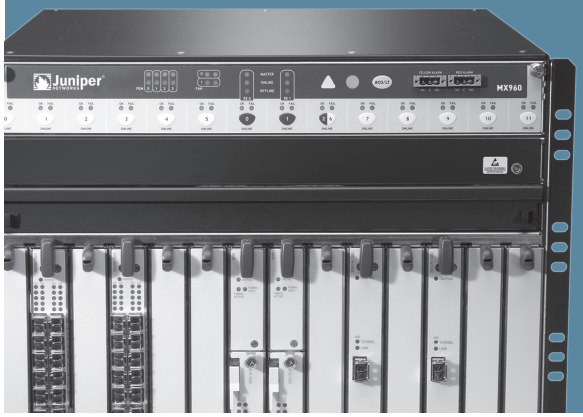


MX SERIES 3D UNIVERSAL EDGE ROUTERS

Product Overview

With continuous technology advances and ongoing standards development, Ethernet is increasingly the technology of choice for enterprises and service providers. Ethernet bandwidth requirements continue to rise as a result of companies needing high-speed connectivity between their geographically dispersed sites. There is an increased reliance on collaborative applications across a globally distributed user base which requires sharing data across the WAN. These are often multimedia applications, including video conferencing and video streaming, and thus require extremely high bandwidth and low latency. To address these requirements, Juniper Networks has introduced the MX Series 3D Universal Edge Routers that deliver a high-performance network infrastructure that provides fast, secure and reliable delivery of the applications that drive business processes while containing cost and increasing operational efficiency.

Ethernet is rapidly becoming the technology of choice for both enterprises and service providers looking to provide connectivity and intelligent services. While in some aspects the requirements may be different, today's advanced services are dictating that both enterprises and service providers build networks that meet increasingly stringent requirements regarding quality of service (QoS), network performance and availability.

In addition to these basic requirements, service providers seeking to provide a differentiated user experience are finding they must scale their networks to support increasingly higher amounts of bandwidth, services and subscribers. Scaling the network in these three dimensions will be critical to securing competitive differentiation for the next generation of services.

Juniper Networks® MX Series 3D Universal Edge Routers are the only routers designed to provide the 3D scaling necessary to address today's advanced Ethernet requirements. Powered by Juniper Networks® Junos software and high-performance silicon such as the I-Chip and Junos Trio chipset, the MX Series enables service providers and enterprises to adapt to—and profit from—Ethernet services in a changing market.

Product Description

The MX Series routers are a portfolio of high-performance Ethernet routers, which function as a Universal Edge platform capable of supporting all types of business, mobile and residential services. With powerful switching and security features, the MX Series delivers unmatched flexibility and reliability to support advanced services and applications. MX Series routers also separate control and forwarding functions to provide maximum scale and intelligent service delivery capabilities.

MX Series 3D Universal Edge Routers are optimized for Ethernet and address a wide range of deployments, architectures, port densities and interfaces for both service provider and enterprise environments. In both markets, the MX Series routers provide scalable, high port-density routing and switching required for applications such as data centers. For service providers, MX Series routers surpass the requirements of carrier-grade Ethernet switches as defined by the Metro Ethernet Forum, making Juniper Networks routers the platforms of choice for service providers seeking 3D scaling in the Universal Edge.

Powered by Junos software, the MX Series provides a consistent operating environment that streamlines network operations and improves the availability, performance, and

security of all types of services supported at the Universal Edge. It offers the most complete, advanced routing features in the industry without compromising performance which maximizes investment protection. These features include traffic segmentation and virtualization with MPLS, ultra low-latency multicast, as well as comprehensive security and QoS implementations to accelerate delivery of time-sensitive applications and services.

The carrier-class reliability and high availability features available on the MX Series include graceful restart, nonstop routing, fast reroute (FRR), Unified In-Service Software Upgrade (ISSU) and VPLS multihoming.

