Chapter 6

Managing Modules

This chapter describes how to manage line modules, switch route processor (SRP) modules, switch fabric modules (SFMs), I/O modules, and I/O adapters (IOAs) in E-series routers.

This chapter contains the following sections:

Overview

When managing modules, you need to consider both software and hardware procedures. For example, before you remove an SRP module, you must enter the **halt** command to prevent damage to nonvolatile storage (NVS).

This chapter describes the software issues associated with managing modules. Each section in the chapter covers a different topic; where appropriate, a section contains an overview of the topic, configuration tasks, and information about monitoring the associated settings.

Platform Considerations

Procedures for managing modules vary depending on the type of E-series router that you have. The following sections describe the types of modules that you can manage for each type of E-series router and the general software procedures associated with them.

ERX-7xx Models, ERX-14xx Models, and the ERX-310 Router

You can manage line modules, I/O modules, and SRP modules on ERX-7xx models, ERX-14xx models, and the ERX-310 router. For more information about these modules, see the *ERX Module Guide*.

For information about upgrading software on SRP modules, see *Chapter 3, Installing JUNOSe Software*. For information about related procedures and installing modules, see *ERX Hardware Guide, Chapter 4, Installing Modules*.

Line Modules and I/O Modules

Most line modules available with these E-series models pair with a corresponding I/O module; however, some line modules do not require a corresponding I/O module. For example, the Service Module (SM) does not have a corresponding I/O module.

By configuring the performance line rate for a line module in the ERX-705, ERX-710, and ERX-1410 routers, you can enable the line modules either to operate at full line rate performance or to allow line modules to operate at a rate dependent on the resources available. For more information, see *Configuring Performance Rate of Line Modules on ERX-7xx Models and the ERX-1410 Router* on page 322.

The ERX-1440 router has two turbo slots (numbered 2 and 4). You can install certain line modules in the turbo slots to achieve greater line rate performance than when the modules are installed in other slots. For more information, see *JUNOSe Physical Layer Configuration Guide, Chapter 3, Configuring Unchannelized OCx/STMx Interfaces* and *JUNOSe Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.

Redundancy is supported for some line modules on these models. For more information, see *Line Module Redundancy* on page 327.

For more information about interface types and specifiers for ERX-7xx models, ERX-14xx models, and the ERX-310 router, see *Interface Types and Specifiers* in *JUNOSe Command Reference Guide, About This Guide*.

SRP Modules

If you want to configure the performance line rate for a line module on supported routers, you must consider the bandwidth requirements of the SRP module that is installed on the router. For more information, see *Configuring Performance Rate of Line Modules on ERX-7xx Models and the ERX-1410 Router* on page 322.

Redundancy is supported for SRP modules on certain E-series routers; for more information, see *SRP Module Redundancy* on page 330.

SRP modules have a corresponding SRP I/O module that contains a Fast Ethernet management port. You can configure this port to access the router from a Telnet session or SNMP. For more information, see *Managing the Ethernet Port on the SRP Module* on page 365.

For information about using high availability mode for stateful SRP switchover, see *Chapter 7, Managing High Availability*.

E120 Router and E320 Router

You can manage line modules, SRP modules, SFMs, and IOAs on the E120 router and E320 router. For more information about these modules, see the *E120 and E320 Module Guide*.

For information about related procedures and installing modules, see *E120 and E320 Hardware Guide, Chapter 4, Installing Modules*. For information about upgrading software on SRP modules, see the *E120 and E320 Hardware Guide*.

Line Modules and IOAs

Line modules on the E120 and E320 routers act as frame-forwarding engines for the physical interfaces, which are the IOAs.

You cannot configure the performance line rate of line modules for E120 and E320 routers. Redundancy is supported for line modules on this router. For more information, see *Line Module Redundancy* on page 327.

On the E120 router, line modules can be installed in slots 0–5. On the E320 router, line modules can be installed in slots 0–5 and 11–16. Both the E120 and E320 routers have two turbo slots, numbered 2 and 4. When a line module is installed in a turbo slot, it spans slots 2–3 and 4–5. The bandwidth of slot 3 or slot 5 is used for a line module in slot 2 or slot 4 if that line module requires the turbo slot.

NOTE: If a line module is installed in slot 3 or slot 5, and the line module in slot 2 or 4 requires bandwidth, the system configures the line module it detects first. The state of the other line module is displayed in the **show version** command output as disabled (cfg error).

The 100 Gbps switch fabric that is available with the SRP 100 on the E320 router allocates 3.4 Gbps of overall bandwidth to each regular line module slot and 10 Gbps of overall bandwidth to each of the turbo slots. With a 100 Gbps fabric configuration, you must install the ES2 10G Uplink LM in the turbo slots. For more information, see *JUNOSe Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.

The 120 Gbps switch fabric on the E120 router allocates 10 Gbps of overall bandwidth to each line module slot. Similarly, the 320 Gbps switch fabric on the E320 router allocates 10 Gbps of overall bandwidth to each line module slot. For both configurations, you can install any line module in any of the slots.

A line module on the E120 and E320 routers can accommodate one full-height IOA or up to two half-height IOAs per slot. In the software, adapter 0 identifies the right IOA bay (E120 router) and the upper IOA bay (E320 router); adapter 1 identifies the left IOA bay (E120 router) and the lower IOA bay (E320 router).

You can configure the slot by using the command-line interface (CLI), as well as the individual IOAs. For example, if you want to disable the line module installed in slot 3, issue the **slot disable 3** command. If you want to disable the IOA in the upper bay or left bay of slot 3, issue the **adapter disable 3/0** command. Table 37 lists the IOA bay values that you use to manage half-height and full-height IOAs.

For some IOAs, issuing the **adapter disable 3/0** command reboots the line module. Modules that support hot-swapping enable you to remove and add an IOA in a slot without rebooting the line module. If the slot is populated with another active IOA, it continues to operate.

Depending on the IOA type, you can manage IOAs from certain slots or bays. Table 37 lists the IOA management information, including valid IOA combinations and hot-swapping support.

Table 37: IOA Management Information

IOA	Right Bay (E120) Upper Bay (E320) (Adapter 0)	Left Bay (E120) Lower Bay (E320) (Adapter 1)	Both Bays Concurrently	Combined with Other IOAs in Same Slot	Hot-Swapping Support
ES2-S1 GE-4	Yes	Yes	No	No	Yes
ES2-S1 GE-8	Yes	Yes	Yes	Yes (GE-8 when paired with ES2 4G LM or ES2 10G LM; GE-8, OC3/STM1, and OC12/STM4 IOAs when paired with ES2 4G LM)	Yes
ES2-S3 GE-20	Yes (Full-height IOA)	Not applicable	Not applicable	Not applicable	No
ES2-S1 10GE	Yes (Full-height IOA)	Not applicable	Not applicable	Not applicable	No
ES2-S2 10GE PR	Yes (Full-height IOA)	Not applicable	Not applicable	Not applicable	No
ES2-S1 OC3-8 STM1 ATM	Yes	Yes	Yes	Yes (GE-8, OC3/STM1, and OC12/STM4 IOAs only)	Yes

Table 37: IOA Management Information

IOA	Right Bay (E120) Upper Bay (E320) (Adapter 0)	Left Bay (E120) Lower Bay (E320) (Adapter 1)	Both Bays Concurrently	Combined with Other IOAs in Same Slot	Hot-Swapping Support
ES2-S1 OC12-2 STM4 ATM	Yes	Yes	Yes	Yes (GE-8, OC3/STM1, and OC12/STM4 IOAs only)	Yes
ES2-S1 OC12-2 STM4 POS	Yes	Yes	Yes	Yes (GE-8, OC3/STM1, and OC12/STM4 IOAs only)	Yes
ES2-S1 OC48 STM16 POS	Yes	Yes	No	No	Yes
ES2-S1 Service	Yes (Full-height IOA)	Not applicable	Not applicable	Not applicable	No
ES2-S1 Redund	Yes (Full-height IOA; slots 0 and 11 only)	Not applicable	Not applicable	Not applicable	No

For more information about interface types and specifiers for the E120 and E320 routers, see *Interface Types and Specifiers* in *JUNOSe Command Reference Guide, About This Guide*.

SRP Modules and SFMs

The router accommodates up to two SRP modules and three SFMs that act as an integrated system controller (SC) and switch fabric system. The SC is located on the SRP modules; the router's switch fabric is distributed between the SRP modules and SFMs. The switch fabric is divided into fabric slices; each SRP module and SFM has a resident fabric slice. At least four of the five possible fabric slices must be installed for the E120 and the E320 routers to operate.

You can configure the E120 router with a 320 Gbps fabric by installing SRP 120 modules and SFM 120 modules, or SRP 320 modules and SFM 320 modules.

You can configure the E320 router with a 100 Gbps fabric by installing SRP 100 modules and SFM 100 modules. To achieve increased switch fabric capacity and speed, you can configure the E320 router with a 320 Gbps fabric by installing SRP 320 modules and SFM 320 modules.

You can configure the SC and the fabric slices on the SRP modules separately. For example, if you disable the fabric slice on the standby SRP module by using the **slot disable 7 fabric** command, the SC on that SRP module is still enabled.

Redundancy is supported for SRP modules on the E120 and E320 routers. For more information, see *SRP Module Redundancy* on page 330.

SRP modules on the E120 and E320 routers have two slots for flash cards; other E-series routers have only a single slot. Cards installed in the second slot can be used only for core dump (.dmp) files. For more information, see *Managing Flash Cards on SRP Modules* on page 341.

SRP modules on the E120 and E320 routers have a corresponding SRP IOA that contains a Fast Ethernet management port. You can configure this port to access the router from the CLI or SNMP. For more information, see *Managing the Ethernet Port on the SRP Module* on page 365.

For information about using high availability mode for stateful SRP switchover, see *Chapter 7, Managing High Availability*.

Disabling and Reenabling Line Modules, SRP Modules, and SFMs

Disabling a line module, an SRP module, or an SFM has the same effect as removing that module from a slot. A disabled module cannot operate, although its configuration remains in NVS. For the module to operate, you must reenable it.

slot disable

- Use to disable the module in the specified slot.
- You can use this command to disable a module so that you can run diagnostic tests on the module.
- You cannot use this command on a standby SRP module.
- If you specify a slot on the E120 router or the E320 router that contains an SRP module, you disable the SC subsystem on that slot by default. You do not, however, disable the fabric slice that resides on the slot.
  - Use the **srp** keyword to disable only the portion of the SC subsystem that resides on a specified SRP module.
  - Use the **fabric** keyword to disable only the fabric slice that resides on the specified SRP module.
- If you specify a slot that contains a line module, you disable only the line module; you do not disable the line module and the I/O modules and IOAs associated with it. To disable a specific IOA on the E120 router or the E320 router, issue the **adapter disable** command.
- Example 1—Disables the module in slot 3

  host1(config)#**slot disable 3**

- Example 2—Disables the SRP module and the SC subsystem in slot 7 (applies only to the E120 and E320 routers)

  host1(config)#**slot disable 7**

- Example 3—Disables only the fabric slice on the SRP module in slot 7 (applies only to E120 and E320 routers)

  host1(config)#**slot disable 7 fabric**

- There is no **no** version.

slot enable

- Use to enable the module in the specified slot.
- Allows you to restart the module that was installed in the slot.
- You cannot use this command on a standby SRP module.
- If you specify a slot on the E120 router or the E320 router that contains an SRP module, you enable the SC subsystem on that slot by default. You do not, however, enable the fabric slice that resides on the slot.
  - Use the **srp** keyword to enable only the portion of the SC subsystem that resides on a specified SRP module.
  - Use the **fabric** keyword to enable only the fabric slice that resides on the specified SRP module.
- If you specify a slot that contains a line module, you enable only the line module; you do not enable the line module and the I/O modules and IOAs associated with it. To enable a specific IOA on the E120 router or the E320 router, use the **adapter enable** command.
- The default is enable.
- Example 1—Enables the module in slot 3

  host1(config)#**slot enable 3**

- Example 2—Enables the SRP module and the SC subsystem in slot 7 (applies only to E120 and E320 routers)

  host1(config)#**slot enable 7**

- Example 3—Enables only the fabric slice on the SRP module in slot 7 (applies only to E120 and E320 routers)

  host1(config)#**slot enable 7 fabric**

- There is no **no** version.

Disabling and Reenabling IOAs

Disabling an IOA on the E120 router or the E320 router has the same effect as removing that IOA from a slot. A disabled IOA cannot operate, although its configuration remains in NVS. To allow the IOA to operate, you must reenable it.

adapter disable

- Use to disable the IOA in the specified IOA bay.
- You can use this command to disable an IOA so that you can run diagnostic tests on it.
- On IOAs that support hot-swapping, issuing this command does not reboot the line module. On unsupported IOAs, issuing this command does reboot the line module associated with the IOA, but does not disable the line module. Issue the **slot disable** command to disable the line module. For a list of IOAs that support hot-swapping, see Table 37 on page 308.

- When you issue the **adapter disable** command in a redundancy configuration, the line module (primary or spare) currently associated with that IOA is rebooted. If the IOA is protected by a line module redundancy group, an automatic line module redundancy switchover or revert can be triggered by the line module reboot. To prevent undesired line module redundancy actions, issue the **redundancy lockout** command for the primary line module slot before issuing the **adapter disable** command. For more information, see *Line Module Redundancy* on page 327.
- In the software, adapter 0 identifies the right IOA bay (E120 router) and the upper IOA bay (E320 router); adapter 1 identifies the left IOA bay (E120 router) and the lower IOA bay (E320 router).
- Example—Disables the IOA residing in the upper bay of slot 5 in an E320 router

  host1(config)#**adapter disable 5/0**

- There is no **no** version.

adapter enable

- Use to enable the IOA in the specified IOA bay.
- Enables you to restart the IOA that was installed in the slot.
- The default is enable.
- On IOAs that support hot-swapping, issuing this command does not reboot the line module. On unsupported IOAs, issuing this command reboots the line module associated with the IOA, but does not enable the line module. Issue the **slot enable** command to enable the line module. For a list of IOAs that support hot-swapping, see Table 37 on page 308.
- When you issue the **adapter enable** command in a redundancy configuration, the line module (primary or spare) currently associated with that IOA is rebooted. If the IOA is protected by a line module redundancy group, an automatic line module redundancy switchover or revert can be triggered by the line module reboot. To prevent undesired line module redundancy actions, issue the **redundancy lockout** command for the primary line module slot before issuing the **adapter enable** command. For more information, see *Line Module Redundancy* on page 327.
- In the software, adapter 0 identifies the right IOA bay (E120 router) and the upper IOA bay (E320 router); adapter 1 identifies the left IOA bay (E120 router) and the lower IOA bay (E320 router).
- Example—Enables the IOA residing in the upper bay of slot 5 in an E320 router

  host1(config)#**adapter enable 5/0**

- There is no **no** version.

Removing an SRP Module

Before you remove an SRP module, you must issue the **halt** command, which stops operation on that module. If the router contains both primary and redundant SRP modules, you can specify which modules the command should affect.You can also configure the router to prompt you when the modules are in a state that might lead to loss of configuration data or NVS corruption.

CAUTION: If you do not use the **halt** command before removing or powering down an SRP module, the router's NVS may become corrupted.

For information about physically removing an SRP module, see *ERX Hardware Guide, Chapter 4, Installing Modules*.

halt

- Use to stop the router's operation before you remove or power down an SRP module
- The following guidelines apply when you issue the **halt** command in Privileged Exec mode:
  - Specify neither the **primary-srp** nor the **standby-srp** keyword to stop operation on both SRP modules.
  - Specify the keyword **primary-srp** to stop operation on the primary SRP module only. This action causes the redundant SRP module to assume the primary role.
  - Specify the keyword **standby-srp** to stop operation on the redundant SRP module only.
  - If you do not specify the **force** keyword, the procedure fails if:
    - The SRP modules are in certain states, such as during a synchronization. In these cases, the router will display a message that indicates that the procedure cannot currently be performed and the reason why. However, if the SRP modules are in other states that could lead to a loss of configuration data or NVS corruption, the router displays a message that explains the state of the SRP modules and asks you to confirm (enter yes or no) whether you want to proceed.
    - The SRP modules are in any state that could lead to loss of configuration data or NVS corruption, and the router will display a message that explains why the command failed.
- In Boot mode, you cannot issue any keywords with this command.
- When the high availability state is active or pending, this command ensures that the router configuration, up to when you issued the **halt** command, is mirrored to the standby SRP.
- When you issue this command, the router prompts you for a confirmation before the procedure starts.
- Remove or power down the SRP module within 2 minutes of executing the **halt** command. Otherwise, the SRP module will automatically reboot.

