

## Chapter 19

# Monitoring the Cooling System

You monitor and maintain the cooling system to keep an acceptable operating temperature for the router chassis and its components. (See Table 67.)

**Table 67: Checklist for Monitoring the Cooling System**

Monitor Cooling System Tasks	Command or Action
<b>Understanding the Cooling System on page 252</b>	
M5 and M10 Router Cooling Systems on page 253	
M7i Router Cooling System on page 253	
M10i Router Cooling System on page 254	
M20 Router Cooling System on page 255	
M40 Router Cooling System on page 256	
M40e and M160 Router Cooling Systems on page 259	
M320 Router Cooling System on page 261	
T320 Router and T640 Routing Node Cooling Systems on page 263	
<b>Checking the Cooling System Status on page 267</b>	show chassis environment
<b>Checking the Cooling System Alarms on page 269</b>	
1. Check the Alarm Indicators on the Craft Interface on page 270	show chassis craft-interface Check the router craft interface.
2. Display Current Cooling System Alarms on page 270	show chassis alarms
3. Display Cooling System Error Messages in the System Log File on page 271	show log messages   match fan
<b>Maintaining the Air Filter on page 272</b>	Inspect the air filter. If dirty, clean it; if damaged, replace it.
<b>Verifying a Fan Failure on page 272</b>	Perform a swap test on the fan. If defective, replace it without powering down the router.
<b>Verifying an Impeller Failure on page 273</b>	Feel the impeller air exhaust. If no airflow, replace without powering down the router.
<b>Replacing a Cooling System Component on page 273</b>	Follow the procedure in the appropriate router hardware guide.

## Understanding the Cooling System

**Purpose** Inspect the router cooling system to ensure that air is flowing through the router to cool the components installed in the router chassis. If the router temperature exceeds the critical level, the router automatically shuts down.

**What Is the Cooling System** The cooling system includes the fans and impellers that provide cooling in the router chassis to keep the components operating at an acceptable temperature.

Table 68 describes the cooling system components for each routing platform.

**Table 68: Router Cooling System Components Per Routing Platform**

Power Supply Characteristic	M5/ M10	M7i	M10i	M20	M40	M40e	M160	M320	T320	T640
Fan tray	1 with 4 fans	1 with 4 fans	2 with 8 fans each	3 front 1 rear		1	1 lower fan tray	2 front, 1 rear	2 front 1 rear	2 front 1 rear
Power supply integrated fan	—	—	—	2	2	—	Cooled by air flowing through the chassis	—	—	—
Impellers	—	—	—	—	2 pairs	1 central impeller  1 rear upper impeller  1 rear lower impeller	1 upper impeller  2 rear impellers	—	—	—
Fan assemblies	—	—	—	—	3	—	—	—	—	—
Air filter	—	—	—	—	1	1	1	1 front, 1 rear	1 front 1 rear	1 front 1 rear

The following sections describe the various routing platform cooling systems:

M5 and M10 Router Cooling Systems on page 253

M7i Router Cooling System on page 253

M10i Router Cooling System on page 254

M20 Router Cooling System on page 255

M40 Router Cooling System on page 256

M40e and M160 Router Cooling Systems on page 259

M320 Router Cooling System on page 261

T320 Router and T640 Routing Node Cooling Systems on page 263

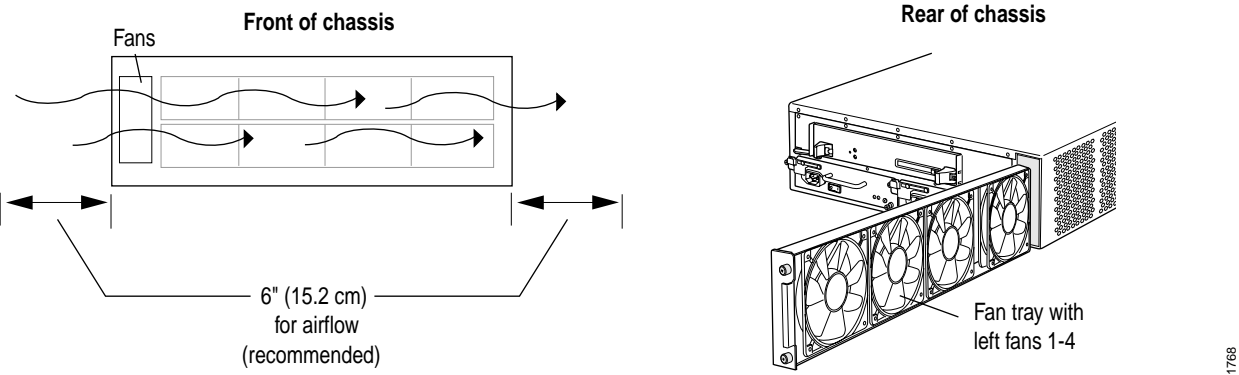
### M5 and M10 Router Cooling Systems

The M5 and M10 router houses four fans, which draw room air into the chassis to keep the internal temperature below a maximum acceptable level. The air flows side-to-side in the chassis (see Figure 105).



**CAUTION:** Do not remove the fan tray for more than one minute while the router is operating. The fans are the sole source of cooling, and the router can overheat when they are absent.

Figure 105: M5 and M10 Router Cooling System and Airflow

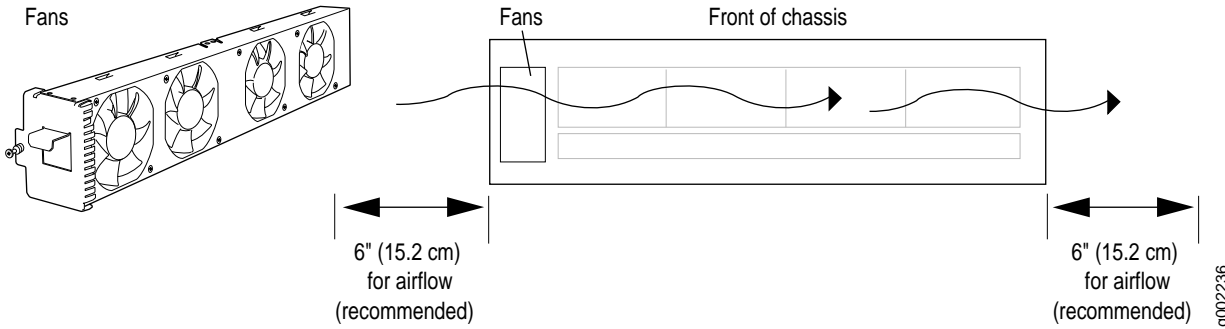


### M7i Router Cooling System

The M7i router cooling system consists of a fan tray, located along the left side of the chassis, that provides side-to-side cooling (see Figure 13). It connects directly to the router midplane. The fan tray is a single unit containing four individually fault-tolerant fans. If a single fan fails, the remaining fans continue to function indefinitely.

The cooling system draws in room air through the air intake vent on the left side of the chassis. After entering the chassis, the air stream separates into separate flows for the front and rear components (see Figure 106).