The MX Series provides the 3D scale, maximum performance, availability, and service agility that enterprises and service providers need to gain a competitive advantage in today's Ethernet environment.

MX80 3D Universal Edge Router

Juniper Networks MX80 3D Universal Edge Router is the most compact member of the MX Series product family. Only 2 RU high and equipped with front end accessible redundant power supplies and fans, this platform is perfectly suited for environments requiring full Ethernet capabilities, but facing space or power constraints. In addition to four embedded 10 Gigabit Ethernet ports, the MX80 leverages the technology used in the Modular Port Concentrators (MPCs), common across the MX Series, and can accommodate multiple combinations of Modular Interface Cards (MICs) for increased flexibility. The MX80-48T variant is a fixed-configuration version of the MX80 which features 48 10/100/1000 Ethernet ports in place of the 2 MIC slots.

In the enterprise, the MX80 and MX80-48T can be deployed in campus, small sites and small data center WAN connectivity; and service providers can utilize the MX80 for mobile backhaul hub site aggregation, metro ring access nodes, cable and Multitenant Unit (MTU) aggregation, distributed PE and high-end CPE.

MX240 3D Universal Edge Router

Juniper Networks MX240 3D Universal Edge Router design delivers increased port density over traditional Ethernet platforms as well as performance of 480 Gbps throughput, scalability and reliability in a space-efficient package. The MX240 offers fully redundant hardware that includes a redundant Switch Control Board (SCB) and Routing Engines (REs) to increase system availability.

MX480 3D Universal Edge Router

Juniper Networks MX480 3D Universal Edge Router provides a dense, highly redundant platform primarily targeted for medium to large enterprise campus and data centers and dense dedicated access aggregation and provider edge services in medium and large Points of Presence (POPs). The MX480 offers common hardware redundancy including the SCBs, REs, fan trays and power supplies.

MX960 3D Universal Edge Router

Juniper Networks MX960 3D Universal Edge Router is a high density Layer 2 and Layer 3 Ethernet platform designed for deployment in a number of enterprise and service provider Ethernet scenarios. For service providers, the wide range of Universal Edge applications supported by the MX960 include VPLS services for multi-point connectivity, Virtual Leased Line for point-to-point services, full support for MPLS VPNs throughout the Ethernet network, Ethernet aggregation at the campus/enterprise edge, and Ethernet aggregation at the multiservice edge. In the enterprise, the MX960 can be used for campus and data center core and aggregation as well as a WAN Gateway.

The MX960 router is ideal for large applications requiring predictable performance for feature-rich infrastructures. In addition, this platform is ideal where SCB and RE redundancy are required. All major components are field replaceable, increasing system serviceability and reliability, and decreasing mean time to repair.

Table 1. MX Series 3D Universal Edge Routers

ROUTER	MX80	MX240	MX480	MX960
System capacity	80 Gbps	480 Gbps	1.4 Tbps	2.6 Tbps
Throughput per slot	N/A	120 Gbps per slot	120 Gbps per slot	120 Gbps per slot
Packet forwarding capacity	65 Mpps	360 Mpps	1.08 Bpps	1.98 Bpps
DPCs and/or MPCs per chassis	Can accommodate 2 MICs (no DPC/MPC slots)	2 or 3	6	11 or 12
Chassis per rack	24	9	6	3
Redundancy	Redundant power, cooling	Yes	Yes	Yes

Features and Benefits

MX Series 3D Universal Edge Routers

Key components of each MX Series 3D Universal Edge Router are the Dense Port Concentrators (DPCs), Modular Port Concentrators (MPCs), the Routing Engine, and the Switch Control Board (SCB).

The DPCs are optimized for Ethernet density and are capable of supporting up to 40 GbE or four 10GbE Ethernet ports. The DPC assembly combines packet forwarding and Ethernet interfaces on a single board, with 40 Gbps Packet Forwarding Engines (PFEs). The DPCs interface with the power supplies and SCBs.