- Examples

  host1#**halt**
  host1#**halt primary-srp**
  host1#**halt standby-srp force**

- There is no **no** version.

Replacing Line Modules on ERX Routers, the E120 Router, and the E320 Router

You can install line modules in slots previously occupied by different types of line modules. For example, on the ERX-1440 router, you can replace a GE-2 line module and a GE-2 SFP I/O module in a slot that previously contained an OCx/STMx/DS3-ATM line module and an OC3-4 I/O module.

When you configure a line module and an I/O module or IOAs, the router stores the configuration in NVS. In some cases, you must erase the interface configuration on the slot and reconfigure it after you have installed the new line module. However, some line modules enable you to replace the line module without reconfiguring the interfaces on the slot.

Tasks to replace a line module are:

- Replacing a Line Module by Erasing the Slot Configuration on page 314
- Replacing a Line Module Without Erasing the Slot Configuration on page 315

Replacing a Line Module by Erasing the Slot Configuration

Use this procedure when you are replacing the following line modules:

- All line modules on ERX routers
- All line modules on the E120 and E320 routers except for:
  - ES2 4G LM and ES2-S1 GE-8 IOA combination
  - ES2 10G LM and ES2-S1 GE-8 IOA combination
  - ES2 4G LM and ES2-S1 Redund IOA combination
  - ES2 10G LM and ES2-S1 Redund IOA combination

To replace a line module:

1. Copy your slot configuration so you can reconfigure the interfaces after replacing the line module.
2. (Optional) If line module redundancy is configured for the slot, disable redundancy for the slot.

   host1(config)#**redundancy lockout 7**

3. Disable the slot.

   host1(config)#**slot disable 7**

4. Remove the current line module and insert the new line module.

5. Issue the **slot accept** command for the affected slot.

   host1(config)#**slot accept 7**

   The **slot accept** command erases the configuration and enables you to reconfigure the new line module.

6. When the replacement line module has come online, reconfigure the interfaces.

7. If you disabled redundancy in Step 2, enable redundancy for the slot when the replacement line module has come online.

   host1(config)#**no redundancy lockout 7**

Replacing a Line Module Without Erasing the Slot Configuration

Use this procedure when you are replacing an ES2 4G LM with an ES2 10G LM, or vice-versa. Both line modules must already be paired with an ES2-S1 GE-8 IOA or the ES2-S1 Redund IOA.

You can replace a single line module or all of the line modules in a redundancy group using this procedure.

NOTE: In some cases, the ES2 4G LM and ES2 10G LM support different system maximums and protocols. Before you replace an ES2 4G LM with an ES2 10G LM, make sure that:

- The ES2 10G LM supports the features already configured on the slot for the ES2 4G LM.
- The ES2 10G LM can support the existing system maximums configured on the ES2 4G LM.

If you have a configuration on the ES2 4G LM that is not supported on the ES2 10G LM, you must erase the configuration before replacing the line module. For more information, see *Replacing a Line Module by Erasing the Slot Configuration* on page 314.

To replace a line module without erasing the slot configuration:

1. (Optional) If line module redundancy is configured for the slot, disable redundancy.

   host1(config)#**redundancy lockout 1**

2. Disable the slot.

host1(config)#**slot disable 1**

3. After the line module has booted, issue the **show version** command to ensure that the status of the line module is `disabled (admin)`.

```
host1#show version
Juniper Edge Routing Switch E120

.......

                                                    running
slot  state   type    admin             spare     release     slot uptime
---- ------- ------- -------           ----- -------------- -------------
0      ---     ---     ---    ---        ---       ---
1    online  LM-10   disabled (admin)    ---  9-1-0b0-9.rel 1d08h:32m:29s
2    online  LM-10   enabled              ---  9-1-0b0-9.rel 1d08h:32m:24s
3      ---     ---     ---               ---       ---           ---

.......
```

4. Remove the current line module and insert the new line module without removing the IOA.

   For example, remove the ES2 4G LM and insert the new ES2 10G LM. Do not remove the ES2-S1 GE-8 IOA or the ES2-S1 Redund IOA.

5. After the new line module has booted, issue the **show version** command to ensure that the status of the line module is `disabled (mismatch)`.

```
host1#show version
Juniper Edge Routing Switch E120

.......

                                                    running
slot  state   type    admin             spare     release     slot uptime
---- ------- ------- -------           ----- -------------- -------------
0      ---     ---     ---    ---        ---       ---
1    online  LM-4    disabled (mismatch) ---  9-1-0b0-9.rel 1d08h:32m:29s
2    online  LM-10   enabled              ---  9-1-0b0-9.rel 1d08h:32m:24s
3      ---     ---     ---               ---       ---           ---

.......
```

6. Issue the **slot replace** command on the slot.

   host1(config)#**slot replace 1**

TIP: If the line module is in a redundancy group and you did not disable redundancy in Step 1, the system switches to the spare line module. The system reloads both the replaced line module and the spare line module when you issue the **slot replace** command.

---

7. If you disabled redundancy for the slot in Step 1, enable redundancy when the replacement line module has come online.

   host1(config)#**no redundancy lockout 1**

8. (Optional) If the following settings were configured before replacing the module, reconfigure the settings:

   a. Configure the Ethernet physical interface configuration using an SNMP set request for entPhysicalAssetID and entPhysicalAlias.

   b. Specify the threshold values for specific interface types for the slot.

      host1(config)#**resource if-type ip slot 1 threshold**

Related Topics

- **redundancy lockout** command
- **resource if-type** command
- **slot accept** command
- **slot replace** command
- **snmp-server** command

Replacing IOAs on the E120 Router and the E320 Router

When you configure an IOA in an IOA bay on the E120 and E320 routers, the router stores the configuration in NVS.

When you replace an IOA that supports hot-swapping with the same type of IOA, the line module goes online immediately. When you replace an IOA that *does no*t support hot-swapping with the same type of IOA, the line module reboots.

Before you install an IOA that was previously occupied by another IOA in the E120 router or the E320 router—for example, an ES2-S1 GE-4 IOA in an IOA bay that previously contained an ES2-S1 OC3-8 STM1 ATM IOA—consider whether the IOA that you are replacing supports hot-swapping. For example:

- When you replace an IOA that does not support hot-swapping, the line module reboots. Before installing the different type of IOA, issue the **adapter erase** or **slot erase** command for the slot that contains the IOA bay.
- When you replace an IOA that supports hot-swapping, the line module becomes inactive with a “mismatch” state. After installing the different type of IOA, issue the **adapter accept** command or the **slot erase** command for the slot that contains the IOA bay.

Replacing SRP Modules and SFMs

If you remove a standby SRP module or an SFM, you must issue the **slot erase** command to delete the configuration. If you fail to issue the **slot erase** command, then the E-series router cannot guarantee that the SRP modules were synchronized. In this situation, the E-series router does not properly execute a simple **reload** command.

To reload the router you must do either of the following:

- Issue the **reload force** command.
- Issue the **slot erase** command followed by the **reload** command.

If you perform one of the following actions, you must reset the configuration of the router to factory default:

- Replace a 5-Gbps SRP module with a 10-Gbps SRP module or vice versa.
- Transfer an SRP module from an ERX-7xx router to an ERX-1410 router or vice versa.

You cannot use the **slot accept** command to force the router to accept the new SRP module.

When you have installed the SRP module in the new location, reset the configuration of the router to factory defaults as follows:

1. Reload the operating router, then press mb key sequence (case-insensitive) during the countdown.

   host1#**reload**

2. Reboot the router with the factory defaults.

   :boot##**boot config factory-defaults**

3. Reload the operating router.

   :boot##**reload**

For more information about the **reload** and **boot config** commands, see *Chapter 11, Booting the System*.

adapter accept

- Use to delete the configuration of the IOA in the specified IOA bay after you install a different type of IOA.
- This command enables you to create a fresh configuration for the module installed in the IOA bay.
- You can also use this command to accept an empty IOA bay that was previously occupied.
- Issuing this command reboots the line module associated with the IOA, but it does not erase the line module's configuration. To erase the configuration of the line module and its associated IOAs, issue the **slot accept** command.
- Issuing this command erases the interfaces associated with the specified IOA. To erase the interfaces for both IOAs installed in a slot, issue the **slot accept** command.
- Depending on the previous configuration of the slot, the system might take a few moments to execute this command.

- Example—Accepting the IOA in the upper bay of slot 5 in an E320 router

  host1(config)#**adapter accept 5/0**

- There is no **no** version.

adapter erase

- Use to delete the configuration of the specified IOA in the specified IOA bay before you install a different type of IOA.
- This command enables you to create a fresh configuration for the IOA to be installed in the IOA bay.
- Issuing this command reboots the line module associated with the IOA, but it does not erase the line module's configuration. To erase the configuration of the line module and its associated IOAs, issue the **slot erase** command.
- Issuing this command erases the interfaces associated with the specified IOA. To erase the interfaces for both IOAs installed in a slot, issue the **slot erase** command.
- Example—Erasing the IOA in the upper bay of slot 5 in an E320 router

  host1(config)#**adapter erase 5/0**

- There is no **no** version.

slot accept

- Use to delete the configuration of the module in the selected slot after you install a different type of module.
- This command enables you to create a fresh configuration for the module installed in the slot.
- You can also use this command to accept an empty slot that was previously occupied.
- You cannot use this command on a primary SRP module; however, you can use it on a standby SRP module.
- You can use this command only when the state of the module in the slot is not present or disabled (mismatch).
- If you specify a slot on an E120 router or an E320 router that contains an SRP module, you accept the configuration of the SC subsystem on that slot by default. You do not, however, accept the configuration of the fabric slice that resides on the slot.
  - Use the **srp** keyword to accept only the configuration of the portion of the SC subsystem that resides on a specified SRP module.
  - Use the **fabric** keyword to accept only the configuration of the fabric slice that resides on the specified SRP module.
- If you specify a slot that contains a line module, you erase the configuration of the line module and the I/O modules or IOAs associated with it. To erase the configuration of a specific IOA on the E120 router or the E320 router, use the **adapter accept** command.
- Depending on the slot's previous configuration, the router might take a few moments to execute this command.

- The following is a sample log message resulting from putting an OC3 line module in a slot that was previously configured for a line module:

```
ERROR 02/07/2003 15:16:20 system (slot 3): boardId mismatch: read 0x6 (OC3
dual port without classifier), configured 0x2e (OC12 ATM)
ERX-00-17-04(config)# slot accept  3
Please wait....
ERX-00-17-04(config)#ERROR 02/07/2003 15:16:31 system (slot 3): unrecognized
board type (0x6)
```

  To resolve the problem, issue the **slot accept** command for slot 3.

- Example 1—Accepts the configuration of the module in slot 3

  host1(config)#**slot accept 3**

- Example 2—Accepts the configuration of the specified SRP module and the SC subsystem in slot 7 (applies only to E120 and E320 routers)

  host1(config)#**slot accept 7**

- Example 3—Accepts the configuration of the SC on the SRP module in slot 7 (applies only to E120 and E320 routers)

  host1(config)#**slot accept 7 srp**

- There is no **no** version.

slot erase

- Use to delete the configuration of the module in the selected slot before you install a different type of module.
- This command enables you to create a fresh configuration for the module installed in the slot.
- You cannot use this command on a primary SRP module; however, you can use it on a standby SRP module.
- If you specify a slot on the E120 router or the E320 router that contains an SRP module, you erase the configuration of the SC subsystem on that slot by default. You do not, however, erase the configuration of the fabric slice that resides on the slot.
  - Use the **srp** keyword to erase only the configuration of the portion of the SC subsystem that resides on a specified SRP module.
  - Use the **fabric** keyword to erase only the configuration of the fabric slice that resides on the specified SRP module.
- If you specify a slot that contains a line module, you erase the configuration of the line module and the I/O modules or IOAs associated with it. To erase the configuration of a specific IOA on the E120 router or the E320 router, use the **adapter erase** command.
- Example 1—Erases the configuration of the module in slot 3

  host1(config)#**slot erase 3**

- Example 2—Erases the configuration of the specified SRP module and the SC subsystem in slot 7 (applies only to E120 and E320 routers)

  host1(config)#**slot erase 7**

- Example 3—Erases the configuration of the SC on the SRP module in slot 7 (applies only to E120 and E320 routers)

  host1(config)#**slot erase 7 srp**

- There is no **no** version.

Software Compatibility

An E-series software release supports a specific set of line modules and associated I/O modules or IOAs. Before you install a new line module, I/O module, or IOA, you should install a software release that supports the new module.

Line Modules

If the router uses a software version that does not support a line module that you install, you see the message unrecognized board type, and the router disables the module. When you issue a **show version** command, the state of the line module is disabled (admin).

If you subsequently boot the router with software that supports the line module, the line module becomes available and its state is enabled.

I/O Modules and IOAs

If the router uses a software version that does not support an I/O module or IOA that you install, the I/O module or IOA will be unavailable, and you will not be able to upgrade the software on the router. To upgrade the software:

1. Remove the I/O module or IOA.
2. Reboot the line module that corresponds to this I/O module or IOA. See *Chapter 11, Booting the System*.
3. When the line module has rebooted, install the I/O module or IOA.
4. Upgrade the software on the router. See *Chapter 3, Installing JUNOSe Software*.

Configuring Performance Rate of Line Modules on ERX-7xx Models and the ERX-1410 Router

NOTE: The information in this section does not apply to the ERX-1440 router, ERX-310 router, E120 router, or the E320 router. It also does not apply to the OC48 line module, which is supported only by the ERX-1440 router.

Line modules in an ERX-1440 router or an ERX-310 router always operate at line rate performance. However, you can configure ERX-7xx models and the ERX-1410 router to enable the line modules either to operate at full line rate performance or to allow line modules to operate at a rate dependent on the resources available.

Operating at full line rate performance restricts the combination of line modules in the router. Operating at a rate dependent on the resources available allows a much more extensive combination of line modules in the router and is known as *bandwidth oversubscription*.

To configure performance:

1. Choose a combination of line modules appropriate for the performance. See *Choosing a Combination of Line Modules* on page 322.
2. Disable slots that contain unwanted line modules, or modify the combination of line modules in the router. See *Disabling and Reenabling Line Modules, SRP Modules, and SFMs* on page 310, and *ERX Hardware Guide, Chapter 4, Installing Modules*.
3. Specify the type of performance. See *Specifying the Type of Performance* on page 325.

Choosing a Combination of Line Modules

For line rate performance, the total bandwidth required by the line modules in the slot group must not exceed the bandwidth available from the SRP module. In this case, the combination of line modules that can reside in a slot group depends on the following:

- The number of slots per group
- The bandwidth available from the SRP module
- The bandwidth required by each line module
- In the case of the SRP-5G+ and SRP-10G modules, the switches (upper and lower) that the line module can use.

Slot Groups

The number of slots in a group depends on the E-series model. For information about slot groups, see *ERX Hardware Guide, Chapter 4, Installing Modules*.

SRP Modules Bandwidth

Different SRP modules offer different bandwidths:

- The SRP-10G module provides 2.5 Gbps bandwidth per slot group.
- The SRP-5G+ module (ERX-705 router only) provides:
  - 2.5 Gbps bandwidth per slot group
  - 5 Gbps bandwidth per router

Line Modules Bandwidth and Switch Usage

The SRP-5G+ and SRP-10G modules comprise two switches; each switch provides 50 percent of the bandwidth.

The line modules in a slot group cannot operate at line rate if:

- The sum of their bandwidths exceeds the bandwidth that the SRP module can supply per slot group.
- The sum of the bandwidths they require from one SRP switch exceeds the bandwidth that the SRP switch can supply per slot group.

Table 38 shows the bandwidth that each line module requires for line rate performance and the switches that the line module can use on the SRP-5G+ and SRP-10G modules.

Table 38: Bandwidth Statistics for Line Modules

Line Module	Total Bandwidth Required (Gbps)	Switches Used on SRP-5G+ and SRP-10G Modules
cOCx/STMx	2.46	Both switches
COCX-F3	2.46	Both switches
CT3/T3-F0	2.46	Both switches
GE/FE	2.46	Both switches
IPSec Service	2.46	Both switches
OC3/STM1 GE/FE	2.46	Both switches
OCx/STMx ATM	1.22	Both switches
OCx/STMx POS	2.46	Both switches

Allowed Combinations for Line Rate Performance

The SRP-5G+ and SRP-10G modules support all the line modules listed in Table 38.

Only certain combinations of line modules allow line rate performance (see Table 39 through Table 41). However, if performance lower than line rate is acceptable, you can use any combination of line modules in a slot group.

