



---

Junos<sup>®</sup> OS

# Installation and Upgrade Guide

Release  
12.3



---

Published: 2012-12-20

Juniper Networks, Inc.  
1194 North Mathilda Avenue  
Sunnyvale, California 94089  
USA  
408-745-2000  
[www.juniper.net](http://www.juniper.net)

This product includes the Envoy SNMP Engine, developed by Epilogue Technology, an Integrated Systems Company. Copyright © 1986-1997, Epilogue Technology Corporation. All rights reserved. This program and its documentation were developed at private expense, and no part of them is in the public domain.

This product includes memory allocation software developed by Mark Moraes, copyright © 1988, 1989, 1993, University of Toronto.

This product includes FreeBSD software developed by the University of California, Berkeley, and its contributors. All of the documentation and software included in the 4.4BSD and 4.4BSD-Lite Releases is copyrighted by the Regents of the University of California. Copyright © 1979, 1980, 1983, 1986, 1988, 1989, 1991, 1992, 1993, 1994. The Regents of the University of California. All rights reserved.

GateD software copyright © 1995, the Regents of the University. All rights reserved. Gate Daemon was originated and developed through release 3.0 by Cornell University and its collaborators. Gated is based on Kirton's EGP, UC Berkeley's routing daemon (routed), and DCN's HELLO routing protocol. Development of Gated has been supported in part by the National Science Foundation. Portions of the GateD software copyright © 1988, Regents of the University of California. All rights reserved. Portions of the GateD software copyright © 1991, D. L. S. Associates.

This product includes software developed by Maker Communications, Inc., copyright © 1996, 1997, Maker Communications, Inc.

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.

Products made or sold by Juniper Networks or components thereof might be covered by one or more of the following patents that are owned by or licensed to Juniper Networks: U.S. Patent Nos. 5,473,599, 5,905,725, 5,909,440, 6,192,051, 6,333,650, 6,359,479, 6,406,312, 6,429,706, 6,459,579, 6,493,347, 6,538,518, 6,538,899, 6,552,918, 6,567,902, 6,578,186, and 6,590,785.

### *Junos® OS Installation and Upgrade Guide*

12.3

Copyright © 2012, 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 . . . . .	xv
	Self-Help Online Tools and Resources . . . . .	xv
	Opening a Case with JTAC . . . . .	xvi
<b>Part 1</b>	<b>Overview</b>	
<b>Chapter 1</b>	<b>Software Overview . . . . .</b>	<b>3</b>
	Junos OS Overview . . . . .	3
	One Operating System . . . . .	3
	One Software Release . . . . .	4
	One Modular Software Architecture . . . . .	4
	Software Naming Convention . . . . .	4
	Junos OS Editions . . . . .	5
	FIPS 140-2 Security Compliance . . . . .	5
	Junos OS Installation Packages . . . . .	6
	Installation Media . . . . .	6
	Installation Bundles . . . . .	7
	Installation Modules . . . . .	7
	Junos OS Release Numbers . . . . .	8
	Junos OS Feature Licenses . . . . .	9
	Software Package Information Security . . . . .	10
	Configuration Files . . . . .	10
	Configuration File Selection Sequence . . . . .	10
	Remote Storage of Configuration Files . . . . .	11
	Automatic Installation of Configuration Files (ACX Series Routers, J Series Routers and SRX Services Gateway) . . . . .	11
	ACX Series Autoinstallation Overview . . . . .	12
	J Series Automatic Installation Overview . . . . .	12
	SRX Services Gateway Automatic Installation Overview . . . . .	13

<b>Chapter 2</b>	<b>Installation Overview . . . . .</b>	<b>15</b>
	Installation Type Overview . . . . .	15
	Standard Installation . . . . .	15
	Category Change Installation . . . . .	15
	Recovery Installation . . . . .	16
	Installation Categories on the ACX Series, M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus Routers . . . . .	16
	Installation Categories on the J Series Routers . . . . .	17
	Verifying PIC Combinations . . . . .	17
<b>Chapter 3</b>	<b>Hardware Overview . . . . .</b>	<b>19</b>
	Hardware Architecture Overview . . . . .	19
	Hardware Overview (ACX Series, M Series, MX Series, T Series, and TX Matrix Routers) . . . . .	20
	System Memory . . . . .	21
	Storage Media . . . . .	22
	Hardware Overview (J Series Routers) . . . . .	23
	System Memory . . . . .	23
	Storage Media . . . . .	24
	Routing Engines and Storage Media Names (ACX Series, M Series, MX Series, PTX Series, T Series, TX Matrix, TX Matrix Plus, and JCS 1200 Routers) . . . . .	24
	Routing Engines and Storage Media Names (J Series Routers) . . . . .	26
	Boot Sequence (M Series, MX Series, T Series, TX Matrix, TX Matrix Plus, and PTX Series Routing Engines) . . . . .	26
	Boot Sequence (ACX Series Routers) . . . . .	28
	Boot Sequence (J Series Routers) . . . . .	28
<b>Part 2</b>	<b>Installation and Upgrade</b>	
<b>Chapter 4</b>	<b>Standard or Change Category Installation . . . . .</b>	<b>31</b>
	Checking the Current Configuration and Candidate Software Compatibility . . . . .	31
	Determining the Junos OS Version . . . . .	32
	Downloading Software . . . . .	32
	Downloading Software with a Browser . . . . .	32
	Downloading Software Using the Command-Line Interface . . . . .	33
	Connecting to the Console Port . . . . .	34
	Backing Up the Current Installation (M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus Routers) . . . . .	34
	Backing Up the Current Installation (J Series Routers and SRX Services Gateway) . . . . .	35
	Installing the Software Package on a Router with a Single Routing Engine . . . . .	35
	Installing the Software Package on a Router with Redundant Routing Engines . . . . .	37
	Preparing the Router for the Installation . . . . .	37
	Installing Software on the Backup Routing Engine . . . . .	38
	Installing Software on the Master Routing Engine . . . . .	39
	Finalizing the Installation . . . . .	41
	Repartitioning System Storage To Increase the Swap Partition . . . . .	42

<b>Chapter 5</b>	<b>Software Upgrade</b> .....	<b>45</b>
	Upgrading Software Packages .....	45
	Upgrading to 64-bit Junos OS .....	48
	Upgrading Routers Using ISSU .....	51
<b>Chapter 6</b>	<b>Recovery Installation</b> .....	<b>53</b>
	Creating an Emergency Boot Device .....	53
	Saving a Rescue Configuration File .....	54
	Performing a Recovery Installation .....	55
	Creating a New Configuration on a Single Routing Engine .....	56
	Log In to the Router Console .....	56
	Configure Administration User Accounts .....	57
	Add the Management Console to the Network .....	57
	Commit Changes .....	58
	Configure Administration User Accounts .....	61
	Creating a New Configuration with Redundant Routing Engines .....	61
	Configure Administration User Accounts .....	61
	Set Up Routing Engine Configuration Groups .....	62
	Complete the Management Console Configuration .....	64
	Commit and Synchronize Changes .....	64
	Restoring a Saved Configuration .....	66
	Copy Saved Files to the Router .....	66
	Load and Commit the Configuration File .....	67
<b>Part 3</b>	<b>Software Licenses</b>	
<b>Chapter 7</b>	<b>Overview</b> .....	<b>71</b>
	Junos OS Feature Licenses .....	71
	License Enforcement .....	71
	Junos OS License Keys .....	72
	Licensable Ports on MX5, MX10, and MX40 Routers .....	72
	Software Feature Licenses .....	74
	Software Features That Require Licenses on M Series, MX Series, and T Series Routers .....	74
	Software Features That Require Licenses on M Series Routers Only .....	77
	Software Features That Require Licenses on MX Series Routers Only .....	78
	Software Features That Require Licenses on J Series Routers and SRX Services Gateway .....	81
	Software Features That Require Licenses on EX Series Switches .....	81
	Software Features That Require Licenses on the QFX Series .....	83
<b>Chapter 8</b>	<b>Managing Licenses</b> .....	<b>85</b>
	Adding New Licenses (CLI Procedure) .....	85
	Deleting a License (CLI Procedure) .....	86
	Saving License Keys .....	87
	Verifying Junos OS License Installation .....	88
	Displaying Installed Licenses .....	88
	Displaying License Usage .....	89

Part 4	Index	
	Index .....	93

# List of Figures

<b>Part 1</b>	<b>Overview</b>	
<b>Chapter 1</b>	<b>Software Overview</b> .....	<b>3</b>
	Figure 1: Configuration Selection Sequence .....	10
<b>Chapter 3</b>	<b>Hardware Overview</b> .....	<b>19</b>
	Figure 2: Routing Engines .....	21
	Figure 3: J Series Routers (J4300 Shown) .....	23
<b>Part 2</b>	<b>Installation and Upgrade</b>	
<b>Chapter 5</b>	<b>Software Upgrade</b> .....	<b>45</b>
	Figure 4: Upgrading to the 64-bit Junos OS with Dual Routing Engines .....	49
	Figure 5: Upgrading to the 64-bit Junos OS with a Single Routing Engine (Master in Either Slot) .....	50
	Figure 6: Upgrading to the 64-bit Junos OS with a Single Routing Engine (Master Must Be in Slot 0) .....	51





# List of Tables

	<b>About the Documentation</b> . . . . .	<b>xi</b>
	Table 1: Notice Icons . . . . .	xiii
	Table 2: Text and Syntax Conventions . . . . .	xiv
<b>Part 1</b>	<b>Overview</b>	
<b>Chapter 1</b>	<b>Software Overview</b> . . . . .	<b>3</b>
	Table 3: Autoinstallation Support . . . . .	11
<b>Chapter 3</b>	<b>Hardware Overview</b> . . . . .	<b>19</b>
	Table 4: Routing Engines and Storage Media Names (ACX Series, M Series, MX Series, T Series, TX Matrix, TX Matrix Plus, and JCS 1200 Routers) . . . . .	24
	Table 5: Routing Engines and Storage Media Names (J Series Routers) . . . . .	26
<b>Part 3</b>	<b>Software Licenses</b>	
<b>Chapter 7</b>	<b>Overview</b> . . . . .	<b>71</b>
	Table 6: Upgrade Licenses for Enhancing Port Capacity . . . . .	73
	Table 7: Junos OS Feature License Model Number for M Series, MX Series, and T Series Routers . . . . .	74
	Table 8: Junos OS Feature License Model Number for M Series Routers . . . . .	77
	Table 9: Junos OS Feature License Model Number for MX Series Routers . . . . .	78
	Table 10: Junos OS Feature License Model Number for J Series and SRX Series Devices . . . . .	81
	Table 11: Junos OS Enhanced Feature License (EFL) and Advanced Feature License (AFL) Model Number for EX Series Devices . . . . .	82
	Table 12: Junos OS Feature Licenses and Model Numbers for QFX Series Devices . . . . .	84



# 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 xv

## 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:

- ACX Series
- M Series
- MX Series
- T Series
- J Series
- EX Series
- PTX Series
- QFX Series
- SRX 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 xiii defines notice icons used in this guide.

Table 1: Notice Icons

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

Table 2 on page 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 book 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 System Basics Configuration 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>
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 [edit protocols <b>ospf area area-id</b>] hierarchy level.</li> <li>The console port is labeled <b>CONSOLE</b>.</li> </ul>
< > (angle brackets)	Enclose optional keywords or variables.	<b>stub</b> <default-metric <i>metric</i> >;
(pipe symbol)	Indicates a choice between the mutually exclusive keywords or variables on either side of the symbol. The set of choices is often enclosed in parentheses for clarity.	<b>broadcast</b>   <b>multicast</b>  ( <i>string1</i>   <i>string2</i>   <i>string3</i> )
# (pound sign)	Indicates a comment specified on the same line as the configuration statement to which it applies.	<b>rsvp { # Required for dynamic MPLS only</b>
[ ] (square brackets)	Enclose a variable for which you can substitute one or more values.	<b>community name members</b> [ <i>community-ids</i> ]
Indentation and braces ( { } )	Identify a level in the configuration hierarchy.	[edit] routing-options { static { route default { nexthop <i>address</i> ; retain; } } }
;(semicolon)	Identifies a leaf statement at a configuration hierarchy level.	

---

#### J-Web GUI Conventions

---

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

Convention	Description	Examples
<b>Bold text like this</b>	Represents J-Web 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 J-Web 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 send your comments to [techpubs-comments@juniper.net](mailto:techpubs-comments@juniper.net), or fill out the documentation feedback form at <https://www.juniper.net/cgi-bin/docbugreport/>. If you are using e-mail, be sure to include the following information with your comments:

- Document or topic name
- URL or page number
- Software release 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: <https://www.juniper.net/alerts/>
- Join and participate in the Juniper Networks Community Forum: <http://www.juniper.net/company/communities/>
- Open a case online in the CSC Case Management tool: <http://www.juniper.net/cm/>

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

## 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](#)
- [Installation Overview on page 15](#)
- [Hardware Overview on page 19](#)



## CHAPTER 1

# Software Overview

- [Junos OS Overview on page 3](#)
- [Software Naming Convention on page 4](#)
- [Junos OS Editions on page 5](#)
- [FIPS 140-2 Security Compliance on page 5](#)
- [Junos OS Installation Packages on page 6](#)
- [Installation Media on page 6](#)
- [Installation Bundles on page 7](#)
- [Installation Modules on page 7](#)
- [Junos OS Release Numbers on page 8](#)
- [Junos OS Feature Licenses on page 9](#)
- [Software Package Information Security on page 10](#)
- [Configuration Files on page 10](#)
- [Automatic Installation of Configuration Files \(ACX Series Routers, J Series Routers and SRX Services Gateway\) on page 11](#)

## Junos OS Overview

---

Juniper Networks provides high-performance network devices that create a responsive and trusted environment for accelerating the deployment of services and applications over a single network. The Junos<sup>®</sup> operating system (Junos OS) is the foundation of these high-performance networks. Unlike other complex, monolithic software architectures, Junos OS incorporates key design and developmental differences to deliver increased network availability, operational efficiency, and flexibility. The key advantages to this approach are:

- [One Operating System on page 3](#)
- [One Software Release on page 4](#)
- [One Modular Software Architecture on page 4](#)

## One Operating System

Unlike other network operating systems that share a common name but splinter into many different programs, Junos OS is a single, cohesive operating system that is shared

across all network devices and product lines. This allows Juniper Networks engineers to develop software features once and share these features across all product lines simultaneously. Because features are common to a single source, they generally are implemented the same way for all product lines, thus reducing the training required to learn different tools and methods for each product. Because all Juniper Networks products use the same code base, interoperability between products is not an issue.

## One Software Release

Each new version of Junos OS is released concurrently for all product lines following a preset quarterly schedule. Furthermore, each new version of software must include all working features released in previous releases of the software, and must have no critical regression errors. This discipline ensures reliable operations for the entire release.

## One Modular Software Architecture

Although individual modules of Junos OS communicate through well-defined interfaces, each module runs in its own protected memory space, preventing one module from disrupting another. This separation enables the independent restart of each module as necessary. This is in contrast to monolithic operating systems where a malfunction in one module can ripple to other modules and cause a full system crash or restart. This modular architecture then provides for high performance, high availability, security, and device scalability not found in other operating systems.

The Junos OS is preinstalled on your Juniper Networks device when you receive it from the factory. Thus, when you first power on the device, all software starts automatically. You simply need to configure the software so that the device can participate in the network.

You can upgrade the device software as new features are added or software problems are fixed. You normally obtain new software by downloading the software installation packages from the Juniper Networks Support Web page onto your device or onto another system on your local network. You then install the software upgrade onto the device.

Juniper Networks routing platforms run only binaries supplied by Juniper Networks, and currently do not support third-party binaries. Each Junos OS image includes a digitally signed manifest of executables that are registered with the system only if the signature can be validated. Junos OS will not execute any binary without a registered signature. This feature protects the system against unauthorized software and activity that might compromise the integrity of your device.

- Related Documentation**
- [Junos OS Editions on page 5](#)
  - [Junos OS Installation Packages on page 6](#)

---

## Software Naming Convention

All Junos OS conforms to the following naming convention:

*package-release-edition-cfxxx-signed.comp*

For example:

`jinstall-9.2R1.8-domestic-signed.tgz`

where:

- **package** is the name of the Junos OS package. For 64-bit Junos OS, the package name is **package64**.
- **cfxxx** designates the CompactFlash card size to use with the software. This value is optional.
- **signed** means that the software includes a digital signature for verification purposes. This value is not used with all software packages.

## Junos OS Editions

---

Junos OS is released in the following editions:

- Domestic—Junos OS for customers in the United States and Canada, and for all other customers with a valid encryption agreement. This edition includes high-encryption capabilities such as ipsec and ssh for data leaving the router or switch.
- Export—Junos OS for all other customers. This edition does not include any high-encryption capabilities for data leaving the router or switch.
- Junos-FIPS—Junos OS that provides advanced network security for customers who need software tools to configure a network of Juniper Networks routers and switches in a Federal Information Processing Standards (FIPS) 140-2 environment. For more information about Junos-FIPS, see [“FIPS 140-2 Security Compliance” on page 5](#).

## FIPS 140-2 Security Compliance

---

For advanced network security, a special version of Junos OS, called Junos-FIPS 140-2, is available. Junos-FIPS 140-2 provides customers with software tools to configure a network of Juniper Networks devices in a FIPS environment. FIPS support includes:

- Upgrade package to convert Junos OS to Junos-FIPS 140-2
- Revised installation and configuration procedures
- Enforced security for remote access
- FIPS user roles (Crypto Officer, User, and Maintenance)
- FIPS-specific system logging and error messages
- IPsec configuration for Routing Engine-to-Routing Engine communication
- Enhanced password creation and encryption

Junos-FIPS has special installation and configuration requirements. Installation procedures include downloading the FIPS software package from [www.juniper.net](http://www.juniper.net). For detailed guidelines on how installation and configuration procedures differ between Junos OS and Junos-FIPS 140-2, see the [Secure Configuration Guide for Common Criteria and Junos-FIPS](#).



**NOTE:** Junos-FIPS has special password requirements. FIPS passwords must be between 10 and 20 characters in length. Passwords must use at least three of the five defined character sets (uppercase letters, lowercase letters, digits, punctuation marks, and other special characters). If Junos-FIPS is installed on the device, you cannot configure passwords unless they meet this standard.

## Junos OS Installation Packages

The installation package is used to upgrade and downgrade from one release to another. When installed, the installation package completely reinstalls the software, rebuilds the Junos OS file system, and may erase system logs and other auxiliary information from the previous installation. The installation package does, however, retain the configuration files from the previous installation.

The following installation packages are available for download:

Installation Package	Description
<b>jinstall*</b>	Junos OS for the ACX Series, M Series, MX Series, T Series, TX Matrix, TX Matrix Plus routers, and PTX Series Packet Transport Switches.
<b>jinstall-ex*</b>	Junos OS for the EX Series Ethernet Switch portfolio.
<b>junos-jsr*</b>	Junos OS for the J Series routers.
<b>junos-juniper*</b>	Junos-FIPS for the M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus routers.  Once the package is installed on a device, you cannot revert back to the standard Junos OS installation without performing a software recovery procedure.
<b>jinstall64*</b>	64-bit Junos OS for the JCS1200 Route Reflector.

## Installation Media

The installation media is used to recover a device from a software failure. The installation media repartitions the media and completely reinstalls Junos OS. No information from previous installations is retained during this installation. Thus, an initial configuration is required before the device can be put back into service. For more information about creating an initial configuration, see the *Getting Started Guide* for your device.



