JUNIPER NETWORKS

Load Balancing

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Supported Platforms

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

- MX 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.

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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.xsl;
       }
     }
   }
   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.xsl; }
   ```

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

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```
[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 ix 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.

Table 2 on page ix 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**
`Fixed-width text like this`	Represents output that appears on the terminal screen.	`user@host>` **show chassis alarms** `No alarms currently active`
Italic text like this	• Introduces or emphasizes important new terms. • Identifies guide names. • Identifies RFC and Internet draft titles.	• A policy *term* is a named structure that defines match conditions and actions. • *Junos OS CLI User Guide* • RFC 1997, *BGP Communities Attribute*

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

Convention	Description	Examples
Italic text like this	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** *domain-name*
Text like this	Represents names of configuration statements, commands, files, and directories; configuration hierarchy levels; or labels on routing platform components.	• 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)	Enclose optional keywords or variables.	**stub <default-metric** ***metric*****>;**
| (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** **(*string1* | *string2* | *string3*)**
# (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)	Enclose a variable for which you can substitute one or more values.	**community name members [** ***community-ids*** **]**

Indention and braces ({ })	Identify a level in the configuration hierarchy.	[edit]
		routing-options {
		  static {
		  route default {
		  nexthop *address*;
		  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.	• In the Logical Interfaces box, select **All Interfaces**. • To cancel the configuration, click **Cancel**.
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select **Protocols>Ospf**.

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- Product warranties—For product warranty information, visit http://www.juniper.net/support/warranty/.
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- 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: https://www.juniper.net/alerts/
- 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/

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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.

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PART 1

Overview

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CHAPTER 1

Aggregated Multiservices (AMS)

Adaptive Services Overview

MultiServices PICs and MultiServices Dense Port Concentrators (MS-DPCs) provide *adaptive services interfaces*, which allow you to coordinate multiple services on a single PIC by configuring a set of services and applications. MultiServices PICs and MS-DPCs offer a special range of services you configure in one or more service sets.

The MultiServices PIC is available in three versions, the MultiServices 100, the MultiServices 400, and the MultiServices 500, which differ in memory size and performance. All versions offer enhanced performance in comparison with AS PICs. MultiServices PICs are supported on M Series and T Series routers except M20 routers.

The MultiServices DPC is available for MX Series routers; it includes a subset of the functionality supported on the MultiServices PIC. Currently the MultiServices DPC supports the following Layer 3 services: stateful firewall, NAT, IDS, IPsec, active flow monitoring, RPM, and generic routing encapsulation (GRE) tunnels (including GRE key and fragmentation); it also supports graceful Routing Engine switchover (GRES) and Dynamic Applicaton Awareness for Junos OS. For more information about supported packages, see *Enabling Service Packages*.

It is also possible to group several Multiservices PICs into an aggregated Multiservices (AMS) system. An AMS configuration eliminates the need for separate routers within a system. The primary benefit of having an AMS configuration is the ability to support load balancing of traffic across multiple services PICs. Starting with Junos OS 11.4, all MX Series routers will support high availability (HA) and Network Address Translation (NAT) on AMS infrastructure. See "Configuring Load Balancing on AMS Infrastructure" on page 11 for more information.

NOTE: **The MultiServices PICs are polling based and not interrupt based; as a result, a high value in the show chassis pic "Interrupt load average" field may not mean that the PIC has reached its maximum limit of processing.**

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The following services are configured within a service set and are available only on adaptive services interfaces:

- Stateful firewall—A type of firewall filter that considers state information derived from previous communications and other applications when evaluating traffic.
- Network Address Translation (NAT)—A security procedure for concealing host addresses on a private network behind a pool of public addresses.
- Intrusion detection service (IDS)—A set of tools for detecting, redirecting, and preventing certain kinds of network attack and intrusion.
- IP Security (IPsec)—A set of tools for configuring manual or dynamic security associations (SAs) for encryption of data traffic.
- Class of service (CoS)—A subset of CoS functionality for services interfaces, limited to DiffServ code point (DSCP) marking and forwarding-class assignment. CoS BA classification is not supported on services interfaces.

The configuration for these services comprises a series of rules that you can arrange in order of precedence as a *rule set*. Each rule follows the structure of a firewall filter, with a **from** statement containing input or match conditions and a **then** statement containing actions to be taken if the match conditions are met.

The following services are also configured on the MultiServices PICs and MS-DPCs, but do not use the rule set definition:

- Layer 2 Tunneling Protocol (L2TP)—A tool for setting up secure tunnels using Point-to-Point Protocol (PPP) encapsulation across Layer 2 networks.
- Link Services Intelligent Queuing (LSQ)—Interfaces that support Junos OS class-of-service (CoS) components, link fragmentation and interleaving (LFI) (FRF.12), Multilink Frame Relay (MLFR) user-to-network interface (UNI) network-to-network interface (NNI) (FRF.16), and Multilink PPP (MLPPP).
- Voice services—A feature that uses the Compressed Real-Time Transport Protocol (CRTP) to enable voice over IP traffic to use low-speed links more effectively.

In addition, Junos OS includes the following tools for configuring services:

- Application protocols definition—Allows you to configure properties of application protocols that are subject to processing by router services, and group the application definitions into application sets.
- Service-set definition—Allows you to configure combinations of directional rules and default settings that control the behavior of each service in the service set.

NOTE: Logging of adaptive services interfaces messages to an external server by means of the **fxp0** port is not supported on M Series routers. The architecture does not support system logging traffic out of a management interface. Instead, access to an external server is supported on a Packet Forwarding Engine interface.

