

M-series, MX-series, and T-series Routing Engine and MCS Installation Instructions

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This document describes how to remove and replace a Routing Engine on a Juniper Networks Internet routing platform. This document also describes how to remove and replace a Miscellaneous Control Subsystem (MCS) on an M40e router.

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Supported Routing Engines by Chassis

Table 1 on page 3 lists the Routing Engines that each chassis supports.

Table 1: Supported Routing Engines by Chassis

Chassis	Supported Routing Engines
M7i	RE-400-768
	RE-850-1536
M10i	RE-400-768
	RE-850-1536
M40e	RE-A-1000-2048
M120	RE-A-1000-2048
	RE-A-2000-4096
	NOTE: These Routing Engines are supported on the M120 router in JUNOS Release 8.0R2 and later.
M320	RE-A-2000-4096
MX240	RE-S-1300-2048
	RE-S-2000-4096
MX480	RE-S-1300-2048
	RE-S-2000-4096
MX960	RE-S-1300-2048
	RE-S-2000-4096
T320	RE-A-2000-4096
T640	RE-A-2000-4096
T1600	RE-A-2000-4096
TX Matrix	RE-A-2000-4096

Routing Engine Specifications

Table 2 on page 4 lists the current specifications for Routing Engines.

Table 2: Routing Engine Specifications

Routing Engine	Processor	Memory	Connection to PFEs	Hard Disk	Internal Flash Disk	First JUNOS Support
RE-400-768	400-MHz Intel Celeron	768 MB	Fast Ethernet	40 GB	1 GB	9.0
RE-850-1536	850-MHz Intel Pentium III	1536 MB	Fast Ethernet	40 GB	1 GB	7.2
RE-A-1000-2048	1.0-GHz Intel Pentium	2048 MB	Gigabit Ethernet	40 GB	1 GB	8.1
RE-A-2000-4096	2.0-GHz Intel Pentium	4096 MB	Gigabit Ethernet	40 GB	1 GB	8.1
RE-S-1300-2048	1.3-GHz Intel Pentium	2048 MB	Gigabit Ethernet	40 GB	1 GB	8.2
RE-S-2000-4096	2.0-GHz Intel Pentium	4096 MB	Gigabit Ethernet	40 GB	1 GB	8.2



NOTE: The memory in Table 2 on page 4 indicates the amount of total memory. To determine the amount of available memory, issue the `show chassis routing-engine` CLI command.

On routing platforms that accept two Routing Engines, you cannot mix Routing Engine types except for a brief period (one minute or so) during an upgrade or downgrade to two Routing Engines of the same type.

Routing Engines for the M40e Router

The Routing Engine is an Intel-based PCI platform that runs JUNOS software. Software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the router, control the router's interfaces, control some chassis components, and provide the interface for system management and user access to the router.

Routing Engine Components

Each Routing Engine is a two-board system with the following components:

- CPU—Runs JUNOS software to maintain the router's routing tables and routing protocols. It has a Pentium-class processor.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- Internal flash disk—Provides primary storage. It accommodates the software image, up to 49 configuration files, and the microcode. This is a fixed compact flash disk and is inaccessible from outside the router.

- Hard disk—Provides secondary storage for log files, memory dumps, and rebooting the system if the internal flash disk fails.
- PC Card slot—Accepts a removable PC Card, which stores software images for system upgrades.
- Interfaces for out-of-band management access—Provide information about Routing Engine status to devices that can be attached to external access ports. On M40e routers, the access ports are located on the Connector Interface Panel (CIP).

Each Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

- EEPROM—Stores the serial number of the Routing Engine.
- LED—Indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.

On the M40e router, the LEDs that report Routing Engine, host module, or host subsystem status are on the craft interface. For more information, see the hardware guide for your router.

- Reset button—Reboots the Routing Engine when pressed.
- Extractor clips—Control the locking system that secures the Routing Engine in the chassis.



NOTE: The appearance and position of electronic components or the PC Card slot on your Routing Engine might differ from those in the figures in this document. These differences do not affect Routing Engine installation and removal or functionality.

For specific information about components in your Routing Engine (for example, the capacity of the hard disk), issue the **show chassis routing-engine** command.

The boot sequence for the three storage media is as follows: the PC Card (if present), then the internal flash disk (if present), then the hard disk.

Host Module Components in M40e Routers

On M40e routers, each Routing Engine is paired with a Miscellaneous Control Subsystem (MCS) in a functional unit called a *host module*. (For more information about the MCS, see “MCS Description” on page 6.) One or two host modules can be installed into the midplane from the rear of the chassis, as shown in Figure 1 on page 6.

When two host modules are installed in the router, both are powered on, but only one is active (the master). At boot time, both Routing Engines run an arbitration algorithm and elect one as master. The second host module is in standby mode and performs no functions. By default, the master host module is the one with components installed in the slots labeled **RE0** and **MCS0**. You can change the default mastership

by including the appropriate **routing-engine** statement at the [edit chassis redundancy] hierarchy level in the configuration, as described in the *JUNOS System Basics Configuration Guide*.

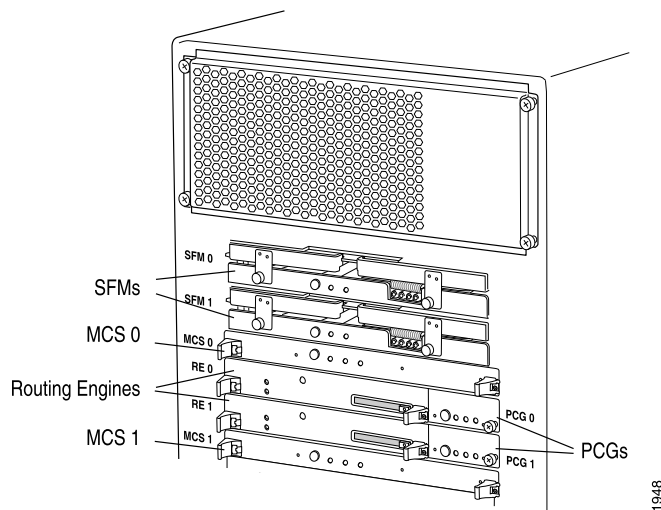
The host module components are hot-pluggable. Removal or failure of either or both components in the standby host module does not affect router function. If one or both components in the master host module are removed from the chassis, the effect depends on whether two host modules are installed:

- If there is only one host module, packet forwarding halts until both the Routing Engine and MCS are reinstalled and functioning normally.
- If there are two host modules, packet forwarding halts while the standby host module becomes the master and the new master Routing Engine resets the Packet Forwarding Engine.

With the default mastership configuration, if one or both components in the master host module experience a hardware or software failure, you must correct the problem manually. You can issue the appropriate **request chassis routing-engine master** command to switch mastership to the other Routing Engine, for example. (For more information, see the *JUNOS System Basics and Services Command Reference*.)

You can configure the router so that the standby Routing Engine automatically assumes mastership if it stops receiving keepalive signals from the master. In JUNOS Release 7.0R1 and later, you can also configure automatic mastership switchover for other problems that occur on the master Routing Engine, such as a hard disk failure. For more information, see the section about Routing Engine redundancy in the *JUNOS System Basics Configuration Guide*.

Figure 1: Rear of M40e Chassis



MCS Description

On M40e routers, the MCS works with its companion Routing Engine to provide control and monitoring functions for router components. It also generates a clock signal for the SONET/SDH interfaces on the router.

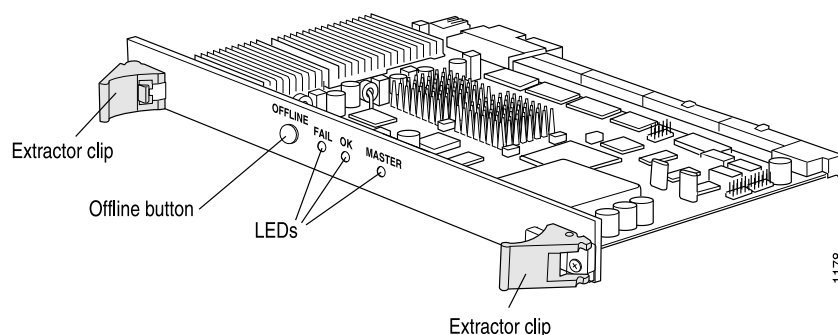
In conjunction with the routing software, the MCS performs the following functions:

- Monitoring and control of router components—The MCS collects statistics from all sensors in the system. When it detects a failure or alarm condition, it sends a signal to the Routing Engine, which generates control messages or sets an alarm. The MCS also relays control messages from the Routing Engine to the router components.
- Controlling component power-up and power-down—The MCS controls the power-up sequence of router components as they start, and powers down components when their offline buttons are pressed.
- Signaling of mastership—In a router with more than one host module, the MCS signals to all router components which host module is the master and which is the standby. It relays the mastership signal for the two Packet Forwarding Engine Clock Generators (PCGs) as well.
- Providing SONET/SDH clock source—The MCS generates a 19.44-MHz SONET/SDH clock signal, along with a signal that indicates which MCS is the master SONET/SDH clock generator (if two MCSs are installed).
- Clock monitoring—The MCS monitors the PCG system clock and its SONET/SDH clock to verify that they are providing the expected signal. It generates an alarm if a clock signal is incorrect.
- Control of Flexible PIC Concentrator (FPC) resets—If the MCS detects errors in an FPC, it attempts to reset the FPC. After three unsuccessful reset attempts, the MCS takes the FPC offline and informs the Routing Engine. Other FPCs are unaffected, and system operation continues.

MCS Components

Each MCS (shown in Figure 2 on page 8) has the following components:

- PCI interface—Connects the MCS to the Routing Engine.
- 100-Mbps Ethernet switch—Carries signals and monitoring data between router components.
- 19.44-MHz stratum 3 reference clock—Generates clock signal for SONET/SDH PICs.
- I²C controller—Monitors the status of router components.
- Three LEDs—Indicate MCS status. There is a blue one labeled **MASTER**, a green one labeled **OK**, and an amber one labeled **FAIL**. Table 3 on page 8 describes the LED states.
- Offline button—Prepares the MCS for removal from the router when pressed.
- Extractor clips—Control the locking system that secures the MCS in the chassis.

Figure 2: Miscellaneous Control Subsystem**Table 3: States for MCS LEDs**

Label	Color	State	Description
MASTER	Blue	On steadily	MCS is master.
OK	Green	On steadily	MCS is functioning normally.
		Blinking	MCS is starting up.
FAIL	Amber	On steadily	MCS has failed.

Tools and Parts Required

To replace a Routing Engine or an MCS, you need the following tools and parts:

- Electrostatic bag or antistatic mat
- Electrostatic discharge (ESD) grounding wrist strap
- Phillips (+) screwdriver, number 2

Replacing the Host Module Components in an M40e Router

On an M40e router, one or two host modules install into the midplane from the rear of the chassis, as shown in Figure 1 on page 6. Each host module consists of a paired Routing Engine and MCS installed in adjacent slots (labeled MCS0 and RE0 or RE1 and MCS1 from top to bottom).

If the host system is redundant, the backup Routing Engine is hot-removable and hot-insertable, but the master Routing Engine is hot-pluggable. A Routing Engine that is not redundant is hot-pluggable. For a description of the effect of removing one or both components, see “Host Module Components in M40e Routers” on page 5.

To replace the host module components in an M40e router, perform the following procedures:

- Switching Host Module Mastership on an M40e Router on page 9
- Replacing a Routing Engine in an M40e Router on page 10
- Replacing an MCS in an M40e Router on page 13

Switching Host Module Mastership on an M40e Router

On an M40e router with two host modules installed, determine whether the component you are removing belongs to the master host module. If it does, switch mastership to the other host module before removing the component. To check and switch host module mastership:

1. Use one of the following two methods to determine which host module is functioning as master:
 - Note which of the green host module **MASTER** LEDs is lit on the craft interface.
 - Issue the following CLI command:

```
user@host> show chassis routing-engine
```

```
Routing Engine status: Slot 0: Current state
Master ...
```

2. If you are removing a component that belongs to the master host module, issue the following CLI command to switch mastership to the standby host module:

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

The backup Routing Engine immediately assumes Routing Engine functions. If graceful switchover and nonstop routing are configured, packet forwarding and routing are continued without interruption. If the Routing Engines are configured for graceful switchover, but nonstop routing is not configured, there is no interruption to packet forwarding, but routing is interrupted momentarily. If neither graceful switchover nor nonstop routing is configured, packet forwarding halts while the backup Routing Engine becomes the master and the Packet Forwarding Engine components reset and connect to the new master Routing Engine. For information about configuring graceful switchover and nonstop routing, see the section about Routing Engine redundancy in the *JUNOS System Basics Configuration Guide*.