For example, the SRP-10G module offers a total bandwidth of 2.5 Gbps for each slot group. The GE line module requires 2.46 Mbps bandwidth for operation at line rate, and can use both switches in the SRP-10G module. If you require line rate from a GE line module, install only one GE line module in the slot group. However, if lower performance is acceptable, you can install two or three GE line modules in a slot group and enable bandwidth oversubscription.

When bandwidth oversubscription is enabled, all line modules optimize use of the resources available. For example, if two GE line modules are installed in a slot group, each line module is allocated 50 percent of the available bandwidth. However, if one line module is using less bandwidth than it is allocated, the other line module can use more bandwidth than it is allocated and can operate at a greater rate.

Table 39, Table 40, and Table 41 indicate combinations of line modules that allow line rate performance.

Table 39: Combinations of Line Modules for Line Rate Performance—SRP-10G Module in an ERX-7xx Model

Possible Combinations of Line Modules	Examples of Allowed Combinations	Examples of Forbidden Combinations
■ One supported line module and one empty slot in slot group 1 **NOTE:** The SRP-10G module supports all line modules listed in Table 38. ■ Two OCx/STMx ATM line modules in slot group 1 ■ One supported line module in slot groups 2, 3 and 4	■ One OCx/STMx POS line module in slot group 1, a GE/FE line module in slot group 2, and one OCx/STMx ATM line module in slot group 4 ■ Two OCx/STMx ATM line modules in slot group 1, one GE/FE line module in slot group 2, and one SM in slot group 3	■ A GE/FE line module and any other line module in slot group 1 ■ Two OCx/STMx POS line modules in slot group 1

Table 40: Combinations of Line Modules for Line Rate Performance—SRP-10G Module in an ERX-1410 Router

Possible Combinations of Line Modules	Examples of Allowed Combinations	Examples of Forbidden Combinations
■ One supported line module and two empty slots in any slot group **NOTE:** The SRP-10G module supports all line modules listed in Table 38. ■ Two OCx/STMx ATM line modules and one GE/FE module and one empty slot in any slot group (bandwidth oversubscription enabled) ■ One OC3/STM1 GE/FE module in any slot (bandwidth oversubscription disabled)	■ One COCX-F3 line module in slot group 1, a GE/FE line module in slot group 2, and a OCx/STMx POS line module in slot group 3	■ Three OCx/STMx ATM line modules in any slot group ■ Two GE/FE line modules in any slot group

Table 41: Combinations of Line Modules for Line Rate Performance—SRP-5G+ Module in an ERX-705 Router

Possible Combinations of Line Modules In Slot Groups	Examples of Allowed Combinations	Examples of Forbidden Combinations
NOTE: The total bandwidth of all line modules must not exceed 5 Gbps. To make optimal use of the available bandwidth, put line modules that require maximum bandwidth in slot 2, 3, or 4.		
■ One supported line module and one empty slot in slot group 1 **NOTE:** The SRP-5G+ module supports all line modules listed in Table 38. ■ Two OCx/STMx ATM line modules in slot group 1 ■ One cOCx/STMx, COCX-F3, CT3/T3 FO, GE/FE, IPSec Service, or OCx/STMx line module in slot groups 2, 3, and 4	■ Two OCx/STMx ATM line modules (total 2.44 Gbps) in slot group 1, and a GE/FE line module (2.46 Gbps) in slot group 4 ■ Two OCx/STMx ATM line modules (total 2.44 Gbps) in slot group 1, and a COCX-F3 line module in slot group 2	■ Two OCx/STMx ATM line modules (total 2.44 Gbps) in slot group 1, a GE/FE line module (2.46 Gbps) in slot group 3, and an OCx/STMx POS line module (2.46 Gbps) in slot 4 (violates chassis limitation) ■ Two OCx/STMx POS line modules (total 4.92 Gbps) in slot group 1 (violates slot group limitation)

Specifying the Type of Performance

After you have installed a suitable combination of line modules, you can specify a different type of performance. To specify the type of performance:

1. Issue the **show bandwidth oversubscription** command.
2. If the setting is not the one you want, enable or disable bandwidth oversubscription.
3. Reboot the router.

bandwidth oversubscription

- Use to enable bandwidth oversubscription for an ERX-7xx model or ERX-1410 router. Reboot the router after you have issued this command to change the bandwidth oversubscription status.
- By default, bandwidth oversubscription is enabled.
- Example

  host1(config)#**bandwidth oversubscription**

- Use the **no** version to disable bandwidth oversubscription. Reboot the router after you have issued this command to change the bandwidth oversubscription status.

Monitoring Bandwidth Oversubscription

Use the **show bandwidth oversubscription** and **show utilization** (see *Monitoring Modules* on page 369) commands to monitor the status of bandwidth oversubscription.

show bandwidth oversubscription

- Use to display the bandwidth oversubscription status for an ERX-7xx model or ERX-1410 router.
- Example 1: This example shows the display when bandwidth oversubscription is enabled.

```
host1#show bandwidth oversubscription
Bandwidth oversubscription is currently in effect.
```

- Example 2: This example shows the display that appears after you issue the **no bandwidth oversubscription** command to disable bandwidth oversubscription.

```
host1#no bandwidth oversubscription
host1#show bandwidth oversubscription
Bandwidth oversubscription is currently in effect.
Bandwidth oversubscription will not be in effect the next time the system
reboots.
```

- Example 3: This example shows the display when bandwidth oversubscription is disabled.

```
host1#show bandwidth oversubscription
Bandwidth oversubscription is currently not in effect.
```

- Example 4: This example shows the display that appears after you issue the **bandwidth oversubscription** command to enable bandwidth oversubscription.

```
host1#bandwidth oversubscription
host1#show bandwidth oversubscription
Bandwidth oversubscription is currently not in effect.
Bandwidth oversubscription will be in effect the next time the system
reboots.
```

Troubleshooting Bandwidth Oversubscription

If you enter a forbidden combination of line modules or exceed the slot group bandwidth when you have not configured bandwidth oversubscription, you will see an error message.

For example, suppose you originally configure the router for bandwidth oversubscription and then want to change to full line rate performance. You forget to remove line modules or disable slots, and enter the **no bandwidth oversubscription** command. The following message appears:

```
host1(config)#no bandwidth oversubscription
% failed : bandwidth over subscribed at slot 0-2
```

To resolve the problem, remove the unwanted line modules, or disable the slots that contain those line modules.

Line Module Redundancy

You can install an extra line module in a group of identical line modules to provide redundancy if one of the modules fails.

The process by which the router switches to the spare line module is called *switchover*. During switchover, the line, circuit, and IP interfaces on the I/O module or one or more IOAs appear to go down temporarily. The duration of the downtime depends on the number of interfaces and the size of the routing table, because the router must reload the interface configuration and the routing table from the SRP module.

If the line module software is not compatible with the running SRP module software release, a warning message appears on the console.

Module Requirements

The requirements for line module redundancy depend on the type of router that you have.

NOTE: The information in this section does not apply to the ERX-310 router, which does not support line module redundancy.

ERX-7xx Models and ERX-14xx Models

To use this feature on ERX-7xx models and ERX-14xx models, you must also install a redundancy midplane and a redundancy I/O module. For a detailed explanation of how the router provides redundancy for line modules and procedures for installing the modules, see the *ERX Hardware Guide*.

E120 Router and E320 Router

To configure line module redundancy on the E120 router or the E320 router, you must also install an ES2-S1 Redund IOA in either slot 0 or slot 11. The ES2-S1 Redund IOA is a full-height IOA. For a detailed explanation of how the router provides redundancy for line modules and procedures for installing the modules, see the *E120 and E320 Hardware Guide*.

On E120 and E320 routers, each side of the chassis is treated as a redundancy group. The lowest numbered slot for each side acts as the spare line module, providing backup functionality when an ES2-S1 Redund IOA is located directly behind it. When the line module does not contain an ES2-S1 Redund IOA, it is considered a primary line module.

The spare line module only backs up a line module of the same type. For example, an ES2 4G LM spare line module backs up any ES2 4G LM, but does not back up an ES2 10G Uplink LM. The router accepts the following redundancy groups:

- ES2 4G LM and ES2 4G LM
- ES2 10G Uplink LM and ES2 10G Uplink LM
- ES2 10G LM and ES2 10G LM

Also, you cannot configure redundancy for the ES2-S1 Service IOA.

IOA Behavior When the Router Reboots

On E120 and E320 routers, switchover is based on the combined states of the line module and the IOAs that are installed in the affected slot.

When the router reboots and the formerly configured primary line module is not present, or is present and fails diagnostics, it switches to a spare line module and takes inventory of the IOAs. If the IOA is present and new, the router reverts back to the primary line module so that the spare line module can service other active primary line modules.

When the router reboots and there is a slot that contains a line module and one active and one inactive IOA, the inactive IOA remains in that state.

Line Module Behavior When Disabling or Enabling IOAs

On E120 and E320 routers, a line module reboots when you issue the **adapter disable** or **adapter enable** commands for an associated IOA.

When you issue the **adapter disable** or **adapter enable** commands, the line module (primary or spare) currently associated with that IOA reboots. If the IOA is protected by a line module redundancy group, an automatic line module redundancy switchover or revert can be triggered by the line module reboot. To prevent undesired line module redundancy actions, issue the **redundancy lockout** command for the primary line module slot before issuing the **adapter disable** or **adapter enable** commands.

Automatic Switchover

Provided you have not issued the **redundancy lockout** command for the primary line module, the router switches over to the spare line module automatically if it detects any of the following failures on the primary line module:

- Power-on self-test (POST) failure
- Software-detected unrecoverable error
- Software watchdog timer expiration
- Primary line module failure to respond to keepalive polling from the SRP module
- Removal, disabling, or reloading of the primary line module
- Missing or disabled primary line modules when the router reboots
- Resetting the primary line module using the concealed push button

Limitations of Automatic Switchover

If automatic switchover is enabled on a slot (the default configuration) and a spare line module is available, issuing some CLI commands for the primary line module causes a switchover (see Table 42).

You can also disable automatic switchover on individual slots. For more information, see *Configuring Line Module Redundancy* on page 329.

Table 42: Commands That Can Cause Automatic Switchover

Command	Reason for Automatic Switchover
slot disable *primary-line-module-slot*	The command disables the primary line module but not the primary I/O module or IOAs.
reload slot *primary-line-module-slot*	The command is equivalent to pushing the reset button on the primary line module.

Reversion after Switchover

You can install only one spare line module in the group of slots covered by the redundancy midplane or redundancy group. If the router is using the spare line module, no redundancy is available. It is desirable to revert to the primary module as soon as possible. By default, the router does not automatically revert to the primary module after switchover; however, you can configure it to do so. (See *Configuring Line Module Redundancy*.) Before reversion can take place, the primary line module must complete the POST diagnostics.

Configuring Line Module Redundancy

You can modify the default redundancy operations on the router as follows:

- Disable automatic switchover on a slot.
- Enable automatic reversion after switchover.

redundancy lockout

- Use to prevent the router from switching automatically to a spare line module if the primary module in the specified slot fails.
- The **redundancy force-switchover** command overrides the **redundancy lockout** command.
- Example

  host1(config)#**redundancy lockout 5**

- Use the **no** version to restart redundancy protection for the slot.

redundancy revertive

- Use to enable the router to revert from all spare line modules to the associated primary line modules automatically.
- Reversion takes place when the primary line module is once again available unless you specify a time of day. In that case, reversion takes place only when the primary module is available and after the specified time.

- Example

  host1(config)#**redundancy revertive 23:00:00**

- Use the **no** version to disable automatic reversion.

Managing Line Module Redundancy

When the router is running and a redundancy group is installed, you can manage the redundancy situation as follows:

- Force switchover manually.
- Force reversion manually.

redundancy force-switchover

- Use to force the router to switch from the primary line module in the specified slot or the primary SRP module to the spare line module or SRP module.
- The command causes a single switchover. When you reboot, the router reverts to the configured setting for this slot.
- The **redundancy force-switchover** command overrides the **redundancy lockout** command.
- Example

  host1#**redundancy force-switchover 5**

- There is no **no** version.

redundancy revert

- Use to force the router to revert to the primary line module in the specified slot.
- The router acts on this command immediately unless you specify a time or a time and date that the action is to take place.
- The command causes a single reversion. When you reboot, the router uses the configured setting for this slot.
- Example

  host1#**redundancy revert 4 23:00:00 5 September 200X**

- There is no **no** version.

SRP Module Redundancy

This section covers general issues of SRP module redundancy. It does not cover NVS cards or the behavior on systems running high availability features such as hitless SRP switchover. For information about managing NVS in a router that contains two SRP modules, see *Managing Flash Cards on SRP Modules* on page 341. For information about managing high availability in a router, see *Chapter 7, Managing High Availability*.

The information in this section does not apply to the ERX-310 router, which does not support SRP module redundancy. For this reason, any references to synchronization that may appear in command output or system messages do not apply to the ERX-310 router.

SRP Module Behavior

The SRP module uses a 1:1 redundancy scheme. When two SRP modules are installed in the router, one acts as a primary and the second as a redundant module. On ERX-7xx models, ERX-14xx models, and the ERX-310 router, both SRP modules share a single SRP I/O module located in the rear of the chassis. On the E120 router and the E320 router, both SRP modules share an SRP IOA located in the rear of the chassis.

After you install two SRP modules, the modules negotiate for the primary role. A number of factors determine which module becomes the primary; however, preference is given to the module in the lower slot. The SRP modules record their latest roles and retain them the next time you switch on the router.

With the default software settings, if the primary SRP module fails, the redundant SRP module assumes control without rebooting itself. For information about preventing the redundant SRP module from assuming control, see *Managing SRP Module Redundancy* on page 335.

On E120 and E320 routers, the switch fabric is distributed between the SFMs and the SRP modules. If the primary SRP module fails a diagnostic test on its resident slice of switch fabric, then it abdicates control to the redundant SRP module if both of the following are true:

- The standby SRP module does not indicate any error.
- The standby SRP module passes diagnostics on its attached fabric slice.

When the redundant SRP module assumes control, the following sequence of events occurs:

1. The original primary SRP module reboots and assumes the redundant role.
2. The redundant SRP module restarts and assumes the primary role without reloading new code. (When upgrading software, you must reload the software on the redundant SRP module. See *Chapter 3, Installing JUNOSe Software*.)
3. All line modules reboot.