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Related Documentation

- *Services PIC Types*
- *Packet Flow Through the Adaptive Services or Multiservices PIC*
- *Enabling Service Packages*
- *Services Configuration Procedure*
- *Supported Platforms*

Understanding Aggregated Multiservices Interfaces

This topic contains the following sections:

Aggregated Multiservices Interface

In Junos OS, you can combine multiple services interfaces to create a bundle of interfaces that can function as a single interface. Such a bundle of interfaces is known as an aggregated multiservices interface (AMS), and is denoted as ams*N* in the configuration, where *N* is a unique number that identifies an AMS interface (for example, **ams0**).

AMS configuration provides higher scalability, improved performance, and better failover and load-balancing options.

The current service set configuration model in Junos OS supports only one service PIC per service set. All services provisioned using a service set must be handled by the only one service PIC associated with that service set. AMS configuration enables you to address this limitation by associating an AMS bundle with a service set. An AMS bundle can have up to eight services PICs as member interfaces and can distribute services among the member interfaces. This allows you to have multiple service interfaces to handle services configured in one service set.

NOTE: Member interfaces are identified as mams in the configuration. The chassisd process in routers that support AMS configuration creates a mams entry each for every multiservices interface on the router.

NOTE: You cannot include MS-DPCs or other multiservices PICs in an AMS configuration that contains MS-MICs or MS-MPCs as member interfaces.

By default, the traffic distribution over the member interfaces of an AMS interface happens in a round-robin fashion. You can also configure the following hash key values to regulate the traffic distribution: **source-ip**, **destination-ip**, **iif** (incoming interface), **oif** (outgoing interface), and **protocol**. For services that require traffic symmetry, you must configure symmetrical hashing. Symmetrical hashing configuration ensures that both forward and reverse traffic are routed through the same member interface.

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NOTE: Junos OS AMS configuration supports only IPv4 traffic.

Member Failure Options and High Availability Settings

Because multiple service interfaces are configured as part of an AMS bundle, AMS configuration also provides for failover and high availability support. You can either configure one of the member interfaces as a backup interface that becomes active when any one of the other member interfaces goes down, or configure the AMS in such a way that when one of the member interfaces goes down, the traffic assigned to that interface is shared across the active interfaces.

The **member-failure-options** configuration statement enables you to configure how to handle traffic when a member interface fails. One option is to redistribute the traffic immediately among the other member interfaces. However, redistribution of traffic involves recalculating the hash tags, and might cause some disruption in traffic on all the member interfaces.

The other option is to configure the AMS to drop all traffic that is assigned to the failed member interface. With this you can optionally configure an interval, **rejoin-timeout**, for the AMS to wait for the failed interface to come back online after which the AMS can redistribute the traffic among other member interfaces. If the failed member interface comes back online before the configured wait time, traffic continues unaffected on all member interfaces, including the interface that has come back online and resumed the operations.

You can also control the rejoining of the failed interface when it comes back online. If you do not include the **enable-rejoin** statement in the **member-failure-options** configuration, the failed interface is not allowed to rejoin the AMS when it comes back online. In such cases, you can manually rejoin that to the AMS by executing the **request interfaces revert** ***interface-name*** operational mode command.

The **rejoin-timeout** and **enable-rejoin** statements enable you to minimize traffic disruptions when member interfaces flap.

NOTE: When member-failure-options are not configured, the default behavior is to redistribute the traffic among the available interfaces.

The **high-availability-options** configuration enables you to designate one of the member interfaces as a backup interface. The backup interface does not participate in routing operations as long as it remains a backup interface. When a member interface fails, the backup interface handles the traffic assigned to the failed interface. When the failed interface comes back online, it becomes the new backup interface.

When both **member-failure-options** and **high-availability-options** are configured for an AMS, the **high-availability-options** configuration takes precedence over the **member-failure-options** configuration. If a second failure occurs before the failed interface

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comes back online to be the new backup, the **member-failure-options** configuration comes into effect.

Related Documentation

- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13
- Example: Configuring Next-Hop Style Services on an Aggregated Multiservices Interface on page 18

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PART 2

Configuration

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CHAPTER 2

Configuration Tasks

Configuring Load Balancing on AMS Infrastructure

Configuring load balancing requires an aggregated Multiservices (AMS) system. AMS involves grouping several Multiservices PICs together. An AMS configuration eliminates the need for separate routers within a system. The primary benefit of having an AMS configuration is the ability to support load balancing of traffic across multiple services PICs.

NOTE: **AMS is supported only on Mobility Gateway (MBG) with the MBG MS-DPC. AMS is not supported with JUNOS services like NAT, FW, IPsec, DAA, HCM on the current MS-DPC.**

Starting with Junos OS 11.4, high availability (HA) is supported on AMS infrastructure on all MX Series 3D Universal Edge routers. AMS has several benefits:

- Support for configuring behavior if a Multiservices PIC that is part of the AMS configuration fails
- Support for specifying hash keys for each service set in either direction
- Support for adding routes to individual PICs within the AMS system

Configuring AMS Infrastructure

AMS supports load balancing across multiple service sets. All ingress or egress traffic for a service set can be load balanced across different services PICs. To enable load balancing, you have to configure an aggregate interface with existing services interfaces.

To configure failure behavior in AMS, include the **member-failure-options** statement:

```
[edit interfaces ams1]
load-balancing-options {
```

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```
    member-failure-options {
      drop-member-traffic {
        rejoin-timeout rejoin-timeout;
      }
      redistribute-all-traffic {
        enable-rejoin;
      }
    }
  }
```

If a PIC fails, the traffic to the failed PIC can be configured to be redistributed by using the **redistribute-all-traffic** statement at the **[edit interfaces *interface-name* load-balancing-options member-failure-options]** hierarchy level. If the **drop-member-traffic** statement is used, all traffic to the failed PIC is dropped. Both options are mutually exclusive.

