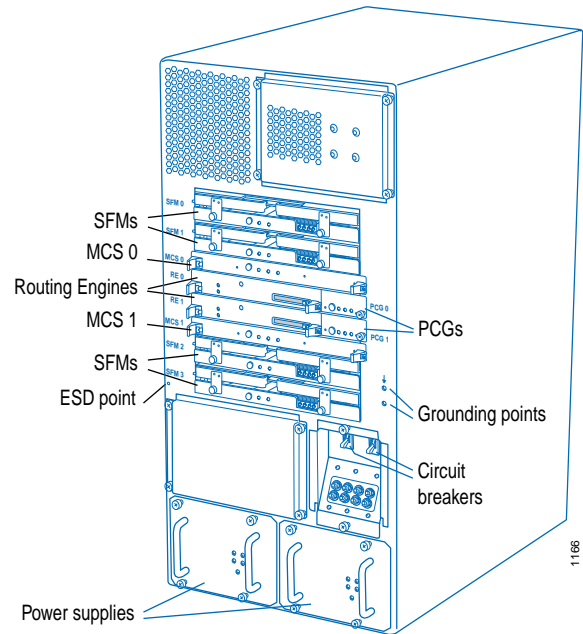


Front View



Rear View

M160 Router Major Hardware Components

Component	Quantity	Function	Redundant	Field-replaceable	Offline Button
Switching and Forwarding Modules (SFMs)	1–4	Provides packet switching, packet forwarding, and route lookup	Yes	Hot-removable Hot-insertable	Yes
Flexible PIC Concentrators (FPCs)	1–8	Connects PICs to other components, houses shared memory	–	Hot-removable Hot-insertable	Yes
Physical Interface Cards (PICs)	1–4 per FPC	Provides interfaces to various network media	–	Hot-removable Hot-insertable	Yes
PFE Clock Generators (PCGs)	2	Provides 125-MHz system clock	Yes	Hot-pluggable	Yes
Host module	1–2	Handles routing protocols, maintains routing tables	Yes	Hot-pluggable	–
Miscellaneous Control Subsystem (MCS)	1–2	Provides system control and monitoring	Yes	Hot-pluggable	Yes
Power supplies	2	Distributes needed voltages to components	Yes	Hot-removable Hot-insertable	–
Cooling system	3 impellers and 1 fan tray (4 fans)	Cools router components	Yes	Hot-removable Hot-insertable	–
Connector Interface Panel (CIP)	1	Provides ports for external management, BITS interfaces, and alarm relay devices	–	Requires system shutdown	–
Craft interface	1	Displays status and allows you to perform control functions	–	Hot-removable Hot-insertable	–

Hot-removable and hot-insertable—Can remove and replace without powering down the router or interrupting the routing functions.

Hot-pluggable—Can remove without powering down the router, but routing functions are interrupted until the replacement is installed.

M160 Router Physical Specifications

Chassis dimensions	35 in. (88.9 cm) high x 19 in. (48.3 cm) wide x 29 in. (73.6 cm) deep
Weight, empty chassis	113.5 lb (51.5 kg) empty chassis 190 lb (86 kg) minimum configuration 370.5 lb (168 kg) maximum configuration
Required clearances	24 in. (61 cm) front and rear; 6 in. (15.2 cm) each side

M160 Internet Backbone Router

M160 Router Power System Specifications

Type	DC power only; 2600 W max output; nonisolated
DC input voltage	Nominal; -48 VDC to 60 VDC
Input DC current rating	65 A @ -48 V
Output voltages	+48 V @ 8 A (cooling system); +8 V @ 6 A (bias); -48 V @ 60 A
Power and grounding cables	4 AWG wire cables with dual ¼ -20 UNC terminal studs @ 0.625 in. (15.86 mm)

M160 Router LEDs

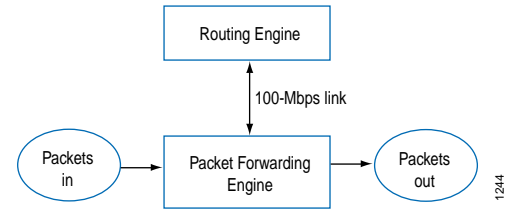
Component	LED	Location
SFMs	Green OK	SFM faceplate
	Amber FAIL	
FPCs	Green OK	Craft interface
	Red FAIL	
	1 LED with 4 states: Red, Green, Amber, Off	
PICs		PIC faceplate
PCGs	Blue MASTER	PCG faceplate
	Green OK	
	Amber FAIL	
Host module	Green MASTER	Craft interface
	Green ONLINE	
	Red OFFLINE	
MCS	Blue MASTER	MCS faceplate
	Green OK	
	Amber FAIL	
Power supplies	Green CB ON	Power supply faceplate
	Blue OUTPUT OK	
	Amber NO AIRFLOW	
	Amber CB OFF	
Alarm LEDs		
Red alarm	Large circular red	Craft interface
Yellow alarm	Large triangular amber	Craft interface
Ethernet LEDs		
10-Mbps link	Yellow	CIP
100-Mbps link	Green	CIP