The following actions activate the redundant SRP module:

- Failure of the primary SRP module (hardware or software)
- Pushing the recessed reset button on the primary SRP module (see Figure 25 on page 332 and Figure 26 on page 332)
- Issuing the **srp switch** command
- Issuing the **redundancy force-switchover** command

Figure 25: SRP Module on ERX-7xx Models and ERX-14xx Models

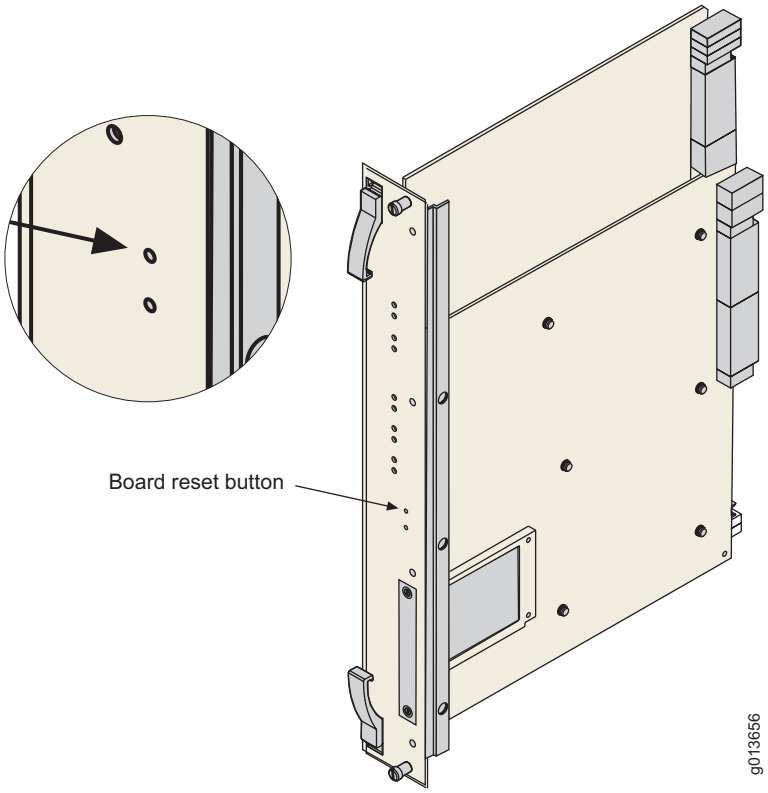
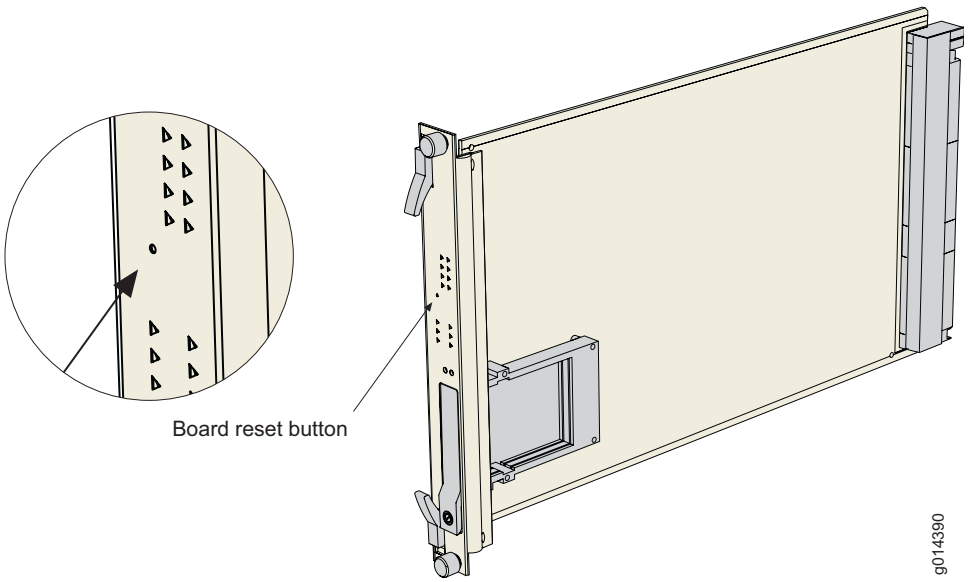


Figure 26: SRP Module on the E120 Router and the E320 Router



Specifying the Configuration for Redundant SRP Modules

On a router with redundant SRP modules, you can specify the configuration that both the primary and redundant modules load in the event of a reload or switchover. A switchover can result from an error on the primary SRP module or from an **srp switch** command. The following behavior takes place only in the event of a cold restart; it does not take place in the event of a warm restart.

When you arm a configuration (.cnf) file by issuing the **boot config** *cnfFilename* command, a subsequent SRP switchover causes the redundant SRP module to assume the role of primary SRP module with the configuration specified by the .cnf file. The new primary SRP module does not use the running configuration.

If you want the redundant SRP module to instead use the running configuration when it assumes the primary role, then you must first arm a configuration file with the **boot config** *cnfFilename* **once** command. To exhaust the **once** option, you must then cause the redundant SRP module to reload for some reason, such as by issuing a **reload** command or by arming a new JUNOSe release or a hotfix file.

When a switchover subsequently occurs, the redundant SRP module reloads with the running configuration and assumes the primary role. For more information about the **boot config** command, see *Chapter 11, Booting the System*.

Installing a Redundant SRP Module

You can install a redundant SRP module into a running router, provided that the redundant SRP module has a valid, armed software release on its NVS card. Access to a software release in NVS ensures that the redundant SRP module can boot; the release need not be the same as that on the primary SRP module. To install a redundant SRP module into a running router, follow these steps:

WARNING: Do not insert any metal object, such as a screwdriver, or place your hand into an open slot or the backplane when the router is on. Remove jewelry (including rings, necklaces, and watches) before working on equipment that is connected to power lines. These actions prevent electric shock and serious burns.

CAUTION: When handling modules, use an antistatic wrist strap connected to the router's ESD grounding jack, and hold modules by their edges. Do not touch the components, pins, leads, or solder connections. These actions help to protect modules from damage by electrostatic discharge.

1. Install the redundant SRP module into the open SRP slot (slot 6 or 7 for ERX-14xx models, the E120 router, and the E320 router; slot 0 or 1 for ERX-7xx models).

   For detailed information about installing the SRP module, see the *ERX Hardware Guide* or the *E120 and E320 Hardware Guide*.

2. Wait for the redundant SRP module to boot, initialize, and reach the standby state.

   When the module is in standby state, the REDUNDANT LED is on and the ONLINE LED is off. If you issue the **show version** command, the state field for the slot that contains the redundant SRP module is standby.

3. Synchronize the NVS file system of the redundant SRP module to that of the primary SRP module.

NOTE: The SRP module reboots after synchronization is complete.

reload slot

- Use to reboot a selected slot on the router.
- If you specify a slot on the E120 router or the E320 router that contains an SRP module, you reboot the SC subsystem on that slot by default. You do not, however, reboot the fabric slice that resides on the slot.
  - Use the **srp** keyword to reboot the portion of the SC subsystem that resides on a specified SRP module.
  - Use the **fabric** keyword to reboot the fabric slice that resides on the specified SRP module.
- Example 1—Reboots the module in slot 7

  host1#**reload slot 7**

- Example 2—Reboots the SC on the SRP module in slot 7 (applies only to E120 and E320 routers)

  host1#**reload slot 7 srp**

- There is no **no** version.

synchronize

- Use to force the file system of the redundant SRP module to synchronize with the NVS file system of the primary SRP module.
- If you synchronize the redundant SRP module with the primary SRP module and the redundant module is armed with a release different from the one it is currently running, the redundant SRP module is automatically rebooted to load the armed release.
- Optionally, you can use the **low-level-check** keyword to force the router to validate all files or only configuration files in NVS, and to synchronize all files that failed the checksum test during the **flash-disk-compare** command as well as any other files that are unsynchronized. See *Validating and Recovering Redundant SRP File Integrity* on page 347 for details.

- Examples

  host1#**synchronize**
  host1#**synchronize low-level-check all**
  host1#**synchronize low-level-check configuration**

- There is no **no** version.

Managing SRP Module Redundancy

You can prevent the redundant SRP module from taking over when:

- The primary SRP module experiences a software failure.
- You push the reset button on the primary SRP module.

NOTE: If you do not configure this option, when troubleshooting an SRP module, disconnect the other SRP module from the router. This action prevents the redundant SRP module from taking over if you push the reset button on the primary SRP module.

To configure this option:

1. Issue the **disable-switch-on-error** command.
2. Synchronize the NVS file system of the redundant SRP module to that of the primary SRP module.

Refer to the commands and guidelines in the previous section and below.

disable-switch-on-error

- Use to prevent the redundant SRP module from taking over if the primary SRP module experiences a software failure or if you push the reset button on the primary SRP module.
- Issue the **synchronize** command immediately before you issue this command.
- If you issue the **disable-switch-on-error** command, and later issue the **srp switch** command, the redundant SRP module waits about 30 seconds before it takes over from the primary SRP module.
- Example

  host1(config)#**disable-switch-on-error**

- Use the **no** version to revert to the default situation, in which the redundant SRP module takes over if the primary SRP module experiences a software failure.

synchronize

- Use to force the NVS file system of the redundant SRP module to synchronize with the NVS file system of the primary SRP module.
- If you synchronize the redundant SRP module with the primary SRP module and the redundant module is armed with a release different from the one it is currently running, the redundant SRP module is automatically rebooted to load the armed release.
- Optionally, you can use the **low-level-check** keyword to force the router to validate all files or only configuration files in NVS, and to synchronize all files that failed the checksum test during the **flash-disk-compare** command as well as any other files that are unsynchronized. See *Validating and Recovering Redundant SRP File Integrity* on page 347 for details.
- Examples

  host1#**synchronize**
  host1#**synchronize low-level-check all**
  host1#**synchronize low-level-check configuration**

- There is no **no** version.

Switching to the Redundant SRP Module

To switch immediately from the primary SRP module to the redundant SRP module, issue the **redundancy force-switchover** command or the **srp switch** command. You can configure the router to prompt you if the modules are in a state that could lead to loss of configuration data or NVS corruption.

redundancy force-switchover

- Use to force the router to switch from the primary line module in the specified slot or the primary SRP module to the spare line module or SRP module.
- The command causes a single switchover. When you reboot, the router reverts to the configured setting for this slot.
- With the **srp** option, the command is equivalent to the **srp switch** command.
- The **redundancy force-switchover** command overrides the **redundancy lockout** command.
- Example

  host1#**redundancy force-switchover 5**

- There is no **no** version.

srp switch

- Use to switch from the primary SRP module to the redundant SRP module.
- When the high availability state is active, this command delays until all transaction data, up to when you issue the command, has been mirrored to the standby SRP module. This preserves legacy behavior requiring that SRP modules be synchronized before the switchover.

- If you specify the **force** keyword, the procedure fails if the SRP modules are in certain states, such as during a synchronization. In these cases, the router displays a message that indicates that the procedure cannot currently be performed and the reason why. However, if the SRP modules are in other states that could lead to a loss of configuration data or an NVS corruption, the router displays a message that explains the state of the SRP modules, and asks you to confirm (enter yes or no) whether you want to proceed.
- If you do not specify the **force** keyword, the procedure fails if the SRP modules are in any state that could lead to a loss of configuration data or an NVS corruption, and the router displays a message explaining the command failure.
- When you issue this command, the router prompts you for a confirmation before the command takes effect.
- If you issue the **disable-switch-on-error** command and later issue the **srp switch** command, the redundant SRP module waits about 30 seconds before it takes over from the primary SRP module.
- If the router does not contain a redundant SRP module, this command has no effect.
- Example

  host1#**srp switch**
  host1#**srp switch force**

- There is no **no** version.

Upgrading Software on a Redundant SRP Module

For information about upgrading software on SRP modules on ERX-7xx models, ERX-14xx models, or the ERX-310 router, see *Chapter 3, Installing JUNOSe Software*.

Monitoring the Status LEDs

You can determine the redundancy state of line modules and SRP modules by examining their status LEDs. See Table 43 for a description of the LEDs functions. In addition, if you issue the **show version** command, the state field for the slot that contains the redundant SRP module should be standby.

Table 43: Function of the Online and Redundant LEDs

Online LED	Redundant LED	State of the Module
Off	Off	Module is booting or is an inactive primary line module.
On	Off	Module is active, but no redundant module is available.
Off	On	Module is in standby state.
On	On	Module is active, and a redundant module is available.

Monitoring Line Module and SRP Module Redundancy

You can use **show** commands to monitor the status of redundancy groups, line modules, and SRP modules.

NOTE: For more information about monitoring high availability, see *Chapter 7, Managing High Availability*.

show environment

- Use to display information about the hardware installed for redundancy.
- See *Chapter 5, Managing the System*, for details and examples.

show hardware

- Use to display detailed information about the line modules and SRP modules.
- See *Monitoring Modules* on page 369 for details and examples.

show redundancy

- Use to display the configuration for line module redundancy and SRP redundancy.
- Field descriptions
  - SRP
    - high-availability state—State of the high availability mode (disabled, active, or pending)
    - current redundancy mode—Redundancy mode currently being used by this router (high-availability or file-system-synchronization)
    - last activation type—Last type of activation that occurred on this router (that is, the method by which the SRP last booted [cold-start or warm-start])
  - Criteria Preventing High Availability from being Active—Criteria required for HA to be active.
  - slot—Slot in which the line module resides
  - hardware role—Function of the line module: primary or spare
  - lockout config—Status of redundancy on this line module
    - protected—Line module redundancy is enabled
    - locked out—Line module redundancy is disabled
  - backed up by slot—Slot that contains the line module that is a spare for this primary line module
  - sparing for slot—Slot that contains the primary line module for which this line module is a spare
  - revert at—Time at which you want the line module to revert
  - midplane type—Identifier for the type of midplane

- midplane rev—Hardware revision number of the redundancy midplane
- fabric slice redundancy—Status of the fabric slice on the SRP modules or SFMs on the E120 and E320 routers
  - slot—Slot in which the fabric slice resides
  - slice state—State of the fabric slice (online, not present)
  - type—Identifier for the type of hardware (SRP module or SFM)

- Example 1

  In the following example, the user issues a **show redundancy** command, and then a **redundancy force switchover** command. Finally, the user issues the **show redundancy line-card** command to display information specific to the line modules. The two displays show how the states of the primary and spare line modules change.

```
host1#show redundancy

SRP
---

high-availability state:  disabled
current redundancy mode:  file-system-synchronization
last activation type:     cold-start

Criteria Preventing High Availability from being Active
-------------------------------------------------------
            criterion                met
---------------------------------   ---
High Availability mode configured?   No
Mirroring Subsystem present?         No

Line Card
---------

automatic reverting is off

                              backed
                                up      sparing
       hardware    lockout      by       for      revert
slot     role      config      slot     slot       at
----   --------   ---------   ------   -------   ------
 0      spare        ---       ---       ---      ---
 2     primary    protected     ---       ---      ---
 12      ---         ---       ---       ---      ---

        midplane   midplane
slots     type       rev
-----   --------   --------
0 - 5      6          0

host1#redundancy force-switchover 2
host1#show redundancy line-card

automatic reverting is off
```

```
                                backed
                                  up     sparing
       hardware    lockout       by       for     revert
slot     role      config       slot     slot       at
----   --------   ---------   ------   -------   ------
 0      spare        ---       ---        2       ---
 2     primary    protected     0         ---      ---
 12      ---         ---       ---       ---      ---

        midplane   midplane
slots     type       rev
-----   --------   --------
0 - 5      6          0
```

- Example 2—Displays the redundancy status on an E320 router

```
host1#show redundancy

SRP
---

high-availability state:  active
current redundancy mode:  high-availability
last activation type:     cold-start

Line Card
---------

automatic reverting is off

                                backed
                                  up     sparing
       hardware    lockout       by       for     revert
slot     role      config       slot     slot       at
----   --------   ---------   ------   -------   ------
 0      spare        ---       ---       ---      ---
 2     primary    protected    ---       ---      ---
 4     primary    protected    ---       ---      ---


fabric slice redundancy: none
slot   state     type
----   ------   -------
6      online   SFM-100
7      online   SFM-100
8       ---       ---
9       ---       ---
10      ---       ---
```

show version

- Use to display information about each module in the router.

  See *Chapter 5, Managing the System*, for details and examples.

Managing Flash Cards on SRP Modules

Each SRP module contains a flash card that stores system files. On the E120 router and the E320 router, each SRP module can have an additional flash card; the second card is reserved for the storage of core dumps.

In this documentation, the flash card on the primary SRP module is referred to as the primary flash card; the flash card on the redundant SRP module is referred to as the redundant flash card.

If you have two SRP modules installed in a router, you can use flash cards of different capacities on the SRP modules. The effective capacity of the higher-capacity flash card equals that of the lower-capacity flash card.

Flash Features

The software contains a number of features that optimize the way the router restores its configuration if it is shut down improperly:

- The router tracks improper shutdowns.
- After an improper shutdown, the router runs an investigation of the file allocation table (FAT) the next time it reboots.
- The router creates backups of critical files.
- When you install a new flash card or restart the router after shutting it down incorrectly, a utility scans the flash card to detect corrupt sectors. If the utility finds files or directories that contain corrupt sectors, it removes the files and directories, because they can no longer be used. The utility also fixes problems with unused sectors. If the utility cannot correct a corrupt sector, it marks the sectors so that they cannot be reused. Errors in the boot block, FAT, or root directory are fatal and cannot be corrected by the scan utility.
- In a router that contains two SRP modules, if the scanning utility detects corrupt sectors in flash on the primary SRP module during rebooting, the primary SRP module reboots again. Both SRP modules now have standby status and reboot. The first SRP module to complete rebooting becomes the primary. Because the former redundant module started to reboot first, it likely becomes the primary. When the former primary module has rebooted and the scan utility has fixed corrupt sectors in its flash card, the SRP modules will synchronize. Any files or directories removed by the scan utility are restored during the synchronization.
- If you reboot the router before it has completely written configuration updates to the flash card, the router starts with the last saved configuration. If you reboot the router after it has written the configuration updates to the flash card, but before it has applied those updates to actual configuration data, the configuration update process resumes immediately following the reboot and is completed before any application accesses its configuration data.

Flash Features on the E120 Router and the E320 Router

The E120 router and the E320 router can have a second flash card installed with its SRP modules. Device names are reserved for the E120 and E320 router flash card slots: disk0, disk1, standby-disk0, and standby-disk1. For backward compatibility, you can use the name standby, which is equivalent to standby-disk0. You can use the second card (disk1 or standby-disk1) only for storage of core dump (.dmp) files. When the a card is installed and mounted as disk1 or standby-disk1, all .dmp files are automatically stored on this card. You must use the card mounted as disk0 or standby-disk0 for all other file types. Core dump files are stored on disk0 or standby-disk0 only when a second card is not installed.

