The M5 and M10 compact design offers tremendous performance and port density where space and power are a premium. ASIC-based packet processing and forwarding across all interfaces enable you to successfully expand networks while offering new, differentiated services. Their proven software and services are common across all other Juniper Networks M-series routers. M5 and M10 advantages are many.

- *High port density and flexibility*
- *Wire-rate raw forwarding performance*
- *Rich, predictable ASIC-based packet processing, including filtering, sampling, and rate limiting on all inbound and outbound interfaces*
- *Compact design with minimal power consumption*
- *Robust, Internet-scale BGP support*
- *Flexible JUNOS policy language*
- *Reliable, performance-based 802.1Q VLAN and VRRP support*

DATASHEET

M5 and M10 Internet Backbone Routers

The M5™ and M10™ Internet backbone routers deliver high-performance and highly flexible interfaces in a space- and power-efficient design. These routers are designed using the same architecture, ASICs, and JUNOS™ Internet software as the already proven M-series Internet backbone routers. This Internet-tested core technology is now available at your network edge, along with value-added services, such as packet filtering and sampling.

The oversized forwarding performance of the Internet Processor II™ ASIC provides wire-speed forwarding with plenty of headroom. In fact, the M5 and M10 routers forward packets at an aggregate throughput rate of 5+ Gbps and 10+ Gbps, respectively.

The M5 and M10 platforms are ideal for a wide range of applications, such as high-speed access, peering, hosting, and high-end customer premise equipment (CPE) environments. The ability to connect a wide range of high-performance interfaces from T1 and E1 through OC-48c/STM-16 ensures you can easily and cost efficiently scale the network. Additionally, the ASIC-based rate limiting, filtering, and sampling features enable you to easily scale value-added services, providing a full set of tools with which to manage larger networks at higher bandwidths. What's more, the M5 and M10 pack all of this performance with features in three rack units (5.25 in / 13.33 cm).

The M5 and M10 routers offer space-efficient configuration flexibility, enabling you to cost-effectively scale core-to-edge networks with proven ASIC technology and JUNOS software.

Advantages

Features	Benefits
Architecture	
Highly integrated ASIC forwarding	■ Oversized ASICs designed to perform lookups at a rate of 40 Mpps. ■ Half-duplex throughput rate of 5+ Gbps and 10+ Gbps (M5 and M10 router, respectively). ■ Scales well with large, complex forwarding tables. ■ Full utilization of expensive circuits. ■ Packet size does not affect forwarding performance. ■ Rock solid system stability. ■ Lower part count for high reliability.
Routing and forwarding cleanly separated	■ Routing fluctuations and network instability do not impede packet forwarding. ■ Rapid convergence. ■ Reliable and predictable performance for latency sensitive traffic, such as voice over IP and streaming video multicasting.
Single-stage buffering	■ Eliminates head-of-line blocking. ■ Efficiently uses available interface bandwidth. ■ Optimal support for multicast traffic. ■ Reduces latency by requiring only one write to and one read from shared memory.
Features are implemented in ASICs	■ Industry-leading performance with value-added services enabled.
All major components are field replaceable	■ Increases system serviceability and availability. ■ Decreases mean time to repair (MTTR).
JUNOS Internet software already deployed in the largest and fastest growing networks	■ Proven performance and reliability.
Interfaces	
Market-leading port density	■ Efficient use of POP rack space. ■ Future growth not limited by space.
Fine granularity of interchangeable interfaces	■ Flexibly deployed in multiple environments, including peering, high-speed access, hosting, and CPE. ■ Lowers the cost of entry configurations.
Environment	
Highly compact	■ High performance and port density in minimal rack space. ■ Dedicated peering and filtering applications without wasted rack space.
Maximum chassis power of 340 watts for M5 router and 434 watts for M10 router	■ Efficiently uses power for economical deployment and operation.
Services	
Flexible and comprehensive support packages	■ Increases network availability. ■ Eases network configuration and deployment. ■ Flexibility to fit your business model. ■ Worldwide 24x7x365 access.
Professional consulting	■ Eases network planning and configuration. ■ Adds expertise to on-site engineering team.
Product and technology training	■ Provides hands-on configuration experience. ■ Increases product and network design knowledge.