**NOTE:** Once you have rebuilt a device using the installation media, access to the device is restricted to the console port until the management port is configured during the initial configuration.

The following installation media files are available for download:

Installation Media	Description
<b>floppy1-&lt;release&gt;*</b> <b>floppy2-&lt;release&gt;*</b>	Junos OS for the M40 router when you use the LS-120 external drive.
<b>install-media*</b>	Junos OS for the ACX Series, M Series, MX Series, T Series, PTX Series Packet Transport Switches, TX Matrix, and TX Matrix Plus routers.
<b>junos-jsr-&lt;release&gt;-export-cf&lt;size&gt;.gz</b>	Junos OS for the J Series routers. You must select the correct installation media file that corresponds to the correct CompactFlash card you are using.

## Installation Bundles

The installation bundle can be used to downgrade or upgrade Junos OS between minor revisions (from Release 9.1 to Release 9.2, for example). When used, the installation bundle modifies only the files required for the upgrade or downgrade between versions.



**NOTE:** You should only use the installation bundle under direction of a Juniper Networks support representative.

The following installation bundle files are available for download:

Installation Bundle	Description
<b>jbundle*</b>	Junos OS for the ACX series, M Series, MX Series, T Series, PTX Series Packet Transport Switches, TX Matrix, and TX Matrix Plus routers.

## Installation Modules

Installation modules are used to upgrade individual software modules within the software. For example, you can upgrade only the Routing Engine software by installing the **jroute\*** installation module.



**NOTE:** You should only use installation module files under the direction of a Juniper Networks support representative.

The following installation module files are available for download:

Installation Module	Description
<b>kernel*</b>	The kernel and network tools package. This package contains the basic operating system files.

<b>jbase*</b>	The base package for Junos OS. This package contains additions to the operating system.
<b>jroute*</b>	The Routing Engine package. This package contains the Routing Engine software.
<b>jpfe*</b>	The Packet Forwarding Engine package. This package contains the PFE software.
<b>jdocs*</b>	The documentation package. This package contains the documentation set for the software.
<b>jcrypto*</b>	The encryption package. This package contains the domestic version of the security software.
<b>jweb*</b>	The J-Web package. This package contains the graphical user interface software for M Series, MX Series, T Series, TX Matrix, TX Matrix Plus, and J Series routers.

---

## Junos OS Release Numbers

The Junos OS release number represents a particular revision of the software that runs on a Juniper Networks routing platform, for example, Junos OS Release 8.5, 9.1, or 9.2. Each Junos OS release has certain new features that complement the software processes that support Internet routing protocols, control the device's interfaces and the device chassis itself, and allow device system management. On the Juniper Networks Support Web page, you download Junos OS for a particular Junos OS release number.

The following example shows how the software release number is formatted:

***m.nZb.s***

For example:

**9.2R1.8**

Where:

- *m* is the major release number of the product
- *n* is the minor release number of the product
- *Z* is the type of software release. The following release types are used:
  - *R*—FRS/Maintenance release software
  - *B*—Beta release software
  - *I*—Internal release software: Private software release for verifying fixes



- *S*—Service release software: Released to customers to solve a specific problem—this release will be maintained along with the life span of the underlying release
- *X*—Special (eXception) release software: Released to customers to solve an immediate problem—customers are expected to migrate to a supported release when available
- *b* is the build number of the product
  - if *b*=1: Software is the FRS release
  - if *b*>1: Software is a maintenance release
- *s* is the spin number of the product

**Related  
Documentation**

- [Junos OS Installation Packages on page 6](#)

---

## Junos OS Feature Licenses

Some Junos OS software features require a license to activate the feature. To enable a licensed feature, you need to purchase, install, manage, and verify a license key that corresponds to each licensed feature. To conform to Junos OS feature licensing requirements, you must purchase one license per feature per device. The presence of the appropriate software license key on your device determines whether you are eligible to configure and use the licensed feature.

To speed deployment of licensed features, Junos OS software implements an honor-based licensing structure and provides you with a 30-day grace period to use a licensed feature without a license key installed. The grace period begins when you configure the feature and your device uses the licensed feature for the first time, but not necessarily when you install the license. After the grace period expires, the system generates system log messages saying that the feature requires a license. To clear the error message and use the licensed feature properly, you must install and verify the required license.

For information about how to purchase software licenses, contact your Juniper Networks sales representative.

**Related  
Documentation**

- [License Enforcement on page 71](#)
- [Junos OS License Keys on page 72](#)
- [Software Feature Licenses on page 74](#)
- [Verifying Junos OS License Installation on page 88](#)

## Software Package Information Security

All Junos OS is delivered in signed packages that contain digital signatures, Secure Hash Algorithm (SHA-1), and Message Digest 5 (MD5) checksums. A package is installed only if the checksum within it matches the hash recorded in its corresponding file. Which checksum is used depends on the software version:

- Digital signatures are used when you upgrade or downgrade between Junos OS Release 7.0 and a later version.
- The SHA-1 checksum is used when you upgrade or downgrade between Junos OS Release 6.4 and a later version.
- The MD5 checksum is used when you upgrade or downgrade between Junos OS Release 6.3 or earlier and a later version.

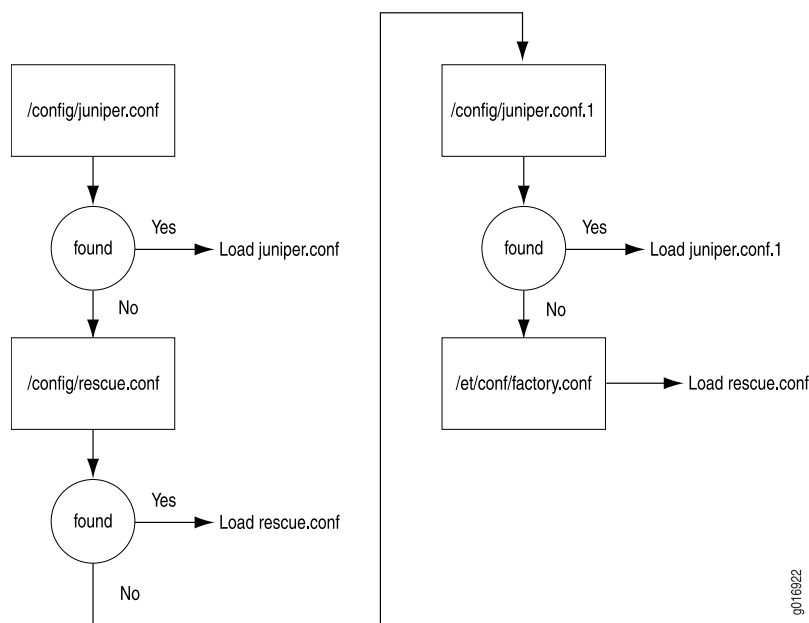
## Configuration Files

All configuration settings for the device are handled in the configuration files on the device. These files are saved in the **/config** directory on the device.

### Configuration File Selection Sequence

During the boot process, the device is configured based on a predefined configuration file. The device selects the configuration file based on the sequence shown in [Figure 1 on page 10](#).

Figure 1: Configuration Selection Sequence



1. **/config/juniper.conf**—Active configuration file.

2. `/config/rescue.conf`—Rescue configuration file. This file is created by the router or switch administrator.
3. `/config/juniper.conf.1`—First rollback configuration.
4. `/etc/config/factory.conf`—Default factory configuration file.

The **factory.conf** file is the initial device configuration file shipped with the system. All configuration settings are returned to the factory default, and access to the device is restricted to the console. For more information about setting up your device from the factory default configuration, see the specific hardware guide for your device.

## Remote Storage of Configuration Files

Configuration files can be stored off the device. This can be helpful if the device encounters a software failure or other problem that forces you to restore the device's software. Once the software is restored, you can then reload the saved configuration file. For more information about restoring Junos OS, see [“Load and Commit the Configuration File” on page 67](#).

When the configuration file is stored off the device, you can encrypt the configuration files using the Data Encryption Standard (DES) encryption algorithm.

## Automatic Installation of Configuration Files (ACX Series Routers, J Series Routers and SRX Services Gateway)

Autoinstallation provides automatic configuration for a new device that you connect to the network and turn on, or for a device configured for autoinstallation.

[Table 3 on page 11](#) lists the autoinstallation support on ACX Series Universal Access routers, SRX Series Secure Services Gateways devices, and J Series Services Routers.

**Table 3: Autoinstallation Support**

Platform	Autoinstallation
SRX100 SRX210 SRX240	Yes
SRX650	Yes
SRX3400 SRX3600 SRX5600 SRX5800	No
J Series Routers	Yes
ACX Series Routers	Yes

## ACX Series Autoinstallation Overview

On ACX Series routers, autoinstallation enables you to deploy multiple routers from a central location in the network. Autoinstallation provides automatic configuration for a new router that you connect to the network and turn on, or for a router configured for autoinstallation. The autoinstallation process begins anytime a router is powered on and cannot locate a valid configuration file in the CompactFlash (CF) card. Typically, a configuration file is unavailable when a router is powered on for the first time, or if the configuration file is deleted from the CF card.

For more information about autoinstallation on the ACX Series, see ACX Series Autoinstallation Overview

## J Series Automatic Installation Overview

On J Series routers, you can specify a remote server where configuration files are located. If a configuration file cannot be found on the router's CompactFlash card, the router automatically retrieves the configuration file from this remote server. For security purposes, you can encrypt these remote files using the DES cipher, and once they have been retrieved, the router decrypts them for use on the server.

To encrypt the files, we recommend the openssl tool. You can get the open SSL tool at: <http://www.openssl.org/>. To encrypt the file, use the following syntax:

```
% openssl enc -des -k passphrase -in original-file -out encrypted-file
```

- ***passphrase***—Passphrase used to encrypt the configuration file. The passphrase should be the name of the file without the path information or file extension.
- ***original-file***—Unencrypted configuration file.
- ***encrypted-file***—Name of the encrypted configuration file.

For example, if you are encrypting the active configuration file **juniper.conf.gz**, the passphrase is **juniper.conf**. The openssl syntax used to encrypt the file is:

```
% openssl enc -des -k juniper.conf -in juniper.conf.gz -out juniper.conf.gz.enc
```

For more information about the automatic installation feature, see the [Junos OS Administration Guide for Security Devices](#).

## SRX Services Gateway Automatic Installation Overview

The autoinstallation process begins any time a services gateway is powered on and cannot locate a valid configuration file in the internal flash. Typically, a configuration file is unavailable when a services gateway is powered on for the first time or if the configuration file is deleted from the internal flash. The autoinstallation feature enables you to deploy multiple services gateways from a central location in the network.

If you are setting up many devices, autoinstallation can help automate the configuration process by loading configuration files onto new or existing devices automatically over the network. You can use either the J-Web configuration editor or the CLI configuration editor to configure a device for autoinstallation.

For the autoinstallation process to work, you must store one or more host-specific or default configuration files on a configuration server in the network and have a service available—typically Dynamic Host Configuration Protocol (DHCP)—to assign an IP address to the services gateway.

Autoinstallation takes place automatically when you connect an Ethernet port on a new services gateway to the network and power on the device. To simplify the process, you can explicitly enable autoinstallation on a device and specify a configuration server, an autoinstallation interface, and a protocol for IP address acquisition.

For more information about the automatic installation feature, see the [Junos OS Administration Guide for Security Devices](#).



## CHAPTER 2

# Installation Overview

- [Installation Type Overview on page 15](#)
- [Installation Categories on the ACX Series, M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus Routers on page 16](#)
- [Installation Categories on the J Series Routers on page 17](#)
- [Verifying PIC Combinations on page 17](#)

## Installation Type Overview

---

The three types of installations used to upgrade or downgrade your routing platform are standard installation, category change, and recovery. The standard installation is the standard method of upgrading and downgrading the software. Use a category change installation when you are moving from one software category to another; for example, if you are changing the device from using the standard Junos OS to the Junos-FIPS category. Perform a recovery installation when the software on the device is damaged or otherwise unable to accommodate a software upgrade or downgrade.

### Standard Installation

A standard installation is the typical method used to upgrade or downgrade software on the server. This method uses the installation package that matches the installation package already installed on the system. For example, you might upgrade an M120 router running Junos OS installed using the **jinstall\*** installation package. If you upgrade the router from Release 9.0R2.10 to Release 9.1R1.8, you use the **jinstall-9.1R1.8-domestic-signed.tgz** installation package. For information on the different installation packages available, see [“Junos OS Installation Packages” on page 6](#).

### Category Change Installation

The category change installation process is used to move from one category of Junos OS to another on the same router; for example, moving from a Junos OS standard installation on an M Series, MX Series, or T Series router to a Junos-FIPS installation. When moving from one installation category to another, you need to be aware of the restrictions regarding this change.



**NOTE:** Juniper Networks does not support using the `request system software rollback` command to restore a different installation category on the device. When installing a different Junos OS category on a device, once the installation is complete, you should execute a `request system snapshot` command to delete the backup installation from the system.

---

## Recovery Installation

A recovery installation is performed to repair a device with damaged software or a condition that prevents the upgrade, downgrade, or change in installation category of the software.

For example, you may need to perform a recovery installation to change a device's software category from Junos-FIPS to standard Junos OS.

## Installation Categories on the ACX Series, M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus Routers

---

The following installation categories are available with the ACX Series, M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus routers:

- Standard Junos OS, domestic—`jinstall-<release>-domestic-signed.tgz`

This software includes high-encryption capabilities for data leaving the router. Because of U.S. government export restrictions, this software can only be installed on systems within the United States and Canada. For all other customers, a valid encryption agreement is required to use this software edition. Furthermore, no router can be shipped out of the United States or Canada without the domestic edition first being overwritten by the export edition. There are no current system-enforced restrictions when you install this software category.

- Standard Junos OS, export—`jinstall-<release>-export-signed.tgz`

This software does not include high-encryption capabilities. It can be installed on any system worldwide. There are no current system-enforced restrictions when you install this software category.

- Junos-FIPS—`junos-juniper-<release>-domestic-signed.tgz` and `junos-juniper-<release>-fips-signed.tgz`

The Junos-FIPS OS base provides customers with the software tools to configure the router for use within a Federal Information Processing Standards (FIPS) environment. Once you have installed this software category onto a router, you cannot install a different software category on the router using the **`request system software add`** command. When attempting to install a different Junos OS category package on the router, you receive the following warning message:

WARNING: Package `jinstall-<release>-<edition>-signed` is not compatible with this system.

WARNING: Please install a supported package (`junos-juniper-*.tgz`).



To return to a standard Junos OS category installation, you must perform a system recovery installation of the software. All configuration files, logs, and other data files on the server are overwritten during a recovery installation.

For more information about Junos-FIPS OS base, see [“FIPS 140-2 Security Compliance” on page 5](#).



**NOTE:** When you install a Junos OS installation package, the previous installation is maintained as a backup installation. You should issue a **request system software snapshot** command to overwrite the backup files any time you change software categories on a router. This is mandatory if the router is to be shipped outside of the United States or Canada after the Export edition of Junos OS has been installed. There are no current system-enforced restrictions when you install this software category.

## Installation Categories on the J Series Routers

The following installation categories are available with the J Series routers:

- Junos OS, domestic—**junos-jsr-<release>-domestic.tgz**

This software includes high-encryption capabilities for data leaving the router. Because of U.S. government export restrictions, this software can only be installed on systems within the United States and Canada. For all other customers, a valid encryption agreement is required to use this software edition. Furthermore, no router can be shipped out of the United States or Canada without the domestic edition first being overwritten by the export edition. There are no current system-enforced restrictions when you install this software category.

- Junos OS, export—**junos-jsr-<release>-export.tgz**

This software does not include high-encryption capabilities. It can be installed on any system worldwide. There are no current system-enforced restrictions when you install this software category.

## Verifying PIC Combinations

On Juniper Networks routing platforms, you can typically install any combination of Physical Interface Cards (PICs) on a single Enhanced Flexible PIC Concentrator (FPC) or in two PIC slots served by a single Layer 2/Layer 3 Packet Processing application-specific integrated circuit (ASIC).

Newer Junos OS services for some PICs can require significant Internet Processor ASIC memory, and some configuration rules limit certain combinations of PICs if they are installed on some platforms.

During software installation, the configuration checker in the installation program checks the router's PICs. If any configuration rules affect your PIC combinations, the installation process stops and displays a message similar to the following:

The combination of PICS in FPC slot 3 is not supported with this release

```
PIC slot 0 -  
PIC slot 1 - 1x OC-12 ATM-II IQ  
PIC slot 2 - 1x G/E IQ, 1000 BASE  
PIC slot 3 - 1x Link Service (4)
```

If you continue the installation, one or more PICs on FPC slot 3 might appear to be online but cannot be enabled and cannot pass traffic with this release of JUNOS. See the Release Notes for more information.

WARNING: This installation attempt will be aborted. If you  
WARNING: wish to force the installation despite these warnings

WARNING: you may use the 'force' option on the command line.

```
pkg_add: package /var/tmp/jbundle-7.6R1.x-domestic-signed.tgz fails requirements  
- not installed
```

The configuration checker has the following limitations:

- If a PIC is offline when you upgrade the router with new software, the configuration checker cannot detect PIC combinations affected by configuration rules and cannot warn about them.
- If you specify the **force** option when you upgrade the Junos OS, the configuration checker warns about the affected PIC combination and the software installation continues. However, after rebooting, one or more PICs might fail to initialize.
- The configuration checker looks for combinations of three affected PICs. If an Enhanced FPC contains four affected PICs, the script generates multiple warnings.

If you install a PIC into a router already running Junos OS, you can identify the presence of affected PIC combinations from messages in the system logging (**syslog**) file:

```
Feb 6 17:57:40 CE1 feb BCHIP 0: uCode overflow - needs 129 inst space to load  
b3_atm2_LSI_decode for stream 12  
Feb 6 17:57:41 CE1 chassisd[2314]: CHASSISD_IFDEV_DETACH_PIC:  
ifdev_detach_pic(0/3)  
Feb 6 17:57:41 CE1 feb BCHIP 0: binding b3_atm2_LSI_decode to stream 12 failed  
Feb 6 17:57:41 CE1 feb PFE: can not bind B3 ucode prog b3_atm2_LSI_decode to FPC  
0: stream 12
```

For more information about checking for unsupported PIC combinations, see the corresponding PIC guide for your router, the [Junos OS Release Notes](#), and *Technical Support Bulletin PSN-2004-12-002, PIC Combination Notes Summary* on the Juniper Networks Support Web site at <http://www.juniper.net/support/>.

## CHAPTER 3

# Hardware Overview

- [Hardware Architecture Overview on page 19](#)
- [Hardware Overview \(ACX Series, M Series, MX Series, T Series, and TX Matrix Routers\) on page 20](#)
- [Hardware Overview \(J Series Routers\) on page 23](#)
- [Routing Engines and Storage Media Names \(ACX Series, M Series, MX Series, PTX Series, T Series, TX Matrix, TX Matrix Plus, and JCS 1200 Routers\) on page 24](#)
- [Routing Engines and Storage Media Names \(J Series Routers\) on page 26](#)
- [Boot Sequence \(M Series, MX Series, T Series, TX Matrix, TX Matrix Plus, and PTX Series Routing Engines \) on page 26](#)
- [Boot Sequence \(ACX Series Routers\) on page 28](#)
- [Boot Sequence \(J Series Routers\) on page 28](#)

## Hardware Architecture Overview

---

Juniper Network routing platforms are made up of two basic routing components:

- **Routing Engine**—The Routing Engine controls the routing updates and system management.
- **Packet Forwarding Engine (PFE)**—The Packet Forwarding Engine performs Layer 2 and Layer 3 packet switching, route lookups, and packet forwarding.

