



---

Junos<sup>®</sup> OS

## SDK Applications Guide

Release

14.1



---

Published: 2014-08-13

Juniper Networks, Inc.  
1194 North Mathilda Avenue  
Sunnyvale, California 94089  
USA  
408-745-2000  
[www.juniper.net](http://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<sup>®</sup> OS SDK Applications Guide*

14.1

Copyright © 2014, 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 . . . . .	xi
	Documentation and Release Notes . . . . .	xi
	Supported Platforms . . . . .	xi
	Using the Examples in This Manual . . . . .	xii
	Merging a Full Example . . . . .	xii
	Merging a Snippet . . . . .	xiii
	Documentation Conventions . . . . .	xiii
	Documentation Feedback . . . . .	xv
	Requesting Technical Support . . . . .	xvi
	Self-Help Online Tools and Resources . . . . .	xvi
	Opening a Case with JTAC . . . . .	xvi
<b>Part 1</b>	<b>Overview</b>	
<b>Chapter 1</b>	<b>Software Overview . . . . .</b>	<b>3</b>
	Introduction to Junos Applications . . . . .	3
	Applications in the Junos Architecture . . . . .	5
	Control Plane . . . . .	6
	Data Plane . . . . .	6
	Services Plane . . . . .	7
	Traffic Types . . . . .	7
	Supported Platforms for Junos Applications . . . . .	8
	Application Versions and Compatibility . . . . .	9
<b>Chapter 2</b>	<b>Feature Overviews . . . . .</b>	<b>11</b>
	Resource Limits Imposed on Applications . . . . .	11
	Restricting Resource Limits . . . . .	11
	Displaying Resource Limits . . . . .	13
<b>Part 2</b>	<b>Configuration</b>	
<b>Chapter 3</b>	<b>Remote Applications Without the JunosV App Engine . . . . .</b>	<b>17</b>
	Configuring the Juniper Distributed Application Framework . . . . .	17
<b>Chapter 4</b>	<b>Deploying Service Applications . . . . .</b>	<b>19</b>
	Deploying Service Applications . . . . .	19
	Configuring Service Interfaces . . . . .	20
	Configuring Control and Data Cores . . . . .	20
	Configuring Packages on the PIC . . . . .	21
	Configuring Packet Distribution Settings . . . . .	22

	Setting the Forwarding Database and Policy Database Sizes . . . . .	23
	Configuring Memory Settings . . . . .	24
	Object Cache . . . . .	24
	Wired Process Memory . . . . .	24
	Configuring System Log Messages . . . . .	25
<b>Chapter 5</b>	<b>Working with Applications . . . . .</b>	<b>29</b>
	Application Execution . . . . .	29
	Verifying the Execution Status of System Processes . . . . .	29
	Disabling a System Process . . . . .	30
	Configuring Application Failure Settings . . . . .	30
	Displaying Resource Limits . . . . .	31
	Restricting Resource Limits . . . . .	32
	Application User Interface Extensions . . . . .	33
	Displaying the Detail for Application Configurations . . . . .	33
	Displaying and Deleting Configuration for Applications . . . . .	34
	Application Health Monitoring . . . . .	36
	Verification of System Information on the Services PIC . . . . .	37
<b>Chapter 6</b>	<b>Traffic Configuration with Applications . . . . .</b>	<b>39</b>
	Configuring Traffic Sampling for Junos Applications . . . . .	39
	Configuring Service Sets for Junos Applications . . . . .	40
	Configuring the Service Order for Service Sets for Junos Applications . . . . .	40
	Configuring the Sampling Service Set . . . . .	41
<b>Chapter 7</b>	<b>Examples . . . . .</b>	<b>43</b>
	Example: Configuring Separate Resource Limits for a Process . . . . .	43
	Example: Displaying and Deleting Configuration Contributed by Applications . . . . .	44
	Example: Service Set Configuration for Junos Applications . . . . .	46
	Example: Traffic Sampling on a Multiservices PIC . . . . .	47
<b>Chapter 8</b>	<b>Configuration Statements . . . . .</b>	<b>49</b>
	control-cores . . . . .	50
	data-cores . . . . .	50
	data-flow-affinity . . . . .	51
	destination (Chassis) . . . . .	52
	extension-provider . . . . .	53
	extensions . . . . .	54
	extension-service . . . . .	55
	forwarding-db-size . . . . .	56
	hash-key (Chassis) . . . . .	57
	ip-address-owner . . . . .	58
	jdaf . . . . .	58
	license-type . . . . .	59
	object-cache-size . . . . .	60
	package (Loading on PIC) . . . . .	61
	package (Resource Limits) . . . . .	62
	policy-db-size . . . . .	63
	process . . . . .	64
	process-monitor . . . . .	65

	providers . . . . .	66
	resource-cleanup . . . . .	67
	resource-limits . . . . .	68
	resources . . . . .	70
	routing-instances . . . . .	71
	service-order . . . . .	72
	syslog (Chassis) . . . . .	73
	traceoptions (Process Monitor) . . . . .	74
	traceoptions (Resource Cleanup) . . . . .	76
	wired-max-processes . . . . .	77
	wired-process-mem-size . . . . .	78
<b>Part 3</b>	<b>Administration</b>	
<b>Chapter 9</b>	<b>Installing and Managing Application Packages . . . . .</b>	<b>81</b>
	Installing Application Packages . . . . .	81
	Upgrading Application Packages . . . . .	84
	Upgrading Application Packages by Re-installing . . . . .	84
	Upgrading Application Packages Using Unified ISSU . . . . .	85
	Removing Application Packages . . . . .	86
	Checking Installed Application Packages . . . . .	87
	Upgrading the Junos OS When Applications Are Installed . . . . .	88
<b>Chapter 10</b>	<b>Managing Resource Information . . . . .</b>	<b>89</b>
	Displaying Resource Limits . . . . .	89
	Application Health Monitoring . . . . .	90
	Verifying the Execution Status of System Processes . . . . .	91
<b>Chapter 11</b>	<b>Installation and Upgrade Commands . . . . .</b>	<b>93</b>
	request system software in-service-upgrade set . . . . .	94
<b>Chapter 12</b>	<b>Applications Status Commands . . . . .</b>	<b>99</b>
	show extension-provider system connections . . . . .	100
	show extension-provider system packages . . . . .	104
	show extension-provider system processes . . . . .	106
	show extension-provider system uptime . . . . .	111
	show extension-provider system virtual-memory . . . . .	112
<b>Chapter 13</b>	<b>Resource Information Commands . . . . .</b>	<b>115</b>
	show system processes health . . . . .	116
	show system processes providers . . . . .	119
	show system processes resource-limits process-name . . . . .	120
	show system resource-cleanup processes . . . . .	123
<b>Chapter 14</b>	<b>JDAF Commands . . . . .</b>	<b>125</b>
	request jdaf clear statistics service (cmd   config   firewall   interface   route) client . . . . .	126
	request jdaf clear statistics service (cmd   config   firewall   interface   route) server . . . . .	127
	show jdaf service (cmd   config   firewall   interface   route) clients . . . . .	128
	show jdaf service (cmd   config   firewall   interface   route) statistics client . . . . .	130

show jdaf service (cmd | config | firewall | interface | route) statistics server . . . 135

## Part 4

## Index

Index . . . . . 139

# List of Figures

Part 1	Overview	
Chapter 1	Software Overview .....	3
	Figure 1: Architecture Summary and Traffic Paths .....	5





# List of Tables

	<b>About the Documentation</b> . . . . .	<b>xi</b>
	Table 1: Notice Icons . . . . .	xiv
	Table 2: Text and Syntax Conventions . . . . .	xiv
<b>Part 2</b>	<b>Configuration</b>	
<b>Chapter 4</b>	<b>Deploying Service Applications</b> . . . . .	<b>19</b>
	Table 3: Wired Memory and Object Cache Combinations in Multiservices PICs . . . . .	25
	Table 4: Severity Levels for Syslog Messages . . . . .	26
<b>Part 3</b>	<b>Administration</b>	
<b>Chapter 12</b>	<b>Applications Status Commands</b> . . . . .	<b>99</b>
	Table 5: show extension-provider system virtual-memory Output Fields . . . . .	112
<b>Chapter 13</b>	<b>Resource Information Commands</b> . . . . .	<b>115</b>
	Table 6: show system processes health Output Fields . . . . .	116
	Table 7: show system processes resource-limits process-name Output Fields . . . . .	120
	Table 8: show system resource-cleanup processes Output Fields . . . . .	123
<b>Chapter 14</b>	<b>JDAF Commands</b> . . . . .	<b>125</b>
	Table 9: show jdaf service route clients Output Fields . . . . .	128
	Table 10: show jdaf service route statistics client Output Fields . . . . .	130
	Table 11: show jdaf service statistics server Output Fields . . . . .	135



# About the Documentation

- Documentation and Release Notes on page xi
- Supported Platforms on page xi
- Using the Examples in This Manual on page xii
- Documentation Conventions on page xiii
- Documentation Feedback on page xv
- Requesting Technical Support on page xvi

## 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:

- SRX650
- SRX240
- SRX220
- SRX210
- SRX110
- SRX100
- EX8200
- EX4200
- EX4500

- [JCS 1200](#)
- [MX Series](#)
- [T Series](#)
- [M 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 xiv 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 xiv defines the text and syntax conventions used in this guide.

Table 2: Text and Syntax Conventions

Convention	Description	Examples
<b>Bold text like this</b>	Represents text that you type.	To enter configuration mode, type the <b>configure</b> command:  user@host> <b>configure</b>
Fixed-width text like this	Represents output that appears on the terminal screen.	user@host> <b>show chassis alarms</b>  No alarms currently active
<i>Italic text like this</i>	<ul style="list-style-type: none"> <li>Introduces or emphasizes important new terms.</li> <li>Identifies guide names.</li> <li>Identifies RFC and Internet draft titles.</li> </ul>	<ul style="list-style-type: none"> <li>A policy <i>term</i> is a named structure that defines match conditions and actions.</li> <li><i>Junos OS CLI User Guide</i></li> <li>RFC 1997, <i>BGP Communities Attribute</i></li> </ul>
<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@# <b>set system domain-name</b> <i>domain-name</i>

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

Convention	Description	Examples
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"><li>To configure a stub area, include the <b>stub</b> statement at the <b>[edit protocols ospf area area-id]</b> hierarchy level.</li><li>The console port is labeled <b>CONSOLE</b>.</li></ul>
< > (angle brackets)	Encloses optional keywords or variables.	<b>stub &lt;default-metric <i>metric</i>&gt;;</b>
(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.	<b>broadcast   multicast</b>  <b>(<i>string1</i>   <i>string2</i>   <i>string3</i>)</b>
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	<b>rsvp { # Required for dynamic MPLS only</b>
[ ] (square brackets)	Encloses a variable for which you can substitute one or more values.	<b>community name members [ <i>community-ids</i> ]</b>
Indentation and braces ( { } )	Identifies a level in the configuration hierarchy.	<pre>[edit] routing-options {   static {     route default {       nexthop <i>address</i>;       retain;     }   } }</pre>
;(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"><li>In the Logical Interfaces box, select <b>All Interfaces</b>.</li><li>To cancel the configuration, click <b>Cancel</b>.</li></ul>
> (bold right angle bracket)	Separates levels in a hierarchy of menu selections.	In the configuration editor hierarchy, select <b>Protocols&gt;Ospf</b> .

## 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 at the Juniper Networks Technical Documentation 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 <https://www.juniper.net/cgi-bin/docbugreport/>.

- E-mail—Send your comments to [techpubs-comments@juniper.net](mailto: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 JNASC 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

- [Software Overview on page 3](#)
- [Feature Overviews on page 11](#)



## CHAPTER 1

# Software Overview

- [Introduction to Junos Applications on page 3](#)
- [Applications in the Junos Architecture on page 5](#)
- [Supported Platforms for Junos Applications on page 8](#)
- [Application Versions and Compatibility on page 9](#)

### Introduction to Junos Applications

---

Using tools provided by Juniper Networks, third-party developers, called *providers* can create innovative applications and manipulate existing features of the Junos OS. The term *application*, as used in this guide, refers to an application built by a provider.

So applications run on the Routing and System applications (formerly called the RE SDK), the Services applications (formerly called the Services SDK), or the Remote Routing and System applications (also known as the Remote applications).

- Routing and System applications run on the control plane. Typically, these applications perform network management and protocol signaling. They also initiate servers. Positioned on the control plane, Routing Engine applications can coordinate other subsystems and services. A Routing Engine is always present in any device, so these applications are always deployable without the addition of any extra hardware or software.
- Services applications run on the services plane. The services plane is specialized to enable high-performance, customized, and stateful packet processing on the transit or monitored traffic selected for servicing. Services applications may also perform operations similar to Routing and System applications, but such activities typically supplement packet processing.
- With the development of the JunosV App Engine platform, providers can also build custom applications that run on other operating systems in a virtual environment. The JunosV App Engine enables non-Junos third-party applications to integrate with the Junos operating system (OS). Unlike the on-box integration model where applications are fully ported to run on Junos OS. JunosV App Engine enables these *remote applications* to run in their native environment requiring network integration only at the programming interfaces exposed by the network device. Each remote application gets built along with its native OS into a virtual device and is then packaged into an installable Junos package. Upon installation onto a Juniper device, the virtual device is deployed

as a guest on top of a hypervisor running on the JunosV App Engine platform. You can learn more about the remote applications that run on the JunosV App Engine from the JunosV App Engine Administration Guide.

As of Junos OS Release 14.1, remote applications no longer necessarily require the JunosV App Engine to run if they invoke JDAF services by configuring the **jda** statement at the **[edit services]** hierarchy level. The **jda** statement configures the routing instances on which JDAF is enabled. If the **jda** statement is not configured, then JDAF is disabled.

On some of the smaller Juniper Networks devices, physical modules do not necessarily plug in to a chassis. Rather a single box contains the necessary hardware. Nonetheless, applications are still supported in the control and services planes and we continue to use the Routing Engine and services modules terminology.

**Related  
Documentation**

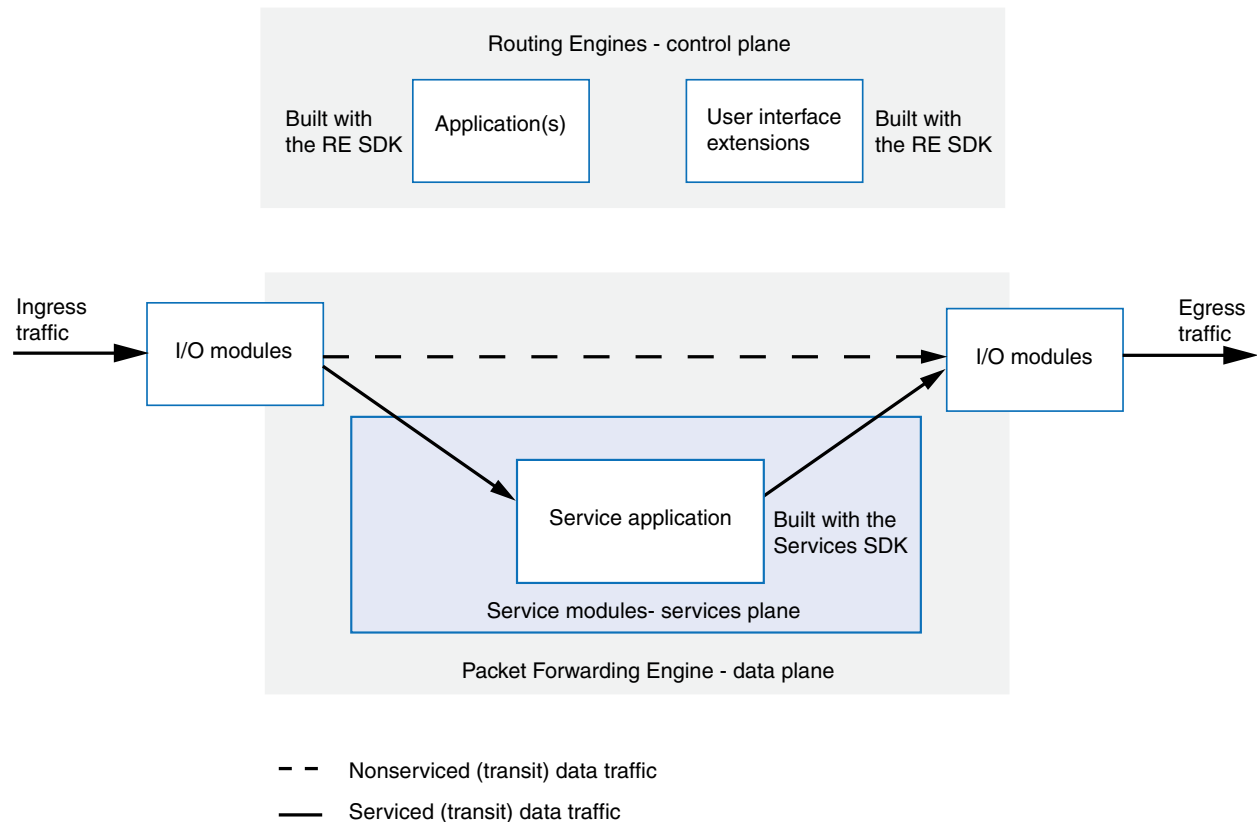
- [Applications in the Junos Architecture on page 5](#)
- [Installing Application Packages on page 81](#)
- [Configuring the Juniper Distributed Application Framework on page 17](#)

## Applications in the Junos Architecture

The Junos operating system (OS) is a single network operating system that integrates routing, switching, and security. Most Juniper Networks platforms run the Junos OS and also support applications created by third-parties, referred to in this guide as *providers*.

This topic presents the Junos OS architecture at a high level and in detail where it pertains to building applications. It continues explaining how the architecture fits over the hardware, and what types of applications are best suited to the environments described.

Figure 1: Architecture Summary and Traffic Paths



9039250

The Junos OS is divided into three logical elements: the control plane, the data plane, and the services plane. These main conceptual separations are summarized in [Figure 1 on page 5](#) and described in more detail in the following sections:

- [Control Plane on page 6](#)
- [Data Plane on page 6](#)
- [Services Plane on page 7](#)
- [Traffic Types on page 7](#)

## Control Plane

The control plane in the Junos OS is a logical element that manages and controls the behavior of the device and the other two planes, the data plane and the services plane. The control plane runs on the Routing Engine. The Routing Engine may be a separate physical module or may be integrated into a device. In some products the Routing Engine cards are hot-swappable physical modules in the chassis. A chassis option for a redundant Routing Engine backing up the master Routing Engine is also available. Applications can take advantage of this redundant Routing Engine to enable their own high availability.

The control plane:

- Has a global view of the device hardware and software
- Exposes the user interface and manages the native Junos OS features

The Routing Engine's key component is the Junos OS. The Junos OS is based on the FreeBSD operating system, an open-source software system. This mature, general-purpose system provides many of the essential functions of an operating system, such as scheduling resources. To transform it into a network operating system, Juniper Networks engineers have extensively modified and hardened it for the specialized requirements of networking.

On the control plane, the Junos kernel, many of the Junos daemons, and some ephemeral utility-style tools launched on demand are run. The daemons and tools that come bundled with the Junos OS are considered part of the Junos OS platform.

Applications for the control plane resemble these daemons and tools. In fact. These applications then become part of the common platform and Junos OS software bundle. Applications can programmatically manipulate the states of the platform software and make use of their services in a dynamic way. The daemons that control the Junos OS user interface also allow for programmatic and seamless extensibility of the user interface. You can configure and administer a modified user interface in the same way as you do for applications.

## Data Plane

The data plane in the Junos OS is a logical element that spans many aspects of a device's chassis and its modules. The data plane's role is to forward traffic according to the forwarding table, primarily formed through the routing control service on the control plane. The data plane's main extended abilities include switching, filtering, rate limiting, shaping, and other quality-of-service (QoS) functions. These functions are controlled by the control plane.

In the Junos environment and the Junos applications architecture, the data plane abstraction is often specifically referred to as the Packet Forwarding Engine. It comprises ASIC-based hardware and software microcode to perform packet processing. Aiming to perform at fast wire speeds and within its hardware resource limits, the Packet Forwarding Engine generally defers stateful packet processing to the services plane. Applications do not run in the data plane, which is tightly bound to the hardware. An application running



in the control or services plane can influence the packet processing mechanism in the data plane, however.

## Services Plane

The services plane in the Junos OS is a logical element that can be thought of as an extension to the data plane to perform stateful services and any services non-native to the Packet Forwarding Engine. A classic example of a Junos OS service application is the stateful firewall.

In traditional forwarding devices, the data plane usually handles much of the packet processing and the services plane runs on optionally installable and hot-swappable hardware, which are generically called services modules. The services plane spans the collection of all services modules in a chassis, and a given service application can be deployed on more than one module. For the M Series, T Series, and MX Series routers, the specific modules supporting the services plane are the Multiservices PIC and the Multiservices DPC.

In security and service-oriented devices, the services plane is the primary packet processor, and the data plane merely connects a chassis containing many services modules. While these devices can perform forwarding, they are purpose built and deployed to service traffic in stateful ways implemented in software running on the services modules.

The Junos kernel on a services engine further logically divides packet handling for applications in two sub-planes. Its services plane (data plane extension) is for fast customized transit traffic processing. Its control plane is for traffic termination with the IP stack. The control plane components frequently implement a server or signaling to communicate outside the device or simply to other components on the Routing Engine.

Applications in the services sub-plane of a service module can take on two roles involving inline packet processing: transforming and monitoring. Transforming applications have access to any traffic flowing through the Packet Forwarding Engine that is selected for servicing at the given service module. They can modify, drop, hold, and create entire packets. Monitoring applications work similarly, but the packets they receive are duplicates of some traffic originally transiting the Packet Forwarding Engine. When monitoring is used, the original traffic is not impacted or serviced. The selection and configuration of either packet processing option is application specific. A hybrid application can differentiate and deal with both original and duplicated packets. Sometimes hybrid applications are named *gateways*, and may combine a server or signaling control plane component with a transforming or monitoring services plane component. Many familiar service applications, such as the Junos IPsec service, work with both styles of components.

## Traffic Types

Applications deal with two different types of traffic: control traffic and data traffic.

Control traffic is in the control plane. You can classify control traffic as traffic that is either internal to the device entirely (for example, interprocess communication) or, more generally, as traffic destined to or sourced from a device address. Most addresses configured on the device belong to the master Routing Engine. For example all addresses configured on network interfaces for I/O ports and the loop back interface pertain to the

Routing Engine, so control traffic destined to those addresses is forwarded to the master Routing Engine and handled there. The Junos OS also allows the configuration of addresses on interfaces representing a service module. Traffic destined to those addresses is forwarded to and handled on the given service engine's control sub-plane.

Data traffic flows through the data plane. You can classify data traffic that relates especially to any application as the traffic selected for servicing or monitoring. This is the traffic seen in the services plane handled by transforming or monitoring applications. Data traffic naturally flows through the Packet Forwarding Engine as transit traffic, but there are application-specific mechanisms by which it can be selected for steering through the service engine's services plane. On exit, the steered traffic is re-routed and filtered in the Packet Forwarding Engine as if it was entering the device from any I/O interface.

**Related  
Documentation**

- [Introduction to Junos Applications on page 3](#)
- [Application Versions and Compatibility on page 9](#)
- [Installing Application Packages on page 81](#)

---

## Supported Platforms for Junos Applications

---

Applications may have components that execute on the control plane and on the service plane.

