

Index

- [Index on page 807](#)

Index

Symbols

#, comments in configuration statements.....	xxvi
(), in syntax descriptions.....	xxvi
< >, in syntax descriptions.....	xxvi
[], in configuration statements.....	xxvi
{ }, in configuration statements.....	xxvi
(pipe), in syntax descriptions.....	xxvi

A

accept-remote-source statement.....	348
usage guidelines.....	320
accounting statement	
AMT	
usage guidelines.....	303
AMT interface.....	538
IGMP.....	434
IGMP interface.....	434
MLD.....	458
MLD interface.....	458
active-source-limit statement.....	562
usage guidelines.....	320
address statement	
anycast RPs.....	349
usage guidelines.....	79
bidirectional PIM	
usage guidelines.....	60
local RPs.....	351
static RPs.....	350, 352
usage guidelines.....	75
addresses	
multicast.....	8
algorithm statement	
BFD authentication.....	353
all (tracing flag)	
PGM.....	584
AMT	
host-query message interval.....	546
overview.....	297
protocol	
configuring.....	305
protocol, displaying.....	753

state	
clearing.....	749
statistics	
clearing.....	748
statistics, displaying.....	750
tunnel	
clearing.....	749
tunnel, displaying.....	755
version.....	555
amt statement	
AMT	
usage guidelines.....	303
IGMP.....	539
IGMP defaults	
configuring.....	303
protocol.....	540
configuring.....	301
anycast RP.....	77
overview.....	76
anycast-pim statement.....	354
usage guidelines.....	79
anycast-prefix statement.....	541
asm-override-ssm statement.....	508
assert (tracing flag).....	424
assert timeout	
configuring.....	112
assert-timeout statement.....	355
usage guidelines.....	112
authentication configuration	
BFD.....	121
authentication statement	
BFD.....	359
BFD protocol.....	356
authentication-key statement	
MSDP.....	563
usage guidelines.....	312
auto-RP	
overview.....	88
auto-rp statement.....	357
usage guidelines.....	89
Automatic Multicast Tunneling See AMT	

B

backoff-period statement	
bidirectional PIM	
usage guidelines.....	60
PIM	
bidirectional.....	358

backup PE groups		
multicast, displaying.....	656	
backup-pe-group statement.....	509	
usage guidelines.....	210	
backups statement.....	510	
usage guidelines.....	210	
bandwidth statement.....	511	
usage guidelines.....	206	
BFD		
authentication configuration.....	121	
protocol.....	120	
BFD authentication		
algorithm statement.....	353	
authentication statement.....	356	
key-chain statement.....	386	
loose-check statement.....	389	
bfd-liveness-detection statement		
PIM.....	359, 367	
minimum-interval.....	393	
threshold.....	423	
transmit-interval.....	427	
usage guidelines.....	120	
bidirectional PIM.....	54	
designated forwarder		
multicast information,		
displaying.....	610, 613	
bidirectional statement		
PIM.....	361	
bidirectional.....	360	
usage guidelines.....	60	
bidirectional-sparse statement		
PIM		
usage guidelines.....	60	
bidirectional-sparse-dense statement		
PIM		
usage guidelines.....	60	
bootstrap (tracing flag).....	424	
bootstrap IPv4 messages.....	85	
bootstrap messages.....	84, 85, 86	
bootstrap routers		
overview.....	84	
bootstrap routers, displaying.....	616	
bootstrap statement.....	362	
bootstrap-export statement.....	363	
usage guidelines.....	85	
bootstrap-import statement.....	364	
usage guidelines.....	85	
bootstrap-priority statement.....	365	
usage guidelines.....	85	
braces, in configuration statements.....	xxvi	
brackets		
angle, in syntax descriptions.....	xxvi	
square, in configuration statements.....	xxvi	
bridge domains		
and IGMP snooping.....	275	
BSR		
policy, import.....	381	
bulk updates		
enabling.....	294	
C		
cache (tracing flag).....	424	
CBT		
defined.....	12	
issues.....	13	
classification		
by egress interface.....	201	
clear amt tunnel command.....	748, 749	
clear igmp membership command.....	680	
clear igmp snooping membership command.....	716	
clear igmp snooping statistics command.....	717	
clear igmp statistics command.....	683	
clear mld membership command.....	700	
clear mld statistics command.....	701	
clear multicast snooping statistics command.....	730	
clear pgm negative-acknowledgments		
command.....	786	
clear pgm source-path-messages command.....	787	
clear pgm statistics command.....	788	
clear pim join command.....	600	
clear pim join-distribution command.....	602	
clear pim register command.....	604	
clear pim statistics command.....	606	
comments, in configuration statements.....	xxvi	
conventions		
text and syntax.....	xxv	
Core Based Trees See CBT		
curly braces, in configuration statements.....	xxvi	
customer support.....	xxvii	
contacting JTAC.....	xxvii	
D		
data-encapsulation statement.....	564	
usage guidelines.....	320	
default-peer statement.....	565	
usage guidelines.....	320	