NOTE: If **member-failure-options** is not explicitly configured, the default behavior is to drop member traffic with a rejoin timeout of 120 seconds.

Only **mams-** interfaces (services interfaces that are part of AMS) can be aggregated. After an AMS interface has been configured, the constituent **mams-** interfaces cannot be individually configured. A **mams-** interface cannot be used as an **rms** interface. AMS supports only IPv4; inet6 family is not supported. It is not possible to configure addresses on an AMS interface. Network Address Translation (NAT) is the only application that runs on AMS infrastructure at this time.

NOTE: Unit 0 on an AMS interface cannot be configured.

To support multiple applications and different types of translation, AMS infrastructure supports configuring hashing for each service set. The hash keys can be configured separately for ingress and egress. The default configuration uses source IP, destination IP, and the protocol for hashing; incoming-interface for ingress and outgoing-interface for egress are also available.

Configuring High Availability

In an AMS system configured with high availability, a designated Multiservices PIC acts as a backup for other active PICs that are part of the AMS system. Presently, only N:1 backup for high availability is supported; only one PIC is available as backup for all other active PICs. High availability for load balancing is configured by adding the **high-availability-options** statement at the **[edit interfaces *interface-name* load-balancing-options]** hierarchy level.

To configure high availability, include the **high-availability-options** statement:

```
[edit interfaces ams1]
load-balancing-options {
  high-availability-options {
    many-to-one {
```


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```
            preferred-backup preferred-backup;
        }
    }
}
```

Load Balancing Network Address Translation Flows

Starting with Junos OS Release 11.4, Network Address Translation (NAT) has been programmed as a plug-in and is a function of load balancing and high availability. The plug-in runs on AMS infrastructure. All flows for translation are automatically distributed to different services PICs that are part of the AMS infrastructure. In case of failure of an active Multiservices PIC, the configured backup Multiservices PIC will take over the NAT pool resources of the failed PIC. The hashing method selected depends on the type of NAT. Using NAT on AMS infrastructure has a few limitations:

- NAT flows to failed PICs cannot be restored.
- There is no support for IPv6 flows.
- Twice NAT is not supported for load balancing.

See "Example: Configuring Static Source Translation on AMS Infrastructure" on page 23 for more details on configuring NAT flows for load balancing.

Related Documentation

- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13
- Example: Configuring Next-Hop Style Services on an Aggregated Multiservices Interface on page 18
- Example: Configuring Static Source Translation on AMS Infrastructure on page 23

Example: Configuring an Aggregated Multiservices Interface (AMS)

Hardware and Software Requirements

This example requires MX Series routers that have services interfaces installed in that and Junos OS Release 13.2 running on that.

Overview

The aggregated multiservices (AMS) interface configuration in Junos OS enables you to combine multiple services interfaces to create a bundle of interfaces that can function as a single interface. This example shows you how to configure an AMS interface, load-balancing options, member failure options, high availability settings on an AMS interface, and an interface-style service set configuration that uses the AMS interface.

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NOTE: You cannot include MS-DPCs or other multiservices PICs in an AMS configuration that contains MS-MICs or MS-MPCs as member interfaces.

For more information about AMS interfaces, see "Understanding Aggregated Multiservices Interfaces" on page 5.

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.

Adding Member Interfaces

```
set interfaces ams0 load-balancing-options member-interface mams-0/0/0
set interfaces ams0 load-balancing-options member-interface mams-0/1/0
set interfaces ams0 load-balancing-options member-interface mams-1/0/0
set interfaces ams0 load-balancing-options member-interface mams-1/1/0
set interfaces ams0 load-balancing-options member-interface mams-2/0/0
set interfaces ams0 load-balancing-options member-interface mams-2/1/0
```

Configuring Logical Units

```
set interfaces ams0 unit 1 family inet
```

Configuring Member Failure Options

```
set interfaces ams0 load-balancing-options member-failure-options drop-member-traffic
  rejoin-timeout 300
set interfaces ams0 load-balancing-options member-failure-options drop-member-traffic
  enable-rejoin
```

Configuring High Availability Options

```
set interfaces ams0 load-balancing-options high-availability-options many-to-one
  preferred-backup mams-1/0/0
```

Configuring Service Set and Interface Services

```
set services service-set ams-ss1 interface-service service-interface ams0.1
set services service-set ams-ss1 interface-service load-balancing-options hash-keys
  ingress-key source-ip
set services service-set ams-ss1 interface-service load-balancing-options hash-keys
  egress-key destination-ip
```

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*.

1. Create an aggregated multiservices interface and add member interfaces.

NOTE: You cannot configure the same mams to be part of two different AMS interfaces at the same time.

