



# MX2000 UNIVERSAL ROUTING PLATFORMS

## Product Overview

*As cloud builders, telecom service providers, and cable operators seek to improve customized digital experiences for their customers, they must concurrently address ever-increasing bandwidth demands on their network. Meeting these objectives requires a dynamic, service-oriented edge routing platform that cost-effectively scales to meet both current demand and long-term forecasts.*

*The SDN-ready MX2000 line of Universal Routing Platforms are true cloud-grade networking platforms that help network operators of all types achieve their business goals by combining unparalleled performance, reliability, and security with a programmable, software-centric design at massive scale including line-rate encryption capabilities. Simply put, the MX2000 routers offer the system capacity, line-rate port density, and service-oriented design that network operators need to thrive today and in the future.*

## Product Description

Increasingly sophisticated technology users are seeking highly responsive and customizable cloud-like online experiences and services that align with their unique needs and interests. At the same time, these users are creating more traffic that consume ever-increasing amounts of network bandwidth. For example, global e-commerce sales are growing at 20 percent annually; enterprises are increasingly moving infrastructure to the cloud<sup>1</sup>; every minute of every day, more than 300 hours of video are uploaded to YouTube<sup>2</sup>; and analysts expect 26 billion Internet of Things (IoT) devices to be in use by 2020—more than a tenfold increase from 2015<sup>3</sup>.

As network operators strive to profitably meet these market demands, they are thwarted by traditional hardware-centric edge routers that lack programmability and scale, which limits their competitiveness, constrains their revenue and market share growth, and increases their CapEx, OpEx, and TCO. Now more than ever, service providers need agile, service-oriented edge routers that cost-effectively scale to create a Cloud-Grade Network that meets current demand and long-term forecasts.

Meeting these challenges head-on, Juniper Networks® MX2000 line of Universal Routing Platforms—consisting of the 80 Tbps-capable MX2020 and the 40 Tbps-capable MX2010 and MX2008—enables network operators to confidently build the best cloud-grade core and edge networks across residential, mobile, business, and cloud/hosting markets.

Significantly, the MX2000 platforms run the same Juniper Networks Junos® OS as the entire MX Series universal routing platform portfolio, ensuring complete feature consistency and a common operational and management framework. This consistency reduces the cost, risk, and complexity of network evolution, helping current MX Series customers rapidly qualify and deploy the MX2000 routers.

Due to increasing security threats and data privacy concerns, Juniper has also made line-rate Layer 2 encryption standard across the majority of its products, including the MX2000 line, by integrating MACsec technology. With the MPC11E line card, the MX2000 platforms integrate MACsec on 10GbE, 40GbE, and 100GbE ports without needing a separate services card. The 40GbE and 100GbE MACsec capability has been available on MPC8E and MPC9E line cards since early 2018, and 10GbE MACsec has been available on the MPC7E-10G line card since 2016.

<sup>1</sup> Source: Digital Business, Rethinking Fundamentals, Bill McNee, Founder and CEO, Saugatuck Technology

<sup>2</sup> Source: YouTube Statistics

<sup>3</sup> Source: Gartner Says the Internet of Things Installed Base Will Grow to 26 Billion Units By 2020

## Architecture and Key Components

### Platform Components

#### Switch Fabric Board

Switch Fabric Boards (SFBs) create a highly scalable and resilient "all-active" centralized switch fabric that delivers up to 4 Tbps of full-duplex switching capacity to each MPC slot in an MX2000 router.

#### Control Board and Routing Engine

Dual redundant Control Board and Routing Engines (CB-REs) run the 64-bit Junos OS and support routing protocol processing, router interface control, and control plane functions such as chassis component, system management, and user access to the router. These processes run on top of a kernel that interacts with the Packet Forwarding Engine (PFE) on Modular Port Concentrators (MPCs) via dedicated high-bandwidth management channels, providing a clean separation of the control and forwarding planes.

#### Power

The MX2000 power and thermal subsystems use advanced technology to optimize power efficiency without sacrificing scale or features. The power subsystem has a highly resilient architecture for full power supply and power cable feed redundancy. MX2000 routers are available with -48 V DC or AC power (in Delta or Wye 3-phase configuration) and allow power to be added to the rack as needed.

#### Modular Port Concentrators

Modular Port Concentrators (MPCs) provide comprehensive routing, switching, inline services, subscriber management, and advanced hierarchical quality of service (HQoS) to address the widest set of network and service applications. Some MPCs provide network connectivity directly; others host Modular Interface Cards (MICs) that allow users to mix-and-match interfaces.