Designed for flexibility, MPCs leverage the Junos Trio chipset to deliver the industry's highest density GbE and 10GbE, as well as the flexibility of modular interfaces, across the MX Series portfolio. These advanced capabilities allow customers to flexibly mix and match interfaces to create service-specific and "pay as you grow" configurations. The MPC houses the PFEs to deliver up to 120 Gbps of comprehensive Layer 3 routing (IPv4 and IPv6), Layer 2 switching, inline services, and advanced H-QoS per MX Series slot.

The Routing Engine provides control plane functions and runs Junos software. Software processes that run on the Routing Engine maintain the routing tables, manage the routing protocols used on the router, control the router interfaces, control some chassis components, and provide the interface for system management and user access to the router.

Routing Engines communicate with DPCs and MPCs via dedicated out-of-band management channels, providing a clear distinction between the control and forwarding planes.

The SCB powers on and off cards, controls clocking, resets, and booting, and monitors and controls systems functions, including fan speed, board power status, PDM status and control, and the system front panel. Integrated into the SCB is the switch fabric, which interconnects all of the DPCs and MPCs within the chassis. The Routing Engine installs directly into the SCB.

The MX Series is purpose-built with full routing and switching capabilities to deliver the lowest cost per port without sacrificing performance, reliability, scalability or functionality.

Ethernet-based services present a significant new revenue opportunity for service providers across all market segments. These business, mobile and residential services include VPNs, point-to-point connectivity, high-speed Internet access, and video-based offerings. With continuous technology advances and ongoing standards development, Ethernet is increasingly the technology of choice at the service provider edge—and the MX Series 3D Universal Edge Routers are capable of supporting all these services. As an example of Juniper's commitment to delivering a Universal Edge solution to meet the needs of next-generation networks and services, the MX Series offers unmatched scalability, performance, reliability, and QoS for all types of business, mobile and residential services. The MX Series is the only high-density Layer 2 and Layer 3 Ethernet platforms designed with 3D scaling for deployment in a number of service provider Ethernet edge scenarios.

Examples of the wide range of applications enabled by the MX Series in the Universal Edge include:

- VPLS for multipoint connectivity—native support for VPLS services
- Virtual leased line for point-to-point services—native support for point-to-point services
- RFC 2547.bis IP/MPLS VPN (L3VPN)—full support for MPLS VPNs throughout the Ethernet network
- Video distribution for IPTV services with advanced capabilities such as multicast MPLS VPNS
- Ethernet aggregation at the multiservice edge—supporting up to 480 GbE ports or 176 10GbE ports in a single platform—for maximum Ethernet density
- Residential multiplay services—with subscriber management capabilities as well as high-density Ethernet aggregation, the MX Series can fulfill multiple roles in the delivery of residential services
- Cloud computing—the MX Series provides the perfect platform for connectivity to and between clouds
- Data center consolidation—with advanced multicasting and unicast capabilities, the MX Series can provide data center connectivity and server live-mirroring and migration
- Virtualization—with software virtualization, the MX Series can virtualize data center and enterprise networks to improve efficiency and utilization
- Mobile backhaul and aggregation—providing cost-effective transport and backhauling of mobile data traffic
- Application monitoring—with integrated performance monitoring systems such as StreamScope eRM and Telchemy Embedded Performance Monitor (TePM), the MX Series can provide advanced application layer diagnostics help service providers deliver a superior user experience for voice, video and other multimedia services

MPLS

MPLS has traditionally been found in network backbones to provide traffic engineering and allow the efficient transport of a wide range of Layer 2 and Layer 3 traffic such as IP, Frame Relay and ATM. Extending MPLS to the Ethernet networks provides complementary capabilities to help deal with more traffic types, provide greater resiliency and QoS, restoration techniques, Operations, Administration & Management (OA&M) diagnostic capabilities and further enables users to consolidate traffic types on a single, common IP/MPLS network—very compelling to businesses from a CapEx/OpEx perspective.