All control-plane-based components work across these Juniper Networks platforms:

- JCS 1200 Control System
- M Series Multiservice Edge Routers
- MX Series 3D Universal Edge Routers
- SRX210, SRX240, and SRX650 Services Gateways
- T Series Core Routers
- TX Matrix

Service-plane-based components work across these Juniper Networks routers:

- M Series Multiservice Edge Routers
- MX Series 3D Universal Edge Routers
- T Series Core Routers

All service-plane-based components work on the Multiservices 100 Physical Interface Card (PIC), the Multiservices 400 PIC, or the Multiservices Dense Port Concentrator (DPC). The Multiservices PICs are optionally installable in the M Series and T Series routers. The Multiservices DPCs are optionally installable in the MX Series routers.



**NOTE:** In the documentation, the term *Multiservices PIC* is equivalent to the Multiservices DPC on the MX Series routers, unless otherwise noted.

---

- Related Documentation**
- [Introduction to Junos Applications on page 3](#)
  - [Applications in the Junos Architecture on page 5](#)

## Application Versions and Compatibility

As of Junos OS Release 12.3, Junos applications will install on Junos only if the application is built with the same release as the Junos OS Release on which the application is being installed. For example, an application built with Release 12.3R2 will only install on Junos OS Release 12.3R2 and will not install on Junos OS Release 12.3R1 or Junos OS Release 12.3R3 or Junos OS Release 13.1R1.

Prior to Junos OS Release 12.3, Junos applications provided binary compatibility across the different releases of the Junos OS in a particular release train. For example, all the applications developed using the Release 10.3 are binary compatible with Junos OS releases 10.3R1, 10.3R2, 10.3R3, and so on.

Suppose you have Junos OS Release 11.1 on your device and you use the **request system software add** command to install an application developed using Release 10.4. The Junos OS gracefully refuses any attempt to add the software to the device.

```
.
.
.
WARNING: Package 'jnx_ifinfo' is not compatible with package 'jkernel':
WARNING:   Major version number mismatch
WARNING:   (jnx_ifinfo:10 != jkernel:11)
ERROR: JUNOS version incompatible - source compatibility supported from 11.1 -
11.current_jbase_minor
ERROR: jnx-example fails requirements check
Installation failed for package '/var/tmp/jnx-example-10.4I20100917_1456.tgz'
```

The following example shows how an application package is verified and installed.

```
user@router> request system software add jnx-example-i386-12.1-app1.0.tgz
NOTICE: Validating configuration against jnx-example-i386-12.1-app1.0.tgz.
NOTICE: Use the 'no-validate' option to skip this if desired.
Checking compatibility with configuration
Initializing...
Using jbase-12.1R1.9
Verified manifest signed by PackageProduction_12_1_0
Verified jbase-12.1R1.9 signed by PackageProduction_12_1_0
Using /var/home/jnpr/jnx-example-i386-12.1-app1.0.tgz
+junos-package.xml validates
Verified jnx-example-12.1-app1.0 signed by juniper-internaldevelopment-2
Verified manifest signed by juniper-internaldevelopment-2
Using jruntime-12.1R1.9
Verified manifest signed by PackageProduction_12_1_0
Verified jruntime-12.1R1.9 signed by PackageProduction_12_1_0
Using jkernel64-12.1R1.9
Verified manifest signed by PackageProduction_12_1_0
Verified jkernel64-12.1R1.9 signed by PackageProduction_12_1_0
Using jroute-12.1R1.9
Verified manifest signed by PackageProduction_12_1_0
Verified jroute-12.1R1.9 signed by PackageProduction_12_1_0
Using jcrypto64-12.1R1.9
Verified manifest signed by PackageProduction_12_1_0
```

```
Verified jcrypto64-12.1R1.9 signed by PackageProduction_12_1_0
Hardware Database regeneration succeeded
Validating against /config/juniper.conf.gz
Validation succeeded
Installing package '/var/home/jnpr/jnx-example-i386-12.1-app1.0.tgz' ...
+junos-package.xml validates
Verified jnx-example-12.1-app1.0 signed by juniper-internaldevelopment-2
Available space: 2959398 require: 3180
Mounted jnx-example package on /dev/md10...
Verified manifest signed by juniper-internaldevelopment-2
Reloading /config/juniper.conf.gz ...
Activating /config/juniper.conf.gz ...
Restarting mgd ...
Restarting bslockd ...
Saving package file in /var/sw/pkg/jnx-example-12.1-app1.0.tgz ...
Saving state for rollback ...
```

```
WARNING: cli has been replaced by an updated version:
CLI release 12.1R1.9 built by builder on 2012-03-24 08:36:49 UTC
Restart cli using the new version ? [yes,no] (yes)
```

```
Restarting cli ...
user@router>
```

Version compatibility is addressed in the Junos SDK Release Notes for each release. Refer to the Release Notes for version compatibility information specific to that release.

**Related  
Documentation**

- [Installing Application Packages on page 81](#)
- [Checking Installed Application Packages on page 87](#)

## CHAPTER 2

# Feature Overviews

- [Resource Limits Imposed on Applications on page 11](#)

## Resource Limits Imposed on Applications

---

Junos applications have four levels of policies to ensure that applications have the minimal impact on the native Junos operating system and system operations. These policies impose limits on the system resources the application uses. Each succeeding policy level overrides the previous level's settings, provided the constraints are within the previous level's settings.

Level I policy is the default global policy generated by Juniper Networks. Level II is a per-provider level policy that enables different resource limits per provider. A Level III policy is implemented in the policy file that providers write for each application package. The Level IV policy is set by you, the administrative user using the **resource-limits** statement at the **[edit system extensions]** hierarchy level.



**NOTE:** This documentation is not application-specific documentation. Features documented in this guide are generic to all applications. Refer to the application-specific documentation developed by your applications' provider for detailed instructions.

- [Restricting Resource Limits on page 11](#)
- [Displaying Resource Limits on page 13](#)

## Restricting Resource Limits

The Level IV policy is set by the administrative user using the **resource-limits** statement at the **[edit system extensions]** hierarchy level.

The limits imposed by a Level IV policy can be configured either by package or by individual processes in the package. Limits defined for individual processes override the limits defined for an entire package. Any limits not set as Level IV limits inherit the limits from Level III if they exist or from Level II.

The following hierarchy shows all the statements for setting resource limits:

**[edit system extensions]**

```
resource-limits {
  package package-name {
    resources {
      cpu {
        priority number;
        time seconds;
      }
      file {
        core-size bytes;
        open number;
        size bytes;
      }
      memory {
        data-size bytes;
        locked-in bytes;
        resident-set-size bytes;
        socket-buffers bytes;
        stack-size bytes;
      }
    }
  }
}
process process-ui-name {
  resources {
    cpu {
      priority number;
      time seconds;
    }
    file {
      core-size bytes;
      open number;
      size bytes;
    }
    memory {
      data-size bytes;
      locked-in bytes;
      resident-set-size bytes;
      socket-buffers bytes;
      stack-size bytes;
    }
  }
}
```

If an application exceeds any of the imposed limits, the router logs it. For example, if a process tries to exceed its stack size, the process is terminated and the system generates a core file.

Level IV policies can be more restrictive than previous policy levels, but they cannot ease the limits set by the other levels. If you try to commit a resource limit that is higher (less stringent) than the inherited value, the commit operation fails with the following error message:

```
[edit system extensions resource-limits]
'process jnx-example-service'
Limit validation failed for program 'jnx-example-service', resource 'file'
limit 'open': raising limits defined in role 'Provider_Daemon' is not allowed.
```

```
commit complete
```

```
[edit system extensions resource-limits]
```

Level IV policies can be applied either during runtime of the application or before the application gets started. However, if the application was already running when a new limit is applied, the application must be restarted manually in order to allow for the new limits to take effect.

If you delete a resource configuration, the setting goes back to the limits from the assigned role in the manifest file (Level II or Level III).

## Displaying Resource Limits

To display the applied policies, use the **show system processes resource-limits process-name process-ui-name** operational command. The following example configuration, when committed, applies resource limits for an application package `jnx-example` and overrides it with process-level settings for the process `jnx-example-service`:

```
[edit system extensions]
user@router# show
resource-limits {
  package jnx-example {
    resources {
      memory {
        stack-size 4m;
      }
    }
  }
  process jnx-example-service {
    resources {
      file {
        size 4m;
      }
    }
  }
}
```

Using the **show system processes resource-limits process-name** command, the output for `jnx-example-foo-binary`, part of package `jnx-example`, looks like the following output because the package-level settings are applied on it:

```
user@router> show system processes resource-limits process-name jnx-example-foo-binary
Resource Limits:
```

Area	Max. allowed	Max. configurable
memory/stack-size	4MB	8MB
memory/data-size	32MB	32MB
memory/resident-set-size	24MB	24MB
memory/locked-in	16MB	16MB
cpu/priority	10	10
file/open	64	64

The output for `jnx-example-service` looks like this:

```
user@router> show system processes resource-limits process-name jnx-example-service
Resource Limits:
```

Area	Max. allowed	Max. configurable
file/size	4MB	unlimited

file/open	64	64
cpu/priority	10	10
memory/stack-size	8MB	8MB
memory/data-size	32MB	32MB
memory/resident-set-size	24MB	24MB
memory/locked-in	16MB	16MB

For more detail on the **show system processes resource-limits process-name**  
***process-ui-name*** operational command, see its command summary.



## PART 2

# Configuration

- [Remote Applications Without the JunosV App Engine on page 17](#)
- [Deploying Service Applications on page 19](#)
- [Working with Applications on page 29](#)
- [Traffic Configuration with Applications on page 39](#)
- [Examples on page 43](#)
- [Configuration Statements on page 49](#)



## CHAPTER 3

# Remote Applications Without the JunosV App Engine

- [Configuring the Juniper Distributed Application Framework on page 17](#)

## Configuring the Juniper Distributed Application Framework

---

Remote applications interact with the Junos operating system and the router through a software services framework that extends access to Junos management-plane, control-plane, and data-plane features as services. The framework is known as the Juniper Distributed Application Framework (JDAF). Through JDAF, the Junos kernel communication, route management, firewall, configuration, and operational command services all become services for the remote application. Any participant in this framework can publish a service or can subscribe to a service. The framework keeps track of all the services that are published and the health of each service, and implements policies you provide for service access.

To access Junos services, remote applications communicate with the JDAF framework using stubs that you include in the application. JDAF relays application requests to the router and returns replies from the router to the application.

JDAF is available to applications in two ways:

- Using an internal JunosV App Engine server that has information about all system states, routing table entries, and so forth. In this case, you need to connect to a VSE Series device. See the JunosV App Engine Administration Guide for configuration instructions for the **[edit services app-engine]** hierarchy level.
- Invoking JDAF services without using the JunosV App Engine. In this case, the VSE Series device is not required. You access JDAF by configuring the **jdaf** statement, introduced in Junos OS Release 14.1, at the **[edit services]** hierarchy level. The **jdaf** statement configures the routing instances on which JDAF is enabled. If the **jdaf** statement is not configured, then JDAF is disabled.

To enable JDAF without JunosV App Engine:

- Specify the routing instances JDAF is to be enabled on.

You can specify one or more routing instances. The default routing instance is enabled by configuring default. For example, you could issue one or both of the following set commands:

```
set services jdaf routing-instances default routing-instances ri1
set services jdaf routing-instances [ ri2 ri3 ]
```

If both of the above set commands are issued and committed and all the routing instances are valid routing instances, the show configuration services command would show the following output:

```
user@host> show configuration services
  jdaf {
    routing-instances [ default ri1 ri2 ri3 ];
  }
```

Related Documentation • [jdaf on page 58](#)

## CHAPTER 4

# Deploying Service Applications

- [Deploying Service Applications on page 19](#)
- [Configuring Service Interfaces on page 20](#)
- [Configuring Control and Data Cores on page 20](#)
- [Configuring Packages on the PIC on page 21](#)
- [Configuring Packet Distribution Settings on page 22](#)
- [Setting the Forwarding Database and Policy Database Sizes on page 23](#)
- [Configuring Memory Settings on page 24](#)
- [Configuring System Log Messages on page 25](#)

## Deploying Service Applications

---

There are several configurations that deal with deploying service applications. Most of these configurations are under the **[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]** hierarchy level, shown here:

```
[edit chassis fpc slot-number pic pic-number adaptive-services service-package]
extension-provider {
  control-cores control-number;
  data-cores data-number;
  data-flow-affinity {
    hash-key (layer-3 | layer-4);
  }
  forwarding-db-size size;
  object-cache-size value;
  package package-name;
  policy-db-size size;
  syslog {
    facility {
      severity;
      destination destination;
    }
  }
  wired-process-mem-size mem-size;
}
```

Changing any of these settings except for the **syslog** statement causes the PIC to reboot.

Another important configuration is setting up service interfaces. The following topics cover this topic and the other configurations seen in the `[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]` hierarchy level. The first three are mandatory items; the others are optional.

Each of these topics contains only generic information. Check the application-specific documentation developed by your application's provider for the appropriate configuration for your application.

## Configuring Service Interfaces

---

To be able to configure services on your PIC, you need to configure the service interfaces. You do this by creating service sets and applying them on an interface or interfaces using the `service-set` statement at the `[edit interfaces interface-name unit logical-unit-number family (inet | inet6) service (input | output)]` hierarchy level.

The following example shows configuring a service interface (`fe-0/1/0`) by applying a service set called **Firewall-Set**:

```
[edit]
interfaces {
  fe-0/1/0 {
    unit 0 {
      family inet {
        service {
          input {
            service-set Firewall-Set;
          }
          output {
            service-set Firewall-Set;
          }
        }
        address 10.1.3.2/24;
      }
    }
  }
}
```

### Related Documentation

- [Configuring Packages on the PIC on page 21](#)
- [Configuring Control and Data Cores on page 20](#)
- [Configuring Packet Distribution Settings on page 22](#)
- [Configuring System Log Messages on page 25](#)

## Configuring Control and Data Cores

---

There are eight cores in a PIC. Some cores, called *control cores*, are dedicated to running control functionality for the application. Cores dedicated to processing data for the application are called *data cores*.

To be able to deploy services on the PIC, you must configure at least one control core.

To configure control and data cores, use the **control-cores** and **data-cores** statements, respectively, at the **[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]** hierarchy level:

```
[edit chassis fpc slot-number pic pic-number adaptive-services service-package]
extension-provider {
  control-cores control-number;
  data-cores data-number;
}
```

Whereas you must designate at least one core as a control core, it is advisable you designate, depending on the nature of the application, a minimum of five data cores to achieve good performance. The total number of cores, both control and data cores, that you can dedicate using the **extension-provider** statement ranges from one through eight. Any cores not configured as control or data cores are treated as *user cores*.



**NOTE:** When the **extension-provider** statement is first configured, the PIC reboots. When the number of control or data cores is changed, the PIC reboots.

#### Related Documentation

- [Configuring Packet Distribution Settings on page 22](#)
- [Configuring Memory Settings on page 24](#)
- [Configuring Packages on the PIC on page 21](#)
- [Configuring System Log Messages on page 25](#)

## Configuring Packages on the PIC

Applications are installed on the Multiservices PIC in one or more packages.

To designate which application package to install on a given PIC, include the **package package-name** option at the **[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]** hierarchy level:

```
[edit chassis fpc slot-number pic pic-number adaptive-services service-package]
extension-provider {
  package package-name;
}
```

Up to eight packages can be installed on a PIC; however, only one data package is allowed per PIC.



**NOTE:** When the **extension-provider** statement is first configured, the PIC reboots. When any package setting is added or removed, the PIC reboots.

As of Junos OS Release 9.5, a stateful firewall plug-in is provided as part of the jbundle package. To load this plug-in on the PIC, include the **package jservices-sfw** statement at

the `[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]` hierarchy level.

```
user@router# show chassis
fpc 0;
  pic 0;
    adaptive-services;
      service-package;
        extension-provider;
          control-cores 1;
          data-cores 4;
          object-cache-size 128;
          package jservices-sfw;
          policy-db-size 64;
        }
      }
    }
  }
}
```



**NOTE:** You cannot install both a Junos service package and an application package on the same PIC. However, you can load both the `jservices-sfw` package and an application package on the same PIC.

You can verify what packages are installed on a PIC by using the `show extension-provider system packages` command. However, you need to wait until the PIC has finished rebooting after adding configuration to the PIC.

#### Related Documentation

- [Checking Installed Application Packages on page 87](#)
- [Configuring Control and Data Cores on page 20](#)
- [Configuring Packet Distribution Settings on page 22](#)
- [Configuring Memory Settings on page 24](#)
- [Configuring System Log Messages on page 25](#)

## Configuring Packet Distribution Settings

Flow affinity distribution is based on a hash distribution. Flow affinity is already the default behavior for the control CPUs, but the default behavior for distributing data packets over data cores is in a round-robin fashion.

You can change the default behavior for the data cores from round-robin to flow affinity by adding the `data-flow-affinity` statement at the `[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]` hierarchy level.

```
extension-provider {
  data-flow-affinity {
    hash-key (layer-3 | layer-4);
  }
}
```



Some applications may need you to set the **hash-key** statement (consult application-specific documentation). The options for the **hash-key** statement are 3-tuple hashing (source IP, destination IP address, and IP protocol) or 5-tuple hashing (3-tuple plus source and destination TCP or UDP ports). If the **hash-key** statement is not configured, the default value is 5-tuple. There is no need to differentiate the hashing between control and data traffic.



**NOTE:** When the **extension-provider** statement is first configured, the PIC reboots. Either adding or removing the **data-flow-affinity** statement causes the PIC to reboot.

#### Related Documentation

- [Configuring Control and Data Cores on page 20](#)
- [Configuring Memory Settings on page 24](#)
- [Configuring Packages on the PIC on page 21](#)
- [Configuring System Log Messages on page 25](#)

## Setting the Forwarding Database and Policy Database Sizes

The forwarding database provides access to route information such as fast routing look-ups. It will typically have information related to route entries, their associated outgoing interfaces, and autonomous system information. The policy database stores the policies of plug-ins only. Both the forwarding database and the policy database are carved out of object cache. So the sum of both databases must be less than the total object cache.

You control the sizes of the forwarding database and the policy database using the **forwarding-db-size** and the **policy-db-size** statements, respectively, at the **[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]** hierarchy level. Both statements are configured in megabytes (MB). When setting these sizes, be guided by your provider's application-specific documentation.



**NOTE:** Changing either the **forwarding-db-size** or the **policy-db-size** statement causes the PIC to reboot.



**NOTE:** You must enable the **sampling** statement at the **[edit forwarding-options]** hierarchy level for the forwarding database to be created.

#### Related Documentation

- [Configuring Control and Data Cores on page 20](#)
- [Configuring Memory Settings on page 24](#)
- [Configuring Packages on the PIC on page 21](#)
- [Configuring System Log Messages on page 25](#)

## Configuring Memory Settings

---

Configuring memory can help tune application performance. Two types of memory are provided: object cache and wired process memory. If wired process memory is exhausted, the processes use unwired memory.

```
[edit chassis fpc slot-number pic pic-number adaptive-services service-package]
extension-provider {
  object-cache-size value;
  wired-process-mem-size mem-size;
}
```

See the following topics for more information on these memory types:

- [Object Cache on page 24](#)
- [Wired Process Memory on page 24](#)

### Object Cache

Object cache is shared memory. Both the size of the forwarding database and the size of the policy database are taken from object cache. Therefore, the size of object cache must be more than the sum of the sizes of both of these databases.

To configure object cache, specify a value that is a multiple of 128 MB and up to 512 MB for the Multiservices 100 PIC or up to 1280 MB for the Multiservices 400 PIC. However, if you set wired process memory as well, the maximum value for the object cache on the Multiservices 100 PIC is 128 MB and 768 MB on the Multiservices 400 PIC.

The current recommendations when configuring memory settings Multiservices PICs are as follows:

- Do not exceed a policy database size of 64 MB.
- Stay with one rule per term.
- Keep the object cache size high (1280 MB on Multiservices 400 PICs and DPCs and 512 MB on Multiservices 100 PICs).
- Do not configure anything for forwarding database.
- Keep the number of service sets per Multiservices PIC below 1000.



**NOTE:** When the `extension-provider` statement is first configured, the PIC reboots. Changing the object cache size, the policy database size, or the forwarding database size on a running system causes the PIC to reboot.

---

### Wired Process Memory

Wired process memory, or Big TLB, is memory used by the operating system that is pretty much "off limits" to another application. If wired process memory is exhausted, the processes use unwired memory.

The size of wired process memory is configurable. To reserve Big TLB, configure the **wired-process-mem-size** statement at the **[edit adaptive-services service-package extension-provider]** hierarchy level.



**NOTE:** When the **wired-process-mem-size** statement is first changed, the PIC reboots.

As of Junos OS Release 11.2, the number of processes supported by Big TLB is also configurable. When you configure multiple Big-TLB-supported processes, the physical memory is divided equally among the number of processes that use it. For example, if **mem-size** is 1024 MB and the number of processes (**num-procs**) supported is 8, then each process is allocated 128 MB of physical memory. Thus, the amount of physical memory that is allocated to each process is **mem-size/num-procs**.

To specify the number of processes that use Big TLB, use the **wired-max-processes** statement at the **[edit adaptive-services service-package extension-provider]** hierarchy level. The amount of memory that can be reserved for Big TLB is platform dependent.

The amount of object cache is also dependent on the amount of wired memory. The following table lists details per platform.

**Table 3: Wired Memory and Object Cache Combinations in Multiservices PICs**

Device	Max. Object Cache (MB)	Max. Wired Memory (MB)	Max. Number of Processes
Multiservices 100 PIC	512	0	0
	0	512	8
Multiservices 400 PIC	1280	0	0
Multiservices 500 PIC	256	1024	8
Multiservices DPC			

## Configuring System Log Messages

To record or view system log messages on a specific PIC, include the **syslog** statement at the **[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]** hierarchy level:

```
[edit chassis fpc slot-number pic pic-number adaptive-services service-package]
extension-provider {
  syslog {
    facility {
      severity;
      destination destination;
    }
  }
}
```



**NOTE:** When the **extension-provider** statement is first configured, the PIC reboots. After that, changing system log settings does not cause the PIC to reboot.

Each system log message belongs to a *facility*, which is a group of messages that are either generated by the same software process or concern a similar condition or activity. Each message is also preassigned a *severity level*, which indicates how seriously the triggering event affects router functions.

For the Junos Applications, there are four values for the **facility** statement that log either actions performed or errors encountered by the following entities:

- **daemon**—Various system processes.
- **external**—Local external applications.
- **kernel**—The PIC kernel.
- **pfe**—The Packet Forwarding Engine.

The **severity** statement has the same values as it does in the native Junos operating system (OS). See [Table 4 on page 26](#) for possible values.

**Table 4: Severity Levels for Syslog Messages**

Level	Description
<b>any</b>	Include all severity levels.
<b>none</b>	Disable logging of the associated facility to a destination.
<b>emergency</b>	System panic or other condition that causes the routing platform to stop functioning.
<b>alert</b>	Conditions that require immediate correction, such as a corrupted system database.
<b>critical</b>	Critical conditions, such as hard errors.
<b>error</b>	Error conditions that generally have less serious consequences than errors in the emergency, alert, and critical levels.
<b>warning</b>	Conditions that warrant monitoring.
<b>notice</b>	Conditions that are not errors but might warrant special handling.
<b>info</b>	Events or nonerror conditions of interest.

Enhancements to the existing infrastructure make debugging on the Multiservices PIC easier by giving the user the option of redirecting the log messages to either the Routing Engine (**routing-engine**) or to the console of the PIC (**pic-console**).

The user does not have to specify a destination for the messages; by default all messages go to the `/var/log` directory on the Routing Engine. When the syslog destination is configured to redirect the log messages to the Routing Engine, you can use the **set system syslog** command, a command available in the Junos OS CLI, to override the syslog settings made on the Multiservices PIC.