The MPC11E, powered by the fifth-generation Trio chipset called Penta, delivers 4 Tbps per slot and provides near-infinite hardware programmability that addresses future innovative protocols. Optimized for speeds above 100GbE, the MPC11E provides 400GbE-ready ports with multi-rate QSFP56DD interfaces for seamless 100GbE to 400GbE upgrades. The MPC11E offers industry-first support of native MACsec and IPsec encryption that can originate and terminate thousands of IPsec sessions with no impact on performance. The technology recalibrates network economics, keeping up with increasing bandwidth demands while being backward-compatible with all prior functionality.

The MPC6E, MPC8E and MPC9E are specifically designed to take advantage of the ultra-high fabric capacity of the MX2000 line. Powered by the programmable Junos Trio chipset, these MPCs offer extremely high 10GbE, 40GbE and 100GbE port densities with line-rate performance. These MPCs also stream telemetry for performance management and billing purposes.

An adapter card<sup>4</sup> allows the use of the MPC1 through MPC5, as well as the MPC7E, in the MX2000 line, protecting existing MPC investments. The MX2000 platforms provide per-port line-rate MACsec encryption and decryption at 10GbE, 40GbE, and 100GbE speeds with no fragmentation impact, providing an inexpensive and simple mechanism for securing L2 communications. The MX2K-MPC11E line card delivers 4 Tbps per slot throughput, and MACsec can be selectively enabled on each interface at 10GbE, 40GbE, and 100GbE speeds. The MX2K-MPC9E and MX2K-MPC8E line cards with the MIC-MACSEC-MRATE pluggable MIC can selectively provide MACsec encryption on 10GbE, 40GbE, and 100GbE speeds. The MPC7E-10G line card offers another option for achieving native 10GbE density with MACsec capability on the MX2000 line of routers.

MS-MPCs, which also require an adapter card for use in the MX2000 line, provide dedicated processing for Network Edge Services (CGN, IPsec, stateful firewall, deep packet inspection [DPI], monitoring, and other compute-intensive services) and efficiently integrate these services directly on the MX2000 platforms at scale and without impacting forwarding performance. MS-MPCs also reduce dependence on appliances and the layers of complexity they add to the operations environment.

#### Junos Operating System

Junos is a reliable, high-performance, modular network operating system that is supported across all of Juniper Networks physical and virtual routing, switching, and security platforms, reducing the cost, complexity, and resources required to implement and maintain the network. With secure programming interfaces, the Juniper Extension Toolkit and versatile scripting support, and integration with popular orchestration frameworks, Junos OS offers flexible options for continuous delivery and DevOps style management that helps service providers of all types unlock more value from the network.

For more details on Junos OS, please visit [www.juniper.net/us/en/products-services/nos/junos/](http://www.juniper.net/us/en/products-services/nos/junos/)

<sup>4</sup> To provide optimal air flow and maximize interface density, MX2000 line MPC slots are wider than the MPC slots on the MX240, MX480, and MX960. An Adapter Card enables MPC1 through MPC5, MPC7 and MSMPC use in the MX2000 line; these cards require no configuration and are visible in the system inventory from the CLI.

## Features and Benefits

### Industry-Leading Scale, Capacity, and Density

The MX2000 line offers extremely high capacity (see Table 1).

Table 1. MX2000 System Overview

|                   | MX2008  | MX2010  | MX2020  |
|-------------------|---------|---------|---------|
| Slots             | 10      | 10      | 20      |
| Per slot capacity | 4 Tbps  | 4 Tbps  | 4 Tbps  |
| System throughput | 40 Tbps | 40 Tbps | 80 Tbps |

The MPC11E, powered by the Penta chipset, delivers dense 100GbE aggregation in a monolithic cost-optimized design. Taking advantage of the SFB3 switch fabric card that enables 4 Tbps per slot, the MX2000 line with the MPC11E provides industry-leading 100GbE and 400GbE port density (see Table 2).

Table 2. MX2000 Maximum Line-Rate Port Density with MPC11E

|        | Per MPC | MX2020 | MX2010 |
|--------|---------|--------|--------|
| 100GbE | 40      | 800    | 400    |
| 400GbE | 8       | 160    | 80     |

The MPC11E line card comes with [Flex licensing](#), which allows for flexible deployment of software features on an as-needed basis. For applications not requiring extremely high throughput, the MPC9E line card leverages the high fabric capacity of the MX2000 to offer dense 10GbE and 40GbE ports with line-rate performance (see Table 3).