As an industry leader in the development and deployment of MPLS, Juniper Networks leads the way in making it possible for enterprises and service providers to implement network architectures and services based on MPLS. The MX Series provides a wide range of MPLS features and functionality powered by Junos software. The feature richness of Junos software provides the MX Series an advantage over other operating systems that are either too immature to support the required MPLS feature breadth or architected in a monolithic fashion, making them too complicated

or unwieldy to efficiently manage. Additionally, the MX Series is designed to lead the industry in the following areas:

Interface Scalability—except for the compact MX80, which does not utilize the larger DPC or MPC cards, each MX Series chassis scales in size with choices of 3, 6 or 12 slots that can be populated with line cards for access or network interfaces. With up to 12 line card slots, the MX960 3D Universal Edge Router supports up to 176 10GbE ports or 480 Gigabit Ethernet ports.

Advanced Packet Processing Performance—each MX Series slot provides line-rate 120 Gbps packet forwarding.

Service Flexibility—Juniper is an industry leader in both MPLS and VPLS, and the MX Series 3D Universal Edge Routers leverage Junos software, which is deployed in the largest 600 services providers and Fortune 100 enterprise worldwide. The field-proven Junos software provides the MX Series feature richness, stability and service breadth not typically found in Ethernet platforms.

Advanced QoS—the MX Series features superior QoS at the interface level, which reduces costs and enables service providers to ensure that applications and services receive the appropriate level of service regardless of traffic conditions.

High Availability—the MX Series delivers the full Junos continuous systems advantage, ensuring non-stop operations and maximum uptime. As the only Carrier Ethernet platform that supports Unified ISSU, the MX Series can be upgraded with new Junos software features and versions with minimal risk or downtime. The MX Series also provide features such as Graceful Routing Engine Switchover (GRES), Non-Stop Active Routing (NSR), and Bi-Directional Forwarding Detection (BFD) to provide rapid recovery and network convergence in the event of link or node failures.

Simplified Management—leveraging Junos software tools such as J-Web and Junos Script, the MX Series reduces the time and expense of provisioning new services. The Commit Scripts feature provides automated rollback capabilities that virtually eliminate the possibility of downtime based on human configuration errors. With the J-Web web-based GUI, the MX Series provides users with simple to use tools to administer and manage routers.

The MX Series Extends Junos Software in the Network

Junos software is a world-class operating system with proven stability coupled with industrial-strength routing protocols, flexible policy language and leading MPLS implementation. When building your Ethernet-centric infrastructure, Junos software can be a tremendous asset as a flexible and reliable operating system.

Junos software runs on Juniper Networks MX Series 3D Universal Edge Routers, M Series Multiservice Edge Routers, T Series Core Routers, as well as EX Series Ethernet Switches, J Series Services Routers and SRX Series Services Gateways. Junos software—the first routing operating system developed specifically for the Internet—is especially designed for large production networks. With native support for both IPv4 and IPv6, as well as advanced interworking capabilities, Junos also eases the transition to IPv6, and ensures long-term investment protection.

Junos software offers XML interfaces for advanced scripting capabilities, and has been designed to configure the routing protocols that run on the MX Series and the properties of its interfaces. After a software configuration is activated, Junos software has been designed to monitor the protocol traffic passing through the MX Series, as well as troubleshooting protocol and network connectivity problems.