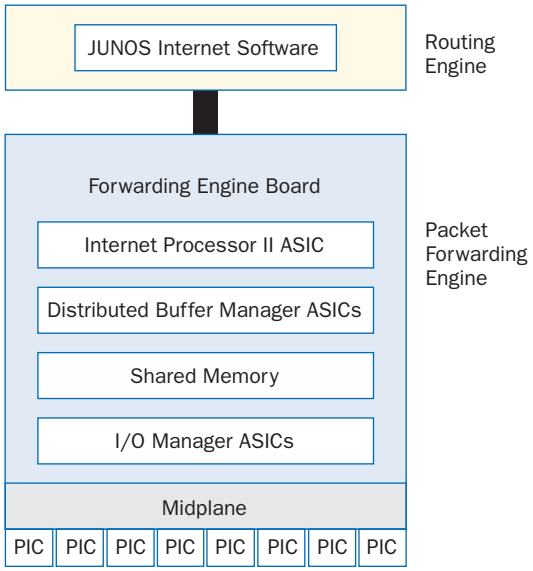
Architecture

The two key components of the architecture are the Packet Forwarding Engine (PFE) and the Routing Engine, which are connected via a 100-Mbps link. Control traffic passing through the 100-Mbps link is prioritized and rate limited to help protect against denial-of-service attacks.

- The PFE is responsible for packet forwarding performance. It consists of the Forwarding Engine Board (FEB), midplane, PICs, and state-of-the-art ASICs.
- The Routing Engine maintains the routing tables and controls the routing protocols. It consists of an Intel-based PCI platform running JUNOS software.

The architecture ensures industry-leading service delivery by cleanly separating the forwarding performance from the routing performance. This separation ensures that stress experienced by one component does not adversely affect the performance of the other since there is no overlap of required resources. Routing fluctuations and network instability do not limit the forwarding of packets. The use of ASICs further ensures forwarding performance.

Logical View of M10 Architecture



Leading-edge ASICs

The feature-rich ASICs deliver a comprehensive hardware-based system for packet processing, including route lookups, filtering, sampling, rate limiting, load balancing, buffer management, switching, encapsulation, and de-encapsulation functions. To ensure a non-blocking forwarding path, all channels between the ASICs are oversized, dedicated paths.

Internet Processor II ASIC

The Internet Processor II ASIC supports a lookup rate of over 40 Mpps. With over one million gates, the Internet Processor II ASIC delivers high-speed forwarding performance with advanced services, such as filtering and sampling, enabled. It is the largest, fastest, and most advanced ASIC ever implemented on a router platform and deployed in the Internet.

Distributed Buffer Manager ASICs

The Distributed Buffer Manager ASICs allocate incoming data packets throughout shared memory on the FEB. This single-stage buffering improves performance by requiring only one write to and one read from shared memory. There are no extraneous steps of copying packets from input buffers to output buffers. The shared memory is completely nonblocking, which in turn, prevents head-of-line blocking.

I/O Manager ASICs

The FEB is equipped with one and two I/O Manager ASICs for the M5 and M10 routers, respectively, for wire-rate packet parsing, packet prioritizing, and queuing. This ASIC divides the packets, stores them in shared memory (managed by the Distributed Buffer Manager ASICs), and re-assembles the packets for transmission.

Media-specific ASICs

The media-specific ASICs perform physical layer functions, such as framing. Each PIC is equipped with an ASIC or FPGA that performs control functions tailored to the PIC's media type.

Packet Forwarding Engine

The PFE provides Layer 2 and Layer 3 packet switching, route lookups, and packet forwarding. The Internet Processor II ASIC forwards up to 40 Mpps for all packet sizes. The aggregate throughput is over 5 Gbps half duplex in an M5 router and over 10 Gbps half duplex in an M10 router.

The PFE supports the same ASIC-based features supported by all other M-series routers. For example, class-of-service features include rate limiting, classification, priority queuing, Random Early Detection, and Weighted Round Robin to increase bandwidth efficiency. Filtering and sampling are also available for restricting access, increasing security, and analyzing network traffic.

Finally, the PFE delivers maximum stability during exceptional conditions, while also providing a significantly lower part count. This stability reduces power consumption and increases mean time between failure.

Forwarding Engine Board

The FEB performs route lookup, filtering, and sampling, as well as provides switching to the destination PIC. Hosting the Internet Processor II ASIC, two Distributed Buffer Manager ASICs, and two I/O Manager ASICs, the FEB is responsible for making forwarding decisions, distributing packets throughout memory, and forwarding notification of outgoing packets.

Physical Interface Cards

PICs provide a complete range of fiber optic and electrical transmission interfaces to the network. The M5 router holds four PICs, and the M10 router holds eight. All PICs except the OC-48c/STM-16 occupy a single PIC space connected to the FEB. The OC-48c/STM-16 PIC, available on the M10 platform only, occupies the same space as four PICs.