To record or view system log messages on a specific PIC, include the **syslog** statement. System log information is passed to the Routing Engine and put in the `/var/log` directory.

**Related  
Documentation**

- [Configuring Control and Data Cores on page 20](#)
- [Configuring Packet Distribution Settings on page 22](#)
- [Configuring Memory Settings on page 24](#)
- [Configuring Packages on the PIC on page 21](#)



## CHAPTER 5

# Working with Applications

- [Application Execution on page 29](#)
- [Displaying Resource Limits on page 31](#)
- [Restricting Resource Limits on page 32](#)
- [Application User Interface Extensions on page 33](#)
- [Application Health Monitoring on page 36](#)
- [Verification of System Information on the Services PIC on page 37](#)

## Application Execution

---

Application execution includes the following topics.

- [Verifying the Execution Status of System Processes on page 29](#)
- [Disabling a System Process on page 30](#)
- [Configuring Application Failure Settings on page 30](#)

## Verifying the Execution Status of System Processes

To see the execution status of system processes, use the **show system processes wide** operational command. The **wide** option is optional, but you must use it to display the provider name of your application.

### show system processes wide

```
user@host> show system processes wide
  PID  TT  STAT      TIME PROVIDER  COMMAND
  ...
    9  ??  DL      0:00.01      [pagedaemon]
  ...
 6463  ??  DL      0:00.18      [md9]
 6738  ??  S       0:00.44      /usr/sbin/mgd -N
 7001  ??  S       0:00.12 jnx      /opt/sbin/jnx-exampld -N
 7063  ??  Ss      0:00.03      mgd: (mgd) (regress)/dev/ttyp0 (mgd)
```

## Disabling a System Process

You can disable Junos OS processes.



**CAUTION:** Never disable any of the software processes unless instructed to do so by a Customer Support engineer.

To disable a software process:

1. Specify the appropriate process to disable at the **[edit system]** hierarchy level using the **processes** statement.

```
[edit system]
user@router# set processes process-name disable
```

2. You can later go back and similarly enable the process.

```
[edit system]
user@router# set processes process-name enable
```



**TIP:** The *process-name* variable is one of the valid process names. You can obtain a complete list of process names by using the CLI command completion feature.

## Configuring Application Failure Settings

For routers or switches with redundant Routing Engines, you can configure the router or switch to switch to backup media that contains a version of the system if a software process fails repeatedly. You can configure the router or switch to fail over to either backup media or the other Routing Engine. When you configure a failover option, the router will try to reboot a few times (within one minute) before going to the failover option you specify.

To configure automatic switchover to backup media if a software process fails:

- Include the **failover** statement at the **[edit system processes *process-name*]** hierarchy level:

```
[edit system]
user@router# set process-name failover (alternate-media | other-routing-engine)
```



**TIP:** The *process-name* variable is one of the valid process names. You can obtain a complete list of process names by using the CLI command completion feature.

### Related Documentation

- [show extension-provider system processes on page 106](#)
- [show system processes providers on page 119](#)



## Displaying Resource Limits

To display the applied policies, use the **show system processes resource-limits process-name process-ui-name** operational command. The following example configuration, when committed, applies resource limits for an application package `jnx-example` and overrides it with process-level settings for the process `jnx-example-service`:

```
[edit system extensions]
user@router# show
resource-limits {
  package jnx-example {
    resources {
      memory {
        stack-size 4m;
      }
    }
  }
  process jnx-example-service {
    resources {
      file {
        size 4m;
      }
    }
  }
}
```

Using the **show system processes resource-limits process-name** command, the output for `jnx-example-foo-binary`, part of package `jnx-example`, looks like the following output because the package-level settings are applied on it:

```
user@router> show system processes resource-limits process-name jnx-example-foo-binary
Resource Limits:
```

Area	Max. allowed	Max. configurable
memory/stack-size	4MB	8MB
memory/data-size	32MB	32MB
memory/resident-set-size	24MB	24MB
memory/locked-in	16MB	16MB
cpu/priority	10	10
file/open	64	64

The output for `jnx-example-service` looks like this:

```
user@router> show system processes resource-limits process-name jnx-example-service
Resource Limits:
```

Area	Max. allowed	Max. configurable
file/size	4MB	unlimited
file/open	64	64
cpu/priority	10	10
memory/stack-size	8MB	8MB
memory/data-size	32MB	32MB
memory/resident-set-size	24MB	24MB
memory/locked-in	16MB	16MB

For more detail on the **show system processes resource-limits process-name process-ui-name** operational command, see its command summary.

**Related  
Documentation**

- [show system processes resource-limits process-name on page 120](#)
- [Restricting Resource Limits on page 11](#)
- [Example: Configuring Separate Resource Limits for a Process on page 43](#)

---

## Restricting Resource Limits

The Level IV policy is set by the administrative user using the **resource-limits** statement at the **[edit system extensions]** hierarchy level.

The limits imposed by a Level IV policy can be configured either by package or by individual processes in the package. Limits defined for individual processes override the limits defined for an entire package. Any limits not set as Level IV limits inherit the limits from Level III if they exist or from Level II.

The following hierarchy shows all the statements for setting resource limits:

```
[edit system extensions]
resource-limits {
  package package-name {
    resources {
      cpu {
        priority number;
        time seconds;
      }
      file {
        core-size bytes;
        open number;
        size bytes;
      }
      memory {
        data-size bytes;
        locked-in bytes;
        resident-set-size bytes;
        socket-buffers bytes;
        stack-size bytes;
      }
    }
  }
}
process process-ui-name {
  resources {
    cpu {
      priority number;
      time seconds;
    }
    file {
      core-size bytes;
      open number;
      size bytes;
    }
    memory {
      data-size bytes;
      locked-in bytes;
    }
  }
}
```

```

        resident-set-size bytes;
        socket-buffers bytes;
        stack-size bytes;
    }
}
}

```

If an application exceeds any of the imposed limits, the router logs it. For example, if a process tries to exceed its stack size, the process is terminated and the system generates a core file.

Level IV policies can be more restrictive than previous policy levels, but they cannot ease the limits set by the other levels. If you try to commit a resource limit that is higher (less stringent) than the inherited value, the commit operation fails with the following error message:

```

[edit system extensions resource-limits]
  'process jnx-example-service'
    Limit validation failed for program 'jnx-example-service', resource 'file'
    limit 'open': raising limits defined in role 'Provider_Daemon' is not allowed.
  commit complete

```

```

[edit system extensions resource-limits]

```

Level IV policies can be applied either during runtime of the application or before the application gets started. However, if the application was already running when a new limit is applied, the application must be restarted manually in order to allow for the new limits to take effect.

If you delete a resource configuration, the setting goes back to the limits from the assigned role in the manifest file (Level II or Level III).

**Related Documentation**

- [Displaying Resource Limits on page 13](#)

## Application User Interface Extensions

Providers can extend the Junos OS user interface. The Junos OS has two configuration mode commands that help you work with applications. The following topics describe these commands in detail:

- [Displaying the Detail for Application Configurations on page 33](#)
- [Displaying and Deleting Configuration for Applications on page 34](#)

### Displaying the Detail for Application Configurations

The **show | display detail** command is not new but has been updated to show application package information. The complete form of the command is as follows:

```

show <statement-path> | display detail

```

The **show | display detail** command displays the characteristics, descriptions, and constraints of each configuration statement in the Junos operating system (OS) configuration schema using comment lines. The configuration schema is piped through

to the **display detail** command. The **show** command displays the entire user-defined configuration unless it is limited to a particular branch of the configuration scheme by the optional **statement-path** variable.

Generally, the information displayed is help strings and the permission bits required to add or modify the configuration statement. For configuration statements that are defined by an application package, the name of the package that defines the statement is also displayed. If a Junos statement is redefined by an application package, the package name is listed. However, if a configuration statement is defined by the native Junos OS only, no package name is displayed.

## Displaying and Deleting Configuration for Applications

To display or delete the configuration for a specific application package, use the **extension package-name (show | delete)** configuration mode command:

```
extension package-name (show | delete) <section>
```

This command filters for configuration based on the package named in the command, starting at the top of the configuration hierarchy, or, if you use the **section** option, starting at the hierarchy level indicated by the **section** option. The output displays the configuration of all matches.



**NOTE:** Remove all the soon-to-be invalid configurations before removing the application package. See [“Removing Application Packages” on page 86](#).

To delete application configuration:

1. Display any configuration specific to the application.

```
[edit]
user@router# extension package-name show
```

2. When you are satisfied that this is the configuration you want to delete, issue the **extension *package-name* delete** command. Use the **section** option to limit the scope of the deletion if needed.

```
[edit]
user@router# extension package-name delete
```



#### NOTE:

#### Matches for the extension show Command

Matches for the **extension *package-name* show** command include those packages whose package names exactly match the value of ***package-name*** as well as those whose names have the same root but may have longer names, similar to a wildcard situation.

The following example shows simplified output illustrating how the **extension *package-name* show** command works. Suppose a router has packageA, packageB, and packageAB installed and you issue the command **extension packageA show**. The output displays configuration for packages with names that not only exactly match packageA but also have roots that match (in this case, packageAB):

```
user@router# extension packageA show
system {
  packageA {
    ....
  }
  packageAB {
    ....
  }
}
```

**Matches for the  
extension delete  
Command**

In contrast, the **extension *package-name* delete** command treats the value of ***package-name*** as a literal. It deletes only configuration contributed by the package whose package name exactly matches the given value.



**NOTE:** A configuration schema defined in any native Junos package is never deleted by the removal of any third-party package.

---

## Application Health Monitoring

Providers can have their applications request and manage system resources. Some of this resource utilization is persistent across, for example, reboots or the restart of the application. Some system tasks such as deleting a package, disabling an application, or accessing shared resources require that resources be cleaned up by entities other than the application itself. Resources that are known to need cleaning up include the following:

- GENCFG blobs
- SYSV shared memory segments
- SYSV semaphores
- Temporary files

Currently, the **traceoptions** statement is the only CLI statement available for configuring resource cleanup.

To configure tracing operations for resource cleanup operations, include the **traceoptions** **flag** option for selectively turning the debugging of trace messages on or off:

```
[edit]
system {
  processes {
    resource-cleanup {
      traceoptions {
        file filename files number match regex size size (world-readable |
          no-world-readable);
        flag flag;
        level level;
        no-remote-trace;
      }
    }
  }
}
```

The available flags for the **traceoptions** statement include:

- **all**—Enable all trace option flags.
- **events**—Display process state change and cleanup events.
- **gencfg**—Display GENCFG blobs recorded for cleanup.
- **sysvsem**—Display SYSV semaphores recorded for cleanup.

- **sysvshm**—Display SYSV shared memory segments recorded for cleanup.
- **ui**—Display tracing messages for UI operational commands.

## Verification of System Information on the Services PIC

---

Show commands exist that give information about the state of the Services PIC and so allow for monitoring of these management functions.

Several of these show commands are in the form of **show extension-provider system**:

- **show extension-provider system packages**—Display the packages that are installed on the PIC.
- **show extension-provider system processes**—Display the system processes running on the PIC.
- **show extension-provider system uptime**—Display the uptime on the Services PIC by interface.
- **show extension-provider system virtual-memory**—Display the kernel dynamic memory usage on the Services PIC.
- **show extension-provider system connections**—Display information about the connection activity on the Services PIC.

These commands collect and display the output for all active and fully booted Services PICs on the system.

### Related Documentation

- [Configuring Packages on the PIC on page 21](#)





# Traffic Configuration with Applications

- [Configuring Traffic Sampling for Junos Applications on page 39](#)
- [Configuring Service Sets for Junos Applications on page 40](#)
- [Configuring the Service Order for Service Sets for Junos Applications on page 40](#)
- [Configuring the Sampling Service Set on page 41](#)

## Configuring Traffic Sampling for Junos Applications

---

You enable sampling for Junos applications much as you do for with the regular Junos operating system (OS). But only family inet and family inet6 are supported for Junos applications receiving traffic on an **ms-** interface.

Developed for Junos applications, the **extension-service** statement provides a section of the configuration hierarchy in which the provider of your application may have added its own traffic-monitoring configuration statements. The **extension-service** statement is available at the following hierarchy levels:

- **[edit services service-set *service-set-name*]**
- **[edit forwarding-options sampling family *family* output]**
- **[edit forwarding-options sampling instance *instance-name* family *family* output]**

To enable sampling for applications and be able to use any application-specific configuration statements your application provider may have added, you must include the **extension-service** statement at the **[edit forwarding-options sampling family *family* output]** or **[edit forwarding-options sampling instance *instance-name* family *family* output]** hierarchy level. For application-specific configuration guidelines, see the documentation provided with your application.



**NOTE:** If you use the **extension-service** statement, the only other statement you can include at the **[edit forwarding-options sampling family *family* output]** hierarchy level is the interface statement. In this case, you must set the interface statement to an interface with an **ms-** prefix.

---

```
[edit]
forwarding-options {
```

```
sampling {  
  family family {  
    output {  
      extension-service service-name {  
        provider-specific rules;  
      }  
      interface ms-fpc/pic/port;  
    }  
  }  
}
```

**Related Documentation**

- [Example: Traffic Sampling on a Multiservices PIC on page 47](#)

---

## Configuring Service Sets for Junos Applications

A *service set* is a collection of policies taken from multiple services that can be applied as a unit to traffic coming to the PIC.

For applications, to include a defined service in a service set, you must reference it using the **extension-service** statement at the **[edit services service-set *service-set-name*]** hierarchy level.

```
[edit]  
services {  
  service-set service-set-name {  
    extension-service service-name;  
    extension-service service-name2;  
  }  
}
```

Up to two plug-ins are supported per PIC and can be chained together in one service set.



**NOTE:** If the **extension-service** statement is used, the **service-order** statement is mandatory.

---

To specify the order of the policies within a service set, configure the **service-order** statement at the **[edit services extension-service]** hierarchy level.

**Related Documentation**

- [Configuring the Service Order for Service Sets for Junos Applications on page 40](#)
- [Example: Service Set Configuration for Junos Applications on page 46](#)

---

## Configuring the Service Order for Service Sets for Junos Applications

The service order is the order in which services are applied for a given service set.

To configure the service order, include the **service-order** statement at the **[edit services service-set *service-set-name* extension-service]** hierarchy level.

```
[edit]
```

```

services {
  service-set service-set-name {
    extension-service service-name1;
    extension-service service-name2;
    service-order {
      forward-flow [ service-name1 service-name2 ];
      reverse-flow [ service-name1 service-name2 ];
    }
  }
}

```



**NOTE:** If the `extension-service` statement is specified, the `service-order` statement is mandatory. Service order should not be configured for native Junos internal services. For the internal services, there is a default service order.

The **service-order** statement must include all services defined in the service set. It is mandatory to specify the forward-flow service order and the reverse-flow service order. If the reverse-flow service order is not specified, the reverse-flow order is the reverse of the forward-flow service order. The exception to this is for the sampling service set type. If a service set is a sampling service set and the reverse-flow service order is not configured, all sampled traffic is considered to be forward traffic.

To change the service order, delete the service order elements and then add them again in the new order.

- Related Documentation**
- [Configuring Service Sets for Junos Applications on page 40](#)
  - [Configuring the Sampling Service Set on page 41](#)

## Configuring the Sampling Service Set

In addition to next-hop and interface service sets there is also a *sampling service set*.

The sampling service set is configured using the **sampling-service** statement at the **[edit services service-set *service-set-name*]** hierarchy level.

```

[edit]
services {
  service-set service-set-name {
    sampling-service {
      service-interface interface-name;
    }
  }
}

```

The *service interface* is the interface the sampling is taken from. In the case of a sampling service set, the service interface must be a Multiservices PIC interface with a subunit number of 0 (zero). The subunit number defaults to 0. The **reverse-flow** statement is not mandatory. All sampled traffic is considered to be forward traffic. If you set the **reverse-flow** statement, it is ignored.

The next example makes sure that any sampled packet to the **ms-6/1/0.0** interface has the service plug-ins **plugin1** and **plugin2** applied to it.

```
[edit]
services {
  service-set sset1 {
    sampling-service {
      service-interface ms-6/1/0;
    }
    service-order {
      forward-flow [ plugin1 plugin2 ];
    }
  }
}
```

**Related  
Documentation**

- [Example: Service Set Configuration for Junos Applications on page 46](#)

## CHAPTER 7

# Examples

- [Example: Configuring Separate Resource Limits for a Process on page 43](#)
- [Example: Displaying and Deleting Configuration Contributed by Applications on page 44](#)
- [Example: Service Set Configuration for Junos Applications on page 46](#)
- [Example: Traffic Sampling on a Multiservices PIC on page 47](#)

### Example: Configuring Separate Resource Limits for a Process

---

In this example there are 10 programs in the application package. The programs have resource limits inherited from a Level II policy. The administrative user wants to limit the number of open files and the stack size but does not want to apply the same limits to the `jnx-example-service` program.

Limits set for a process will override those set for packages. Any limits not set inherit the Level II limits.

In the example output for this example, the maximum configurable amounts normally shown in the left column are omitted to make room for notation showing which policy level the maximum allowed values come from.

1. Commit the following configuration. It specifies limits for the `jnx-example` package. these limits will be in place except for any process (program) that has other limits set. There is a block that configures limits for the process `jnx-example-service`. Any limits not specified inherit the limits from the Level II policy.

```
[edit]
resource-limits {
  package jnx-example {
    resources {
      file {
        open 8;
      }
      memory {
        stack-size 4m;
      }
    }
  }
  process jnx-example-service {
    resources {
      memory {
```

```

        resident-set-size 8m;
    }
}
}
}

```

2. Use the **show system processes resource-limits process-name *ui-process-name*** command to see the resource limits for each of the processes. For nine of them (represented by *jnx-foo-service*), the **file/open** and **memory/stack-size** fields show the more stringent limits you committed for the package.

```
user@router> show system processes resource-limits process-name jnx-foo-service
```

#### Resource Limits

Area	Max. allowed	
cpu/priority	10	<-- inherited from Level II
file/open	8	<-- defined in config
memory/data-size	32MB	<-- inherited from Level II
memory/locked-in	16MB	<-- inherited from Level II
memory/resident-set-size	24MB	<-- inherited from Level II
memory/stack-size	4MB	<-- defined in config

3. Use the **show system processes resource-limits process-name *process-ui-name*** command to see the resource limits for the *jnx-example-service* process. Since separate limits were set for *jnx-example-service*, it uses those limits defined in the CLI configuration and any not so set revert to the inherited values from Level II.

```
user@router> show system processes resource-limits process-name jnx-example-service
```

#### Resource Limits

Area	Max. allowed	
cpu/priority	10	<-- inherited from Level II
file/open	64	<-- inherited from Level II
memory/data-size	32MB	<-- inherited from Level II
memory/locked-in	16MB	<-- inherited from Level II
memory/resident-set-size	8MB	<-- defined in config
memory/stack-size	8MB	<-- inherited from Level II

#### Related Documentation

- [show system processes resource-limits process-name on page 120](#)
- [Resource Limits Imposed on Applications on page 11](#)
- [Restricting Resource Limits on page 11](#)
- [Displaying Resource Limits on page 13](#)

## Example: Displaying and Deleting Configuration Contributed by Applications

This example demonstrates the usefulness of the **extension *package-name* show** command over the simple **show** command using a sample configuration.

1. If you use the **show** command at the top of the hierarchy, all configuration is shown.

```

[edit]
user@router# show
system {
  radius-server {
    10.1.1.1 {
      timeout 10;
    }
  }
}

```

```

        backup-server 10.1.1.2; # Contributed by pkg1
    }
}
protocols {
    ospf {
        ....
    }
    proto1 { # Contributed by pkg1
        ....
    }
}

```

2. In contrast, the following is the output from the **extension pkg1 show** command. Notice that this command selects configurations contributed by and leading to the package named in the command. The **extension pkg1 show** command filters out the **timeout** and **ospf** commands from the displayed output, which were not contributed by the pkg1 package.

```

[edit]
user@router# extension pkg1 show
system {
    radius-server {
        10.1.1.1 {
            backup-server 10.1.1.2;
        }
    }
}
protocols {
    proto1 {
        ....
    }
}

```

3. Continuing with the same example, notice how the configuration changes when the **extension pkg1 delete** command is used. Using this command, you can delete all user-defined configuration statements related to the pkg1 package.



**TIP:**

This one command accomplishes the same thing as issuing the following two commands:

- **delete system radius-server 10.1.1.1 backup-server**
- **delete protocols proto1**

```

[edit]
user@router# extension pkg1 delete
[edit]
user@router# show
system {
    radius-server {
        10.1.1.1 {
            timeout 10;
        }
    }
}

```

```
}
protocols {
  ospf {
    ....
  }
}
```

**Related Documentation** • [Displaying and Deleting Configuration for Applications on page 34](#)

---

## Example: Service Set Configuration for Junos Applications

In the following configuration example, the **acme-svc1** service is defined by three rules (their content is unspecified) and the **acme-svc2** service is defined by a rule set made up of an unspecified number of rules. In this example, these services are defined at the **[edit acme services]** hierarchy level.

```
[edit]
acme {
  services {
    acme-svc1 { #Provider-defined service
      svc1-rule1 { # First rule's name
        ... # First rule defined
      }
      svc1-rule2 { # Second rule's name
        ... # Second rule defined
      }
      svc1-rule3 { # Third rule's name
        ... # Third rule defined
      }
    }
    acme-svc2 { # Provider-defined service
      rule-set svc2-rule-set { # Rule-set name
        [ rules rule-names ]; # Rules definitions start here
      }
    }
  }
}
```

At the **[edit services]** hierarchy level (no intervening “acme” level here), the **service-set sset1** is defined by referencing the three rule names for **acme-svc1** and the one rule set name for **acme-svc2** using the **service-set service-set-name extension-service** statement at the **[edit services service-set service-set-name]** hierarchy level.

The service order is also configured at the **[edit services service-set service-set-name]** hierarchy level.

The following is an example of configuring service sets, extension service rules, and the service order:

```
[edit]
services {
  service-set sset1 {
    extension-service acme-svc1 {
```



```

        svc1-rule1;
        svc1-rule2;
        svc1-rule3;
    }
    extension-service acme-svc2 {
        rule-set svc2-rule-set;
    }
    /* Now define the order */
    service-order {
        forward-flow [acme-svc1 acme-svc2];
        reverse-flow [acme-svc1 acme-svc2];
    }
}
}

```

**Related  
Documentation**

- [Configuring the Sampling Service Set on page 41](#)
- [Configuring the Service Order for Service Sets for Junos Applications on page 40](#)
- [Configuring Service Sets for Junos Applications on page 40](#)

## Example: Traffic Sampling on a Multiservices PIC

The following example shows a firewall filter **sample-monitor**, which, when attached to an interface, ensures that all traffic entering that interface with a source address matching address 10.1.1.1 is sampled and sent to the output interface **ms-2/0/0**.

```

[edit]
firewall {
    family inet {
        filter sample-monitor {
            term sample-term {
                from {
                    source-address {
                        10.1.1.1/32;
                    }
                }
                then {
                    sample;
                    accept;
                }
            }
        }
    }
}
forwarding-options {
    sampling {
        input {
            family inet {
                rate 1;
            }
        }
        output {
            extension-service abc-sample {
                provider-specific rules;
            }
        }
    }
}

```

```
    }  
    interface ms-2/0/0;  
  }  
}
```

You can attach the firewall filter created in the above sample to any interface in your network.