Figure 106: M7i Router Cooling System and Airflow

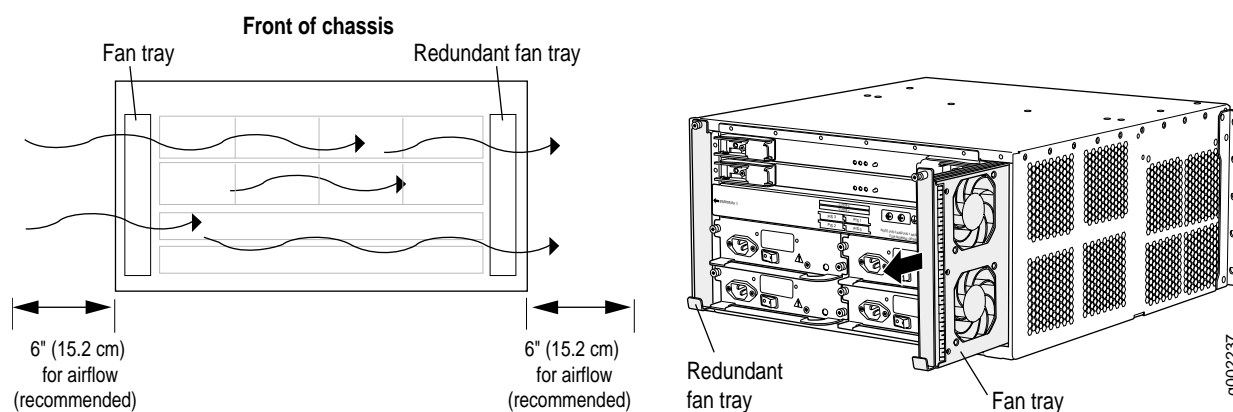


## M10i Router Cooling System

The M10i router cooling system consists of two fan trays, located along the left and right side of the chassis that provide side-to-side cooling. The fan trays house eight fans that draw room air into the chassis to maintain an acceptable operating temperature for the Routing Engine, Physical Interface Cards (PICs), Compact Forwarding Engine Board (CFEB), and other components. The fan trays connect directly to the router midplane. If a single fan fails, the remaining fans continue to function indefinitely (see Figure 107).

Figure 107: M10i Router Cooling System and Airflow

M10i



For proper airflow, the primary fan tray should be installed in slot 1 (the left slot looking at the chassis from the rear) and must be installed for proper cooling at all times. The redundant fan tray, if present, should be installed in slot 0 on the right. This fan tray provides additional cooling and redundancy.

## M20 Router Cooling System

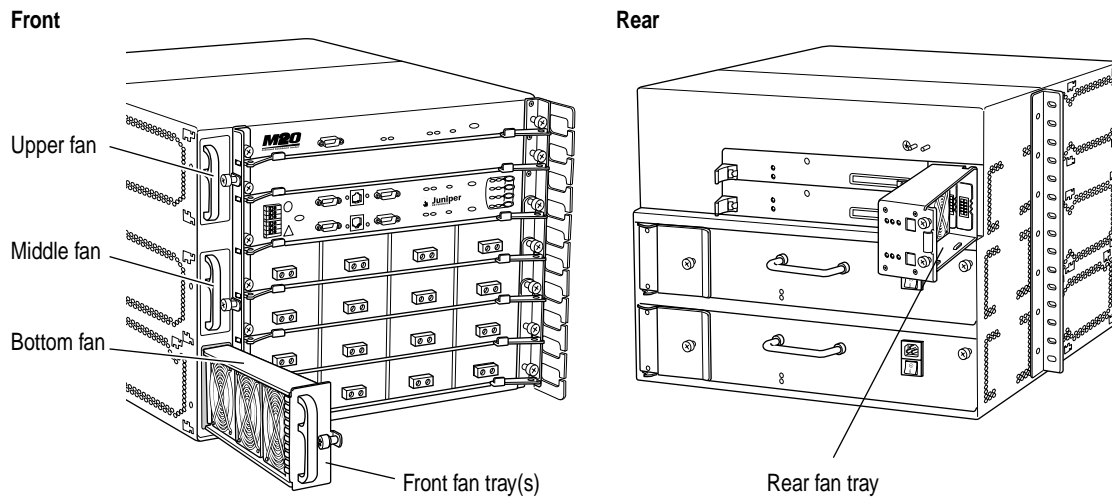
The M20 router cooling system consists of the following components (see Figure 109):

Three front fan trays—Cool the Flexible PIC Concentrators (FPCs) and the System and Switch Boards (SSBs). The fan trays are located on the left front side of the chassis. Each tray houses three fans.

Routing Engine fan tray—Cools the Routing Engines. The fan tray is located behind the Routing Engine panel. It houses two fans.

Power supply integrated fan—Cools each power supply. It is built into the supply.

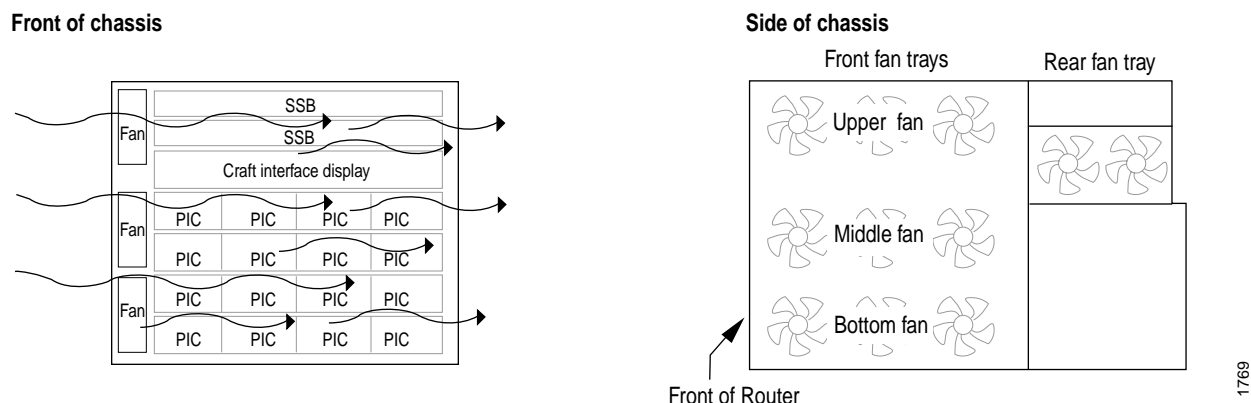
Figure 108: M20 Router Cooling System Components



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The cooling system includes several fan trays that draw room air into the chassis to keep its internal temperature below a maximum acceptable level. The cooling subsystems have redundant components, which are controlled by the SSB. If a fan fails, the remaining fans provide sufficient cooling for the unit indefinitely (see Figure 109).

**Figure 109: M20 Router Cooling System and Airflow**



## M40 Router Cooling System

The M40 router cooling system consists of the following components:

**Air intake vent and air filter** (see Figure 111 on page 257)—Provide an opening for room air to enter the router. They are located at the bottom of the chassis front, below the craft interface. The air filter prevents dust and other particles from entering the cooling system. For replacement instructions, see the M40 router hardware guide.



**CAUTION:** Do not remove the air filter for more than a minute while the router is operating. The fans and impellers are powerful enough to draw in foreign material, such as bits of wire, through the unfiltered air intake, which could damage router components.

**Upper and lower impeller assemblies** (see Figure 110 on page 257)—Cool the Packet Forwarding Engine components (backplane, SCB, FPCs, and PICs). The lower impeller assembly is located behind the craft interface at the front the chassis, and the upper assembly is located above the fan tray at the rear of the chassis. Each assembly houses two impellers for redundancy. The assemblies are not interchangeable. For replacement instructions, see the M40 router hardware guide.

**Fan tray** (see Figure 111 on page 257)—Cools the Routing Engine and backplane. The tray houses three fans for redundancy and is located above the Routing Engine at the upper rear of the chassis. For replacement instructions, see “Maintain and Replace the Fan Tray” on page 155.