We recommend you run JUNOS Release 7.0 or later on the M10i router to support graceful switchover.



NOTE: Router performance might change if the backup Routing Engine's configuration differs from the former master's configuration. For the most predictable performance, configure the two Routing Engines identically, except for parameters unique to a Routing Engine, such as the hostname defined at the `[edit system]` hierarchy level and the management interface (`fxp0` or equivalent) defined at the `[edit interfaces]` hierarchy level.

To configure Routing Engine-specific parameters and still use the same configuration on both Routing Engines, include the appropriate configuration statements under the `re0` and `re1` statements at the `[edit groups]` hierarchy level and use the `apply-groups` statement. For instructions, see the *JUNOS System Basics Configuration Guide*.

Replacing a Routing Engine in an M40e Router

The router can have a Routing Engine in each of the slots labeled `RE0` and `RE1` at the rear of the chassis, as shown in Figure 1 on page 6. Each Routing Engine weighs approximately 1.5 lb (0.7 kg).

The Routing Engines are hot-pluggable. For a description of the effect of removing a Routing Engine, see “Host Module Components in M40e Routers” on page 5.

Removing a Routing Engine from an M40e Router

To remove a Routing Engine from an M40e router:

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
3. Remove the rear component cover by loosening the thumbscrews at the corners of the cover and pulling it straight off of the chassis.
4. If two host modules are installed, check whether the Routing Engine you are removing belongs to the master host module. If so, switch mastership to the standby host module. For instructions, see “Switching Host Module Mastership on an M40e Router” on page 9.
5. On the console or other management device connected to the Routing Engine that you are removing, enter CLI operational mode and issue the following command:

```
user@host> request system halt
```

The command shuts down the Routing Engine cleanly, so that its state information is preserved.

Wait to continue until a message appears on the console confirming that the operating system has halted.

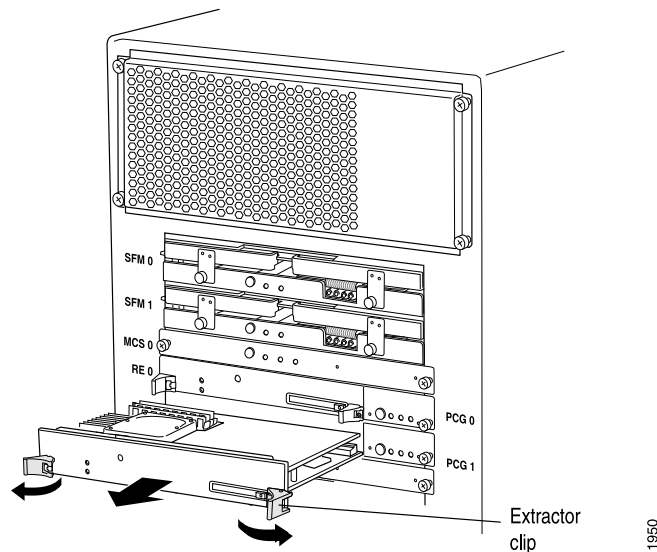
6. If applicable, loosen the screws on the extractor clips on either side of the Routing Engine faceplate, using a Phillips screwdriver (see Figure 3 on page 11).
7. Flip the ends of the extractor clips outward (see Figure 3 on page 11).
8. Grasp the extractor clips and slide the unit about halfway out of the chassis.



CAUTION: Be careful to slide the Routing Engine straight out of the chassis. Damage can result if the Routing Engine gets lodged because of uneven movement.

9. Place one hand under the Routing Engine to support it, slide it completely out of the chassis, and place it on an antistatic mat or in an electrostatic bag.

Figure 3: Removing a Routing Engine from an M40e Router



Installing a Routing Engine in an M40e Router

To install a Routing Engine in an M40e router:

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Verify that the extractor clip at each end of the Routing Engine is flipped toward the outer edge of the unit. If necessary, use your thumbs to push and hold the red tab on each extractor clip toward the outer edge, and then push the ends of the extractor clips outward.
3. Place one hand under the Routing Engine to support it and grasp one of the extractor clips on the faceplate with the other hand.
4. Align the rear of the Routing Engine with the guide rails inside the chassis and slide it in completely.



CAUTION: Align the Routing Engine carefully with the guide rails and push it in evenly. Damage can result if the Routing Engine gets lodged in the rails because of uneven movement.

5. Press the extractor clip at each end of the Routing Engine inward to seat the unit firmly in the chassis.
6. If applicable, tighten the screws on the extractor clips, using a Phillips screwdriver. Be sure to tighten the screws enough to seat the Routing Engine properly.

The Routing Engine might require several minutes to boot.

7. After the Routing Engine boots, check the host module LEDs on the craft interface to verify that the green LED labeled **ONLINE** is lit for the host module to which the Routing Engine belongs.

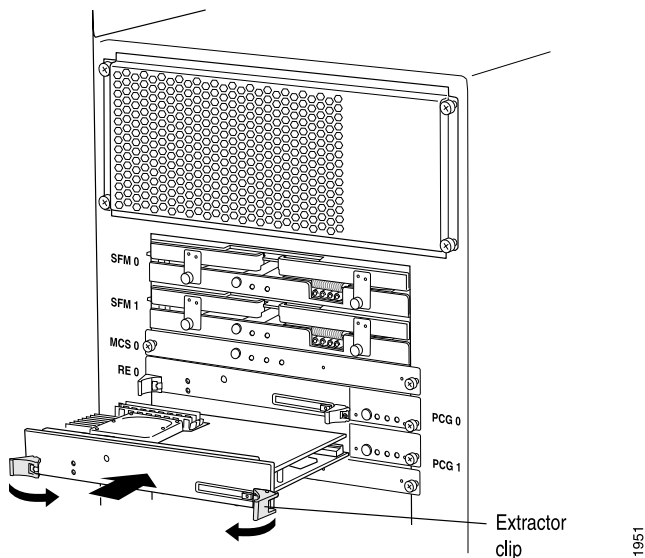
You can also issue the following CLI command to verify correct Routing Engine functioning:

```
user@host> show chassis routing-engine
```

For further information, see the *JUNOS System Basics and Services Command Reference*.

8. Reinstall the rear component cover and tighten the thumbscrews at the corners to secure it to the chassis.

Figure 4: Installing a Routing Engine in an M40e Router



Replacing an MCS in an M40e Router

The router can have an MCS in each of the slots labeled **MCS0** and **MCS1** at the rear of the chassis, as shown in Figure 1 on page 6. Each MCS weighs approximately 2.5 lb (1 kg).

The MCSs are hot-pluggable. For a description of the effect of removing an MCS, see “Host Module Components in M40e Routers” on page 5.

Removing an MCS from an M40e Router

To remove an MCS from an M40e router:

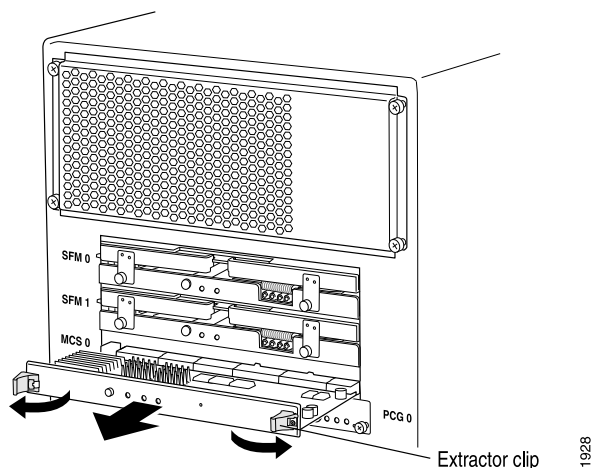
1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
3. Remove the rear component cover by loosening the thumbscrew at each corner of the cover and pulling it straight off the chassis.
4. If two host modules are installed, check whether the MCS you are removing belongs to the master host module. If so, switch mastership to the standby host module. For instructions, see “Switching Host Module Mastership on an M40e Router” on page 9.
5. On the console or other management device connected to the Routing Engine that is paired with the MCS you are removing, enter CLI operational mode and issue the following command:

```
user@host> request system halt
```

The command shuts down the Routing Engine cleanly, so its state information is preserved.

Wait to continue until a message appears on the console confirming that the operating system has halted.

6. Push the end of each extractor clip (located at each end of the MCS) outward.
7. Grasp the extractor clips and slide the MCS about halfway out of the chassis.
8. Place one hand under the MCS to support it, slide it completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

Figure 5: Removing an MCS from an M40e Router**Installing an MCS in an M40e Router**

To install an MCS in an M40e router:

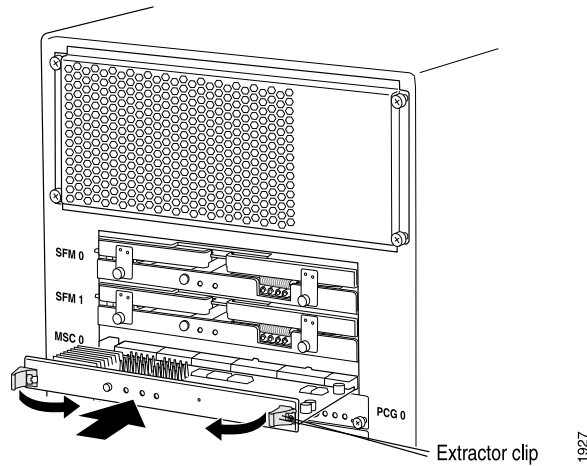
1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
2. Place one hand under the MCS to support it and grasp one of the extractor clips on the faceplate with the other hand.
3. Align the rear of the MCS with the guides inside the chassis and slide it in completely.
4. Press the extractor clip at each end of the MCS inward.
5. Verify that the green LED labeled **OK** on the MCS faceplate is lit. Also check the host module LEDs on the craft interface to verify that the green LED labeled **ONLINE** is lit for the host module to which the MCS belongs.

You can also issue the following CLI command to verify correct Routing Engine functioning:

```
user@host> show chassis environment mcs
```

For further information, see the *JUNOS System Basics and Services Command Reference*.

6. Reinstall the rear component cover and tighten the thumbscrews at the corners to secure it to the chassis.

Figure 6: Installing an MCS in an M40e Router

Routing Engines for the M7i and M10i Routers

The Routing Engine is an Intel-based PCI platform that runs JUNOS software. Software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the router, control the router's interfaces, control some chassis components, and provide the interface for system management and user access to the router.

The Routing Engine is installed into the midplane from the front of the chassis. When two Routing Engines are installed, both are powered on, but only one is active (the master); the second Routing Engine is in standby mode and performs no functions. At boot time, both Routing Engines run an arbitration algorithm and elect one as master.

If the host system is redundant, the backup Routing Engine is hot-removable and hot-insertable, but the master Routing Engine is hot-pluggable. A Routing Engine that is not redundant is hot-pluggable. You can remove and replace the master Routing Engine without powering down the router, but the routing functions of the system are interrupted when the component is removed. A backup Routing Engine can be removed without interrupting routing functions.

Routing Engine Components

The Routing Engine (shown in Figure 7 on page 16) is a single-board system with the following components:

- CPU—Runs JUNOS software to maintain the router's routing tables and routing protocols. It has a Pentium-class processor.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- Internal flash disk—A compact flash disk, standard on the RE-850-1536 Routing Engine. If installed, it provides primary storage. It can accommodate software images, configuration files, and microcode.