**Related  
Documentation**

- [Configuring Traffic Sampling for Junos Applications on page 39](#)

## CHAPTER 8

# Configuration Statements

- [control-cores on page 50](#)
- [data-cores on page 50](#)
- [data-flow-affinity on page 51](#)
- [destination \(Chassis\) on page 52](#)
- [extension-provider on page 53](#)
- [extensions on page 54](#)
- [extension-service on page 55](#)
- [forwarding-db-size on page 56](#)
- [hash-key \(Chassis\) on page 57](#)
- [ip-address-owner on page 58](#)
- [jdaf on page 58](#)
- [license-type on page 59](#)
- [object-cache-size on page 60](#)
- [package \(Loading on PIC\) on page 61](#)
- [package \(Resource Limits\) on page 62](#)
- [policy-db-size on page 63](#)
- [process on page 64](#)
- [process-monitor on page 65](#)
- [providers on page 66](#)
- [resource-cleanup on page 67](#)
- [resource-limits on page 68](#)
- [resources on page 70](#)
- [routing-instances on page 71](#)
- [service-order on page 72](#)
- [syslog \(Chassis\) on page 73](#)
- [traceoptions \(Process Monitor\) on page 74](#)
- [traceoptions \(Resource Cleanup\) on page 76](#)

- [wired-max-processes on page 77](#)
- [wired-process-mem-size on page 78](#)

---

## control-cores

---

Syntax	<code>control-cores control-number;</code>
Hierarchy Level	<code>[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]</code>
Release Information	Statement introduced in Junos OS Release 9.0.
Description	Configure control cores. Any cores not configured as either control or data cores are treated as user cores. When the number of control cores is changed, the PIC reboots.
Options	<b>control-number</b> —Number of control cores. At least one core must be a control core. <b>Range:</b> 1 through 8
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"><li>• <a href="#">Configuring Control and Data Cores on page 20</a></li><li>• <a href="#">data-cores on page 50</a></li></ul>

---

## data-cores

---

Syntax	<code>data-cores data-number;</code>
Hierarchy Level	<code>[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]</code>
Release Information	Statement introduced in Junos OS Release 9.0.
Description	Configure data cores. Any cores not configured as either data or control cores are treated as user cores. When the number of data cores is changed, the PIC reboots.
Options	<b>data-number</b> —Number of data cores. Although it is not mandatory to dedicate any cores as data cores, it is advisable, depending on the nature of the application, to dedicate a minimum of five as data cores to achieve good performance. <b>Range:</b> 0 through 7
Required Privilege Level	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"><li>• <a href="#">Configuring Control and Data Cores on page 20</a></li><li>• <a href="#">control-cores on page 50</a></li></ul>

---

## data-flow-affinity

---

<b>Syntax</b>	<code>data-flow-affinity {     <a href="#">hash-key</a> (layer-3   layer-4); }</code>
<b>Hierarchy Level</b>	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> adaptive-services service-package <a href="#">extension-provider</a> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.5.
<b>Description</b>	<p>Enable flow affinity distribution for packets over data CPUs on the PIC. Once enabled, the default behavior distributing data packets changes from a round-robin distribution to a flow affinity distribution based on a hash distribution. Adding or deleting this statement causes the PIC to reboot.</p> <p>The statements are explained separately.</p>
<b>Required Privilege Level</b>	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Configuring Packet Distribution Settings on page 22</a></li></ul>

## destination (Chassis)

---

Syntax	<code>destination <i>destination</i>;</code>
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> adaptive-services service-package extension-provider <a href="#">syslog facility</a> ]
Release Information	Statement introduced in Junos OS Release 10.1.
Description	<p>Configure where log messages go. By default, all messages go to the <code>/var/log</code> directory on the Routing Engine. Enhancements to the existing infrastructure make debugging on the Multiservices PIC easier by giving the user the option of redirecting log messages. When the <b>syslog destination</b> statement is configured to redirect the log messages, you can use the <b>set system syslog</b> command, a command available in the native Junos OS CLI, to override the syslog settings made on the Multiservices PIC.</p>
Options	<p><b>destination</b>—Choose one of the following options:</p> <ul style="list-style-type: none"><li>• <b>routing-engine</b>—Forward log messages to the Routing Engine.</li><li>• <b>pic-console</b>—Forward log messages to the console of the PIC.</li></ul>
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"><li>• <a href="#">Configuring System Log Messages on page 25</a></li><li>• <a href="#">extension-provider on page 53</a></li></ul>

## extension-provider

<b>Syntax</b>	<pre> extension-provider {   control-cores <i>control-number</i>;   data-cores <i>data-number</i>;   data-flow-affinity {     hash-key (layer-3   layer-4);   }   forwarding-db-size <i>size</i>;   object-cache-size <i>size</i>;   package <i>package-name</i>;   policy-db-size <i>size</i>;   syslog {     facility {       severity;       destination <i>destination</i>;     }   }   wired-max-processes <i>num-procs</i>;   wired-process-mem-size <i>mem-size</i>; } </pre>
<b>Hierarchy Level</b>	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> adaptive-services service-package]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.0.
<b>Description</b>	<p>Configure an application on a PIC. When the <b>extension-provider</b> statement is first configured, the PIC reboots.</p> <p>The statements are explained separately.</p>
<b>Required Privilege Level</b>	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">Configuring Control and Data Cores on page 20</a></li> <li>• <a href="#">Configuring Packet Distribution Settings on page 22</a></li> <li>• <a href="#">Configuring Memory Settings on page 24</a></li> <li>• <a href="#">Configuring Packages on the PIC on page 21</a></li> <li>• <a href="#">Configuring System Log Messages on page 25</a></li> </ul>

## extensions

```

Syntax extensions {
  providers {
    provider-id {
      license-type license deployment-scope [ deployments ];
    }
  }
  resource-limits {
    package package-name {
      resources {
        cpu {
          priority number;
          time seconds;
        }
        file {
          core-size bytes;
          open number;
          size bytes;
        }
        memory {
          data-size bytes;
          locked-in bytes;
          resident-set-size bytes;
          socket-buffers bytes;
          stack-size bytes;
        }
      }
    }
  }
  process process-ui-name {
    resources {
      cpu {
        priority number;
        time seconds;
      }
      file {
        core-size bytes;
        open number;
        size bytes;
      }
      memory {
        data-size bytes;
        locked-in bytes;
        resident-set-size bytes;
        socket-buffers bytes;
        stack-size bytes;
      }
    }
  }
}


```

Hierarchy Level [edit system]




<b>Release Information</b>	Statement introduced in Junos OS Release 9.0.
<b>Description</b>	<p>Configure extensions to Junos operating system (OS). You must turn configure the <b>providers</b> <i>provider-id</i> statement to enable application packages to be deployed and run on the router.</p> <p>The statements are explained separately.</p>
<b>Required Privilege Level</b>	<p>admin—To view this statement in the configuration.</p> <p>admin-control—To add this statement to the configuration.</p>
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">Installing Application Packages on page 81</a></li> </ul>

## extension-service

<b>Syntax</b>	<pre>extension-service <i>service-name</i> {     <i>provider-specific rules</i>; }</pre>
<b>Hierarchy Level</b>	<p>[edit forwarding-options sampling instance <i>instance-name</i> family (inet  inet6) output]</p> <p>[edit forwarding-options sampling family (inet  inet6) output]</p> <p>[edit services service-set <i>service-set-name</i>]</p>
<b>Release Information</b>	Statement introduced in Junos OS Release 9.0.
<b>Description</b>	<p>Define a customer specific sampling configuration.</p> <p>Define a service set or traffic monitoring for applications using application-specific configuration guidelines.</p>
<div style="display: flex; align-items: center;">  <div> <p><b>NOTE:</b> If the <b>extension-service</b> statement is specified while configuring a service set, the <b>service-order</b> statement is mandatory.</p> </div> </div>	
<b>Options</b>	<p><b><i>provider-specific rules</i></b>—Provider-specific subhierarchy for services and service sets. See the application-specific documentation for details.</p> <p><b><i>service-name</i></b>—Name of the service.</p>
<b>Required Privilege Level</b>	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">service-order on page 72</a></li> <li>• <a href="#">sampling</a></li> </ul>

## forwarding-db-size

---

<b>Syntax</b>	forwarding-db-size <i>size</i> ;
<b>Hierarchy Level</b>	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> adaptive-services service-package <a href="#">extension-provider</a> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.2.
<b>Description</b>	Configure the size of the forwarding database (FDB). When this setting is changed, the PIC reboots.
<div> <b>NOTE:</b> You need to enable the forwarding-options sampling statement for the FDB to be created.</div>	
<b>Options</b>	<b>size</b> —Size of the FDB, in megabytes (MB). The size of the FDB and the size of the policy database together must be smaller than the size of the object cache. <b>Range:</b> 0 through 12879 MB
<b>Required Privilege Level</b>	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Configuring Memory Settings on page 24</a></li><li>• <a href="#">policy-db-size on page 63</a></li><li>• <a href="#">wired-process-mem-size on page 78</a></li><li>• <a href="#">object-cache-size on page 60</a></li></ul>

## hash-key (Chassis)

---

<b>Syntax</b>	hash-key (layer-3   layer-4);
<b>Hierarchy Level</b>	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> adaptive-services service-package extension-provider <b>data-flow-affinity</b> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 10.2.
<b>Description</b>	Set the hashing distribution of flow affinity. This is an optional setting. Once the <b>data-flow-affinity</b> statement is enabled, you may need to choose the hashing distribution. Modifying this statement causes the PIC to reboot.
<b>Default</b>	If you do not configure the <b>hash-key</b> statement, the hashing distribution is 5-tuple hashing, or <b>layer-4</b> .
<b>Options</b>	<b>layer-3</b> —3-tuple hashing (source IP address, destination IP address, and IP protocol). <b>layer-4</b> —5-tuple hashing (3-tuple plus source and destination TCP or UDP ports).
<b>Required Privilege Level</b>	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">Configuring Packet Distribution Settings on page 22</a></li> <li>• <a href="#">extension-provider on page 53</a></li> </ul>

## ip-address-owner

---

<b>Syntax</b>	<code>ip-address-owner <i>owner</i>;</code>
<b>Hierarchy Level</b>	[edit interfaces <i>interface-name</i> unit <i>logical-unit-number</i> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 13.2R1.
<b>Description</b>	Define the owner for IP addresses hosted on an ms- interface. This statement is used to specify that the steering of control plane packets to the Multiservices PIC be preserved. The provider of your application or its user documentation will tell you when you need to set this configuration.
<b>Options</b>	<p><b>owner</b>—Owner of the IP address for the interface. There are two options:</p> <p><b>Values:</b></p> <p><b>routing-engine</b>—IP address defined on the interface is hosted by the Routing Engine. This option is not used.</p> <p><b>service-plane</b>—IP address defined on the interface is hosted by the service plane. This option is used to preserve the packet steering behavior built into your application. The provider of your application or its user documentation will tell you when you need to set this configuration.</p>
<b>Required Privilege Level</b>	view

## jdaf

---

<b>Syntax</b>	<pre>jdaf {     routing-instances [ <i>routing-instance-names</i> ]; }</pre>
<b>Hierarchy Level</b>	[edit services]
<b>Release Information</b>	Statement introduced in Junos OS Release 14.1.
<b>Description</b>	Configure Juniper distributed application framework (JDAF).  The remaining statements are explained separately.
<b>Required Privilege Level</b>	system—To view this statement in the configuration. system-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Configuring the Juniper Distributed Application Framework on page 17</a></li></ul>

---

## license-type

---

<b>Syntax</b>	<code>license-type <i>license</i> deployment-scope [ <i>deployments</i> ];</code>
<b>Hierarchy Level</b>	[edit system extensions <a href="#">providers</a> <i>provider-id</i> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 10.2. Statement introduced in Junos OS Release 11.1 for the QFX Series.
<b>Description</b>	Configure the license type and the scope of application deployment.
<b>Options</b>	<b><i>license</i></b> —Type of license. Obtain correct value from the application's provider. <b><i>deployment</i></b> —Scope of application deployment. You can configure a set of deployments. Obtain correct value from the application's provider.
<b>Required Privilege Level</b>	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Installing Application Packages on page 81</a></li><li>• <a href="#">extensions on page 54</a></li></ul>

## object-cache-size

---

<b>Syntax</b>	<code>object-cache-size value;</code>
<b>Hierarchy Level</b>	<code>[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]</code>
<b>Release Information</b>	Statement introduced in Junos OS Release 9.0.
<b>Description</b>	Configure the size of the object cache. When this setting is changed, the PIC reboots.
<b>Options</b>	<p><b>value</b>—Amount of object cache, in MB. Only values in increments of 128 MB are allowed.</p> <p><b>Range:</b> For Multiservices 100 PIC, range is 128 MB through 512 MB. If the <b>wired-process-mem-size</b> statement at the same hierarchy level has a value of 512 MB, the maximum value for this statement is 128 MB.</p> <p><b>Range:</b> For Multiservices 400 PIC, range is 128 MB through 1280 MB. If the <b>wired-process-mem-size</b> statement at the same hierarchy level has a value of 512 MB, the maximum value for this statement is 512 MB.</p>
<b>Required Privilege Level</b>	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Configuring Memory Settings on page 24</a></li><li>• <a href="#">forwarding-db-size on page 56</a></li><li>• <a href="#">policy-db-size on page 63</a></li><li>• <a href="#">wired-process-mem-size on page 78</a></li></ul>

## package (Loading on PIC)

---

<b>Syntax</b>	<code>package <i>package-name</i>;</code>
<b>Hierarchy Level</b>	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> adaptive-services service-package <a href="#">extension-provider</a> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.1.
<b>Description</b>	Identify a package to be loaded on the PIC. When a package is added or removed, the PIC reboots.
<b>Options</b>	<b><i>package-name</i></b> —Name of the package to be loaded on the PIC. There can be up to eight packages loaded on a PIC; however, only one data package is allowed per PIC. An error message is displayed if more than eight packages are specified.
<b>Required Privilege Level</b>	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Configuring Packages on the PIC on page 21</a></li></ul>

## package (Resource Limits)

---

Syntax	<pre>package <i>package-name</i> {   resources {     cpu {       priority <i>number</i>;       time <i>seconds</i>;     }     file {       core-size <i>bytes</i>;       open <i>number</i>;       size <i>bytes</i>;     }     memory {       data-size <i>bytes</i>;       locked-in <i>bytes</i>;       resident-set-size <i>bytes</i>;       socket-buffers <i>bytes</i>;       stack-size <i>bytes</i>;     }   } }</pre>
Hierarchy Level	[edit system extensions <a href="#">resource-limits</a> ]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Set resource limits for an entire package of an application.
Options	<p><b><i>package-name</i></b>—Name of the application package.</p> <p>The remaining statements are explained separately.</p>
Required Privilege Level	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
Related Documentation	<ul style="list-style-type: none"><li>• <a href="#">Restricting Resource Limits on page 11</a></li><li>• <a href="#">process on page 64</a></li><li>• <a href="#">resources on page 70</a></li><li>• <a href="#">extensions on page 54</a></li></ul>



## policy-db-size

<b>Syntax</b>	<code>policy-db-size size;</code>
<b>Hierarchy Level</b>	<code>[edit chassis fpc slot-number pic pic-number adaptive-services service-package extension-provider]</code>
<b>Release Information</b>	Statement introduced in Junos OS Release 9.3.
<b>Description</b>	Configure the size of the policy database. When this setting is changed, the PIC reboots.



**NOTE:** At least one data core must be configured to configure the size of the policy database.

<b>Options</b>	<p><b>size</b>—Size of the policy database, in megabytes (MB). The size of the forwarding database and the size of the policy database together must be smaller than the size of the object cache.</p> <p><b>Range:</b> 0 through 1279 MB</p>
<b>Required Privilege Level</b>	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">Configuring Memory Settings on page 24</a></li> <li>• <a href="#">forwarding-db-size on page 56</a></li> <li>• <a href="#">object-cache-size on page 60</a></li> <li>• <a href="#">wired-process-mem-size on page 78</a></li> </ul>

## process

---

**Syntax**    `process process-ui-name {  
              resources {  
                  cpu {  
                    priority number;  
                    time seconds;  
                  }  
                  file {  
                    core-size bytes;  
                    open number;  
                    size bytes;  
                  }  
                  memory {  
                    data-size bytes;  
                    locked-in bytes;  
                    resident-set-size bytes;  
                    socket-buffers bytes;  
                    stack-size bytes;  
                  }  
              }  
          }`

**Hierarchy Level**    [edit system extensions [resource-limits](#)]

**Release Information**    Statement introduced in Junos OS Release 9.6.

**Description**    Set resource limits for a process in an application package. Limits defined for individual processes override the limits defined for an entire package.

**Options**    *process-ui-name*—Name of the process.  
  
The remaining statements are explained separately.

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

**Related Documentation**

- [package \(Resource Limits\) on page 62](#)
- [resources on page 70](#)
- [extensions on page 54](#)

## process-monitor

---

<b>Syntax</b>	<pre> process-monitor {   disable;   traceoptions {     file <i>filename</i> files <i>number</i> match <i>regex</i> size <i>size</i> (world-readable   no-world-readable);     flag <i>flag</i>;     level <i>level</i>;     no-remote-trace;   } } </pre>
<b>Hierarchy Level</b>	[edit system processes]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.0.
<b>Description</b>	Configure tracing options for the process health monitor (pmond).
<b>Options</b>	<p><b>disable</b>—Disable the health monitor process.</p> <p>The remaining statements are explained separately.</p>
<b>Required Privilege Level</b>	<p><b>admin</b>—To view this statement in the configuration.</p> <p><b>admin-control</b>—To add this statement to the configuration.</p>
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">traceoptions (Process Monitor) on page 74</a></li> <li>• <a href="#">Verification of System Information on the Services PIC on page 37</a></li> </ul>

## providers

---

<b>Syntax</b>	<pre>providers {   provider-id {     license-type license deployment-scope [ deployments ];   } }</pre>
<b>Hierarchy Level</b>	[edit system <a href="#">extensions</a> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.0.
<b>Description</b>	Activate the certificate of the provider of the application and enable the PIC for loading of the application.
<b>Options</b>	<p><b><i>provider-id</i></b>—Provider ID for the application package. The provider ID identifies the provider of the application to the system. The provider ID must be activated on the router to allow the application to be deployed on the router and run.</p> <p>The remaining statements are explained separately.</p>
<b>Required Privilege Level</b>	admin—To view this statement in the configuration. admin-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Installing Application Packages on page 81</a></li></ul>

## resource-cleanup

---

<b>Syntax</b>	<pre>resource-cleanup {   disable;   traceoptions {     file <i>filename</i> files <i>number</i> match <i>regex</i> size <i>size</i> (world-readable   no-world-readable);     flag <i>flag</i>;     level <i>level</i>;     no-remote-trace;   } }</pre>
<b>Hierarchy Level</b>	[edit system processes]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.3.
<b>Description</b>	Selectively turn on or off the debugging of trace messages for the resource cleanup process.
<b>Options</b>	<p><b>disable</b>—Disable the resource cleanup process.</p> <p>The remaining statements are explained separately.</p>
<b>Required Privilege Level</b>	<p><b>trace</b>—To view this statement in the configuration.</p> <p><b>trace-control</b>—To add this statement to the configuration.</p>
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">traceoptions (Resource Cleanup) on page 76</a></li> <li>• <a href="#">Application Health Monitoring on page 36</a></li> </ul>

## resource-limits

```
Syntax  resource-limits {
        package package-name {
            resources {
                cpu {
                    priority number;
                    time seconds;
                }
                file {
                    core-size bytes;
                    open number;
                    size bytes;
                }
                memory {
                    data-size bytes;
                    locked-in bytes;
                    resident-set-size bytes;
                    socket-buffers bytes;
                    stack-size bytes;
                }
            }
        }
        process process-ui-name {
            resources {
                cpu {
                    priority number;
                    time seconds;
                }
                file {
                    core-size bytes;
                    open number;
                    size bytes;
                }
                memory {
                    data-size bytes;
                    locked-in bytes;
                    resident-set-size bytes;
                    socket-buffers bytes;
                    stack-size bytes;
                }
            }
        }
    }
```

**Hierarchy Level** [edit system [extensions](#)]

**Release Information** Statement introduced in Junos OS Release 9.6.

**Description** Set resource limits for applications using the command-line interface (CLI). You can set limits for all applications listed in the application package's manifest file or define limits for individual processes in the package. Limits defined for individual processes override the limits defined for an entire package.

The statements are explained separately.

<b>Required Privilege</b>	admin—To view this statement in the configuration.
<b>Level</b>	admin-control—To add this statement to the configuration.

<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Restricting Resource Limits on page 11</a></li></ul>
------------------------------	--

## resources

---

Syntax	<pre>resources {   cpu {     priority <i>number</i>;     time <i>seconds</i>;   }   file {     core-size <i>bytes</i>;     open <i>number</i>;     size <i>bytes</i>;   }   memory {     data-size <i>bytes</i>;     locked-in <i>bytes</i>;     resident-set-size <i>bytes</i>;     socket-buffers <i>bytes</i>;     stack-size <i>bytes</i>;   } }</pre>
Hierarchy Level	[edit system extensions resource-limits <b>package</b> <i>package-name</i> ], [edit system extensions resource-limits <b>process</b> <i>process-ui-name</i> ]
Release Information	Statement introduced in Junos OS Release 9.6.
Description	Set resource limits for applications.
Options	<p><b>bytes</b>—Maximum size of each file, in kilobytes (KB) or megabytes (MB). <b>Syntax:</b> Where <i>x</i> is some number, use <i>xk</i> to specify KB or <i>xm</i> to specify MB.</p> <p><b>cpu</b>—CPU resources.</p> <ul style="list-style-type: none"><li>• <b>priority <i>number</i></b>—Highest priority number (nice level) at which the process can run.</li><li>• <b>time <i>seconds</i></b>—Maximum amount of CPU time that can be accumulated.</li></ul> <p><b>file</b>—File system resources.</p> <ul style="list-style-type: none"><li>• <b>core-size <i>bytes</i></b>—Maximum size of a core file that can be created.</li><li>• <b>open <i>number</i></b>—Maximum number of simultaneous open files.</li><li>• <b>size <i>bytes</i></b>—Maximum size of a file that can be created.</li></ul> <p><b>memory</b>—Memory resources.</p> <ul style="list-style-type: none"><li>• <b>data-size <i>bytes</i></b>—Maximum size of the data segment.</li><li>• <b>locked-in <i>bytes</i></b>—Maximum number of bytes that can be locked into memory.</li><li>• <b>resident-set-size <i>bytes</i></b>—Maximum amount of private or shared memory at any given moment.</li></ul>



- **socket-buffers bytes**—Maximum amount of physical memory that may be dedicated to the socket buffers.
- **stack-size bytes**—Maximum size of the stack segment.

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

**Related Documentation**

- [Restricting Resource Limits on page 11](#)
- [resource-limits on page 68](#)
- [extensions on page 54](#)

---

## routing-instances

---

**Syntax** routing-instances [ *routing-instance-names* ];

**Hierarchy Level** [edit services jdaf]

**Release Information** Statement introduced in Junos OS Release 14.1.

**Description** Configure the routing instances on which Juniper Distributed Application Framework (JDAF) is enabled. If the **jdaf** statement is not configured, then JDAF is disabled.

**Options** routing-instances [ *routing-instance-names* ]—Name or names of routing instances for JDAF clients. If multiple names are being configured, these can be set as an open set of values.

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

**Related Documentation**

- [jdaf on page 58](#)

## service-order

---

<b>Syntax</b>	<pre>service-order {     forward-flow [ <i>service-name1</i> <i>service-name2</i> ];     reverse-flow [ <i>service-name1</i> <i>service-name2</i> ]; }</pre>
<b>Hierarchy Level</b>	[edit services service-set <i>service-set-name</i> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.3.
<b>Description</b>	Define the order of services in service set to be applied to traffic coming to the PIC.