-
- defaults statement
 - AMT.....542
 - usage guidelines.....303
 - dense-groups statement.....366
 - usage guidelines.....141
 - designated forwarder
 - bidirectional PIM
 - multicast information,
 - displaying.....610, 613
 - designated router.....36
 - detection-time statement
 - PIM.....367
 - df-election statement
 - bidirectional PIM
 - usage guidelines.....60
 - PIM
 - bidirectional.....368
 - disable statement
 - DVMRP.....587
 - usage guidelines.....340
 - IGMP.....435
 - usage guidelines.....241
 - MLD.....458
 - usage guidelines.....269
 - MSDP.....566
 - usage guidelines.....327
 - PIM family.....369
 - PIM graceful restart.....368
 - usage guidelines.....136
 - PIM interfaces.....369
 - PIM protocol.....369
 - SAP and SDP.....557
 - usage guidelines.....309, 336
 - Distance Vector Multicast Routing Protocol *See*
 - DVMRP
 - distribution trees
 - RPT.....103
 - shared.....103
 - documentation
 - comments on.....xxvii
 - dr-election-on-p2p statement.....370
 - PIM
 - usage guidelines.....32
 - dr-register-policy statement.....370
 - usage guidelines.....101
 - DVMRP
 - configuration statements.....336
 - defined.....11
 - disabling.....340
 - enabling.....336, 588
 - groups, displaying.....772
 - hold-time period.....336
 - interfaces, displaying.....796
 - metric.....336, 591
 - neighbors, displaying.....798
 - overview.....335
 - policy, routing.....340, 589, 590
 - prefixes, displaying.....800
 - prunes, displaying active.....802
 - routing tables.....336, 592
 - supported software standards.....17
 - dvmrp statement.....588
 - usage guidelines.....336
- ## E
- eibgp load balancing.....141
 - embedded RP
 - IPv6
 - configuring.....95
 - overview.....93
 - embedded-rp statement.....371
 - usage guidelines.....95
 - enable IGMP static group membership.....231
 - enable MLD static group membership.....258
 - enabling multicast on an interface.....184
 - event recording
 - IGMP.....237
 - MLD.....265
 - exclude statement
 - IGMP.....435
 - usage guidelines.....231
 - MLD.....459
 - usage guidelines.....258
 - export statement
 - DVMRP.....589
 - usage guidelines.....340
 - MSDP.....567
 - usage guidelines.....312
 - PIM.....372
 - configuring.....99
 - PIM RP
 - usage guidelines.....86
- ## F
- family statement.....543
 - bootstrap.....373
 - local RP.....375

PIM interfaces.....	374
PIM protocol.....	374
flood groups	
and multicast snooping.....	289
flood-groups statement	
multicast snooping.....	500
flow-map statement.....	512
usage guidelines.....	206
font conventions.....	xxv
forwarding cache	
and multicast snooping.....	289
forwarding cache limits, overview.....	203
forwarding classes	
classifying packets by egress interface.....	201
forwarding table	
multicast information, displaying.....	662
multicast snooping information,	
displaying.....	731
forwarding-cache statement	
flow maps.....	513
multicast.....	513
multicast snooping.....	500
usage guidelines.....	203, 206
forwarding-classes-interface-specific statement	
usage guidelines.....	201
frames	
multicast snooping.....	9, 271, 287
G	
graceful restart	
and multicast snooping.....	289
disabling.....	136
PIM	
sparse mode.....	136
sparse-dense mode.....	141
graceful Routing Engine switchover	
example.....	125
graceful-restart statement	
multicast snooping.....	501
PIM.....	376
usage guidelines.....	136
snooping	
usage guidelines.....	289
graft (tracing flag)	
DVMRP.....	593
PIM.....	424
group joins	
limiting.....	238, 267
group membership	
SSM maps.....	178, 241
group statement	
IGMP.....	436
usage guidelines.....	231
IGMP snooping.....	480
usage guidelines.....	277
MLD.....	460
usage guidelines.....	258
MSDP.....	568
usage guidelines.....	312
PIM RPF selection.....	377
usage guidelines.....	163
group-count statement	
IGMP.....	437
usage guidelines.....	231
MLD.....	461
usage guidelines.....	258
group-increment statement	
IGMP.....	437
usage guidelines.....	231
MLD.....	461
usage guidelines.....	258
group-limit statement	
configuring.....	238
IGMP interface.....	438
IGMP snooping.....	481
usage guidelines.....	277
MLD	
usage guidelines.....	267
MLD interface.....	462
group-policy statement	
AMT.....	544
usage guidelines.....	303
IGMP.....	438
usage guidelines.....	227
MLD.....	462
usage guidelines.....	255
group-ranges statement.....	378
bidirectional PIM	
usage guidelines.....	60
usage guidelines.....	75
groups	
DVMRP, displaying.....	772
IGMP membership, displaying.....	685
MLD	
clearing.....	700
displaying.....	702