- **Hard disk**—If no internal flash disk is installed, provides primary storage for software images, configuration files, and microcode. If an internal flash disk is installed, the hard disk provides secondary storage for log files and memory dumps, and can reboot the system if the internal flash disk fails.
- **PC Card slot**—Accepts a removable PC Card, which stores software images for system upgrades.
- **Four LEDs**—A green LED labeled **HDD**, a blue LED labeled **MASTER**, a red LED labeled **FAIL**, and a green LED labeled **ONLINE** indicate Routing Engine status. Table 4 on page 16 describes the LED states.
- **Interfaces for out-of-band management access**—Provide information about Routing Engine status to devices (console, laptop, or terminal server) that can be attached to access ports located on the Routing Engine.

Each Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

- **I2C/EEPROM**—Stores the serial number of the Routing Engine.
- **Reset button**—Reboots the Routing Engine when pressed.
- **Offline button**—Makes the Routing Engine safe to remove when pressed.
- **Thumbscrews**—Secure the Routing Engine in the chassis.

The boot sequence for the three storage media is as follows: the PC Card (if present), then the internal flash disk (if present), then the hard disk.

Figure 7: Routing Engine for the M7i and M10i Routers

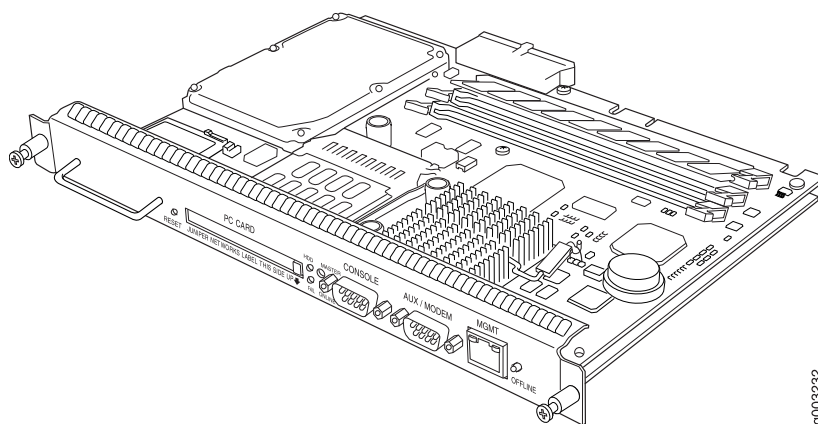


Table 4: States for Routing Engine LEDs

Label	Color	State	Description
HDD	Green	Blinking	There is read/write activity on the PC Card.
MASTER	Blue	On steadily	Routing Engine is functioning as master. On an M7i router, this LED is always lit.

Table 4: States for Routing Engine LEDs *(continued)*

Label	Color	State	Description
FAIL	Red	On steadily	Routing Engine is not operational.
ONLINE	Green	On steadily	Routing Engine is running normally.

Tools and Parts Required

To replace a Routing Engine, you need the following tools and parts:

- Electrostatic bag or antistatic mat
- Electrostatic discharge (ESD) grounding wrist strap
- Phillips (+) screwdriver, number 2

Replacing the Routing Engine in an M7i Router

To replace the Routing Engine in an M7i router, perform the following procedures:

- Removing the Routing Engine from an M7i Router on page 17
- Installing the Routing Engine in an M7i Router on page 18

Removing the Routing Engine from an M7i Router

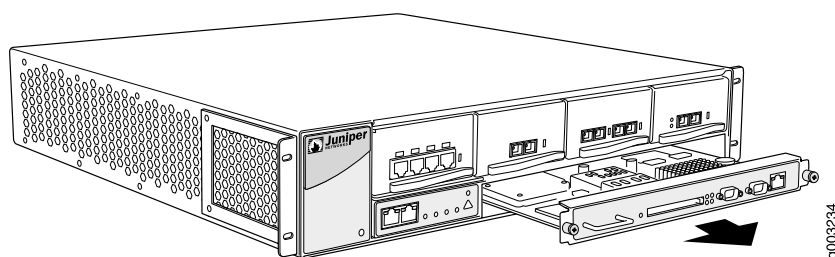
To remove the Routing Engine (see Figure 8 on page 18):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis.
3. Press and hold the offline button on the faceplate of the Routing Engine until the green **ONLINE** LED turns off, which takes about 5 seconds.
4. Loosen the thumbscrews securing the Routing Engine, using a Phillips screwdriver if necessary.
5. Grasp the handle and slide the unit about halfway out of the chassis.



CAUTION: Be careful to slide the Routing Engine straight out of the chassis. Damage can result if the Routing Engine gets lodged because of uneven movement.

6. Place one hand under the Routing Engine to support it, slide it completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

Figure 8: Remove the Routing Engine from an M7i Router

Installing the Routing Engine in an M7i Router

To install the Routing Engine (see Figure 9 on page 18):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Place one hand under the Routing Engine to support it and grasp the handle on the faceplate with the other hand.
3. Align the rear of the Routing Engine with the guide rails inside the chassis and slide it in completely.

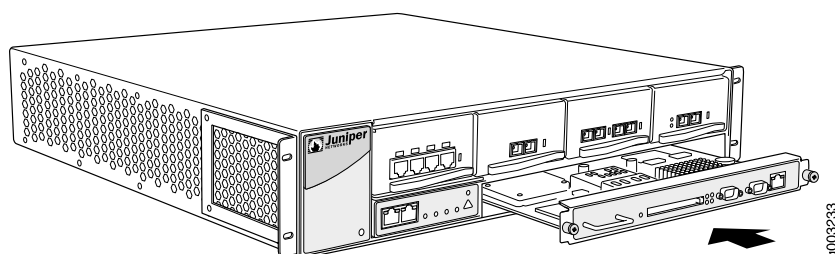


CAUTION: Be careful to align the Routing Engine correctly with the guide rails and push it in evenly. Damage can result if the Routing Engine gets lodged in the rails because of uneven movement.

4. Tighten the thumbscrews at each end of the Routing Engine.

The Routing Engine might require several minutes to boot.

5. After the Routing Engine boots, issue the `show chassis routing-engine` command to verify correct Routing Engine functioning.

Figure 9: Install the Routing Engine in an M7i Router

Replacing a Routing Engine in an M10i Router

To replace a Routing Engine in an M10i router, perform the following procedures:

- Removing a Routing Engine from an M10i Router on page 19
- Installing a Routing Engine in an M10i Router on page 21

Removing a Routing Engine from an M10i Router

To remove a Routing Engine (see Figure 10 on page 21):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. If two Routing Engines are installed, use one of the following two methods to determine which is functioning as master:
 - Note which of the blue **MASTER** LEDs is lit on the Routing Engine faceplates.
 - Issue the following CLI command. The master Routing Engine is designated **Master** in the **Current state** field:

```
user@host> show chassis routing-engine
```

```
Routing Engine status:      Slot 0:      Current state
Master ...
```

3. If you are removing the master Routing Engine and a second Routing Engine is installed, issue the following CLI command to switch mastership to the backup host module:

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

The backup Routing Engine immediately assumes Routing Engine functions. If graceful switchover and nonstop routing are configured, packet forwarding and routing are continued without interruption. If the Routing Engines are configured for graceful switchover, but nonstop routing is not configured, there is no interruption to packet forwarding, but routing is interrupted momentarily. If neither graceful switchover nor nonstop routing is configured, packet forwarding halts while the backup Routing Engine becomes the master and the Packet Forwarding Engine components reset and connect to the new master Routing Engine. For information about configuring graceful switchover and nonstop routing, see the section about Routing Engine redundancy in the *JUNOS System Basics Configuration Guide*.

We recommend that you run JUNOS Release 7.0 or later on the M10i router to support graceful switchover.



NOTE: Router performance might change if the backup Routing Engine's configuration differs from the former master's configuration. For the most predictable performance, configure the two Routing Engines identically, except for parameters unique to a Routing Engine, such as the hostname defined at the `[edit system]` hierarchy level and the management interface (`fxp0` or equivalent) defined at the `[edit interfaces]` hierarchy level.

To configure Routing Engine-specific parameters and still use the same configuration on both Routing Engines, include the appropriate configuration statements under the `re0` and `re1` statements at the `[edit groups]` hierarchy level and use the `apply-groups` statement. For instructions, see the *JUNOS System Basics Configuration Guide*.

4. On the console or other management device connected to the Routing Engine, enter CLI operational mode and issue the following command to shut down the router software cleanly and preserve Routing Engine state information.

```
user@host> request system halt
```



NOTE: Wait until a message appears on the console confirming that the operating system has halted.

For more information about the command, see the *JUNOS System Basics and Services Command Reference*.



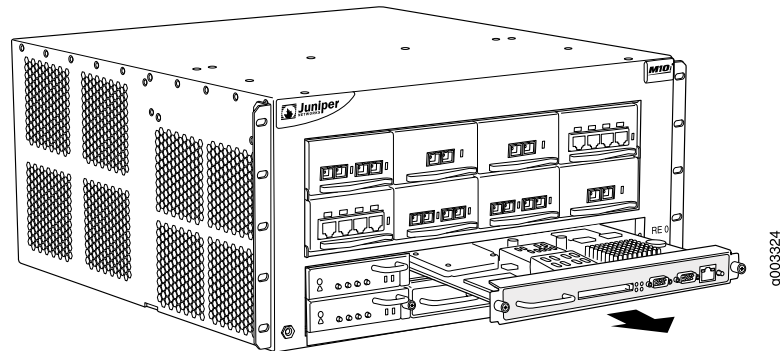
NOTE: The router might continue forwarding traffic for a few minutes after the `request system halt` command has been issued.

5. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
6. Loosen the thumbscrews located at each end of the Routing Engine faceplate, using a Phillips screwdriver if necessary.
7. Grasp the handle and slide the unit about halfway out of the chassis.



CAUTION: Slide the Routing Engine straight out of the chassis. Damage can result if the Routing Engine gets lodged because of uneven movement.

8. Place one hand under the Routing Engine to support it, slide it completely out of the chassis, and place it on the antistatic mat or in the electrostatic bag.

Figure 10: Removing a Routing Engine from an M10i Router**Installing a Routing Engine in an M10i Router**

To install a Routing Engine (see Figure 11 on page 22):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Place one hand under the Routing Engine to support it and grasp the handle on the faceplate with the other hand.
3. Align the rear of the Routing Engine with the guide rails inside the chassis and slide it in completely.

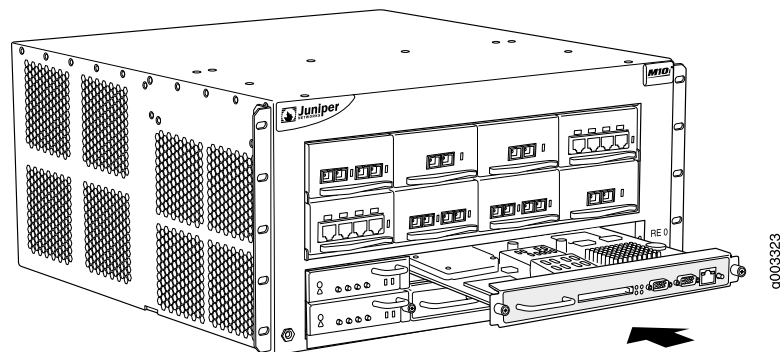


CAUTION: Align the Routing Engine carefully with the guide rails and push it in evenly. Damage can result if the Routing Engine gets lodged in the rails because of uneven movement.

4. Tighten the thumbscrews on the Routing Engine faceplate to secure the Routing Engine.

The Routing Engine might require several minutes to boot.

5. After the Routing Engine boots, issue the `show chassis routing-engine` command to verify correct Routing Engine functioning.

Figure 11: Installing a Routing Engine in an M10i Router

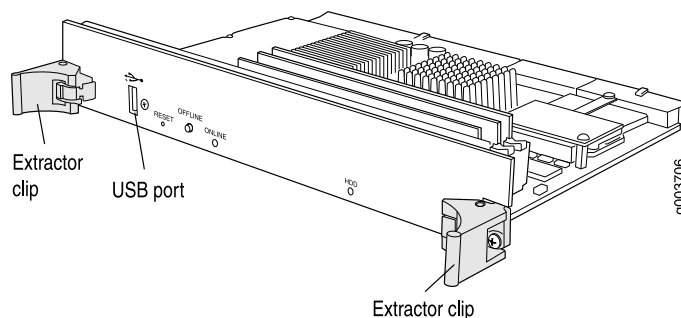
Routing Engines for the M120 Router

The Routing Engine is an Intel-based Peripheral Component Interconnect (PCI) platform that runs JUNOS software. Software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the router, control the router interfaces, control some chassis components, and provide the interface for system management and user access to the router.