The **copy**, **dir**, **delete**, and **rename** commands all recognize the device names, as in the following examples. Disk1 and standby-disk1 accept only dump files. This means that you can copy only .dmp files to the second disk, delete only .dmp files from the second disk, and rename only .dmp files on the second disk.

```
host1#copy reset05.dmp server2:reset05.dmp
host1#copy disk0:051802.dmp server2:reset05.dmp

host1#delete disk1:reset05.dmp
host1#delete standby:reset05.dmp
host1#delete standby-disk0:reset05.dmp
host1#delete standby-disk1:reset05.dmp

host1#rename standby-disk1:foo.dmp standby-disk1:bar.dmp
host1#rename foo.dmp /outgoing/bar.dmp

host1#dir
Please wait...

active/standby file systems are synchronized

   unshared                                                              in
     file                   size         size         date (UTC)        use
--------------            ---------    --------   -------------------   ---
disk0:reboot.hty             654336      654336   03/01/2005 16:08:28
disk0:system.log               3644        3644   11/30/2004 20:48:18
disk0:special.rel          159256660    61695156   02/18/2005 10:31:48
disk0:lm4_12.dmp           344200394   344200394   02/12/2005 12:12:12
standby-disk0:lm4_13.dmp   344200394   344200394   02/13/2005 13:13:13
disk1:lm4_14.dmp           344200394   344200394   02/14/2005 14:14:14
standby-disk1:lm4_15.dmp   344200394   344200394   02/15/2005 15:15:15
disk0:boston.scr                 833         833   02/22/2005 17:46:18
disk0:bulkstats.scr              170         170   02/13/2006 17:34:30
ram:bulkstats1.sts               737         737   03/07/2006 09:07:52

              Disk capacity
              -------------
          Capacity      Free      Reserved
Device    (bytes)      (bytes)    (bytes)
------   ----------   ---------   --------
disk0:   1025482752   342066375   68157440
ram:        5767168     5734400          0
```

Because the device names are reserved, if you upgrade from a release where you previously used those names for remote hostnames, an error message appears when you try to use that remote hostname:

```
%ambiguous file name, reserved disk device name "disk1" must be removed from
host table
```

To prevent corruption of flash cards, always issue the **halt** command before you remove an SRP module. See *Removing an SRP Module* on page 313. Issue the **halt** command before you remove a flash card installed as disk 0 or standby disk 0. Flash cards installed and mounted as disk1 or standby disk1 can be safely removed by issuing the **no mount** command for the card and then ejecting the card. Always reboot the router using the rebooting procedure. See *Chapter 11, Booting the System*. Do not reboot the router by switching it off and on.

Installing and Removing Flash Cards

For information about replacing flash cards, see *ERX Hardware Guide, Chapter 4, Installing Modules*, or *E120 and E320 Hardware Guide, Chapter 4, Installing Modules*.

Before you remove the second flash card (disk1) on the SRP 120 module or the SRP 320 module, you must first unmount the card with the **no mount** command. This command causes the file system to reject all subsequent requests for opening files on the flash card and closes all open files. When this is accomplished, the disk is marked as safely unmounted and a status message indicates that is safe to eject the disk. A status message is displayed when you issue the **mount** or **no mount** command:

- When you issue the **mount** command:

  ```
  % Device is mounted
  % Device is already mounted
  % Device is not present
  ```

- When you issue the **no mount** command:

  ```
  % Device is dismounted
  % Device is already dismounted
  % Device is not present
  % Command failed, files are open on device
  ```

CAUTION: When you eject a mounted disk 0 while the router is in an operational state, the SRP module initiates a reload. When you eject a mounted disk 1, data on the disk can be corrupted, but the router does not reboot.

mount

- Use to mount the disk. If the disk was not safely unmounted previously, then before mounting the file system and permitting user access the command initiates disk and file system integrity checks. These checks are the same ones that are automatically performed when a disk is installed and the SRP module is reloaded.
- This command applies only to the flash card installed in slot 1 on an SRP 320 module. The command is rejected if you specify disk0, because that card is required for system operation and cannot be unmounted.
- Example

  host1#**mount disk1**

- The **no** version prepares the flash card for safe removal. The router subsequently behaves as if the second flash card is no longer present. To access the second card, you must either eject and re-insert the card, or issue the mount command for the card. You can use the **force** keyword to force the dismount even when files on the flash disk are open for modification.

Synchronizing Flash Cards

NOTE: The information in this section does not apply to the ERX-310 router, which does not support SRP module redundancy.

When the router contains two SRP modules, the contents of the modules' flash cards need to be synchronized. Synchronization prevents the redundant flash card from overwriting saved files on the primary flash card if the primary SRP module fails and the redundant SRP module takes control.

By default, autosynchronization is enabled on the router. Autosynchronization runs as a background process every 5 minutes, tracking changes in image, configuration, and script files, and keeping the two SRP modules synchronized. You can also synchronize the SRP modules manually by issuing the **synchronize** command.

Before synchronization, the router does the following:

- Verifies that critical files on the primary SRP module are present. If files are missing, the router does not proceed with the synchronization.
- Verifies whether there is enough space on the redundant flash card to copy all the new or changed files from the primary flash card.

Depending on the outcome of the space verification, the router proceeds as follows:

- If the card has enough space, the router copies new or changed files from the primary flash card to the redundant flash card without deleting any files on the redundant flash card. If the router is interrupted while it is synchronizing with this method, the synchronization resumes when it has recovered from the interruption.

- If the card does not have enough space, the router deletes any files on the redundant flash card that do not appear on the primary flash card, then copies new or changed files from the primary flash card to the redundant flash card. If the router is interrupted while it is synchronizing with this method, it does not resume the synchronization when it has recovered from the interruption.

If an SRP synchronization is in progress or has failed and the router is recovering, the router prevents the redundant SRP module from taking the primary role while the primary is rebooting and for 30 seconds after the primary module has rebooted. These conditions prevent a redundant SRP module with corrupted or missing files from becoming the primary and overwriting files or directories on the primary module.

synchronize

- Use to force the file system of the redundant SRP module to synchronize with the flash file system of the primary SRP module.
- If you synchronize the redundant SRP module with the primary SRP module and the redundant module is armed with a release different from the one it is currently running, the redundant SRP module is automatically rebooted to load the armed release.
- Optionally, you can use the **low-level-check** keyword to force the router to validate all files or only configuration files in NVS, and to synchronize all files that failed the checksum test during the **flash-disk-compare** command as well as any other files that are unsynchronized. See *Validating and Recovering Redundant SRP File Integrity* on page 347 for details.

NOTE: In most cases, use the **synchronize** command instead of the **synchronize low-level-check** command. The **synchronize low-level-check** command is provided for troubleshooting, and is intended to be used under direction from JTAC.

- Examples

  host1#**synchronize**
  host1#**synchronize low-level-check all**
  host1#**synchronize low-level-check configuration**

- There is no **no** version.

Synchronizing Flash Cards of Different Capacities

If the capacity of the primary flash card is equal to or smaller than that of the redundant flash card, the router copies all the files from the primary flash card to the redundant flash card. However, if the capacity of the primary flash card exceeds that of the redundant flash card, the router creates a hidden synchronization reserve file on the primary flash card, provided enough space is available for the file.

The purpose of the synchronization file is to prevent the creation of data that cannot fit on the redundant flash card. The file contains no useful data, and does not appear when you view the files in NVS. The size of the file is equal to the difference in capacities of the two flash cards. For example, if the primary flash card has a capacity of 224 MB, and the redundant flash card has a capacity of 220 MB, the size of the synchronization file is 4 MB, and only 220 MB of space is available on the primary flash card.

If the primary flash card does not have enough space to create the synchronization reserve file, the **synchronize** command fails, and you see a warning message on the console. To resolve this issue, either delete unwanted files from the primary flash card or replace the redundant flash card with a higher-capacity flash card.

Disabling Autosynchronization

If autosynchronization is enabled while you are copying long scripts or installing new software releases, it detects a disparity between the modules during the middle of the process. This feature causes significant unnecessary synchronization, resulting in prolonged copy times.

If you have installed a redundant SRP module, perform the following steps before copying long scripts:

1. Turn off autosynchronization with the **disable-autosync** command.
2. Perform the installation or copy the script.
3. Reenable autosynchronization with the **no disable-autosync** command.
4. Manually synchronize the modules with the **synchronize** command.

Refer to the commands and guidelines in the previous section and in the sections that follow.

disable-autosync

- Use to turn off automatic synchronization between the primary and redundant SRP modules.
- Example

  host1(config)#**disable-autosync**

- Use the **no** version to revert to the default situation, in which automatic synchronization runs as a background process every 5 minutes.

Validating and Recovering Redundant SRP File Integrity

NOTE: The information in this section does not apply to the ERX-310 router, which does not support SRP module redundancy.

Even when flash cards on the primary and redundant SRP modules are synchronized, differences can exist in the content of files that reside on the primary flash card and the redundant flash card. You can use the **flash-disk compare** command to detect these differences so you can validate and, if necessary, recover the file integrity of the redundant SRP module.

The **flash-disk compare** command validates only those files that are synchronized between the primary and redundant SRP modules. It does not compare files that are normally excluded from the synchronization process, such as log files and core dump files. The command uses a simple checksum error detection algorithm to compare the contents of a file residing on the flash card of the primary SRP module with the contents of the same file residing on the flash card of the redundant SRP module.

To validate and recover redundant SRP file integrity:

1. Ensure that the file systems on the primary flash card and the redundant flash card are synchronized. (See *Synchronizing Flash Cards* on page 344 for details.)

2. Issue the **flash-disk compare** command, specifying whether to perform the checksum validation for all files in NVS or only for configuration files.

   host1#**flash-disk compare all**
   host1#**flash-disk compare configuration**

   The **flash-disk compare configuration** command, which validates only configuration files, excludes larger files such as software releases and scripts from the validation process. As a result, this command takes less time to complete than the **flash-disk compare all** command, which validates all NVS files.

3. Review the **flash-disk compare** output to determine whether any files failed the checksum validation.

   If the **flash-disk compare** command detects differences in the content of one or more files, the router reports a checksum test failure.

4. If one or more files failed the checksum validation, determine whether the corrupted files reside on the primary SRP module or on the redundant SRP module.

5. If the corrupted file resides on the primary SRP module, issue the **srp switch** command to force a switch from the primary SRP module to the redundant SRP module.

   This action ensures that the error-free version of the file will be on the SRP module that takes control after the switch.

6. Issue the **synchronize** command with the **low-level-check** keyword to force the router to:

   - Validate all files in NVS (when you use the **all** keyword) or only configuration files in NVS (when you use the **configuration** keyword).
   - Synchronize all files that failed the checksum test during the **flash-disk compare** command, as well as any other unsynchronized files.

   host1#**synchronize low-level-check all**
   host1#**synchronize low-level-check configuration**

   This action resolves any file discrepancies between the primary and redundant SRP modules and restore SRP file integrity.

NOTE: Both the **flash-disk compare** and **synchronize low-level-check** commands perform CPU-intensive processing that can take several minutes to complete. For best results, do not run these commands simultaneously on the same router. In addition, do not run multiple instances of the **flash-disk-compare** command simultaneously on the same router.

flash-disk compare

- Use to perform a checksum validation that compares the contents of the NVS file system on the primary SRP module with the contents of the NVS file system on the redundant SRP module.
- The command validates only those files that are synchronized between the primary and redundant SRP modules; it does not validate log files, core dump files, and other files that are excluded from the system synchronization process.
- Specify one of the following keywords:
  - **all**—Compares all files in NVS; this option can take several minutes to complete.
  - **configuration**—Compares only configuration files; this option takes less time to complete because it compares only a subset of the files in the NVS file system.
- If all files pass the validation test, the router reports that all checksums matched and displays the total number of files and total number of bytes of information compared.
- If one or more files fail the validation test, the router reports a checksum test failure and does not display the total number of files and bytes compared.
- If one or more of the following conditions exist, the command fails and the router displays a message that explains why it cannot perform the checksum test:
  - The file systems on the primary flash card and the redundant flash card are not synchronized.
  - The router does not contain a redundant SRP module.
  - The redundant SRP module is offline.

- Example 1—Shows output when all files passed the validation test

```
host1#flash-disk compare all
WARNING: This command may take several minutes to complete.
Proceed? [confirm]
WARNING: No changes should be made to the system while this command is in
         progress.
Please wait.....................................................
All file checksums matched.
Number of Files = 866
Number of Bytes = 61660650
```

- Example 2—Shows output when one or more configuration files failed the validation test

```
host1#flash-disk compare configuration
WARNING: This command may take several minutes to complete.
Proceed? [confirm]
WARNING: No changes should be made to the system while this command is in
         progress.
Please wait......
At least one configuration file failed checksum test.
```

- There is no **no** version.

synchronize

- Use to force the NVS file system of the redundant SRP module to synchronize with the NVS file system of the primary SRP module.
- If you synchronize the redundant SRP module with the primary SRP module and the redundant module is armed with a release different from the one it is currently running, the redundant SRP module is automatically rebooted to load the armed release.
- Optionally, you can use the **low-level-check** keyword to force the router to validate all files or only configuration files in NVS, and to synchronize all files that failed the checksum validation test during the **flash-disk-compare** command as well as any other files that are unsynchronized.
- When you use the **low-level-check** keyword, you must also specify one of the following keywords:
  - **all**—Validates all files in NVS, and synchronizes all files that failed the checksum test as well as any other unsynchronized files; this option can take several minutes to complete.
  - **configuration**—Validates all configuration files in NVS, and synchronizes all files that failed the checksum test as well as any other unsynchronized files; this option takes less time to complete because it validates only a subset of the files in the NVS file system.
- If one or more of the following conditions exist when you use the **low-level-check** keyword, the command fails and the router displays a message that explains why it cannot perform the synchronization:
  - The router does not contain a redundant SRP module.
  - The redundant SRP module is offline.
  - The armed releases are different on the primary SRP and redundant SRP.

- Examples

  host1#**synchronize**
  host1#**synchronize low-level-check all**
  host1#**synchronize low-level-check configuration**

- There is no **no** version.

Reformatting the Primary Flash Card

You can reformat the primary flash card. To do so:

1. Access Boot mode.

   a. From Privileged Exec mode, enter the **reload** command. Information about the reloading process is displayed.

   b. When the countdown begins, press the mb key sequence (case-insensitive).

      The CLI enters Boot mode (:boot## prompt). If you do not press the mb key sequence, the reloading process continues and returns the CLI to the normal User Exec mode.

2. Issue the **flash-disk initialize** command.

flash-disk initialize

- Use to reformat the flash card.
- You can perform a low-level format of the flash card.
- On the E120 and E320 routers only, you can use this command to format a second flash card installed as disk1. You can issue this command in Boot mode for either flash card. In Privileged Exec mode, you can use the **disk1** keyword to access the unmounted second flash card while the router is in an operational state.
- This command is available for disk1 in Privileged Exec mode only on SRP 320 modules. This command is not accepted for disk0 in Privileged Exec mode.
- Example 1

```
host1#halt primary-srp
host1#reload
WARNING: Execution of this command will cause the system to reboot.
Proceed with reload? [confirm]
Reload operation commencing, please wait...
[ Press mb]
:boot##flash-disk initialize
```

- Example 2—On an SRP 320 module

```
host1#no mount disk1
% Device is dismounted
host1#flash-disk initialize disk1
WARNING: Execution of this command will cause the contents of disk1 to be
erased.
Proceed with Flash disk initialization? [confirm]
Please wait.............................
```

- There is no **no** version.

Copying the Image on the Primary SRP Module

NOTE: The information in this section does not apply to the ERX-310 router, which does not support SRP module redundancy.

You can copy the contents of NVS on the primary SRP module to a spare flash card. To do so:

1. Access Boot mode.
   a. From Privileged Exec mode, enter the **reload** command. Information about the reloading process is displayed.
   b. When the countdown begins, press the mb key sequence (case-insensitive).

      This CLI enters Boot mode (:boot## prompt).
      If you do not press the mb key sequence, the reloading process continues and returns the CLI to the normal User Exec mode.
2. Issue the **flash-disk duplicate** command.
3. Follow the instructions on the screen. When prompted, insert the original or spare flash card in the primary SRP module.

flash-disk duplicate

- Use to copy the contents of the primary flash card to a spare flash card.
- The primary and spare flash cards must be from the same manufacturer and must have the same size.

NOTE: This command is available only in Boot mode.