Additionally, the routers support the Tunnel Services PIC, which enables them to function as the ingress or egress point of an IP-IP unicast tunnel, a Cisco generic routing encapsulation (GRE) tunnel, or a Protocol Independent Multicast - Sparse Mode (PIM-SM) tunnel.

For a list of available PICs, see the *M-series Internet Backbone Routers Physical Interface Cards* datasheet.

Routing Engine

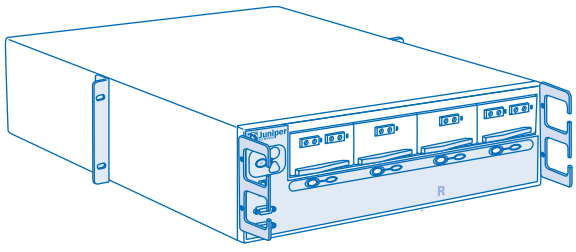
The Routing Engine maintains the routing tables and controls the routing protocols, as well as the JUNOS software processes that control the router's interfaces, the chassis components, system management, and user access to the router. These routing and software processes run on top of a kernel that interacts with the PFE.

- The Routing Engine processes all routing protocol updates from the network, so PFE performance is not affected.
- The Routing Engine constructs and maintains routing tables with a complete set of Internet features and provides full flexibility for advertising, filtering, and modifying routes. Routing policies are set according to route parameters, such as prefixes, prefix lengths, and BGP attributes.

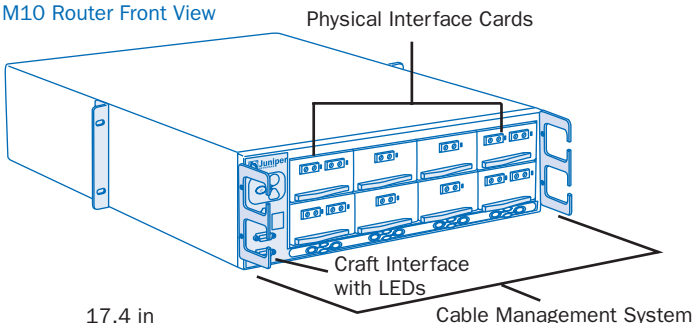
JUNOS Internet Software

JUNOS software is optimized to scale to large numbers of network interfaces and routes. The software consists of a series of system processes running in protected memory on top of an independent operating system. The modular design improves reliability by protecting against system-wide failure since the failure of one software process does not affect other processes.

