M-series Routing Platforms

Juniper Networks M-series routers deliver the same features and predictable performance across platforms. This consistency accelerates time to revenue, improves cost efficiency while scaling the network, and decreases operational overhead.

"We've offered a very popular residential Metro Ethernet service, Megapass Ntopia, for the last two years. To support the expansion of Metro Ethernet to enterprise customers, we selected the Juniper Networks M-series [platform] for its high performance and strong feature set, including stable and rich MPLS Layer 2 VPN and the quality of service (QoS) control necessary to meet the requirements of businesses.."

Man-joon Ghil
KT

M-series Routing Platforms

Juniper Networks M-series Multiservice Edge platforms are deployed in the world's largest networks delivering advanced IP/MPLS services at scale, enabling service providers to reduce costs through network consolidation while simultaneously generating new revenues. Constructed with a clean separation between control plane, forwarding plane, and services plane, M-series routers support multiple services over any type of access connection without compromise on a single platform - maximizing revenue and minimizing operational and capital costs. These services include a broad array of VPNs, network-based security, real-time voice and video, bandwidth on demand, rich multicast of premium content, IPv6 services, granular accounting and much more. This service portfolio continues to grow with every release of JUNOS software, leveraging the tremendous flexibility and performance headroom of the service-built architecture.

Enhanced for the Edge

The M-series platforms are extremely versatile as they can be deployed at the edge of provider networks, in small and medium cores, and in peering, route reflector, and data center applications. However, recent M-series platforms innovations have dramatically expanded their edge capabilities by leveraging the highly programmable Internet Processor II ASIC and IP/MPLS-rich JUNOS software. M-series routers are now deployed and scaling services at the edge of some of the world's largest production networks.

Consistent Services to All Customers

The M-series platforms boast a portfolio that spans from 5 Gbps up to 320 Gbps of throughput, including the M7i, M10i, M20, M40e, M160, and M320 platforms. Because the same scalable and production-hardened JUNOS software runs on all M-series platforms, a consistent set of capabilities is available at all network locations regardless of customer connection or serving area density.

Access Agnostic with Leading Density

With its broad interface portfolio, a single M-series platform can provide a single point of edge aggregation for thousands of customers over any access type including ATM, Frame Relay, Ethernet, and TDM as well as at any speed from DS0 up to OC-192/STM-64 and 10 Gigabit Ethernet. Leveraging dense Ethernet and highly channelized interfaces, the M-series platforms boast leading densities for virtually all port types.

Most Comprehensive VPN Portfolio

The M-series platforms also support the industry's most comprehensive VPN portfolio with the ability to simultaneously run and scale Layer 2 virtual circuits, Layer 2 VPNs, Layer 2.5 Interworking VPNs, Layer 3 2547 VPNs, VPLS, IPSec, GRE, IP over IP and other tunneling mechanisms with no performance compromise. This broad set of VPNs meets the needs of the widest possible set of customers, maximizing the service provider's revenue while minimizing required infrastructure. For example, a provider can use Layer 3 VPNs to deliver an outsourced routing service and can also use Layer 2 VPNs to provide a point-to-point ATM service over a common IP/MPLS infrastructure.

Granular QoS and Statistics

Rich packet processing enables the M-series platforms to support multiple levels of granular QoS per-port, per-logical circuit (DLCI, VC/VP, VLAN), and per-channel (to DS0) for traffic prioritization. These comprehensive QoS functions include classification, rate limiting, shaping, weighted round robin scheduling, strict priority queuing, weighted random early detection, random early detection, and packet marking. For network convergence applications, Layer 2 CoS can be mapped to Layer 3 CoS on a per DLCI, per VP/VC, or per VLAN basis. Simultaneously, extensive statistics can be collected and diagnostics performed at this same level of granularity to enable flexible billing, traffic planning, and rapid troubleshooting.

Rich Packet Processing

A broad portfolio of services can be layered on top of VPNs for additional revenue generation. A comprehensive suite of multicast capabilities, including multicast over MPLS VPNs, enables efficient distribution of premium content. Hardware-based IPv6 and a number of IPv6 migration tools such as IPv6 over MPLS ease access to the benefits of this next-generation IP protocol without performance compromise. NAT and stateful firewall can be configured per VRF to enable network-based security for additional revenues and IPSec can be used to support a premium security service for end users with high security requirements. The M-series Service-Built Edge is continuously enhanced with new packet processing capabilities to ensure maximum revenue generation opportunities.