From a system administration perspective, you install the software onto the Routing Engine and during the installation, the appropriate software is forwarded to other components as necessary. Most Routing Engines include a CompactFlash card that stores Junos OS. On M Series Multiservice Edge Routers, MX240, MX480, and MX960 3D Universal Edge Routers, T Series Core Routers, and TX Matrix routers, the system also includes a hard disk or solid-state drive (SSD) that acts as a backup boot drive. PTX Series Packet Transport Switches and the TX Matrix Plus router include a solid state drive as a backup boot drive.



**NOTE:** The MX80 router is a single-board router with a built-in Routing Engine and single Packet Forwarding Engine. On an MX80 router, Junos OS is stored on dual, internal NAND flash devices. These devices provide the same functionality as a CompactFlash card and hard disk or solid-state drive (SSD).



**NOTE:** The ACX Series router is a single board router with a built-in Routing Engine and one Packet Forwarding Engine. The ACX router supports dual-root partitioning, which means that the primary and backup Junos OS images are kept in two independently bootable root partitions. If the primary partition becomes corrupted, the system remains fully functional by booting from the backup Junos OS image located in the other root partition.

On routing platforms with dual Routing Engines, each Routing Engine is independent with regard to upgrading the software. To install new software on both Routing Engines, you need to install the new software on each Routing Engine. On platforms with dual Routing Engines configured for high availability, you can use the unified in-service software upgrade procedure to upgrade the software. For more information about this procedure, see the [Junos OS High Availability Configuration Guide](#).

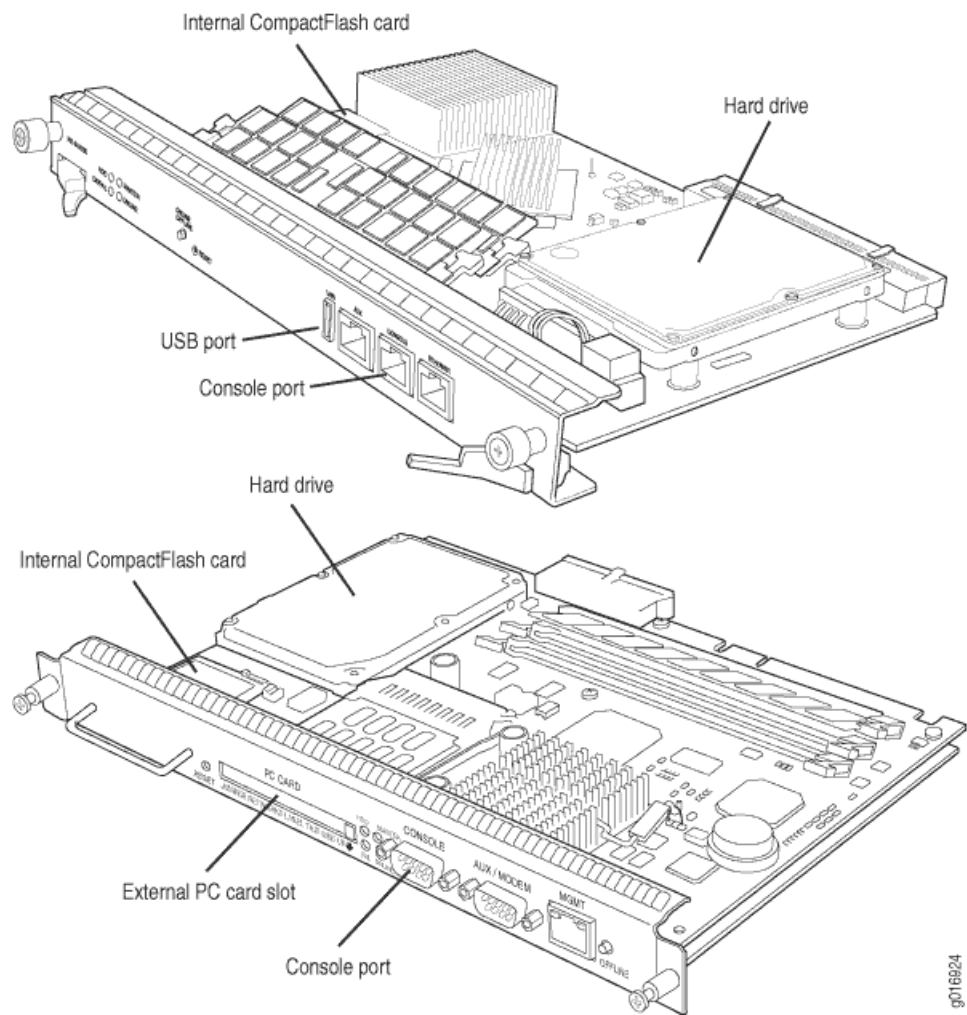
**Related  
Documentation**

- [Dual-Root Partitioning ACX Series Universal Access Routers Overview](#)

## [Hardware Overview \(ACX Series, M Series, MX Series, T Series, and TX Matrix Routers\)](#)

Figure 2 on page 21 shows examples of Routing Engines.

Figure 2: Routing Engines



The ACX Series, M Series, MX Series, PTX Series, T Series, TX Matrix, and TX Matrix Plus routers include the following:

- [System Memory on page 21](#)
- [Storage Media on page 22](#)

## System Memory

Starting with Junos OS Release 9.0, all routing platforms require a minimum of 512 MB of system memory on each Routing Engine. All M7i and M10i routers delivered before December 7, 2007, had 256 MB of memory. These routers require a system memory upgrade before you install Junos OS Release 9.0 or a later release. To determine the amount of memory currently installed on your system, use the **show chassis routing-engine** command in the command-line interface (CLI).

For more information about upgrading your M7i or M10i router, see the Customer Support Center JTAC Technical Bulletin PSN-2007-10-001:

<https://www.juniper.net/alerts/viewalert.jsp?txtAlertNumber=PSN-2007-10-001&actionBtn=Search>.

ACX2000 routers are shipped with 2 GB of memory and ACX1000 routers with 1 GB of memory.

## Storage Media

Except for the ACX Series and MX80 routers, the M Series, MX Series, PTX Series, T Series, TX Matrix, and TX Matrix Plus routers use the following media storage devices:

- CompactFlash card—The CompactFlash card is typically the primary storage device for most routers.



**NOTE:** M7i and M10i routers using RE-400 are not delivered from the factory with the CompactFlash card installed. In this case, the hard disk is the primary and only boot device. The M7i and M10i routers with RE-400 can be upgraded to include the CompactFlash card.

- Hard disk or solid-state drive—For most routers,, a hard disk or solid-state drive is the secondary boot device. When the CompactFlash card is not installed on the router, the hard disk or the solid-state drive becomes the primary boot device. The hard disk or solid-state drive is also used to store system log files and diagnostic dump files.
- Emergency boot device—Depending on the router, the emergency boot device can be a PC card, a USB storage device, or an LS-120 floppy disk.

On MX80 routers, the internal NAND flash devices (first *da0*, then *da1*) act as the primary and secondary boot devices.

On ACX Series routers, the internal NAND flash devices (first *da0s1*, then *da0s2*) act as the primary and secondary boot devices.

Emergency boot devices can be used to revive a routing platform that has a damaged Junos OS. When an emergency boot device is attached to the router, the router attempts to boot from that device before it boots from the CompactFlash card, solid-state drive (SSD), or hard disk.

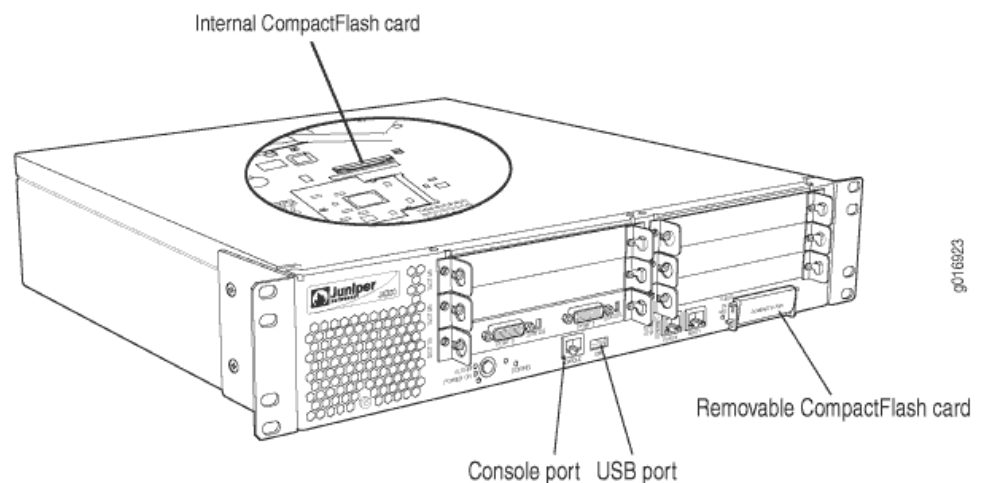
On an ACX Series router, the emergency boot device is a USB storage device.

When booting from an emergency boot device, the router requests a boot acknowledgment on the console interface. If you enter yes, the emergency boot device repartitions the primary boot device and reloads Junos OS onto the primary boot device. After the loading is complete, the routing platform requests that you remove the emergency boot device and reboot the system. After the reboot is complete, you must perform an initial configuration of the router before it can be used on your network.

## Hardware Overview (J Series Routers)

The Junos OS is installed on the internal CompactFlash card. This internal CompactFlash card is the primary and only boot drive on the J Series routers when they are delivered from the factory. All J Series routers have one or more USB ports. The 4300 and 6300 J Series routers also include an external CompactFlash card slot. You can install external storage devices through the USB ports and CompactFlash card slots. When external storage devices are installed, these external devices can be used as backup boot drives. You can also create a backup internal boot drive on any externally attached CompactFlash card. This CompactFlash card can then be used to replace the internal CompactFlash card on the J Series router in the event that the internal card is damaged or otherwise made unusable by the router. [Figure 3 on page 23](#) shows the location of the memory and ports on a J Series router.

**Figure 3: J Series Routers (J4300 Shown)**



The J Series routers include the following:

- [System Memory on page 23](#)
- [Storage Media on page 24](#)

### System Memory

Starting with Junos OS Release 9.1, all J Series routers require a minimum of 512 MB of router memory on each Routing Engine. Any router without this minimum requires a system memory upgrade before you install Junos OS Release 9.1. To determine the amount of memory currently installed on your router, use the CLI **show chassis routing-engine** command.

For more information about memory requirements for the J Series routers, see the Customer Support Center JTAC Technical Bulletin PSN-2008-04-021:  
<http://www.juniper.net/alerts/viewalert.jsp?txtAlertNumber=PSN-2008-04-021&actionBtn=Search>.

## Storage Media

The J Series routers use the following media storage devices:

- Internal CompactFlash card—The CompactFlash card is the primary boot device.
- External media device—Depending on the system, this external device can be a CompactFlash card or a USB storage device. Juniper Networks recommends that you attach an external device to the system and use this external device as the backup boot device for the system.

### Routing Engines and Storage Media Names (ACX Series, M Series, MX Series, PTX Series, T Series, TX Matrix, TX Matrix Plus, and JCS 1200 Routers)

Table 4 on page 24 specifies the storage media names by Routing Engine. The storage media device names are displayed when the router boots.

**Table 4: Routing Engines and Storage Media Names (ACX Series, M Series, MX Series, T Series, TX Matrix, TX Matrix Plus, and JCS 1200 Routers)**

Routing Engine	CompactFlash Card	Hard Disk	Solid State Drive	Removable Media Emergency Boot Device
RE-400-768 (RE5)	ad0	ad1	No	ad3
RE-600-2048 (RE3)	ad0	ad1	No	ad3
RE-850-1536 (RE-850)	ad0	ad1	No	ad3
RE-A-1000-2048 (RE-A-1000)	ad0	ad2	No	da0
RE-A-1800x2 (RE-A-1800)	ad0	No	Yes SSD1: ad1 SSD2: ad2	da0
RE-S-1300-2048 (RE-S-1300)	ad0	ad2	No	da0
RE-S-1800x2 RE-S-1800x4 (RE-S-1800)	ad0	No	Yes SSD1: ad1 SSD2: ad2	da0
RE-B-1800X1-4G-S	ad0	No	Yes SSD1: ad1	da0



**Table 4: Routing Engines and Storage Media Names (ACX Series, M Series, MX Series, T Series, TX Matrix, TX Matrix Plus, and JCS 1200 Routers) (continued)**

Routing Engine	CompactFlash Card	Hard Disk	Solid State Drive	Removable Media Emergency Boot Device
RE-1600-2048 (RE4)	ad0	ad1	No	ad3 and ad4
RE-A-2000-4096 (RE-A-2000)	ad0	ad2	No	da0
RE-S-2000-4096 (RE-S-2000)	ad0	ad2	No	da0
RE-DUO-C2600-16G (RE-DUO-2600)	ad0	No	ad1	da0
RE-DUO-C1800-8G- (RE-DUO-1800)	ad0	No	ad1	da0
RE-DUO-C1800-16G	ad0	No	ad1	da0
RE-JCS1200-1x2330	da0	da1	No	da2



**NOTE:** On MX80 routers, the Routing Engine is a built-in device and has no model number. The dual internal NAND flash devices are *da0* and *da1*. The USB storage device is *da2*.



**NOTE:** On ACX Series routers, the Routing Engine is a built-in device, which does not have a model number. The dual internal NAND flash devices are *da0s1* and *da0s2*. The USB storage device is *da0s2a*. Use the **show chassis hardware models** command to obtain the field-replaceable unit (FRU) model number—for example, **ACX2000BASE-DC** for the ACX2000 router.

To view the storage media currently available on your system, use the CLI **show system storage** command. For more information about this command, see the CLI User Guide.

#### Related Documentation

- Supported Routing Engines by Chassis
- Routing Engine Specifications
- RE-S-1300 Routing Engine Description
- RE-S-2000 Routing Engine Description
- RE-S-1800 Routing Engine Description for MX Series

- JCS1200 Routing Engine Description

## Routing Engines and Storage Media Names (J Series Routers)

Table 5 on page 26 specifies the storage media names used by the J Series routers. The storage media device names are displayed as the router boots.

**Table 5: Routing Engines and Storage Media Names (J Series Routers)**

Routing Engine	Internal CompactFlash Card	External CompactFlash Card J4300 and J6300 Routers Only	USB Storage Media Devices
J Series Routers	ad0	ad2	da0

To view the storage media currently available on your system, use the CLI **show system storage** command. For more information about this command, see the CLI User Guide.

## Boot Sequence (M Series, MX Series, T Series, TX Matrix, TX Matrix Plus, and PTX Series Routing Engines )



**NOTE:** For information about which Routing Engines are supported by each device, see [http://www.juniper.net/techpubs/en\\_US/release-independent/junos/topics/reference/general/routing-engine-m-mx-t-series-support-by-chassis.html](http://www.juniper.net/techpubs/en_US/release-independent/junos/topics/reference/general/routing-engine-m-mx-t-series-support-by-chassis.html).

The M Series, MX Series (except for the MX80 routers), T Series, and TX Matrix routers with a Routing Engine that has a hard disk attempt to boot from the storage media in the following order:

1. Removable media emergency boot device, such as a PC Card (if present)
2. CompactFlash card (if present)
3. Hard disk

The M Series and MX Series with a Routing Engine that has a solid-state drive (SSD) attempt to boot from the storage media in the following order:

1. USB media emergency boot device (if present)
2. CompactFlash card
3. Solid-state drive (SSD) in the SSD slot 1 or SSD slot 2 (if present)

MX80 routers attempt to boot from the storage media in the following order:

1. USB media emergency boot device
2. Dual, internal NAND flash device (first *da0*, then *da1*)

The T series routers with a Routing Engine that has a solid-state drive (SSD) and TX Matrix Plus routers attempt to boot from the storage media in the following order:

1. USB media emergency boot device
2. CompactFlash card (if present)
3. Solid-state drive (SSD) in the Disk 1 slot (if present)



**NOTE:** The Disk 2 slot is not currently supported.

4. Storage media available on the LAN

The PTX Series Packet Transport Switches attempt to boot from the storage media in the following order:

1. USB media emergency boot device
2. CompactFlash card
3. Solid-state drive (SSD) in the Disk 1 slot (if present)
4. Storage media available on the LAN



**NOTE:** Do not insert an emergency boot device during normal operations. The router does not operate normally when it is booted from an emergency boot device.

If the router boots from an alternate boot device, Junos OS displays a message indicating this when you log in to the router. For example, the following message shows that the software booted from the hard disk (`/dev/ad1s1a`):

```
login: username
Password: password
Last login: date on terminal
```

```
--- Junos 8.0 R1 built date
```

```
---
```

```
--- NOTICE: System is running on alternate media device (/dev/ad2s1a).
```

This situation results when the router detects a problem with the primary boot device—usually the CompactFlash card—that prevents it from booting, and consequently boots from the alternate boot device (the hard disk drive). When this happens, the primary boot device is removed from the list of candidate boot devices. The problem is usually a serious hardware error. We recommend you contact the Juniper Networks Technical Assistance Center (JTAC).

When the router boots from the alternate boot device, the software and configuration are only as current as the most recent **request system snapshot** command. However, if the **mirror-flash-on-disk** command was enabled, then the hard disk drive contains a

synchronized, mirror image of the compact flash drive and therefore the current software and configuration.

- Related Documentation**
- Routing Engine Specifications

---

## Boot Sequence (ACX Series Routers)

The router attempts to boot from the storage media in the following order:

1. USB storage media device.
2. Dual, internal NAND flash device (first da0s1, then da0s2).

- Related Documentation**
- Dual-Root Partitioning ACX Series Universal Access Routers Overview
  - Understanding How the Primary Junos OS Image with Dual-Root Partitioning Recovers on the ACX Series Router

---

## Boot Sequence (J Series Routers)

The router attempts to boot from the storage media in the following order:

1. Internal CompactFlash card
2. External CompactFlash card (J4300 and J6300 routers only)
3. USB storage media device

## PART 2

# Installation and Upgrade

- [Standard or Change Category Installation on page 31](#)
- [Software Upgrade on page 45](#)
- [Recovery Installation on page 53](#)



## CHAPTER 4

# Standard or Change Category Installation

- [Checking the Current Configuration and Candidate Software Compatibility on page 31](#)
- [Determining the Junos OS Version on page 32](#)
- [Downloading Software on page 32](#)
- [Connecting to the Console Port on page 34](#)
- [Backing Up the Current Installation \(M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus Routers\) on page 34](#)
- [Backing Up the Current Installation \(J Series Routers and SRX Services Gateway\) on page 35](#)
- [Installing the Software Package on a Router with a Single Routing Engine on page 35](#)
- [Installing the Software Package on a Router with Redundant Routing Engines on page 37](#)
- [Repartitioning System Storage To Increase the Swap Partition on page 42](#)

### Checking the Current Configuration and Candidate Software Compatibility

---

When you upgrade or downgrade Junos OS, we recommend that you include the **validate** option with the **request system software add** command to check that the candidate software is compatible with the current configuration. By default, when you add a package with a different release number, the validation check is done automatically. For more information about the **request system software add** command, see the [Junos OS System Basics and Services Command Reference](#).



**NOTE:** On an ACX Series router, you must ensure that the primary and backup partitions are synchronized after an upgrade by issuing the **request system snapshot** command.