Table 3. MX2000 Maximum Line-Rate Port Density with MPC9E

|        | Per MPC | MX2020 | MX2010 | MX2008 |
|--------|---------|--------|--------|--------|
| 10GbE  | 96      | 1,920  | 960    | 960    |
| 40GbE  | 24      | 480    | 240    | 240    |
| 100GbE | 16      | 320    | 160    | 160    |

### Unmatched Network Availability

The MX2000 line of Universal Routing Platforms offers a broad set of hardware and software features that together ensure nonstop network availability. The MX2000 line supports N+1 fabric redundancy, control plane redundancy, N+N power feed redundancy, and even N+1 power supply module redundancy. In addition, Virtual Chassis technology supports chassis-level redundancy while allowing users to manage two routers as a single element. Juniper's link aggregation group (LAG) implementation also supports stateful card and port redundancy, as well as subscriber and session persistence.

From a software perspective, Junos OS runs each program independently in its own protected memory space, ensuring individual processes do not interfere with one another. Unified ISSU permits non-disruptive OS upgrades, while Junos Continuity allows new hardware to be added to an MX Series router with the addition of a simple plug-in package, which is installed fully in service without any interruption.

### Embedded Element-Layer Analytics

The programmable Trio chipsets provide the power to monitor and collect data at the component level, and use the Junos Telemetry Interface to stream this data in a scalable manner into monitoring, analytics, and performance management applications (see Figure 1), and to Path Computation Elements such as Juniper Networks NorthStar Controller.

This information will help identify current and trending congestion, resource utilization, traffic volume, latency and delay, which network operators can use to detect issues, make informed decisions on network design, optimization and investment.

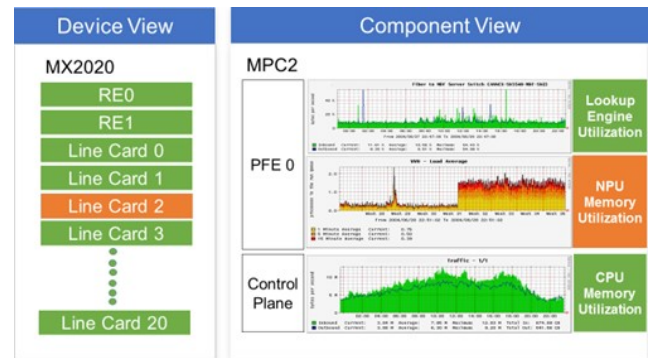


Figure 1: Visualized analytics derived from an MX2020 router and MPCs

### Integrated Network Edge Services

Hosting Network Edge Services directly on MX2000 routers—without impacting routing or forwarding performance—helps streamline operations and reduce TCO by consolidating and eliminating service-specific appliances as well as their operating systems and management systems.

Juniper's Network Edge Services portfolio includes:

- Junos Subscriber Aware, which allows per-subscriber traffic steering, policy enforcement, and accounting
- Junos Application Aware, which allows L4-L7 traffic identification, policy-based traffic handling, and accounting
- Junos Address Aware, which conserves the IPv4 address pool, ensures IPv4/IPv6 coexistence, and aids in the transition to IPv6
- Junos Network Secure, which provides stateful firewall services for network protection and managed security
- Junos VPN Site Secure, which uses standard encryption modes to secure communications over access networks, and for added security over L3 VPNs
- Junos Traffic Vision, which provides the granular traffic visibility needed to improve network efficiency, increase security, and support operational tasks

- Junos Video Focus, which provides standards-based video monitoring and automatic issue mitigation to ensure high-quality customer experiences
- Junos Web Aware, a powerful application that tracks HTTP requests and responses, and enables tag insertion and header enrichment
- Junos L4 Load Balancer, a hybrid traffic load balancer based on advanced Junos OS capabilities that increases network efficiency

Network Edge Services are optional and licensed individually; the MX2000 routers can host multiple services concurrently.

For more details on network edge services, see

[www.juniper.net/us/en/products-services/network-edge-services/](http://www.juniper.net/us/en/products-services/network-edge-services/)

### Outstanding Power Design and Efficiency

The MX2000 line sets the bar for edge router power design and efficiency, increasingly important considerations for Cloud-Grade Networks.

At the system level, power can be flexibly provisioned to meet site-specific environmental conditions, and less power can be provisioned in facilities that consistently operate at < 25C, providing significant operational savings. Power consumption is also dynamically managed based on actual hardware configuration; additional power is only allocated when a MIC is installed versus pre-provisioning power for worst-case scenarios. Additionally, fan speed is dynamically governed by actual temperature monitoring; at ambient temperature, fans consume only 20 percent of their maximum power.