Highly Reliable

The M-series service-built architecture has been fundamentally constructed with scale and stability in mind, including the modular and fault-protected design of JUNOS software along with a rigorous system testing process. Furthermore, all M-series routers offer redundant power and cooling and the M10i, M20, M40e, M160, and M320 offer fully redundant hardware including redundant Routing Engines and Switching/Forwarding Engine Boards. JUNOS software features enhance this redundant architecture by enabling non-stop forwarding in the event of a routing engine failure via a Hitless Switchover and when a minor software upgrade is required by supporting In-service Software Upgrades. This functionality augments other high availability capabilities that include graceful protocol routing restart, MPLS fast reroute, VRRP, SONET APS, SDH MSP, BFD, and LACP.

Robust Security

All M-series platforms support highly scalable J-Protect filtering capabilities, unicast reverse path forwarding and high performance rate limiting for industry-leading DOS attack protection. The J-Protect security capabilities of the M-series platforms can be further enhanced with the Adaptive Services PIC that accelerates, in hardware, additional network-based security services such as high-speed NAT, stateful firewall with attack detection, and J-Flow accounting. With the rich feature set of JUNOS software combined with industry-leading ASIC technology, the M-series Service-built Edge provides a new level of reliable and secure service delivery at the edge of service provider networks.

Advantage

Features	Benefits	Features	Benefits

New Service Models	• Industry's most comprehensive VPN portfolio meets the largest number of customer needs and maximizes provider revenues
	  • Run Layer 2 Virtual Circuit, Layer 2 VPN, Layer 2.5 Interworking VPNs, Layer 3 2547 VPN, VPLS, IPSec, IP over IP, GRE simultaneously
	  • Highly scalable, supporting thousands of VPNs
	• Granular QoS with low latency and jitter performance to support voice, video, and other real time applications
	  • Per DLCI, per VP, per VC, per VLAN, per channel (DS0), and per port QoS
	  • Classification, rate limiting, shaping, weighted round robin scheduling, strict priority scheduling, weighted random early detection, random early detection, and packet marking
	  • Mapping Layer 2 (802.1p, CLP, DE) to Layer 3 QoS (IP DSCP, MPLS EXP)
	• Hardware-based IPv6 performance, IPv6 over MPLS, IPv6 over IPv4 GRE tunnels, and IPv6/IPv4 dual stack functionality
	• Robust multicast support including IGMP v1/v2/v3, PIM-SM, PIM-DM, MLD, SSM, RP, MSDP, BSR, multicast in MPLS/BGP VPNs to support resource-efficient delivery of high-value content
	• Network-based security services including NAT and stateful firewall, and NAT and stateful firewall per VRF
	• MLPPP, MLFR .15 and MLFR .16, 802.3ad (including LACP) for aggregated links
	• J-Flow accounting, source class usage, and destination class usage for flexible billing on a per application or per CoS resource usage basis and for distance-based billing.
	• Multivendor network management solution through partnerships
	  • Industry-leading, XML-based JUNOScript API facilitates third-party and in-house OSS development
		Services Everywhere	• One feature-rich JUNOS image runs across all M-series platforms, ensuring consistent services and enabling providers to market all services to all users regardless of connection or serving area density
			  • From the smallest PoPs to the largest PoPs
			  • Over virtually any access technology including ATM, FR, Ethernet, and TDM connections
			  • At any speed from DS0 to OC-192/STM-64
			• Lowers operational costs
			• Seamless migration to larger platforms to meet network growth

		More from Less Infrastructure	• Service-built architecture provides clean separation between control plane, forwarding plane, and services plane to support multiple services on a single platform
			  • Maximum revenue with the lowest possible capex and opex
			  • Consolidate functions previously performed by discrete devices such as NAT, stateful firewall, IPSec, and QoS into a single M-series platform
			  • Multiple services on a single platform allows customers to trial many different services without capital investment and then to scale successful services to large user populations
			• Robust Layer 2 VPNs, Layer 2.5 Interworking VPNs, and Layer 2 to Layer 3 QoS mapping for transparently consolidating multiple networks to a common IP/MPLS infrastructure
			• Logical routers enables providers to segment a router into multiple administrative and routing domains, so that two completely different organization can share infrastructure