**NOTE:** If the `extension-service` statement is specified, the `service-order` statement is mandatory.

---

<b>Options</b>	<p><b>forward-flow</b>—Order of services in service set to be applied in forward flow.</p> <p><b>reverse-flow</b>—Order of services in service set to be applied in reverse flow. If you want the order to be the reverse of that specified for forward flow, this is optional. However, if, for example, you want the order to be the same regardless of direction of flow, you must include this statement. (The exception to this is for the sampling service set type. If a service set is a sampling service set and the reverse-flow service order is not configured, all sampled traffic is considered to be forward traffic.)</p>
<b>Required Privilege Level</b>	<p>system—To view this statement in the configuration.</p> <p>system-control—To add this statement to the configuration.</p>
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">extension-service on page 55</a></li></ul>

## syslog (Chassis)

Syntax	<pre> syslog {     facility {         severity;         destination destination;     } } </pre>
Hierarchy Level	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> adaptive-services service-package <i>extension-provider</i> ]
Release Information	<p>Statement introduced in Junos OS Release 9.2.</p> <p>Options <b>daemon</b> and <b>kernel</b> (for <b>facility</b>) introduced in Junos OS Release 9.5.</p>
Description	Enable PIC system logging to record or view system log messages on a specific PIC. The system log information is passed to the kernel for logging in the <b>/var/log</b> directory.
Options	<p><b>facility</b>—Group of messages that are either generated by the same software process or concern a similar condition or activity. Possible values include the following: <b>daemon</b>, <b>external</b>, <b>kernel</b>, and <b>pfe</b>.</p> <p><b>severity</b>—Classification of effect on functioning. Possible values are the following options:</p> <ul style="list-style-type: none"> <li>• <b>any</b>—Include all severity levels.</li> <li>• <b>none</b>—Disable logging of the associated facility to a destination.</li> <li>• <b>emergency</b>—System panic or other condition that causes the routing platform to stop functioning.</li> <li>• <b>alert</b>—Conditions that require immediate correction, such as a corrupted system database.</li> <li>• <b>critical</b>—Critical conditions, such as hard errors.</li> <li>• <b>error</b>—Error conditions that generally have less serious consequences than errors in the emergency, alert, and critical levels.</li> <li>• <b>warning</b>—Conditions that warrant monitoring.</li> <li>• <b>notice</b>—Conditions that are not errors but might warrant special handling.</li> <li>• <b>info</b>—Events or nonerror conditions of interest.</li> </ul> <p>The remaining statement is explained separately.</p>
Required Privilege Level	<p>interface—To view this statement in the configuration.</p> <p>interface-control—To add this statement to the configuration.</p>
Related Documentation	<ul style="list-style-type: none"> <li>• <a href="#">Configuring System Log Messages on page 25</a></li> </ul>

## traceoptions (Process Monitor)

---

<b>Syntax</b>	<pre>traceoptions {     file <i>filename</i> files <i>number</i> match <i>regex</i> size <i>size</i> (world-readable   no-world-readable);     flag <i>flag</i>;     level <i>level</i>;     no-remote-trace; }</pre>
<b>Hierarchy Level</b>	[edit system processes <a href="#">process-monitor</a> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.0.
<b>Description</b>	Enable tracing options for the process health monitor (pmond).
<b>Options</b>	<p><b>file <i>filename</i></b>—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. To include the <b>file</b> statement, you must specify a filename.</p> <p><b>files <i>number</i></b>—(Optional) Maximum number of trace files. When a trace file named <b>trace-file</b> reaches its maximum size, it is renamed <b>trace-file.0</b>, then <b>trace-file.1</b>, 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 also must specify a maximum file size with the <b>size</b> option.</p> <p><b>flag <i>flag</i></b>—Specify which tracing operation to perform. To specify more than one tracing operation, include multiple <b>flag</b> statements. You can include the following flags:</p> <ul style="list-style-type: none"><li>• <b>all</b>—Enable all trace options flags.</li><li>• <b>events</b>—Trace process state change and cleanup events.</li><li>• <b>gencfg</b>—Trace GENCFG blobs recorded for cleanup.</li><li>• <b>module</b>—Trace module code.</li><li>• <b>sysvsem</b>—Trace SYSV semaphores recorded for cleanup.</li><li>• <b>sysvshm</b>—Trace SYSV shared memory segments recorded for cleanup.</li><li>• <b>tracking</b>—Trace tracking code.</li><li>• <b>ui</b>—Trace user interface operations.</li></ul> <p><b>level <i>level</i></b>—Specify the level of debugging output:</p> <ul style="list-style-type: none"><li>• <b>all</b>—Match all levels.</li><li>• <b>error</b>—Match error conditions.</li><li>• <b>info</b>—Match informational messages.</li><li>• <b>notice</b>—Match conditions that warrant special handling (but are not errors).</li><li>• <b>verbose</b>—Match verbose messages.</li></ul>

- **warning**—Match warning messages.

**match *regex***—(Optional) Refine the output to include lines that contain the regular expression.

**no-remote-trace**—Disable remote tracing.

**size *size***—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). If you specify a maximum file size, you also must specify a maximum number of trace files with the **files *number*** option.

**Syntax:** **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

**Range:** 10 KB through 1 GB

**Default:** 128 KB

**world-readable | no-world-readable**—(Optional). Grant all users permission to read log files, or restrict the permission only to the **root** user and users who have the Junos **maintenance** permission.

<b>Required Privilege</b>	trace—To view this statement in the configuration.
<b>Level</b>	trace-control—To add this statement to the configuration.

<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Verifying the Execution Status of System Processes on page 91</a></li></ul>
------------------------------	---

## traceoptions (Resource Cleanup)

---

<b>Syntax</b>	<pre>traceoptions {     file <i>filename</i> files <i>number</i> match <i>regex</i> size <i>size</i> (world-readable   no-world-readable);     flag <i>flag</i>;     level <i>level</i>;     no-remote-trace; }</pre>
<b>Hierarchy Level</b>	[edit system processes <a href="#">resource-cleanup</a> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.3.
<b>Description</b>	Enable debugging tracing for resource cleanup process.
<b>Options</b>	<p><b>file <i>filename</i></b>—Name of the file to receive the output of the tracing operation. Enclose the name within quotation marks. To include the <b>file statement</b>, you must specify a filename.</p> <p><b>files <i>number</i></b>—(Optional) Maximum number of trace files. When a trace file named <b>trace-file</b> reaches its maximum size, it is renamed <b>trace-file.0</b>, then <b>trace-file.1</b>, 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 also must specify a maximum file size with the <b>size</b> option.</p> <p><b>flag <i>flag</i></b>—Specify which tracing operation to perform. To specify more than one tracing operation, include multiple <b>flag</b> statements. You can include the following flags:</p> <ul style="list-style-type: none"><li>• <b>all</b>—Enable all trace options flags.</li><li>• <b>events</b>—Trace process state change and cleanup events.</li><li>• <b>gencfg</b>—Trace GENCFG blobs recorded for cleanup.</li><li>• <b>module</b>—Trace module code.</li><li>• <b>sysvsem</b>—Trace SYSV semaphores recorded for cleanup.</li><li>• <b>sysvshm</b>—Trace SYSV shared memory segments recorded for cleanup.</li><li>• <b>tracking</b>—Trace tracking code.</li><li>• <b>ui</b>—Trace user interface operations.</li></ul> <p><b>level <i>level</i></b>—Specify the level of debugging output:</p> <ul style="list-style-type: none"><li>• <b>all</b>—Match all levels.</li><li>• <b>error</b>—Match error conditions.</li><li>• <b>info</b>—Match informational messages.</li><li>• <b>notice</b>—Match conditions that warrant special handling (but are not errors).</li><li>• <b>verbose</b>—Match verbose messages.</li></ul>

- **warning**—Match warning messages.

**match *regex***—(Optional) Refine the output to include lines that contain the regular expression.

**no-remote-trace**—Disable remote tracing.

**size *size***—(Optional) Maximum size of each trace file, in kilobytes (KB), megabytes (MB), or gigabytes (GB). If you specify a maximum file size, you also must specify a maximum number of trace files with the **files *number*** option.

**Syntax:** **xk** to specify KB, **xm** to specify MB, or **xg** to specify GB

**Range:** 10 KB through 1 GB

**Default:** 128 KB

**world-readable | no-world-readable**—(Optional). Grant all users permission to read log files, or restrict the permission only to the **root** user and users who have the Junos **maintenance** permission.

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

**Related Documentation** • [Application Health Monitoring on page 36](#)

## wired-max-processes

**Syntax** `wired-max-processes num-procs;`

**Hierarchy Level** [edit chassis fpc *slot-number* pic *slot-number* adaptive-services service-package extension-provider]

**Release Information** Statement introduced in Junos OS Release 11.4.

**Description** Configure the number of processes that use wired process memory. Performance can degrade if a process uses memory beyond its Big TLB memory. If this setting is changed, the PIC will reboot.

**Options** ***num-procs***—Number of processes that use the reserved wired process memory.  
**Range:** 1 through 8

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

**Related Documentation** • [Configuring Memory Settings on page 24](#)  
• [wired-process-mem-size on page 78](#)  
• [forwarding-db-size on page 56](#)  
• [object-cache-size on page 60](#)  
• [policy-db-size on page 63](#)

## wired-process-mem-size

---

<b>Syntax</b>	<code>wired-process-mem-size <i>mem-size</i>;</code>
<b>Hierarchy Level</b>	[edit chassis fpc <i>slot-number</i> pic <i>pic-number</i> adaptive-services service-package <a href="#">extension-provider</a> ]
<b>Release Information</b>	Statement introduced in Junos OS Release 9.3.
<b>Description</b>	Configure the size of the reserved wired process memory. You can also configure object cache. If this setting is changed, the PIC reboots.
<b>Options</b>	<b><i>megabytes</i></b> —Size of the reserved wired process memory, in MB. The only size you can set for this statement is 512 MB. <b>Default:</b> 512 MB <b>Range:</b> 0 through 512 MB
<b>Required Privilege Level</b>	interface—To view this statement in the configuration. interface-control—To add this statement to the configuration.
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Configuring Memory Settings on page 24</a></li><li>• <a href="#">forwarding-db-size on page 56</a></li><li>• <a href="#">object-cache-size on page 60</a></li><li>• <a href="#">policy-db-size on page 63</a></li><li>• <a href="#">wired-max-processes on page 77</a></li></ul>



## PART 3

# Administration

- [Installing and Managing Application Packages on page 81](#)
- [Managing Resource Information on page 89](#)
- [Installation and Upgrade Commands on page 93](#)
- [Applications Status Commands on page 99](#)
- [Resource Information Commands on page 115](#)
- [JDAF Commands on page 125](#)



## CHAPTER 9

# Installing and Managing Application Packages

- [Installing Application Packages on page 81](#)
- [Upgrading Application Packages on page 84](#)
- [Removing Application Packages on page 86](#)
- [Checking Installed Application Packages on page 87](#)
- [Upgrading the Junos OS When Applications Are Installed on page 88](#)

## Installing Application Packages

---

To install an application you install the application package or packages, and then you install the application on the router. An application package consists of binaries and their supplements. Application packages are distributed in a single **.tgz** file, which contains all the necessary resources to run the application.

As of Junos OS Release 12.3, Junos applications will install on Junos only if the application is built with the same release as the Junos OS Release on which the application is being installed. For example, an application built with Release 12.3R2 will only install on Junos OS Release 12.3R2 and will not install on Junos OS Release 12.3R1 or Junos OS Release 12.3R3 or Junos OS Release 13.1R1.

To install an application on a router, you configure the statements that describe the certificate. These statements include the provider name, the type of certificate, and the scope of application deployment. The provider name identifies the provider of the application to the system and allows application packages from that provider to be installed on the router. Furthermore, each package's embedded certificate contains parameters about the provider's partnership with Juniper Networks: the license type and deployment scope parameters. As with the provider name, these parameters for the package must be allowed by the configuration in order for the package's installation to be allowed.



**NOTE:** If graceful routing engine switchover (GRES), or nonstop active routing (NSR) is enabled when you initiate a software installation, the software does not install properly. Make sure you issue the CLI `delete chassis redundancy` command when prompted. If GRES is enabled, it will be removed with this command. By default, NSR is disabled. If NSR is enabled, remove the `nonstop-routing` statement from the `[edit routing-options]` hierarchy level to disable it.

To install an application:

1. Go to configuration mode of the CLI.

```
user@router> configure
Entering configuration mode
[edit]
user@router#
```

2. Go to the `[edit system extensions]` hierarchy level.

```
[edit]
user@router# edit system extensions
[edit system extensions]
```

3. Configure the provider name, the license type, and the deployment scope associated with the application package. This information is supplied by the application's provider.



**NOTE:** Older certificates have all the certificate information concatenated in the `providers name` statement. These older certificates are still supported, and you can install packages signed with them.

```
[edit system extensions]
user@router# set providers name license-type license deployment-scope deployment
```

For example, if `abc` is a provider name issued to a provider with a customer type of `license` and two deployment scopes, you might issue the following command.

```
[edit system extensions]
user@router# set providers abc license-type customer deployment-scope [ private
commercial ]
```

4. Make other application-specific configuration changes as required by the application's provider.
5. Commit the changes to the configuration.

```
[edit system extensions]
user@router# top
[edit]
user@router# commit
commit complete
```

6. Exit the configuration mode.

```
[edit]
user@router# exit
Exiting configuration mode
```

7. If you have a rescue configuration, update the rescue configuration by issuing the **request system configuration rescue save** command.

```
user@host> request system configuration rescue save
```



**NOTE:** Making sure the active configuration and the rescue configuration are consistent will prevent errors when installing applications. The system will find the same provider information in both.

8. In the operational mode of the CLI, install the application package. You can add one or multiple packages at one time.

- To add one package at a time, use the **request system software add** command.

```
user@router> request system software add package-name
```

- To add multiple packages at once, use the **request system software add set** command.

```
user@router> request system software add set [package-name1 package-name2
package-name3]
```

For example, this **set** command allows you to install the core Junos OS package and Junos application packages simultaneously.

You will see the application package being installed. For example, if your package's filename is **abcapps-11.1\_2011.tgz**.

```
user@router> request system software add abcapps-11.1_2011.tgz
```

```
Installing package '/var/home/user/abcapps-11.1_2011.tgz'
...
Verified abcapps-11.1_2011.tgz signed by abc-enggroup
Adding abcapps...
Available space: 150060 require: 2598
Saving package file in /var/sw/pkg/abcapps-11.1_2011.tgz Saving state
for rollback ...
```

Multiple provider names can be enabled on a router. For example, if abc and xyz are provider names issued to two providers, then the following configuration enables the router for the applications built by either provider. Notice that a provider can have more than one license type and that each license type can have multiple deployment scopes:

```
[edit]
system {
  extensions {
    providers {
      abc {
        license-type customer deployment-scope [ private commercial ];
      }
      xyz {
```

```
        license-type juniper deployment-scope private;  
        license-type research deployment-scope public;  
    }  
}  
}
```

**Related  
Documentation**

- [Application Versions and Compatibility on page 9](#)
- [Creating and Returning to a Rescue Configuration](#)
- [Installing the Software Package on a Router with Redundant Routing Engines](#)
- [Upgrading Application Packages on page 84](#)
- [Removing Application Packages on page 86](#)
- [Checking Installed Application Packages on page 87](#)

---

## Upgrading Application Packages

As of Junos OS Release 12.2, if you are upgrading an application package over an installed application package (that is, re-installing), you do not have to first remove the configuration contributed by that application. Also, if you have more than one package to install, you can add them at the same time using the **request system software add set** command.

As of Junos OS Release 12.3, Junos applications will install on Junos OS only if the application is built with the same release as the Junos OS Release on which the application is being installed. For example, an application built with Release 12.3R2 will only install on Junos OS Release 12.3R2 and will not install on Junos OS Release 12.3R1 or Junos OS Release 12.3R3 or Junos OS Release 13.1R1.

As of Junos OS Release 13.3R1, you can install multiple packages at a time using unified in-service software upgrade (ISSU). Unified ISSU enables you to upgrade the Junos OS release with no disruption on the control plane and minimal disruption of data traffic.

This topic describes the procedures for normal upgrade (re-install) and unified ISSU.

- [Upgrading Application Packages by Re-installing on page 84](#)
- [Upgrading Application Packages Using Unified ISSU on page 85](#)

### Upgrading Application Packages by Re-installing



**NOTE:** If graceful routing engine switchover (GRES), or nonstop active routing (NSR) is enabled when you initiate a software installation, the software does not install properly. Make sure you issue the CLI **delete chassis redundancy** command when prompted. If GRES is enabled, it will be removed with this command. By default, NSR is disabled. If NSR is enabled, remove the **nonstop-routing** statement from the [edit routing-options] hierarchy level to disable it.

---

You can upgrade to the latest version of an application by reinstalling the application using the new package name.

To upgrade an application:

- Add both the application package. If there are more than one package, you can add them at the same time.

```
user@router> request system software add set [new-package-name1
new-package-name2 junos-package1 junos-package2]
```



**TIP:** After you have upgraded the software in the device and are satisfied that the new application package is successfully installed and running, take a snapshot to back up the new software to the `/altroot` and `/altconfig` file systems.

```
user@router> request system snapshot
```

After you run the `request system snapshot` command, you cannot return to the previous version of the software, because the running and backup copies of the software are identical.

## Upgrading Application Packages Using Unified ISSU

As of Junos OS Release 13.3R1, you can install multiple packages at a time using the unified in-service software upgrade (ISSU) operational command.

Unified in-service software upgrade (ISSU) is for the M Series, MX Series, and T Series only.

A unified ISSU is only supported by dual Routing Engine platforms. The Routing Engines must have same release of Junos OS installed.

In addition, graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) must be enabled.

1. Enable GRES and NSR by committing the following configuration commands:

```
user@router# set chassis redundancy graceful-switchover
user@router# set routing-options nonstop-routing
user@router# set system commit synchronize
user@router# commit
```

2. Exit to the operational CLI prompt and use the **request system software in-service-upgrade set** command to name the packages to be installed. Include the path if needed in the *package-name*. Include any other options you need after the value set (in square brackets).

```
user@router> request system software in-service-upgrade set [ package-name1
package-name2 ]
```



**NOTE:** Only \*-signed.tgz packages will be accepted.

For example:

```
user@router> request system software in-service-upgrade set [
  jinstall-13.3-20131009_ib_13_3_psd.0-domestic-signed.tgz
  jtools-13.3-20131009_ib_13_3_psd.0-signed.tgz ]
```

#### Related Documentation

- [request system software in-service-upgrade set on page 94](#)
- [Installing Application Packages on page 81](#)
- [Removing Application Packages on page 86](#)
- [Upgrading the Junos OS When Applications Are Installed on page 88](#)
- [Checking Installed Application Packages on page 87](#)

---

## Removing Application Packages

To remove an application, you may want to remove one application package, multiple packages, or an entire bundle. See the appropriate procedure for each in this section.

Before you delete an application package, you need to remove the configuration contributed by that application. See [“Displaying and Deleting Configuration for Applications” on page 34](#) for instructions on removing application-specific configuration.



**NOTE:** If you do not remove the configuration before deleting the application package, you will get error messages. You will need to do a commit to fix the configuration database. If you prefer not to see the error messages, remove the configuration contributed by the application before removing the application package.

To remove an application package:

1. Remove the configuration contributed by the application.
2. Delete the application package.

```
user@router>request system software delete package-name
```

To remove multiple application packages:

1. Remove the configuration contributed by the applications.
2. Delete the application packages using the **request system software delete set** command.

```
user@router>request system software delete set [package-name1 package-name2]
```



To remove a bundle:

- Uninstall each part of the bundle separately:
  - a. Remove the configuration contributed by the application.
  - b. Delete the application packages, either one by one or several at the same time.

**Related  
Documentation**

- [Installing Application Packages on page 81](#)
- [Checking Installed Application Packages on page 87](#)
- [Upgrading Application Packages on page 84](#)
- [Upgrading the Junos OS When Applications Are Installed on page 88](#)

---

## Checking Installed Application Packages

You can get a list of the installed applications using the **show version** command.

The following is sample output from the **show version** command:

```
user@router> show version
jnpr@MX240-SDK-RE0> show version
Hostname: MX240-SDK-RE0
Model: mx240
JUNOS Base OS boot [12.1R1.9]
JUNOS Base OS Software Suite [12.1R1.9]
JUNOS 64-bit Kernel Software Suite [12.1R1.9]
JUNOS Crypto Software Suite [12.1R1.9]
JUNOS Packet Forwarding Engine Support (M/T Common) [12.1R1.9]
JUNOS Packet Forwarding Engine Support (MX Common) [12.1R1.9]
JUNOS Online Documentation [12.1R1.9]
JUNOS Voice Services Container package [12.1R1.9]
JUNOS Border Gateway Function package [12.1R1.9]
JUNOS Services ACL Container package [12.1R1.9]
JUNOS Services LL-PDF Container package [12.1R1.9]
JUNOS Services PTSP Container package [12.1R1.9]
JUNOS Services Stateful Firewall [12.1R1.9]
JUNOS Services NAT [12.1R1.9]
JUNOS Services Application Level Gateways [12.1R1.9]
JUNOS Services Captive Portal and Content Delivery Container package [12.1R1.9]
JUNOS Services RPM [12.1R1.9]
JUNOS Services HTTP Content Management package [12.1R1.9]
JUNOS AppId Services [12.1R1.9]
JUNOS IDP Services [12.1R1.9]
JUNOS Services Crypto [12.1R1.9]
JUNOS Services SSL [12.1R1.9]
JUNOS Services IPSec [12.1R1.9]
JUNOS Runtime Software Suite [12.1R1.9]
JUNOS Routing Software Suite [12.1R1.9]
```

The packages at the top of the list in the output are application packages provided by Juniper Networks with the Junos OS. If the application package names do not start with the Junos name, then you can take them to be third-party software. However, Juniper Networks reserves the right to deploy application packages separately under the Junos name.

- Related Documentation**
- [Installing Application Packages on page 81](#)
  - [Removing Application Packages on page 86](#)
  - [Upgrading Application Packages on page 84](#)

---

## Upgrading the Junos OS When Applications Are Installed

As of Junos OS Release 12.2, when you upgrade a Junos OS release, you can do so without first having to remove the configuration contributed by an application or applications.

As of Junos OS Release 12.3, Junos applications will install on Junos only if the application is built with the same release as the Junos OS Release on which the application is being installed. For example, an application built with Release 12.3R2 will only install on Junos OS Release 12.3R2 and will not install on Junos OS Release 12.3R1 or Junos OS Release 12.3R3 or Junos OS Release 13.1R1.

To upgrade Junos OS with application configuration:

- Add the Junos OS and application packages at one time using the **request system software add set** command.

```
user@router> request system software add set [junos-release-packages  
application-packages]
```

The Junos application configuration is validated against the Junos application package mentioned in the **set** command.