- When you issue the **flash-disk duplicate** command, insert the original and spare flash cards when prompted. The router copies the flash card contents incrementally, so you may need to exchange the flash cards several times.

- Example

```
host1#halt primary-srp
host1#reload
WARNING: Execution of this command will cause the system to reboot.
Proceed with reload? [confirm]
Reload operation commencing, please wait...
[ Press mb]
:boot##flash-disk duplicate
```

- There is no **no** version.

Scanning Flash Cards

You can find both structural errors in the data in NVS and physical errors in the flash card. You can also remove files with errors, and attempt to repair structural or physical errors.

check-disk

- Use to find and repair structural inconsistencies and damage in the DOS file system in NVS on the primary SRP module.
- If the router contains primary and redundant modules, only NVS on the primary SRP module is scanned.
- On the E120 and E320 routers only, you can use this command to check and repair a second flash card installed as disk1. You can issue this command in Boot mode for either flash card. In Privileged Exec mode, you can use the **disk1** keyword to access the unmounted second flash card while the router is in an operational state.
- This command is available for disk1 in Privileged Exec mode only on SRP 320 modules. This command is not accepted for disk0 in Privileged Exec mode.
- Example

```
:boot##check-disk disk0
Copyright (c) 1993-1996 RST Software Industries Ltd. Israel. All rights reserved
ver: 2.6 FCS

Disk Check In Progress ...


        total disk space (bytes) :                    512,122,880
        bytes in each allocation unit :               8,192
        total allocation units on disk :              62,515
        bad allocation units :                        1
        available bytes on disk :                     120,651,776
        available clusters on disk :                  14,728
        maximum available contiguous chain (bytes) :  120,651,776
        available space fragmentation (%) :           0
        clusters allocated :                          47,786
Done Checking Disk.
```

- There is no **no** version.

flash-disk scan

- Use to find and repair files with physical errors in NVS. These errors are created if the router is not powered down or reset correctly.
- If the router contains primary and redundant modules, only NVS on the primary SRP module is scanned.
- Use the **repair** keyword to fix nonfatal errors found on the disk. If the repair fails, the router no longer uses the corrupted areas.
- On the E120 and E320 routers only, you can use this command to find and repair files on a second flash card installed as disk1. You can issue this command in Boot mode for either flash card. In Privileged Exec mode, you can use the disk1 keyword to access the unmounted second flash card while the router is in an operational state.
- This command is available for disk1 in Privileged Exec mode only on SRP 320 modules. This command is not accepted for disk0 in Privileged Exec mode.
- Example
  In this example, the user scans NVS and finds one file with an error. The user then issues the **flash-disk scan** with the **repair** keyword to remove the file. Finally, the user scans NVS again, and finds no files with errors.

```
:boot##flash-disk scan
Proceed with Flash disk scan? [confirm]
Srp PCMCIA Card Scan...
Boot Block OK
File Allocation Table OK
Root Directory OK
Checking File Space
Please Wait...
Checking Free Space
Please Wait...
PCMCIA Card Scan Detected Errors in:
\\images\ct1Diag\ct1Diag3c440e9e.cmp

PCMCIA Card Scan successful!


:boot##flash-disk scan repair
WARNING: Execution of this command may cause the contents of the Flash disk
to be modified.
Proceed with Flash disk scan? [confirm]
Srp PCMCIA Card Scan...
Boot Block OK
File Allocation Table OK
Root Directory OK
Checking File Space
Please Wait...
Checking Free Space
Please Wait...
PCMCIA Card Scan Removed:
\\images\ct1Diag\ct1Diag3c440e9e.cmp

PCMCIA Card Scan successful!


:boot##flash-disk scan
Proceed with Flash disk scan? [confirm]
Srp PCMCIA Card Scan...
Boot Block OK
File Allocation Table OK
```

```
Root Directory OK
Checking File Space
Please Wait...
Checking Free Space
Please Wait...
PCMCIA Card Scan successful!
```

- There is no **no** version.

Monitoring Flash Cards

Use the **show nvs** command to monitor the status of NVS on the primary SRP module. Use the **show flash** command to view information about the flash card.

show flash

- Use to display information about the flash card.
- Field descriptions
  - Active System Controller—Information for flash cards on the active SRP module
  - disk0—Flash card installed in slot 0 of the SRP module
  - disk1—Flash card installed in slot 1 of the SRP module; available only on SRP modules for the E120 and E320 routers
  - Manufacturer—Name of manufacturer of the installed flash card
  - Capacity—Total capacity of the flash card, in bytes
  - Standby System Controller—Information for flash cards on the standby SRP module
- Example

```
host1#show flash

          Active System Controller:
          -------------------------
Device    Manufacturer     Capacity    Status
------   --------------   ----------   -------
 disk0   SILICONSYSTEMS   1047126528   mounted
 disk1   STI              1024966656   mounted

             Standby System Controller:
             --------------------------
   Device         Manufacturer     Capacity    Status
-------------   --------------   ----------   -------
standby-disk0   SILICONSYSTEMS   1047674880   mounted
standby-disk1   SILICONSYSTEMS   1047674880   mounted
```

show nvs

- Use to monitor NVS status.
- Field descriptions
  - total nvs file sizes—Sum of sizes of all files in NVS, in bytes
  - total nvs file errors—Number of read and write errors in all files in NVS
  - nvs flash in use—NVS used, in bytes
  - available nvs flash—NVS available, in bytes
- Example

```
host1#show nvs
total nvs file sizes =  228864
total nvs file errors = 0
nvs flash in use =      1265152
available nvs flash =   35435008
```

Updating the Router with JUNOSe Hotfix Files

A JUNOSe hotfix is a file or collection of files that you can apply to update an operational E-series router to address one or more specific, critical software issues. The hotfix can replace or add functionality to one or more software components. Hotfixes also enable the delivery of software updates without having to load an entire software release. Hotfixes can also deploy debugging code to collect data that facilitates troubleshooting of software issues.

Although most hotfixes can also be manually activated without reloading the router, some hotfixes cannot. You can configure any hotfix to be activated automatically when the router reloads.

A hotfix consists of a .hfx file and possibly other supporting files. The .hfx file manages the associated files in much the same way that a .rel file manages supporting files associated with a release image.

To use a hotfix, you must use the **copy** command to download the file from a network host to the router. You cannot copy the hotfix to an FTP file server. You can use file system commands such as **dir**, **rename**, and **delete** with the hotfix. After a hotfix is copied to the local flash card, it remains there until you explicitly delete it.

Hotfixes must be activated to take effect. A *startup* hotfix is automatically activated during system initialization. A *hot-patchable* hotfix does not require a reload to become active; it takes effect immediately if compatibilities and dependencies are correctly met. You can manually install hot-patchable hotfixes with the **hotfix activate** command. Hot-patchable hotfixes can also be configured to be activated as a startup hotfix.

Arming a hotfix prepares it for activation after a system reload. You can configure hotfixes in several ways with the **boot hotfix** and **hotfix activate** commands, as in the following examples:

- Activated immediately on an active router but not armed as a startup hotfix. In this case, the hotfix is activated only until the SRP module reloads. If the SRP module reloads, then you must manually activate the hotfix again (if desired) with the **hotfix activate** command.

- Activated immediately on an active router and armed as a startup hotfix. In this case the hotfix is automatically activated after every reload.

- Armed as a startup hotfix with the **boot hotfix** command but not immediately activated. In this case the hotfix is activated when the SRP module reloads.

When a system reloads with the backup settings specified by the **boot backup** command, no armed hotfixes are activated. The currently armed hotfix settings are retained in the event that the router reverts back to its normal boot settings.

Hotfix Compatibility and Dependency

Hotfixes can have compatibility and dependency requirements. A given hotfix is compatible with one or more releases. It can be dependent on one or more other hotfixes being active. Compatibility and dependency requirements are stored as part of the hotfix. The requirements are enforced at the time of arming or activation. If the software installed and active on the router does not match the requirements specified in the hotfix, then activation of the hotfix fails. Such a failure generates appropriate error and log messages.

The following restrictions can apply to a hotfix:

- Dependency—A hotfix that must be active or armed before another hotfix can be activated or armed.

- Safe With—A list of hotfixes with which another hotfix is compatible and can safely be concurrently armed or activated. This list applies only to hotfixes that have some patched functionality in common and are armed or activated concurrently.

- Unsafe With—A list of hotfixes with which another hotfix is not compatible and cannot safely be concurrently armed or activated. The CLI displays a warning message when you try to activate a hotfix that is unsafe with one or more active or armed hotfixes.

- Manual Activate [Active / Standby] Srp—The name of a binary flag that indicates whether manual activation of the hotfix is allowed on the active and standby SRP modules. When the flag is set to false, you cannot manually activate the hotfix; instead, the hotfix can only be activated as a startup hotfix. The CLI displays a warning message when you try to activate a hotfix that cannot be manually activated.

- Manual Deactivate [Active / Standby] Srp—The name of a binary flag that indicates whether manual deactivation of the hotfix is allowed on the active and standby SRP modules. When the flag is set to false, you cannot manually deactivate the hotfix. You must disarm the hotfix and reload the router. The CLI displays a warning message when you try to deactivate a hotfix that cannot be manually deactivated.

- Line card requires reload—The name of a binary flag that indicates whether line modules require a reload for the hotfix to become active on the module. The CLI displays a warning message if the line modules must be reloaded. If the warning is confirmed, the SRP module reloads each line module. The flag applies to all line modules targeted by the hotfix that are installed in the router.

Hotfixes remain armed only for compatible releases. If you change the armed release by issuing the **boot system** command, hotfixes that are not compatible with the new release are no longer armed. However, if you subsequently rearm a compatible release, the previously armed hotfixes for that release are automatically armed again.

Removing Hotfixes

You can deactivate, disarm, and delete hotfixes from a router. When you deactivate a hotfix, any functionality that was added as part of the hotfix is automatically removed (even though the .hfx file remains on the router).

You cannot deactivate a hotfix that is a dependency for other hotfixes until you deactivate the dependent hotfixes. When a hotfix is no longer active, you can use the **delete** command to remove the hotfix file from the flash card.

Hotfixes and Backup Settings

The **boot backup** command does not explicitly support hotfix files. When a system reloads with the backup settings specified by the **boot backup** command, no armed hotfixes are activated. However, the armed hotfix settings are retained in the event that the system reverts to its normal (nonbackup) boot settings. If that happens, these hotfixes are automatically rearmed and reactivated after a reload.

Hotfixes and Standby SRP Modules

Hotfixes are supported in redundant SRP module configurations. Hotfix files are synchronized between the active and standby SRP modules by both automatic and manual synchronization. Hotfix activation restrictions are enforced identically on the active and standby SRP modules. A hotfix that is hot-patchable on the active module is hot-patchable on the standby module. A hotfix that requires startup activation on the active SRP module also requires startup activation on the standby SRP module.

Hotfixes are synchronized from the active SRP module to the standby SRP module. The standby SRP automatically activates the hotfixes that are armed as startup hotfixes. However, if the synchronization reveals that the set of active hotfixes on the standby SRP module is different from the set of armed hotfixes on the active SRP module, then the standby SRP module automatically reboots. This action causes the standby SRP module to activate the startup hotfixes. When you activate or arm a hotfix for startup activation, compatibility and dependency checks are performed independently on the active and standby SRP modules.

Hotfixes and Line Modules

For line modules, a hotfix consists of one or more image fixes specific to a particular model of module or to a module type, depending on the fix. When a hotfix is activated, each image fix contained in the hotfix is activated on all applicable modules that are installed in the router. When existing line modules come online during startup and when new line modules are inserted in the chassis, image fixes for that particular line module are requested and activated during module startup.

Line module image hotfixes that have been armed as startup hotfixes are activated before application configuration occurs on the line module.

Only image fixes contained in hotfixes that are active on the primary SRP module can be activated on the line modules during startup. Hotfixes that are armed but not active on the primary SRP module are not activated on line modules.

A hotfix can contain a combination of image fixes. System controller (SC) and interface controller (IC) image fixes are cumulative and activated in the order in which they were armed. For forwarding controller (FC) image fixes, the last one armed is the only one applied.

NOTE: Because image fixes are activated in a particular order, we recommend that you create a list of any hotfixes that you are currently running or intend to run with a new FC image fix. JTAC can then provide you with the correct order of activation.

A hotfix cannot be partially activated on a router. If activation of any image hotfix fails on any corresponding module, the entire activation fails for all applicable line modules. Activation failure results in the generation of an appropriate log message. E-series routers do not support activation of a hotfix on a per-slot basis or a per-subsystem basis.

For example, suppose that a hotfix contains an image fix for the SRP module and the GE-2 line module. The SRP image fix is successfully activated on the SRP module, but the activation of the GE-2 image fix fails for some reason. In this case, the SRP module image fix is deactivated and no further attempts are made to activate the image fix on other GE-2 modules.

boot hotfix

- Use to arm the specified hotfix as a startup hotfix that is automatically activated the next time the SRP module reboots.
- Arming fails if the specified hotfix depends on a hotfix that is not already armed. In this event, the CLI displays an error message similar to the following:

  ```
  % The hotfix, 975, requires the following hotfixes to be armed:
        990
  ```

- Arming fails if the hotfix is not compatible with the armed release. The CLI displays the following error message:

  ```
  % Hotfix is incompatible with armed release.
  ```

- When a router reverts to its backup boot settings, as specified by the **boot backup** command, no armed hotfixes are activated. The armed hotfix settings are retained in the event the router reverts back to its normal boot settings.
- Example

  host1(config)#**boot hotfix hf63037.hfx**

- Use the **no** version to disarm a specified hotfix. You can disarm all hotfixes armed for all releases by specifying the **all-releases** keyword. If any startup hotfixes are armed, the CLI then prompts you to confirm the deletion,

  If the hotfix being disarmed is a dependency for another armed hotfix, the command fails and the CLI displays an error message similar to the following:

  ```
  The hotfix, 990, has the following armed dependents which must be disarmed
  first:
        975

  % Disarming failed
  ```

  When you disarm hotfixes that have dependencies, you must disarm them in the reverse sequence from which they were armed. However, if you have issued the **all-releases** keyword, the disarming automatically takes place in the correct order.

no boot hotfix all-releases

- Use in Boot mode to disarm all armed hotfixes for all releases.
- Example

  :boot##**no boot hotfix all-releases**

- There is no affirmative version of this command; there is only a **no** version.

hotfix activate

- Use to manually activate the specified hotfix.
- Each image fix contained in the hotfix is downloaded from the local flash card to the SRP module and any corresponding line module, and then activated on the modules.
- When a new line module is inserted in the router, all applicable image fixes are activated during initialization of the module. Activation is performed by the line module operational image before application configuration takes place on the module.
- An activation failure for any image fix on its corresponding line module causes the entire activation to fail. The image fix is then deactivated on any modules on which it was successfully activated.

- Activation fails if the specified hotfix is incompatible with the running release, In this event, an error message similar to the following is displayed:

  % Hotfix is incompatible with running release.

- Activation fails if the specified hotfix depends on other hotfixes that have not been activated. The CLI displays an error message similar to the following:

  The hotfix, 975, requires the following hotfixes to be activated:
  990

  % Activation failed

- Startup hotfixes cannot be manually activated. If you attempt to manually activate a startup hotfix, the operation fails and generates the following error message:

  % Manual activation not allowed

- Example

  host1#**hotfix activate hf63037.hfx**

- Use the **no** version to manually deactivate the specified hotfix. Deactivation restores the system to the state that existed before the hotfix was activated. You can specify the **all** keyword to deactivate all active hotfixes.

  When you deactivate hotfixes that have dependencies, you must deactivate them in the reverse sequence from which they were armed. However, if you have issued the **all** keyword, the disarming automatically takes place in the correct order.

Monitoring Hotfixes

Several commands provide information about hotfixes that have been loaded on the router. You can use the **show hotfix** command to discover the armed and activation status of all hotfixes or a specific hotfix. The output lists the hotfix by name and a unique ID number, which is useful if the filename has been changed. This command also displays dependencies for each hotfix; that is, other hotfixes that must be activated before that hotfix can be activated. For more usage details and sample output, see **show hotfix** on page 361.