```
[edit]
user@router1# set interfaces ams0 load-balancing-options member-interface
  mams-0/0/0
```


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```
user@router1# set interfaces ams0 load-balancing-options member-interface
  mams-0/1/0
user@router1# set interfaces ams0 load-balancing-options member-interface
  mams-1/0/0
user@router1# set interfaces ams0 load-balancing-options member-interface
  mams-1/1/0
user@router1# set interfaces ams0 load-balancing-options member-interface
  mams-2/0/0
user@router1# set interfaces ams0 load-balancing-options member-interface
  mams-2/1/0
```

2. Configure logical units for the AMS interface.

NOTE: An AMS interface and its member interfaces cannot share the same logical interface units. For example, if one of the member interfaces has logical units 1 and 2 configured on it, you cannot configure logical units 1 and 2 for the AMS. Similarly, if you have configured logical units 3 and 4 on the AMS, you cannot configure those units on any of the member interfaces.

```
[edit interfaces]
user@router1# set ams0 unit 1 family inet
```

3. Configure member failure options.

```
[edit interfaces ams0]
user@router1# set load-balancing-options member-failure-options
  drop-member-traffic rejoin-timeout 300
user@router1# set load-balancing-options member-failure-options
  drop-member-traffic enable-rejoin
```

NOTE: This example shows the drop-member-traffic configuration. However, you if you would like to redistribute the traffic to other available members when one of the member interfaces goes down, you can include the redistribute-all-traffic statement instead of the drop-member-traffic statement.

The default behavior, when the member-failure-options configuration is not included, is to redistribute the traffic among available member interfaces.

4. Configure the high-availability options.

```
[edit interfaces ams0]
user@router1# set load-balancing-options high-availability-options many-to-one
  preferred-backup mams-1/0/0
```

5. Configure interface style services.

```
[edit services]
user@router1# set service-set ams-ss1 interface-service service-interface ams0.1
```

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```
user@router1# set service-set ams-ss1 interface-service load-balancing-options
  hash-keys ingress-key source-ip
user@router1# set service-set ams-ss1 interface-service load-balancing-options
  hash-keys egress-key destination-ip
```

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

```
[edit]
user@router1# commit
```

Table 3: Key Configuration Statements Used in this Example

Statement	Description
member-interface	Adds a member interface (mams) to the AMS bundle.
drop-member-traffic	Specifies that all traffic to a member be dropped in case the member interface fails.
rejoin-timeout	Specifies the time interval, in seconds, for the AMS to wait before declaring a member interface down. If the failed member comes back online during this period, it can rejoin the AMS and resume traffic forwarding. The range is 0 through 1000 seconds.
enable-rejoin	Specifies whether a failed interface be allowed to rejoin the AMS when it comes back online. If this statement is not included in the configuration, you must manually add the interface to the AMS when the interface is back online.
preferred-backup	Designates a member interface as the floating backup.
interface-services	Specifies a service interface, an AMS interface in this example, to handle interface services.
hash-keys	Specifies the load-balancing hash keys. You can configure the following hash key values: **source-ip**, **destination-ip**, **iif** (incoming interface), **oif** (outgoing interface), and **protocol**. NOTE: For services that require traffic symmetry, you must configure symmetrical hashing. Symmetrical hashing configuration ensures that both forward and reverse traffic are routed through the same member interface.

Results From the configuration mode, confirm your configuration by entering the **show interfaces ams0** command. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@router1# show interfaces ams0
load-balancing-options {
   member-interface mams-0/0/0;
   member-interface mams-0/1/0;
   member-interface mams-1/0/0;
```


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```
    member-interface mams-1/1/0;
    member-interface mams-2/0/0;
    member-interface mams-2/1/0;
    member-failure-options {
      drop-member-traffic {
        rejoin-timeout 300;
        enable-rejoin;
      }
    }
    high-availability-options {
      many-to-one {
        preferred-backup mams-1/0/0;
      }
    }
  }
    unit 1 {
      family inet;
    }

user@router1# show services
service-set ams-ss1 {
  interface-service {
    service-interface ams0.1;
    load-balancing-options {
      hash-keys {
        ingress-key source-ip;
        egress-key destination-ip;
      }
    }
  }
}
```

Verification

Confirm that the configuration is working properly.

- Verifying the AMS Configuration on page 17

Verifying the AMS Configuration

Purpose Verify the AMS configuration and status of member interfaces.

Action From operational mode, enter the **show** command.

```
user@router1> show interfaces load-balancing detail
Load-balancing interfaces detail
Interface        : ams0
  State          : Up
  Last change    : 00:01:28
  Member count   : 6
  HA Model       : Many-to-One
  Members        :
      Interface    Weight   State
      mams-0/0/0   10       Active
      mams-0/1/0   10       Active
      mams-1/0/0   10       Backup
      mams-1/1/0   10       Active
```

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```
mams-2/0/0    10        Active
mams-2/1/0    10        Active
```

Meaning Shows that **ams0** has six member interfaces with a many-to-one backup configuration. Of the six member interfaces, five are in active state and one, mams-1/0/0, is in backup state.

Related Documentation

- Example: Configuring Next-Hop Style Services on an Aggregated Multiservices Interface on page 18
- Understanding Aggregated Multiservices Interfaces on page 5

Example: Configuring Next-Hop Style Services on an Aggregated Multiservices Interface

Hardware and Software Requirements

MX Series routers with services interfaces installed and running Junos OS Release 13.2.

Overview

Starting with Release 13.2, Junos OS extends next-hop style services support to aggregated multiservices (AMS) interfaces. In releases earlier than 12.3, only interface style services configurations were supported on AMS interfaces.