PIM	
general information, displaying.....	621
usage information, displaying.....	772
SSM.....	530
H	
hello (tracing flag)	
PIM.....	424
hello-interval statement	
PIM.....	379
usage guidelines.....	24
hold-time statement	
bidirectional PIM	
usage guidelines.....	60
DVMRP.....	589
usage guidelines.....	336
PIM.....	380
host-only-interface statement.....	482
usage guidelines.....	277
I	
IGMP	
and nonstop active routing.....	241
configuration statements.....	223, 275
configuring.....	223, 275
configuring PIM-to-IGMP message	
translation.....	217
disabling.....	241
enabling.....	224, 439
event recording.....	237
flags for tracing operations.....	283
group membership	
SSM maps for different groups to different	
sources.....	178, 241
group membership, displaying.....	685
host-query message interval.....	225, 445
interface group limit.....	438
interfaces, displaying.....	689
last-member query interval.....	228, 446
overview.....	222
PIM-to-IGMP message translation.....	215
PIM-to-IGMP message translation information,	
displaying.....	693
query response interval.....	226, 447
robustness variable.....	229, 448
snooping (interface).....	718
snooping (membership).....	721
snooping (statistics).....	725
snooping and bridge domains.....	275
snooping interfaces.....	273
snooping overview.....	272
snooping proxies.....	273
static group membership.....	231
statistics, displaying.....	695
supported software standards.....	17
tracing operations.....	239
version.....	230, 455
IGMP snooping	
enabling.....	483
group limit.....	481
host-only interface.....	482
host-query message interval.....	489
last-member query interval.....	490
multicast-router interface.....	487
proxy.....	488
query response interval.....	491
robust count.....	492
source address.....	493
igmp statement.....	439
usage guidelines.....	224
igmp-snooping statement.....	483
IGMPv3.....	223
interoperability with older versions.....	223
ignore-stp-topology-change statement.....	501
usage guidelines.....	289
immediate-leave statement	
IGMP.....	441
usage guidelines.....	226
IGMP snooping.....	485
usage guidelines.....	277
MLD.....	463
usage guidelines.....	254
import statement	
bootstrap.....	381
usage guidelines.....	86
DVMRP.....	590
usage guidelines.....	340
MSDP.....	569
usage guidelines.....	312
PIM.....	382
usage guidelines.....	100
inet statement.....	544
infinity statement.....	383
usage guidelines.....	114
ingress PE redundancy	
configuring.....	210
example.....	210
overview.....	210