#### Related Documentation

- [request system software add](#)
- [request system snapshot](#)

## Determining the Junos OS Version

---

To determine which software packages are running on the device and to get information about these packages, use the **show version** operational mode command at the top level of the command-line interface (CLI).



**NOTE:** The **show version** command does not show the software category installed, only the release number of the software.

## Downloading Software

---

You can download the software in one of two ways:

- [Downloading Software with a Browser on page 32](#)
- [Downloading Software Using the Command-Line Interface on page 33](#)

### Downloading Software with a Browser

You download the software package you need from the Juniper Networks Support Web site at <http://www.juniper.net/support/>.



**NOTE:** To access the download section, you must have a service contract and an access account. If you need help obtaining an account, complete the registration form at the Juniper Networks Web site:  
<https://www.juniper.net/registration/Register.jsp>.

To download the software:

1. In a browser, go to <http://www.juniper.net/support/>.

The Support page opens.

2. In the Download Software section, select the software version to download.

Depending on your location, select Junos Canada and US, or Junos Worldwide.

3. Select the current release to download.

4. Click the Software tab and select the Junos OS Installation Package to download.

A dialog box opens.

5. Save the file to your system. If you are placing the file on a remote system, you must make sure that the file can be accessible by the router or switch using HTTP, FTP, or scp.



## Downloading Software Using the Command-Line Interface

Download the software package you need from the Juniper Networks Support Web site at <http://www.juniper.net/support/>, and place the package on a local system. You can then transfer the downloaded package to the device using either the router or switch command-line interface, or the local system command-line interface.



**NOTE:** To access the download section, you must have a service contract and an access account. If you need help obtaining an account, complete the registration form at the Juniper Networks Web site: <https://www.juniper.net/registration/Register.jsp>.

Before you transfer the software package, ensure that the FTP service is enabled on the device.

Enable the FTP service using the **set system services ftp** command:

```
user@host# set system services ftp
```

To transfer the software package using the device command-line interface:

1. From the router or switch command line, initiate an FTP session with the local system (host) where the package is located using the **ftp** command:

```
user@host> ftp host
```

*host* is the Hostname or address of the local system.

2. Log in with your customer support–supplied username and password:

```
User Name: username
331 Password required for username.
Password: password
```

Once your credentials have been validated, the FTP session opens.

3. Navigate to the software package location on the local system, and transfer the package using the **get** command:

```
user@host> get installation-package
```

Following is an example of an *installation-package* name:

```
jinstall-9.2R1.8-domestic-signed.tgz
```

4. Close the FTP session using the **bye** command:

```
user@host> bye
Goodbye
```

To transfer the package using the local system command-line interface:

1. From the local system command line, initiate an FTP session with the device using the **ftp** command:

```
user@host> ftp host
```

*host* is the Hostname or address of the router or switch.

2. Log in with your customer support–supplied username and password:

```
User Name: username
331 Password required for username.
Password: password
```

Once your credentials have been validated, the FTP session opens.

3. Navigate to the software package location on the local system, and transfer the package using the **put** command:

```
user@host> put installation-package
```

Following is an example of an *installation-package* name:

```
jinstall-9.2R1.8–domestic-signed.tgz
```

4. Close the FTP session using the **bye** command:

```
user@host> bye
Goodbye
```

---

## Connecting to the Console Port

The console port is a data terminal equipment (DTE) interface, providing a direct and continuous interface with the device. It is important to connect to the console during installation procedures so you can respond to any required user input and detect any errors that may occur.

For more information about connecting to the console port, see the administration guide for your particular router or switch.

---

## Backing Up the Current Installation (M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus Routers)

You should back up the current installation so that you can return to the current software installation. In a dual Routing Engine system, you need to back up both Routing Engines. This section covers the following:

The installation process using the installation package (**jinstall\***, for example) removes all stored files on the router except the **juniper.conf** and SSH files. Therefore, you should back up your current configuration in case you need to return to the current software installation after running the installation program.

To back up Junos OS on the M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus routers, issue the **request system snapshot** CLI operational command. This command saves the current software installation on the hard disk or solid-state drive (SSD).



**NOTE:** On M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus routers with dual Routing Engines, complete this operation on both Routing Engines. On routers without a CompactFlash card, where the hard disk is the primary boot device, you cannot back up your software installation.

---

When the **request system snapshot** command is issued, the **/root** file system is backed up to **/altroot**, and **/config** is backed up to **/altconfig**. The **/root** and **/config** file systems are on the router's CompactFlash card, and the **/altroot** and **/altconfig** file systems are on the router's hard disk or solid-state drive (SSD). When the backup is completed, the current and backup software installations are identical.

To copy the files to the router's hard disk or solid-state drive (SSD), use the following command:

```
user@host> request system snapshot
```

## Backing Up the Current Installation (J Series Routers and SRX Services Gateway)

You should back up the current installation so that you can return to the current software installation. In a dual Routing Engine system, you need to back up both Routing Engines.

The installation process using the installation package (**junos-jsr\***) removes all stored files on the router except the **juniper.conf** and SSH files. Therefore, you should back up your current configuration in case you need to return to the current software installation after running the installation program.

For information about backing up SRX Services Gateway, see the [Performing Software Upgrades and Reboots](#) section in the *Junos OS Administration Guide for Security Devices*.

The following instructions offer the minimum steps required to create a backup on a J Series router during the installation process. For a complete description of the backup process on the J Series routers, see the *Junos OS Administration Guide for Security Devices* and the *Junos OS Systems Basics Configuration Guide*.

To back up Junos OS on the J Series routers:

1. Attach an external memory device to the router.



**NOTE:** Even when attached to a J Series router, the USB memory device is not listed as a storage device in the **show system storage** CLI command output. You can view the installed USB memory device on the J-Web interface's system monitor screen.

2. Issue the **request system snapshot media usb** command.

The current software installation and configuration are saved on the external USB storage device.

## Installing the Software Package on a Router with a Single Routing Engine

To upgrade the router or switch software, follow these steps:

1. Install the new software package using the **request system software add** command:

```
user@host> request system software add /var/tmp/installation-package
```

*installation-package* is the name of the installation package; for example `jinstall-9.2R1.8-domestic-signed.tgz`

For M Series, MX Series, and T Series routers and Branch SRX Series firewall filters running Junos OS Release 12.2 and above, you can use the **request system software add set** command to install multiple software packages at one time:

```
user@host> request system software add set /var/tmp/installation-package
```

*installation-package* can either be a list of installation packages, each separated by a blank space, or the full URL to the directory or tar file containing the list of installation packages.



**WARNING:** Do not include the *re0* | *re1* option when you install a package using the **request system software add** command, if the Routing Engine on which the package is located and the Routing Engine on which you want to install the package are the same. In such cases, the package gets deleted after a successful upgrade.

For more information about the **request system software add** command, see the [Junos OS System Basics and Services Command Reference](#).

2. Reboot the device to start the new software using the **request system reboot** command:

```
user@host> request system reboot
Reboot the system? [yes, no] (no) yes
```



**NOTE:** You must reboot the device to load the new installation of Junos OS on the device.

To abort the installation, do not reboot the device. Instead, finish the installation and then issue the **request system software delete jinstall** command. This is your last chance to stop the installation.

The software is loaded when you reboot the system. Installation can take between 5 and 10 minutes. The device then reboots from the boot device on which the software was just installed. When the reboot is complete, the device displays the login prompt.

While the software is being upgraded, the Routing Engine on which you are performing the installation does not route traffic.

3. Log in and issue the **show version** command to verify the version of the software installed.
4. (Optional) Add the **jweb** package using the **request system software add** command. Before you can add this package, you must first download the software as you did the installation package. For more information about downloading the **jweb** package, see [“Downloading Software” on page 32](#).

The **jweb** installation module adds a device management graphical user interface that you can use to view and configure your device. For more information about the **jweb** package, see [“Installation Modules” on page 7](#).

5. After you have upgraded or downgraded the software and are satisfied that the new software is successfully running, issue the **request system snapshot** command to back up the new software.

**Related Documentation**

- [Rep partitioning System Storage To Increase the Swap Partition on page 42](#)

## Installing the Software Package on a Router with Redundant Routing Engines

If the router has two Routing Engines, perform a Junos OS installation on each Routing Engine separately to avoid disrupting network operation.



**WARNING:** 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 the **redundancy** 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 upgrade the router software, perform the following tasks:

1. [Preparing the Router for the Installation on page 37](#)
2. [Installing Software on the Backup Routing Engine on page 38](#)
3. [Installing Software on the Master Routing Engine on page 39](#)
4. [Finalizing the Installation on page 41](#)

### Preparing the Router for the Installation

Perform the following steps before installing the software:

1. Log in to the master Routing Engine's console.

For more information about logging in to the Routing Engine through the console port, see the specific hardware guide for your router.

2. From the router command line, enter configuration mode:

```
a. user@host# > configure
   Entering configuration mode
```

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

3. Disable Routing Engine redundancy:

```
[edit]
```

```
user@host# delete chassis redundancy
```

4. Save the configuration change on both Routing Engines:

```
[edit]  
user@host# commit synchronize
```

5. Exit out of the CLI configuration mode:

```
[edit]  
user@host# exit
```

## Installing Software on the Backup Routing Engine

After the router has been prepared, you first install the new Junos OS release on the backup Routing Engine while keeping the currently running software version on the master Routing Engine. This enables the master Routing Engine to continue operations, minimizing disruption to your network.

After making sure that the new software version is running correctly on the backup Routing Engine, you are ready to switch routing control to the backup Routing Engine and then upgrade or downgrade the software version on the other Routing Engine.

1. Log in to the console port on the other Routing Engine (currently the master).

For more information about logging in to the Routing Engine through the console port, see the specific hardware guide for your router.

2. Install the new software package using the **request system software add** command:

```
user@host> request system software add validate  
/var/tmp/jinstall-9.2R1.8-domestic-signed.tgz
```

For M Series, MX Series, and T Series routers and Branch SRX Series firewall filters running Junos OS Release 12.2 and above, you can use the **request system software add set** command to install multiple software packages at the same time:

```
user@host> request system software add set /var/tmp/installation-package
```

**installation-package** can either be a list of installation packages, each separated by a blank space, or the full URL to the directory or tar file containing the list of installation packages.

Use the **request system software add set** command to retain any SDK configuration by installing the SDK add-on packages along with the core Junos OS installation package.



**WARNING:** Do not include the *re0* | *re1* option when you install a package using the **request system software add** command, if the Routing Engine on which the package is located and the Routing Engine on which you want to install the package are the same. In such cases, the package gets deleted after a successful upgrade.

---

For more information about the **request system software add** command, see the [Junos OS System Basics and Services Command Reference](#).

3. Reboot the router to start the new software using the **request system reboot** command:

```
user@host> request system reboot
Reboot the system? [yes, no] (no) yes
```



**NOTE:** You must reboot the device to load the new installation of Junos OS on the router.

To abort the installation, do not reboot your device. Instead, finish the installation and then issue the **request system software delete jinstall** command. This is your last chance to stop the installation.

All the software is loaded when you reboot the device. Installation can take between 5 and 10 minutes. The router then reboots from the boot device on which the software was just installed. When the reboot is complete, the router displays the login prompt.

While the software is being upgraded, the Routing Engine on which you are performing the installation is not routing traffic.

4. Log in and issue the **show version** command to verify the version of the software installed.
5. (Optional) Add the **jweb** package using the **request system software add** command. Before you can add this package, you must first download the software as you did the installation package. For more information about downloading the **jweb** package, see [“Downloading Software” on page 32](#).

The **jweb** installation module adds a router management graphical user interface that you can use to view and configure your router. For more information about the **jweb** package, see [“Installation Modules” on page 7](#).

## Installing Software on the Master Routing Engine

Once the software is installed on the backup Routing Engine, you are ready to switch routing control to the backup Routing Engine and then upgrade or downgrade the master Routing Engine software:

1. Log in to the master Routing Engine console port.

For more information about logging in to the Routing Engine through the console port, see the specific hardware guide for your router.

2. Transfer routing control to the backup Routing Engine:

```
user@host> request chassis routing-engine master switch
```

For more information about the **request chassis routing-engine master** command, see the [Junos OS System Basics and Services Command Reference](#).

3. Verify that the backup Routing Engine (slot 1) is the master Routing Engine:

```
user@host> show chassis routing-engine
Routing Engine status:
Slot 0:
Current state      Backup
```

Election priority	Master (default)
Routing Engine status:	
Slot 1:	
Current state	Master
Election priority	Backup (default)

4. Install the new software package using the **request system software add** command:

```
user@host> request system software add validate  
/var/tmp/jinstall-9.2R1.8-domestic-signed.tgz
```

For M Series, MX Series, and T Series routers and Branch SRX Series firewall filters running Junos OS Release 12.2 and above, you can use the **request system software add set** command to install multiple software packages at the same time:

```
user@host> request system software add set /var/tmp/installation-package
```

**installation-package** can either be a list of installation packages, each separated by a blank space, or the full URL to the directory or tar file containing the list of installation packages.

Use the **request system software add set** command to retain any SDK configuration by installing the SDK add-on packages along with the core Junos OS installation package.



**WARNING:** Do not include the *re0* | *re1* option when you install a package using the **request system software add** command, if the Routing Engine on which the package is located and the Routing Engine on which you want to install the package are the same. In such cases, the package gets deleted after a successful upgrade.

For more information about the **request system software add** command, see the [Junos OS System Basics and Services Command Reference](#).

5. Reboot the Routing Engine using the **request system reboot** command:

```
user@host> request system reboot  
Reboot the system? [yes, no] (no) yes
```



**NOTE:** You must reboot to load the new installation of Junos OS on the router.

To abort the installation, do not reboot your system. Instead, finish the installation and then issue the **request system software delete jinstall** command. This is your last chance to stop the installation.

The software is loaded when you reboot the system. Installation can take between 5 and 10 minutes. The router then reboots from the boot device on which the software was just installed. When the reboot is complete, the router displays the login prompt.

While the software is being upgraded, the Routing Engine on which you are performing the installation does not route traffic.



6. Log in and issue the **show version** command to verify the version of the software installed.
7. (Optional) Add the **jweb** package using the **request system software add** command. Before you can add this package, you must first download the software as you did the installation package. For more information about downloading the **jweb** package, see [“Downloading Software” on page 32](#).

The **jweb** installation module adds a router management graphical user interface that you can use to view and configure your router. For more information about the **jweb** package, see [“Installation Modules” on page 7](#).

8. Transfer routing control back to the master Routing Engine:

```
user@host> request chassis routing-engine master switch
```

For more information about the **request chassis routing-engine master** command, see the [Junos OS System Basics and Services Command Reference](#).

9. Verify the master Routing Engine (slot 0) is indeed the master Routing Engine:

```
user@host> show chassis routing-engine
Routing Engine status:
Slot 0:
  Current state      Master
  Election priority  Master (default)
Routing Engine status:
Slot 1:
  Current state      Backup
  Election priority  Backup (default)
```

## Finalizing the Installation

Once the software is installed on both Routing Engines, you return the router back to its original configuration and back up the new installation.

1. Restore the configuration that existed before you deleted it at the start of this procedure:

```
{backup}
user@host-re0> configure
[edit]
user@host-re0# rollback 1
```

2. Save the configuration change on both Routing Engines:

```
[edit]
user@host-re0> commit synchronize and-quit
```

3. After you have installed the new software and are satisfied that it is successfully running, issue the **request system snapshot** command to back up the new software on both master and backup Routing Engines:

```
{master}
user@host-re0> request system snapshot
{master}
user@host-re0> request routing-engine login other routing-engine
{backup}
```

```
user@host-re1> request system snapshot  
{backup}
```

The root file system is backed up to `/altroot`, and `/config` is backed up to `/altconfig`. The root and `/config` file systems are on the router's CompactFlash card, and the `/altroot` and `/altconfig` file systems are on the router's hard disk or solid-state drive (SSD).

For more information about the `request routing-engine login` command, see the [Junos OS System Basics and Services Command Reference](#).



**NOTE:** After you issue the `request system snapshot` command, you cannot return to the previous version of the software because the running copy and backup copy of the software are identical.

**Related  
Documentation**

- [Repartitioning System Storage To Increase the Swap Partition on page 42](#)

---

## Repartitioning System Storage To Increase the Swap Partition

---

You can increase the size of the swap partition by repartitioning the drive (hard disk or solid-state drive (SSD)) on the Routing Engine. This feature is first available in Junos OS Release 10.4R5, 11.1R3, and 11.2R1; in earlier Junos OS releases, the swap partition is not increased by the methods described here.

This behavior applies only to Routing Engines with more than 2 GB of RAM. The new size of the swap partition depends on the size of the drive and the amount of Routing Engine RAM.

- When the drive is 32 GB or less, the swap partition is limited to 8 GB.
- When the drive is larger than 32 GB, the swap partition matches the size of the Routing Engine RAM.

To repartition the drive, perform one of the following actions:

- During the installation of a Junos OS software package (`jinstall*`), issue the **request system reboot media disk** command to boot from the drive instead of issuing the **request system reboot** command. The drive is automatically repartitioned. The **request system reboot media disk** command repartitions the drive only during a software upgrade.
- Manually partition the drive by issuing the **request system partition hard-disk** command, and then reboot the router when the command completes.



**CAUTION:** Repartitioning the drive re-creates the `/config` and `/var` directories in the router file system. Although the contents of `/config` and `/var/db` are preserved, the remaining contents of `/var` are lost. For this reason, we recommend that you back up the `/var` directory before you repartition the SSD on a router with this configuration.

- Related Documentation**
- [Installing the Software Package on a Router with a Single Routing Engine on page 35](#)
  - [Installing the Software Package on a Router with Redundant Routing Engines on page 37](#)



## CHAPTER 5

# Software Upgrade

- Upgrading Software Packages on page 45
- Upgrading to 64-bit Junos OS on page 48
- Upgrading Routers Using ISSU on page 51

## Upgrading Software Packages

---



**NOTE:** When you install individual software packages, the following notes apply:

- When upgrading from Junos OS Release 8.2 or earlier to Junos OS Release 8.5, use the `system software add <image> no-validate` command option.
- Only use the `jinstall` Junos OS image when upgrading or downgrading to or from Junos OS Release 8.5. Do not use the `jbundle` image.
- Before upgrading to Junos OS Release 8.5, ensure that the routing platform's CompactFlash card is 256 MB or larger to avoid disk size restrictions. (M7i routers without a CompactFlash card are excluded.)

To upgrade an individual Junos OS package, follow these steps:

1. Download the software packages you need from the Juniper Networks Support Web site at <http://www.juniper.net/support/>. For information about downloading software packages, see “[Downloading Software](#)” on page 32.



**NOTE:** We recommend that you upgrade all individual software packages using an out-of-band connection from the console or management Ethernet interface, because in-band connections can be lost during the upgrade process.

2. Back up the currently running and active file system so that you can recover to a known, stable environment in case something goes wrong with the upgrade:

```
user@host> request system snapshot
```

The root file system is backed up to **/altroot**, and **/config** is backed up to **/altconfig**. The root and **/config** file systems are on the router's CompactFlash card, and the **/altroot** and **/altconfig** file systems are on the router's hard disk or solid-state drive (SSD).



**NOTE:** After you issue the **request system snapshot** command, you cannot return to the previous version of the software, because the running copy and the backup copy of the software are identical.