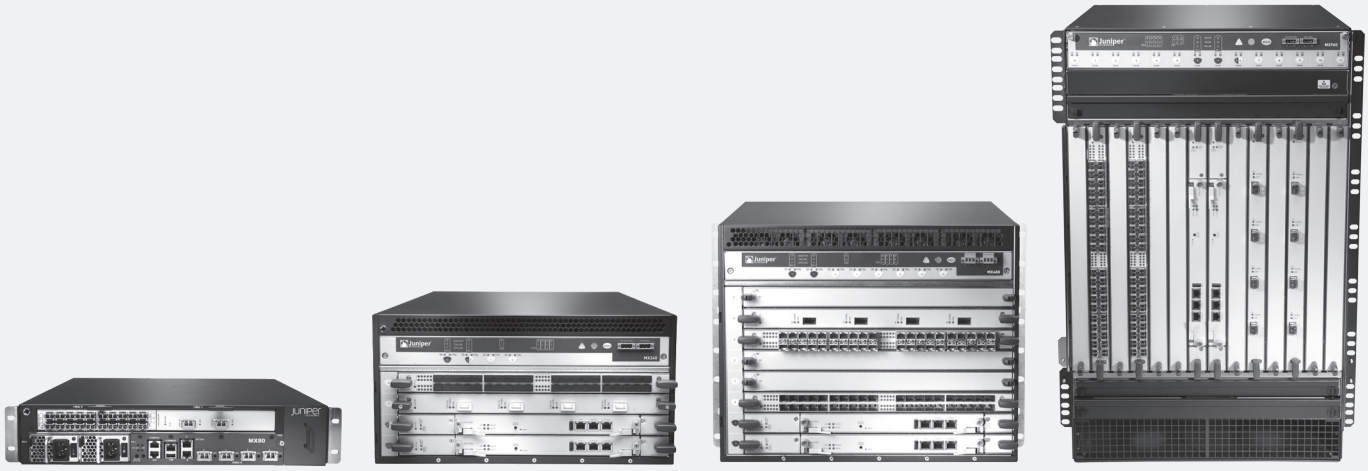
MX Series VPNs

Junos software supports of the industry's richest portfolio of VPNs:.

- **MPLS Layer 2 VPNs**—the MX Series offers full support for both LDP and BGP-based Virtual Private LAN Services (VPLS), as well as LDP and BGP based pseudowires. With support for up to 1 million MAC addresses and 64,000 VLANs, the MX Series delivers industry-leading scale for Layer 2 VPNs.
- **MPLS Layer 3 VPNs**—with support for all types of IPv4 VPNs, as well as IPV6 VPNs such as 6PE and 6VPE, the MX Series expands the range of services carriers can offer customers. The MX Series supports VPNs with advanced, application-layer features such as Session Border Controller, Dynamic Application Awareness, Intrusion Prevention System and Stateful Firewall Services.
- **Carrier-of-Carrier VPNs**—the MX Series allows a VPN service provider to supply VPN service to a customer who is also a service provider. The latter service provider supplies Internet or VPN service to the end customer.
- **Interprovider VPNs**—Juniper supports standards-based Interprovider VPNs, enabling customers to supply connectivity between two VPNs in separate autonomous systems (ASs). This functionality could be used by a VPN customer with connections to several Internet service providers (ISPs), or different connections to the same ISP in various geographic regions.
- **Virtual router-based VPNs**—with the virtualization capabilities in Junos, the MX Series can be divided into multiple virtual or logical routing instances, each supporting an individual VPN. This opens up new possibilities for VPN services or enterprise network segmentation.

Table 2. MX Series Features and Benefits

ADVANTAGE	FEATURES	BENEFITS
High availability	• Fully redundant hardware (cooling, power supplies, Routing Engines, SCBs) • Modular operating system • Separate data and control planes • Graceful restart • Nonstop routing • MPLS fast reroute • VPLS multihoming	• The MX Series design provides the highest level of redundancy and resiliency to ensure that critical services and customers stay connected • Enables service providers to maximize revenues and ensure customer satisfaction
High performance	Powered by Juniper's I-Chip ASIC and Junos Trio chipset, the MX Series features include: • Enhanced QoS capabilities • Additional packet processing flexibility • Scaling enhancements that include route lookup, next hop, logical interface scaling, and interface accounting • Additional microcode capacity that provides headroom for the next 3-5 years of Junos Software features • Enhanced multicast performance	Industry-leading performance enables the MX Series to satisfy critical applications at the edge, including voice, video, and data
Service flexibility	Simultaneous support for Layer 2 and Layer 3 3D Universal Edge: VPLS, RFC 2547bis IP/MPLS VPNs, Triple Play services	Providing enterprise and residential services from a common platform increases service breadth and optimizes OpEx and CapEx