You can install one or two Routing Engines in the router. The Routing Engines install into the rear of the chassis in vertical slots directly into the Control Board (CB) labeled **CB0** and **CB1**. If two Routing Engines are installed, one functions as the master and the other acts as the backup. If the master Routing Engine fails or is removed and the backup is configured appropriately, the backup takes over as the master.

If the host system is redundant, the backup Routing Engine is hot-removable and hot-insertable, but the master Routing Engine is hot-pluggable. A Routing Engine that is not redundant is hot-pluggable. Each Routing Engine requires a CB to be installed in the adjacent slot. **RE0** installs below **CB0**, and **RE1** installs below **CB1**. A Routing Engine does not power up if it is not installed into the CB.

There is a USB memory device that connects directly into the front of the Routing Engine. The USB port allows you to plug in a USB keychain device.

Figure 12: Routing Engine

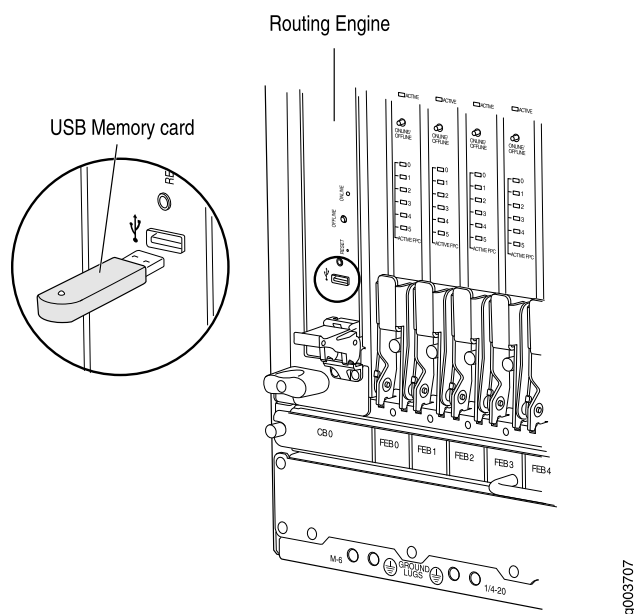
Routing Engine Components

Each Routing Engine (shown in Figure 12 on page 22) consists of the following components:

- CPU—Runs JUNOS software to maintain the router's routing tables and routing protocols. It has a Pentium-class processor.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- USB port—Provides a removable media interface through which you can install the JUNOS software manually. See Figure 13 on page 24. JUNOS supports USB version 1.0.
- Internal flash disk—Provides primary storage for software images, configuration files, and microcode. The disk is a fixed compact flash and is inaccessible from outside the router.
- Hard disk—Provides secondary storage for log files, memory dumps, and rebooting the system if the internal compact flash disk fails.
- LED—Indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.
- HDD LED—Indicates disk activity for the hard disk drive.
- Interfaces for out-of-band management access—Provide information about Routing Engine status to devices (console, laptop, or terminal server) that can be attached to access ports located on the Routing Engine.

Each Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

- EEPROM—Stores the serial number of the Routing Engine.
- Reset button—Reboots the Routing Engine when pressed.
- Offline button—Takes the Routing Engine offline when pressed.
- Extractor clips—Control the locking system that secures the Routing Engine.

Figure 13: USB Memory Device in a Routing Engine

Each Routing Engine has two LEDs that indicates its status. The LEDs, labeled **ONLINE** and **HDD**, are located directly on the faceplate of the Routing Engine. Table 5 on page 24 describes the functions of the Routing Engine LEDs.

Table 5: Routing Engine LEDs

Label	Color	State	Description
ONLINE	Green	Blinking	Routing Engine is transitioning online.
		On steadily	Routing Engine is functioning normally.
	Red	On steadily	Routing Engine has failed.
HDD	Blue	On steadily	Hard disk is functioning normally.

Routing Engine Boot Sequence

The Routing Engine boots from the storage media in this order: the USB device, then the internal flash disk (if present), then the hard disk, then the LAN.



NOTE: The LEDs that report host module status (including Routing Engine status) are on the craft interface rather than the Routing Engine faceplate.



NOTE: For specific information about Routing Engine components (for example, the amount of DRAM), issue the `show chassis routing-engine` command.



NOTE: If two Routing Engines are installed, they must both be the same hardware version.

Replacing a Routing Engine in an M120 Router

Removing a Routing Engine

The router can have one or two Routing Engines. They are located within the CB in the rear of the chassis on either side of the Forwarding Engine Boards (FEBs) in the slots marked **CB0** and **CB1**. Each Routing Engine weighs approximately 2.4 lb (1.1 kg).

To remove a Routing Engine from a CB (see Figure 14 on page 26):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Make sure the router is attached to a proper earth ground.
3. Check whether the Routing Engine is functioning as the backup or as the master. If necessary, take the host subsystem offline as described in the hardware guide for your routing platform.



NOTE: Router performance might change if the standby Routing Engine's configuration differs from the former master's configuration. For the most predictable performance, configure the two Routing Engines identically, except for parameters unique to a Routing Engine, such as the hostname defined at the `[edit system]` hierarchy level and the management interface (`fxp0` or equivalent) defined at the `[edit interfaces]` hierarchy level.

To configure Routing Engine-specific parameters and still use the same configuration on both Routing Engines, include the appropriate configuration statements under the `re0` and `re1` statements at the `[edit groups]` hierarchy level and use the `apply-groups` statement. For instructions, see the *JUNOS System Basics Configuration Guide*.

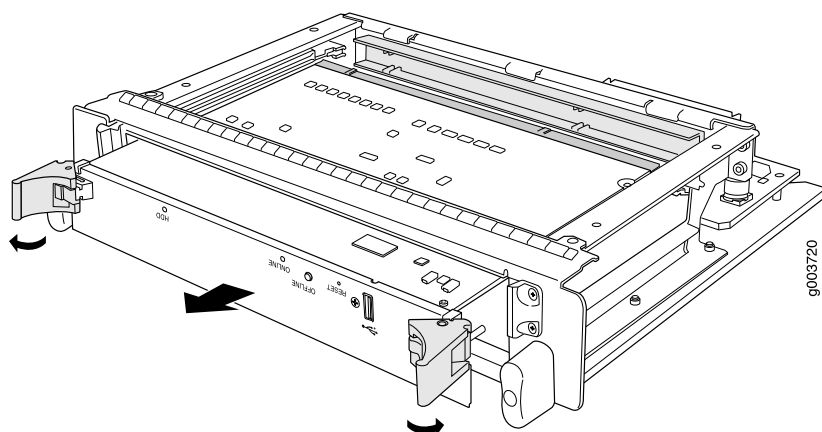
4. Press the red tabs on the ejector handles on both sides of the Routing Engine faceplate.
5. Flip the ejector handles outward to unseat the Routing Engine.
6. Grasp the Routing Engine by the ejector handles and slide it about halfway out of the chassis.

7. Place one hand underneath the Routing Engine to support it and slide it completely out of the chassis.
8. Place the Routing Engine on the antistatic mat.



NOTE: To maintain proper airflow through the chassis, do not leave a CB installed in the chassis without a Routing Engine for extended periods of time. If a Routing Engine is removed, install a replacement Routing Engine as soon as possible.

Figure 14: Removing a Routing Engine



Installing a Routing Engine

To install a Routing Engine into a CB (see Figure 15 on page 27):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Ensure that the ejector handles are not in the locked position. If necessary, press the red tabs and flip the ejector handles outward.
3. Place one hand underneath the Routing Engine to support it. With the other hand, grasp one of the ejector handles on the faceplate.
4. Carefully align the sides of the Routing Engine with the guides inside the chassis.
5. Slide the Routing Engine into the chassis until you feel resistance, and then press the Routing Engine's faceplate until it engages the midplane connectors.
6. Press both the ejector handles inward to seat the Routing Engine.

The Routing Engine might require several minutes to boot.

7. If applicable, tighten the screws on the extractor handles, using a Phillips screwdriver. Be sure to tighten the screws enough to seat the Routing Engine properly.
8. After the Routing Engine boots, verify that it is installed correctly by checking the RE0 and RE1 LEDs on the craft interface. If the router is operational and the Routing Engine is functioning properly, the green **OK** LED lights steadily. If the red **FAIL** LED lights steadily instead, remove and install the Routing Engine again (see “Replacing a Routing Engine in an M120 Router” on page 25 and “Installing a Routing Engine” on page 26). If the red **FAIL** LED still lights steadily, the Routing Engine is not functioning properly. Contact your customer support representative.

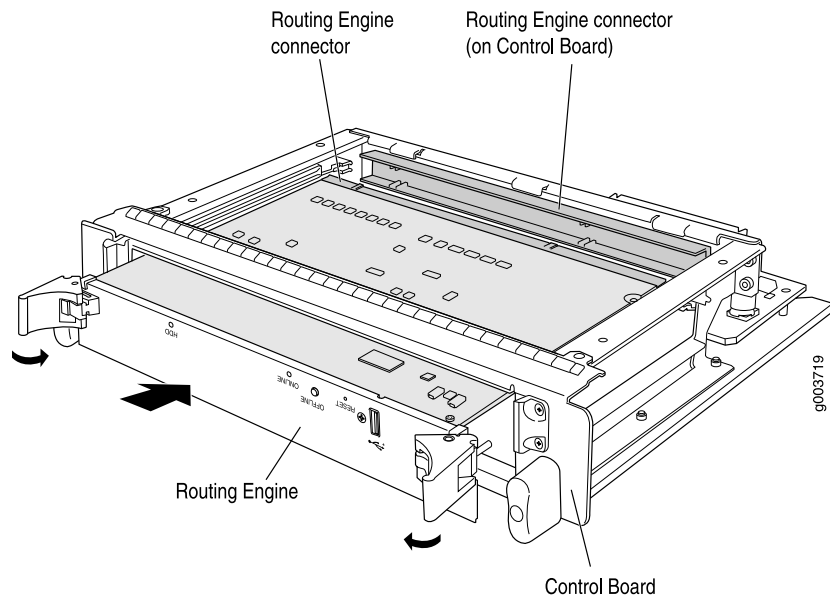
To check the status of the Routing Engine, use the CLI command:

```
user@host> show chassis routing-engine
```

```
Routing Engine status:      Slot 0:      Current state
Master ...
```

For more information about using the CLI, see the JUNOS software manuals.

Figure 15: Installing a Routing Engine



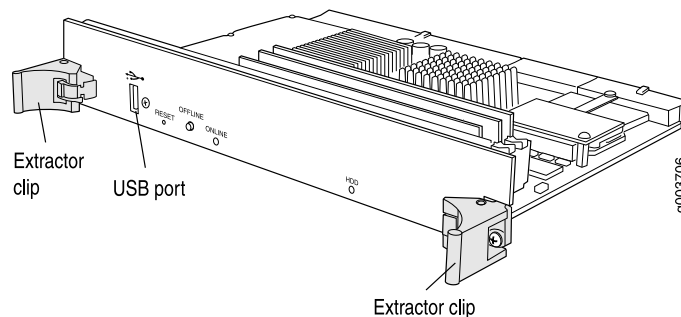
Routing Engines for the M320 and T320 Routers, T640 and T1600 Routing Node, and TX Matrix Platform

The Routing Engine is an Intel-based Peripheral Component Interconnect (PCI) platform that runs JUNOS software. Software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the routing platform, control the router's interfaces, control some chassis components, and provide the interface for system management and user access to the routing platform.

You can install one or two Routing Engines in the routing platform. The Routing Engines install into the upper rear of the chassis in the slots labeled RE0 and RE1. If two Routing Engines are installed, one functions as the master and the other acts as the backup. If the master Routing Engine fails or is removed and the backup is configured appropriately, the backup takes over as the master.