3. If you are copying multiple software packages to the router, copy them to the **/var/tmp** directory on the hard disk or solid-state drive (SSD):

```
user@host> file copy ftp://username :prompt@ftp.hostname
.net/filename/var/tmp/filename
```

4. Add the new software package:

- To add an individual software package:

```
user@host> request system software add /var/tmp/ installation-package validate
```

*installation-package* is the full URL to the file.

If you are upgrading more than one package at the same time, add **jbase** first. If you are using this procedure to upgrade all packages at once, add them in the following order:

```
user@host> request system software add /var/tmp/jbase-release-signed.tgz
user@host> request system software add /var/tmp/jkernel-release-signed.tgz
user@host> request system software add /var/tmp/jpfe-release-signed.tgz
user@host> request system software add /var/tmp/jdocs-release-signed.tgz
user@host> request system software add /var/tmp/jweb-release-signed.tgz
user@host> request system software add /var/tmp/jroute-release-signed.tgz
user@host> request system software add /var/tmp/jcrypto-release-signed.tgz
```

- For M Series, MX Series, and T Series routers and Branch SRX Series firewall filters running Junos OS Release 12.2 and above, you can add more than one software package at the same time. To add multiple software packages:

```
user@host> request system software add set /var/tmp/
installation-package/var/tmp/ installation-package validate
```

*installation-package* can be any of the following:

- A list of installation packages, each separated by a blank space. For example,

```
user@host> request system software add set /var/tmp/
jinstall-10.2R1.8-domestic-signed.tgz /var/tmp/ jtools*.tgz validate
```

- The full URL to the directory or tar file containing the list of installation packages.

Use the **request system software add set** command to retain any SDK configuration by installing the SDK add-on packages along with the core Junos OS installation package.



**WARNING:** Do not include the *re0* | *re1* option when you install a package using the **request system software add** command, if the Routing Engine on which the package is located and the Routing Engine on which you want to install the package are the same. In such cases, the package gets deleted after a successful upgrade.

The system might display the following message:

```
pkg_delete: couldn't entirely delete package
```

This message indicates that someone manually deleted or changed an item that was in a package. You do not need to take any action; the package is still properly deleted.

For more information about the **request system software add** command, see the [Junos OS System Basics and Services Command Reference](#).

5. Reboot the router to start the new software:

```
user@host> request system reboot
```

6. After you have upgraded or downgraded the software and are satisfied that the new software is successfully running, issue the **request system snapshot** command to back up the new software:

```
user@host> request system snapshot
```



**NOTE:** On an ACX router, you must issue the **request system snapshot slice alternate** command.

The root file system is backed up to **/altroot**, and **/config** is backed up to **/altconfig**. The root and **/config** file systems are on the router's CompactFlash card, and the **/altroot** and **/altconfig** file systems are on the router's hard disk or solid-state drive (SSD).



**NOTE:** After you issue the **request system snapshot** command, you cannot return to the previous version of the software, because the running copy and backup copy of the software are identical.

## Upgrading to 64-bit Junos OS

---

Just like any other operating system, the 64-bit version of Junos OS can address more memory than the 32-bit version of the operating system. In order to support larger Routing Engine memory sizes, an upgrade from the 32-bit to the 64-bit Junos OS running on the Routing Engine hardware is necessary. The upgrade path is relatively straightforward and another form of Routing Engine hardware and software upgrade. However, there are three different and distinct Routing Engine configurations that must be taken into account when upgrading to the 64-bit Junos OS. This topic covers all three.

The In Service Software Upgrade (ISSU) procedure is not supported while upgrading from the 32-bit version of Junos OS to the 64-bit version of Junos OS. The upgrade process involves some downtime, so traffic will be affected.



---

**NOTE:**

The 64-bit Junos OS is supported on the following Routing Engines only:

- RE-DUO-C1800-8G
  - RE-DUO-C2600-16G
  - RE-A-1800x2-16G
  - RE-S-1800x4-16G
  - RE-DUO-C1800-16G
  - RE-JCS1200-1x2330
- 

For a list of which routers support each Routing Engine, see

[http://www.juniper.net/pub/en\\_US/tech/papers/US/tech\\_papers/junos/qps/64bit/engines/mm-xts-support-by-chassis.html](http://www.juniper.net/pub/en_US/tech/papers/US/tech_papers/junos/qps/64bit/engines/mm-xts-support-by-chassis.html)

Before you begin, you must have:

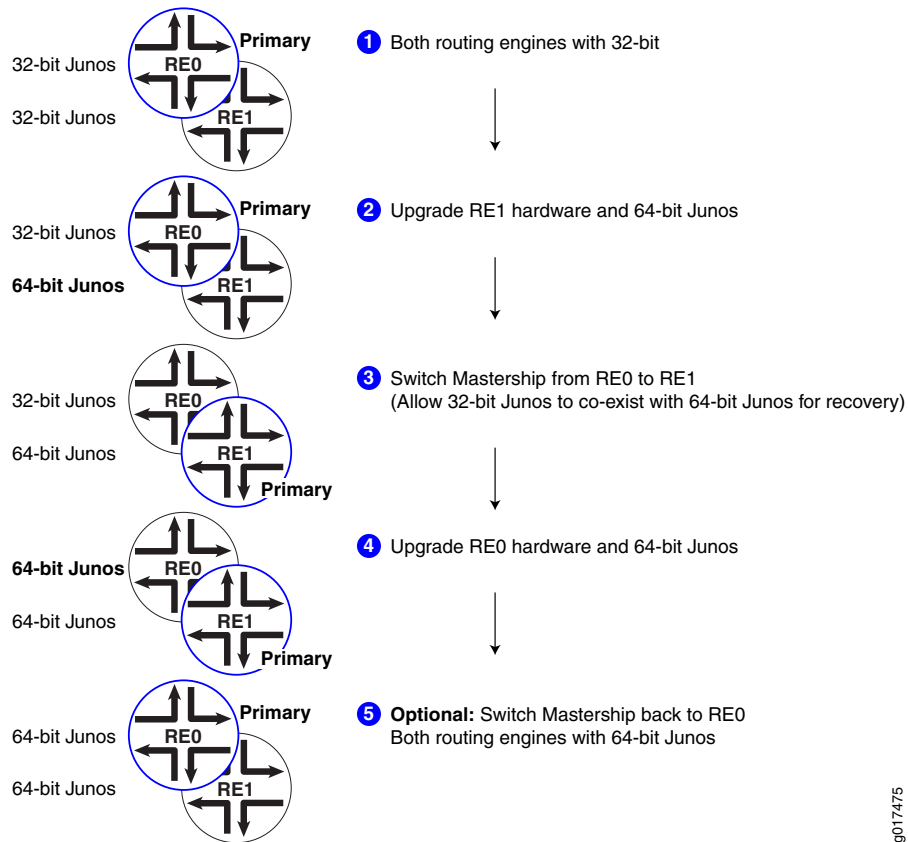
- A properly configured and functional router
- One or two Routing Engines installed that support the 64-bit Junos OS
- Decided to allow single Routing Engines systems to use either slot 0 or slot 1 as master or not (this decision will determine which upgrade path to follow for single Routing Engine systems)

When you upgrade a Routing Engine to the 64-bit Junos OS, you can support larger Routing Engine memory sizes. However, the exact procedure depends on whether there are one or two Routing Engines installed. For systems with a single Routing Engine, the procedure varies based on whether the master Routing Engine must always be in slot 0 or not.



To upgrade a system with two Routing Engines, refer to [Figure 4 on page 49](#) and perform the following steps:

**Figure 4: Upgrading to the 64-bit Junos OS with Dual Routing Engines**

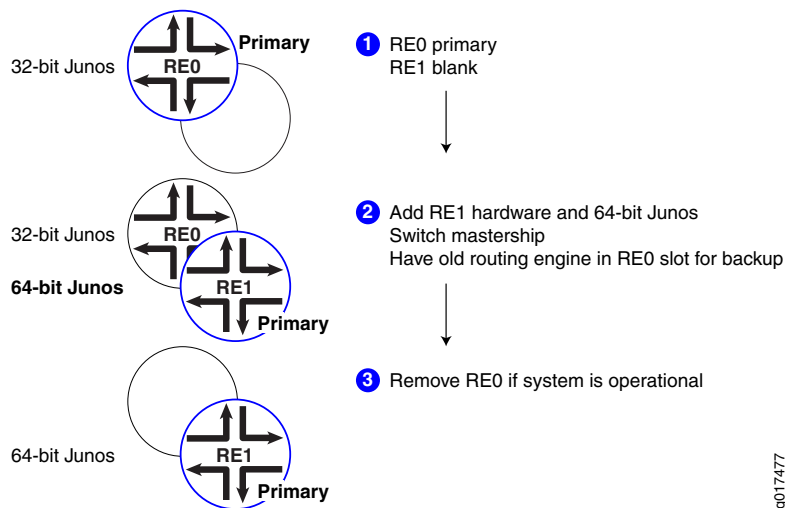


1. In the initial state, both Routing Engines are running the 32-bit Junos OS, and slot 0 has the master Routing Engine.
2. Upgrade the slot 1 Routing Engine hardware and install the 64-bit Junos OS.  
For instructions on replacing a Routing Engine, see the hardware guide for your router.
3. Switch the master Routing Engine from slot 0 to slot 1 (allow the 32-bit Junos OS to co-exist with the 64-bit Junos OS).
4. Upgrade the slot 0 routing engine hardware and install the 64-bit Junos OS.
5. Both Routing Engines now run the 64-bit Junos OS. Optionally, you can switch the master Routing Engine back to slot 0.



**NOTE:** Mixing the 32-bit Junos OS with the 64-bit Junos OS is only supported temporarily during the upgrade process. Mixing the two operating systems is not supported for normal operations.

**Figure 5: Upgrading to the 64-bit Junos OS with a Single Routing Engine (Master in Either Slot)**

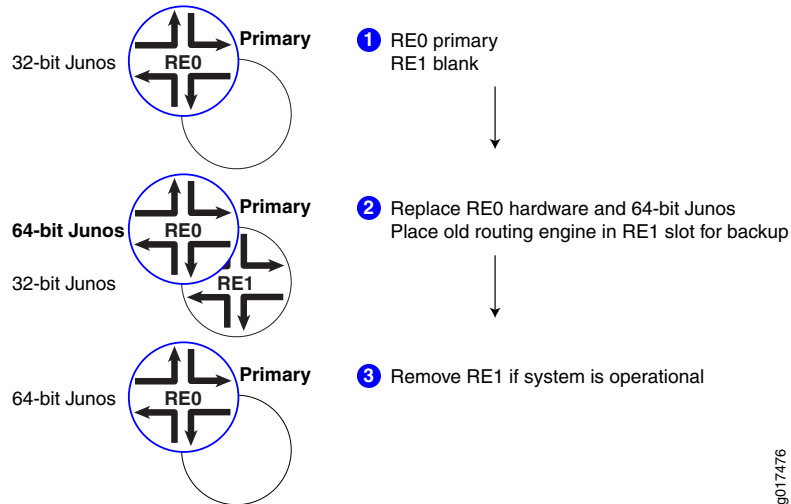


To upgrade a system with a single Routing Engine, where the master Routing Engine can be in either slot 0 or slot 1, refer to [Figure 4 on page 49](#) and perform the following steps:

1. In the initial state, the slot 0 Routing Engine is running the 32-bit Junos OS and slot 1 is blank.
2. Install the upgraded Routing Engine hardware in slot 1 and install the 64-bit Junos OS.  
For instructions on installing a Routing Engine, see the hardware guide for your router.
3. When the 64-bit Junos OS is configured properly, remove the slot 0 Routing Engine running the 32-bit Junos OS.

To upgrade a system with a single Routing Engine, where the master Routing Engine must be in slot 0, refer to [Figure 6 on page 51](#) and perform the following steps:

**Figure 6: Upgrading to the 64-bit Junos OS with a Single Routing Engine (Master Must Be in Slot 0)**



1. In the initial state, the slot 0 Routing Engine is running the 32-bit Junos OS and slot 1 is blank.
2. Install the slot 0 Routing Engine hardware in slot 1. Install the upgraded Routing Engine hardware in slot 0 and install the 64-bit Junos OS.  
For instructions on installing a Routing Engine, see the hardware guide for your router.
3. When the 64-bit Junos OS is configured properly, remove the slot 1 routing engine running the 32-bit Junos OS.

**Related Documentation**

- [Checklist for Reinstalling Junos OS](#)

## Upgrading Routers Using ISSU

Unified in-service software upgrade (ISSU) enables you to upgrade between two different Junos OS releases with no disruption on the control plane and with minimal disruption of traffic. ISSU is only supported by dual Routing Engine platforms. In addition, graceful Routing Engine switchover (GRES) and nonstop active routing (NSR) must be enabled.

For additional information about using ISSU, see the [Junos OS High Availability Guide](#).



## CHAPTER 6

# Recovery Installation

- [Creating an Emergency Boot Device on page 53](#)
- [Saving a Rescue Configuration File on page 54](#)
- [Performing a Recovery Installation on page 55](#)
- [Creating a New Configuration on a Single Routing Engine on page 56](#)
- [Configure Administration User Accounts on page 61](#)
- [Creating a New Configuration with Redundant Routing Engines on page 61](#)
- [Restoring a Saved Configuration on page 66](#)

### Creating an Emergency Boot Device

---

If the device's Junos OS software is damaged in some way that prevents Junos OS software from loading completely, you can use the emergency boot device to revive the device. The emergency boot device repartitions the primary disk and reloads a fresh installation of Junos OS software.

The procedures outlined in this section discuss how to create an emergency boot device for any ACX Series, M Series, MX Series, T Series, TX Matrix, or TX Matrix Plus router.

To create an emergency boot device:

1. Use FTP to copy the installation media into the router's **/var/tmp** directory.
2. Insert the PC Card into the external PC Card slot or USB storage device into the USB port.
3. In the UNIX shell, navigate to the **/var/tmp** directory:

```
start shell
cd /var/tmp
```
4. Log in as **su**:

```
su [enter]
password: [enter SU password]
```
5. Issue the following commands:

```
dd if=/dev/zero of=/dev/externalDrive count=20
dd if=installMedia of=/dev/externalDrive bs=64k
```

where:

- **externalDrive**—Refers to the removable media name of the emergency boot device. For example, the removable media name for an emergency boot device on the M120 router is *da0* for both Routing Engines. For the names of the storage media, see [“Routing Engines and Storage Media Names \(ACX Series, M Series, MX Series, PTX Series, T Series, TX Matrix, TX Matrix Plus, and JCS 1200 Routers\)”](#) on page 24.
- **installMedia**—Refers to the installation media downloaded into the */var/tmp* directory. For example, **install-media-9.0R2.10-domestic.tgz**.

The following code example can be used to create an emergency boot device using a PC Card on an M20 router:

```
dd if=/dev/zero of=/dev/ad3 count=20
dd if=install-media-9.0R2.10-domestic.tgz of=/dev/ad3 bs=64k
```

The following code example can be used to create an emergency boot device using a USB storage device on an M120 router or a TX Matrix Plus router:

```
dd if=/dev/zero of=/dev/da0 count=20
dd if=install-media-9.0R2.10-domestic.tgz of=/dev/da0 bs=64k
```

6. Log out as **su**:

```
exit
```

---

## Saving a Rescue Configuration File

A rescue configuration file is helpful in the event that your device's configuration file has been misconfigured. You can restore the device to this rescue configuration to bring the device back online. If you save this file off the device, the rescue configuration can also be used to restore your device in the event of a software failure.

To save a current device configuration as a rescue configuration file:

1. Edit the configuration file on the device to reflect the base configuration you wish to use.

For more information about editing the configuration, see the [Junos OS System Basics Configuration Guide](#).

2. In the CLI operational mode, save this edited base configuration as the rescue configuration file:

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

3. Copy the rescue configuration to a remote server:

```
user@host> ftp host
Name: username
Password: password
230 User user logged in.
ftp> cd /filepath
ftp> lcd /config
ftp> bin
```

```
Type set to l.
ftp> put rescue.conf.gz
Transfer complete.
ftp> bye
Goodbye.
```

## Performing a Recovery Installation

If the device's software is corrupted or otherwise damaged, you may need to perform a recovery installation, using the emergency boot device to restore the default factory installation. Once you have recovered the software you will need to restore the router or switch's configuration. You can either create a new configuration as you did when the device was shipped from the factory, or if you saved the device's previous configuration, you can simply restore that file to the system.

Depending on the situation, you should try to perform the following steps before you perform the recovery installation:

1. Ensure you have an emergency recovery disk to use during the installation. When the router or switch is first shipped, an emergency recovery disk is provided with it. For instructions on creating an emergency boot device, see ["Creating an Emergency Boot Device" on page 53](#)
2. Copy the existing configuration in the file `/config/juniper.conf.gz` from the device to a remote system. For extra safety, you can also copy the backup configurations (the files named `/config/juniper.conf.n`, where *n* is a number from 0 through 9).



**WARNING:** The recovery installation process completely overwrites the entire contents of the fixed storage media.

3. Copy any other stored files to a remote system as desired.

To reinstall Junos OS:

1. Insert the removable media emergency boot device into the device.



**NOTE:** You can store a configuration on installation media such as a PC Card or USB stick.

2. Reboot the device. Do not power off the device if it is already on. Issue the CLI **request system reboot** command.
3. When the software prompts you with the following question, type **y**:  

```
WARNING: The installation will erase the contents of your disk. Do you wish
to continue (y/n)? y
```
4. The device copies the software from the removable media emergency boot device onto your system, occasionally displaying status messages. Copying the software can take up to 10 minutes.

5. Remove the removable media emergency boot device when prompted. The device then reboots from the boot device on which the software was just installed. When the reboot is complete, the device displays the login prompt.
6. Create a new configuration as you did when the device was shipped from the factory, or restore a previously saved configuration file to the system. For more information, see [“Creating a New Configuration on a Single Routing Engine” on page 56](#), [“Creating a New Configuration with Redundant Routing Engines” on page 61](#), and [“Restoring a Saved Configuration” on page 66](#).

## Creating a New Configuration on a Single Routing Engine

---

To create a new base configuration on a single Routing Engine:

- [Log In to the Router Console on page 56](#)
- [Configure Administration User Accounts on page 57](#)
- [Add the Management Console to the Network on page 57](#)
- [Commit Changes on page 58](#)

### Log In to the Router Console

To log in to the device's console interface and open the CLI in configuration mode:

1. Verify the device is powered on.
2. Log in through the console port as root.

```
Amnesiac <ttyd0>
```

```
login: root
```



**NOTE:** From the factory, the root administration user account is not associated with a password. However, you must add a password to the root administration account before you can successfully commit a configuration.