Juniper has also implemented power optimizations at the silicon level. "Clock gating" reduces dynamic power dissipation by disabling unused logic circuitry; unused memory is also dynamically placed in "sleep mode" to conserve power.

These optimizations, when coupled with Juniper's most advanced MPCs and optics, enable the MX2000 line to achieve an incredible power-to-throughput efficiency ratio of 0.25W/GbE; this means the MX2020 consumes just one quarter of a watt to forward 1GB of traffic.

### Addresses Broadest Set of Service Provider Applications

#### Broadband Edge

The MX2000 line offers powerful Broadband Network Gateway (BNG) features that allow broadband services to be provisioned for today and tomorrow. The MX2000 line supports the highest subscriber density and the most sophisticated broadband edge features, including hierarchical quality of service (HQoS), support for Point-to-Point Protocol (PPP) subscriber termination, Dynamic Host Configuration Protocol (DHCP), IPv4/IPv6 local server, and relay proxy for subscriber migration to DHCP access models.

Juniper's BNG also supports hierarchical queuing, granular QoS, and dynamic multilayer service activation, RADIUS, and diameter support for backend server integration to facilitate authentication, policy control, and accounting, as well as support for flexible L2/L3 wholesale models.

#### Business Edge

The MX2000 line of routers includes a comprehensive VPN toolkit to support feature-rich, standards-based, secure internetworking for innovative business services. In addition to basic L2/L3 VPN and VPLS support, the MX2000 line offers enhanced VPN services such as QoS-prioritized VPN traffic for voice and video, VPN-aware multicast and firewall services that leverage technologies such as LDP-BGP / VPLS internetworking, point-to-multipoint label-switched paths (P2MP LSPs), BGP-based multicast L3VPN, L2 VPN internetworking to connect dissimilar L2 access networks, MPLS plug-and-play, and IPsec/generic routing encapsulation (GRE) VPNs.

#### IP Core

The feature-rich MX2000 line of routers is ideal for core, consolidated edge/core, and peering applications. Key features include high system capacity, high FIB scale, high-density 400GbE interfaces as well as DWDM and IP/optical support, inline video monitoring, and node virtualization. Additionally, Junos OS supports Source Packet Routing in Networking (SPRING, RFC 7855), which enables a trusted source node to specify a forwarding route other than the normal shortest path that a particular packet will traverse.

#### Metro Ethernet

The MX2000 line of routers provides outstanding support for metro and aggregation networks by offering a full suite of routing and switching features, allowing network operators to choose a deployment model that fits their business and technical needs. The MX2000 line can be deployed as IP/IP VPN edge routers, Ethernet VPN (E-VPN) and VPLS provider edge routers (VPLS-PE), MPLS label-switching routers (LSR), and as Layer 2 Ethernet switches or Layer 3 IP routers.

#### Universal SDN Gateway

The MX2000 routers are ideal universal SDN gateways, interconnecting virtual and physical networks and virtual networks operating with different technologies. Key enabling features include support for Multiprotocol BGP (MBGP), dynamic tunnels using MPLS-over-GRE or VXLAN encapsulation, virtual routing and forwarding (VRF) tables or E-VPNs, and Netconf, as well as mechanisms to send traffic between VRF and global routing tables based on configuration and policy.

## Service Control Gateway

The MX2000 line provides an excellent foundation for the Service Control Gateway, an advanced solution that considers network state, application type, subscriber privilege, and operator policy to deliver networked services. Leveraging Junos Application Aware, which uses deep-packet inspection techniques to identify and classify traffic on a per application basis, and Junos Subscriber Aware, which associates traffic flows with the subscriber that generated them, the Service Control Gateway supports differentiated service creation and delivery, and when used with Contrail Cloud Platform, can create and dynamically direct traffic into complex service chains.

For more information on the Service Control Gateway, see [www.juniper.net/assets/us/en/local/pdf/datasheets/1000540-en.pdf](http://www.juniper.net/assets/us/en/local/pdf/datasheets/1000540-en.pdf).



## Specifications and Approvals

This section lists basic specifications by platform. For full details, please refer to the hardware installation manuals at [www.juniper.net/techpubs/en\\_US/release-independent/junos/information-products/pathway-pages/mx-series/](http://www.juniper.net/techpubs/en_US/release-independent/junos/information-products/pathway-pages/mx-series/).