**NOTE:** You cannot add more than one jinstall package at a time, even with the **set** command.

---

- Related Documentation**
- [Installing the Software Package on a Router with Redundant Routing Engines](#)
  - [Checking Installed Application Packages on page 87](#)

# Managing Resource Information

- [Displaying Resource Limits on page 89](#)
- [Application Health Monitoring on page 90](#)
- [Verifying the Execution Status of System Processes on page 91](#)

## Displaying Resource Limits

---

To display the applied policies, use the **show system processes resource-limits process-name process-ui-name** operational command. The following example configuration, when committed, applies resource limits for an application package `jnx-example` and overrides it with process-level settings for the process `jnx-example-service`:

```
[edit system extensions]
user@router# show
resource-limits {
  package jnx-example {
    resources {
      memory {
        stack-size 4m;
      }
    }
  }
  process jnx-example-service {
    resources {
      file {
        size 4m;
      }
    }
  }
}
```

Using the **show system processes resource-limits process-name** command, the output for `jnx-example-foo-binary`, part of package `jnx-example`, looks like the following output because the package-level settings are applied on it:

```
user@router> show system processes resource-limits process-name jnx-example-foo-binary
Resource Limits:
  Area                               Max. allowed   Max. configurable
  memory/stack-size                  4MB            8MB
  memory/data-size                   32MB           32MB
  memory/resident-set-size           24MB           24MB
  memory/locked-in                   16MB           16MB
  cpu/priority                        10             10
  file/open                           64             64
```

The output for `jnx-example-service` looks like this:

```
user@router> show system processes resource-limits process-name jnx-example-service
Resource Limits:
  Area                               Max. allowed   Max. configurable
  file/size                          4MB            unlimited
  file/open                           64             64
  cpu/priority                        10             10
  memory/stack-size                   8MB            8MB
  memory/data-size                   32MB           32MB
  memory/resident-set-size           24MB           24MB
  memory/locked-in                   16MB           16MB
```

For more detail on the **show system processes resource-limits process-name process-ui-name** operational command, see its command summary.

#### Related Documentation

- [show system processes resource-limits process-name on page 120](#)
- [Restricting Resource Limits on page 11](#)
- [Example: Configuring Separate Resource Limits for a Process on page 43](#)

---

## Application Health Monitoring

Providers can have their applications request and manage system resources. Some of this resource utilization is persistent across, for example, reboots or the restart of the application. Some system tasks such as deleting a package, disabling and application, or accessing shared resources require that resources be cleaned up by entities other than the application itself. Resources that are known to need cleaning up include the following:

- GENCFG blobs
- SYSV shared memory segments
- SYSV semaphores
- Temporary files

Currently, the **traceoptions** statement is the only CLI statement available for configuring resource cleanup.

To configure tracing operations for resource cleanup operations, include the **traceoptions flag** option for selectively turning the debugging of trace messages on or off:

```
[edit]
system {
  processes {
    resource-cleanup {
      traceoptions {
        file filename files number match regex size size (world-readable |
          no-world-readable);
        flag flag;
        level level;
        no-remote-trace;
      }
    }
  }
}
```

The available flags for the **traceoptions** statement include:

- **all**—Enable all trace option flags.
- **events**—Display process state change and cleanup events.
- **gencfg**—Display GENCFG blobs recorded for cleanup.
- **sysvsem**—Display SYSV semaphores recorded for cleanup.
- **sysvshm**—Display SYSV shared memory segments recorded for cleanup.
- **ui**—Display tracing messages for UI operational commands.

## Verifying the Execution Status of System Processes

The *process health monitor* process (pmond) is the central monitoring process for applications. It tracks resource usage and performs actions on processes when they trigger certain events (for example, when there is a runaway process event or when low-water or high-water resource marks are exceeded). Process monitoring ensures that applications are operating appropriately and provides an interface for operators to monitor the impact of their applications on the Routing Engine.

To trace process monitoring operations, include the **process-monitor** statement at the **[edit system processes]** hierarchy level:

```
[edit]
system {
  processes {
    process-monitor {
      disable;
      traceoptions {
        file filename files number match regex size size (world-readable |
          no-world-readable);
        flag flag;
        level level;
        no-remote-trace;
      }
    }
  }
}
```

The **traceoptions** statement is the only container statement at the **[edit system processes process-monitor]** hierarchy level. The available flags for the **traceoptions** statement include:

- **all**—Enable all trace options flags.
- **process-tracking**—Display process life-cycle events and parent/child pedigree changes.
- **heartbeat**—Display heartbeat updates from applications.
- **ui**—Display tracing messages for UI operational commands.

## CHAPTER 11

# Installation and Upgrade Commands

- request system software in-service-upgrade set

## request system software in-service-upgrade set

---

**Syntax**    `request system software in-service-upgrade set [ package-name1 package-name2 ]`  
              `<no-copy>`  
              `<no-old-master-upgrade>`  
              `<reboot>`  
              `<unlink>`

**Release Information**    Command introduced in Junos OS Release 13.3.

**Description**    (For M Series, MX Series, and T Series only) Perform a unified in-service software upgrade (ISSU) for a list of packages for Junos SDK applications. Using this command you can enable a list of packages to be upgraded through unified ISSU. (You can also specify just one package without the brackets.)

A unified ISSU enables you to upgrade from one Junos OS Release to another with no disruption on the control plane and with minimal disruption of traffic. A unified ISSU is only supported by dual Routing Engine platforms. The Routing Engines must have same release of Junos OS installed. In addition, graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) must be enabled.

The **request system software in-service-upgrade** command, which upgrades only one package, is still supported.



**NOTE:** Any of the packages given in the list must be compatible with ISSU-INDB. Use only packages ending with **\*-signed.tgz**.

---

**Options**    ***package-name***—Name of a package. Include the path. Include multiple packages by listing the packages' filenames inside an open set of values with square brackets as shown in the Syntax section.

**no-copy**—(Optional) Do not save copies of package files installed.

**no-old-master-upgrade**—(Optional) Do not upgrade the old master after switchover. When the **no-old-master-upgrade** option is included, after the backup Routing Engine is rebooted with the new software package and a switchover occurs to make it the new master Routing Engine, the former master (new backup) Routing Engine will not be upgraded to the new software. In this case, you must manually upgrade the former master (new backup) Routing Engine. If you do not include the **no-old-master-upgrade** option, the system will automatically upgrade the former master Routing Engine.

**reboot**—(Optional) Reboot system after adding package. When the **reboot** option is included, the former master (new backup) Routing Engine is automatically rebooted after being upgraded to the new software. When the **reboot** option is not included, you must manually reboot the former master (new backup) Routing Engine using the **request system reboot** command.



**unlink**—(Optional) Remove the package after successful installation. Use the **unlink** option to remove the software package from this directory (that is, the directory indicated in the **package-name** path) after a successful upgrade is completed.

**Additional Information** For more information about unified ISSU, see the *Junos OS High Availability Configuration Guide*.

**Required Privilege Level** view

**Related Documentation**

- [Upgrading Application Packages Using Unified ISSU on page 85](#)

**List of Sample Output**

[request system software in-service-upgrade set - successful on page 95](#)  
[request system software in-service-upgrade set - GRES not configured on page 96](#)  
[request system software in-service-upgrade set - version mismatch on page 96](#)  
[request system software in-service-upgrade set - Could not extract 'issu-indb' bundle on page 97](#)

## Sample Output

[request system software in-service-upgrade set - successful](#)

```
{master}
user@host> request system software in-service-upgrade set [
jinstall-13.3-20131009_ib_13_3_psd.0-domestic-signed.tgz
jtools-13.3-20131009_ib_13_3_psd.0-signed.tgz ]
Chassis ISSU Check Done
ISSU: Validating Image
Checking compatibility with configuration
Initializing...
Using jbase-13.3-20131009_ib_13_3_psd.0
verexec: accepting signer: PackageDevelopmentEc_2013
Verified manifest signed by PackageDevelopmentEc_2013
Using /var/tmp/jinstall-13.3-20131009_ib_13_3_psd.0-domestic-signed.tgz
Verified jinstall-13.3-20131009_ib_13_3_psd.0-domestic.tgz signed by
PackageDevelopmentEc_2013
...

Using /var/tmp/jtools-13.3-20131009_ib_13_3_psd.0-signed.tgz
Verified jtools-13.3-20131009_ib_13_3_psd.0.tgz signed by PackageDevelopmentEc_2013
Using jtools-13.3-20131009_ib_13_3_psd.0.tgz
Checking jtools requirements on /
Available space: 2752176 require: 10466
verexec: accepting signer: PackageDevelopmentEc_2013
Verified manifest signed by PackageDevelopmentEc_2013
verexec: accepting signer: PackageDevelopmentEc_2013
Verified jtools-13.3-20131009_ib_13_3_psd.0 signed by PackageDevelopmentEc_2013
Hardware Database regeneration succeeded
Validating against /config/juniper.conf.gz
mgd: commit complete
Validation succeeded
ISSU: Preparing Backup RE
Pushing /var/tmp/jinstall-13.3-20131009_ib_13_3_psd.0-domestic-signed.tgz to re1
Pushing /var/tmp/jtools-13.3-20131009_ib_13_3_psd.0-signed.tgz to re1
Installing package
'/var/tmp/jinstall-13.3-20131009_ib_13_3_psd.0-domestic-signed.tgz' ...
Verified jinstall-13.3-20131009_ib_13_3_psd.0-domestic.tgz signed by
```

```
PackageDevelopmentEc_2013
Adding jinstall...

WARNING:    The software that is being installed has limited support.
WARNING:    Run 'file show /etc/notices/unsupported.txt' for details.
...

Saving the config files ...
NOTICE: uncommitted changes have been saved in
/var/db/config/juniper.conf.pre-install
Installing the bootstrap installer ...

WARNING:    A REBOOT IS REQUIRED TO LOAD THIS SOFTWARE CORRECTLY. Use the
WARNING:    'request system reboot' command when software installation is
WARNING:    complete. To abort the installation, do not reboot your system,
WARNING:    instead use the 'request system software delete jinstall'
WARNING:    command as soon as this operation completes.

Saving package file in
/var/sw/pkg/jinstall-13.3-20131009_ib_13_3_psd.0-domestic-signed.tgz ...
Saving state for rollback ...
Backup upgrade done
Rebooting Backup RE

Rebooting re1
ISSU: Backup RE Prepare Done
Waiting for Backup RE reboot
GRES operational
Initiating Chassis In-Service-Upgrade
Chassis ISSU Started
...

Adding jinstall...

WARNING:    The software that is being installed has limited support.
...
Saving package file in
/var/sw/pkg/jinstall-13.3-20131009_ib_13_3_psd.0-domestic-signed.tgz ...
Saving state for rollback ...
ISSU: Old Master Upgrade Done
ISSU: IDLE

{backup}
user@host>
```

#### request system software in-service-upgrade set - GRES not configured

```
user@host> request system software in-service-upgrade set [
jinstall-13.3-20131009_ib_13_3_psd.0-domestic-signed.tgz
jtools-13.3-20131009_ib_13_3_psd.0-signed.tgz ]

warning: GRES not configured
```

#### request system software in-service-upgrade set - version mismatch

```
{master}
user@host> request system software in-service-upgrade set [
jinstall-13.3-20131009_ib_13_3_psd.0-domestic-signed.tgz
jtools-13.3-20131009_ib_13_3_psd.0-signed.tgz ]

Chassis ISSU Check Done
```

```
ISSU: Validating Image
error: Backup RE not ready for ISSU (version_mismatch )
Chassis ISSU Aborted
ISSU: IDLE
error: ISSU Aborted!
```

#### request system software in-service-upgrade set - Could not extract 'issu-indb' bundle

```
{master}
user@host> request system software in-service-upgrade set
[jinstall-13.3-20131009_ib_13_3_psd.0-domestic-signed.tgzjtools-13.3-20131009_ib_13_3_psd.0.tgz]
{master}
joannem@abelia> ...s-13.3-20131009_ib_13_3_psd.0-signed.tgz ]
Chassis ISSU Check Done
ISSU: Validating Image
error: Could not extract 'issu-indb' bundle (error-code: 1.4)
error: Could not extract 'issu-indb' bundle (error-code: 1.4)
Chassis ISSU Aborted
ISSU: IDLE
error: ISSU Aborted!
```



## CHAPTER 12

# Applications Status Commands

- `show extension-provider system connections`
- `show extension-provider system packages`
- `show extension-provider system processes`
- `show extension-provider system uptime`
- `show extension-provider system virtual-memory`

## show extension-provider system connections

<b>Syntax</b>	show extension-provider system connections <extensive> <inet   inet6> <interface> <show-routing-instances>
<b>Release Information</b>	Command introduced in Junos OS Release 9.1.
<b>Description</b>	Show connection activity on the extension provider PIC. This command functions similarly to <b>show system connections</b> command.
<b>Options</b>	<p><b>extensive</b>—(Optional) Display exhaustive system process information.</p> <p><b>inet   inet6</b>—(Optional) Display IPv4 connections or IPv6 connections, respectively.</p> <p><b>interface</b>—(Optional) Display the name of the extension provider interface.</p> <p><b>show-routing-instances</b>—(Optional) Display routing instances.</p>
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li><a href="#">show system connections</a></li> <li><a href="#">Verifying the Execution Status of System Processes on page 91</a></li> </ul>
<b>List of Sample Output</b>	<a href="#">show extension-provider system connections on page 100</a> <a href="#">show extension-provider system connections extensive interface on page 101</a> <a href="#">show extension-provider system connections inet on page 101</a> <a href="#">show extension-provider system connections inet6 on page 101</a> <a href="#">show extension-provider system connections interface on page 102</a> <a href="#">show extension-provider system connections show-routing-instances on page 102</a> <a href="#">show extension-provider system connections show-routing-instances interface inet6 on page 103</a>
<b>Output Fields</b>	For a description of the output fields, see the output fields table for the <b>show system connections</b> command in the <i>Junos System Basics and Services Command Reference</i> .

## Sample Output

### show extension-provider system connections

```

user@host> show extension-provider system connections
Interface: ms-0/0/0
Active Internet connections (including servers)
Proto Recv-Q Send-Q Local Address      Foreign Address    (state)
tcp4      0      0 20.0.0.16.32004    20.0.0.1.64292    ESTABLISHED
tcp4      0      0 20.0.0.16.3000     20.0.0.1.58036    ESTABLISHED
tcp4      0      0 20.0.0.16.59517    20.0.0.1.3000     ESTABLISHED
tcp4      0      0 *.3000             *.*                LISTEN
tcp4      0      0 *.32004            *.*                LISTEN

```

```

tcp4  66312      0  20.0.0.16.59592      20.0.0.1.32003      ESTABLISHED
tcp4      0      0  *.23                  *.*                  LISTEN
tcp4      0      0  *.33005                *.*                  LISTEN
tcp4      0      0  128.0.1.16.49900      128.0.0.1.6234      ESTABLISHED
udp4      0      0  *.842                  *.*                  *
udp4      0      0  127.0.0.1.123          *.*                  *
udp4      0      0  *.123                  *.*                  *
udp46     0      0  *.514                  *.*                  *
udp4      0      0  *.514                  *.*                  *
Interface: ms-0/2/0
Active Internet connections (including servers)
Proto Recv-Q Send-Q Local Address      Foreign Address      (state)
tcp4      0      0  20.0.0.18.32004      20.0.0.1.62402      ESTABLISHED
tcp4      0      0  *.33005                *.*                  LISTEN
tcp4      0      0  128.0.3.16.59592      128.0.0.1.6234      ESTABLISHED
tcp4      0      0  *.23                    *.*                  LISTEN
tcp4      0      0  *.32004                *.*                  LISTEN
tcp4      0      0  20.0.0.18.49900      20.0.0.1.32003      ESTABLISHED
udp4      0      0  *.789                  *.*                  *
udp4      0      0  127.0.0.1.123          *.*                  *
udp4      0      0  *.123                  *.*                  *
udp46     0      0  *.514                  *.*                  *
udp4      0      0  *.514                  *.*                  *

```

#### show extension-provider system connections extensive interface

```

user@host> show extension-provider system connections extensive interface ms-0/2/0
Interface: ms-0/2/0
Active Internet connections (including servers)
Proto Recv-Q Send-Q Local Address      Foreign Address      (state)
tcp4      0      0  20.0.0.18.32004      20.0.0.1.49792      ESTABLISHED
sndsbcc:      0 sndsbmbcnt:      0 sndsbmbmax:      265248
sndsblwat:      2048 sndsbhiwat:      33156
rcvsbcc:      0 rcvsbmbcnt:      0 rcvsbmbmax:      530496
rcvsblwat:      1 rcvsbhiwat:      66312
proc id:      1 proc name:
iss: 4025626166 sndup: 4025626167
snduna: 4025626167 sndnxt: 4025626167 sndwnd:      66312
sndmax: 4025626167 sndcwnd:      131070 sndssthresh: 1073725440
irs: 3544420903 rcvup: 3544420904
rcvnxt: 3544421176 rcvadv: 3544487488 rcvwnd:      66312
rtt:      0 srtt:      64 rttv:      16
rxtcur:      1200 rxtshift:      0 rtseq:      0
rttmin:      1000 mss:      1228
flags: REQ_SCALE RCVD_SCALE REQ_TSTMP RCVD_TSTMP SACK_PERMIT [0x20003e0]
...

```

#### show extension-provider system connections inet

The output for the **show extension-provider system connections inet** command is identical to that for the **show extension-provider system connections** command. For sample output, see [show extension-provider system connections on page 100](#).

#### show extension-provider system connections inet6

```

user@host> show extension-provider system connections inet6
Interface: ms-0/0/0
Active Internet connections (including servers)
Proto Recv-Q Send-Q Local Address      Foreign Address      (state)
udp6      0      0  *.123                *.*                  *
udp46     0      0  *.514                *.*                  *

```

```

Interface: ms-0/2/0
Active Internet connections (including servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         (state)
udp6      0      0 *.123                   *.*
udp46     0      0 *.514                   *.*

```

### show extension-provider system connections interface

```

user@host> show extension-provider system connections interface ms-0/2/0
Interface: ms-0/2/0
Active Internet connections (including servers)
Proto Recv-Q Send-Q Local Address           Foreign Address         (state)
tcp4      0      0 20.0.0.18.32004         20.0.0.1.59521         ESTABLISHED
tcp4      0      0 *.33005                 *.*                     LISTEN
tcp4      0      0 128.0.3.16.51534       128.0.0.1.6234         ESTABLISHED
tcp4      0      0 *.23                    *.*                     LISTEN
tcp4      0      0 *.32004                 *.*                     LISTEN
tcp4      0      0 20.0.0.18.61044        20.0.0.1.32003         ESTABLISHED
udp4      0      0 *.914                   *.*
udp4      0      0 127.0.0.1.123          *.*
udp4      0      0 *.123                   *.*
udp46     0      0 *.514                   *.*
udp4      0      0 *.514                   *.*

```

### show extension-provider system connections show-routing-instances

```

user@host> show extension-provider system connections show-routing-instances

Interface: ms-0/0/0
Active Internet connections (including servers) (including routing-instances)
Proto Recv-Q Send-Q Local Address           Foreign Address         Routing Instance (state)
tcp4      0      0 20.0.0.16.32004        20.0.0.1.52590         __juniper_private2__ ESTABLISHED
tcp4      0      0 20.0.0.16.3000         20.0.0.1.58036         __juniper_private2__ ESTABLISHED
tcp4      0      0 20.0.0.16.59517        20.0.0.1.3000          __juniper_private2__ ESTABLISHED
tcp4      0      0 *.3000                  *.*                     __juniper_private2__ LISTEN
tcp4      0      0 *.32004                 *.*                     __juniper_private2__ LISTEN
tcp4 66312 0 20.0.0.16.59592        20.0.0.1.32003         __juniper_private2__ ESTABLISHED
tcp4      0      0 *.23                    *.*                     __juniper_private1__ LISTEN
tcp4      0      0 *.33005                 *.*                     __juniper_private2__ LISTEN
tcp4      0      0 128.0.1.16.49900       128.0.0.1.6234         __juniper_private1__ ESTABLISHED
udp4      0      0 *.842                   *.*                     __juniper_private1__
udp4      0      0 127.0.0.1.123          *.*                     default
udp4      0      0 *.123                   *.*                     __juniper_private1__
udp46     0      0 *.514                   *.*                     default
udp4      0      0 *.514                   *.*                     __juniper_private1__

Interface: ms-0/2/0
Active Internet connections (including servers) (including routing-instances)
Proto Recv-Q Send-Q Local Address           Foreign Address         Routing Instance (state)
tcp4      0      0 20.0.0.18.32004        20.0.0.1.54602         __juniper_private2__ ESTABLISHED
tcp4      0      0 *.33005                 *.*                     __juniper_private2__ LISTEN
tcp4      0      0 128.0.3.16.59592       128.0.0.1.6234         __juniper_private1__ ESTABLISHED
tcp4      0      0 *.23                    *.*                     __juniper_private1__ LISTEN
tcp4      0      0 *.32004                 *.*                     __juniper_private2__ LISTEN
tcp4      0      0 20.0.0.18.49900        20.0.0.1.32003         __juniper_private2__ ESTABLISHED
udp4      0      0 *.789                   *.*                     __juniper_private1__
udp4      0      0 127.0.0.1.123          *.*                     default
udp4      0      0 *.123                   *.*                     __juniper_private1__
udp46     0      0 *.514                   *.*                     default
udp4      0      0 *.514                   *.*                     __juniper_private1__

```



**show extension-provider system connections show-routing-instances interface inet6**

```
user@host> show extension-provider system connections show-routing-instances interface
ms-0/0/0 inet6
```

```
Interface: ms-0/0/0
```

```
Active Internet connections (including servers) (including routing-instances)
```

Proto	Recv-Q	Send-Q	Local Address	Foreign Address	Routing Instance
(state)					
udp6	0	0	*.123	*.*	default
udp46	0	0	*.514	*.*	default

## show extension-provider system packages

<b>Syntax</b>	show extension-provider system packages <detail> <interface>
<b>Release Information</b>	Command introduced in Junos OS Release 9.1.
<b>Description</b>	Show packages loaded on the extension provider PIC. This command functions similarly to <b>show system software</b> command.
<b>Options</b>	<b>detail</b> —(Optional) Display detailed output.  <b>interface</b> —(Optional) Display the name of the extension provider interface.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li><i>show system software</i></li> <li><a href="#">Verifying the Execution Status of System Processes on page 91</a></li> </ul>
<b>List of Sample Output</b>	<a href="#">show extension-provider system packages on page 104</a> <a href="#">show extension-provider system packages detail on page 105</a> <a href="#">show extension-provider system packages interface on page 105</a>
<b>Output Fields</b>	For a description of the output fields, see . Output fields are listed in the approximate order in which they appear.

Field Name	Field Description	Level of Detail
<b>interface</b>	Name of the interface.  In the <b>brief</b> output, <b>interface</b> is the only named field, but it is followed by a line or lines, each with the following information: the name of a package and the contents and version of the package.	all
<b>Information for</b>	Name of the package.	<b>detail</b>
<b>Comment</b>	Contents and version of the package.	<b>detail</b>
<b>Description</b>	Description of package including contents and copyright information.	<b>detail</b>
<b>Software version</b>	Software version of package.	<b>detail</b>

## Sample Output

### show extension-provider system packages

```
user@host> show extension-provider system packages
```

```

Interface: ms-0/0/0
jmpsdk          JUNOS MPSDK Base OS boot [9.2R1.3]
jnx-flow-data-pic JUNOS SDK JNX-FLOW Dataplane Component [9.2I20080801_1059]
Interface: ms-0/2/0
jmpsdk          JUNOS MPSDK Base OS boot [9.2R1.3]

```

### show extension-provider system packages detail

```

user@host> show extension-provider system packages detail
Interface: ms-0/0/0
Information for jmpsdk:
Comment:
JUNOS MPSDK Base OS boot [9.2R1.3]
Description:
JUNOS MPSDK Base OS
Copyright (c) 1996-2008, Juniper Networks, Inc.
All rights reserved.
Software version:      9.2R1.3
This package contains the MPSDK base operating system components.
Information for jnx-flow-data-pic:
Comment:
JUNOS SDK JNX-FLOW Dataplane Component [9.2I20080801_1059]
Description:
JUNOS SDK JNX-FLOW Data Component Package
Copyright (c) 1996-2008, Juniper Networks, Inc.
All rights reserved.
Software version:      9.2I20080801_1059
This package contains SDK JNX-FLOW dataplane component
Interface: ms-0/2/0
Information for jmpsdk:
Comment:
JUNOS MPSDK Base OS boot [9.2R1.3]
Description:
JUNOS MPSDK Base OS
Copyright (c) 1996-2008, Juniper Networks, Inc.
All rights reserved.
Software version:      9.2R1.3
This package contains the MPSDK base operating system components.