MX80 MX240 MX480 MX960

Specifications

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

SPECIFICATION	MX80	MX240	MX480	MX960
Dimensions and Power				
Physical dimensions (W x H x D)	17.5 x 3.5 x 23.48 in (44.5 x 8.76 x 59.6 cm)	17.5 x 8.7 x 23.8 in (44.5 x 22.1 x 60.5 cm)	17.5 x 14 x 23.8 in (44.5 x 35.6 x 60.5 cm)	17.5 x 27.8 x 23.5 in (44.5 x 70.5 (16 RU) x 59.7 cm)
Weight (lb/kg) fully configured	30 lb / 13.7 kg	130 lb / 59 kg	180 lb / 81.7 kg	334 lb / 151.6 kg
Mounting	Front or center	Front or center	Front or center	Front or center
Power (DC/AC)	-40 to -60 VDC 100 to 240 VAC	-40 to -60 VDC 100 to 240 VAC	-40 to -60 VDC 100 to 240 VAC	-40 to -60 VDC 200 to 240 VAC
AC power consumption (theoretical aggregate)	500 W	1743 W	3383 W	6018 W
DC power consumption (theoretical aggregate)	500 W	1420 W	2880 W	5093 W
Operating temperature	32º to 104º F (0º to 40º C)	32º to 104º F (0º to 40º C)	32º to 104º F (0º to 40º C)	32º to 104º F (0º to 40º C)
Humidity	5% to 90% noncondensing humidity			
Altitude	No performance degradation to 13,000 ft / 4,000 m			

Agency Approvals

Safety

- CAN/CSA-22.2 No. 60950-00/UL 1950 Third Edition, Safety of Information Technology Equipment
- EN 60825-1 Safety of Laser Products - Part 1: Equipment Classification, Requirements and User's Guide
- EN 60950 Safety of Information Technology Equipment

EMC

- AS/NZS 3548 Class A (Australia/New Zealand)
- EN 55022 Class A Emissions (Europe)
- FCC Part 15 Class A (USA)
- VCCI Class A (Japan)

NEBS

- GR-63-Core: NEBS, Physical Protection
- GR-1089-Core: EMC and Electrical Safety for Network Telecommunications Equipment

ETSI

- ETS-300386-2 Telecommunication Network Equipment Electromagnetic Compatibility Requirements

Immunity

- EN 61000-3-2 Power Line Harmonics
- EN 61000-3-3 Voltage Fluctuations and Flicker
- 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 1000-4-11 Voltage Dips and Sags

Management

Element Management

- Juniper Networks J-Web Software graphical user interface

Policy Management

- Juniper Networks Junos Scope
- Juniper Networks Session and Resource Control Portfolio

Third-Party Management Applications

- HP, IBM, InfoVista, Intelliden, WANDL

SNMP

- SNMP v2/v3 bilingual agent support

Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services and support, which are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to bring revenue-generating capabilities online faster so you can realize bigger productivity gains and faster rollouts of new business models and ventures. At the same time, Juniper Networks ensures operational excellence by optimizing your network to maintain required levels of performance, reliability, and availability. For more details, please visit **www.juniper.net/us/en/products-services/.**