3. Start the CLI, which initially opens in operational mode. Note the command prompt ends with > in the CLI operational mode.

```
root@% cli  
root>
```

4. Enter the CLI configuration mode. Note the command prompt ends with # in the CLI configuration mode.

```
root> configure  
[edit]  
root#
```



## Configure Administration User Accounts

Set the root administration user account password. You also need to set up one or more administration user accounts. These administration user accounts are used to log in to the device through the management console. To configure administration user accounts:

1. Add a password to the root (superuser) administration user account.

```
[edit]
root# set system root-authentication plain-text-password
New password: password
Retype new password: password
```

2. Create a management console user account.

```
[edit]
root# set system login user user-name authentication plain-text-password
New Password: password
Retype new password: password
```

3. Set the user account class to **super-user**.

```
[edit]
root# set system login user user-name class super-user
```

## Add the Management Console to the Network

To add the management console to the network:

1. Specify the device hostname.



**NOTE:** The hostname specified in the device configuration is not used by the DNS server to resolve to the correct IP address. This hostname is used to display the name of the Routing Engine in the CLI. For example, this hostname appears on the command line prompt when the user is logged in to the CLI:

```
user-name@host-name>
```

```
[edit]
root# set system host-name host-name
```

2. Configure the IP address of the DNS server.

```
[edit]
root# set system name-server address
```

3. Configure the router or switch domain name.

```
[edit]
root# set system domain-name domain-name
```

4. Configure the IP address and prefix length for the router or switch Ethernet interface.

- For all devices *except* the TX Matrix Plus router and T1600 routers in a routing matrix, and PTX Series Packet Transport Switches:

```
[edit]
root@# set interfaces fxp0 unit 0 family inet address address/prefix-length
```

- For TX Matrix Plus and T1600 routers in a routing matrix only, and PTX Series Packet Transport Switches:

```
[edit]
root@# set interfaces em0 unit 0 family inet address address/prefix-length
```

To use **em0** as an out-of-band management Ethernet interface, you must configure its logical port, **em0.0**, with a valid IP address.

- For a T1600 standalone router (not connected to a TX Matrix Plus router and not in a routing matrix):

```
[edit]
root@# set interfaces fxp0 unit 0 family inet address address/prefix-length
```

5. Configure the IP address of a backup router. The backup router is used while the local router is booting and if the routing process fails to start. Once the routing process starts, the backup router address is removed from the local routing and forwarding tables. For more information about the backup router, see the [Junos OS System Basics Configuration Guide](#).

```
[edit]
root# set system backup-router address
```

6. (Optional) Configure the static routes to remote subnets with access to the management port. Access to the management port is limited to the local subnet. To access the management port from a remote subnet, you need to add a static route to that subnet within the routing table. For more information about static routes, see the [Junos OS System Basics Configuration Guide](#).

```
[edit]
root# set routing-options static route remote-subnet next-hop destination-IP retain
no-readvertise
```

7. Configure telnet service at the **[edit system services]** hierarchy level.

```
[edit]
root# set system services telnet
```

## Commit Changes

Now that you have completed your changes to the configuration file, commit the configuration changes.

1. Before committing the configuration, you can review your changes to the configuration with the **show** command.

```
root# show
## Last changed: 2008-08-27 22:30:42 UTC
version 9.3B1.5;
system {
  host-name tp8;
  domain-name subnet.juniper.net;
  backup-router 192.168.71.254;
  root-authentication {
```

```
    encrypted-password "xxxxxxxxxxxxxxxxxxxxxxxxxxxxx"; ## SECRET-DATA
}
name-server {
    192.168.5.68;
    172.17.28.101;
}
login {
    user regress {
        class super-user;
        authentication {
            encrypted-password "xxxxxxxxxxxxxxxxxxxxxxxxxxxxx"; ## SECRET-DATA
        }
    }
}
services {
    telnet;
}
syslog {
    user * {
        any emergency;
    }
    file messages {
        any notice;
        authorization info;
    }
    file interactive-commands {
        interactive-commands any;
    }
}
}
interfaces {
    fxp0 {
        unit 0 {
            family inet {
                address 192.128.69.205/21;
            }
        }
    }
}
routing-options {
    static {
        route 172.16.0.0/12 {
            next-hop 192.168.71.254;
            retain;
            no-readvertise;
        }
        route 192.168.0.0/16 {
            next-hop 192.168.71.254;
            retain;
            no-readvertise;
        }
    }
}
}
```

On a TX Matrix Plus router and PTX Series Packet Transport Switches, the management Ethernet interface is **em0** and not **fxp0**. Therefore, when you issue the **show** command in the configuration mode, the configuration statements would be:

```
[edit]
root@ show
system {
  host-name hostname;
  domain-name domain.name;
  backup-router address ;
  root-authentication {
    (encrypted-password "password" | public-key);
    ssh-rsa "public-key";
    ssh-dsa "public-key";
  }
  name-server {
    address;
  }
  interfaces {
    em0 {
      unit 0 {
        family inet {
          address address ;
        }
      }
    }
  }
}
```

2. Commit the configuration.

```
[edit]
root# commit
commit complete
```



**NOTE:** If you receive an error message after you issue the **commit** statement, you can review the configuration using the **show** command to find the errors in your configuration. You can delete incorrect entries using the **delete** command. For example, to delete a **hostname** from the configuration, issue the following statement:

```
[edit]
root# delete system host-name host-name
```

3. Exit configuration mode.

```
[edit]
root# exit
Exiting configuration mode

root>
```

## Configure Administration User Accounts

Set the root administration user account password. You also need to set up one or more administration user accounts. These administration user accounts are used to log in to the device through the management console. To configure administration user accounts:

1. Add a password to the root (superuser) administration user account.

```
[edit]
root# set system root-authentication plain-text-password
New password: password
Retype new password: password
```

2. Create a management console user account.

```
[edit]
root# set system login user user-name authentication plain-text-password
New Password: password
Retype new password: password
```

3. Set the user account class to **super-user**.

```
[edit]
root# set system login user user-name class super-user
```

## Creating a New Configuration with Redundant Routing Engines

To create a new base configuration on a router with redundant Routing Engines:

- [Configure Administration User Accounts on page 61](#)
- [Set Up Routing Engine Configuration Groups on page 62](#)
- [Complete the Management Console Configuration on page 64](#)
- [Commit and Synchronize Changes on page 64](#)

## Configure Administration User Accounts

Set the root administration user account password. You also need to set up one or more administration user accounts. These administration user accounts are used to log in to the device through the management console. To configure administration user accounts:

1. Add a password to the root (superuser) administration user account.

```
[edit]
root# set system root-authentication plain-text-password
New password: password
Retype new password: password
```

2. Create a management console user account.

```
[edit]
root# set system login user user-name authentication plain-text-password
New Password: password
Retype new password: password
```

3. Set the user account class to **super-user**.

```
[edit]
root# set system login user user-name class super-user
```

## Set Up Routing Engine Configuration Groups

In a router with two Routing Engines, one configuration should be shared between both Routing Engines. This ensures that both Routing Engine configurations are identical. Within this configuration, create two Routing Engine groups, one for each Routing Engine. Within these groups, you specify the Routing Engine–specific parameters.

For more information about creating configuration groups, see CLI User Guide.

For more information about the initial configuration for redundant Routing Engine systems and the `re0` group, see [Junos OS High Availability Configuration Guide](#).

1. Create the configuration group `re0`. The `re0` group is a special group designator that is only used by `RE0` in a redundant routing platform.

```
[edit]
root# set groups re0
```

2. Navigate to the `groups re0` level of the configuration hierarchy.

```
[edit]
root# edit groups re0
```

3. Specify the router hostname.

```
[edit groups re0]
root# set system host-name host-name
```



**NOTE:** The hostname specified in the router configuration is not used by the DNS server to resolve to the correct IP address. This hostname is used to display the name of the Routing Engine in the CLI. For example, the hostname appears at the command-line prompt when the user is logged in to the CLI:

```
user-name@host-name>
```

4. Configure the IP address and prefix length for the router Ethernet interface.

- For all devices *except* the TX Matrix Plus router, T1600 routers in a routing matrix, and PTX Series Packet Transport Switches:

```
[edit]
root@# set interfaces fxp0 unit 0 family inet address address/prefix-length
```

- For TX Matrix Plus and T1600 routers in a routing matrix only, and PTX Series Packet Transport Switches:

```
[edit]
root@# set interfaces em0 unit 0 family inet address address/prefix-length
```

To use `em0` as an out-of-band management Ethernet interface, you must configure its logical port, `em0.0`, with a valid IP address.

- For a T1600 standalone router (not connected to a TX Matrix Plus router and not in a routing matrix):

```
[edit]
root@# set interfaces fxp0 unit 0 family inet address address/prefix-length
```

5. Return to the top level of the hierarchy.

```
[edit groups re0]
root# top
```

6. Create the configuration group **re1**.

```
[edit]
root# set groups re1
```

7. Navigate to the **groups re1** level of the configuration hierarchy.

```
[edit]
root# edit groups re1
```

8. Specify the router hostname.

```
[edit groups re1]
root# set system host-name host-name
```

9. Configure the IP address and prefix length for the router Ethernet interface.

- For all devices *except* the TX Matrix Plus router, T1600 routers in a routing matrix, and PTX Series Packet Transport Switches:

```
[edit]
root@# set interfaces fxp0 unit 0 family inet address address/prefix-length
```

- For TX Matrix Plus and T1600 routers in a routing matrix only:

```
[edit]
root@# set interfaces em0 unit 0 family inet address address/prefix-length
```

To use **em0** as an out-of-band management Ethernet interface, you must configure its logical port, **em0.0**, with a valid IP address.

- For a T1600 standalone router (not connected to a TX Matrix Plus router and not in a routing matrix):

```
[edit]
root@# set interfaces fxp0 unit 0 family inet address address/prefix-length
```

10. Return to the top level of the hierarchy.

```
[edit groups re0]
root# top
```

11. Specify the group application order.

```
[edit]
root# set apply-groups [ re0 re1 ]
```

## Complete the Management Console Configuration

To configure the global management console parameters.

1. Configure the IP address of the DNS server.

```
[edit]
root# set system name-server address
```

2. Configure the router domain name.

```
[edit]
root# set system domain-name domain-name
```

3. Configure the IP address of a backup router. The backup router is used while the local router is booting and if the routing process fails to start. Once the routing process starts, the backup router address is removed from the local routing and forwarding tables. For more information about the backup router, see the [Junos OS System Basics Configuration Guide](#).

```
[edit]
root# set system backup-router address
```

4. (Optional) Configure the static routes to remote subnets with access to the management port. Access to the management port is limited to the local subnet. To access the management port from a remote subnet, you need to add a static route to that subnet within the routing table. For more information about static routes, see the [Junos OS System Basics Configuration Guide](#).

```
[edit]
root# set routing-options static route remote-subnet next-hop destination-IP retain
no-readvertise
```

5. Configure telnet service at the `[edit system services]` hierarchy level.

```
[edit]
root# set system services telnet
```

## Commit and Synchronize Changes

Commit the configuration changes. When you issue the **synchronize** command, the configuration is shared between both Routing Engines and committed on both Routing Engines simultaneously.

1. Before committing the configuration, you can review the configuration entries using the **show** command.

```
root# show
## Last changed: 2008-10-17 18:32:25 UTC
version 9.1R1.8;
groups {
  re0 {
    system {
      host-name spice-re0;
    }
    interfaces {
      fxp0 {
```



```
        unit 0 {
            family inet {
                address 192.168.69.155/21;
            }
        }
    }
}
re1 {
    system {
        host-name spice-re1;
    }
    interfaces {
        fxp0 {
            unit 0 {
                family inet {
                    address 192.168.70.72/21;
                }
            }
        }
    }
}
global;
}
apply-groups [ re0 re1 ];
system {
    domain-name englab.juniper.net;
    backup-router 192.168.71.254;
    root-authentication {
        encrypted-password "xxxxxxxxxx"; ## SECRET-DATA
    }
    name-server {
        192.168.1.1;
    }
    login {
        user regress {
            uid 2001;
            class super-user;
            authentication {
                encrypted-password "xxxxxxxxxx"; ## SECRET-DATA
            }
        }
    }
}
services {
    telnet;
}
syslog {
    user * {
        any emergency;
    }
    file messages {
        any notice;
        authorization info;
    }
    file interactive-commands {
        interactive-commands any;
    }
}
```

```
    }  
  }  
}  
routing-options {  
  static {  
    /* corporate office */  
    route 172.16.0.0/12 {  
      next-hop 192.168.71.254;  
      retain;  
      no-readvertise;  
    }  
  }  
}
```

2. Commit and synchronize the configuration. The **commit synchronize** command commits this new configuration on both Routing Engines simultaneously.

```
[edit]  
root# commit synchronize  
re0:  
configuration check succeeds  
re1:  
commit complete  
re0:  
commit complete
```

If you receive an error message after you issue the **commit** statement, you can review the configuration using the **show** command to find the errors in your configuration. You can delete incorrect entries using the **delete** command. For example, to delete a hostname from the configuration, issue the following command:

```
[edit]  
root# delete system host-name host-name
```

3. Exit configuration mode.

```
[edit]  
root# exit  
Exiting configuration mode  
  
root>
```

---

## Restoring a Saved Configuration

To restore a saved configuration, perform the following tasks:

1. [Copy Saved Files to the Router on page 66](#)
2. [Load and Commit the Configuration File on page 67](#)

### Copy Saved Files to the Router

To copy the saved configuration to the router:

1. Log in to the console as **root**. There is no password.

```
Escape character is '^['.  
[Enter]
```

```
router (ttyd0)
```

```
login: root
Password: [Enter]
```

Initially, access to the router is limited to the console port after a recovery installation. Access through the management ports and interfaces is set in the configuration. For information about accessing the router through the console port, see the administration guide for your particular router.

2. Start the CLI:

```
# cli
```

3. Copy the configuration file on the remote server to the router's `/var/tmp` directory:

```
root@host> ftp remote-server
user: username
password: password
ftp> bin
Type set to I.
ftp> get /path/file
ftp> bye
Goodbye.
```

## Load and Commit the Configuration File

Once the saved configuration file is copied to the router, you load and commit the file:

1. Start the CLI configuration mode.

```
user@routename> configure
Entering configuration mode
```

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

2. Load the file into the current configuration. You should override the existing file.

```
user@host#
load override /var/tmp/filename
load complete
```

3. Commit the file.

```
user@host# commit
commit complete
```

4. Exit the CLI configuration mode.

```
user@host# exit
user@host>
```

5. Back up Junos OS.

After you have installed the software on the router, committed the configuration, and are satisfied that the new configuration is successfully running, issue the **request system snapshot** command to back up the new software to the `/altconfig` file system. If you do not issue the **request system snapshot** command, the configuration on the

alternate boot drive will be out of sync with the configuration on the primary boot drive.

The **request system snapshot** command causes the root file system to be backed up to **/altroot**, and **/config** to be backed up to **/altconfig**. The root and **/config** file systems are on the router's CompactFlash card, and the **/altroot** and **/altconfig** file systems are on the router's hard disk or solid-state drive (SSD).

## PART 3

# Software Licenses

- [Overview on page 71](#)
- [Managing Licenses on page 85](#)



## CHAPTER 7

# Overview

- [Junos OS Feature Licenses on page 71](#)
- [License Enforcement on page 71](#)
- [Junos OS License Keys on page 72](#)
- [Software Feature Licenses on page 74](#)

### Junos OS Feature Licenses

---

Some Junos OS software features require a license to activate the feature. To enable a licensed feature, you need to purchase, install, manage, and verify a license key that corresponds to each licensed feature. To conform to Junos OS feature licensing requirements, you must purchase one license per feature per device. The presence of the appropriate software license key on your device determines whether you are eligible to configure and use the licensed feature.

To speed deployment of licensed features, Junos OS software implements an honor-based licensing structure and provides you with a 30-day grace period to use a licensed feature without a license key installed. The grace period begins when you configure the feature and your device uses the licensed feature for the first time, but not necessarily when you install the license. After the grace period expires, the system generates system log messages saying that the feature requires a license. To clear the error message and use the licensed feature properly, you must install and verify the required license.

For information about how to purchase software licenses, contact your Juniper Networks sales representative.

#### Related Documentation

- [License Enforcement on page 71](#)
- [Junos OS License Keys on page 72](#)
- [Software Feature Licenses on page 74](#)
- [Verifying Junos OS License Installation on page 88](#)

### License Enforcement

---

For features or scaling levels that require a license, you must install and properly configure the license to meet the requirements for using the licensable feature or scale level. The

router or switch enables you to commit a configuration that specifies a licensable feature or scale without a license for a 30-day grace period. The grace period is a short-term grant that enables you to start using features in the pack or scale up to the system limits (regardless of the license key limit) without a license key installed. The grace period begins when the licensable feature or scaling level is actually used by the device (not when it is first committed). In other words, you can commit licensable features or scaling limits to the device configuration, but the grace period does not begin until the device uses the licensable feature or exceeds a licensable scaling level.



**NOTE:** Configurations might include both licensed and nonlicensed features. For these situations, the license is enforced up to the point where the license can be clearly distinguished. For example, an authentication-order configuration is shared by both Authentication, Authorization, and Accounting (AAA), which is licensed, and by Layer 2 Tunneling Protocol (L2TP), which is not licensed. When the configuration is committed, the device does not issue any license warnings, because it is not yet known whether AAA or L2TP is using the configuration. However, at runtime, the device checks for a license when AAA authenticates clients, but does not check when L2TP authenticates clients.

The device reports any license breach as a warning log message whenever a configuration is committed that contains a feature or scale limit usage that requires a license. Following the 30-day grace period, the device periodically reports the breach to syslog messages until a license is installed and properly configured on the device to resolve the breach.



**NOTE:** Successful commitment of a licensable feature or scaling configuration does not imply that the required licenses are installed or not required. If a required license is not present, the system issues a warning message after it commits the configuration.

#### Related Documentation

- [Junos OS Feature Licenses on page 9](#)
- [Junos OS License Keys on page 72](#)
- [Software Feature Licenses on page 74](#)
- [Verifying Junos OS License Installation on page 88](#)

---

## Junos OS License Keys

### Licensable Ports on MX5, MX10, and MX40 Routers

Starting with Junos OS Release 12.2, license keys are available to enhance the port capacity on MX5, MX10, and MX40 routers up to the port capacity of an MX80 router. The MX5, MX10, and MX40 routers are derived from the modular MX80 chassis with similar slot and port assignments, and provide all functionality available on an MX80 router, but at a lower capacity. Restricting port capacity is achieved by making a set of MIC slots and



ports licensable. MICs without a license are locked, and are unlocked or made usable by installing appropriate upgrade licenses.

The base capacity of a router is identified by the Ideeprom assembly ID (I2C ID), which defines the board type. However, the Junos OS licensing infrastructure allows the use of restricted ports without a license for a grace period of 30 days. After the grace period expires, the router reverts back to the base capacity if no upgrade license is purchased and installed for the locked ports. The I2C ID along with an upgrade license determine the final capacity of an MX5, MX10, or MX40 router.

The MX5, MX10, MX40, and MX80 routers support the following types of MICs:

- A built-in 10-Gigabit Ethernet MIC with four 10-Gigabit Ethernet ports
- Two front-pluggable MICs

A feature ID is assigned to every license upgrade for enhancing port capacity. [Table 6 on page 73](#) displays the chassis types and their associated port capacity, I2C ID, base capacity, feature ID, feature name, and the final capacity after a license upgrade.