```

### show extension-provider system packages interface

```

user@host> show extension-provider system packages interface ms-0/2/0
Interface: ms-0/2/0
jmpsdk          JUNOS MPSDK Base OS boot [9.2R1.3]

```

## show extension-provider system processes

---

<b>Syntax</b>	show extension-provider system processes <brief   detail   extensive> <interface> <wide>
<b>Release Information</b>	Command introduced in Junos OS Release 9.1.
<b>Description</b>	Show system process table on the extension provider PIC.
<b>Options</b>	<b>brief   detail   extensive</b> —(Optional) Display the specified level of output.  <b>interface</b> —(Optional) Name of the extension provider interface.  <b>wide</b> —(Optional) Display information even if it is wider than 80 columns.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>• <a href="#">Verifying the Execution Status of System Processes on page 91</a></li></ul>
<b>List of Sample Output</b>	<a href="#">show extension-provider system processes on page 106</a> <a href="#">show extension-provider system processes brief on page 107</a> <a href="#">show extension-provider system processes detail on page 107</a> <a href="#">show extension-provider system processes extensive on page 108</a> <a href="#">show extension-provider system processes interface on page 109</a> <a href="#">show extension-provider system processes wide on page 109</a> <a href="#">show extension-provider system processes wide detail on page 109</a>
<b>Output Fields</b>	For a description of the output fields, see the output fields table for the <b>show system processes</b> command in the <i>Junos System Basics and Services Command Reference</i> .

## Sample Output

### show extension-provider system processes

```
user@host> show extension-provider system processes
```

```
Interface: ms-0/0/0
```

PID	TT	STAT	TIME	COMMAND
0	??	WLS	0:00.00	[swapper]
1	??	SLs	0:00.75	/sbin/init --
2	??	DL	0:05.91	[g_event]
3	??	DL	0:03.96	[g_up]
4	??	DL	0:04.24	[g_down]
5	??	DL	0:00.00	[kqueue taskq]
6	??	DL	0:00.00	[thread taskq]
9	??	DL	0:00.15	[pagedaemon]
10	??	DL	0:00.00	[ktrace]
11	??	RL	0:00.00	[idle: cpu31]
12	??	RL	0:00.00	[idle: cpu30]
13	??	RL	0:00.00	[idle: cpu29]

```

14 ?? RL 0:00.13 [idle: cpu28]
15 ?? RL 0:00.00 [idle: cpu27]
16 ?? RL 0:00.00 [idle: cpu26]
17 ?? RL 0:00.00 [idle: cpu25]
18 ?? RL 0:00.13 [idle: cpu24]
19 ?? RL 0:00.00 [idle: cpu23]
20 ?? RL 0:00.00 [idle: cpu22]
21 ?? RL 0:00.00 [idle: cpu21]
22 ?? RL 0:00.13 [idle: cpu20]
23 ?? RL 0:00.00 [idle: cpu19]
24 ?? RL 0:00.00 [idle: cpu18]
25 ?? RL 0:00.00 [idle: cpu17]
26 ?? RL 0:00.13 [idle: cpu16]
27 ?? RL 0:00.00 [idle: cpu15]
28 ?? RL 0:00.00 [idle: cpu14]
29 ?? RL 0:29.15 [idle: cpu13]
30 ?? RL 443:15.66 [idle: cpu12]
31 ?? RL 0:29.15 [idle: cpu11]
32 ?? RL 0:29.14 [idle: cpu10]
. . .

```

### show extension-provider system processes brief

```

user@host> show extension-provider system processes brief
Interface: ms-0/0/0
last pid: 20238; load averages: 11.64, 11.71, 11.74 up 0+07:24:28 22:23:18
91 processes: 45 running, 34 sleeping, 12 waiting
Mem: 8924K Active, 1768K Inact, 152M Wired, 156K Cache, 77M Buf, 200M Free
Swap:
Interface: ms-0/2/0
last pid: 13025; load averages: 4.16, 4.08, 4.02 up 0+04:43:20 22:23:18
88 processes: 37 running, 32 sleeping, 19 waiting
Mem: 6488K Active, 1212K Inact, 156M Wired, 24K Cache, 75M Buf, 460M Free
Swap:

```

### show extension-provider system processes detail

```

user@host> show extension-provider system processes detail
Interface: ms-0/0/0

```

PID	UID	PPID	CPU	PRI	NI	RSS	WCHAN	STARTED	TT	STAT	TIME	COMMAND
20	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
21	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
22	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.13	[idle: cp
28	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
15	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
19	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
11	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
12	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
13	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
16	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
17	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
18	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.13	[idle: cp
26	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.13	[idle: cp
68	0	0	0	-16	0	8	-	2:59PM	??	RL	0:00.00	[pot: cpu
70	0	0	0	-16	0	8	-	2:59PM	??	RL	0:00.00	[poller:
14	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.13	[idle: cp
24	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
25	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
27	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp
69	0	0	0	-16	0	8	-	2:59PM	??	RL	0:00.00	[poller:
23	0	0	0	171	0	8	-	2:59PM	??	RL	0:00.00	[idle: cp

```

30      0      0      0 171 0      8 -      2:59PM ?? RL 444:58.30 [idle: cp
259     0      1      0 139 0     840 -      2:59PM ?? R 3111:46.43 /opt/sdk/

120     0      1      0 139 0     652 select 2:59PM ?? Ss 154:48.02 syslogd -
142     0      1      0   8 0     1132 wait 2:59PM ?? S 122:57.26 /usr/sbin
20287   0     142      0 109 0     1100 -      10:24PM ?? R 0:00.08 /bin/ps -
0       0      0      0 -16 0      0 -      2:59PM ?? WLS 0:00.00 [swapper]
1       0      0      0   8 0     1152 wait 2:59PM ?? SLs 0:00.75 /sbin/ini
. . .

```

## show extension-provider system processes extensive

```

user@host> show extension-provider system processes extensive
Interface: ms-0/0/0
last pid: 20384; load averages: 11.51, 11.63, 11.69 up 0+07:27:42 22:26:32
91 processes: 45 running, 34 sleeping, 12 waiting
Mem: 8924K Active, 1784K Inact, 152M Wired, 156K Cache, 77M Buf, 200M Free
Swap:
  PID USERNAME  THR PRI NICE   SIZE    RES STATE  C  TIME  WCPU COMMAND
  259 root        8 139   0   643M   840K CPU13  d 52.1H 658.40% jnx-flow-data

  22 root         1 171  52    OK    8K CPU20  14 0:00 99.22% idle: cpu20
  21 root         1 171  52    OK    8K CPU21  0 0:00 99.22% idle: cpu21
  20 root         1 171  52    OK    8K CPU22  0 0:00 99.22% idle: cpu22
  15 root         1 171  52    OK    8K CPU27  0 0:00 98.49% idle: cpu27
  19 root         1 171  52    OK    8K CPU23  0 0:00 97.71% idle: cpu23
  28 root         1 171  52    OK    8K CPU14  0 0:00 97.71% idle: cpu14
  18 root         1 171  52    OK    8K CPU24  18 0:00 96.97% idle: cpu24
  26 root         1 171  52    OK    8K CPU16  10 0:00 96.97% idle: cpu16
  70 root         1 -16   0    OK    8K CPU8   0 0:00 96.97% poller: cpu8
  68 root         1 -16   0    OK    8K CPU1   0 0:00 96.97% pot: cpu1
  25 root         1 171  52    OK    8K CPU17  0 0:00 96.97% idle: cpu17
  17 root         1 171  52    OK    8K CPU25  0 0:00 96.97% idle: cpu25
  13 root         1 171  52    OK    8K CPU29  0 0:00 96.97% idle: cpu29
  12 root         1 171  52    OK    8K CPU30  0 0:00 96.97% idle: cpu30
  11 root         1 171  52    OK    8K CPU31  0 0:00 96.97% idle: cpu31
  16 root         1 171  52    OK    8K CPU26  0 0:00 96.97% idle: cpu26
  14 root         1 171  52    OK    8K CPU28  1c 0:00 96.24% idle: cpu28
Interface: ms-0/2/0
last pid: 13175; load averages: 4.00, 4.04, 4.00 up 0+04:46:34 22:26:32
88 processes: 37 running, 32 sleeping, 19 waiting
Mem: 6488K Active, 1228K Inact, 156M Wired, 24K Cache, 75M Buf, 460M Free
Swap:
  PID USERNAME  THR PRI NICE   SIZE    RES STATE  C  TIME  WCPU COMMAND
  12 root         1 171  52    OK    8K CPU30  0 0:00 98.49% idle: cpu30
  23 root         1 171  52    OK    8K CPU19  0 0:00 98.49% idle: cpu19
  20 root         1 171  52    OK    8K CPU22  0 0:00 98.49% idle: cpu22
  21 root         1 171  52    OK    8K CPU21  0 0:00 98.49% idle: cpu21
  75 root         1 -16   0    OK    8K CPU16  4 0:00 97.71% poller: cpu16
  76 root         1 -16   0    OK    8K CPU20  4 0:00 97.71% poller: cpu20
  13 root         1 171  52    OK    8K CPU29  0 0:00 97.71% idle: cpu29
  14 root         1 171  52    OK    8K CPU28  1c 0:00 96.24% idle: cpu28
  77 root         1 -16   0    OK    8K CPU24  4 0:00 96.24% poller: cpu24
  16 root         1 171  52    OK    8K CPU26  0 0:00 96.24% idle: cpu26
  11 root         1 171  52    OK    8K CPU31  0 0:00 96.24% idle: cpu31
  24 root         1 171  52    OK    8K CPU18  0 0:00 96.24% idle: cpu18
  25 root         1 171  52    OK    8K CPU17  0 0:00 96.24% idle: cpu17
  17 root         1 171  52    OK    8K CPU25  0 0:00 96.24% idle: cpu25
  19 root         1 171  52    OK    8K CPU23  0 0:00 96.24% idle: cpu23
  29 root         1 171  52    OK    8K CPU13  d 284:04 93.95% idle: cpu13

```

```

30 root          1 171  52    OK    8K CPU12  c 284:05 92.48% idle: cpu12
33 root          1 171  52    OK    8K CPU9   9 283:52 92.48% idle: cpu9

```

### show extension-provider system processes interface

The output for the **show extension-provider system processes interface** command is identical to that for the **show extension-provider system processes** command except that the output for the former is for the specified interface only and the output for the latter is for all ms interfaces. For sample output, see [show extension-provider system processes](#) on page 106.

### show extension-provider system processes wide

```
user@host> show extension-provider system processes wide
```

```

Interface: ms-1/0/0
  PID  TT  STAT      TIME PROVIDER  COMMAND
    0  ??  Wls    0:00.00 (null)  [swapper]
    1  ??  SLs    0:00.83      /sbin/init --
    2  ??  DL    0:24.86      [g_event]
    3  ??  DL    0:24.52      [g_up]
    4  ??  DL    0:24.38      [g_down]
    5  ??  DL    0:00.00      [thread taskq]
    6  ??  DL    0:00.00      [kqueue taskq]
    9  ??  DL    0:00.53      [pagedaemon]
   10  ??  DL    0:00.00      [ktrace]
   11  ??  RL    0:00.00      [idle: cpu31]
   12  ??  RL    0:00.00      [idle: cpu30]
   13  ??  RL    0:00.00      [idle: cpu29]
   14  ??  RL    0:00.17      [idle: cpu28]
   15  ??  RL    0:00.00      [idle: cpu27]
   16  ??  RL    0:00.00      [idle: cpu26]
   17  ??  RL    0:00.00      [idle: cpu25]
   18  ??  RL    0:00.17      [idle: cpu24]
   19  ??  RL    0:00.00      [idle: cpu23]
   20  ??  RL    0:00.00      [idle: cpu22]
   21  ??  RL    0:00.00      [idle: cpu21]
   22  ??  RL    0:00.17      [idle: cpu20]
   23  ??  RL    0:00.00      [idle: cpu19]
  ...

```

### show extension-provider system processes wide detail

```
user@host> show extension-provider system processes wide detail
```

```

Interface: ms-0/2/0
  PID  UID  PPID  CPU  PRI  NI  RSS  WCHAN  STARTED  TT  STAT  TIME  COMMAND  PROVIDER
   12   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu30]
   20   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu22]
   23   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu19]
   21   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu21]
   25   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu17]
   11   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu31]
   13   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu29]
   14   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.36  [idle: cpu28]
   16   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu26]
   17   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu25]
   19   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu23]
   24   0   0    0  171   0    8  -   5:40PM  ??  RL   0:00.00  [idle: cpu18]
   75   0   0    0  -16   0    8  -   5:40PM  ??  RL   0:00.00  [poller: cpu16]

```

```

76 0 0 0 -16 0 8 - 5:40PM ?? RL 0:00.00 [poller: cpu20]
77 0 0 0 -16 0 8 - 5:40PM ?? RL 0:00.00 [poller: cpu24]
29 0 0 0 171 0 8 - 5:40PM ?? RL 288:22.84 [idle: cpu13]
15 0 0 0 171 0 8 - 5:40PM ?? RL 0:00.00 [idle: cpu27]
74 0 0 0 -16 0 8 - 5:40PM ?? RL 0:00.00 [pot: cpu1]
33 0 0 0 171 0 8 - 5:40PM ?? RL 288:47.94 [idle: cpu9]
30 0 0 0 171 0 8 - 5:40PM ?? RL 287:07.79 [idle: cpu12]
34 0 0 0 171 0 8 - 5:40PM ?? RL 288:57.04 [idle: cpu8]
37 0 0 0 171 0 8 - 5:40PM ?? RL 288:01.05 [idle: cpu5]
38 0 0 0 171 0 8 - 5:40PM ?? RL 285:08.89 [idle: cpu4]
42 0 0 0 171 0 8 - 5:40PM ?? RL 281:47.55 [idle: cpu0]
0 0 0 0 -16 0 0 - 5:40PM ?? WLS 0:00.00 [swapper] null)
1 0 0 0 8 0 1144 wait 5:40PM ?? SLs 0:00.58 /sbin/init -
...

```



## show extension-provider system uptime

<b>Syntax</b>	show extension-provider system uptime <interface>
<b>Release Information</b>	Command introduced in Junos OS Release 9.1.
<b>Description</b>	Show uptime on the extension provider PIC.
<b>Options</b>	<b>interface</b> —(Optional) Name of the extension provider interface.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">Verifying the Execution Status of System Processes on page 91</a></li> </ul>
<b>List of Sample Output</b>	<a href="#">show extension-provider system uptime on page 111</a> <a href="#">show extension-provider system uptime interface on page 111</a>
<b>Output Fields</b>	For a description of the output fields, see the output fields table for the <b>show system uptime</b> command in the <i>Junos System Basics and Services Command Reference</i> .

## Sample Output

### show extension-provider system uptime

```
user@host> show extension-provider system uptime
Interface: ms-0/0/0
  5:08PM up 26 mins, 0 users, load averages: 0.09, 0.06, 0.04
Interface: ms-0/2/0
  5:08PM up 26 mins, 0 users, load averages: 0.15, 0.03, 0.01
```

### show extension-provider system uptime interface

```
user@host> show extension-provider system uptime interface ms-0/2/0
Interface: ms-0/2/0
  5:08PM up 26 mins, 0 users, load averages: 0.15, 0.03, 0.01
```

## show extension-provider system virtual-memory

<b>Syntax</b>	show extension-provider system virtual-memory <interface>
<b>Release Information</b>	Command introduced in Junos OS Release 9.1.
<b>Description</b>	Show kernel dynamic memory usage on the extension provider PIC. Display the usage of Junos kernel memory listed first by size of allocation and then by type of usage.
<b>Options</b>	<b>interface</b> —(Optional) Name of the extension provider interface.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">Verifying the Execution Status of System Processes on page 91</a></li> </ul>
<b>List of Sample Output</b>	<a href="#">show extension-provider system virtual-memory on page 112</a> <a href="#">show extension-provider system virtual-memory interface on page 113</a>
<b>Output Fields</b>	For a description of the output fields, see <a href="#">Table 5 on page 112</a> . Output fields are listed in the approximate order in which they appear.

**Table 5: show extension-provider system virtual-memory Output Fields**

Field	Field Description
Size (unlabeled)	Memory block size in bytes.
Type(s) (unlabeled)	Kernel modules that are using the memory blocks. For a definition of each type, see a FreeBSD book.
<b>interrupt</b>	Type of interrupt: <ul style="list-style-type: none"> <li>• <b>total</b>—Total number of interrupts for each type.</li> <li>• <b>rate</b>—Interrupt rate.</li> </ul>
<b>Total</b>	Total of all interrupts.

## Sample Output

### show extension-provider system virtual-memory

```

user@host> show extension-provider system virtual-memory
Interface: ms-0/0/0
  916976 cpu context switches
193097320 device interrupts
  43468 software interrupts
    0 traps
  199882 system calls
    78 kernel threads created
    2416 fork() calls

```

```

0 vfork() calls
0 rfork() calls
0 swap pager pageins
0 swap pager pages paged in
0 swap pager pageouts
0 swap pager pages paged out
1307 vnode pager pageins
1307 vnode pager pages paged in
0 vnode pager pageouts
0 vnode pager pages paged out
0 page daemon wakeups
0 pages examined by the page daemon
454 pages reactivated
54109 copy-on-write faults
11 copy-on-write optimized faults
65858 zero fill pages zeroed
65190 zero fill pages prezeroed
10 intransit blocking page faults
206484 total VM faults taken
0 pages affected by kernel thread creation
102942 pages affected by fork()
0 pages affected by vfork()
0 pages affected by rfork()
144325 pages freed
0 pages freed by daemon
102373 pages freed by exiting processes
1749 pages active
317 pages inactive
28 pages in VM cache
38743 pages wired down
51895 pages free
4096 bytes per page
0 swap pages used
0 peak swap pages used
109540 total name lookups
cache hits (86% pos + 12% neg) system 0% per-directory
deletions 0%, falsehits 0%, toolong 0%
interrupt          total          rate
clock              177515903      59689
Total              177515903      59689

```

#### show extension-provider system virtual-memory interface

```

user@host> show extension-provider system virtual-memory interface ms-0/2/0
Interface: ms-0/2/0
6971866 cpu context switches
757808764 device interrupts
101858 software interrupts
0 traps
1129382 system calls
80 kernel threads created
15764 fork() calls
0 vfork() calls
0 rfork() calls
0 swap pager pageins
0 swap pager pages paged in
0 swap pager pageouts
0 swap pager pages paged out
1212 vnode pager pageins
1212 vnode pager pages paged in
0 vnode pager pageouts

```

```

    0 vnode pager pages paged out
    0 page daemon wakeups
    0 pages examined by the page daemon
    420 pages reactivated
354621 copy-on-write faults
    0 copy-on-write optimized faults
430183 zero fill pages zeroed
424776 zero fill pages prezeroed
    1434 intransit blocking page faults
1332189 total VM faults taken
    0 pages affected by kernel thread creation
648103 pages affected by fork()
    0 pages affected by vfork()
    0 pages affected by rfork()
892030 pages freed
    0 pages freed by daemon
673820 pages freed by exiting processes
    1604 pages active
    309 pages inactive
    6 pages in VM cache
39994 pages wired down
117802 pages free
    4096 bytes per page
    0 swap pages used
    0 peak swap pages used
702497 total name lookups
    cache hits (86% pos + 13% neg) system 0% per-directory
    deletions 0%, falsehits 0%, toolong 0%
interrupt          total      rate
clock              987886798    47811
Total              987886798    47811
```

## CHAPTER 13

# Resource Information Commands

- `show system processes health`
- `show system processes providers`
- `show system processes resource-limits process-name`
- `show system resource-cleanup processes`

## show system processes health

<b>Syntax</b>	show system processes health <process-name <i>name</i>   pid <i>pid</i> >
<b>Release Information</b>	Command introduced in Junos OS Release 8.5.
<b>Description</b>	Display the resource utilization (health), of all the Junos applications currently running. You can display health information about one specific process by specifying either the process name or the process ID (PID).
<b>Options</b>	<p><b>process-name <i>name</i></b>—(Optional) Display health information about the process identified by the process name.</p> <p><b>pid <i>pid</i></b>—(Optional) Display health information about the process identified by the PID.</p>
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">Verifying the Execution Status of System Processes on page 91</a></li> <li>• <a href="#">traceoptions (Process Monitor) on page 74</a></li> <li>• <a href="#">process-monitor on page 65</a></li> </ul>
<b>List of Sample Output</b>	<a href="#">show system processes health on page 117</a> <a href="#">show system processes health pid on page 118</a> <a href="#">show system processes health process-name on page 118</a>
<b>Output Fields</b>	For a description of the output fields, see <a href="#">Table 6 on page 116</a> . Output fields are listed in the approximate order in which they appear.

**Table 6: show system processes health Output Fields**

Field Name	Field Description
<b>PID</b>	Process ID, a number that identifies the process.
<b>Provider</b>	Provider prefix. A string that identifies the provider of the Junos application.
<b>Parent process</b>	Process ID of the process that spawned the process in question.
<b>Child processes</b>	Process ID of the process that is launched from the process in question: <ul style="list-style-type: none"> <li>• Process ID for child process—A number that identifies the child process.</li> <li>• Name of child process—A string that identifies the child process.</li> </ul>
<b>CPU accumulated</b>	Maximum amount of CPU time that can be accumulated.

Table 6: show system processes health Output Fields (*continued*)

Field Name	Field Description
<b>Heartbeat</b>	<p>A regular signal sent from a router to indicate that the router is up and running:</p> <ul style="list-style-type: none"> <li>• <b>Interval</b>—Number of seconds between heartbeats.</li> <li>• <b>Allowed misses</b>—Number of missed heartbeats allowed before the application restarts.</li> <li>• <b>Last seen</b>—Time in seconds when the last heartbeat occurred.</li> <li>• <b>Total misses</b>—Number of heartbeats missed so far.</li> </ul>
<b>Resource utilization</b>	<p>How memory is divided:</p> <ul style="list-style-type: none"> <li>• <b>Area</b>—Segment of memory.</li> <li>• <b>Current</b>—Current size of memory segment.</li> <li>• <b>Max. allowed</b>—Maximum size allowed for memory segment.</li> <li>• <b>data size</b>—Current and maximum sizes of data segment.</li> <li>• <b>open files</b>—Number of currently open files and the maximum allowed.</li> <li>• <b>resident set size</b>—Current and maximum size of resident set segment.</li> <li>• <b>shared memory size</b>—The amount of shared memory the process is using.</li> <li>• <b>stack size</b>—Current and maximum sizes of stack segment.</li> </ul>

## Sample Output

### show system processes health

```

user@host> show system processes health
PID: 10075 (jnx-flow-mgmt)
Provider: jnx
Parent process: 1 (init)
CPU accumulated: 0 seconds
Resource utilization:
  Area          Current  Max. allowed
  data size     7KB      32MB
  open files    20       64
  resident set size 12KB    24MB
  shared memory size 4KB
  stack size    2KB      8MB
PID: 420 (jnx-exampled)
Provider: jnx
Parent process: 1 (init)
Child processes: 1
  PID  Process name
  421  jnx-exampled
CPU accumulated: 21 seconds
Heartbeat:
  Interval: 1s
  Allowed misses: 5
  Last seen: 1s ago (0 missed)
  Total misses: 2
Resource utilization:
  Area          Current  Max. allowed
  data size     24KB    16MB
  open files    23      128

```

resident set size	1532KB	24MB
shared memory size	43KB	
stack size	8KB	8MB

#### **show system processes health pid**

The output for the **show system processes health pid *pid*** command is identical to that for the **show system processes health** command except that health information is displayed for only the process specified by the PID. For sample output, see [show system processes health on page 117](#).