init (tracing flag)		
PGM.....	584	
interface lists.....	10	
interface statement		
DVMRP.....	590	
usage guidelines.....	336	
IGMP.....	442	
usage guidelines.....	224	
IGMP snooping.....	486	
usage guidelines.....	277	
MLD.....	464	
usage guidelines.....	251	
multicast.....	514	
multicast scoping.....	515	
PIM.....	384	
usage guidelines.....	139	
routing options		
usage guidelines.....	184	
Internet Group Management Protocol See IGMP		
IP IGMP snooping		
membership		
clearing.....	716	
statistics		
clearing.....	717	
IP multicast		
announced sessions, displaying.....	674	
backup PE groups, displaying.....	656	
flow map information, displaying.....	658	
forwarding table, displaying.....	662	
interface information, displaying.....	660	
PIM-to-IGMP message translation information,		
displaying.....	693	
PIM-to-MLD message translation information,		
displaying.....	712	
RPF calculations, displaying.....	668	
SAP announcements, displaying.....	760	
scoped information, displaying.....	672	
supported software standards.....	17	
IP multicast snooping		
forwarding table, displaying.....	731	
statistics		
clearing.....	730	
displaying.....	734	
IPsec		
with PIM-SM.....	46	
IPv6		
embedded RP		
configuring.....	95	
overview.....	93	
J		
join (tracing flag).....	424	
join states, clearing PIM.....	600	
join states, redistributing.....	602	
join-load-balance statement.....	385	
usage guidelines.....	38	
join-prune-timeout statement.....	386	
K		
keepalive (tracing flag)		
MSDP.....	579	
key-chain statement		
BFD authentication.....	386	
L		
Layer 3 VPNs.....	428	
leave (tracing flag)		
IGMP.....	453	
MLD.....	475	
listen statement.....	558	
usage guidelines.....	309, 336	
load balancing.....	428	
for PIM join.....	38	
load balancing PIM joins.....	145	
local statement		
PIM.....	387	
usage guidelines.....	73	
local-address statement.....	516, 545	
MSDP		
usage guidelines.....	312	
MSDP group.....	570	
usage guidelines.....	312	
MSDP peer.....	570	
usage guidelines.....	312	
PIM.....	388	
usage guidelines.....	210	
loose-check statement		
BFD authentication.....	389	
M		
manuals		
comments on.....	xxvii	
mapping-agent-election statement.....	390	
usage guidelines.....	89	
mappings		
SSM.....	531	
maximum statement		
MSDP.....	571	
usage guidelines.....	320	

- maximum-bandwidth statement.....517
 - usage guidelines.....184
- maximum-rps statement.....391
 - usage guidelines.....95
- maximum-transmit-rate statement
 - IGMP.....443
 - usage guidelines.....230
 - MLD.....465
 - usage guidelines.....257
- mesh groups
 - MSDP.....320
- metric statement
 - DVMRP.....591
 - usage guidelines.....336
- metrics
 - DVMRP.....336, 591
- minimum-interval
 - PIM.....393
- minimum-interval statement
 - PIM.....392
 - usage guidelines.....120
- minimum-receive-interval statement
 - PIM.....359, 394
 - usage guidelines.....120
- MLD
 - configuring PIM-to-MLD message
 - translation.....218
 - disabling.....269
 - enabling.....466
 - event recording.....265
 - group membership
 - clearing.....700
 - displaying.....702
 - SSM maps for different groups to different
 - sources.....178, 241
 - host-query message interval.....252, 469
 - immediate-leave host removal
 - configuring.....254
 - interface group limit.....462
 - interfaces, displaying.....706
 - last-member query interval.....254, 469
 - overview.....247
 - PIM-to-MLD message translation.....215
 - PIM-to-MLD message translation information,
 - displaying.....712
 - query response interval.....253, 470
 - robustness variable.....256, 470
 - static group membership.....258
- statistics
 - clearing.....701
 - displaying.....709
 - supported software standards.....17
 - tracing operations.....268
- mld
 - enabling.....251
- mld statement.....466
 - usage guidelines.....250, 251
- mode statement
 - DVMRP.....591
 - usage guidelines.....340
 - MSDP.....572
 - usage guidelines.....320
 - PIM.....395
 - usage guidelines.....37, 141
- MOSPF, defined.....11
- MSDP
 - active source limit.....562
 - maximum.....571
 - per-source.....577
 - threshold.....578
 - authentication.....312, 563
 - configuration statements.....311
 - configuring.....311
 - data-encapsulation.....564
 - default peer.....320, 565
 - disabling.....327
 - enabling.....573
 - general information, displaying.....764
 - groups.....312, 568
 - local address.....570
 - message source information, displaying.....766
 - mode.....572
 - peer statistics
 - displaying.....770
 - peers.....312
 - policy, routing.....567, 569
 - remote source.....320
 - routing tables.....576
 - source-active cache, displaying.....768
 - supported software standards.....17
 - tracing operations.....326
- msdp statement.....573
 - usage guidelines.....312
- mt (tracing flag).....424
- mt interfaces.....428