The **dir** command displays all hotfixes present on the local flash card. The in use field indicates that the hotfix is either currently activated or armed to be activated as a startup hotfix for the currently armed release.

```
host1#dir

*** Active/standby file systems are not synchronized. ***

Active System Controller:
                                      unshared                          in
          file                 size      size          date (UTC)        use
-------------------------   ---------  ---------   -------------------   ---
reboot.hty                     596288     596288   03/07/2005 19:35:52
system.log                       6762       6762   03/07/2005 17:30:08
haIpSetup.mac                    4874       4874   03/24/2004 10:02:08
6-0-1p0-5.rel                148489185  148489185   02/28/2005 18:17:32   !
hf63035.hfx                      30445      30445   03/07/2005 14:04:02   !
```

```
hf63030.hfx                     28675       28675   03/05/2005 18:22:32
...
```

You can use the **show version** command to display a summary of each of the hotfixes currently activated on the system, including the hotfix name and hotfix ID.

```
host1#show version

Juniper Edge Routing Switch ERX-1400
Copyright (c) 1999-2005 Juniper Networks, Inc.  All rights reserved.
System Release: 6-0-1p0-5.rel
        Version: 6.0.1 patch-0.5   (January 28, 2005  14:55)
        Active hotfixes:
                  hf63036.hfx (Id: 1020)
                  hf63037.hfx (Id: 1030)
System running for: 7 days, 3 hours, 55 minutes, 5 seconds
        (since FRI FEB 04 2005 13:01:30 UTC)
```

The **show boot** command displays the current boot settings, including armed hotfixes that will be activated when the router reboots.

```
host1#show boot

System Release:   6-0-1p0-5.rel
        Armed Hotfixes: hf63035.hfx
        hf63036.hfx
        hf63037.hfx
System Configuration: running-configuration
```

The header of the **show configuration** command output includes the armed hotfix summary. You can issue the **show configuration system file-system** command to display the **boot hotfix** commands that restore the router to its current configuration when you issue the configuration script on a router configured with factory defaults.

Hotfixes that are active when you issue the **show configuration** command are not part of the command output or the resulting configuration script. Only armed hotfixes are part of the **show configuration** script.

```
host1#show configuration system file-system

! Configuration script being generated on TUE MAR 22 2005 16:43:41 UTC
! Juniper Edge Routing Switch ERX-1400
! Version: 6.0.1 patch-0.5   (January 28, 2005  14:55)
!     Active hotfixes: hf63036.hfx (Id: 23453036)
!                      hf63037.hfx (Id: 34563037)
! Copyright (c) 1999-2005 Juniper Networks, Inc.  All rights reserved.
!
! Commands displayed are limited to those available at privilege level 15
!
boot config running-configuration
boot system 6-0-1p0-5.rel
boot hotfix hf63036.hfx
boot hotfix hf63037.hfx
no boot backup
no boot subsystem
no boot backup subsystem
no boot force-backup
```

show hotfix

- Use to display the name, ID, activation and arming status, and dependencies for all hotfixes or a specific hotfix available on the local file system.
- You can issue the **detail** keyword to additionally display a synopsis of the hotfix behavior. The detailed output for a specific hotfix also indicates compatible and incompatible hotfixes and lists modules affected by the hotfix.
- Field descriptions
  - name—Filename of the hotfix
  - id—Number uniquely identifying the hotfix; nonconfigurable so that you can identify the hotfix if the filename has been changed
  - active—Status of hotfix activation; X indicates that the hotfix is active

- armed—Status of hotfix arming; X indicates that the hotfix is armed to be activated; only hotfixes armed for the currently armed release are displayed as armed
- requires—Hotfix ID number or numbers identifying hotfix dependencies, which are hotfixes that must be activated before this hotfix can be activated
- synopsis—Brief description of the functionality or behavior of the hotfix
- Description—More detailed description of the functionality or behavior of the hotfix
- Dependencies—Hotfix ID number or numbers identifying hotfix dependencies, which are hotfixes that must be activated before this hotfix can be activated
- Safe to repatch—Hotfix ID number or numbers of hotfixes that can be concurrently active with this hotfix; applies only to hotfixes that fix the same existing functionality
- Unsafe with—Hotfix ID number or numbers of hotfixes that are incompatible and cannot be activated at the same time as this hotfix
- Notes—Restrictions on manual activations or deactivations

- Example 1

```
host1#show hotfix

      name          id    active   armed   requires
----------------   ----   ------   -----   ----------
sleep.hfx           975     X        X          990
clock.hfx           990     X        X
showHotfix.hfx     2010
incompatible.hfx    410
hfActivate.hfx      960
```

- Example 2—The **detail** keyword additionally displays a synopsis of the hotfix.

```
host1#show hotfix detail

      name          id    active   armed   requires
----------------   ----   ------   -----   ----------
sleep.hfx           975     X        X          990
clock.hfx           990     X        X
showHotfix.hfx     2010
incompatible.hfx    410
hfActivate.hfx      960
      name                          synopsis
----------------   ------------------------------------------------
sleep.hfx          Modify the output of the sleep command.
clock.hfx          Modify the behavior of show clock.
showHotfix.hfx     Changes the output of show hotfix.
incompatible.hfx   Changes the output of show hotfix.
hfActivate.hfx      Change log message severity for hotfix activate.
```

- Example 3—The **detail** keyword for a particular hotfix displays the most detailed information.

```
host1#show hotfix clock.hfx detail
HotfixId: 990

Synopsis: Modify the behavior of show clock.

Active: Yes
Armed: Yes

Description:  Changes the output of the show clock command.

Affected modules: SRP, GE, VTM

Dependencies:

Safe to repatch:

Unsafe with:

Notes:
1) This hotfix can only be activated when the active SRP reloads
2) Arming this hotfix will cause the standby SRP to reload
```

Example: Using and Monitoring Hotfixes

This example presents several aspects of hotfix use. In this example, 6-0-1p0-5.rel is the currently armed and active release. Hotfix hf63035.hfx is compatible with this release and is currently activated and armed as a startup hotfix.

```
host1#dir

Active System Controller:
                                        unshared                          in
          file                  size        size          date (UTC)       use
-------------------------   ---------   ---------   -------------------   ---
reboot.hty                      596288      596288   03/07/2005 19:35:52
system.log                        6762        6762   03/07/2005 17:30:08
haIpSetup.mac                     4874        4874   03/24/2004 10:02:08
6-0-1p0-5.rel                125987342   125987342   02/30/2005 18:17:32    !
6-1-0.rel                    148489185   148489185   02/28/2005 20:19:20
hf63035.hfx                       30445       30445   03/07/2005 14:04:02   !
hf63036.hfx                       27445       27445   03/07/2005 16:12:05
hf63037.hfx                       28324       28324   03/07/2005 16:13:25

host1#show hotfix detail

   name         id     active  armed   requires
-----------  --------  ------  -----   -----------
hf63035.hfx  12343035    X       X
hf63036.hfx  23453036
hf63037.hfx  34563037                   23453036

    name            synopsis
-----------      -------------------------------------------
hf63035.hfx      Fix for CQ63035, bgp crash, out of resources
hf63036.hfx      Fixed show version formatting issue
hf63037.hfx      Increased max session limit on ERX310 to 32,000
```

```
host1(config)#boot hotfix hf63037.hfx
% The hotfix, 34563037, requires the following hotfix(es) to be armed:
        23453036
```

The hf63036.hfx hotfix must be armed as a startup hotfix:

```
host1(config)#boot hotfix hf63036.hfx
```

This command succeeds because hf63036.hfx is compatible with the currently armed release, 6-1-0.rel, and has no dependencies on other hotfixes.

Now the attempt to arm hf63037.hfx succeeds because its dependency on hf63036.hfx has been met.

```
host1(config)#boot hotfix hf63037.hfx
```

Now suppose the user reloads the router:

```
host1#reload
```

As the router loads the armed release, 6-1-0.rel, the hotfix loader discovers three armed startup hotfixes, hf63035.hfx, hf63036.hfx, and hf63037.hfx. Only hf63036.hfx and hf63037.hfx are activated. Hotfix hf63035.hfx is disarmed because it is incompatible with the new running release. The router therefore becomes operational running 6-1-0.rel with hf63036.hfx and hf63037.hfx activated.

```
host1#dir

                                        unshared                          in
          file                  size        size          date (UTC)       use
-------------------------   ---------   ---------   --------------------   ---
reboot.hty                     596288      596288   03/07/2005 19:35:52
system.log                       6762        6762   03/07/2005 17:30:08
haIpSetup.mac                    4874        4874   03/24/2004 10:02:08
6-0-1p0-5.rel                125987342   125987342   02/30/2005 18:17:32
6-1-0.rel                    148489185   148489185   02/28/2005 20:19:20   !
hf63035.hfx                      30445       30445   03/07/2005 14:04:02
hf63036.hfx                      27445       27445   03/07/2005 16:12:05    !
hf63037.hfx                      28324       28324   03/07/2005 16:13:25    !
```

```
host1#show hotfix

   name      active  armed   requires
-----------  ------  -----   --------
hf63035.hfx
hf63036.hfx    X       X
hf63037.hfx    X       X      23453036
```

Now suppose the user attempts to deactivate hf63036.hfx:

```
host1#no hotfix activate hf63036.hfx
The hotfix, 23453036, has the following active dependents which must be
deactivated first:
        34563037
% De-activation failed.
```

The command fails because hf63037.hfx is dependent on hf63036.hfx. Interdependent hotfixes must be deactivated and disarmed in the reverse order that they were activated.

When 6-0-1p0-5.rel is re-armed and the router reloaded, the hotfix loader determines that the startup hotfixes, hf63036.hfx and hf63037.hfx, are incompatible with the release. It disarms these hotfixes. The user decides to delete the now unnecessary hotfixes from the router.

```
host1#delete hf63036.hfx
host1#delete hf63037.hfx

host1#dir

Active System Controller:
                                        unshared                          in
          file                  size        size          date (UTC)       use
-------------------------   ---------   ---------   -------------------   ---
reboot.hty                     596288      596288   03/07/2005 19:35:52
system.log                       6762        6762   03/07/2005 17:30:08
haIpSetup.mac                    4874        4874   03/24/2004 10:02:08
6-0-1p0-5.rel                125987342   125987342   02/30/2005 18:17:32   !
6-1-0.rel                    148489185   148412851   02/28/2005 20:19:20
hf63035.hfx                      30445       30445   03/07/2005 14:04:02   !

host1#show hotfix detail

   name         active     armed   requires
-----------  ------------  -----   --------
hf63035.hfx       X          X         ---
```

Managing the Ethernet Port on the SRP Module

You can configure the Fast Ethernet management port to access the router from a Telnet session or SNMP.

On ERX-7xx models, ERX-14xx models, and ERX-310 routers, the Fast Ethernet port is located on the SRP I/O module. For more information about configuring the Fast Ethernet port on an SRP I/O module, see *ERX Hardware Guide, Chapter 7, Accessing ERX Routers*.

Use the Fast Ethernet port on the SRP I/O module only as a router management port. Do not use this port to route traffic for Fast Ethernet or higher-level protocols such as transport or routing protocols, because doing so affects the performance of the router.

On the E120 router and the E320 router, the Fast Ethernet port is located on the SRP IOA. For more information about configuring the Fast Ethernet port on an SRP IOA, see *E120 and E320 Hardware Guide, Chapter 7, Accessing E-Series Routers*.

interface fastEthernet

- Use to select a Fast Ethernet interface on a line module or an SRP module.
- On ERX-7xx models, ERX-14xx models, and the ERX-310 router, specify the Fast Ethernet interface management port by using the *slot/port* format.
- On the E120 and E320 routers, you can specify the Fast Ethernet port on the SRP IOA by using the *slot/adapter/port* format. The port on the SRP IOA is always identified as 0.

- Example 1—Selects a Fast Ethernet management port on ERX-7xx models, ERX-14xx models, or the ERX-310 router

  host1(config)#**interface fastEthernet 0/0**

- Example 2—Selects a Fast Ethernet management port on the E320 router

  host1(config)#**interface fastEthernet 6/0/0**

- Use the **no** version to remove IP from an interface or subinterface.

Monitoring Statistics

You can set a baseline and view statistics on the Fast Ethernet port of the SRP module in the same way that you would for other Ethernet interfaces. See *JUNOSe Physical Layer Configuration Guide, Chapter 5, Configuring Ethernet Interfaces*.

Monitoring the Ethernet Configuration for the SRP Module

Slots 0 and 1 are reserved for SRP modules on ERX-7xx models; slots 6 and 7 are reserved for SRP modules on ERX-14xx models, the E120 router, and the E320 router. When you configure the Fast Ethernet interface on an SRP module, the output of the **show configuration** command always indicates that the interface is configured in the lower of the two slots (slot 0 or slot 6). This indication is true if you configure the interface on a redundant SRP module in the higher slot or even if you have only one SRP module and it is installed in the higher slot, as shown in the following example:

```
host1#show version
Juniper Edge Routing Switch ERX-700
Copyright (c) 1999-2005 Juniper Networks, Inc.  All rights reserved.
System Release: erx_7-1-0.rel Partial
        Version: 7.1.0 [BuildId 4518]   (December 21, 2005  11:23)
System running for: 25 days, 3 hours, 31 minutes, 5 seconds
        (since THU DEC 22 2005 11:36:41 UTC)

slot  state     type     admin  spare  running release    slot uptime
---- ------- ---------- ------- ----- ------------------ --------------
0    standby SRP-10Ge   enabled  ---  erx_7-1-0.rel           ---
1    online  SRP-10Ge   enabled  ---  erx_7-1-0.rel      25d03h:28m:49s
2      ---      ---       ---    ---         ---              ---
3      ---      ---       ---    ---         ---              ---
4    online  CT3-12     enabled  ---  erx_7-1-0.rel      25d03h:24m:46s
5    online  OC3-4A-APS enabled  ---  erx_7-1-0.rel      25d03h:24m:22s
6    online  GE         enabled  ---  erx_7-1-0.rel      25d03h:24m:44s

host1#configure terminal
Enter configuration commands, one per line.  End with ^Z.
host1(config)#interface fastethernet 0/0
host1(config-if)#ip address 10.6.130.83 255.255.128.0
host1(config-if)#exit
host1(config)#ip route 0.0.0.0 0.0.0.0 10.6.128.1
host1(config)#exit
host1#show config
! Configuration script being generated on TUE SEP 14 2004 13:22:06 UTC
! Juniper Edge Routing Switch ERX-700
! Version: 6.0.0 beta-1.8 [BuildId 2538] (September 7, 2004  12:46)
! Copyright (c) 1999-2004 Juniper Networks, Inc.  All rights reserved.
!
! Commands displayed are limited to those available at privilege level 10
```

```
!
boot config running-configuration
boot system erx_6-0-0b1-8.rel
no boot backup
no boot subsystem
no boot backup subsystem
no boot force-backup
!
! Note:  The following commands are here to ensure that all virtual routers
and
! vrfs are created before other commands that may need to reference them.
! These commands will be repeated further on as each virtual router and vrf
! has its configuration presented.
!
virtual-router default
virtual-router vr8
!
!
hostname "host1"
exception protocol ftp anonymous null
!
controller t3 2/0
[...]
!
interface fastEthernet 0/0
 ip address 10.6.130.83 255.255.128.0
!
ip route 0.0.0.0 0.0.0.0 10.6.128.1
! Trap Source: <not configured>
! Note: SNMP server not running.
!
```

Enabling Warm Restart Diagnostics on Modules

You can enable the system to perform diagnostic tests on SRP modules and line modules when the specified module is warm restarted. The system performs all the diagnostic tests that normally run when the module is cold started.

SRP modules on all E-series routers support warm restart diagnostics. Table 44 lists the line modules that support warm restart diagnostics.

Table 44: Supported Line Modules

Line Module
cOCx FO
CT3/T3-F0
OCx/STMx ATM
GE/FE
GE-2
GE-HDE
OC3/STM1 GE/FE
OC48
ES2 4G LM
ES2 10G Uplink LM

The number of diagnostic tests that the system performs on line modules depends on whether you have configured line module redundancy. If you enable warm restart diagnostics on the spare line module when all other line modules are active, the system performs diagnostic tests on the spare line module including the spare I/O module.

Enabling warm restart diagnostics on a primary line module forces the line module to switch over to the spare line module.

To ensure complete diagnostic test coverage, we recommend that you disable line module redundancy using the **redundancy lockout** command before enabling warm restart diagnostics.

Enabling Warm Restart Diagnostics

Use the **diag** command to enable warm restart diagnostics on a module.

diag

- Use to restart the specified SRP module or line module and enable the system to perform diagnostic tests on the module.
- Use the **force** keyword to enable the system to manually confirm conflicting conditions when the slot of the active SRP module is specified.
- If you specify a slot on the E120 router and the E320 router that contains an SRP module, you can use the *subsystem* variable to perform diagnostic tests on a subsystem on the SRP module. We recommend that you perform diagnostic tests on one subsystem at a time to avoid interrupting network traffic transmitting through the fabric modules.
  - Use the **srp** keyword to perform diagnostic tests on the SC subsystem that resides on a specified SRP module.
  - Use the **fabric** keyword to run diagnostic tests on the fabric slice that resides on the specified SRP module.
- Example 1—Enables warm restart diagnostics on a line module

  host1#**diag 3 force**

- Example 2—Enables warm restart diagnostics on the fabric subsystem of an active SRP module on the E320 router

  host1#**diag 6 fabric**

- There is no **no** version.