If the host system is redundant, the backup Routing Engine is hot-removable and hot-insertable, but the master Routing Engine is hot-pluggable. A Routing Engine that is not redundant is hot-pluggable. Each Routing Engine requires a Control Board (CB) or T640-specific Control Board (T-CB) to be installed in the adjacent slot. RE0 installs below CB0, and RE1 installs above CB1. A Routing Engine does not power on if no CB or T-CB is present in the adjacent slot.

Figure 16: Routing Engine 2000



Routing Engine Components

Each Routing Engine (shown in Figure 16 on page 28) consists of the following components:

- CPU—Runs JUNOS software to maintain the routing platform's routing tables and routing protocols. It has a Pentium-class processor.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- Internal flash disk—Provides primary storage for software images, configuration files, and microcode. The drive is a fixed compact flask disk and is inaccessible from outside the routing platform.
- Hard disk—Provides secondary storage for log files, memory dumps, and rebooting the system if the internal flash disk fails.
- USB port—Provides a removable media interface through which you can install the JUNOS software manually (see Figure 13 on page 24). JUNOS supports USB version 1.0. Supported on RE-A-2000-4096 only.
- LED—Indicates disk activity for the internal IDE interface. It does not necessarily indicate routing-related activity.
- Interfaces for out-of-band management access—Provide information about Routing Engine status to devices (console, laptop, or terminal server) that can be attached to access ports located on the Connector Interface Panel (CIP).

Each Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

- EEPROM—Stores the serial number of the Routing Engine.
- Reset button—Reboots the Routing Engine when pressed.



NOTE: The LEDs that report host module status (including Routing Engine status) are on the craft interface rather than the Routing Engine faceplate.



NOTE: For specific information about Routing Engine components (for example, the amount of DRAM), issue the `show chassis routing-engine` command.



NOTE: If two Routing Engines are installed, they must both be the same hardware version.

Tools and Parts Required

To replace a Routing Engine, you need the following tools and parts:

- Electrostatic bag or antistatic mat
- Electrostatic discharge (ESD) grounding wrist strap
- Phillips (+) screwdriver, number 2

Replacing a Routing Engine in an M320 or T320 Router, T640 or T1600 Routing Node, or TX Matrix Platform

This section describes how to replace a Routing Engine in an M320 or T320 router, a T640 or T1600 routing node, or a TX Matrix platform.

Replacing a Routing Engine

The Routing Engine is hot-pluggable. If the routing platform contains a redundant host subsystem, the Routing Engine and control board are hot-removable and hot-insertable. Before you replace a control board or a Routing Engine, you must take the host subsystem offline (see the hardware guide for your routing platform).

Removing a Routing Engine

The routing platform can have one or two Routing Engines. They are located in the upper rear of the chassis in the slots marked **RE0** and **RE1**. Each Routing Engine weighs approximately 2.4 lb (1.1 kg).

To remove a Routing Engine (see Figure 17 on page 31 which shows the M320 routing platform):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
3. Check whether the Routing Engine is functioning as the backup or as the master. If necessary, take the host subsystem offline as described in the hardware guide for your routing platform.

If the Routing Engines are configured for graceful switchover and are running a JUNOS release that supports graceful switchover, the standby Routing Engine immediately assumes Routing Engine functions and there is no interruption to packet forwarding. Otherwise, packet forwarding halts while the standby Routing Engine becomes the master and the Packet Forwarding Engine components reset and connect to the new master Routing Engine. For information about configuring graceful switchover, see the section about Routing Engine redundancy in the *JUNOS System Basics Configuration Guide*.

We recommend that you run JUNOS Release 7.0 or later on the M320 and T320 routers, and on the T640 routing node to support graceful switchover. We recommend that you run JUNOS Release 7.3 or later on the TX Matrix platform to support graceful switchover.



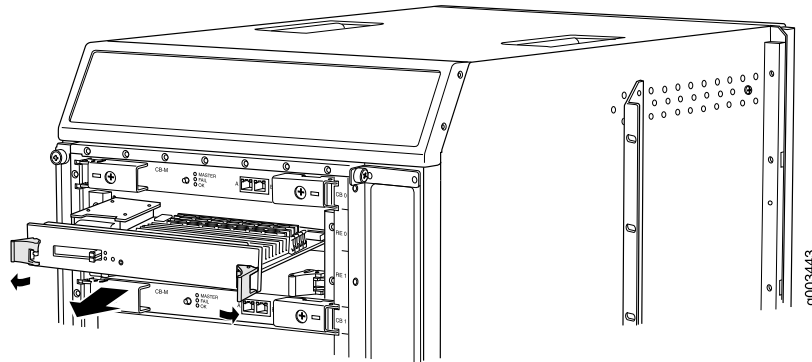
NOTE: Router performance might change if the standby Routing Engine's configuration differs from the former master's configuration. For the most predictable performance, configure the two Routing Engines identically, except for parameters unique to a Routing Engine, such as the hostname defined at the `[edit system]` hierarchy level and the management interface (`fxp0` or equivalent) defined at the `[edit interfaces]` hierarchy level.

To configure Routing Engine-specific parameters and still use the same configuration on both Routing Engines, include the appropriate configuration statements under the `re0` and `re1` statements at the `[edit groups]` hierarchy level and use the `apply-groups` statement. For instructions, see the *JUNOS System Basics Configuration Guide*.

4. If applicable, loosen the screws on the extractor handles at either end of the Routing Engine faceplate, using a Phillips screwdriver.
5. Press the red tabs on the ejector handles on both sides of the Routing Engine faceplate.
6. Flip the ejector handles outward to unseat the Routing Engine.
7. Grasp the Routing Engine by the ejector handles and slide it about halfway out of the chassis.
8. Place one of your hands underneath the Routing Engine to support it and slide it completely out of the chassis.

9. Place the Routing Engine on the antistatic mat.
10. If you are not replacing the Routing Engine now, install a blank panel over the empty slot.

Figure 17: Removing a Routing Engine



Installing a Routing Engine

To install a Routing Engine (see Figure 18 on page 32, which shows the M320 router):

1. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
2. Ensure that the ejector handles are not in the locked position. If necessary, press the red tabs and flip the ejector handles outward.
3. Place one hand underneath the Routing Engine to support it. With the other hand, grasp one of the ejector handles on the faceplate.
4. Carefully align the sides of the Routing Engine with the guides inside the chassis.
5. Slide the Routing Engine into the chassis until you feel resistance, and then press the Routing Engine's faceplate until it engages the midplane connectors.
6. Press both the ejector handles inward to seat the Routing Engine.

The Routing Engine might require several minutes to boot.

7. If applicable, tighten the screws on the extractor handles, using a Phillips screwdriver. Be sure to tighten the screws enough to seat the Routing Engine properly.
8. After the Routing Engine boots, verify that it is installed correctly by checking the RE0 and RE1 LEDs on the craft interface. If the router is operational and the Routing Engine is functioning properly, the green OK LED lights steadily. If the red FAIL LED lights steadily instead, remove and install the Routing Engine again (see "Removing a Routing Engine" on page 29 and "Installing a Routing Engine" on page 31). If the red FAIL LED still lights steadily, the Routing Engine is not functioning properly. Contact your customer support representative.

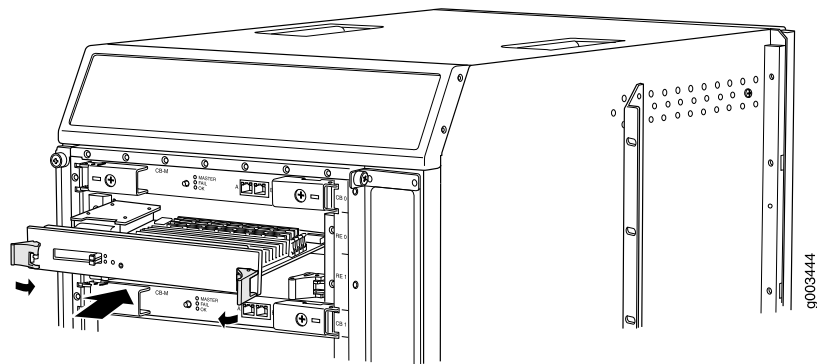
To check the status of the Routing Engine, use the CLI command:

```
user@host> show chassis routing-engine
```

```
Routing Engine status:      Slot 0:      Current state
Master ...
```

For more information about using the CLI, see the JUNOS software manuals.

Figure 18: Installing a Routing Engine



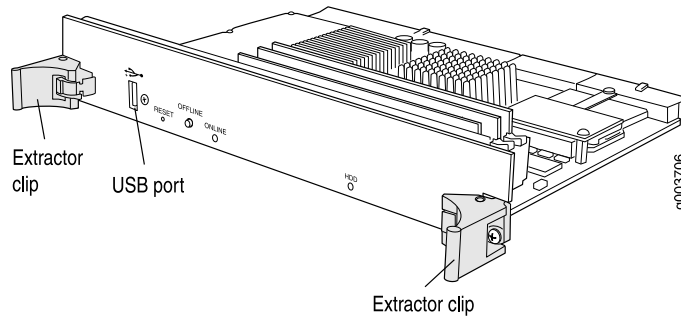
Routing Engines for the MX240, MX480, and MX960 Ethernet Services Routers

The Routing Engine is an Intel-based PC platform that runs JUNOS software. Software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the router, control the router interfaces, control some chassis components, and provide the interface for system management and user access to the router.

You can install one or two Routing Engines in the router. The Routing Engines install into the front of the chassis in slots directly into the Switch Control Boards (SCBs) labeled 0 and 1. If two Routing Engines are installed, one functions as the master and the other acts as the backup. If the master Routing Engine fails or is removed, and the backup is configured appropriately, the backup takes over as the master.

On the MX960 router, a Routing Engine installed in SCB slot 2/6 receives no power and supplies no additional routing functions. If no SCB is installed in slot 2/6, install a blank panel in the slot.

If the host system is redundant, the backup Routing Engine is hot-removable and hot-insertable, but the master Routing Engine is hot-pluggable. A Routing Engine that is not redundant is hot-pluggable. Each Routing Engine must be installed directly into an SCB. A USB port on the Routing Engine accepts a USB memory device that allows you to load JUNOS software.

Figure 19: Routing Engine 1300

Routing Engine Components

Each Routing Engine (shown in Figure 19 on page 33) consists of the following components:

- CPU—Runs JUNOS software to maintain the router's routing tables and routing protocols. It has a Pentium-class processor.
- DRAM—Provides storage for the routing and forwarding tables and for other Routing Engine processes.
- USB port—Provides a removable media interface through which you can install the JUNOS software manually. See Figure 20 on page 34, Figure 21 on page 34, and Figure 22 on page 35. JUNOS software installed on a USB memory device supports USB version 1.0.
- Internal flash disk—Provides primary storage for software images, configuration files, and microcode. The disk is a fixed compact flash and is inaccessible from outside the router.
- Hard disk—Provides secondary storage for log files, memory dumps, and rebooting the system if the internal compact flash disk fails.
- Interface ports—The **AUX**, **CONSOLE**, and **Ethernet** ports provide access to management devices.
- LEDs—Indicate disk activity for the internal IDE interface. They do not necessarily indicate routing-related activity.
- HDD LED—Indicates disk activity for the hard disk drive.
- Interfaces for out-of-band management access—Provide information about Routing Engine status to devices (console, laptop, or terminal server) that can be attached to access ports located on the Routing Engine.

Each Routing Engine has one 10/100-Mbps Ethernet port for connecting to a management network, and two asynchronous serial ports—one for connecting to a console and one for connecting to a modem or other auxiliary device.

- EEPROM—Stores the serial number of the Routing Engine.
- Reset button—Reboots the Routing Engine when pressed.
- Offline button—Takes the Routing Engine offline when pressed.

- Extractor clips—used for inserting and extracting the Routing Engine.
- Captive screws—Secure the Routing Engine in place.