mtrace (tracing flag)	
IGMP.....	239
MLD.....	268
multicast	
addresses.....	8
anycast RP.....	76
auto-RP.....	88
bootstrap router.....	84
configuration statements.....	518
configuring PIM-to-IGMP message translation.....	217
configuring PIM-to-MLD message translation.....	218
defined.....	3
forwarding cache limits.....	203
ingress PE redundancy.....	210
Layer 2 frames.....	9, 271, 287
leaf and branch.....	7
packet replication.....	13
PIM-to-IGMP and PIM-to-MLD message translation.....	215
protocols	
group membership.....	221
routing protocols.....	11
compared, table.....	12
scoping.....	527
snooping.....	9, 271, 287
snooping and flood groups.....	289
snooping and forwarding cache.....	289
snooping and graceful restart.....	289
snooping configuration statements.....	288
SSM groups.....	530
SSM mapping.....	531
terminology.....	6
tunnel interfaces.....	428
uses.....	5
multicast filters.....	96
MAC filters.....	96
MSDP SA messages.....	97
RP/DR register messages.....	96
configuring.....	101
multicast group joins	
limiting.....	238, 267
multicast interfaces.....	36
Multicast Listener Discovery See MLD	
Multicast Open Shortest Path First See MOSPF	
multicast snooping	
and VPLS root protection	
overview.....	288
multicast statement.....	518
usage guidelines.....	184, 203, 206
multicast-router-interface statement.....	487
usage guidelines.....	277
multicast-snooping-options statement.....	502
multichassis-lag-replicate-state statement.....	503
usage guidelines.....	295
multihomed environment	
VPLS Layer 2 ring and multicast snooping	
overview.....	288
multiplier statement	
PIM.....	359, 396
usage guidelines.....	120
mvpn	
pim join load balancing.....	141
MVPN	
Next-generation	
PIM join load balancing.....	145
N	
neighbor (tracing flag).....	593
neighbor-policy statement.....	396
usage guidelines.....	98
neighbors	
MSDP.....	312
Next-generation MVPN	
PIM join load balancing.....	145
next-hop statement	
usage guidelines.....	163
nexthop-hold-time statement.....	503
no-accounting statement	
IGMP.....	434
MLD.....	458
no-adaptation	
PIM.....	397
no-bidirectional-mode statement	
PIM	
graceful restart.....	398
no-multicast-echo statement	
PIM	
usage guidelines.....	25
no-qos-adjust statement.....	520
nonstop active routing	
example.....	125
role in PIM.....	124
role of IGMP.....	241
NSR	
example.....	125
nsr-synchronization (tracing flag).....	425

O

offer-period statement	
bidirectional PIM	
usage guidelines.....	60
PIM	
bidirectional.....	399
oif-map statement	
IGMP.....	443
MLD (interface).....	467
output-forwarding-class-map statement	
usage guidelines.....	201
override statement.....	400
override-interval	
PIM.....	401
override-interval statement	
usage guidelines.....	41

P

packets (tracing flag)	
DVMRP.....	593
IGMP.....	453
MLD.....	475
PGM.....	584
PIM.....	425
parentheses, in syntax descriptions.....	xxvi
parser (tracing flag)	
PGM.....	584
passive statement	
IGMP.....	444
MLD (interface).....	468
pd multicast interface.....	36
pe multicast interface.....	36
peer statement	
MSDP.....	575
usage guidelines.....	312
PGM	
architecture.....	330
configuring.....	333
negative acknowledgments	
clearing.....	786
displaying.....	789
overview.....	329
routers.....	332
source path messages	
clearing.....	787
displaying.....	791
statistics	
clearing.....	788
displaying.....	792

supported software standards.....	17
tracing operations.....	584
pgm statement.....	583
usage guidelines.....	333
PIM	
and nonstop active routing.....	124, 125
anycast RP.....	354, 417
assert timeout.....	355, 420
configuring.....	112
background.....	13
BFD.....	120, 359, 392, 394, 396, 429
bidirectional.....	54, 60
bidirectional mode	
defined.....	11
bootstrap messages import and	
export.....	85, 86
bootstrap router.....	85, 86
bootstrap routers.....	84
bootstrap routers, displaying.....	616
configuring.....	26
configuring PIM messages to IGMP	
messages.....	217
configuring PIM messages to MLD	
messages.....	218
dense mode.....	137, 139
defined.....	12
designated router.....	36
embedded RP.....	371
configuring.....	95
overview.....	93
enabling.....	402
filters See multicast filters	
graceful restart	
disabling.....	136
sparse mode.....	136
sparse-dense mode.....	141
groups	
general information, displaying.....	621
usage information, displaying.....	772
hello interval.....	24
hold-time period.....	380, 589
incoming join filter policy, applying.....	100
interfaces	
displaying.....	618
pd.....	36
pe.....	36
pimd.....	36
pime.....	36