**Power supply integrated fan**—Cools the power supply. It is not field-replaceable.

Figure 110 shows the M40 router cooling system impeller trays.

**Figure 110: M40 Router Impeller Trays**

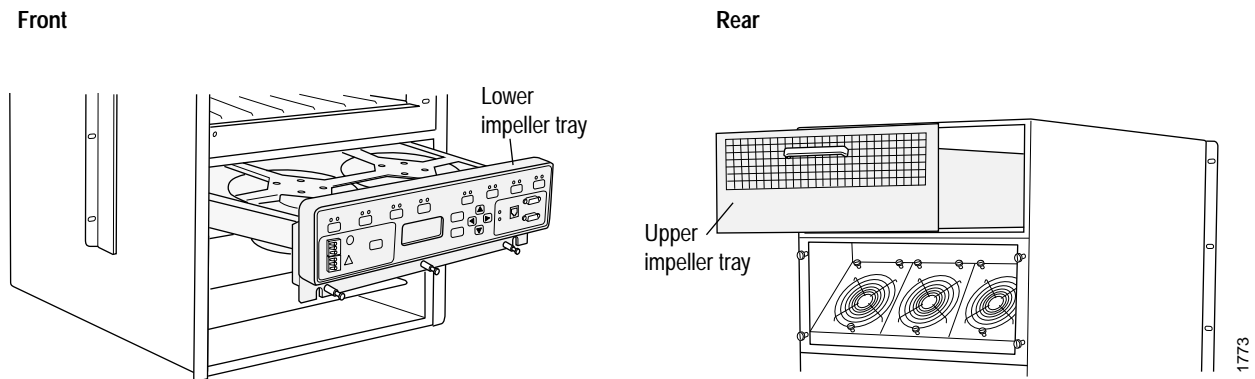
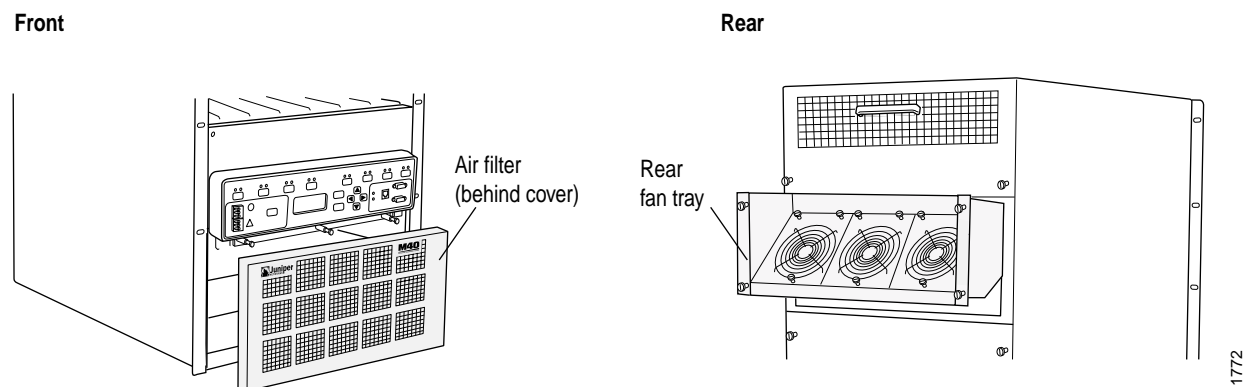


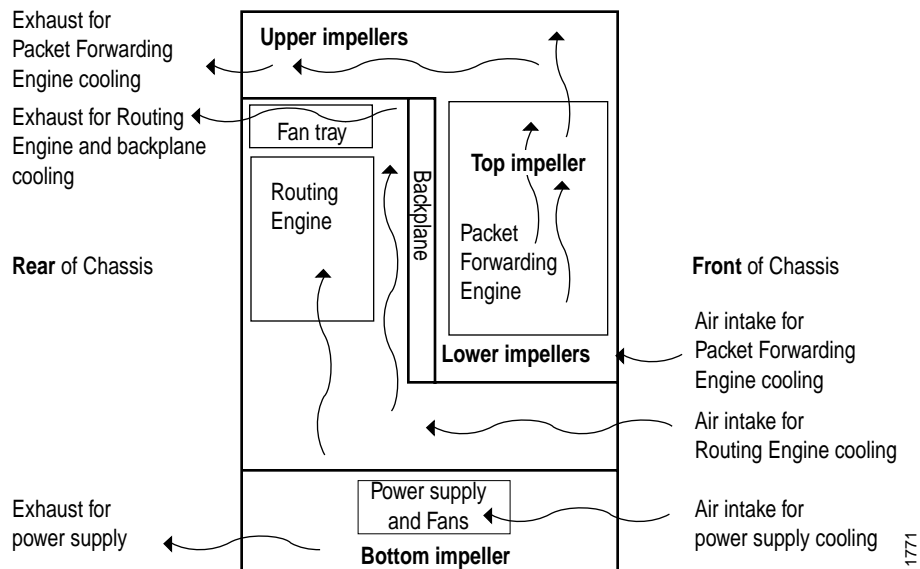
Figure 111 shows the M40 router air filter and fan tray.

**Figure 111: M40 Router Air Filter and Fan Tray**



The M40 router cooling system consists of separate subsystems (sets of fans and impellers) that draw room air into the chassis to keep its internal temperature below a maximum acceptable level. After entering the chassis, the air stream separates into separate flows for the front and rear subsystems, and the temperature of each flow is monitored independently. Figure 112 shows the M40 router cooling system airflow.

**Figure 112: M40 Router Cooling System and Airflow**





## ***M40e and M160 Router Cooling Systems***

The M40e and M160 router cooling system has the following components:

Air intake vent, air filter, and intake cover—Provide an opening for room air to enter the router. They are located at the bottom of the chassis front, below the cable management system, as shown in Figure 113 on page 260. The air filter is removable and covers the air intake vent, preventing dust and other particles from entering the cooling system. For maintenance and replacement instructions, see the M40e or M160 router hardware guide. The nonremovable air intake cover is located behind the air filter and provides EMC shielding.



**CAUTION:** Do not remove the air filter for more than a few minutes while the router is operating. The fans and impellers are powerful enough to draw in foreign material, such as bits of wire, through the unfiltered air intake, which could damage router components.

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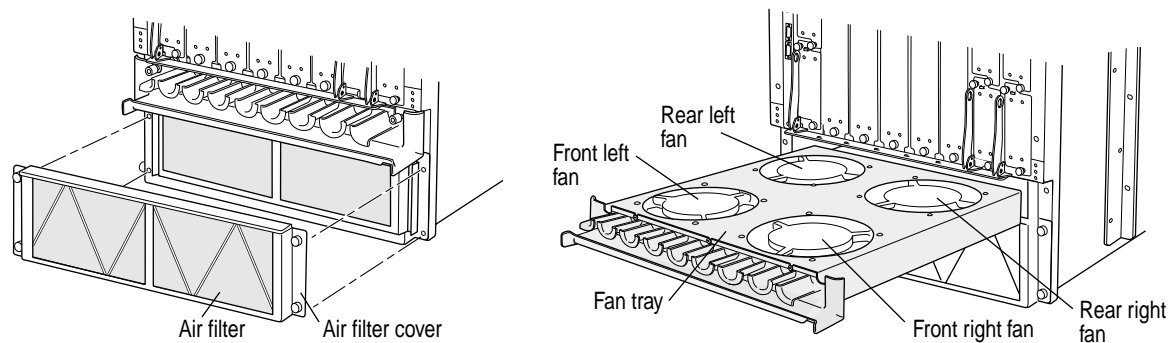
Front cooling subsystem—Cools the FPCs, PICs, and midplane. It includes a fan tray located behind the cable management system and a large, central impeller behind the craft interface. For replacement instructions, see the M40e or M160 router hardware guide.