Figure 20: USB Memory Device in a Routing Engine of an MX240 Router

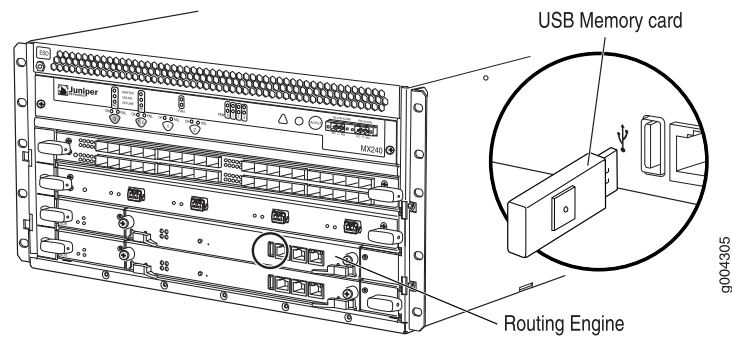


Figure 21: USB Memory Device in a Routing Engine of an MX480 Router

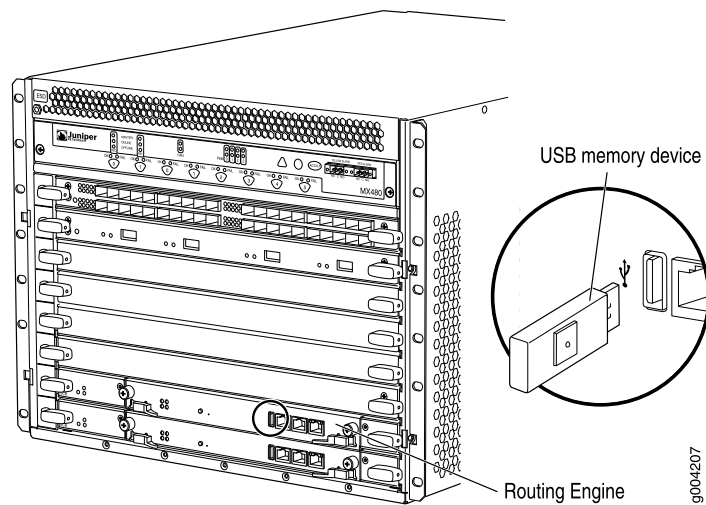
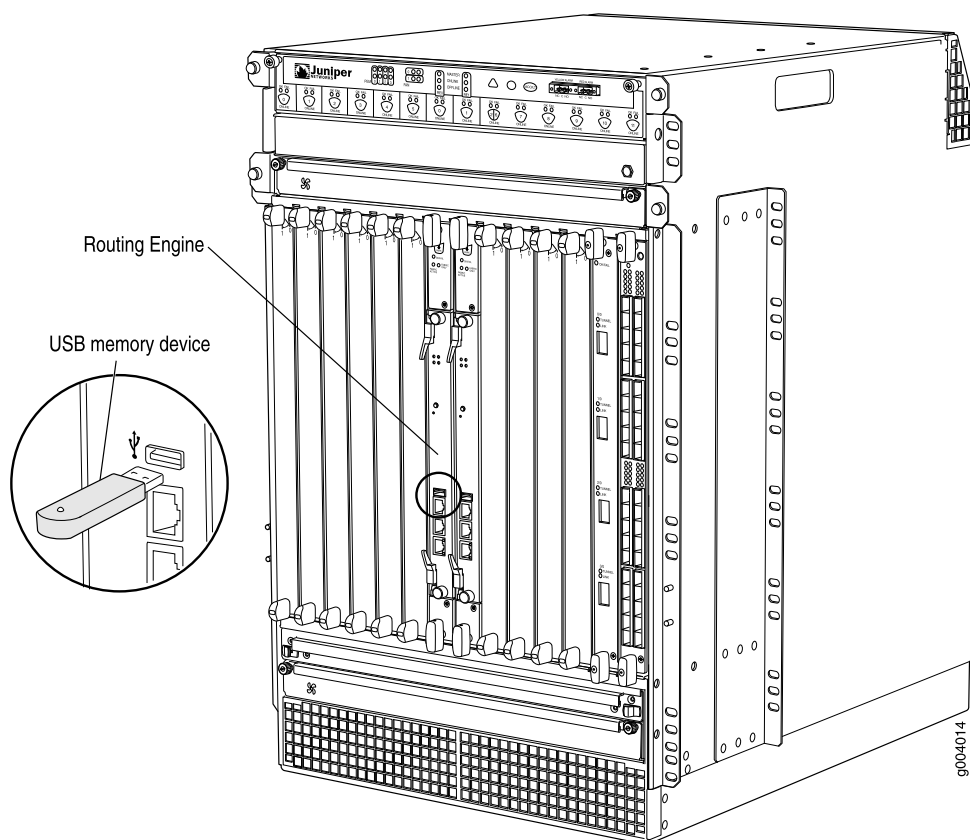


Figure 22: USB Memory Device in a Routing Engine of an MX960 Router

Each Routing Engine has four LEDs that indicates its status. The LEDs, labeled **MASTER**, **HDD**, **ONLINE**, and **FAIL** are located directly on the faceplate of the Routing Engine. Table 6 on page 35 describes the functions of the Routing Engine LEDs.

Table 6: Routing Engine LEDs

Label	Color	State	Description
MASTER	Blue	On steadily	Routing Engine is Master.
HDD	Green	Green blinking	Hard disk is functioning normally.
ONLINE	Green	Blinking	Routing Engine is transitioning online.
		On steadily	Routing Engine is functioning normally.
FAIL	Red	On steadily	Routing Engine has failed.

Routing Engine Boot Sequence

The Routing Engine boots from the storage media in this order: the USB device, then the internal flash disk (if present), then the hard disk, then the LAN.

If the Routing Engines are configured for graceful switchover, the backup Routing Engine automatically synchronizes its configuration and state with the master Routing Engine. Any update to the master Routing Engine state is replicated on the backup Routing Engine. If the backup Routing Engine assumes mastership, packet forwarding continues through the router without interruption. For more information about graceful switchover, see the *JUNOS System Basics Configuration Guide*.



NOTE: For specific information about Routing Engine components (for example, the amount of DRAM), issue the `show chassis routing-engine` command.



NOTE: If two Routing Engines are installed, they must both be the same hardware version.

Replacing a Routing Engine in an MX240, MX480, or MX960 Ethernet Services Router

The Routing Engine is hot-pluggable. If the router contains a redundant host subsystem, the Routing Engine and control board are hot-removable and hot-insertable. Before you replace a control board or a Routing Engine, you must take the host subsystem offline (see the hardware guide for your routing platform).

Removing a Routing Engine

The router can have one or two Routing Engines. They are located within the SCB in the front center of the chassis in the slots marked **0**, and **1**. On the MX960 router, a spare Routing Engine can be installed in slot **2/6**, but it will not receive power. Each Routing Engine weighs approximately 2.4 lb (1.1 kg).

To remove a Routing Engine from an SCB (see Figure 23 on page 37, Figure 24 on page 38, and Figure 25 on page 38):

1. Place an electrostatic bag or antistatic mat on a flat, stable surface.
2. Attach an electrostatic discharge (ESD) grounding strap to your bare wrist and connect the strap to one of the ESD points on the chassis. Verify that the router is attached to a proper earth ground.
3. Check whether the Routing Engine is functioning as the backup or as the master. If necessary, take the host subsystem offline as described in the hardware guide for your routing platform.



NOTE: Router performance might change if the standby Routing Engine's configuration differs from the former master's configuration. For the most predictable performance, configure the two Routing Engines identically, except for parameters unique to a Routing Engine, such as the hostname defined at the [edit system] hierarchy level and the management interface (fxp0 or equivalent) defined at the [edit interfaces] hierarchy level.

To configure Routing Engine-specific parameters and still use the same configuration on both Routing Engines, include the appropriate configuration statements under the **re0** and **re1** statements at the [edit groups] hierarchy level and use the **apply-groups** statement. For instructions, see the *JUNOS System Basics Configuration Guide*.

4. Verify that the Routing Engine LEDs are off.
5. Loosen the captive screws at each end of the Routing Engine.
6. Flip the ejector handles outward to unseat the Routing Engine.
7. Grasp the Routing Engine by the ejector handles and slide it about halfway out of the chassis.
8. Place one hand underneath the Routing Engine to support it and slide it completely out of the chassis.
9. Place the Routing Engine on the antistatic mat.



NOTE: To maintain proper airflow through the chassis, do not leave an SCB installed in the chassis without a Routing Engine for extended periods of time. If a Routing Engine is removed, install a replacement Routing Engine as soon as possible.

Figure 23: Removing a Routing Engine from an MX240 Router

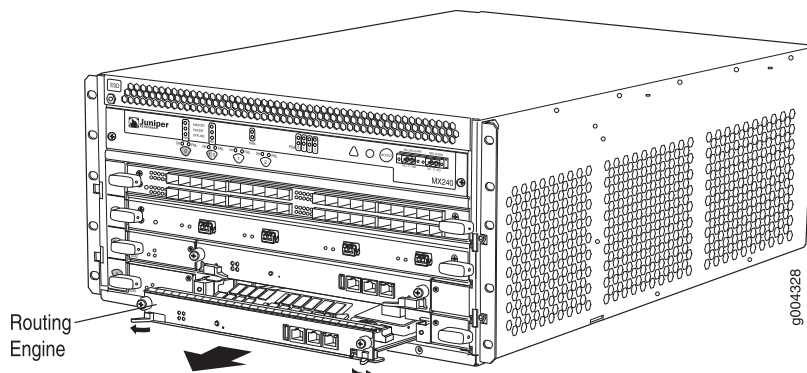


Figure 24: Removing a Routing Engine from an MX480 Router

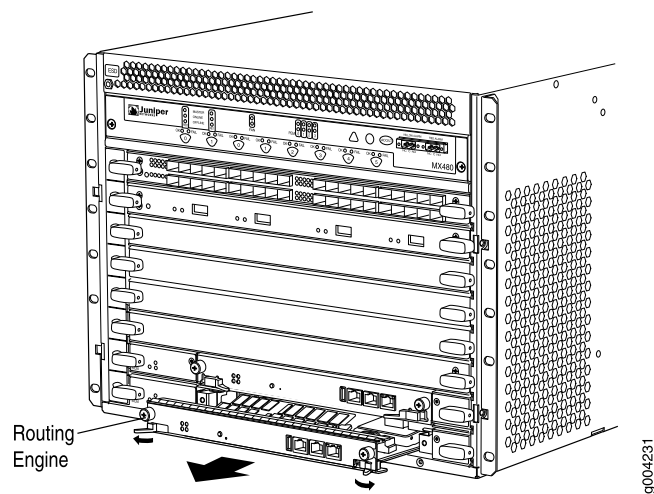
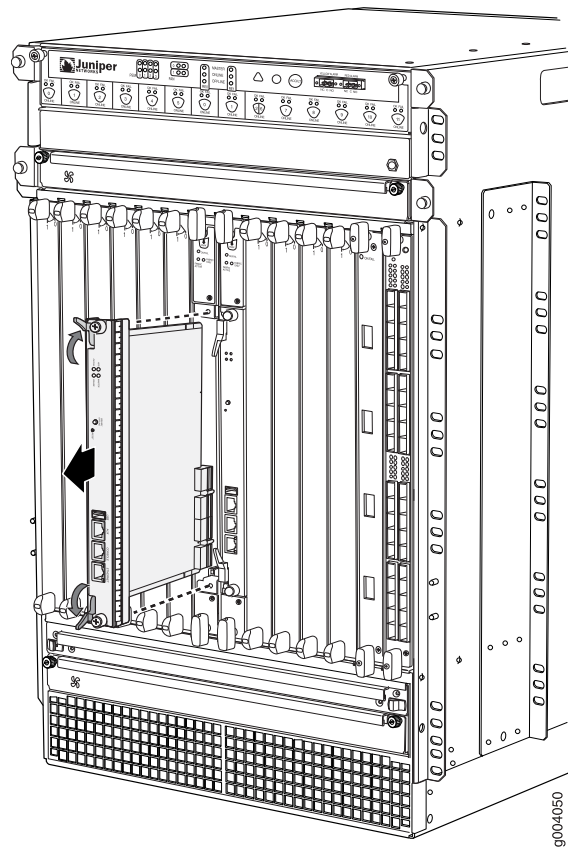


Figure 25: Removing a Routing Engine from an MX960 Router



Installing a Routing Engine

To install a Routing Engine into an SCB (see Figure 26 on page 39, Figure 27 on page 40, and Figure 28 on page 40):

1. Ensure that the ejector handles are not in the locked position. If necessary, flip the ejector handles outward.
2. Place one hand underneath the Routing Engine to support it.
3. Carefully align the sides of the Routing Engine with the guides inside the opening on the SCB.
4. Slide the Routing Engine into the SCB until you feel resistance, and then press the Routing Engine's faceplate until it engages the connectors.
5. Press both the ejector handles inward to seat the Routing Engine.
6. Tighten the captive screws at each end of the Routing Engine.