#### **show system processes health process-name**

The output for the **show system processes health *process-name*** name command is identical to that for the **show system processes health** command except that health information is displayed for only the process named. For sample output, see [show system processes health on page 117](#).



## show system processes providers

<b>Syntax</b>	show system processes providers
<b>Release Information</b>	Command introduced in Junos OS Release 8.5.
<b>Description</b>	Display information about software processes that are running on the router. The output is similar to that of the <b>show system processes extensive</b> command, but this command displays only provider processes (that is, only external processes). Also, this command's output has an extra column labeled <b>PROVIDER</b> to display the provider prefix.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">providers on page 66</a></li> </ul>
<b>List of Sample Output</b>	<a href="#">show system processes providers on page 119</a>
<b>Output Fields</b>	For a description of the output fields, see the output fields table for the <b>show system processes</b> command in the <i>Junos System Basics and Services Command Reference</i> . This table explains all the fields except for <b>PROVIDER</b> which is for the string that is the provider prefix for the Junos application running the process.

## Sample Output

### show system processes providers

```

user@host> show system processes providers
last pid: 7014; load averages:  0.19,  0.09,  0.05  up 0+00:57:29   12:54:45
54 processes:  1 running, 53 sleeping
Mem: 101M Active, 105M Inact, 31M Wired, 132M Cache, 69M Buf, 369M Free
Swap: 1536M Total, 1536M Free
  PID USERNAME PROVIDER PRI NICE  SIZE   RES STATE   TIME  WCPU COMMAND
  7001 root      jnx       96   0 3240K 2700K select   0:00  0.00% jnx-exampled

```

## show system processes resource-limits process-name

<b>Syntax</b>	show system processes resource-limits process-name <i>process-ui-name</i>
<b>Release Information</b>	Command introduced in Junos OS Release 9.6.
<b>Description</b>	Display the resource limits of a process in a Junos applications package.
<b>Options</b>	<i>process-ui-name</i> —Name of the program or process.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">Displaying Resource Limits on page 13</a></li> <li>• <a href="#">resource-limits on page 68</a></li> <li>• <a href="#">Restricting Resource Limits on page 11</a></li> </ul>
<b>List of Sample Output</b>	<a href="#">show system processes resource-limits process-name on page 121</a> <a href="#">show system processes resource-limits process-name brief on page 121</a> <a href="#">show system processes resource-limits process-name detail on page 121</a>
<b>Output Fields</b>	For a description of the output fields, see <a href="#">Table 7 on page 120</a> . Output fields are listed in the approximate order in which they appear.

**Table 7: show system processes resource-limits process-name Output Fields**

Field Name	Field Description
<b>Provider-ID</b>	Process ID, a number that identifies the process.
<b>Provider-prefix</b>	Provider prefix. A string that identifies the provider of the Junos application.
<b>Area</b>	Segment of memory.
<b>Max. allowed</b>	Current value of the limits applied in the kernel (effective limit).
<b>Max. configurable</b>	Maximum value the administrator can set for the limit in the configuration.
<b>cpu/priority</b>	Highest priority number (nice level) process can run at.
<b>cpu/time</b>	Maximum amount of CPU time that can be accumulated.
<b>file/core-size</b>	Maximum size of a core file that can be created.
<b>file/open</b>	Maximum number of simultaneous open files.

**Table 7: show system processes resource-limits process-name Output Fields (continued)**

Field Name	Field Description
<b>file/size</b>	Maximum size of a file that can be created.
<b>memory/data size</b>	Maximum size of data segment.
<b>memory/locked-in</b>	Maximum number of bytes that can be locked into memory.
<b>memory/resident set size</b>	Maximum size of resident set.
<b>memory/stack size</b>	Maximum size of stack segment.
<b>memory/socket-buffers</b>	Maximum amount of physical memory that may be dedicated to the socket buffers.

## Sample Output

### show system processes resource-limits process-name

```
user@host> show system processes resource-limits process-name jnx-example-service
Resource Limits
Area                Max. allowed  Max. configurable
cpu/priority         10            10
file/open            16            64
memory/data-size     32MB          32MB
memory/locked-in     16MB          16MB
memory/resident-set-size 8MB          24MB
memory/stack-size    4MB           8MB
```

### show system processes resource-limits process-name brief

The output for the **show system processes resource-limits process-name jnx-example-service brief** command is the same as for the **show system processes resource-limits process-name jnx-example-service** command.

### show system processes resource-limits process-name detail

```
user@host> show system processes resource-limits process-name jnx-example-service detail
Provider-ID: 0x8000
Provider-prefix: jnx

Resource Limits
Area                Max. allowed  Max. configurable
cpu/priority         10            10
cpu/time             unlimited     unlimited
file/size            unlimited     unlimited
file/open            16            64
file/core-size       unlimited     unlimited
memory/data-size     32MB          32MB
memory/locked-in     16MB          16MB
memory/resident-set-size 8MB          24MB
memory/stack-size    4MB           8MB
```

memory/socket-buffers

unlimited

unlimited

## show system resource-cleanup processes

<b>Syntax</b>	show system resource-cleanup processes <detail> <pid <i>number</i> > <process-name <i>name</i> >
<b>Release Information</b>	Command introduced in Junos OS Release 9.3. Command introduced in Junos OS Release 11.1 for the QFX Series.
<b>Description</b>	Display the list of processes that have been registered for resource cleanup services.
<b>Options</b>	<p><b>detail</b>—(Optional) Display the list of processes that have been registered for resource cleanup services, along with the resources that have been requested for cleanup.</p> <p><b>pid <i>number</i></b>—(Optional) Display a process that has been registered for resource cleanup services by specifying the Process Identifier number.</p> <p><b>process-name <i>name</i></b>—(Optional) Display a process that has been registered for resource cleanup services by name of the process.</p>
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">resource-cleanup on page 67</a></li> <li>• <a href="#">traceoptions (Resource Cleanup) on page 76</a></li> </ul>
<b>List of Sample Output</b>	<a href="#">show system resource-cleanup processes on page 123</a> <a href="#">show system resource-cleanup processes detail on page 124</a>
<b>Output Fields</b>	For a description of the output fields, see <a href="#">Table 8 on page 123</a> . Output fields are listed in the approximate order in which they appear.

**Table 8: show system resource-cleanup processes Output Fields**

Field Name	Field Description
<b>PID</b>	Process ID, a number that identifies a process.
<b>Process name</b>	String that identifies the process.
<b>Resources to clean</b>	Resources that have been registered to be cleaned up.

## Sample Output

### show system resource-cleanup processes

```

user@host> show system resource-cleanup processes
PID      Process name      Resources to clean
420      jnx-exampld       GENCFG, SYSV shared memory

```

**show system resource-cleanup processes detail**

```
user@host> show system resource-cleanup processes detail
PID      Process name      Resources to clean
420      jnx-exampld        GENCFG blob major ID 0x8000, minor ID 0x0000
          SYSV shared memory ID 65536, key 1108955839
          SYSV shared memory ID 65537, key 1108955837
```

## CHAPTER 14

# JDAF Commands

- request jdaf clear statistics service (cmd | config | firewall | interface | route) client
- request jdaf clear statistics service (cmd | config | firewall | interface | route) server
- show jdaf service (cmd | config | firewall | interface | route) clients
- show jdaf service (cmd | config | firewall | interface | route) statistics client
- show jdaf service (cmd | config | firewall | interface | route) statistics server

## request jdaf clear statistics service (cmd | config | firewall | interface | route) client

<b>Syntax</b>	request jdaf clear statistics service (cmd   config   firewall   interface   route) client < <i>client-id</i> >
<b>Release Information</b>	Command introduced in Junos OS Release 14.2.
<b>Description</b>	Clear JDAF client side statistics for either command, configuration, firewall, interface, or route service.
<b>Options</b>	<i>client-id</i> —Identifier for client.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>•</li></ul>



## request jdaf clear statistics service (cmd | config | firewall | interface | route) server

<b>Syntax</b>	request jdaf clear statistics service (cmd   config   firewall   interface   route) server
<b>Release Information</b>	Command introduced in Junos OS Release 14.2.
<b>Description</b>	Clear JDAF server statistics for either command, configuration, firewall, interface, or route service.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"><li>•</li></ul>

## show jdaf service (cmd | config | firewall | interface | route) clients

<b>Syntax</b>	show jdaf service (cmd   config   firewall   interface   route) clients
<b>Release Information</b>	Command introduced in Junos OS Release 14.2.
<b>Description</b>	Display client state.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	<ul style="list-style-type: none"> <li>• <a href="#">Configuring the Juniper Distributed Application Framework on page 17</a></li> <li>• <a href="#">jdaf on page 58</a></li> </ul>
<b>List of Sample Output</b>	<a href="#">show jdaf service cmd clients on page 128</a> <a href="#">show jdaf service config clients on page 128</a> <a href="#">show jdaf service firewall clients on page 128</a> <a href="#">show jdaf service Interface clients on page 129</a> <a href="#">show jdaf service route clients on page 129</a>
<b>Output Fields</b>	For a description of the output fields, see <a href="#">Table 9 on page 128</a> . Output fields are listed in the approximate order in which they appear.

**Table 9: show jdaf service route clients Output Fields**

Field Name	Field Description
Client-id	Client ID.
State	State, as in active or inactive.
URL	The URL contains three pieces of information: protocol (TCP), IP address, and port number.

## Sample Output

### show jdaf service cmd clients

```
user@host> show jdaf service cmd clients
Client-id  State      URL
7          active    tcp://192.88.88.42:61614
8          active    tcp://192.88.88.42:62109
```

### show jdaf service config clients

```
user@host> show jdaf service config clients
Client-id  State      URL
1          active    tcp://192.88.88.42:59019
```

### show jdaf service firewall clients

```
user@host> show jdaf service firewall clients
```

Client-id	State	URL
14	active	tcp://10.102.43.179:37955

#### show jdaf service Interface clients

```
user@host> show jdaf service interface clients
```

Client-id	State	URL
2	active	tcp://10.102.43.179:48951

#### show jdaf service route clients

```
user@host> show jdaf service route clients
```

Client-id	State	URL
28	active	tcp://199.2.2.10:38269

## show jdaf service (cmd | config | firewall | interface | route) statistics client

<b>Syntax</b>	show jdaf service (cmd   config   firewall   interface   route) statistics client <client-id>
<b>Release Information</b>	Command introduced in Junos OS Release 14.2.
<b>Description</b>	Display JDAF message statistics.
<b>Options</b>	client <i>client-id</i> —(Optional) The client connection you want to view statistics for.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	•
<b>List of Sample Output</b>	<a href="#">show jdaf service route statistics client on page 134</a>
<b>Output Fields</b>	For a description of the output fields, see <a href="#">Table 10 on page 130</a> . Output fields are listed in the approximate order in which they appear.

**Table 10: show jdaf service route statistics client Output Fields**

Field Name	Field Description
rx-bytes	Bytes received.
tx-bytes	Bytes transmitted.
rx-queued	Queued bytes.
rx-msgs	Number of received messages.
rx-errors	Number of errors received messages.
tx-msgs	Number of transmitted messages.
tx-errors	Number of errors during transmitted messages.

Table 10: show jdaf service route statistics client Output Fields (*continued*)

Field Name	Field Description
	<p>For each RPC, the following statistics are shown:</p> <ul style="list-style-type: none"><li>• Requests</li><li>• Successes</li><li>• Failures</li></ul>

Table 10: show jdaf service route statistics client Output Fields (*continued*)

Field Name	Field Description
<b>Name</b>  This section lists different remote procedure calls (RPCs) depending on the JDAF service:	
cmd <ul style="list-style-type: none"> <li>• CmdRegister</li> <li>• CmdUnregister</li> <li>• CmdShowRequest</li> <li>• CmdShowResponse</li> </ul>	
config <ul style="list-style-type: none"> <li>• CnfRegister</li> <li>• CnfUnregister</li> <li>• CnfRequest</li> <li>• CnfCSNRequest</li> </ul>	
firewall <ul style="list-style-type: none"> <li>• AddFilter</li> <li>• DeleteFilter</li> <li>• ChangeFilter</li> <li>• AttachFilter</li> <li>• DetachFilter</li> <li>• AddPolicer</li> <li>• DeletePolicer</li> <li>• ReplacePolicer</li> <li>• BulkModeStart</li> <li>• BulkModeEnd</li> <li>• GetStatistics</li> <li>• ClearStatistics</li> </ul>	
interface <ul style="list-style-type: none"> <li>• IfdGetNext</li> <li>• IfdSubscribeToChange</li> <li>• IfdGetByIdx</li> <li>• IfdGetBySnmplIdx</li> <li>• IfdGetByName</li> <li>• IflGetNext</li> <li>• IflSubscribeToChange</li> <li>• IflGetByIdx</li> <li>• IflGetBySnmplIdx</li> <li>• IflGetByName</li> <li>• IfffGetNext</li> <li>• IfffSubscribeToChange</li> <li>• IfffGetByIdx</li> <li>• IfffGetByName</li> <li>• IffaGetNext</li> </ul>	

Table 10: show jdaf service route statistics client Output Fields (*continued*)

Field Name	Field Description
<ul style="list-style-type: none"> <li>IfaSubscribeToChange</li> <li>IfaGetByLocalAddr</li> <li>IfaGetAllIPv6GlobalAddrs</li> <li>IfaGetIPv6LinkLocalAddr</li> <li>RouteTablesGetNext</li> <li>RouteTablesSubscribeToChange</li> <li>RouteEntriesGetNext</li> <li>RouteEntriesSubnetGetNext</li> <li>RouteGetLongestMatch</li> <li>RouteGetOutputIfI</li> <li>RouteSubscribeToChange</li> <li>RouteUnsubscribeToChange</li> <li>RouteAddLong</li> <li>RouteDeleteLong</li> <li>TrafficStatsGetByIfdName</li> <li>TrafficStatsGetByIfdIndex</li> <li>TrafficStatsGetByIfdSnmpIndex</li> <li>TrafficStatsGetAbsByIfdName</li> <li>TrafficStatsGetAbsByIfdIndex</li> <li>TrafficStatsGetAbsByIfdSnmpIndex</li> <li>TrafficStatsGetLocalByIfIName</li> <li>TrafficStatsGetLocalByIfIIndex</li> <li>TrafficStatsGetLocalByIfISnmpIndex</li> <li>TrafficStatsGetAbsLocalByIfIName</li> <li>TrafficStatsGetAbsLocalByIfIIndex</li> <li>TrafficStatsGetAbsLocalByIfISnmpIndex</li> <li>TrafficStatsGetRemoteByIfIName</li> <li>TrafficStatsGetRemoteByIfIIndex</li> <li>TrafficStatsGetRemoteByIfISnmpIndex</li> <li>TrafficStatsGetAbsRemoteByIfIName</li> <li>TrafficStatsGetAbsRemoteByIfIIndex</li> <li>TrafficStatsGetAbsRemoteByIfISnmpIndex</li> <li>ErrorStatsGetByIfdName</li> <li>ErrorStatsGetByIfdIndex</li> <li>ErrorStatsGetByIfdSnmpIndex</li> <li>ErrorStatsGetAbsByIfdName</li> <li>ErrorStatsGetAbsByIfdIndex</li> <li>ErrorStatsGetAbsByIfdSnmpIndex</li> </ul>	
route	
<ul style="list-style-type: none"> <li>TableLookup</li> <li>RouteLookup</li> <li>RouteAdd</li> <li>RouteDelete</li> </ul>	

## Sample Output

### show jdaf service route statistics client

```
user@host> show jdaf service route statistics client client-id
Client-id: 1
rx-bytes: 164  tx-bytes: 159  tx-queued: 0
rx-msgs: 3     rx-errors: 0   tx-msgs: 2   tx-errors: 0
```

Name	Requests	Successes	Failures
TableLookup	1	1	0
RouteLookup	0	0	0
RouteAdd	1	1	0
RouteDelete	0	0	0



## show jdaf service (cmd | config | firewall | interface | route) statistics server

<b>Syntax</b>	show jdaf service (cmd   config   firewall   interface   route) statistics server
<b>Release Information</b>	Command introduced in Junos OS Release 14.2.
<b>Description</b>	Show JDAF server side statistics.
<b>Required Privilege Level</b>	view
<b>Related Documentation</b>	•
<b>List of Sample Output</b>	<a href="#">show jdaf service cmd statistics server on page 135</a> <a href="#">show jdaf service config statistics server on page 136</a> <a href="#">show jdaf service firewall statistics server on page 136</a> <a href="#">show jdaf service interface statistics server on page 136</a> <a href="#">show jdaf service route statistics server on page 136</a>
<b>Output Fields</b>	For a description of the output fields, see <a href="#">Table 11 on page 135</a> . Output fields are listed in the approximate order in which they appear.

**Table 11: show jdaf service statistics server Output Fields**

Field Name	Field Description
<b>Requests</b>	Number of requests. This is further broken down to the following categories: <ul style="list-style-type: none"> <li>• <b>Accepts</b>—Number of (cmd   config   firewall   interface   route) requests accepted.</li> <li>• <b>Rejects</b>—Number of (cmd   config   firewall   interface   route) requests rejected.</li> <li>• <b>Errors</b>—Number of (cmd   config   firewall   interface   route) requests returned with an error.</li> </ul>
<b>Routing-Instance-Id</b>	Routing instance where JDAF service is running. This is broken down to the following categories: <ul style="list-style-type: none"> <li>• <b>Accepts</b>—Number of (cmd   config   firewall   interface   route) requests accepted.</li> <li>• <b>Errors</b>—Number of (cmd   config   firewall   interface   route) requests returned with an error.</li> </ul>

## Sample Output

### show jdaf service cmd statistics server

```

user@host> show jdaf service cmd statistics server
Requests      Accepts      Rejects      Errors
4             4            0            0
Routing-Instance-Id  Accepts      Errors
0                4            0

```

**show jdaf service config statistics server**

```
user@host> show jdaf service config statistics server
Requests      Accepts      Rejects      Errors
1             1             0             0
Routing-Instance-Id  Accepts      Errors
0             1             0
```

**show jdaf service firewall statistics server**

```
user@host> show jdaf service firewall statistics server
Requests      Accepts      Rejects      Errors
14            14            0             0
Routing-Instance-Id  Accepts      Errors
0             14            0
```

**show jdaf service interface statistics server**

```
user@host> show jdaf service interface statistics server
Requests      Accepts      Rejects      Errors
2             2             0             0
Routing-Instance-Id  Accepts      Errors
0             2             0
```

**show jdaf service route statistics server**

```
user@host> show jdaf service route statistics server
Requests      Accepts      Rejects      Errors
0             0             0             0
Routing-Instance-Id  Accepts      Errors
0             0             0
```

## PART 4

# Index

- [Index on page 139](#)



# Index

## Symbols

#, comments in configuration statements.....	xv
( ), in syntax descriptions.....	xv
< >, in syntax descriptions.....	xv
[ ], in configuration statements.....	xv
{ }, in configuration statements.....	xv
(pipe), in syntax descriptions.....	xv

## A

applications	
defined.....	3
deployment.....	81
applications configuration	
overview.....	3

## B

braces, in configuration statements.....	xv
brackets	
angle, in syntax descriptions.....	xv
square, in configuration statements.....	xv

## C

certificate	
enabling.....	81
comments, in configuration statements.....	xv
configuration mode commands.....	33, 34
control-cores statement.....	50
usage guidelines.....	20
conventions	
text and syntax.....	xiv
curly braces, in configuration statements.....	xv
customer support.....	xvi
contacting JTAC.....	xvi

## D

data-cores statement.....	50
usage guidelines.....	20
data-flow-affinity statement.....	51
usage guidelines.....	22
destination statement.....	52

documentation	
comments on.....	xv

## E

extension package-name (show   delete) command	
usage guidelines.....	34
extension package-name show command	
usage guidelines.....	44
extension-provider statement.....	53
usage guidelines.....	25
extension-service statement.....	55
usage guidelines.....	39, 40
extensions statement.....	54
usage guidelines.....	81

## F

font conventions.....	xiv
forwarding-db-size statement.....	56
usage guidelines.....	24

## H

hash-key statement.....	57
usage guidelines.....	22

## J

jdaf .....	17
jdaf statement.....	58

## L

Level I policy.....	11
Level II policy.....	11
Level III policy.....	11
Level IV policy	
usage guidelines.....	11, 32
license-type statement.....	59
usage guidelines.....	81

## M

manifest file.....	11
manuals	
comments on.....	xv
Multiservices PIC	
configuring control and data cores.....	20
configuring data flow affinity.....	22
configuring forwarding database.....	24
configuring object cache.....	24
configuring packages on the PIC.....	21
configuring policy database.....	24
configuring syslog.....	25

## O

object-cache-size statement.....	60
usage guidelines.....	24

## P

package statement	
loading on PIC.....	61
resource limits.....	62
usage guidelines	
loading on PIC.....	21
resource limits.....	11, 32
packages	
application, installed on PIC.....	21
parentheses, in syntax descriptions.....	xv
pmond See process health monitor	
policy levels.....	11
and inheriting limits.....	43
and manifest file.....	11
and roles.....	11
Level I through Level III.....	11
Level IV.....	11, 32
policy-db-size statement.....	63
usage guidelines.....	24
process health monitor.....	91
process statement.....	11, 32, 64
process-monitor statement.....	65
usage guidelines.....	91
provider	
defined.....	3
providers statement.....	66
usage guidelines.....	81

## R

request jdaf clear statistics service client	
command.....	126
request jdaf clear statistics service sever	
command.....	127
resource limits	
displaying.....	13, 31, 89
example.....	43
resource-cleanup statement.....	67
usage guidelines.....	36, 90
resource-limits statement.....	68
usage guidelines.....	11, 32
resources	
cleaning up.....	36, 90
monitoring.....	91
resources statement.....	70
routing-instances statement.....	71

## S

service order	
configuring.....	40
service sets	
configuring.....	40
service-order statement.....	72
usage guidelines.....	40
show extension-provider system connections	
command.....	100
show extension-provider system packages	
command.....	104
show extension-provider system processes	
command.....	106
show extension-provider system uptime	
command.....	111
show extension-provider system virtual-memory	
command.....	112
show jdaf service clients command.....	128
show jdaf service statistics client command.....	130
show jdaf service statistics server command.....	135
show system processes health command.....	116
show system processes providers command.....	119
show system processes resource-limits	
process-name command.....	120
example.....	43
usage guidelines.....	13, 31, 89
show system resource-cleanup processes	
command.....	123
show system statistics command.....	123
show   display detail command	
usage guidelines.....	33
support, technical See technical support	
syntax conventions.....	xiv
syslog statement.....	73
usage guidelines.....	25

## T

technical support	
contacting JTAC.....	xvi
traceoptions statement	
process monitor.....	74
resource cleanup.....	76
usage guidelines	
process monitor.....	91
resource cleanup.....	36, 90
traffic sampling	
in Junos applications.....	39

**U**

user cores.....20

**W**

wired-process-mem-size statement.....78