Rear cooling subsystem—Cools the Switching and Forwarding Modules (SFMs), host module, Packet Forwarding Engine Clock Generator (PCGs), and power supplies. It includes one impeller located at the upper right of the chassis rear and another at the lower left. The upper and lower impellers are not interchangeable. For replacement instructions, see the M40e or M160 router hardware guide.

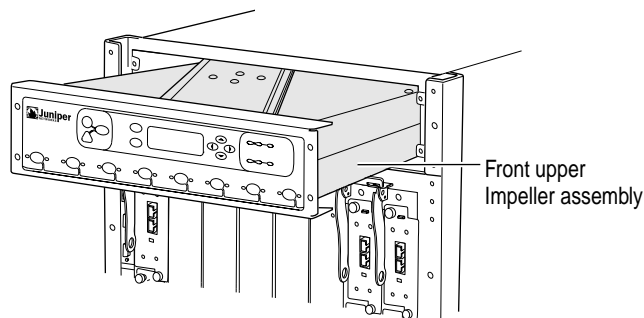
Figure 113 shows the M40e and M160 router cooling system components.

Figure 113: M40e and M160 Router Cooling System Components

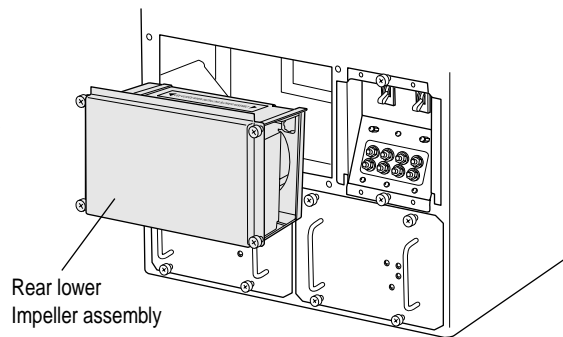
M40e and M160 router front



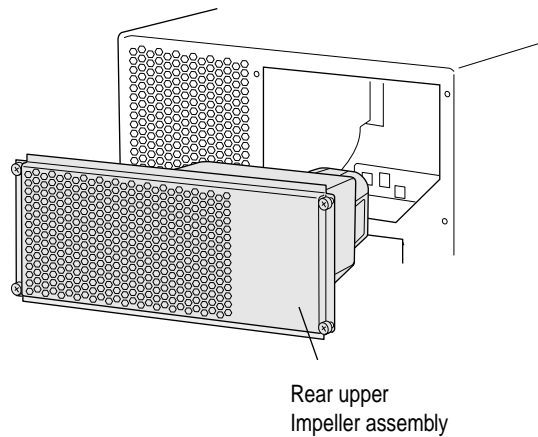
M40e and M160 router front



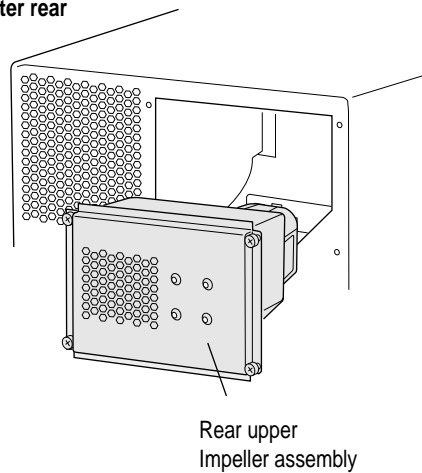
M40e and M160 router rear



M40e router rear



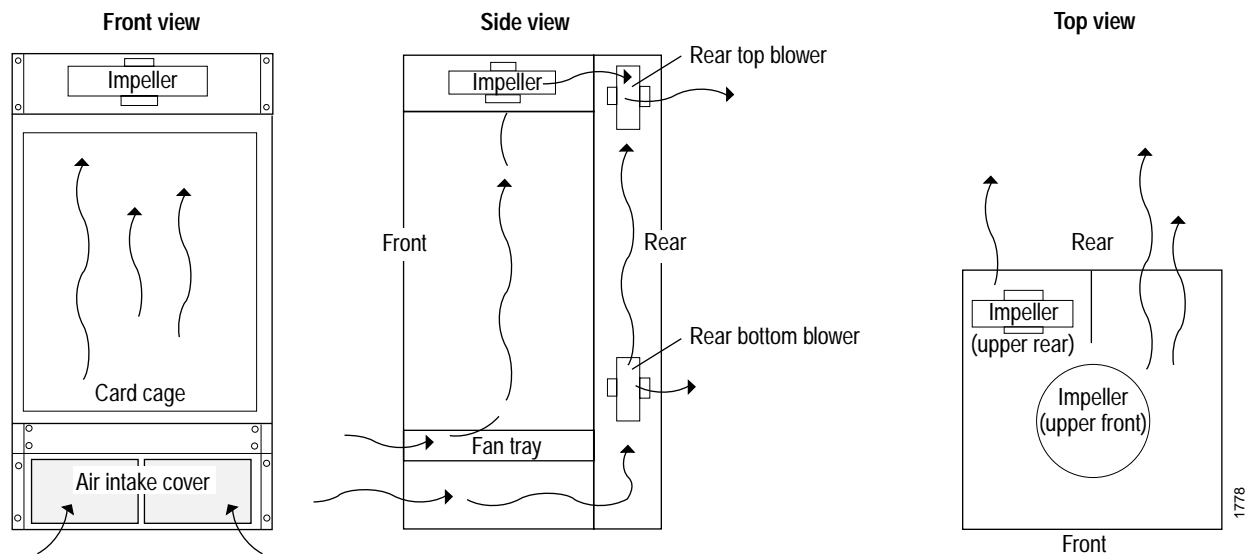
M160 router rear



The cooling system draws in room air through the air intake vent located at the front of the chassis below the cable management system. After entering the chassis, the air stream separates into separate flows for the front and rear subsystems, and the Miscellaneous Control Subsystem (MCS) monitors the temperature of each flow independently.

Figure 114 shows the M40e and M160 router cooling system components and airflow.