Ordering Information

COMPONENT	MODEL NUMBER	DESCRIPTION			
		MX80	MX240	MX480	MX960
Base unit	DC Chassis AC Chassis	MX80-48T-DC MX80-48T-AC	MX240BASE-DC MX240BASE-AC	MX480BASE-DC MX480BASE-AC	MX960BASE-DCC MX960BASE-AC
DPC	DPCE-R-40GE-SFP		40x1 GbE L2/L3 capable		
	DPCE-R-4XGE-XFP		4x10 GbE L2/L3 capable		
	DPCE-X-40GE-SFP		40x1 GbE L2+ capable		
	DPCE-X-4XGE-XFP		4x10 GbE L2+ capable		
	DPCE-R-Q-40GE-SFP		40x1 GbE L2/L3 capable board with enhanced queuing		
	DPCE-R-Q-4XGE-XFP		4x10 GbE L2/L3 capable board with enhanced queuing		
	DPCE-X-Q-40GE-SFP		40x1 GbE L2+ capable board with enhanced queuing		
	DPCE-X-Q-4XGE-XFP		4x10 GbE L2+ capable board with enhanced queuing		
	DPCE-R-Q-20GE-SFP		20x1 GbE L2/L3 capable with enhanced queuing		
	DPCE-R-2XGE-XFP		2x10 GbE L2/L3 capable		
	DPCE-R-40GE-TX		40x 10/100/1000 Ethernet L2/L3 capable with RJ45		
	DPCE-X-40GE-TX		40x 10/100/1000 Ethernet L2+ capable with RJ45		
	MX-FPC2		DPC with 2 slots for type 2 PICs		
	MX-FPC3		DPC with 2 slots for type 3 PICs		
	MS-DPC		IP services line card for MX Series		
MPC	MX-MPC1-3D		20 ports of 10/100/1000 Ethernet with SFP interfaces		
	MX-MPC2-3D		2 10GbE modular interface card with 10-gigabit small form-factor pluggable transceiver (XFP) interfaces		
	MX-MPC1-3D-Q		4 10GbE modular interface card with XFP interfaces		
	MX-MPC2-3D-Q		40 ports of 10/100/1000 Ethernet with Tx interfaces		
	MX-MPC2-3D-EQ		16 port 10GbE MPC requires SFP+ interfaces		
	MPC-3D-16XGE-SFPP				
MIC	MIC-3D-20GE-SFP		20 ports of 10/100/1000 Ethernet with small form-factor pluggable transceiver (SFP) interfaces		
	MIC-3D-2XGE-XFP		2 10GbE modular interface card with XFP interfaces		
	MIC-3D-XGE-XFP		4 10GbE modular interface card with XFP interfaces		
	MIC-3D-40GE-TX		40 ports of 10/100/1000 Ethernet with Tx interfaces		
Routing Engine	RE-S-1300-2048-BB		1.3 GHz CPU and 2 GB memory, Base Bundle		
	RE-S-2000-4096-UPG-BB		2 GHz CPU and 4 GB memory, Base Bundle		
	RE-S-1300-2048-R		1.3 GHz CPU and 2 GB memory, Redundant		
	RE-S-2000-4096-R		2 GHz CPU and 4 GB memory, Redundant		
DPC support	DPCE-Q	No	Yes	Yes	Yes
	DPCE-X	No	Yes	Yes	Yes
	DPCE-R	No	Yes	Yes	Yes
Routing Engine	1300	No	Yes	Yes	Yes
	2000	No	Yes	Yes	Yes
SCB	Primary	No	Yes	Yes	Yes
	Redundant	No	Yes	Yes	Yes
Junos Software	USA	Junos	Junos	Junos	Junos
	Worldwide	Junos-WW	Junos-WW	Junos-WW	Junos-WW

About Juniper Networks

Juniper Networks, Inc. is the leader in high-performance networking. Juniper offers a high-performance network infrastructure that creates a responsive and trusted environment for accelerating the deployment of services and applications over a single network. This fuels high-performance businesses. Additional information can be found at **www.juniper.net**.

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1000208-003-EN Oct 2009

Printed on recycled paper