Taking Components Offline

Component	Procedure
FPC	<ol style="list-style-type: none"> 1. Press the offline button located above the FPC on the craft interface. 2. Press and hold the button until the red FAIL LED lights (about 5 seconds).
PIC	<ol style="list-style-type: none"> 1. Press the PIC offline button. 2. Press and hold the button until the PIC LED lights red (about 5 seconds). For an FPC1, the PIC offline button is located on the FPC. For an FPC2, the PIC offline button is located on the PIC faceplate.
SFM	<ol style="list-style-type: none"> 1. Press the OFFLINE button on the SFM faceplate. 2. Press and hold the button until the red FAIL LED lights (about 5 seconds).
PCG	<ol style="list-style-type: none"> 1. Press the OFFLINE button on the PCG faceplate. 2. Press and hold the button until the red FAIL LED lights (about 3 seconds). <p>Taking the master PCG offline causes the FPCs and SFMs to power down and restart with the other PCG selected as master. The forwarding and routing functions are interrupted during this process. Taking the backup PCG offline does not affect the functioning of the router.</p> <p>You can determine which PCG is functioning as master in one of two ways:</p> <ul style="list-style-type: none"> ■ Check the blue MASTER LED on the PCG faceplate. If this LED is on steadily, the PCG is functioning as master. ■ To display which PCG is functioning as master, use the following CLI command: <pre>user@host > show chassis clocks</pre>
Host module	<p>You take the host module (the Routing Engine and the MCS) offline as a unit. Before you replace a Routing Engine or an MCS, you take the host module offline. The host module is hot-pluggable.</p> <p>Normally, if two host modules are installed in the router, HOST0 functions as the master and HOST1 as the backup. You can remove the backup host module (or either of its components) without interrupting the functioning of the router. If you take the master host module offline, the router reboots and the backup host module becomes the master. If the router has only one host module, taking it offline causes the router to shut down.</p> <p>To take the host module offline:</p> <ol style="list-style-type: none"> 1. Determine whether the host module is functioning as master or as backup, using one of the following two methods: <ul style="list-style-type: none"> ■ Check the host module LEDs on the craft interface. If the green MASTER LED is lit, the corresponding host module is functioning as master. ■ Display which host module is functioning as the master: <pre>user@host > show chassis routing-engine</pre> 2. If the host module is master, switch the host module to backup: <pre>user@host > request chassis routing-engine master switch</pre> <p>When you switch the host module from master to backup, the functioning of the router is interrupted for up to several minutes as the system reboots and the new master host module downloads software to the SFMs.</p>

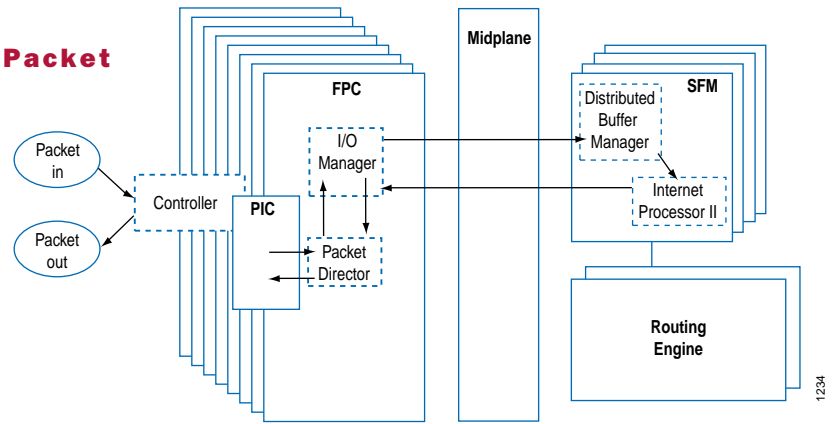
System Architecture

The router has two major architectural components: the Routing Engine, which provides Layer 3 routing services and network management; and the Packet Forwarding Engine, which provides packet switching, route lookups, and packet forwarding. The Routing Engine and Packet Forwarding Engine operate independently, but constantly communicate through a 100-Mbps link, as illustrated in the figure at the right.



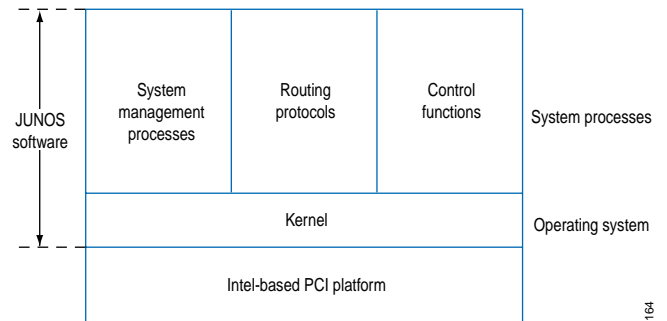
Packet Flow through the Packet Forwarding Engine

To ensure efficient packet flow through the system, data packet forwarding is handled by ASICs on the hardware components. The figure at the right shows the sequence of packet flow through the Packet Forwarding Engine.