**Figure 114: M40e and M160 Router Cooling System and Airflow**



### **M320 Router Cooling System**

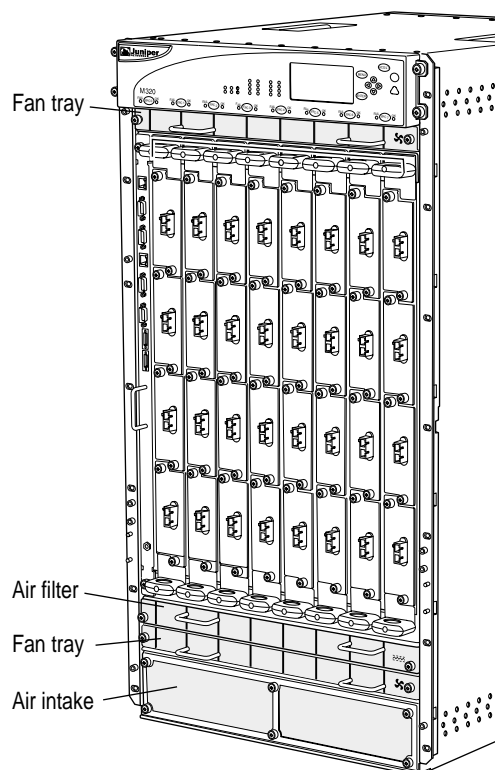
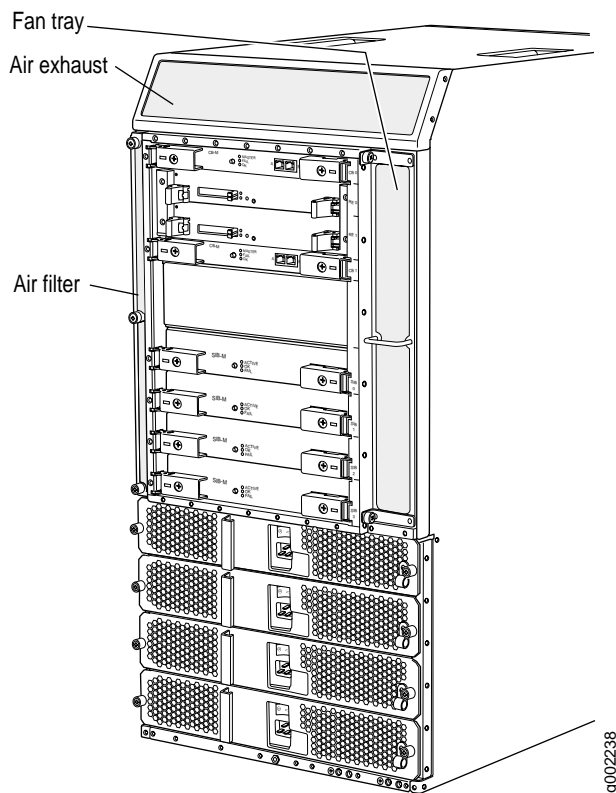
The M320 cooling system consists of the following components (see Figure 115 on page 262):

**Two front fan trays**—The front fan trays each contain four fans and are interchangeable. The front fan trays cool the components installed in the FPC card cage (the FPCs, PICs, Connector Interface Panel [CIP], and midplane).

**Rear fan tray**—The rear fan tray contains seven fans and is not interchangeable with the front trays. The rear fan tray cools the components installed in the rear card cage (the Routing Engines, Control Boards, and the Switch Interface Boards [SIBs]).

**Front and rear air filter**—Air filters for both the front and rear fan trays help keep dust and other particles from entering the cooling system.

**Power supply fans**—Each power supply has two fans that cool that power supply.

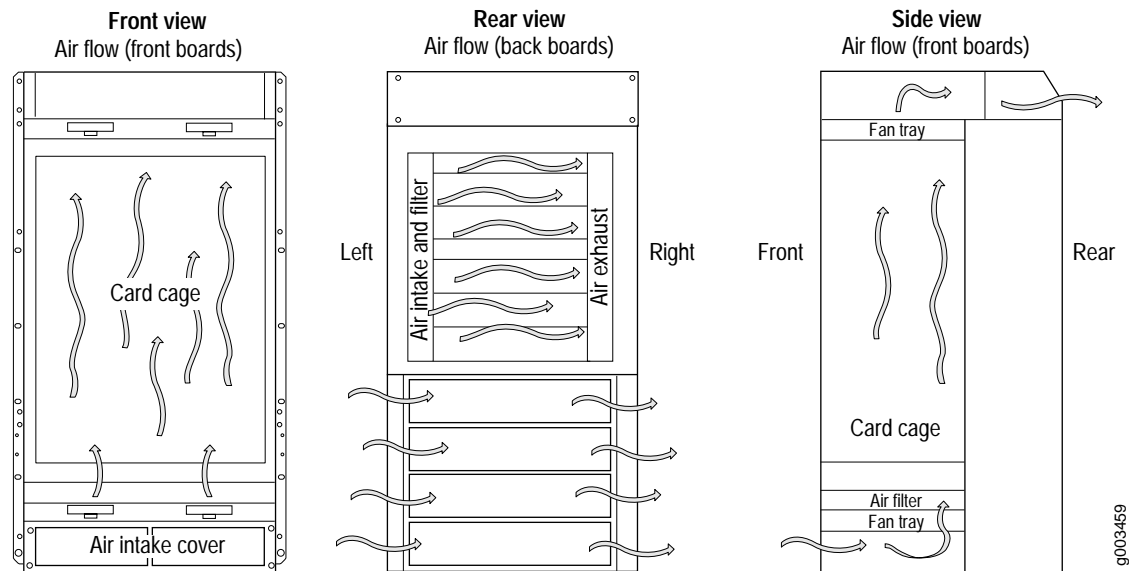
**Figure 115: M320 Router Cooling System and Airflow****M320 router front****M320 router rear**

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The host subsystem monitors the temperature of the router components. When the router is operating normally, the fans function at lower than full speed. If a fan fails or the ambient temperature rises above a threshold, the speed of the remaining fans is automatically adjusted to keep the temperature within the acceptable range. If the ambient maximum temperature specification is exceeded and the system cannot be adequately cooled, the Routing Engine shuts down some or all of the hardware components.

Figure 116 shows the M320 router airflow.

**Figure 116: M320 Router Cooling System and Airflow**



### ***T320 Router and T640 Routing Node Cooling Systems***

The T320 cooling system consists of the following components:

**Two front fan trays**—The front fan trays each contain six fans and are interchangeable. The fan trays in the front of the chassis, each with six fans, cool the components installed in the FPC card cage (the FPCs, PICs, CIP, and midplane).

**Rear fan tray**—The rear fan tray contains five fans and is not interchangeable with the front trays. It cools the components installed in the rear card cage (the Routing Engines, Control Boards, PCGs, and SIBs).

**Front and rear air filter**—Air filters for both the front and rear fan trays help keep dust and other particles from entering the cooling system.

**Power supply fans**—The power supplies each have a fan that cools that power supply.

During normal operation, the fans in each fan tray function at less than full capacity. Temperature sensors on the midplane and the host subsystem control the speed of the fans. A fan failure triggers the red alarm LED on the craft interface. If the temperature passes a certain threshold, the JUNOS software turns off the power supplies.

Figure 117 shows the T320 router cooling system components.