Advantage

Features	Benefits	Features	Benefits
Proven Dependability	• Production-proven services scaled in the world's largest networks • Hitless switchover for RE switchover with non-stop forwarding • In-service Software Upgrades for disruption-free minor upgrades • MPLS FRR to ensure traffic can quickly reroute around failures • MPLS TE path control for path optimization combined with predictable performance for latency-sensitive traffic such as voice and video • Advanced OA&M features such as LSP ping for troubleshooting MPLS • IETF Graceful Protocol Restart mechanism for hitless restarts of IS-IS, BGP, OSPF, OSPFv3, LDP, RSVP, Layer 2 VPN, and Layer 3 VPN • Modular JUNOS software ensures that a failure of one module does not impact the entire operating system • User-friendly commands for safely deploying new configurations to live networks and for rolling back to previous working configurations	Secure Networks	• High performance J-Protect NAT, stateful firewall, attack detection, and IPSec via the Adaptive Services PIC • Separate routing plane and control plane enables stateful firewall protection of the control plane • J-Flow stateful monitoring of packet flows with standard flowd v5 and v8 records for comprehensive monitoring of the network • Highly scalable filtering, unicast RPF and rate limiting protects against IP spoofing and DOS attacks • High performance IPSec and IPSec over MPLS with digital certificate support for an additional layer of security • Additional ubiquitous security features such as port mirroring, encrypted management session traffic, secure tunneling capabilities, secure remote logins, and configurable privilege levels and user accounts

M-series Routers

Router	Aggregate Half-Duplex Throughput	FPC Slots & Full Duplex Throughput per Slot	Size	PICs per Chassis	Chassis per Rack Switch Fabric and Routing Engine	Redundancy
M7i	8.4 Gbps	1 built-in 3.2 Gbps + 1 Gbps FIC 3.5 x 17.5 x	18 in 8.9 x 44.5 x 45.7 cm	4 + 2 fixed FE or + 1 fixed GE	24	No
M10i	12.8 Gbps	2 built-in 3.2 Gbps	8.5 x 17.5 x 18 in 22.2 x 44.5 x 45.7 cm	8	9	Yes
M20	25.6 Gbps	4 FPC slots 3.2 Gbps	14 x 17.4 x 21 in 35.56 x 44.3 x 53.34 cm	16	5	Yes
M40e	51.2 Gbps	8 FPC slots 3.2 Gbps	35 x 17.4 x 26 in 88.9 x 44.3 x 66.66 cm	32	2	Yes
M320	320 Gbps	8 FPC slots 20 Gbps	34.8 x 17.4 x 25.7 in 88.4 x 44.3 x 65.1 cm	32	2	Yes

M7i Router

The M7i router is Juniper Networks most compact routing platform at 3.5 inches (8.9 cm) in height, supporting 7+ Gbps throughput. It is ideal as an IP/MPLS provider edge router in small POPs or, with its integrated Adaptive Services Module supporting hardware-accelerated NAT, stateful firewall, IPSec, and J-Flow accounting, it can be used as a campus border router or as head office customer premise equipment. The M7i supports either 2 fixed Fast Ethernet ports or 1 fixed Gigabit Ethernet port via a Fixed Interface Concentrator (FIC) as well as supporting 4 ejector-enabled PICs. It supports interface speeds of up to OC-12c/STM-4 and Gigabit Ethernet. PICs are interchangeable between the M7i and M10i routers.

M10i Router

At only 8.5 inches (22.2 cm) the Juniper Networks M10i router is the company's most compact and cost-effective fully redundant M-series edge router. The M10i boasts fully redundant common hardware components including redundant Routing Engines, Compact Forwarding Engine Boards, fan trays, and power supplies. Combined with JUNOS reliability features, the M10i router is the product of choice for enabling reliable and secure services in small and medium POPs. The M10i supports 8 ejector-enabled PICs via 2 built-in Flexible PIC concentrators and interface speeds up to OC-12/STM-4 and Gigabit Ethernet. PICs are interchangeable between the M7i and M10i routers.

M20 Router

Only 14 inches (35.56 cm) in height, the M20 design delivers increased port density, performance of 20+ Gbps throughput, scalability, and reliability in a space-efficient package. The M20 offers fully redundant hardware, including redundant switching fabrics and Routing Engines to increase system availability. The M20 supports 16 PICs and up to OC-48/STM-16 uplink speeds in a compact package ideal for the provider edge in medium and large PoPs.