**Table 6: Upgrade Licenses for Enhancing Port Capacity**

Chassis Type	Port Capacity	I2C ID	Base Capacity	Feature ID and Feature Name	Upgrade Capacity
MX5	20G	0x556	Slot 1 <ul style="list-style-type: none"> <li>• 1/MIC0</li> </ul>	f1—MX5 to MX10 upgrade	Slot 1 and 2 <ul style="list-style-type: none"> <li>• 1/MIC0</li> <li>• 1/MIC1</li> </ul>
MX10	40G	0x555	Slot 1 and 2 <ul style="list-style-type: none"> <li>• 1/MIC0</li> <li>• 1/MIC1</li> </ul>	f2—MX10 to MX40 upgrade	Slot 2 and first 2 ports on Slot 0 <ul style="list-style-type: none"> <li>• 1/MIC1</li> <li>• First 2 ports on 0/MIC0</li> </ul>
MX40	60G	0x554	Slot 1, Slot 2 and first 2 ports on Slot 0 <ul style="list-style-type: none"> <li>• 1/MIC0</li> <li>• 1/MIC1</li> <li>• First 2 ports on 0/MIC0</li> </ul>	f3—MX40 to MX80 upgrade	Slot 2 and all ports on Slot 0 <ul style="list-style-type: none"> <li>• 1/MIC1</li> <li>• All 4 ports on 0/MIC0</li> </ul>

When installing an upgrade license for enhancing port capacity on MX5, MX10 and MX40 routers, consider the following:

- To upgrade an MX5 router to MX80 router capacity, licenses for all three features (f1, f2, f3) must be installed. All three features can be provided in a single license key.
- To upgrade an MX10 router to MX40 router capacity, installing a license key with f2 feature is sufficient.
- Non-applicable feature IDs in a license key reject the upgrade license. For example:

- An f1 feature ID on an MX10 upgrade license key rejects the license.
- Feature IDs f1 and f2 on an MX40 upgrade license key reject the entire license.

#### Related Documentation

- [Junos OS Feature Licenses on page 9](#)
- [License Enforcement on page 71](#)
- [Software Feature Licenses on page 74](#)
- [Verifying Junos OS License Installation on page 88](#)

## Software Feature Licenses

Each license is tied to one software feature pack, and that license is valid for only one device.

For information about how to purchase software licenses, contact your Juniper Networks sales representative at <http://www.juniper.net/in/en/contact-us/>.

- [Software Features That Require Licenses on M Series, MX Series, and T Series Routers on page 74](#)
- [Software Features That Require Licenses on M Series Routers Only on page 77](#)
- [Software Features That Require Licenses on MX Series Routers Only on page 78](#)
- [Software Features That Require Licenses on J Series Routers and SRX Services Gateway on page 81](#)
- [Software Features That Require Licenses on EX Series Switches on page 81](#)
- [Software Features That Require Licenses on the QFX Series on page 83](#)

### Software Features That Require Licenses on M Series, MX Series, and T Series Routers

[Table 7 on page 74](#) lists the licenses you can purchase for each M Series, MX Series, and T Series software feature. Each license allows you to run the specified software feature on a single device.

For information about how to purchase a software license, contact your Juniper Networks sales representative at <http://www.juniper.net/in/en/contact-us/>.

**Table 7: Junos OS Feature License Model Number for M Series, MX Series, and T Series Routers**

Licensed Software Feature	Supported Devices	Model Number
Generalized Multi-Protocol Label Switching (GMPLS) Support on Junos OS	M10i, M7i, M120, M160, M20, M320, M40e, T320, T640, and MX Series Routers	JS-GMPLS
IPv6 Support on Junos OS	M120, M160, M20, M320, M40e, T320, T640, and MX Series Routers	JS-IPv6
Logical Router Support for Junos OS	M10i, M120, M160, M20, M320, M40e, M7i, T320, T640, and MX Series Routers	JS-LR

**Table 7: Junos OS Feature License Model Number for M Series, MX Series, and T Series Routers (*continued*)**

Licensed Software Feature	Supported Devices	Model Number
J- Flow accounting license for Adaptive Services (AS) PIC and Multiservices PIC	M10i, M120, M160, M20, M320, M40e, M7i, T320, M10, M5, T640, and T1600	S-ACCT
Chassis license for Application Traffic Optimization service, policy enforcement and application statistics. This license includes S-AI and S-LDPF functionality, and 1 Year Signature Subscription License	MX240, MX480, MX960, M Series, and T Series Routers	S-ATO
Software License for Passive Monitoring Flow Collector Application, supporting 100Kpps throughput; Chassis based license for Multiservices PIC.	M320, T640, T320, T1600	S-COLLECTOR-100K
License to use Compressed Real-Time Transport Protocol (CRTP) feature in AS PIC and Multiservices PIC	M10i, M120, M160, M20, M320, M40e, M7i, T320, M10, M5, T640, and T1600	S-CRTP
Software License for Passive Monitoring DFC Application, supporting 100Kpps throughput; Chassis based license for Multiservices PIC	M320, T640, T320, T1600	S-DFC-100K
Security Services license for AS PIC and Multiservices PIC	M10i, M7i, M5, M120, M160, M20, M320, M40e, T320, T640, M10, T1600	S-ES
Chassis license for IDP service, policy enforcement. This license includes S-AI and S-LDPF functionality, and 1 Year Signature Subscription License	MX240, MX480, MX960, M Series, and T Series Routers	S-IDP
Junos-FIPS Software License	M10i, M7i, M320, M40e, T320, T640	S-JUNOS-FIPS
Link Services Software License—up to 1023 ML bundles per Chassis for Multiservices PIC and Multiservices Dense Port Concentrator (DPC)	M5, M7i, M10, M10i, M20, M40e, M120, M320, T320, T640, T1600, MX240, MX480, MX960	S-LSSL-1023
Link Services Software Upgrade License—from 255 to 1023 ML bundles per Chassis for Multiservices PIC and Multiservices DPC	M5, M7i, M10, M10i, M20, M40e, M120, M320, T320, T640, T1600, MX240, MX480, MX960	S-LSSL-1023-UPG
Link Services Software Upgrade License—from 64 to 255 ML bundles per Chassis for AS PIC, Multiservices PIC, and Multiservices DPC	M5, M7i, M10, M10i, M20, M40e, M120, M320, T320, T640, T1600, MX240, MX480, MX960	S-LSSL-255-UPG
Link Services Software License—up to 255 ML bundles per Chassis for AS PIC, Multiservices PIC, and Multiservices DPC	M10, M7i, M5, M120, M20, M320, M40e, T320, T640, M10i, T1600, MX240, MX480, MX960	S-LSSL-256

**Table 7: Junos OS Feature License Model Number for M Series, MX Series, and T Series Routers (*continued*)**

Licensed Software Feature	Supported Devices	Model Number
Link Services Software License—up to 4 ML bundles per Chassis for AS PIC, Multiservices PIC, and Multiservices DPC	M10i, M120, M20, M320, M40e, M7i, T320, M10, M5, T640, T1600, MX240, MX480, MX960	S-LSSL-4
Link Services Software License—up to 64 ML bundles per Chassis for AS PIC, MS PIC and MS DPC	M10, M7i, M5, M120, M20, M320, M40e, T320, T640, M10i, T1600, MX240, MX480, MX960	S-LSSL-64
Link Services Software Upgrade License—from 4 to 64 ML bundles per Chassis for AS PIC, Multiservices PIC, and Multiservices DPC	M5, M7i, M10, M10i, M20, M40e, M120, M320, T320, T640, T1600, MX240, MX480, MX960	S-LSSL-64-UPG
Software License for Passive Monitoring Flow Monitor Application, supporting 1M flows. Chassis based license for Multiservices PIC	M320, T640, T320, T1600	S-MONITOR-1M
Network Address Translation (NAT), FW license on AS PIC and Multiservices PIC: Multi-instance	M10, M7i, M5, M120, M160, M20, M320, M40e, T320, T640, M10i, T1600	S-NAT-FW-MULTI
NAT, FW license on AS PIC and Multiservices PIC: Single-instance	M10, M7i, M5, M120, M160, M20, M320, M40e, T320, T640, M10i, T1600	S-NAT-FW-SINGLE
Software license for Packet trigger subscriber policy	MX240, MX480, MX960, M120, M320	S-PTSP
Subscriber Access Feature Pack License Scaling (128000)	MX240, MX480, MX960, M120, M320	S-SA-128K
Subscriber Access Feature Pack License Scaling (32000)	MX240, MX480, MX960, M120, M320	S-SA-32K
Subscriber Access Feature Pack License Scaling (4000)	MX240, MX480, MX960, M120, M320, MX80	S-SA-4K
Subscriber Access Feature Pack License Scaling (64000)	MX240, MX480, MX960, M120, M320	S-SA-64K
Subscriber Access Feature Pack License Scaling (8000)	MX240, MX480, MX960, M120, M320, MX80	S-SA-8K
Subscriber Access Feature Pack License Scaling (96000)	MX240, MX480, MX960, M120, M320	S-SA-96K
Subscriber Access Feature Pack license	MX240, MX480, MX960, M120, M320	S-SA-FP
Stateful Failover for Services on AS PIC and Multiservices PIC: Multilink PPP (MLPPP) only	M10, M7i, M5, M120, M160, M20, M320, M40e, T320, T640, M10i, T1600	S-SERVICES-SFO

**Table 7: Junos OS Feature License Model Number for M Series, MX Series, and T Series Routers (*continued*)**

Licensed Software Feature	Supported Devices	Model Number
Subscriber Service Management Feature Pack License (RADIUS/SRC based Service Activation and Deactivation) Per-Service Accounting Features for Subscribers	MX240, MX480, MX960, M120, M320	S-SSM-FP
Subscriber Traffic Lawful Intercept Feature Pack License	MX240, MX480, MX960, M120, M320, MX80	S-SSP-FP
Software license for application aware traffic direct feature	MX240, MX480, MX960, M120, M320	S-TFDIRECT-APP
Software license for subscriber aware traffic direct feature	MX240, MX480, MX960, M120, M320	S-TFDIRECT-SUB
Video Services Feature Pack license	M120, M320, MX240, MX480, MX960, MX80	S-VIDEO-FP
Port capacity enhancement Feature Pack License for MX5 routers	MX5	mx5-to-mx10-upgrade
Port capacity enhancement Feature Pack License for MX10 routers	MX10	mx10-to-mx40-upgrade
Port capacity enhancement Feature Pack License for MX40 routers	MX40	mx40-to-mx80-upgrade

### Software Features That Require Licenses on M Series Routers Only

Table 8 on page 77 lists the licenses you can purchase for each M Series software feature. Each license allows you to run the specified software feature on a single device.

For information about how to purchase a software license, contact your Juniper Networks sales representative at <http://www.juniper.net/in/en/contact-us/>.

**Table 8: Junos OS Feature License Model Number for M Series Routers**

Licensed Software Feature	Supported Devices	Model Number
J-Flow accounting license on Integrated Adaptive Services Module (ASM) and Integrated Multi-Services Module	M7i	S-ACCT-BB
Security Services license on ASM and Integrated Multi-Services Module	M7i	S-ES-BB
Layer 2 Tunneling Protocol (L2TP) L2TP Network Server (LNS) license for 16000 sessions on Multiservices PIC	M120	S-LNS-16K
L2TP LNS license Upgrade—from 8000 to 16000 sessions on Multiservices PIC	M120	S-LNS-16K-UPG

**Table 8: Junos OS Feature License Model Number for M Series Routers (*continued*)**

Licensed Software Feature	Supported Devices	Model Number
L2TP LNS license for 2000 sessions on AS PIC or Integrated Adaptive Services Module and Multiservices PIC	M7i, M10i, M120	S-LNS-2K
L2TP LNS license for 4000 sessions on AS PIC or Integrated Adaptive Services Module and Multiservices PIC	M7i, M10i, M120	S-LNS-4K
L2TP LNS license Upgrade—from 2000 to 4000 sessions on AS PIC or Integrated Adaptive Services Module and Multiservices PIC	M7i, M10i, M120	S-LNS-4K-UPG
L2TP LNS license for 8000 sessions on Multiservices PIC	M7i, M10i, M120	S-LNS-8K
L2TP LNS license Upgrade—from 4000 to 8000 sessions on AS PIC and Multiservices PIC	M7i, M10i, M120	S-LNS-8K-UPG
Link services software license on integrated ASM and Integrated Multi Services Module—up to 4 ML bundles	M7i	S-LSSL-BB
NAT, FW license on Integrated ASM and Integrated Multi Services Module: Multi instance	M7i	S-NAT-FW-MULTI-BB
NAT, FW license on Integrated ASM and Integrated Multi Services Module: Single instance	M7i	S-NAT-FW-SINGLE-BB
Tunnel services software license for AS PIC and Multiservices PIC (chassis license)	M7i, M10i	S-TUNNEL

### Software Features That Require Licenses on MX Series Routers Only

Table 9 on page 78 lists the licenses you can purchase for each MX Series software feature. Each license allows you to run the specified software feature on a single device.

For information about how to purchase a software license, contact your Juniper Networks sales representative at <http://www.juniper.net/in/en/contact-us/>.

**Table 9: Junos OS Feature License Model Number for MX Series Routers**

Licensed Software Feature	Supported Devices	Model Number
Upgrade license—from MX80-10G-ADV to MX80-40G-ADV	MX80	MX80-10G40G-UPG-ADV-B
Upgrade license—from MX80-10G to MX80-40G	MX80	MX80-10G40G-UPG-B
Upgrade license—from MX80-40G-ADV to full MX80	MX80	MX80-40G-UPG-ADV-B
Upgrade license—from MX80-40G to full MX80	MX80	MX80-40G-UPG-B
Upgrade license to upgrade from MX80-5G-ADV to MX80-10G-ADV	MX80	MX80-5G10G-UPG-ADV-B

Table 9: Junos OS Feature License Model Number for MX Series Routers (*continued*)

Licensed Software Feature	Supported Devices	Model Number
Upgrade license—from MX80-5G to MX80-10G	MX80	MX80-5G10G-UPG-B
Port capacity enhancement Feature Pack License for MX5 routers	MX5	mx5-to-mx10-upgrade
Port capacity enhancement Feature Pack License for MX10 routers	MX10	mx10-to-mx40-upgrade
Port capacity enhancement Feature Pack License for MX40 routers	MX40	mx40-to-mx80-upgrade
Flow monitoring and accounting features using J-Flow service on any Modular Port Concentrator (MPC) or Multiservices DPC	MX960	S-ACCT-JFLOW-CHASSIS
Software License for In-line JFlow Service on Trio MPCs	MX960, MX480, MX240	S-ACCT-JFLOW-IN
Flow monitoring and accounting features using J-Flow service on any MPC limited to 10G of total JFLOW traffic	MX80	S-ACCT-JFLOW-IN-10G
Flow monitoring and accounting features using J-Flow service on any MPC limited to 10G of total JFLOW traffic	MX80	S-ACCT-JFLOW-IN-10G-UPG
Flow monitoring and accounting features using J-Flow service on any MPC limited to 5G of total JFLOW traffic	MX80	S-ACCT-JFLOW-IN-5G
2000 IKE sessions on Multiservices DPC; Chassis based, limited to 6000 per Chassis	MX240, MX480, MX960	S-ES-2K
4000 IKE sessions on Multiservices DPC; Chassis based, limited to 6000 per Chassis	MX240, MX480, MX960	S-ES-4K
Upgrade from 2000 IKE sessions to 4000 IKE sessions on Multiservices DPC; Chassis based, limited to 6K per Chassis	MX240, MX480, MX960	S-ES-4K-UPG
6000 IKE sessions on Multiservices DPC; Chassis based, limited to 6000 per Chassis	MX240, MX480, MX960	S-ES-6K
Upgrade from 4000 IKE sessions to 6000 IKE Sessions on Multiservices DPC; Chassis based, limited to 6000 per Chassis	MX240, MX480, MX960	S-ES-6K-UPG
License to support DS3 Channelization (down to DS0) on each MIC for MIC-3D-8DS3-E3; also requires license S-MX80-Q when used on MX80 platform	MX960, MX480, MX240, MX80	S-MIC-3D-8CHDS3
License to support full scale L3 route and L3 VPN on each slot for MPC-3D-16XGE-SFPP	MX960, MX480, MX240	S-MPC-3D-16XGE-ADV-R
License to support full scale L3 route and L3 VPN on each slot for port queuing MPCs	MX960, MX480, MX240	S-MPC-3D-PQ-ADV-R
License to support full scale L3 route and L3 VPN on each slot for Hierarchical quality of service (HQoS) MPCs	MX960, MX480, MX240	S-MPC-3D-VQ-ADV-R

Table 9: Junos OS Feature License Model Number for MX Series Routers (*continued*)

Licensed Software Feature	Supported Devices	Model Number
License to support full scale L3 route and L3 VPN	MX80	S-MX80-ADV-R
Subscriber Management Feature Pack License	MX80	S-MX80-SA-FP
Subscriber Service Management Feature Packet License (RADIUS/SRC based Service Activation and Deactivation) Per-Service Accounting Features for Subscribers	MX80	S-MX80-SSM-FP
Subscriber Aware Traffic Direct (per Multiservices DPC)	MX960	S-MX-TD
Subscriber and Application Aware Traffic Direct ( per Multiservices DPC)	MX960	S-MX-TD-APP
Upgrade to Traffic Direct Advanced (per Multiservices DPC)	MX960	S-MX-TD-UPG
Run one instance of the NAT and software on the Multiservices DPC	MX960, MX480, MX240	S-NAT
Subscriber Access Feature Pack License Scaling (16000)	MX240, MX480, MX960, MX80	S-SA-16K
Subscriber Access Feature Pack License Scaling (256000)	MX240, MX480, MX960	S-SA-256K
Software License for Secure Flow Mirroring Service (FlowTap) (does not require Multiservices DPC)	MX240, MX480, MX960, MX80	S-SFM-FLOWTAP-IN
Run one instance of the SFW and software on the Multiservices DPC	MX960, MX480, MX240	S-SFW
Software License for one member of an MX Virtual Chassis	MX960, MX480, MX240	S-VCR
Upgrade license—from MX10 to equivalent of MX40. Allows additional 2x10G fixed ports to be used on the MX10 router	MX10-T	MX10-40-UPG
Upgrade license—from MX10 to equivalent of MX80. Allows additional 4x10G fixed ports to be used on the MX10 router	MX10-T	MX10-80-UPG
Upgrade license—from MX40 to equivalent of MX80. Allows additional 2x10G fixed ports to be used on the MX40 router	MX40-T	MX40-80-UPG
Upgrade license—from MX5 to equivalent of MX10. Allows second MIC slot to be used on the MX5 router	MX5-T	MX5-10-UPG
Upgrade license—from MX5 to equivalent of MX40. Allows second MIC slot and 2x10G fixed ports to be used on the MX5 router	MX5-T	MX5-40-UPG
Upgrade license—from MX5 to equivalent of MX80. Allows second MIC slot and 4x10G fixed ports to be used on the MX5 router	MX5-T	MX5-80-UPG



## Software Features That Require Licenses on J Series Routers and SRX Services Gateway

Table 10 on page 81 lists the licenses you can purchase for each J Series or SRX Series software feature. Each license allows you to run the specified advanced software features on a single device.

For information about how to purchase a software license, contact your Juniper Networks sales representative at <http://www.juniper.net/in/en/contact-us/>.