**Figure 117: T320 Router Cooling System Components**

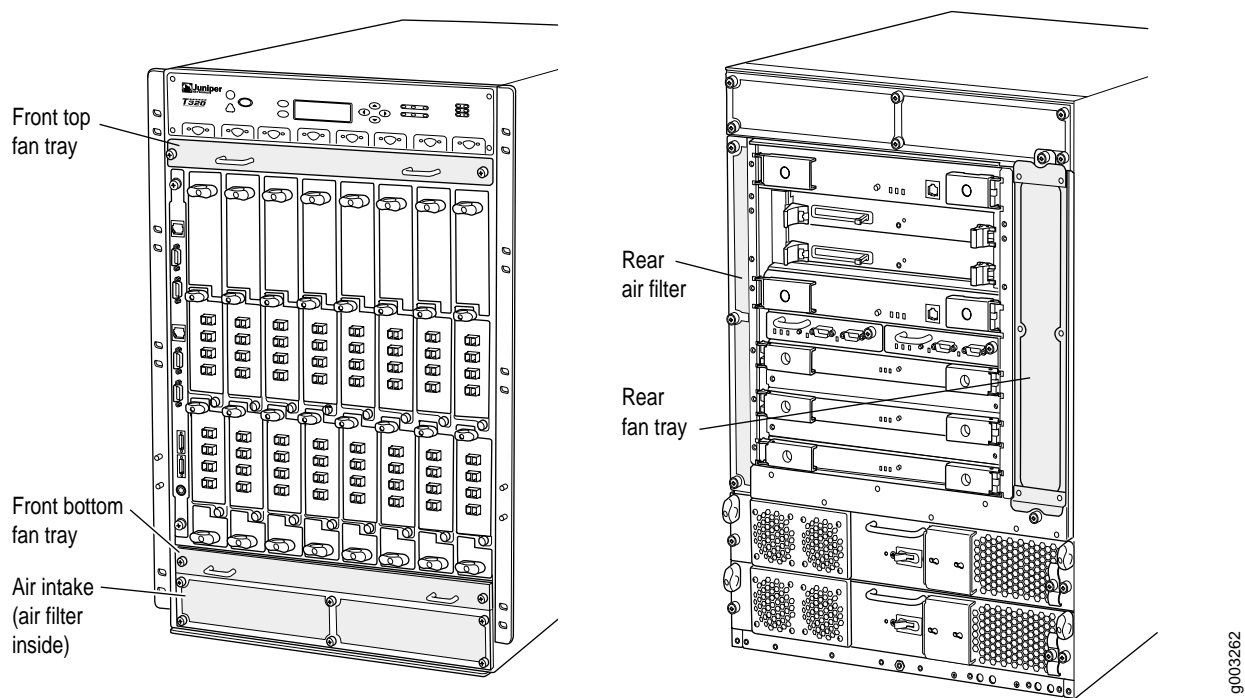


Figure 118 shows the T320 router airflow.

**Figure 118: T320 Router Cooling System and Airflow**

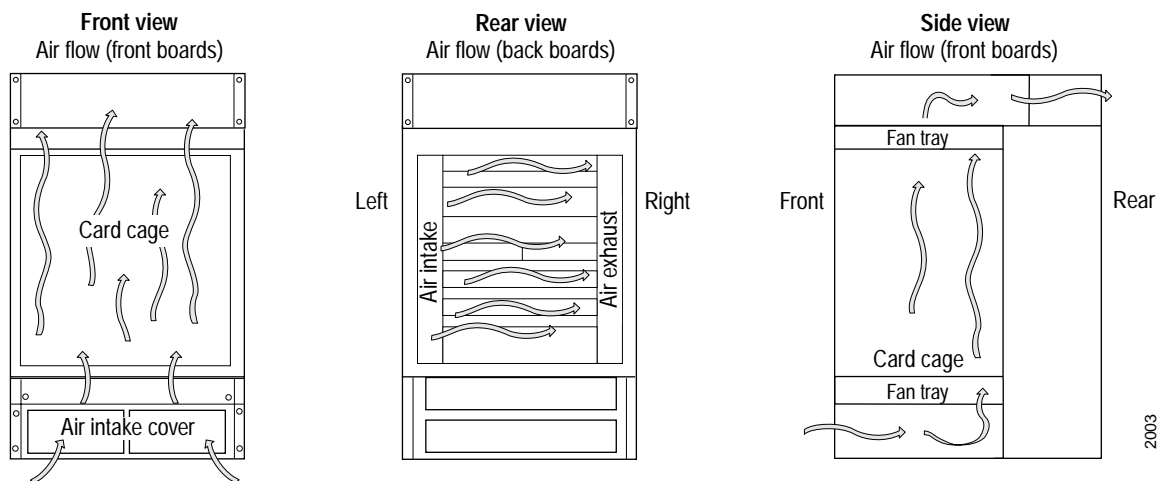


Figure 119 shows the T640 routing node airflow.

Figure 119: T640 Routing Node Cooling System and Airflow

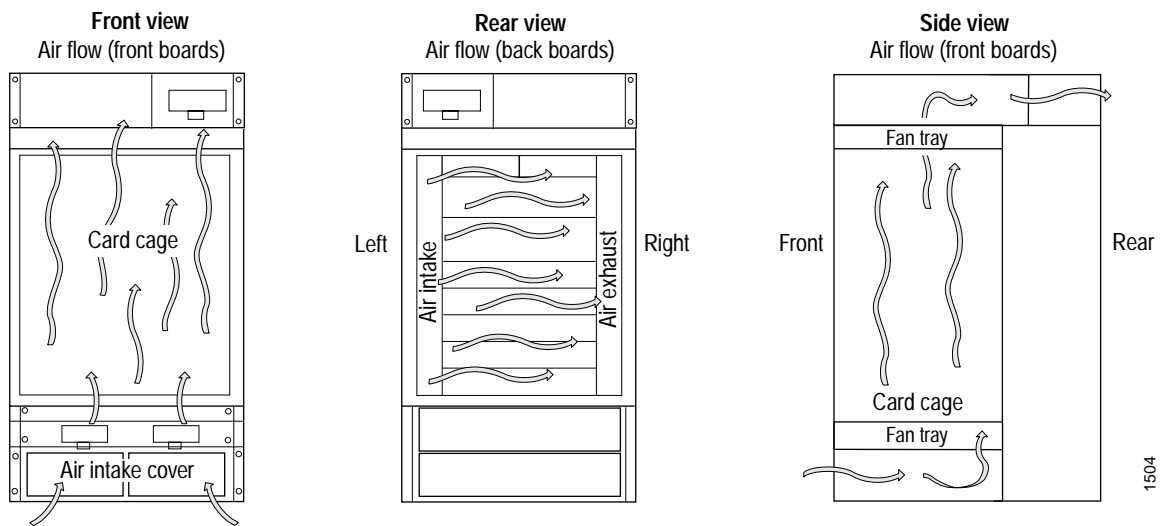
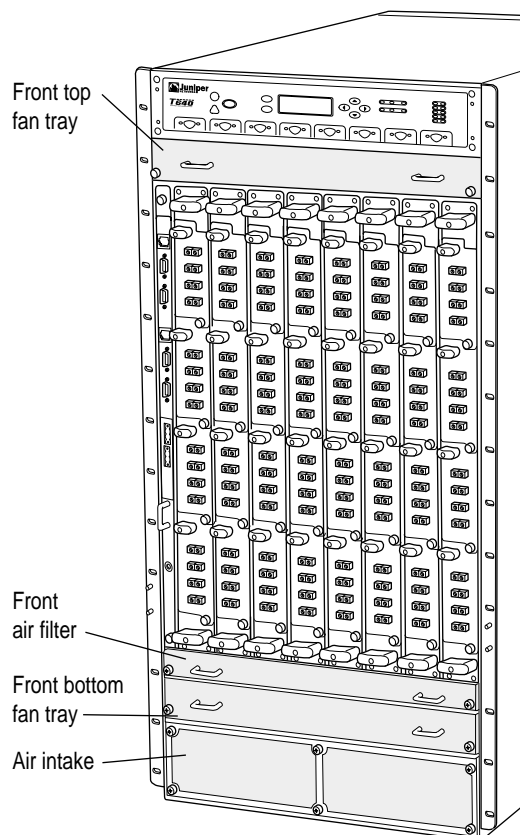