join load balancing.....	145	pim join load balancing.....	141
configuring.....	38	draft-rosen.....	141
join states, clearing.....	600	next-generation.....	141
join suppression		overview.....	141
configuring.....	41	pim statement.....	402
join-prune-timeout.....	386	usage guidelines.....	26
maximum RPs.....	391	PIM-RP	
mixing modes.....	140	SPT	
neighbors, displaying.....	630	configuring threshold cutover policy.....	114
network components.....	15	pim-to-igmp-proxy statement.....	521
outgoing join filter policy, applying.....	99	pim-to-mlt-proxy statement.....	522
overview.....	13	pimd multicast interface.....	36
PIM-to-IGMP message translation information,		pime multicast interface.....	36
displaying.....	693	policer, single-rate two-color	
PIM-to-MLD message translation information,		example.....	179, 242
displaying.....	712	policy statement	
policy, routing.....	382	flow map.....	523
prune states, clearing.....	600	SSM map.....	523
redistributing join states.....	602	policy, import	
register		BSR.....	381
clearing.....	604	policy, routing	
rendezvous point tree.....	105	DVMRP.....	340, 589, 590
restart-duration statement.....	411	MSDP.....	312, 567, 569
usage guidelines.....	136	PIM.....	382
routing tables.....	412	PIM join filter.....	99, 100
RPF, displaying source state.....	641	Pragmatic General Multicast See PGM	
RPs.....	35, 73, 89, 103, 414	prefix statement.....	524
anycast.....	354	prefix-list statement	
anycast RP.....	76	PIM RPF selection.....	405
displaying.....	634	usage guidelines.....	163
embedded.....	371	priority	
mapping options.....	35	PIM RPs.....	408
maximum.....	391	priority statement	
source registration.....	105	bidirectional PIM	
SPT cutover control.....	112	usage guidelines.....	60
sparse mode.....	33, 37	bootstrap.....	406
defined.....	12	PIM.....	407
with IPsec.....	46	usage guidelines.....	31
sparse-dense mode.....	140, 366	usage guidelines.....	86
defined.....	12	probe (tracing flag).....	593
SSM.....	167, 168, 171	promiscuous-mode statement	
statistics		IGMP.....	445
clearing.....	606	usage guidelines.....	228
displaying.....	644	propagation-delay statement.....	409
supported software standards.....	17	usage guidelines.....	41
translating PIM messages to IGMP and MLD		Protocol Independent Multicast See PIM	
messages.....	215		
version.....	24, 37, 430		

- protocols
 - group membership.....221
 - multicast routing.....11
 - compared, table.....12
 - proxy statement
 - IGMP snooping.....488
 - usage guidelines.....277
 - prune (tracing flag)
 - DVMRP.....593
 - PIM.....425
 - prune states, clearing PIM.....600
 - prunes, DVMRP, displaying.....802
- Q**
- query-interval statement
 - AMT.....546
 - usage guidelines.....303
 - IGMP.....445
 - usage guidelines.....225
 - IGMP snooping.....489
 - usage guidelines.....277
 - MLD.....469
 - usage guidelines.....252
 - query-last-member-interval statement
 - IGMP.....446
 - usage guidelines.....228
 - IGMP snooping.....490
 - usage guidelines.....277
 - MLD.....469
 - usage guidelines.....254
 - query-response-interval statement.....547
 - AMT
 - usage guidelines.....303
 - IGMP.....447
 - usage guidelines.....226
 - IGMP snooping.....491
 - usage guidelines.....277
 - MLD.....470
 - usage guidelines.....253
- R**
- redundant-sources statement.....524
 - register (tracing flag).....425
 - regular expressions
 - IP multicast sessions
 - displaying.....674
 - relay statement.....548, 549
 - AMT
 - usage guidelines.....303
 - rendezvous points See RPs See PIM and RP
 - replication
 - multicast packet.....13
 - report (tracing flag)
 - DVMRP.....593
 - IGMP.....454
 - MLD.....476
 - request pim multicast-tunnel rebalance
 - command.....609
 - reset-tracking-bit statement.....410
 - usage guidelines.....41
 - restart-duration statement.....411
 - PIM graceful restart
 - usage guidelines.....136
 - reverse path forwarding See RPF
 - reverse-oif-mapping statement.....525
 - usage guidelines.....187
 - reverse-path forwarding See RPT
 - RFC 5015.....358, 360, 368, 399, 413
 - rib-group statement
 - DVMRP.....592
 - usage guidelines.....336
 - MSDP.....576
 - usage guidelines.....312
 - PIM.....412
 - usage guidelines.....139
 - usage guidelines.....158
 - robust-count statement.....550
 - AMT
 - usage guidelines.....303
 - IGMP.....448
 - usage guidelines.....229
 - IGMP snooping.....492
 - usage guidelines.....277
 - MLD.....470
 - usage guidelines.....256
 - robustness-count statement
 - bidirectional PIM
 - usage guidelines.....60
 - PIM
 - bidirectional.....413
 - route (tracing flag)
 - MSDP.....579
 - route-socket (tracing flag)
 - PGM.....584
 - routes, displaying
 - in a specific routing table.....737, 775
 - routing policies
 - displaying.....677