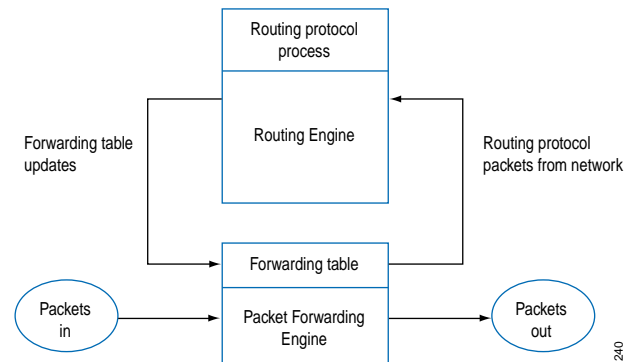
Routing Engine Architecture

The Routing Engine handles all the routing protocol processes as well as processes controlling interfaces, router components, system management, and user access. These processes run on top of a kernel that interacts with the Packet Forwarding Engine.



Control Packet Handling

The Routing Engine constructs and maintains routing tables, and derives a table of active routes, called the forwarding table, from the routing tables. The forwarding table is then copied into the Packet Forwarding Engine.



M160 Internet Backbone Router

General Safety Guidelines

- Only trained and qualified personnel should install or replace the router.
- Perform only the procedures described in the *M160 Internet Backbone Router Hardware Installation Guide*. Other services should be performed by authorized service personnel only.
- For protection against shock hazard, verify that all power cables are disconnected before servicing the router.
- Before installing the router, read the guidelines in the “Prepare the Site” section of the *M160 Internet Backbone Router Hardware Installation Guide* to make sure that the site meets power, environmental, and clearance requirements for the router.
- Manually installing the router requires three people to lift the chassis and a fourth person to secure the mounting screws. Before lifting the chassis, remove components and attach the installation lifting handle as described in the *M160 Internet Backbone Router Hardware Installation Guide*. To prevent injury, keep your back straight and lift with your legs, not your back. Do not attempt to lift the chassis with the handles on the power supplies.
- Do not work on the router or connect or disconnect cables during electrical storms.
- Never install electrical jacks in wet locations unless the jacks are specifically designed for wet environments.
- Operate the router only when the grounding wire is connected.
- Use copper conductors only.
- Avoid touching uninsulated electrical wires or terminals that have not been disconnected from their power source. Doing so could cause electrical shock.
- Do not open or remove chassis covers or sheet metal parts when instructions are not provided in the *M160 Internet Backbone Router Hardware Installation Guide*. Doing so could cause severe electrical shock.
- Do not push or force any objects through any of the openings in the chassis frame. Doing so could result in electrical shock or fire.
- Avoid spilling liquid into the router chassis or onto any router components. Doing so could cause electrical shock or damage the router.
- Before working on equipment that is connected to power lines, remove jewelry, including rings, necklaces, and watches. Metal objects heat up when connected to power and ground and can cause serious burns or weld the metal object to the terminals.
- Failure to observe these safety warnings could result in serious physical injury.

Agency Approvals

Category	Approval
Safety	<ul style="list-style-type: none">■ CSA C22.2 No. 950■ UL 1950■ EN 60950, Safety of Information Technology Equipment■ EN 60825-1 Safety of Laser Products—Part 1: Equipment Classification, Requirements and User’s Guide■ EN 60825-2 Safety of Laser Products—Part 2: Safety of Optical Fibre Communication Systems
EMI	<ul style="list-style-type: none">■ AS 3548 Class A (Australia)■ EN 55022 Class A emissions (Europe)■ FCC Class A (USA)■ VCCI Class A (Japan)
Immunity	<ul style="list-style-type: none">■ EN 61000-3-2 Power Line Harmonics■ EN 61000-4-2 ESD■ EN 61000-4-3 Radiated Immunity■ EN 61000-4-4 EFT■ EN 61000-4-5 Surge■ EN 61000-4-6 Low Frequency Common Immunity■ EN 61000-4-11 Voltage Dips and Sags
NEBS	Designed to meet the following standards: <ul style="list-style-type: none">■ GR-63-Core: NEBS, Physical Protection■ GR-1089-Core: EMC and Electrical Safety for Network Telecommunications Equipment■ SR-3580 NEBS Criteria Levels (Level 3 Compliance)
ETSI	<ul style="list-style-type: none">■ ETS-300386-2 Switching Equipment

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For support issues, contact the Juniper Networks Technical Assistance Center (JTAC) at 1-888-314-JTAC (within the United States) or 408-745-2121 (from outside the United States). For other contact information, refer to www.juniper.net/contactus.html.