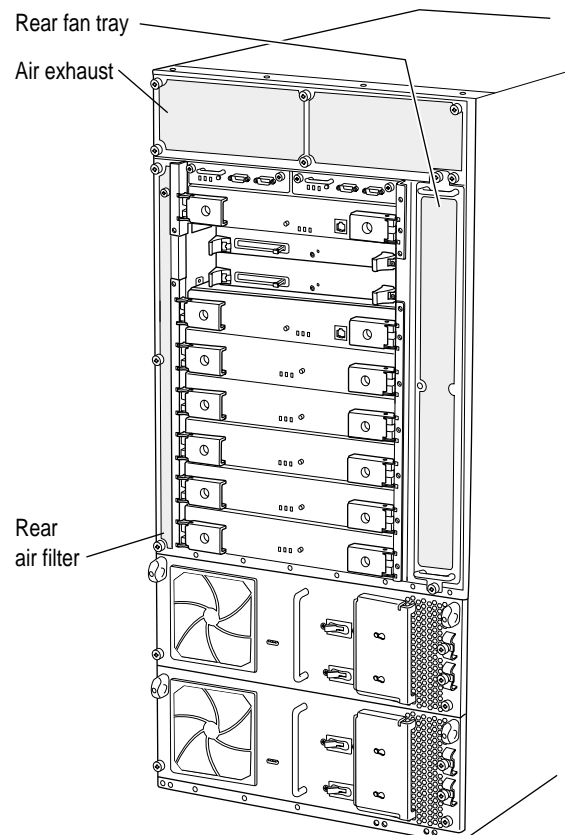
Figure 120 shows the T640 routing node cooling system components.

**Figure 120: T640 Routing Node Cooling System Components**

**T640 front**



**T640 rear**



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**See Also** “Monitoring Power Supplies” on page 217



## Checking the Cooling System Status

For the cooling system to operate properly, the clearance around the chassis must be sufficient for unobstructed airflow. For clearance and maintenance requirements, see the appropriate router hardware guide.

**Action** To check the cooling system status, use the following JUNOS command-line interface (CLI) operational mode command:

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

**Sample Output** For M5 and M10 routers (see also Figure 105 on page 253):

```
user@host> show chassis environment
Class Item      Status  Measurement
[...Output truncated...]
Fans  Left Fan 1   OK      Spinning at normal speed
      Left Fan 2   OK      Spinning at normal speed
      Left Fan 3   OK      Spinning at normal speed
      Left Fan 4   OK      Spinning at normal speed
Misc  Craft Interface OK
```

For M7i routers (see also Figure 106 on page 253):

```
user@host> show chassis environment
Class Item      Status  Measurement
[...Output truncated...]
Fans  Fan 1        OK      Spinning at normal speed
      Fan 2        OK      Spinning at normal speed
      Fan 3        OK      Spinning at normal speed
      Fan 4        OK      Spinning at normal speed
```

For M10i routers (see also Figure 107 on page 254):

```
user@host> show chassis environment
Class Item      Status  Measurement
[...Output truncated...]
Fans  Fan Tray 0 Fan 1 OK      Spinning at normal speed
      Fan Tray 0 Fan 2 OK      Spinning at normal speed
      Fan Tray 0 Fan 3 OK      Spinning at normal speed
      Fan Tray 0 Fan 4 OK      Spinning at normal speed
      Fan Tray 0 Fan 5 OK      Spinning at normal speed
      Fan Tray 0 Fan 6 OK      Spinning at normal speed
      Fan Tray 0 Fan 7 OK      Spinning at normal speed
      Fan Tray 0 Fan 8 OK      Spinning at normal speed
      Fan Tray 1 Fan 1 OK      Spinning at normal speed
      Fan Tray 1 Fan 2 OK      Spinning at normal speed
      Fan Tray 1 Fan 3 OK      Spinning at normal speed
      Fan Tray 1 Fan 4 OK      Spinning at normal speed
      Fan Tray 1 Fan 5 OK      Spinning at normal speed
      Fan Tray 1 Fan 6 OK      Spinning at normal speed
      Fan Tray 1 Fan 7 OK      Spinning at normal speed
      Fan Tray 1 Fan 8 OK      Spinning at normal speed
```

For an M20 router (see also Figure 109 on page 256):

```
user@host> show chassis environment
Class Item           Status  Measurement
[...Output truncated...]
Fans  Rear Fan        OK      Spinning at normal speed
      Front Upper Fan  OK      Spinning at normal speed
      Front Middle Fan OK      Spinning at normal speed
      Front Bottom Fan OK      Spinning at normal speed
Misc  Craft Interface OK
```

For an M40 router (see also Figure 112 on page 258):

```
user@host> show chassis environment
Class Item           Status  Measurement
[...Output truncated...]
Fans  Top Impeller     OK      Spinning at normal speed
      Bottom impeller  OK      Spinning at normal speed
      Rear Left Fan    OK      Spinning at normal speed
      Rear Center Fan  OK      Spinning at normal speed
      Rear Right Fan   OK      Spinning at normal speed
Misc  Craft Interface  OK
```

For M40e and M160 routers (see also Figure 114 on page 261):

```
user@host> show chassis environment
Class Item           Status  Measurement
[...Output truncated...]
Fans  Rear Bottom Blower OK      Spinning at normal speed
      Rear Top Blower  OK      Spinning at normal speed
      Front Top Blower  OK      Spinning at normal speed
      Fan Tray Rear Left OK      Spinning at normal speed
      Fan Tray Rear Right OK     Spinning at normal speed
      Fan Tray Front Left OK     Spinning at normal speed
      Fan Tray Front Right OK    Spinning at normal speed
Misc  CIP              OK
```

For M320 routers (see also Figure 116 on page 263):

```
user@host> show chassis environment
Class Item           Status  Measurement
Fan  Top Left Front fan OK      Spinning at normal speed
      Top Right Rear fan OK     Spinning at normal speed
      Top Right Front fan OK    Spinning at normal speed
      Top Left Rear fan  OK     Spinning at normal speed
      Bottom Left Front fan OK   Spinning at normal speed
      Bottom Right Rear fan OK   Spinning at normal speed
      Bottom Right Front fan OK   Spinning at normal speed
      Bottom Left Rear fan OK    Spinning at normal speed
      Rear Fan 1 (TOP)  OK     Spinning at normal speed
      Rear Fan 2        OK     Spinning at normal speed
      Rear Fan 3        OK     Spinning at normal speed
      Rear Fan 4        OK     Spinning at normal speed
      Rear Fan 5        OK     Spinning at normal speed
      Rear Fan 6        OK     Spinning at normal speed
      Rear Fan 7 (Bottom) OK    Spinning at normal speed
```

For T320 routers and T640 routing nodes (see also Figure 118 on page 264, Figure 117 on page 264, Figure 119 on page 265, and Figure 120 on page 266):

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

Class	Item	Status	Measurement
Fans	Top Left Front fan	OK	Spinning at normal speed
	Top Left Middle fan	OK	Spinning at normal speed
	Top Left Rear fan	OK	Spinning at normal speed
	Top Right Front fan	OK	Spinning at normal speed
	Top Right Middle fan	OK	Spinning at normal speed
	Top Right Rear fan	OK	Spinning at normal speed
	Bottom Left Front fan	OK	Spinning at normal speed
	Bottom Left Middle fan	OK	Spinning at normal speed
	Bottom Left Rear fan	OK	Spinning at normal speed
	Bottom Right Front fan	OK	Spinning at normal speed
	Bottom Right Middle fan	OK	Spinning at normal speed
	Bottom Right Rear fan	OK	Spinning at normal speed
	Fourth Blower from top	OK	Spinning at normal speed
	Bottom Blower	OK	Spinning at normal speed
	Middle Blower	OK	Spinning at normal speed
	Top Blower	OK	Spinning at normal speed
	Second Blower from top	OK	Spinning at normal speed

**What It Means** The command output shows the fans, impellers, or blowers monitored for the router type. The command output displays the fan, impeller, or blower status and the spinning speed. Top Left and Top Right refer to fans in the upper front fan tray; Bottom Left and Bottom Right refer to fans in the lower front fan tray; Blower refers to fans in the rear fan tray. The status can be OK, Testing (during initial power-on), Failed, or Absent. Measurement indicates if the fan or impeller is spinning at normal or high speed.