routing tables		shortest-path trees.....	108
DVMRP.....	336, 592	See also SPT	
MSDP.....	576	show (tracing flag)	
PIM.....	412	PGM.....	584
RP		show amt statistics command.....	750
anycast.....	354	show amt summary command.....	753
embedded.....	371	show amt tunnel command.....	755
rp (tracing flag).....	425	show dvmrp interfaces command.....	796
rp statement.....	414	show dvmrp neighbors command.....	798
rp-register-policy statement.....	416	show dvmrp prefix command.....	800
usage guidelines.....	101	show dvmrp prunes command.....	802
rp-set statement.....	417	show igmp group command.....	685
usage guidelines.....	79	show igmp interface command.....	689
RPF.....	155	show igmp snooping interface command.....	718
calculations, displaying.....	668	show igmp snooping membership command.....	721
checks.....	156	show igmp snooping statistics command.....	725
PIM source state, displaying.....	641	show igmp statistics command.....	695
policies.....	157	show mld group command.....	702
table.....	156	show mld interface command.....	706
populating.....	156	show mld statistics command.....	709
RPF check, multicast		show msdp command.....	764
RPF policy.....	526	show msdp source command.....	766
rpf-check-policy statement.....	526	show msdp source-active command.....	768
usage guidelines.....	161	show msdp statistics command.....	770
rpf-selection statement		show multicast backup-pe-groups	
PIM.....	418	command.....	656
usage guidelines.....	163	show multicast flow-map command.....	658
RPs		show multicast interface command.....	660
displaying.....	634	show multicast pim-to-igmp-proxy	
maximum.....	391	command.....	693
RPT.....	103	show multicast pim-to-mld-proxy command.....	712
		show multicast route command.....	662
S		show multicast rpf command.....	668
SAP		show multicast scope command.....	672
configuring.....	309, 336	show multicast sessions command.....	674
supported software standards.....	17	show multicast snooping route command.....	731
SAP session announcements, displaying.....	760	show multicast snooping statistics command.....	734
sap statement.....	559	show multicast usage command.....	772
usage guidelines.....	309, 336	show pgm negative-acknowledgments	
scope statement.....	527	command.....	789
scope-policy statement.....	528	show pgm source-path-messages command.....	791
scoping, multicast.....	527	show pgm statistics command.....	792
with scope policy.....	528	show pim bidirectional df-election command.....	610
SDP		show pim bidirectional df-election interface	
supported software standards.....	17	command.....	613
secret-key-timeout statement.....	551	show pim bootstrap command.....	616
Session Announcement Protocol See SAP		show pim interfaces command.....	618
shared trees.....	103	show pim join command.....	621
		show pim neighbors command.....	630