M40e Router

The M40e router provides a dense, highly redundant platform primarily targeted for dense dedicated access aggregation and provider edge services in medium and large POPs. This 40+ Gbps platform supports 32 ejector-enabled PICs via 8 FPCs and up to OC-48/STM-16 uplink speeds in a half-rack package. The M40e offers common hardware redundancy including the switch fabrics, Routing Engines, fan trays, and power supplies. This platform supports M160 PICs and many PICs are forward-portable to the T-series routing platforms.

M160 Router

The M160 router offers up to 8 OC-192c/STM-64 PICs per chassis (16 per rack) or up to 32 OC-48c/STM-16 PICs per chassis (64 per rack) with up to 160+ Gbps throughput. The M160 platform is ideal for medium-sized backbone cores requiring predictable performance for feature-rich infrastructures and also supports provider edge services in 10-gigabits POPs. In addition, this platform is ideal where switching fabric and Routing Engine redundancy are required. All major components are field replaceable, increasing system serviceability and reliability, and decreasing mean time to repair. For investment protection and smooth migration path, this platform supports M40e PICs. As well, many PICs are forward-portable to the T-series routing platforms.

M320 Router

The M320 is a high performance, 10Gbps-capable, distributed architecture edge router. It offers up to 16 OC-192c/STM-64 PICs per chassis (32 per rack) or up to 64 OC-48c/STM-16 ports per chassis (128 per rack) with up to 320 Gbps throughput. The M320 platform is ideal for medium-sized backbone cores requiring predictable performance for feature-rich infrastructures and also supports provider edge services in 10-gigabit POPs with the ability to support up to 32 type 1 and type 2 PICs and up to 16 type 3 PICs for 10 Gbps uplinks. In addition, this platform is ideal where switching fabric and Routing Engine redundancy are required. All major components are field replaceable, increasing system serviceability and reliability, and decreasing mean time to repair. PICs are compatible with M40e, M160, T320, and T640.

Key Components

Key components of each M-series router are the Packet Forwarding Engine (PFE) and the Routing Engine.

- The PFE is a logical entity that is responsible for packet forwarding. It physically consists of the PICs, FPCs, FIC, control/system/forwarding board, and state-of-the-art ASICs

  - Physical Interface Cards provide a complete range of fiber optic and electrical transmission interfaces to the network. For a listing of available PICs, see the M-series PICs and FPCs datasheet.

  - Flexible PIC Concentrators house PICs and connect them to the rest of the PFE. FPCs parse, prioritize, and queue the packets before forwarding them across the midplane to the appropriate destination interface. On egress, FPCs prioritize, queue, re-assemble, and forward packets out through the appropriate port. Up to four PICs can be mixed and matched within a single FPC slot, increasing configuration flexibility and network scalability, while maximizing POP efficiency.

The FPC required depends on the platform and on the PICs that are needed. For a listing of available FPCs, see the M-series PICs and FPCs datasheet.

- The Fixed Interface Concentrator is available only on the M7i and contains either 2 fixed Fast Ethernet interfaces or 1 fixed Gigabit Ethernet Interface. The Gigabit Ethernet interface requires Small Form factor Pluggable optics (SFP ordered separately).

- On M7i, M10i, M20, M40e, and M160 platforms, the control/system/forwarding board performs route lookup and switching to the destination FPC. It makes forwarding decisions, distributes data cells throughout memory, processes exception and control packets, monitors system components, and controls FPC resets. There are different names for this component on various platforms:

  - M7i/M10i Compact Forwarding Engine Board
  - M20 System and Switch Board
  - M40e/M160 Switching and Forwarding Module

- M320 uses a distributed architecture, where the PFE is contained entirely within the FPC. Route lookup and packet processing occurs on the ingress PFE, and is then switched across the Switch Interface Board (switching fabric) to the egress PFE for final route lookup and packet processing. The feature-rich programmable ASICs deliver a comprehensive, hardware-based system for packet processing and support uncompromising 40 Gbps performance per PFE. To ensure a non-blocking forwarding path, all channels between the ASICs and between ingress and egress PFEs are oversized, dedicated paths.

- The feature-rich programmable ASICs deliver a comprehensive, hardware-based system for packet processing. To ensure a non-blocking forwarding path, all channels between the ASICs are oversized, dedicated paths.