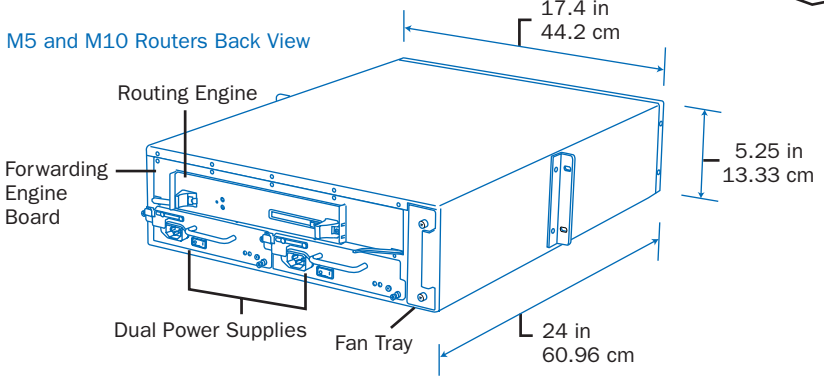
M5 Router Front View



M10 Router Front View



M5 and M10 Routers Back View



Specifications

Specification	Description	
Physical	Height	5.25 in / 13.33 cm
	Width	17.4 in / 44.2 cm
	Depth	24 in / 60.96 cm
	M5 Weight	61 lbs / 27.67 kg
	M10 Weight	65 lbs / 29.5 kg
	Mounting	Front or center rack mount
FEB	■ M5 throughput of 6.4 Gbps half duplex ■ M10 throughput of 12.8 Gbps half duplex ■ 266-MHz CPU and supporting logic ■ Internet Processor II ASIC (40 Mpps forwarding performance) ■ Two Distributed Buffer Manager ASICs for coordinating pooled, single-stage buffering ■ One (M5 router) or two (M10 router) I/O Manager ASICs for wire-rate parsing, prioritizing, and queuing of packets ■ Four banks of 2-MB SRAM for forwarding tables associated with ASICs ■ 64-MB DRAM storage for the microkernel ■ Two 512-KB boot flash EPROM (programmable on the board)	
Routing Engine	■ 333-MHz mobile Pentium II with integrated 256-KB Level 2 cache ■ 256-MB or 768-MB of ECC SDRAM memory ■ 80-MB compact flash drive for primary storage ■ 6.4-GB IDE hard drive for secondary storage ■ 110-MB flash PC card for tertiary storage ■ 10/100 Base-T auto-sensing RJ-45 Ethernet port for out-of-band management ■ Two RS-232 (DB9 connector) asynchronous serial ports for console and remote management	
DC Power Requirements	M5 Power Supply	340 watts maximum output
	M10 Power Supply	434 watts maximum output
	Input Voltage	–42.5 to –72 VDC operating range
	Input Current	13.5 A at –48 VDC
AC Power Requirements	M5 Power Supply	340 watts maximum output
	M10 Power Supply	434 watts maximum output
	Input Voltage	100 to 264 VAC operating range
	Input Line Frequency	47 to 63 Hz, autoranging
	Input Current	8.0 A at 100 VAC
Environmental	Temperature	32 to 104 degrees F / 0 to 40 degrees C
	Maximum Altitude	No performance degradation to 10,000 ft / 3,048 m
	Relative Humidity	5 to 90 percent noncondensing
	Seismic/Earthquake	Designed to meet Bellcore Zone 4 requirements
	Thermal Output	2,550 BTU/hour
Agency Approvals	Safety	■ 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
	EMC	■ AS 3548 Class A (Australia) ■ EN 55022 Class A emissions (Europe) ■ FCC Class A (USA) ■ VCCI Class A (Japan)
	Immunity	■ 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 these standards ■ 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	■ ETS-300386-2 Switching Equipment

Ordering Information

Model Number	Description
Routers	
M5BASE-DC	M5 base unit; four-PIC slot chassis, one built-in FPC, cooling, midplane, Forwarding Engine Board (with Internet Processor II ASIC, 8-MB SSRAM), 1 DC power supply, complete documentation (CD ROM).
M5BASE-AC	M5 base unit; four-PIC slot chassis, one built-in FPC, cooling, midplane, Forwarding Engine Board (with Internet Processor II ASIC, 8-MB SSRAM), 1 AC power supply (AC cables are country specific and sold separately), complete documentation (CD ROM).
M10BASE-DC	M10 base unit; eight-PIC slot chassis, two built-in FPCs, cooling, midplane, Forwarding Engine Board (with Internet Processor II ASIC, 8-MB SSRAM), 1 DC power supply, complete documentation (CD ROM).
M10BASE-AC	M10 base unit; eight-PIC slot chassis, two built-in FPCs, cooling, midplane, Forwarding Engine Board (with Internet Processor II ASIC, 8-MB SSRAM), 1 AC power supply (AC power cables are country specific and sold separately), complete documentation (CD ROM).
Components	
RE-333-256	Routing Engine (333-MHz mobile Pentium II, 256-MB DRAM, 80-MB Flash Disk, 6.4-GB hard drive, JUNOS software for the USA and Canada)
RE-333-768	Routing Engine (333-MHz mobile Pentium II, 768-MB DRAM, 80-MB Flash Disk, 6.4-GB hard drive, JUNOS software for the USA and Canada)
Power Cables	
CBL-PWR-10AC-AU	M5/M10 AC power cable, Australia (10A, 8.2 ft / 2.5 m)
CBL-PWR-10AC-EU	M5/M10 AC power cable, Europe (10A, 8.2 ft / 2.5 m)
CBL-PWR-10AC-IT	M5/M10 AC power cable, Italy (10A, 8.2 ft / 2.5 m)
CBL-PWR-10AC-JP	M5/M10 AC power cable, Japan (10A, 8.2 ft / 2.5 m)
CBL-PWR-10AC-UK	M5/M10 AC power cable, UK (10A, 8.2 ft / 2.5 m)
CBL-PWR10AC-US	M5/M10 AC power cable, US (10A, 8.2 ft / 2.5 m)
Software	
JUNOS	JUNOS Internet software (flash PC card) for USA and Canada (not for export)
JUNOS-WW	JUNOS Internet software (flash PC card) for all countries except the USA and Canada (satisfies USA government requirements for the export of encryption technology)

Juniper® NETWORKS

www.juniper.net

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For contact information, refer to www.juniper.net/contactus.html.

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