The next-hop style services configuration on AMS interfaces is different from the interface style services configuration. For next-hop style services, the load-balancing hash keys are defined as part of the logical unit configuration of the AMS interface. For interface style services, the hash keys configuration falls under the service-set configuration.

This example explains the next-hop style services configuration on an AMS interface, and shows the verification steps to verify that the configuration is working correctly.

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.

Configuring an aggregated multiservices interface

```
set interfaces ams0 load-balancing-options member-interface mams-1/0/0
set interfaces ams0 load-balancing-options member-interface mams-1/1/0
set interfaces ams0 load-balancing-options member-interface mams-2/0/0
set interfaces ams0 load-balancing-options member-interface mams-2/1/0
set interfaces ams0 unit 1 family inet
set interfaces ams0 unit 1 service-domain inside
set interfaces ams0 unit 2 family inet
set interfaces ams0 unit 2 service-domain outside
```


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Configuring Routing Instances that Use AMS interfaces

```
set routing-instances ri-internal instance-type virtual-router
set routing-instances ri-internal interface ge-0/0/2.0
set routing-instances ri-internal interface ams0.1
set routing-instances ri-internal routing-options static route 22.22.22.0/24 next-hop
  ams0.1
set routing-instances ri-external instance-type virtual-router
set routing-instances ri-external interface ge-2/0/6.0
set routing-instances ri-external interface ams0.2
set routing-instances ri-external routing-options static route 0.0.0.0/0 next-hop ams0.2
```

Configuring Hash Keys

```
set interfaces ams0 unit 1 load-balancing-options hash-keys ingress-key source-ip protocol
set interfaces ams0 unit 2 load-balancing-options hash-keys ingress-key destination-ip
  protocol
```

Configure Next Hop Services

```
set services service-set ams-test stateful-firewall-rules sfw1
set services service-set ams-test next-hop-service inside-service-interface ams0.1
set services service-set ams-test next-hop-service outside-service-interface ams0.2
```

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*.

1. Configure an aggregated multiservices interface and the load-balancing options.

   ```
   [edit interfaces ams0]
   user@router1# set load-balancing-options member-interface mams-1/0/0
   user@router1# set load-balancing-options member-interface mams-1/1/0
   user@router1# set load-balancing-options member-interface mams-2/0/0
   user@router1# set load-balancing-options member-interface mams-2/1/0
   user@router1# set unit 1 family inet
   user@router1# set unit 1 service-domain inside
   user@router1# set unit 2 family inet
   user@router1# set unit 2 service-domain outside
   ```

2. Configure routing instances that use the aggregated multiservices interfaces configured in the first step.

   ```
   [edit routing-instances]
   user@router1# set ri-internal instance-type virtual-router
   user@router1# set ri-internal interface ge-0/0/2.0
   user@router1# set ri-internal interface ams0.1
   user@router1# set ri-internal routing-options static route 22.22.22.0/24 next-hop
     ams0.1
   user@router1# set ri-external instance-type virtual-router
   user@router1# set ri-external interface ge-2/0/6.0
   user@router1# set ri-external interface ams0.2
   user@router1# set ri-external routing-options static route 0.0.0.0/0 next-hop ams0.2
   ```

3. Configure hash keys for the aggregated multiservices interfaces.

   

   NOTE: Unlike in the interface-style configuration where hash keys are defined in the service-set configuration, for next-hop services, the hash keys are specified in the AMS configuration under the logical units.

   ```
   [edit interfaces ams0]
   ```

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```
user@router1# set unit 1 load-balancing-options hash-keys ingress-key source-ip
  protocol
user@router1# set unit 2 load-balancing-options hash-keys ingress-key destination-ip
  protocol
```

4. Configure next-hop style services under the service-set configuration.

```
[edit services service-set ams-test]
user@router1# set stateful-firewall-rules sfw1
user@router1# set next-hop-service inside-service-interface ams0.1
user@router1# set next-hop-service outside-service-interface ams0.2
```

5. Commit the configuration.

```
[edit]
user@router1# commit
```

Results From the configuration mode, confirm your configuration by entering the **show interfaces ams0**, **show routing-instances**, and **show services service-set ams-test** commands. If the output does not display the intended configuration, repeat the instructions in this example to correct the configuration.

```
user@router1# show interfaces ams0
load-balancing-options {
  member-interface mams-1/0/0;
  member-interface mams-1/1/0;
  member-interface mams-2/0/0;
  member-interface mams-2/1/0;
  member-failure-options {
    redistribute-all-traffic {
      enable-rejoin;
    }
  }
}
  unit 1 {
    family inet;
    service-domain inside;
    load-balancing-options {
      hash-keys {
        ingress-key [ source-ip protocol ];
      }
    }
  }
  unit 2 {
    family inet;
    service-domain outside;
    load-balancing-options {
      hash-keys {
        ingress-key [ destination-ip protocol ];
      }
    }
  }
```

```
user@router1# show routing-instances
ri-internal {
  instance-type virtual-router;
  interface ge-0/0/2.0;
```


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```
    interface ams0.1
    routing-options {
      static {
        route 22.22.22.0/24 next-hop ams0.1;
      }
    }
}
    ri-external {
      instance-type virtual-router;
      interface ge-2/0/6.0;
      interface ams0.2
      routing-options {
        static {
          route 0.0.0.0/0 next-hop ams0.2;
        }
      }
    }

user@router1# show services service-set ams
stateful-firewall-rules sfw1;
next-hop-service {
  inside-service-interface ams0.1;
  outside-service-interface ams0.2;
}
```

Related Documentation

- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13
- Understanding Aggregated Multiservices Interfaces on page 5

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CHAPTER 3

NAT on AMS Infrastructure Examples

Example: Configuring Static Source Translation on AMS Infrastructure

This example shows a static source translation configured on an AMS interface. The flows will be load balanced across member interfaces with this example.