The Routing Engine might require several minutes to boot.

After the Routing Engine boots, verify that it is installed correctly by checking the RE0 and RE1 LEDs on the craft interface. If the router is operational and the Routing Engine is functioning properly, the green **ONLINE** LED lights steadily. If the red **FAIL** LED lights steadily instead, remove and install the Routing Engine again (see “Removing a Routing Engine” on page 36 and “Installing a Routing Engine” on page 39). If the red **FAIL** LED still lights steadily, the Routing Engine is not functioning properly. Contact your customer support representative.

To check the status of the Routing Engine, use the CLI command:

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

For more information about using the CLI, see the JUNOS software manuals.

Figure 26: Installing a Routing Engine in an MX240 Router

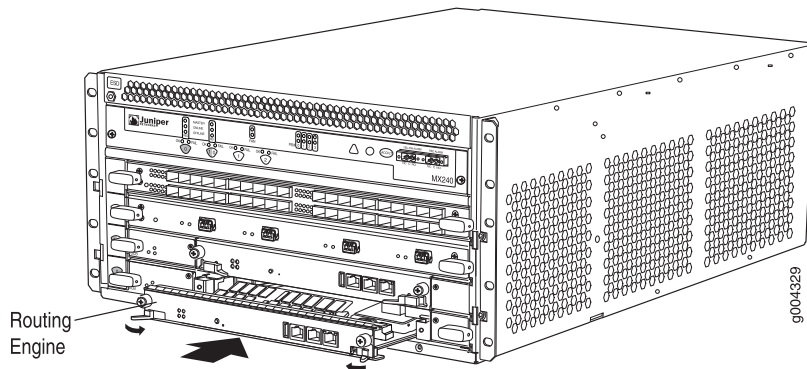


Figure 27: Installing a Routing Engine in an MX480 Router

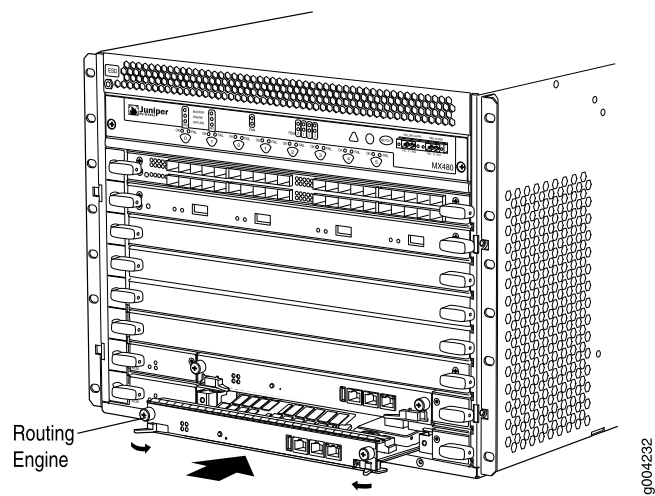
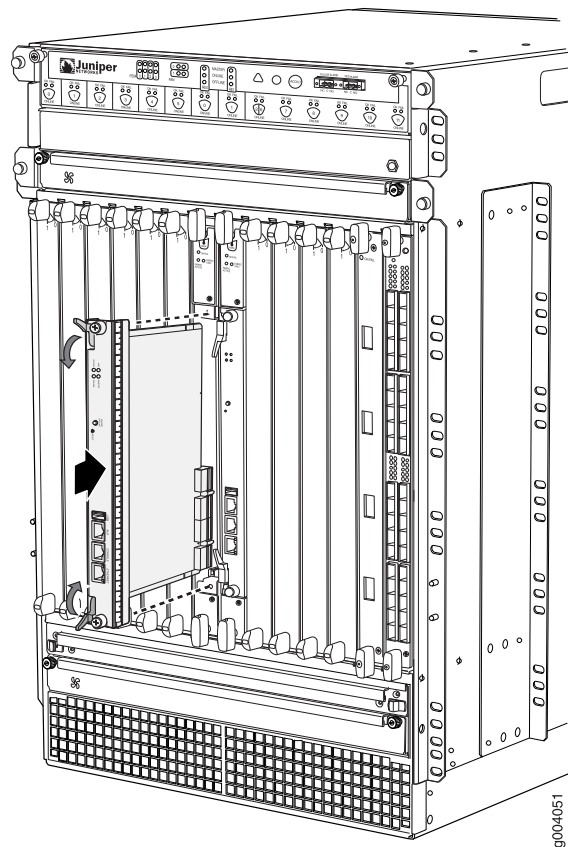


Figure 28: Installing a Routing Engine in an MX960 Router



Compliance Statements for Environmental Requirements

Lithium Battery

Batteries in this product are not based on mercury, lead, or cadmium substances. The batteries used in this product are in compliance with EU Directives 91/157/EEC, 93/86/EEC, and 98/101/EEC. The product documentation includes instructional information about the proper method of reclamation and recycling.

List of Technical Publications

Table 7 on page 41 lists the software and hardware guides and release notes for Juniper Networks J-series, M-series, MX-series, and T-series routing platforms and describes the contents of each document. Table 8 on page 45 lists the books included in the *Network Operations Guide* series. Table 9 on page 46 lists the manuals and release notes supporting JUNOS software with enhanced services. All documents are available at <http://www.juniper.net/techpubs/>.

Table 10 on page 47 lists additional books on Juniper Networks solutions that you can order through your bookstore. A complete list of such books is available at <http://www.juniper.net/books>.

Table 7: Technical Documentation for Supported Routing Platforms

Book	Description
JUNOS Software for Supported Routing Platforms	
<i>Access Privilege</i>	Explains how to configure access privileges in user classes by using permission flags and regular expressions. Lists the permission flags along with their associated command-line interface (CLI) operational mode commands and configuration statements.
<i>Class of Service</i>	Provides an overview of the class-of-service (CoS) functions of the JUNOS software and describes how to configure CoS features, including configuring multiple forwarding classes for transmitting packets, defining which packets are placed into each output queue, scheduling the transmission service level for each queue, and managing congestion through the random early detection (RED) algorithm.
<i>CLI User Guide</i>	Describes how to use the JUNOS command-line interface (CLI) to configure, monitor, and manage Juniper Networks routing platforms. This material was formerly covered in the <i>JUNOS System Basics Configuration Guide</i> .
<i>Feature Guide</i>	Provides a detailed explanation and configuration examples for several of the most complex features in the JUNOS software.
<i>High Availability</i>	Provides an overview of hardware and software resources that ensure a high level of continuous routing platform operation and describes how to configure high availability (HA) features such as nonstop active routing (NSR) and graceful Routing Engine switchover (GRES).

Table 7: Technical Documentation for Supported Routing Platforms (continued)

Book	Description
<i>MPLS Applications</i>	Provides an overview of traffic engineering concepts and describes how to configure traffic engineering protocols.
<i>Multicast Protocols</i>	Provides an overview of multicast concepts and describes how to configure multicast routing protocols.
<i>Multiplay Solutions</i>	Describes how you can deploy IPTV and voice over IP (VoIP) services in your network.
<i>MX-series Layer 2 Configuration Guide</i>	Provides an overview of the Layer 2 functions of the MX-series routers, including configuring bridging domains, MAC address and VLAN learning and forwarding, and spanning-tree protocols. It also details the routing instance types used by Layer 2 applications. All of this material was formerly covered in the <i>JUNOS Routing Protocols Configuration Guide</i> .
<i>MX-series Layer 2 Solutions Guide</i>	Describes common configuration scenarios for the Layer 2 features supported on the MX-series routers, including basic bridged VLANs with normalized VLAN tags, aggregated Ethernet links, bridge domains, Multiple Spanning Tree Protocol (MSTP), and integrated routing and bridging (IRB).
<i>Network Interfaces</i>	Provides an overview of the network interface functions of the JUNOS software and describes how to configure the network interfaces on the routing platform.
<i>Network Management</i>	Provides an overview of network management concepts and describes how to configure various network management features, such as SNMP and accounting options.
<i>Policy Framework</i>	Provides an overview of policy concepts and describes how to configure routing policy, firewall filters, and forwarding options.
<i>Protected System Domain</i>	Provides an overview of the JCS 1200 platform and the concept of Protected System Domains (PSDs). The JCS 1200 platform, which contains up to six redundant pairs of Routing Engines running JUNOS software, is connected to a T320 router or to a T640 or T1600 routing node. To configure a PSD, you assign any number of Flexible PIC concentrators (FPCs) in the T-series routing platform to a pair of Routing Engines on the JCS 1200 platform. Each PSD has the same capabilities and functionality as a physical router, with its own control plane, forwarding plane, and administration.
<i>Routing Protocols</i>	Provides an overview of routing concepts and describes how to configure routing instances, and unicast routing protocols.
<i>Secure Configuration Guide for Common Criteria and JUNOS-FIPS</i>	Provides an overview of secure Common Criteria and JUNOS-FIPS protocols for the JUNOS software and describes how to install and configure secure Common Criteria and JUNOS-FIPS on a routing platform.
<i>Services Interfaces</i>	Provides an overview of the services interfaces functions of the JUNOS software and describes how to configure the services interfaces on the router.

Table 7: Technical Documentation for Supported Routing Platforms (*continued*)

Book	Description
<i>Software Installation and Upgrade Guide</i>	Describes the JUNOS software components and packaging and explains how to initially configure, reinstall, and upgrade the JUNOS system software. This material was formerly covered in the <i>JUNOS System Basics Configuration Guide</i> .
<i>Subscriber Access</i>	Provides an overview of the subscriber access features of the JUNOS software and describes how to configure subscriber access support on the router, including dynamic profiles, class of service, AAA, and access methods.
<i>System Basics</i>	Describes Juniper Networks routing platforms and explains how to configure basic system parameters, supported protocols and software processes, authentication, and a variety of utilities for managing your router on the network.
<i>VPNs</i>	Provides an overview and describes how to configure Layer 2 and Layer 3 virtual private networks (VPNs), virtual private LAN service (VPLS), and Layer 2 circuits. Provides configuration examples.
JUNOS References	
<i>Hierarchy and RFC Reference</i>	Describes the JUNOS configuration mode commands. Provides a hierarchy reference that displays each level of a configuration hierarchy, and includes all possible configuration statements that can be used at that level. This material was formerly covered in the <i>JUNOS System Basics Configuration Guide</i> .
<i>Interfaces Command Reference</i>	Describes the JUNOS software operational mode commands you use to monitor and troubleshoot interfaces.
<i>Routing Protocols and Policies Command Reference</i>	Describes the JUNOS software operational mode commands you use to monitor and troubleshoot routing policies and protocols, including firewall filters.
<i>System Basics and Services Command Reference</i>	Describes the JUNOS software operational mode commands you use to monitor and troubleshoot system basics, including commands for real-time monitoring and route (or path) tracing, system software management, and chassis management. Also describes commands for monitoring and troubleshooting services such as class of service (CoS), IP Security (IPsec), stateful firewalls, flow collection, and flow monitoring.
<i>System Log Messages Reference</i>	Describes how to access and interpret system log messages generated by JUNOS software modules and provides a reference page for each message.
J-Web User Guide	
<i>J-Web Interface User Guide</i>	Describes how to use the J-Web graphical user interface (GUI) to configure, monitor, and manage Juniper Networks routing platforms.
JUNOS API and Scripting Documentation	
<i>JUNOScript API Guide</i>	Describes how to use the JUNOScript application programming interface (API) to monitor and configure Juniper Networks routing platforms.