Monitoring Modules

Use the following commands to view information about all router modules.

show hardware

- Use to display information about SRP modules, line modules, and I/O modules in ERX-7xx models, ERX-14xx models, and the ERX-310 router.
- Use to display information about the chassis, SRP modules, SFMs, line modules, IOAs, and the fan tray in the E120 router and the E320 router.
- Field descriptions
  - slot—Physical slot that contains the module
  - type—Kind of module or chassis and fan tray in the E120 and E320 routers; an “e” at the end of an SRP module type (for example, SRP-5Ge) indicates that the module includes error-checking code (ECC) memory.
  - serial number—Serial number of the module, chassis, or fan tray
  - assembly number—Part number of the module, chassis, or fan tray
  - assembly rev.—Hardware revision of the module, chassis, or fan tray
  - ram (MB)—Memory capacity of the host processor
  - number of MAC addresses—Total number of Ethernet addresses on an I/O module or an IOA
  - base MAC address—Lowest Ethernet address on an I/O module or an IOA
  - Tray—Number of the fan tray in the E120 and E320 routers; 0 indicates the primary fan
  - Major/Minor rev—Revision number of the module on the E120 and E320 routers
- Example 1—Displays the status of hardware on an ERX-7xx model

```
host1#show hardware
                            serial      assembly    assembly   ram
slot        type            number       number       rev.    (MB)
----   ----------------   ----------   ----------   --------   ----
0      SRP-10Ge           4305358981   3500005472     A06      2048
1      SRP-10Ge           4305359020   3500005472     A06      2048
2            ---             ---          ---         ---      ---
3            ---             ---          ---         ---      ---
4      CT3-12             4305337201   3500010901     A07      128
5      OC3/OC12/DS3-ATM   4605300290   3500103958     A06      256
6      GE/FE              4605340294   3500104554     A08      256

                                                              number
                                                                of
                          serial      assembly    assembly      MAC
slot       type           number       number       rev.     addresses
----   -------------   ----------   ----------   --------   ---------
0          ---             ---          ---         ---        ---
1      SRP-10Ge I/O    4605250426   3500003302     A02          1
2          ---             ---          ---         ---        ---
3          ---             ---          ---         ---        ---
4      CT3/T3-12 I/O   4305316605   3500010801     A02
5      OC3(8)-MM I/O   4304443600   4500001501     A03          4
6      GE-SFP I/O      4605310064   4500002001     A05          1
```

```
           base
slot    MAC address
----   --------------
0           ---
1      0090.1aa0.577a
2           ---
3           ---
4
5      0090.1a41.7c68
6      0090.1aa0.6216
```

- Example 2—Displays the status of hardware on the E320 router

```
host1#show hardware
```

```
                        Chassis
                        -------
           serial      assembly    assembly   Major/Minor
 type       number      number       rev.         rev
-------   ----------   ----------   --------   -----------
Chassis   5504200687   4400006402      01         0.101

                              Modules
                              -------
                  serial      assembly    assembly   ram    Major/Min
slot    type       number      number       rev.     (MB)       rev
----   -------   ----------   ----------   --------   ----   ---------
0        ---        ---          ---          ---      ---       ---
1        ---        ---          ---          ---      ---       ---
2      LM-4      4303470363   4500006301      01      256       1.101
3        ---        ---          ---          ---      ---       ---
4        ---        ---          ---          ---      ---       ---
5        ---        ---          ---          ---      ---       ---
6        ---        ---          ---          ---      ---       ---
6        ---        ---          ---          ---      ---       ---
7      SRP-100   4304218323   4500006601      03      1024      1.103
7      SFM-100   4304218323   4500006601      03      ---       1.103
8      SFM-100   4304206756   4500006701      04      ---       1.104
9      SFM-100   4304206762   4500006701      04      ---       1.104
10     SFM-100   4304206737   4500006701      04      ---       1.104
11       ---        ---          ---          ---      ---       ---
12       ---        ---          ---          ---      ---       ---
13       ---        ---          ---          ---      ---       ---
14       ---        ---          ---          ---      ---       ---
15       ---        ---          ---          ---      ---       ---
16       ---        ---          ---          ---      ---       ---

                            Adapters
                            --------
                                                          number
                                                            of
                  serial      assembly    assembly        MAC
slot    type       number      number       rev.       addresses
----   --------   ----------   ----------   --------   ---------
0/0      ---        ---          ---          ---        ---
0/1      ---        ---          ---          ---        ---
1/0      ---        ---          ---          ---        ---
1/1      ---        ---          ---          ---        ---
2/0    GE-4 IOA   4304020462   4500006800      11         4
2/1      ---        ---          ---          ---        ---
3/0      ---        ---          ---          ---        ---
3/1      ---        ---          ---          ---        ---
4/0      ---        ---          ---          ---        ---
```

```
4/1      ---          ---           ---          ---          ---
5/0      ---          ---           ---          ---          ---
5/1      ---          ---           ---          ---          ---
7/0    SRP IOA    4303470366    4500006500       02           2
11/0     ---          ---           ---          ---          ---
11/1     ---          ---           ---          ---          ---
12/0     ---          ---           ---          ---          ---
12/1     ---          ---           ---          ---          ---
13/0     ---          ---           ---          ---          ---
13/1     ---          ---           ---          ---          ---
14/0     ---          ---           ---          ---          ---
14/1     ---          ---           ---          ---          ---
15/0     ---          ---           ---          ---          ---
15/1     ---          ---           ---          ---          ---
16/0     ---          ---           ---          ---          ---
16/1     ---          ---           ---          ---          ---
            base        Major/Minor
slot    MAC address         rev
----   --------------   -----------
0/0         ---             ---
0/1         ---             ---
1/0         ---             ---
1/1         ---             ---
2/0    0090.1a00.17ec      1.111
2/1         ---             ---
3/0         ---             ---
3/1         ---             ---
4/0         ---             ---
4/1         ---             ---
5/0         ---             ---
5/1         ---             ---
7/0    0090.1a00.17ae      1.102
11/0        ---             ---
11/1        ---             ---
12/0        ---             ---
12/1        ---             ---
13/0        ---             ---
13/1        ---             ---
14/0        ---             ---
14/1        ---             ---
15/0        ---             ---
15/1        ---             ---
16/0        ---             ---
16/1        ---             ---

                              Fan(s)
                              ------
                      serial      assembly    assembly   Major/Minor
Tray      type        number       number       rev.         rev
----   -----------   ----------   ----------   --------   -----------
0      Primary FAN   4303370009   4400007000      01         1.101
---        ---          ---          ---         ---          ---
```

- Example 3—Displays the status of hardware on the E120 router

```
host1#show hardware
                          Chassis
                          -------
            serial      assembly    assembly   Major/Minor
 type       number       number       rev.         rev
-------   ----------   ----------   --------   -----------
Chassis   4307018011   4580002602      01         0.101
```

```
                                Modules
                                -------
                   serial       assembly    assembly   ram    Major/Minor
slot    type       number       number      rev.       (MB)       rev
----    -------    ----------   ----------  --------   ----   -----------
0         ---        ---          ---         ---       ---        ---
1       LM-10      4306493492   4500009501    08       1024       1.108
2       LM-10      4306493502   4500009501    08       1024       1.108
3         ---        ---          ---         ---       ---        ---
4         ---        ---          ---         ---       ---        ---
5         ---        ---          ---         ---       ---        ---
6       SRP-120    4306483377   4501008401    02       4096       1.102
6       SFM-120    4306483377   4501008401    02       ---        1.102
7       SRP-120    4306483378   4501008401    02       4096       1.102
7       SFM-120    4306483378   4501008401    02       ---        1.102
8       SFM-120    4306493692   4501008501    02       ---        1.102
9       SFM-120    4306493725   4501008501    02       ---        1.102
10      SFM-120    4306493734   4501008501    02       ---        1.102

                              Adapters
                              --------
                                                                  number
                                                                    of
                   serial       assembly    assembly              MAC
slot    type       number       number      rev.                addresses
----    --------   ----------   ----------  --------            ---------
0/0       ---        ---          ---         ---                 ---
0/1       ---        ---          ---         ---                 ---
1/0       ---        ---          ---         ---                 ---
1/1     GE-8 IOA   4306472048   4500009102    A04                  8
2/0       ---        ---          ---         ---                 ---
2/1     GE-8 IOA   4306362247   4500009102    A03                  8
3/0       ---        ---          ---         ---                 ---
3/1       ---        ---          ---         ---                 ---
4/0       ---        ---          ---         ---                 ---
4/1       ---        ---          ---         ---                 ---
5/0       ---        ---          ---         ---                 ---
5/1       ---        ---          ---         ---                 ---
6/0     SRP IOA    4306483232   4501006502    A00                  2
          base          Major/Minor
slot    MAC address         rev
----    --------------   -----------
0/0         ---              ---
0/1         ---              ---
1/0         ---              ---
1/1     0090.1a42.7327       2.4
2/0         ---              ---
2/1     0090.1a42.5223       2.3
3/0         ---              ---
3/1         ---              ---
4/0         ---              ---
4/1         ---              ---
5/0         ---              ---
5/1         ---              ---
6/0     0090.1a42.76c4       2.0

                                Fan(s)
                                ------
                     serial      assembly    assembly   Major/Minor
Tray      type       number      number      rev.          rev
----    -----------  ----------  ----------  --------   -----------
0       Primary FAN  4306505285  4400010001    01         1.101
```

show utilization

- Use to display information about the resources that modules consume.
- When you issue this command, the router releases available memory on the SRP module immediately; however, the display appears a few seconds later.
- To display detailed information about the average CPU utilization percentage calculated over 5-second, 1-minute, and 5-minute intervals for each module installed in the router, use the **detail** keyword.
- Field descriptions
  - slot—Slot in which the module resides
  - type—Type of module
  - heap (%)—Percentage of the RAM that is currently in use by software running on the module
  - cpu (%)—Percentage of the module CPU capacity currently used; this field appears only when the **detail** keyword is omitted
  - bw exceed—Status of bandwidth oversubscription for this slot; this field appears only when bandwidth oversubscription is configured
    - Y indicates that this slot is in an oversubscribed slot group
    - --- indicates that no module is installed or slot has no bandwidth oversubscription
  - The following additional fields appear when the **detail** keyword is used:
    - last available cpu (%)—Average CPU utilization percentage for each installed module during the last 5-second interval for which data was available. If the current CPU utilization data for a module is *not* available at any point, the last available cpu (%) field displays the last available 5-second CPU utilization percentage, which is the same value that appears in the cpu (%) field when the **detail** keyword is omitted. If the current 5-second CPU utilization data is available, the last available cpu (%) field and the 5 sec cpu (%) field display the same value.
    - 5 sec cpu (%)—Average CPU utilization percentage for each installed module during the most recent 5-second interval
    - 1 min cpu (%)—Average CPU utilization percentage for each installed module during the most recent 1-minute interval
    - 5 min cpu (%)—Average CPU utilization percentage for each installed module during the most recent 5-minute interval
  - Depending on the output of the **show utilization** command when you use the **detail** keyword, some or all of the following symbols and explanatory notes might appear:
    - --- indicates an empty slot on ERX-7xx models, ERX-14xx models, or the ERX-310 router. For the E120 and E320 routers, this symbol indicates either an empty slot, or a fabric slice that resides on an SRP module or on a switch fabric module (SFM).
    - ??? indicates that the current CPU utilization data is unavailable for the specified interval. Data might be unavailable for one or more of the following reasons:

- A slot is in an inactive state.
- A line module is very busy (that is, using 100 percent of its CPU capacity) and is unable to send its CPU utilization data to the SRP module.
- A line module is experiencing communication problems that prevent it from sending its CPU utilization data to the SRP module.

- *** indicates that a module installed in the slot is running an incompatible version of JUNOSe software.

- Example 1—Displays basic information about the resources consumed on the router

```
host1#show utilization
Please wait....
        System Resource Utilization
        ---------------------------
                       heap   cpu     bw
slot       type        (%)    (%)   exceed
----   ------------   ----   ---   ------
0          ---         ---    ---    ---
1      OC12Atm(P2)      59     44      Y
2      OC3/OC12-ATM     67     53      Y
3          ---         ---    ---    ---
4          ---         ---    ---    ---
5      OC3d             79      0     ---
6      SRP-10G          27      1     ---
7          ---         ---    ---    ---
8          ---         ---    ---    ---
9          ---         ---    ---    ---
10         ---         ---    ---    ---
11         ---         ---    ---    ---
12         ---         ---    ---    ---
13         ---         ---    ---    ---
```

- Example 2—Displays detailed information about the average CPU utilization percentage calculated over 5-second, 1-minute, and 5-minute intervals for each module installed in an ERX-7xx model, ERX-14xx model, or ERX-310 router

  In this example, slot 12 is empty (as indicated by the --- symbol), the CPU utilization for the FE-8 module installed in slot 10 is unavailable (as indicated by the ??? symbol), and the SRP module installed in slot 7 is running an incompatible version of JUNOSe software (as indicated by the *** symbol).

```
host1#show utilization detail
Please wait...
                  System Resource Utilization
                  ---------------------------
                                                  5      1      5
                          last                   sec    min    min
                  heap  available     bw        cpu    cpu    cpu
slot      type    (%)    cpu (%)   exceed     (%)    (%)    (%)
----   ----------  ----  ---------  ------    ---    ---    ---
0      OC3-4A       63      76        ---      76     70     71
1      COC3/COC12   11       2        ---       2      4      3
2      COC3-4       39      11        ---      11     17     20
3      OC3-4A       58      61        ---     ???    ???     68
4      OC3-4A       88     100        ---     100     96     92
5      OC3-4A       94     100        ---     100     93     87
```

```
6       SRP-40G+       11       84          ---      84      85     73
7       SRP-40G+       18       29          ---     ***     ***    ***
8       OC3-4P         25       20          ---      20      17     22
9       FE-8           61       48          ---      48      53     47
10      FE-8          ???      ???          ---     ???     ???    ???
11      CT3-12         11        2          ---       2       4     10
12        ---         ---      ---          ---     ---     ---    ---
13      CT3-12         32       16          ---      16      12     16

Note: '---' indicates empty slots.
      '???' indicates data not available.
      '***' indicates board running incompatible version of software.
```

- Example 3—Displays detailed information about the average CPU utilization percentage calculated over 5-second, 1-minute, and 5-minute intervals for each module installed in an E320 router.

  In this example, slots 3, 5, 12, 14, and 16 are empty (as indicated by the *---* symbol), fabric slices are present on the SFM-100 modules in slots 8, 9, and 10 (also indicated by the *---* symbol), the CPU utilization for the LM-4 module installed in slot 1 is unavailable (as indicated by the ??? symbol), and the SRP-100 module installed in slot 7 is running an incompatible version of JUNOSe software (as indicated by the *** symbol).

```
host1#show utilization detail
Please wait...
                  System Resource Utilization
                  ---------------------------

                                                          5      1      5
                                 last                   sec    min    min
                    heap      available      bw         cpu    cpu    cpu
slot      type      (%)        cpu (%)     exceed      (%)    (%)    (%)
----   ----------   ----      ---------    ------      ---    ---    ---
0       LM-4         9          1           ---        1      1      1
1       LM-4        ???        ???          ---       ???    ???    ???
2       LM-4         23         3           ---       ???     4      8
3         ---       ---        ---          ---       ---    ---    ---
4       LM-4         60         1           ---        1      1      1
5         ---       ---        ---          ---       ---    ---    ---
6       SRP-100      15         3           ---        3      2      3
7       SRP-100      10         1           ---       ***    ***    ***
8       SFM-100     ---        ---          ---       ---    ---    ---
9       SFM-100     ---        ---          ---       ---    ---    ---
10      SFM-100     ---        ---          ---       ---    ---    ---
11      LM-4         60         1           ---        1      1      1
12        ---       ---        ---          ---       ---    ---    ---
13      LM-4         68         3           ---        3      3      3
14        ---       ---        ---          ---       ---    ---    ---
15      LM-4         66         1           ---        1      1      1
16        ---       ---        ---          ---       ---    ---    ---
  Note: '---' indicates empty slots or fabric Slices.
        '???' indicates data not available.
        '***' indicates board running incompatible version of software.
```