- 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

  - The Routing Engine processes all routing protocol updates from the network, so forwarding performance is not affected.

  - The Routing Engine implements each routing protocol 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.

> **"** *Cable & Wireless will provision new IP capabilities over both dedicated high-speed access lines and lower speed consumer broadband services using Juniper Networks MPLS-based infrastructure. The delivery of multiple, concurrent IP services will have a positive impact on our total cost of ownership and ultimately simplify our network operations. Juniper Networks M-series infrastructure will intelligently speed IP traffic through our network.* **"**

> **Phil Green**
> *Senior Vice President, Global Operations*
> *Cable & Wireless*

Specifications

This section lists basic platform specifications. For further details, refer to the hardware installation manuals on www.juniper.net/techpubs/hardware/.

Specification	Description	M7i	M10i	M20	M40e	M320
Physical	Dimensions (H x W x D)	3.5 x 17.5 x 18 in 8.9 x 44.5 x 45.7 cm	8.75 x 17.5 x 18 in 22.2 x 44.5 x 45.7 cm	14 x 17.4 x 21 in 35.6 x 44.3 x 53.3 cm	35 x 17.4 x 26 in 88.9 x 44.3 x 73.7 cm	34.8 x 17.4 x 25.7 in 88.4 x 44.3 x 65.1 cm
	Maximum Weight	38.2 lbs / 17.3 Kg	79 lbs / 36 Kg	150 lbs / 68 kg	370.5 lbs / 168 kg	439 / 199.6 kg
	Mounting	Front or center	Front or center	Front or center	Front or center	Front or center
DC System Input Power (Fully Loaded)		10 A at −48 VDC 378 watts	12 A at −48 VDC 576 watts	24 A at -48 VDC 1,200 watts	54 A at -48 VDC 2,600 watts	65 A at -48 VDC 3,150 watts
DC Input Power Supply (per individual power supply)	Nominal Voltage	-48, -60 VDC	-48, -60 VDC	-48, -60 VDC	-48, -60 VDC	-48, -60 VDC
	Operating Range	-42 to -72 VDC	-42 to -72 VDC	-42 to -72 VDC	-42 to -72 VDC	-42 to -72 VDC
	Power	378 watts	576 watts	1,200 watts	3,150 watts	2,000 watts
	Current Rating	10 A at −48 VDC	12 A at −48 VDC	24 A at -48 VDC	65 A at -48 VDC*	42A at -48 VDC
	# of power supplies required (non-redundant/ redundant)	1/2	2/4	1/2	1/2	2/4
AC System Input Power (Fully Loaded)		4 to 2 A 100 to 240 VAC 47 to 63 Hz 400 watts	8 to 4 A 100 to 240 VAC 47 to 63 Hz 800 watts	12 to 6 A 200 to 240 VAC 47 to 63 Hz 1,950 watts	15 to 13 A 200 to 240 VAC 47 to 63 Hz 3,000 watts	17 A to 14 A 200 to 240 VAC 47-63 Hz 3,500 watts
AC Input Power Supply (per individual power supply)		100, 120, 200, 208, 220, 240 VAC	100, 120, 200, 208, 220, 240 VAC	100, 120, 200, 208, 220, 240 VAC	200, 208, 220, 240 VAC	200, 208, 220, 240 VAC
	Operating Range	90 to 264 VAC	90 to 264 VAC	90 to 264 VAC	180 to 264 VAC	180 to 264 VAC
	Power	400 watts	800 watts	1,200 watts	3,000 watts	1,750 watts
	Current Rating	4 to 2 A 100 to 240 VAC	8 to 4 A 100 to 240 VAC	12 to 6 A 100 to 240 VAC	16 A 200 to 240 VAC	10 to 8.5 A 200 to 240 VAC
	# of power supplies required (non-redundant/ redundant)	1/2	2/3	1/2	1/2	3/4

* The M40e router does not require circuit breakers greater than 60 A, and does not draw greater input current than 54 A.

* The depth of all chassis are measured from the front flange to the rear of the product. Please add 4-6" for cables and airflow clearance.