**Table 10: Junos OS Feature License Model Number for J Series and SRX Series Devices**

Licensed Software Feature	Supported Devices	Model Number
Advanced BGP License	J4350, J6350, J2320, J2350	JX-BGP-ADV-LTU
(For Junos OS Release 9.5 and earlier) JFlow License	J4350, J6350, J2320, J2350	JX-JFlow-LTU
1 Incremental Logical Systems License	SRX3400	SRX-3400-LSYS-1
5 Incremental Logical Systems License	SRX3400	SRX-3400-LSYS-5
25 Incremental Logical Systems License	SRX3400	SRX-3400-LSYS-25
1 Incremental Logical Systems License	SRX3600	SRX-3600-LSYS-1
5 Incremental Logical Systems License	SRX3600	SRX-3600-LSYS-5
25 Incremental Logical Systems License	SRX3600	SRX-3600-LSYS-25
1 Incremental Logical Systems License	SRX5600	SRX-5600-LSYS-1
5 Incremental Logical Systems License	SRX5600	SRX-5600-LSYS-5
25 Incremental Logical Systems License	SRX5600	SRX-5600-LSYS-25
1 Incremental Logical Systems License	SRX5800	SRX-5800-LSYS-1
5 Incremental Logical Systems License	SRX5800	SRX-5800-LSYS-5
25 Incremental Logical Systems License	SRX5800	SRX-5800-LSYS-25

## Software Features That Require Licenses on EX Series Switches

The following Junos OS features require an Enhanced Feature License (EFL) or Advanced Feature License (AFL) on EX Series devices:

- (EX2200 only) Bidirectional forwarding detection (BFD)
- (EX2200 only) Connectivity fault management (IEEE 802.lag)

- (EX2200 only) Internet Group Management Protocol version 1 (IGMPv1), IGMPv2, and IGMPv3
- (EX2200 and EX3300) OSPFv1/v2 (with 4 active interfaces)
- (EX2200 only) Protocol Independent Multicast (PIM) dense mode, PIM source-specific mode, PIM sparse mode
- (EX2200 and EX3300) Q-in-Q tunneling (IEEE 802.1ad)
- (EX2200 only) Real-time performance monitoring (RPM)
- (EX3200, EX4200, EX4500, EX6200, and EX8200) Border Gateway Protocol (BGP) and multiprotocol BGP (MBGP)
- (EX3200, EX4200, EX4500, EX6200, and EX8200) Intermediate System-to-Intermediate System (IS-IS)
- (EX3200, EX4200, EX4500, EX6200, and EX8200) IPv6 protocols: OSPFv3, PIPng, IS-IS for IPv6, IPv6 BGP
- (EX3200, EX4200, EX4500, EX6200, and EX8200) MPLS with RSVP-based label-switched paths (LSPs) and MPLS-based circuit cross-connects (CCCs)

Table 11 on page 82 lists the licenses you can purchase for each EX Series software feature. Each license allows you to run the specified enhanced software features on a single device.



**NOTE:**

For a Virtual Chassis deployment, two license keys are recommended for redundancy—one for the device in the master role and the other for the device in the backup role:

- In an EX8200 Virtual Chassis, the devices in the master and backup roles are always XRE200 External Routing Engines.
- In all other Virtual Chassis, the devices in the master and backup roles are switches.

You do not need additional license keys for Virtual Chassis member switches that are in the licensed role or for the redundant Routing Engine (RE) modules or the redundant Switch Fabric and Routing Engine (SRE) modules in an EX8200 member switch.

For information about how to purchase a software license, contact your Juniper Networks sales representative at <http://www.juniper.net/in/en/contact-us/>.

**Table 11: Junos OS Enhanced Feature License (EFL) and Advanced Feature License (AFL) Model Number for EX Series Devices**

Licensed Software Feature	Supported Devices	Model Number
Enhanced Feature License for EX 2200-24T/P	EX2200	EX-24-EFL

**Table 11: Junos OS Enhanced Feature License (EFL) and Advanced Feature License (AFL) Model Number for EX Series Devices (*continued*)**

Licensed Software Feature	Supported Devices	Model Number
Enhanced Feature License for EX 2200-48T/P	EX2200	EX-48-EFL
Enhanced Feature License for EX2200-C	EX2200-C	EX-12-EFL
Advanced Feature License for EX 3200-24T/P and EX 4200-24T/P/F/PX	EX3200, EX4200	EX-24-AFL
Advanced Feature License for EX 3200-48T/P, EX 4200-48T/P/F/PX, and EX4500-40F	EX3200, EX4200, EX4500	EX-48-AFL
Advanced Feature License for EX6200	EX6200	EX6200-AFL
XRE200 Advanced Feature License for EX8200	EX8200	EX-XRE200-AFL
Advanced Feature License for EX8208	EX8208	EX8208-AFL
Advanced Feature License for EX8216	EX8216	EX8216-AFL

## Software Features That Require Licenses on the QFX Series

The following Junos OS features require an Advanced Feature License (AFL) on QFX Series devices:



**NOTE:** If you try to configure a feature that is not licensed, you will receive syslog messages saying that you are using a feature that is licensable and that you do not possess a license for the feature. If you try to commit configuration changes for a feature that is not licensed, you will receive a commit warning saying that you have exceeded the allowed license limit for the feature.

- Border Gateway Protocol (BGP)
- Intermediate System-to-Intermediate System (IS-IS)
- Fibre Channel support

Table 12 on page 84 lists the licenses you can purchase for each QFX Series software feature.

For information about how to purchase a software license, contact your Juniper Networks sales representative.

Table 12: Junos OS Feature Licenses and Model Numbers for QFX Series Devices

Licensed Software Feature	Supported Devices	Number of Licenses Required	Model Number
QFX Series advanced feature license for Border Gateway Protocol (BGP) and Intermediate System-to-Intermediate System (IS-IS)	QFX3500 switch	One per switch	QFX-JSL-EDGE-ADV1
QFX Series advanced feature license for Border Gateway Protocol (BGP)	QFX3100 Director device	One per Node device in a network Node group	QFX-JSL-DRCTR-ADV1
QFX Series advanced feature license for Fibre Channel	QFX3500 switch	One per switch on which fibre channel ports are configured	QFX-JSL-EDGE-FC
QFX Series advanced feature license for Fibre Channel	QFX3100 Director device	One per QFX3500 Node device on which fibre channel ports are configured	QFX-JSL-DRCTR-FC
QFX Series advanced feature license for Fibre Channel - Capacity 16	QFX3100 Director device	One for up to 16 QFX3500 Node devices on which fibre channel ports are configured	QFX-JSL-DRCTR-FC-C16
QFX Series feature license for enabling fabric mode	QFX3500 and QFX3600 device	One per device	QFX3000-JSL-EDGE-FAB
QFX Series feature license for base software for QFX3000-G QFabric system	QFX3100 Director device	One per QFX3000-G QFabric system	QFX3008-JSL-DRCTR-FAB
QFX Series feature license for base software for QFX3000-M QFabric system	QFX3100 Director device	One per QFX3000-M QFabric system	QFX3000M-JSL-DRCTR-FAB

## CHAPTER 8

# Managing Licenses

- [Adding New Licenses \(CLI Procedure\) on page 85](#)
- [Deleting a License \(CLI Procedure\) on page 86](#)
- [Saving License Keys on page 87](#)
- [Verifying Junos OS License Installation on page 88](#)

### Adding New Licenses (CLI Procedure)

---

Before adding new licenses, complete the following tasks:

- Purchase the required licenses.
- Establish basic network connectivity with the router or switch. For instructions on establishing basic connectivity, see the *Getting Started Guide* or *Quick Start Guide* for your device.

To add a new license key to the device using the CLI:

1. From the CLI operational mode, enter one of the following CLI commands:

- To add a license key from a file or URL, enter the following command, specifying the filename or the URL where the key is located:

```
user@host> request system license add filename | url
```

- To add a license key from the terminal, enter the following command:

```
user@host> request system license add terminal
```

2. When prompted, enter the license key, separating multiple license keys with a blank line.

If the license key you enter is invalid, an error appears in the CLI output when you press Ctrl+d to exit license entry mode.



**NOTE:** If the router has two Routing Engines, add the new license on each Routing Engine separately. This ensures that the license key is enabled on the backup Routing Engine during changeover of mastership between the Routing Engines.

To add a new license key to a router with dual Routing Engines:

1. After adding the new license key on the master Routing Engine, use the `request chassis routing-engine master switch` command to have the backup Routing Engine become the master Routing Engine.
2. Log in to the active Routing Engine and add the new license key, repeating the same process.

3. Go on to [“Verifying Junos OS License Installation” on page 88](#).



**NOTE:** Adding a license key to the router or switch might be delayed if a kernel resynchronization operation is in progress at that time. The following message is displayed on the CLI when the license-adding operation is about to be delayed:

A kernel re-sync operation is in progress. License update may take several minutes to complete.

**Related  
Documentation**

- [Deleting a License \(CLI Procedure\) on page 86](#)
- [Junos OS Feature Licenses on page 9](#)
- [Verifying Junos OS License Installation on page 88](#)
- `request system license add`

---

## Deleting a License (CLI Procedure)

Before deleting a license, establish basic network connectivity with the router or switch. For instructions on establishing basic connectivity, see the *Getting Started Guide* or *Quick Start Guide* for your router or switch.

To delete a license key from a device using the CLI:

1. From the CLI operational mode, enter the following command for each license, specifying the license ID. You can delete only one license at a time.

```
user@host> request system license delete license-id
```

2. Go on to [“Verifying Junos OS License Installation” on page 88](#).



**NOTE:** Deleting a license key from the router or switch might be delayed if a kernel resynchronization operation is in progress at that time. The following message is displayed on the CLI when the license-deleting operation is about to be delayed:

A kernel re-sync operation is in progress. License update may take several minutes to complete.

#### Related Documentation

- [Adding New Licenses \(CLI Procedure\) on page 85](#)
- [Saving License Keys on page 87](#)
- [Junos OS Feature Licenses on page 9](#)
- [Verifying Junos OS License Installation on page 88](#)
- `request system license delete`

## Saving License Keys

Before saving a license, establish basic network connectivity with the router or switch. For instructions on establishing basic connectivity, see the *Getting Started Guide* or *Quick Start Guide* for your router or switch.

To save the licenses installed on a device to a file using the CLI:

1. From the CLI operational mode, enter one of the following CLI commands:

- To save the installed license keys to a file or URL, enter the following command:

```
user@host> request system license save filename | url
```

For example, the following command saves the installed license keys to a file named `license.config`:

- To save a license key from the terminal, enter the following command:

```
user@host> request system license save ftp://user@host/license.config
```

2. Go on to [“Verifying Junos OS License Installation” on page 88](#).

#### Related Documentation

- [Adding New Licenses \(CLI Procedure\) on page 85](#)
- [Deleting a License \(CLI Procedure\) on page 86](#)
- [Junos OS Feature Licenses on page 9](#)
- [Verifying Junos OS License Installation on page 88](#)

## Verifying Junos OS License Installation

To verify Junos OS license management, perform the following tasks:

- [Displaying Installed Licenses on page 88](#)
- [Displaying License Usage on page 89](#)

### Displaying Installed Licenses

**Purpose** Verify that the expected licenses are installed and active on the router or switch.

**Action** From the CLI, enter the **show system license** command.

### Sample Output

```
user@host> show system license
```

License usage:

Feature name	Licenses used	Licenses installed	Licenses needed	Expiry
subscriber-acct	0	1	0	permanent
subscriber-auth	0	1	0	permanent
subscriber-addr	0	1	0	permanent
subscriber-vlan	0	1	0	permanent
subscriber-ip	0	1	0	permanent
scale-subscriber	0	1000	0	permanent
scale-l2tp	0	1000	0	permanent
scale-mobile-ip	0	1000	0	permanent

Licenses installed:

License identifier: E000185416

License version: 2

Features:

```
subscriber-acct - Per Subscriber Radius Accounting
permanent
subscriber-auth - Per Subscriber Radius Authentication
permanent
subscriber-addr - Address Pool Assignment
permanent
subscriber-vlan - Dynamic Auto-sensed Vlan
permanent
subscriber-ip   - Dynamic and Static IP
permanent
```

**Meaning** The output shows a list of the license usage and a list of the licenses installed on the router or switch. Verify the following information:

- Each license is present. Licenses are listed in ascending alphanumeric order by license ID.
- The state of each license is **permanent**.



**NOTE:** A state of invalid indicates that the license key is not a valid license key. Either it was entered incorrectly or it is not valid for the specific device.



- The feature for each license is the expected feature. The features enabled are listed by license. An all-inclusive license has all features listed.
- All configured features have the required licenses installed. The Licenses needed column must show that no licenses are required.

## Displaying License Usage

**Purpose** Verify that the licenses fully cover the feature configuration on the router or switch.

**Action** From the CLI, enter the **show system license usage** command.

## Sample Output

```
user@host> show system license usage
```

Feature name	Licenses used	Licenses installed	Licenses needed	Expiry
subscriber-addr	1	0	1	29 days
scale-subscriber	0	1000	0	permanent
scale-l2tp	0	1000	0	permanent
scale-mobile-ip	0	1000	0	permanent

**Meaning** The output shows any licenses installed on the router or switch and how they are used. Verify the following information:

- Any configured licenses appear in the output. The output lists features in ascending alphabetical order by license name. The number of licenses appears in the third column. Verify that you have installed the appropriate number of licenses.
- The number of licenses used matches the number of configured features. If a licensed feature is configured, the feature is considered used. The sample output shows that the subscriber address pooling feature is configured.
- A license is installed on the router or switch for each configured feature. For every feature configured that does not have a license, one license is needed.

For example, the sample output shows that the subscriber address feature is configured but that the license for the feature has not yet been installed. The license must be installed within the remaining grace period to be in compliance.



## PART 4

# Index

- [Index on page 93](#)



# Index

## Symbols

#, comments in configuration statements.....	xiv
( ), in syntax descriptions.....	xiv
/config/juniper.conf file.....	10
/config/juniper.conf.1 file.....	11
/config/rescue.conf file.....	11
/etc/config/factory.conf file.....	11
64-bit	
Upgrade Routing Engine Junos OS.....	48
< >, in syntax descriptions.....	xiv
[ ], in configuration statements.....	xiv
{ }, in configuration statements.....	xiv
(pipe), in syntax descriptions.....	xiv

## A

acx-series-universal-access	
autoinstallation.....	12
autoinstallation	
overview.....	12, 13

## B

backing up current installation	
J Series Routers.....	35
M Series, MX Series, T Series, TX Matrix, and	
TX Matrix Plus routers.....	34
boot devices	
alternative media.....	27
boot sequence.....	10
ACX Series routers.....	28
J Series routers.....	28
M Series, MX Series, T Series, TX Matrix, TX	
Matrix Plus , and PTX Series routing	
engines.....	26
braces, in configuration statements.....	xiv
brackets	
angle, in syntax descriptions.....	xiv
square, in configuration statements.....	xiv
browser	
downloading software.....	32

## C

category change software installation.....	15
command-line interface	
downloading software.....	33
comments, in configuration statements.....	xiv
configuration files	
automatic installation.....	12
remote storage.....	11
sequence of selection.....	10
conventions	
text and syntax.....	xiii
creating a new router configuration.....	56
creating emergency boot device.....	53
curly braces, in configuration statements.....	xiv
customer support.....	xv
contacting JTAC.....	xv

## D

deleting	
licenses (CLI).....	86
documentation	
comments on.....	xv
downloading Junos OS.....	32

## E

emergency boot device	
booting from.....	27
creating.....	53

## F

feature licenses See licenses	
finalizing software installation.....	41
FIPS See Junos-FIPS	
font conventions.....	xiii

## H

hard disk.....	22, 24
hardware architecture	
ACX Series, M Series, MX Series, T Series, and	
TX Matrix routers.....	20
hardware architecture overview	
J Series routers.....	23

**I**

installation	
licenses (CLI).....	85
memory requirements	
J Series routers.....	23
M Series, MX Series, PTX Series, T Series, TX Matrix, and TX Matrix Plus routers.....	21
on router with redundant Routing Engines.....	37
on router with single Routing Engine.....	35
installation bundles.....	7
installation media.....	6
installation modules.....	7
installation packages.....	6
installation types.....	15
ISSU See unified in-service software upgrade	

**J**

Junos OS	
configuration files.....	10
downloading.....	32
editions.....	5
Canada and U.S.....	5
Junos-FIPS.....	5
worldwide.....	5
information security.....	10
installation	
current configuration, confirming.....	31
PIC combinations, verifying.....	17
installation bundles.....	7
installation media.....	6
installation modules.....	7
installation packages.....	6
introduction.....	3
naming convention.....	4
packages	
digital signatures.....	10
MD5 checksum.....	10
naming conventions.....	8
SHA-1 checksum.....	10
reinstalling.....	27
using emergency boot devices.....	55
using removable media.....	55
release naming conventions.....	8
release numbers.....	8
software installation types.....	15
storage media.....	22, 24
device names.....	24, 26

Upgrade Routing Engine to 64-bit.....	48
version, displaying.....	32
Junos OS versions See Junos OS editions	
Junos-FIPS.....	5
installation and configuration requirements.....	5
password requirements.....	6

**L**

license infringement	
verifying license usage.....	89
verifying licenses installed.....	88
license keys	
components.....	72
licenses.....	72
adding (CLI).....	85
deleting (CLI).....	86
displaying (CLI).....	88
displaying usage.....	89
overview.....	9, 71
saving (CLI).....	87
verifying.....	88

**M**

manuals	
comments on.....	xv
MD5 (Message Digest 5) checksum.....	10
memory requirements	
J Series routers.....	23
M Series, MX Series, PTX Series, T Series, TX Matrix, and TX Matrix Plus routers.....	21

**N**

naming conventions, software.....	4
-----------------------------------	---

**P**

parentheses, in syntax descriptions.....	xiv
PIC combinations	
verifying during Junos OS installation.....	17

**R**

recovery software installation.....	16
procedures.....	55
reinstalling Junos OS.....	55
release names.....	8
removable media	
booting from.....	27
reinstalling Junos OS, using.....	55
request system license add command.....	85

request system license add terminal command.....	85
request system license delete command.....	86
request system license save command.....	87
request system snapshot.....	16
request system snapshot command.....	35
request system software rollback.....	16
rescue configuration file saving.....	54
restoring a saved router configuration.....	66
routers boot sequence.....	10
ACX Series routers.....	28
J Series routers.....	28
M Series, MX Series, T Series, TX Matrix, TX Matrix Plus , and PTX Series routing engines.....	26
storage media.....	22, 24
Routing Engine Upgrade to 64-bit Junos OS.....	48
Routing Engines backup installing software.....	38
illustrations.....	21
master installing software.....	39
storage media ACX Series, M Series, MX Series, T Series, TX Matrix, TX Matrix Plus, and JCS routers.....	24
J Series routers.....	26
 <b>S</b>	
saving licenses (CLI).....	87
saving rescue configuration file.....	54
services gateway autoinstallation.....	13
SHA-1 (Secure Hash Algorithm) checksum.....	10
show chassis routing-engine.....	21, 23
show system license command.....	88
explanation.....	88
show system license usage command.....	89
explanation.....	89
show system storage.....	23, 25
show version.....	32
show version command.....	32
software categories on M Series, MX Series, T Series, TX Matrix, and TX Matrix Plus routers.....	16

software installation category change installation description.....	15
recovery installation description.....	16
standard installation description.....	15
software installation packages enhanced Junos OS for J Series routers, domestic description.....	17
enhanced Junos OS for J Series routers, export description.....	17
Junos-FIPS description.....	16
standard Junos OS for J Series routers, domestic description.....	17
standard Junos OS, domestic description.....	16
standard Junos OS, export description.....	16
software packages upgrading individual.....	45
standard software installation.....	15
storage media.....	22, 24
device names ACX Series, M Series, MX Series, T Series, TX Matrix, TX Matrix Plus, and JCS routers.....	24
J Series routers.....	26
J Series routers.....	24
M Series, MX Series, T Series, TX Series, and TX Matrix Plus routers.....	22
support, technical See technical support	
syntax conventions.....	xiii
system memory J Series routers.....	23
M Series, MX Series, T Series, TX series, and TX Matrix Plus routers.....	21

## T

technical support contacting JTAC.....	xv
---	----

## U

unified in-service software upgrade.....	51
upgrading or downgrading Junos OS.....	45

## V

validating software compatibility.....	31
verification	
active licenses.....	88
license usage.....	89
licenses .....	88