Configure the AMS interface **ams0** with load balancing options.

```
[edit interfaces ams0]
load-balancing-options {
member-interface mams-5/0/0;
member-interface mams-5/1/0;
}
unit 1 {
    family inet;
}
unit 2 {
    family inet;
}
```

Configure hashing for the service set for both ingress and egress traffic.

```
[edit services service-set ss1]
interface-service {
    service-interface ams0.1;
    load-balancing-options {
        hash-keys {
            ingress-key destination-ip;
            egress-key source-ip;
        }
    }
}
```

NOTE: Hashing is determined based on whether the service set is applied on the ingress or egress interface.

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Configure two NAT pools because you have configured two member interfaces for the AMS interface.

```
[edit services]
nat {
    pool p1 {
        address-range low 20.1.1.80 high 20.1.1.80;
    }
pool p2 {
        address 20.1.1.81/32;
    }
}
```

Configure the NAT rule and translation.

```
[edit services]
nat {
    rule r1 {
        match-direction input;
        term t1 {
            from {
                source-address {
                    20.1.1.2/32;
                }
            }
            then {
                translated {
                    source-pool p1;
                    translation-type {
                        basic-nat44;
                    }
                }
           }
        term t1 {
              from {
                  source-address {
                      40.1.1.2/32;
                  }
             }
             then {
                 translated {
                     source-pool p2;
                     translation-type {
                         basic-nat44;
                     }
                 }
            }
      }
 }
```

NOTE: A similar configuration can be applied for translation types dynamic-nat44 and napt-44. Twice NAT cannot run on AMS infrastructure at this time.

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Related Documentation

- Configuring Load Balancing on AMS Infrastructure on page 11
- Understanding Aggregated Multiservices Interfaces on page 5

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CHAPTER 4

Configuration Statements

drop-member-traffic (Aggregated Multiservices)

Syntax

```
drop-member-traffic {
  rejoin-timeout rejoin-timeout;
}
```

Hierarchy Level [edit interfaces *interface-name* load-balancing-options member-failure-options]

Release Information Statement introduced in Junos OS Release 11.4.

Description Specify whether the broadband gateway should drop traffic to a Multiservices PIC when it fails.

For many-to-one (N:1) high availability (HA) for service applications like Network Address Translation (NAT), this configuration is valid only when two or more Multiservices PICs have failed.

The remaining statement is explained separately.

Default If this statement is not configured, then the default behavior is to drop member traffic with a rejoin timeout of 120 seconds.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- member-failure-options (Aggregated Multiservices) on page 33
- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13

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enable-rejoin (aggregated Multiservices)

Syntax enable-rejoin;

Hierarchy Level [edit interfaces *interface-name* load-balancing-options member-failure-options redistribute-all-traffic]

Release Information Statement introduced in Junos OS Release 11.4.

Description Enable the failed member to rejoin the aggregated Multiservices (AMS) interface after the member comes back online.

For many-to-one (N:1) high availability (HA) for service applications like Network Address Translation (NAT), this configuration allows the failed members to rejoin the pool of active members automatically.

Default If you do not configure this option, then the failed members do not automatically rejoin the **ams** interface even after coming back online.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- redistribute-all-traffic (Aggregated Multiservices) on page 36
- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13

family (aggregated Multiservices)

Syntax family *family*;

Hierarchy Level [edit interfaces *interface-name* unit *interface-unit-number*]

Release Information Statement introduced in Junos OS Release 11.4.

Description Configure protocol family information for the logical interface.

Options ***family***—Protocol family. Currently, only one option, **inet** (IP version 4 suite), is supported.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- unit (Aggregated Multiservices) on page 38
- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13

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high-availability-options (aggregated Multiservices)

Syntax

```
high-availability-options {
  many-to-one {
    preferred-backup preferred-backup;
  }
}
```

Hierarchy Level [edit interfaces *interface-name* load-balancing-options]

Release Information Statement introduced in Junos OS Release 11.4.

Description Configure the high availability options for the aggregated Multiservices (AMS) interface. For service applications, if only the load-balancing feature is being used, then this configuration is optional.

For many-to-one (N:1) high availability support for service applications like Network Address Translation (NAT), the preferred backup Multiservices PIC, in hot standby mode, backs up one or more (N) active Multiservices PICs.

NOTE: In both cases, if one of the active Multiservices PICs goes down, then the backup replaces it as the active Multiservices PIC. When the failed PIC comes back up, it becomes the new backup. This is called floating backup.

The remaining statements are explained separately.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- load-balancing-options on page 31
- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13

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interfaces (Aggregated Multiservices)

Syntax

```
interfaces interface-name {
  load-balancing-options {
    high-availability-options {
      many-to-one {
        preferred-backup preferred-backup;
      }
    }
    member-failure-options {
      drop-member-traffic {
        rejoin-timeout rejoin-timeout;
      }
      redistribute-all-traffic {
        enable-rejoin;
      }
    }
    member-interface interface-name;
  }
  unit interface-unit-number {
    family family;
  }
}
```

Hierarchy Level [edit]

Release Information Statement introduced in Junos OS Release 11.4.