Forwarding and Switch Interface Boards	**M7i, M10i CFEB**
	Compact Forwarding Engine Board
	• M7i router
	    • 8.4 Gbps throughput rate (4.2-Gbps full duplex)
	    • Optional Adaptive Services Module
	• M10i router
	    • 12.8-Gbps throughput rate (6.4-Gbps full duplex)
	    • Does not support Adaptive Services Module
	• 266-MHz CPU and supporting logic
	• Internet Processor II-based ASIC for 16-Mpps packet lookup
	• Two enhanced I/O Manager ASICs
	    • Parsing, prioritizing, and queuing of packets
	    • 4-MB parity-protected SSRAM per I/O Manager ASIC
	    • 8-MB SSRAM for forwarding tables associated with ASICs
	• 200 ms of delay-bandwidth buffering
	• Two 512-KB boot flash EPROM (programmable on the board)
		M20 SSB
		System and Switch Board
		• 25.6-Gbps throughput (12.8-Gbps full duplex)
		• One Internet Processor II ASIC for 40-Mpps packet lookup
		• Two Distributed Buffer Manager ASICs for coordinating pooled, single-stage buffering
		• 33-MHz PCI bus, which connects the PowerPC 603e processor and the Internet Processor II ASIC
		• 512-KB boot flash EPROM (programmable on the board)
		• Optional redundancy
		• 16-MB Version
		    • PowerPC 603e processor running at 266 MHz for handling exception packets
		    • 16-MB SSRAM
		    • 256-MB DRAM

	M40e SFM
	Switching and Forwarding Module
	• 51.2-Gbps throughput (25.6-Gbps full duplex)
	• One Internet Processor II ASIC for 40-Mpps aggregate packet lookup
	• Two Distributed Buffer Manager ASICs for coordinating pooled, single-stage buffering
	• 256-KB parity-protected Level 2 cache
	• Optional redundancy
	• 16-MB Version
	    • PowerPC 603e processor running at 266 MHz
	    • 16-MB parity-protected SSRAM
	    • 256-MB parity-protected DRAM
		M320 SIB
		Switch Interface Board for interconnecting FPCs
		• Four required per M320 chassis; all four active
		• 80-Gbps throughput per SIB, 320 Gbps throughput per system
		• Processor subsystem 300-MHz CPU
		    • System controller
		    • 256-MB DRAM
		    • Two Fast Ethernet interfaces

FPC	**M20**
	• 3.2-Gbps full-duplex throughput per FPC
	• Enhanced I/O Manager ASIC
	    • Parsing, prioritizing, and queuing of packets
	    • 2-MB parity-protected SSRAM per I/O Manager ASIC
	• 200 ms of delay-bandwidth buffering per FPC
		M40e
		• 3.2-Gbps full-duplex throughput per M40e-FPC, M40e-FPC1, and M40e-FPC2
		• Two Packet Director ASICs for dispersing and balancing packets across the enhanced I/O Manager ASICs
		• Two enhanced I/O Manager ASICs
		    • Parsing, prioritizing, and queuing of packets
		    • 2-MB parity-protected SSRAM per I/O Manager ASIC
		• 200 ms of delay-bandwidth buffering per FPC

	M320 • 4-Gbps full-duplex throughput per M320-FPC1 • 16-Gbps full-duplex throughput per M320-FPC2 • 20-Gbps full-duplex throughput per M320-FPC3 • Layer 2 / Layer 3 Packet Processing ASICs • Switch Interface ASICs • Internet Processor ASICs • Memory subsystem, including Queuing and Memory Interface ASICs • Processor subsystem	

Routing Engine	**400 MHz (M7i, M10i)**
	• 400-MHz Celeron processor with default 256-KB Level 2 cache
	• 256-MB SDRAM DIMMs, upgradeable to 512-MB or 768-MB SDRAM in 256-MB increments
	• 20-GB IDE hard drive for secondary storage
	• Fast Ethernet RJ-45 port for out-of-band management
	• Two RS-232 (DB-9 connector) asynchronous serial ports for console and remote management
	• Backup boot media
	   • Optional PCMCIA card adapter and 256-MB compact flash card
		600 MHz (M20, M40e)
		• 600-MHz Intel Pentium III
		• Memory
		   • M20, M40e: 2-GB ECC DRAM
		• 256-MB flash drive for primary storage
		• 30-GB IDE hard drive for secondary storage
		• Tertiary storage
		   • M20, M40e: 128-MB flash PC card