show pim rps command.....	634	source-increment statement	
show pim source command.....	641	IGMP.....	450
show pim statistics command.....	644	usage guidelines.....	231
show policy command.....	677	MLD.....	472
show route table command.....	737, 775	usage guidelines.....	258
show sap listen command.....	760	source-specific multicast See SSM	
snooping		SPT.....	108
configuration statements.....	288	configuring threshold cutover policy.....	114
flood groups and	289	cutover control.....	112
forwarding cache and	289	spt-threshold statement.....	420
graceful restart and	289	usage guidelines.....	114
IGMP and VLANs.....	276	SSM.....	167, 171
IGMP interfaces.....	273	configuring.....	175
IGMP overview.....	272	domains.....	174
IGMP proxies.....	273	mapping.....	176
IGMP tracing operations.....	283	SSM maps.....	178, 241
multicast.....	9, 271, 287	example.....	179, 242
spanning tree interfaces state changes.....	289	SSM maps for different groups to different	
snooping (interface)		sources.....	178, 241
IGMP.....	718	ssm-groups statement.....	530
snooping (membership)		usage guidelines.....	171
IGMP.....	721	ssm-map statement	
snooping (statistics)		AMT.....	551
IGMP.....	725	usage guidelines.....	303
source filtering.....	223	IGMP.....	451
source statement		usage guidelines.....	176
IGMP.....	449	MLD.....	472
usage guidelines.....	231	usage guidelines.....	176
IGMP snooping.....	493	SSM.....	531
MLD.....	471	usage guidelines.....	176
usage guidelines.....	258	ssm-map-policy statement	
MSDP.....	577	IGMP interface.....	451
PIM RPF selection.....	397, 419	MLD interface.....	473
SSM.....	529	state (tracing flag)	
usage guidelines.....	176, 206	PGM.....	584
usage guidelines.....	163	static statement	
source-active (tracing flag).....	579	IGMP.....	452
source-active-request (tracing flag).....	579	usage guidelines.....	231
source-active-response (tracing flag).....	579	IGMP snooping.....	494
source-address statement		usage guidelines.....	277
IGMP snooping.....	493	MLD.....	474
usage guidelines.....	277	usage guidelines.....	258
source-count statement		PIM.....	421
IGMP.....	450	usage guidelines.....	75
usage guidelines.....	231	subscriber-leave-timer statement.....	532
MLD.....	471	usage guidelines.....	187
usage guidelines.....	258	support, technical See technical support	
		syntax conventions.....	xxv

T

technical support		
contacting JTAC.....	xxvii	
threshold		
PIM.....	422, 423	
threshold statement		
forwarding cache.....	533	
usage guidelines.....	203, 206	
MSDP.....	578	
usage guidelines.....	320	
multicast snooping.....	504	
timeout statement		
flow map.....	534	
forwarding cache.....	535	
traceoptions statement.....	552	
DVMRP.....	593	
usage guidelines.....	343	
IGMP.....	453	
usage guidelines.....	239	
IGMP snooping.....	495	
usage guidelines.....	283	
MLD.....	475	
usage guidelines.....	268	
MSDP.....	579	
usage guidelines.....	326	
multicast snooping.....	505	
PGM.....	584	
usage guidelines.....	333	
PIM.....	424	
usage guidelines.....	26	
tracing flags		
all		
PGM.....	584	
assert.....	424	
bootstrap.....	424	
cache, PIM.....	424	
graft		
DVMRP.....	593	
PIM.....	424	
hello		
PIM.....	424	
init		
PGM.....	584	
join.....	424	
keepalive		
MSDP.....	579	
leave		
IGMP.....	453	
MLD.....	475	
MLD		
leave.....	475	
mt.....	424	
mtrace		
IGMP.....	239	
MLD.....	268	
neighbor.....	593	
nsr-synchronization.....	425	
packets		
DVMRP.....	593	
IGMP.....	453	
MLD.....	475	
PGM.....	584	
PIM.....	425	
parser, PGM.....	584	
probe.....	593	
prune		
DVMRP.....	593	
PIM.....	425	
register.....	425	
report		
DVMRP.....	593	
IGMP.....	454	
MLD.....	476	
route		
MSDP.....	579	
route-socket		
PGM.....	584	
rp.....	425	
show		
PGM.....	584	
source-active.....	579	
source-active-request.....	579	
source-active-response.....	579	
state		
PGM.....	584	
tracing operations		
DVMRP.....	343, 593	
IGMP.....	239, 453	
IGMP snooping.....	283	
MLD.....	268, 475	
MSDP.....	326, 579	
PGM.....	584	
PIM.....	424	
transmit-interval		
PIM.....	427	
Tunnel Services PIC.....	36	
tunnel-devices statement.....	428	
tunnel-limit statement.....	554	

U

upstream-interface statement.....536

V

verification

 bidirectional PIM.....66

version statement

 AMT.....555

 usage guidelines.....303

 BFD.....429

 IGMP.....455

 usage guidelines.....230

 MLD.....477

 usage guidelines.....252

 PIM.....430

 usage guidelines.....24, 37, 75, 120

virtual-router statement

 usage guidelines.....50

vlan statement

 IGMP snooping.....497

 usage guidelines.....276

VLANs

 IGMP snooping.....276

VPLS root protection

 and multicast snooping

 overview.....288

vpn-group-address statement.....431

W

wildcard-source statement

 PIM RPF selection.....431