Description Configure the aggregated Multiservices (AMS) interface. The AMS interface provides the infrastructure for load balancing and high availability (HA).

NOTE: The interfaces must be valid aggregated Multiservices interfaces (ams)—for example, ams0 or ams1, and so on. The ams infrastructure is supported only in chassis with Trio-based modules and Multiservices Dense Port Concentrators (MS-DPCs).

The remaining statements are explained separately.

Options **interface-name**—Name of the aggregated Multiservices interface (**ams**)—for example, **ams0** or **ams1**, and so on.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Configuring Load Balancing on AMS Infrastructure on page 11
- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13

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load-balancing-options (Aggregated Multiservices)

Syntax

```
load-balancing-options {
  high-availability-options {
    many-to-one {
      preferred-backup preferred-backup;
    }
  }
  member-failure-options {
    drop-member-traffic {
      rejoin-timeout rejoin-timeout;
    }
    redistribute-all-traffic {
      enable-rejoin;
    }
  }
  member-interface interface-name;
}
```

Hierarchy Level [edit interfaces *interface-name*]

Release Information Statement introduced in Junos OS Release 11.4.

Description Configure the high availability (HA) options for the aggregated Multiservices (AMS) interface.

Many-to-one (N:1) high availability mode for service applications like Network Address Translation (NAT) is supported. In this case, one Multiservices PIC is the backup (in hot standby mode) for one or more (N) active Multiservices PICs. If one of the active Multiservices PICs goes down, then the backup replaces it as the active Multiservices PIC. When the failed PIC comes back online, it becomes the new backup. This is called floating backup mode.

The remaining statements are explained separately.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- interfaces on page 30
- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13

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many-to-one (Aggregated Multiservices)

Syntax

```
many-to-one {
  preferred-backup preferred-backup;
}
```

Hierarchy Level [edit interfaces *interface-name* load-balancing-options high-availability-options]

Release Information Statement introduced in Junos OS Release 11.4.

Description Configure the initial preferred backup for the aggregated Multiservices (AMS) interface.

NOTE: The preferred backup must be one of the member interfaces (mams–) that have already been configured at the [edit interfaces *interface-name* load-balancing-options] hierarchy level. Even in the case of mobile control plane redundancy, which is one-to-one (1:1), the initial preferred backup is configured at this hierarchy level.

The remaining statements are explained separately.

Options

preferred-backup *preferred-backup*—Name of the preferred backup member interface. The member interface format is **mams-a/b/0**, where **a** is the Flexible PIC Concentrator (FPC) slot number and **b** is the PIC slot number.

Required Privilege Level

interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- high-availability-options (aggregated Multiservices) on page 29
- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13

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member-failure-options (Aggregated Multiservices)

Syntax

```
member-failure-options {
  drop-member-traffic {
    rejoin-timeout rejoin-timeout;
  }
  redistribute-all-traffic {
    enable-rejoin;
  }
}
```

Hierarchy Level [edit interfaces *interface-name* load-balancing-options]

Release Information Statement introduced in Junos OS Release 11.4.

Description Configure the possible behavior for the aggregated Multiservices (AMS) interface in case of failure of more than one active member.

NOTE: The **drop-member-traffic** configuration and the **redistribute-all-traffic** configuration are mutually exclusive.

Table 4 on page 33 displays the behavior of the member interface after the failure of the first Multiservices PIC. Table 5 on page 34 displays the behavior of the member interface after the failure of two Multiservices PICs.

NOTE: The AMS infrastructure has been designed to handle one failure automatically. However, in the unlikely event that more than one Multiservices PIC fails, the AMS infrastructure provides configuration options to minimize the impact on existing traffic flows.

Table 4: Behavior of Member Interface After One Multiservices PIC Fails

High Availability Mode	Member Interface Behavior
Many-to-one (N:1) high availability support for service applications	Automatically handled by the AMS infrastructure

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Table 5: Behavior of Member Interface After Two Multiservices PICs Fail

High Availability Mode	Configuration	rejoin-timeout	Behavior when member rejoins before rejoin-timeout expires	Behavior when member rejoins after rejoin-timeout expires
Many-to-one (N:1) high availability support for service applications	**drop-member-traffic**	Configured	The existing traffic for the second failed member will *not* be redistributed to the other members. The first member to rejoin becomes an active member. The second member to rejoin becomes the backup. This behavior is handled automatically by the AMS infrastructure.	The existing traffic for the second failed member will *not* be redistributed to the other members. The first member will rejoin the AMS automatically. However, the other members who are rejoining will be moved to the discard state.
Many-to-one (N:1) high availability support for service applications	**redistribute-all-traffic**	Not applicable	Before rejoin, the traffic is redistributed to existing active members. After a failed member rejoins, the traffic is load-balanced afresh. This may impact existing traffic flows.	

The remaining statements are explained separately.

Default If **member-failure-options** are not configured, then the default behavior is to drop member traffic with a rejoin timeout of 120 seconds.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- load-balancing-options (Aggregated Multiservices) on page 31
- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13

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member-interface (Aggregated Multiservices)

Syntax member-interface *interface-name*;

Hierarchy Level [edit interfaces *interface-name* load-balancing-options]

Release Information Statement introduced in Junos OS Release 11.4.