Table 7: Technical Documentation for Supported Routing Platforms (continued)

Book	Description
<i>JUNOS XML API Configuration Reference</i>	Provides reference pages for the configuration tag elements in the JUNOS XML API.
<i>JUNOS XML API Operational Reference</i>	Provides reference pages for the operational tag elements in the JUNOS XML API.
<i>NETCONF API Guide</i>	Describes how to use the NETCONF API to monitor and configure Juniper Networks routing platforms.
<i>JUNOS Configuration and Diagnostic Automation Guide</i>	Describes how to use the commit script and self-diagnosis features of the JUNOS software. This guide explains how to enforce custom configuration rules defined in scripts, how to use commit script macros to provide simplified aliases for frequently used configuration statements, and how to configure diagnostic event policies.
Hardware Documentation	
<i>Hardware Guide</i>	Describes how to install, maintain, and troubleshoot routing platforms and components. Each platform has its own hardware guide.
<i>PIC Guide</i>	Describes the routing platform's Physical Interface Cards (PICs). Each platform has its own PIC guide.
<i>DPC Guide</i>	Describes the Dense Port Concentrators (DPCs) for all MX-series routers.
JUNOScope Documentation	
<i>JUNOScope Software User Guide</i>	Describes the JUNOScope software graphical user interface (GUI), how to install and administer the software, and how to use the software to manage routing platform configuration files and monitor routing platform operations.
Advanced Insight Solutions (AIS) Documentation	
<i>Advanced Insight Solutions Guide</i>	Describes the Advanced Insight Manager (AIM) application, which provides a gateway between JUNOS devices and Juniper Support Systems (JSS) for case management and intelligence updates. Explains how to run AI-Scripts on Juniper Networks devices.
J-series Routing Platform Documentation	
<i>Getting Started Guide</i>	Provides an overview, basic instructions, and specifications for J-series routing platforms. The guide explains how to prepare your site for installation, unpack and install the router and its components, install licenses, and establish basic connectivity. Use the <i>Getting Started Guide</i> for your router model.
<i>Basic LAN and WAN Access Configuration Guide</i>	Explains how to configure the interfaces on J-series Services Routers for basic IP routing with standard routing protocols, ISDN backup, and digital subscriber line (DSL) connections.

Table 7: Technical Documentation for Supported Routing Platforms (*continued*)

Book	Description
<i>Advanced WAN Access Configuration Guide</i>	Explains how to configure J-series Services Routers in virtual private networks (VPNs) and multicast networks, configure data link switching (DLSw) services, and apply routing techniques such as policies, stateless and stateful firewall filters, IP Security (IPsec) tunnels, and class-of-service (CoS) classification for safer, more efficient routing.
<i>Administration Guide</i>	Shows how to manage users and operations, monitor network performance, upgrade software, and diagnose common problems on J-series Services Routers.
Release Notes	
<i>JUNOS Release Notes</i>	Summarize new features and known problems for a particular software release, provide corrections and updates to published JUNOS, JUNOScript, and NETCONF manuals, provide information that might have been omitted from the manuals, and describe upgrade and downgrade procedures.
<i>Hardware Release Notes</i>	Describe the available documentation for the routing platform and summarize known problems with the hardware and accompanying software. Each platform has its own release notes.
<i>JUNOScope Release Notes</i>	Contain corrections and updates to the published JUNOScope manual, provide information that might have been omitted from the manual, and describe upgrade and downgrade procedures.
<i>AIS Release Notes</i>	Summarize AIS new features and guidelines, identify known and resolved problems, provide information that might have been omitted from the manuals, and provide initial setup, upgrade, and downgrade procedures.
<i>AIS AI-Scripts Release Notes</i>	Summarize AI-Scripts new features, identify known and resolved problems, provide information that might have been omitted from the manuals, and provide instructions for automatic and manual installation, including deleting and rolling back.
<i>J-series Services Router Release Notes</i>	Briefly describe Services Router features, identify known hardware problems, and provide upgrade and downgrade instructions.

Table 8: JUNOS Software Network Operations Guides

Book	Description
<i>Baseline</i>	Describes the most basic tasks for running a network using Juniper Networks products. Tasks include upgrading and reinstalling JUNOS software, gathering basic system management information, verifying your network topology, and searching log messages.
<i>Interfaces</i>	Describes tasks for monitoring interfaces. Tasks include using loopback testing and locating alarms.

Table 8: JUNOS Software Network Operations Guides (*continued*)

Book	Description
<i>MPLS</i>	Describes tasks for configuring, monitoring, and troubleshooting an example MPLS network. Tasks include verifying the correct configuration of the MPLS and RSVP protocols, displaying the status and statistics of MPLS running on all routing platforms in the network, and using the layered MPLS troubleshooting model to investigate problems with an MPLS network.
<i>MPLS Log Reference</i>	Describes MPLS status and error messages that appear in the output of the <code>show mpls lsp extensive</code> command. The guide also describes how and when to configure Constrained Shortest Path First (CSPF) and RSVP trace options, and how to examine a CSPF or RSVP failure in a sample network.
<i>MPLS Fast Reroute</i>	Describes operational information helpful in monitoring and troubleshooting an MPLS network configured with fast reroute (FRR) and load balancing.
<i>Hardware</i>	Describes tasks for monitoring M-series and T-series routing platforms.

To configure and operate a J-series Services Router running JUNOS software with enhanced services, you must also use the configuration statements and operational mode commands documented in JUNOS configuration guides and command references. To configure and operate a WX Integrated Services Module, you must also use WX documentation.

Table 9: JUNOS Software with Enhanced Services Documentation

Book	Description
All Platforms	
<i>JUNOS Software Interfaces and Routing Configuration Guide</i>	Explains how to configure J-series interfaces for basic IP routing with standard routing protocols, ISDN service, firewall filters (access control lists), and class-of-service (CoS) traffic classification.
<i>JUNOS Software Security Configuration Guide</i>	Explains how to configure and manage security services such as stateful firewall policies, IP Security (IPsec) virtual private networks (VPNs), firewall screens, Network Address Translation (NAT), Public Key Cryptography, and Application Layer Gateways (ALGs).
<i>JUNOS Software Administration Guide</i>	Shows how to monitor J-series devices and routing operations, firewall and security services, system alarms and events, and network performance. This guide also shows how to administer user authentication and access, upgrade software, and diagnose common problems.
<i>JUNOS Software CLI Reference</i>	Provides the complete JUNOS software with enhanced services configuration hierarchy and describes the configuration statements and operational mode commands not documented in the standard JUNOS manuals.

Table 9: JUNOS Software with Enhanced Services Documentation (continued)

Book	Description
J-series Only	
<i>JUNOS Software with Enhanced Services Design and Implementation Guide</i>	Provides guidelines and examples for designing and implementing IPsec VPNs), firewalls, and routing on J-series Services Routers running JUNOS software with enhanced services.
<i>JUNOS Software with Enhanced Services Quick Start</i>	Explains how to quickly set up a J-series Services Router. This document contains router declarations of conformity.
<i>JUNOS Software with Enhanced Services J-series Services Router Hardware Guide</i>	Provides an overview, basic instructions, and specifications for J-series Services Routers. This guide explains how to prepare a site, unpack and install the router, replace router hardware, and establish basic router connectivity. This guide contains hardware descriptions and specifications.
<i>JUNOS Software with Enhanced Services Migration Guide</i>	Provides instructions for migrating an SSG device running ScreenOS software or a J-series Services Router running the JUNOS software to JUNOS software with enhanced services.
<i>WXC Integrated Services Module Installation and Configuration Guide</i>	Explains how to install and initially configure a WXC Integrated Services Module in a J-series Services Router for application acceleration.
<i>JUNOS Software with Enhanced Services Release Notes</i>	Summarizes new features and known problems for a particular release of JUNOS software with enhanced services on J-series Services Routers, including J-Web interface features and problems. The release notes also contain corrections and updates to the manuals and software upgrade and downgrade instructions for JUNOS software with enhanced services.

Table 10: Additional Books Available Through <http://www.juniper.net/books>

Book	Description
<i>Interdomain Multicast Routing</i>	Provides background and in-depth analysis of multicast routing using Protocol Independent Multicast sparse mode (PIM SM) and Multicast Source Discovery Protocol (MSDP); details any-source and source-specific multicast delivery models; explores multiprotocol BGP (MBGP) and multicast IS-IS; explains Internet Gateway Management Protocol (IGMP) versions 1, 2, and 3; lists packet formats for IGMP, PIM, and MSDP; and provides a complete glossary of multicast terms.
<i>JUNOS Cookbook</i>	Provides detailed examples of common JUNOS software configuration tasks, such as basic router configuration and file management, security and access control, logging, routing policy, firewalls, routing protocols, MPLS, and VPNs.
<i>MPLS-Enabled Applications</i>	Provides an overview of Multiprotocol Label Switching (MPLS) applications (such as Layer 3 virtual private networks [VPNs], Layer 2 VPNs, virtual private LAN service [VPLS], and pseudowires), explains how to apply MPLS, examines the scaling requirements of equipment at different points in the network, and covers the following topics: point-to-multipoint label switched paths (LSPs), DiffServ-aware traffic engineering, class of service, interdomain traffic engineering, path computation, route target filtering, multicast support for Layer 3 VPNs, and management and troubleshooting of MPLS networks.

Table 10: Additional Books Available Through <http://www.juniper.net/books> (continued)

Book	Description
<i>OSPF and IS-IS: Choosing an IGP for Large-Scale Networks</i>	Explores the full range of characteristics and capabilities for the two major link-state routing protocols: Open Shortest Path First (OSPF) and IS-IS. Explains architecture, packet types, and addressing; demonstrates how to improve scalability; shows how to design large-scale networks for maximum security and reliability; details protocol extensions for MPLS-based traffic engineering, IPv6, and multitopology routing; and covers troubleshooting for OSPF and IS-IS networks.
<i>Routing Policy and Protocols for Multivendor IP Networks</i>	Provides a brief history of the Internet, explains IP addressing and routing (Routing Information Protocol [RIP], OSPF, IS-IS, and Border Gateway Protocol [BGP]), explores ISP peering and routing policies, and displays configurations for both Juniper Networks and other vendors' routers.
<i>The Complete IS-IS Protocol</i>	Provides the insight and practical solutions necessary to understand the IS-IS protocol and how it works by using a multivendor, real-world approach.

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 postsales 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/customers/support/downloads/710059.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 located at <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, visit us at <http://www.juniper.net/support/requesting-support.html>.

Revision History

7 November 2008—530-023242-01. Revision 2. Removed EOL RE-600-2048 and RE-1600-2048. Corrected image of the Routing Engine 2000 (RE-A-2000).

28 January 2008—530-023242-01. Revision 1. Added Routing Engines supported on the MX240, MX480, and T1600 routing platforms. Added new RE-400-768, and removed EOL RE-400-256. Removed information about the EOL M20 router. Added compliance statements for environmental requirements.

29 June 2007—530-017473-01. Revision 3. Updated internal flash disk and hard disk sizes in the Routing Engine Specifications table. Removed “Product Reclamation and Recycling Program” section.

12 March 2007—530-017473-01. Revision 2. Added Routing Engines for the MX960 router. Added T320 support for RE-A-2000-4096.

27 October 2006—530-017473-01. Revision 1. Added new content for RE-A-1000-2048 on the M40e and RE-A-2000-4096 on the M320, T640, and TX Matrix Routing Platforms.

6 October 2006—530-016146-01. Revision 1. Added Routing Engines for the M120 router. Removed M5, M10, and M40 routers. Removed all occurrences of RE-333-256, RE-333-768, RE-600-512, RE-M40, RE-M40-333-768, RE-M40-600-2048 Routing Engines.

9 January 2006—530-012980-01. Revision 2. Changed replacement procedures to reflect the fact that some Routing Engines might or might not have retaining screws.

13 April 2005—530-012980-01. Revision 1. Added table of supported Routing Engines by chassis. Added table of Routing Engine specifications. Added information about removing and replacing a Routing Engine on the M7i, M10i, M320, and T320 routers, T640 routing node, and TX Matrix platform.

29 October 2004—530-012374-01. Revision 1. Changed document title and deleted information about removing and replacing a Routing Engine on the T320 router and the T640 routing node.

8 July 2002—530-008051-01. Revision 1.

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