	1.6 GHz (M320) • 1.6-GHz Pentium IV processor with integrated 256-KB Level 2 cache • 2-GB DRAM • 256-MB Compact flash drive for primary storage • 30-GB IDE hard drive for secondary storage • 10/100 Base-T autosensing RJ-45 Ethernet port for out-of-band management • Two RS-232 (DB9 connector) asynchronous serial ports for console and remote management • Optional redundancy	
Control Systems	**M40e, M160** Miscellaneous Control Subsystem • 19.44-MHz stratum 3 reference clock for PICs • Controller to monitor the status of router components	**M320** Control Board • Provides buses and control processors used for chassis management • 10/100Base-T/TX Ethernet switch for intermodule communication • Processor subsystem • Two external clock inputs for 19.44-MHz stratum 3 reference clock • Optional redundancy
Agency Approvals	**Safety** • CAN/CSA-C22.2 No. 60950-00/UL 60950—Third Edition, 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 • EN 60950 Safety of Information Technology Equipment	**EMC (M20, M40e, M160, M320)** • AS/NZS 3548 Class A (Australia / New Zealand) • BSMI Class A (Taiwan) • EN 55022 Class A Emissions (Europe) • FCC Part 15 Class A (USA) • VCCI Class A (Japan)
	EMC (M7i, M10i) • AS/NZS 3548 Class B (Australia / New Zealand) • BSMI Class B (Taiwan) • EN 55022 Class B Emissions (Europe) • FCC Part 15 Class B (USA) • VCCI Class B (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 M7i, M10i, M20, M40e: Compliant M320: 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 Telecommunication Network Equipment Electromagnetic Compatibility Requirements
Environment	**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 Telecordia Technologies Zone 4 earthquake requirements

Ordering Information

This section lists only the base units and basic options. Note, PICs are not included as part of the base units and must be ordered separately. For PIC ordering information, see the PICs datasheets at www.juniper.net. For further details on bundles, options, and spares, contact your nearest Juniper Networks sales representative

Component	Description	Model Number				
		M7i	M10i	M20	M40e	M320
Base Unit	DC chassis	M7iBASE-DC-2FETX or M7iBASE-DC-1GE	M10iBASE-DC	M20BASE-DC	M40eBASE-DC	M320BASE-DC
	AC chassis	M7iBASE-AC-2FETX or M7iBASE-AC-1GE	M10iBASE-AC	M20BASE-AC	M40eBASE-AC	M320BASE-AC
System Switching and Forwarding Boards	Primary 8-MB DRAM	In base bundle	In base bundle	In base bundle	In base bundle	—
	Redundant 8-MB DRAM	—	FEB-M10i-M7i-R	SSB-E-M20	SFM-R	—
	Adaptive Services Module Option	FEB-M7i-SVCS-BB	—	—	—	—
	Primary 16-MB DRAM Option	—	—	SSB-E-16-M20	SFM-16-BB	—
	Redundant 16-MB DRAM Option	—	—	SSB-E-16-M20	SFM-16-R	—
	M320 Switch Interface Board	—	—	—	—	4 included in base bundle
Flexible PIC Concentrator	FPC	Built into chassis	Built into chassis	FPC-E	M40e-FPC-S	—
	FPC1	—	—	—	M40e-FPC1	M320-FPC1
	FPC2	—	—	—	M40e-FPC2	M320-FPC2
	FPC3	—	—	—	—	M320-FPC3
Routing Engine	400 MHz256 MB	In base bundle	In base bundle	—	—	—
	Redundant 400 MHz 256 MB	—	RE-400-256-R	—	—	—
	600 MHz 512MB	—	—	—	—	—
	600 MHz 2 GB	—	—	In base bundle	In base bundle	—
	Redundant 600 MHz 2 GB	—	—	RE-600-2048-R	RE-600-2048-R	—
	1.6 GHz 2 GB	—	—	—	—	Included in base bundle
	Redundant 1.6 GHz 2 GB	—	—	—	—	RE-1600-2048-R
Control Board	Primary	—	—	—	—	Included in base bundle
	Redundant	—	—	—	—	CB-M-R
MCS	Redundant	—	—	—	MCS-R	—
JUNOS Software	USA	JUNOS	JUNOS	JUNOS	JUNOS	JUNOS
	Worldwide	JUNOS-WW	JUNOS-WW	JUNOS-WW	JUNOS-WW	JUNOS-WW