Description Specify the member interfaces for the aggregated Multiservices (AMS) interface. You can configure multiple interfaces by specifying each interface in a separate statement.

For high availability service applications like Network Address Translation (NAT) that support many-to-one (N:1) redundancy, you can specify two or more interfaces.

NOTE: The member interfaces that you specify must be members of aggregated Multiservices interfaces (**mams-**).

The remaining statements are explained separately.

Options *interface-name*—Name of the member interface. The member interface format is **mams-a/b/0**, where **a** is the Flexible PIC Concentrator (FPC) slot number and **b** is the PIC slot number.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13
- **load-balancing-options (Aggregated Multiservices) on page 31**

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redistribute-all-traffic (Aggregated Multiservices)

Syntax

```
redistribute-all-traffic {
  enable-rejoin;
}
```

Hierarchy Level [edit interfaces *interface-name* load-balancing-options member-failure-options]

Release Information Statement introduced in Junos OS Release 11.4.

Description Enable the option to redistribute traffic of a failed active member to the other active members.

For many-to-one (N:1) high availability support for Network Address Translation (NAT), the traffic for the failed member is automatically redistributed to the other active members.

The remaining statement is explained separately.

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13
- member-failure-options (Aggregated Multiservices) on page 33

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rejoin-timeout (Aggregated Multiservices)

Syntax rejoin-timeout *rejoin-timeout*;

Hierarchy Level [edit interfaces *interface-name* load-balancing-options member-failure-options drop-member-traffic]

Release Information Statement introduced in Junos OS Release 11.4.

Description Configure the time by when a failed member should rejoin the aggregated Multiservices (AMS) interface automatically. If the failed member does not rejoin by the configured time, then the member is moved to the "inactive" state and the traffic meant for this member is dropped.

Default If you do not configure a value, the default value of 120 seconds is used.

Options ***rejoin-timeout***—Time, in seconds, by which a failed member must rejoin.

Default: 120 seconds

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13
- drop-member-traffic (Aggregated Multiservices) on page 27

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unit (Aggregated Multiservices)

Syntax

```
unit interface-unit-number {
  family family;
}
```

Hierarchy Level [edit interfaces *interface-name*]

Release Information Statement introduced in Junos OS Release 11.4.

Description Configure the logical interface on the physical device. You must configure a logical interface to be able to use the physical device.

The remaining statements are explained separately.

Options ***interface-unit-number***—Number of the logical unit.

NOTE: **Unit 0 is reserved and cannot be configured under the aggregated Multiservices interface (ams).**

Range: 1 through 16,384

Required Privilege Level interface—To view this statement in the configuration.
interface-control—To add this statement to the configuration.

Related Documentation

- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13
- **interfaces on page 30**

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PART 3

Administration

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CHAPTER 5

Load Balancing Operational Mode Commands

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show interfaces load-balancing

Syntax show interfaces load-balancing
<detail>

Release Information Command introduced in Junos OS Release 11.4.

Description Display status information about load balancing on aggregated Multiservices (AMS) interfaces.

Options **none**—Display standard information about status of all AMS interfaces.

detail—(Optional) Display detailed status of all AMS interfaces.

Required Privilege Level view

Related Documentation
- Understanding Aggregated Multiservices Interfaces on page 5
- Example: Configuring an Aggregated Multiservices Interface (AMS) on page 13

List of Sample Output
show interfaces load-balancing on page 44
show interfaces load-balancing detail on page 44

Output Fields Table 6 on page 42 lists the output fields for the **show interfaces load-balancing** (aggregated Multiservices interfaces) command. Output fields are listed in the approximate order in which they appear.

Table 6: Aggregated Multiservices show interfaces load-balancing Output Fields

Field Name	Field Description	Level of Output
Interface	Name of the aggregated Multiservices (AMS) interface.	All levels
State	Status of AMS interfaces: • **Up**—Interface is configured and operational. • **Coming Up**—Interface is becoming operational. • **Wait Timer**—Interface is waiting for member interfaces (mams) to come online. • **Members Seen**—Member interfaces (mams) are available. • **Wait for Members**—Member interfaces (mams) are not available.	All levels
Last change	Time elapsed since the last change to the interface.	All levels
Member count	Number of member PICs (mams) that are part of the aggregated interface.	All levels
Members Interface	List of all member PICs (mams) that are part of the aggregated interface.	**detail**
Weight	Weight associated with each member PIC for load balancing. The minimum weight is 1, maximum weight is 100; default weight is 10.	**detail**

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Table 6: Aggregated Multiservices show interfaces load-balancing Output Fields *(continued)*

Field Name	Field Description	Level of Output
State	Status of each member PIC (mams) : • **Invalid**—Configured interface is not valid. • **Down**—Interface is not operational. • **Active**—Interface is configured and operational. • **Discard**—Interface has been discarded. • **Inactive**—Configured interface is not online. • **Backup**—Interface has been configured as backup.	**detail**

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Sample Output

show interfaces load-balancing

```
user@host> show interfaces load-balancing
Interface  State           Last change  Member count
ams0       Up              1d 00:50     2
ams1       Up              00:00:59     2
```

show interfaces load-balancing detail

```
user@host>show interfaces load-balancing detail
Load-balancing interfaces detail
Interface        : ams0
  State          : Up
  Last change    : 1d 00:51
  Member count   : 2
  Members        :
      Interface    Weight   State
      mams-2/0/0    10        Active
      mams-2/1/0    10        Active
```


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PART 4

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