## Checking the Cooling System Alarms

For a listing of cooling system alarm conditions, remedy, and alarm severity by routing platform type, see “Display the Current Router Alarms” on page 61.

**Steps To Take** To check for cooling system alarms, follow these steps:

1. Check the Alarm Indicators on the Craft Interface on page 270
2. Display Current Cooling System Alarms on page 270
3. Display Cooling System Error Messages in the System Log File on page 271

## Step 1: Check the Alarm Indicators on the Craft Interface

**Action** To check the craft interface alarm indicators, use the following CLI command:

```
user@host> show chassis craft-interface
```

**Sample Output** user@host> **show chassis craft-interface**

```
Status   Measurement
Red alarm: LED on, relay on
Yellow alarm: LED off, relay off
Host OK LED: On
Host fail LED: Off
```

[...Output truncated...]

LCD screen:

```
+-----+
|myrouter |
|2 Alarms active |
|R: Fan Failure |
|R: Fan Removed |
+-----+
```

**What It Means** The command output displays the alarm indicator status. The alarm indicators can be either On or Off. If an indicator is on, an alarm has occurred. The command output also displays the active alarms on the craft interface LCD display. To list the current alarms, use the show chassis alarms command.

**Alternative Action** You can also physically view the craft interface to see the alarm indicators and alarm descriptions displayed on the LCD display.

## Step 2: Display Current Cooling System Alarms

For information that triggers cooling system alarms in each router type, see “Gather Component Alarm Information” on page 60. For fan alarms by router type, see Table 69 on page 271.

**Action** To display the current cooling system alarms, use the following CLI command:

```
user@host> show chassis alarms
```

**Sample Output** user@host> **show chassis alarms**

```
2 alarms currently active
Alarm time      Class Description
2002-04-08 15:25:12 PDT Major Rear left fan stopped spinning
2002-04-08 15:25:12 PDT Major Rear left fan Failure
```

**What It Means** The command output displays the current cooling system alarms, including the time and date stamp, severity level, and description. Table 69 on page 271 shows the possible cooling system alarms for each router type. The alarm LCD short version appears on the craft interface LCD display. The alarm long version appears at the CLI when you use the show chassis alarms command.

**Table 69: Cooling System Alarm Messages**

Routing Platform	LCD Short Version	CLI Long Version
M5 and M10	N/A	<i>fan-name</i> stopped spinning
	N/A	<i>fan-name</i> removed
	N/A	Too few fans installed or working
M7i and M10i	N/A	<i>fan-name</i> stopped spinning
	N/A	<i>fan-name</i> removed
	N/A	Too few fans installed or working
M20	N/A	<i>fan-name</i> stopped spinning
	N/A	<i>fan-name</i> removed
	N/A	Too few fans installed or working
M40	<i>fan-name</i> FAIL	<i>fan-name</i> stopped spinning
	<i>fan-name</i> RMVD	<i>fan-name</i> removed
	Too few fans	Too few fans installed or working
M40e and M160	Fan Failure	RED ALARM - <i>fan-name</i> Failure
	Fan Removed	YELLOW ALARM - <i>fan-name</i> Removed
	Fans Missing	RED ALARM - Too many fans missing or failing
T320 and T640	Fan Failure	RED ALARM - <i>fan-name</i> Failure
	Fan Removed	YELLOW ALARM - <i>fan-name</i> Removed
	Fans Missing	RED ALARM - Too many fans missing or failing

### Step 3: Display Cooling System Error Messages in the System Log File

**Action** To view cooling system error messages in the system log file, use the following CLI command:

```
user@host> show log messages | match fan
```

**Sample Output**

```
user@host> show log messages | match fan
Apr  8 14:00:15 myrouter scb CM: ALARM SET: (Major) Power Supply A fan failed
Apr  8 14:00:15 myrouter alarmd[584]: Alarm cleared: Pwr supply color=RED, class=CHASSIS, myrouter=Power Supply A fan failed
Apr  8 14:00:18 myrouter scb CM: ALARM CLEAR: Power Supply A fan failed
Apr  8 14:00:21 myrouter alarmd[584]: Alarm set: Pwr supply color=RED, class=CHASSIS, reason=Power Supply A fan failed
Apr  8 14:00:23 myrouter scb CM: ALARM SET: (Major) Rear left fan stopped spinning
Apr  8 14:05:16 myrouter alarmd[584]: Alarm set: Fan color=RED, class=CHASSIS, reason=Rear left fan stopped spinning
```

**What It Means** The messages system log file records the time when the failure or event occurred, the severity level, a code, and a message description. Use the `show log messages | match fan` command to view only fan error messages. Use this information to diagnose a cooling system problem and to let the Juniper Networks Technical Assistance Center (JTAC) know what error messages were generated and the router events prior to the problem. For more information about system log messages, see the *JUNOS System Log Messages Reference*.

## Maintaining the Air Filter

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**Action** To maintain the air filter on M40, M40e, M160, and T320 routers and T640 routing nodes, follow these steps:

1. Check the air filter for dust, debris, or holes. If the air filter needs cleaning, clean it as described in the appropriate hardware guide.
2. If the air filter needs repair, replace it as described in the appropriate hardware guide.



**CAUTION:** Because the impellers and fans are quite powerful, it is important to keep the air filter in place while the router is operating. The impellers and fans could pull in foreign material, such as bits of wire, through an unfiltered air intake, resulting in damage to router components.

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## Verifying a Fan Failure

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**Action** To verify a fan failure, follow these steps:

1. Perform a swap test on the fan. Remove the problem fan tray and put it into another bay. If the fan tray does not work in the other bay, it is probably faulty and must be replaced. If the fan tray works in another bay, there is probably a problem with the power connectivity from the midplane.
2. Check the fan power connector.
3. Check the fan connector on the router midplane.
4. If the fan fails, replace it as described in the appropriate hardware guide. The fans are hot-removable and hot-insertable. You can replace the fans without powering down the router.



**NOTE:** The cooling system components (fans and impellers) do not have serial numbers. Therefore, you will not see a serial number listed in the hardware inventory or a serial number ID label on the component.

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## Verifying an Impeller Failure

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**Action** To verify an impeller failure, follow these steps:

1. Place your hand near the exhaust in the router chassis to determine whether the impellers are pushing air out. If you do not feel much air or no air at all, the impeller is not working.
2. If the impeller fails, replace it as described in the appropriate hardware guide. The impellers are hot-removable and hot-insertable. You can replace the fans without powering down the router.



**NOTE:** The cooling system components (fans and impellers) do not have serial numbers. Therefore, you will not see a serial number listed in the hardware inventory or a serial number ID label on the component.

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## Replacing a Cooling System Component

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The cooling system components are hot-removable and hot-insertable. You can remove or replace a cooling system component without powering down the system and disrupting routing functions. However, you should not operate a router for more than a few minutes without the air filter in place to avoid dust, particles, or other material being sucked into the router chassis.

**Action** To replace a cooling system component, see the appropriate router hardware guide.