Table 4. MX2020, MX2010 and MX2008 Physical Specifications

| Specification                      | MX2020  | MX2010  | MX2008  |
|------------------------------------|---|---|---|
| Physical dimensions (H x D x W) in | 78.75 x 36.2 x 17.5<br>(200 x 91.95 x 44.45 cm) | 59.5 x 36.2 x 17.5 in<br>(151.1 x 91.95 x 44.45 cm) | 42 x 34.5 x 17.37 in<br>(106.68 x 87.63 x 44.13 cm) |
| Airflow                            | Front to back                                   | Front to back                                       | Front to back                                       |
| Number of fan trays                | 4   | 4   | 2   |
| Approximate maximum weight         | 1,500 lbs<br>(680.39 kg)                        | 1,000 lbs<br>(453.59 kg)                            | 915 lbs (415.04 kg)                                 |
| System mounting                    | Four-post rack mounting                         | Four-post rack mounting                             | Four-post rack mounting                             |
| Rack units                         | 45  | 34  | 24  |

## Juniper Networks Services and Support

Juniper Networks is the leader in performance-enabling services that are designed to accelerate, extend, and optimize your high-performance network. Our services allow you to maximize operational efficiency while reducing costs and minimizing risk, achieving a faster time to value for your network. Juniper Networks ensures operational excellence by optimizing the network to maintain required levels of performance, reliability, and availability. For more details, please visit [www.juniper.net/us/en/products-services](http://www.juniper.net/us/en/products-services).

## Ordering Information

| Product Number                        | Description   |
|---------------------------------------|---|
| <b>Premium and Base Units, Spares</b> |   |
| MX2020-BASE-AC                        | 20 slot MX2020 chassis, base bundle with 1 Routing Engine, SFBs, fan trays, AC power            |
| MX2020-BASE-DC                        | 20 slot MX2020 chassis, base bundle with 1 Routing Engine, SFBs, fan trays, DC power            |
| MX2010-BASE-AC                        | 10 slot MX2010 chassis, base bundle with 1 Routing Engine, SFBs, fan trays, AC power            |
| MX2010-BASE-DC                        | 10 slot MX2010 chassis, base bundle with 1 Routing Engine, SFBs, fan trays, DC power            |
| MX2008-BASE                           | 10 slot MX2008 chassis, base bundle with 1 Routing Engine, SFBs, fan trays                      |
| MX2020-PREMIUM-AC                     | 20 slot MX2020 chassis, premium bundle with redundant Routing Engine, SFBs, fan trays, AC power |
| MX2020-PREMIUM-DC                     | 20 slot MX2020 chassis, premium bundle with redundant Routing Engine, SFBs, fan trays, DC power |
| MX2010-PREMIUM-AC                     | 10 slot MX2010 chassis, premium bundle with redundant Routing Engine, SFBs, fan trays, AC power |
| MX2010-PREMIUM-DC                     | 10 slot MX2010 chassis, premium bundle with redundant Routing Engine, SFBs, fan trays, DC power |
| MX2008-PREMIUM                        | 10 slot MX2008 chassis, premium bundle with redundant Routing Engine, SFBs, fan trays           |
| MX2020-PREMIUM2-AC                    | 20 slot MX2020 premium 2 chassis with optimized AC power  |
| MX2020-PREMIUM2-DC                    | 20 slot MX2020 premium 2 chassis with optimized DC power  |
| MX2010-PREMIUM2-AC                    | 10 slot MX2010 premium 2 chassis with optimized AC power  |
| MX2010-PREMIUM2-DC                    | 10 slot MX2010 premium 2 chassis with optimized DC power  |
| CHAS-BP-MX2020-S                      | 20 slot MX2020 chassis with backplane installed, spare  |
| CHAS-BP-MX2010-S                      | 10 slot MX2010 chassis with backplane installed, spare  |
| CHAS-MX2008-BB                        | 10 slot MX2008 chassis with backplane installed, base   |
| CHAS-MX2008-S                         | 10 slot MX2008 chassis with backplane installed, spare  |



| Product Number                     | Description  |
|------------------------------------|--|
| <b>Routing Engines (REs)</b>       |  |
| REMX2K-X8-64G-BB                   | Routing Engine and control board, 8 Core 2.3 GHz per CPU with 64 GB memory, base bundle for MX2010 and MX2020                              |
| REMX2008-X8-64G-BB                 | Routing Engine and Control Board, 8 Core, 2.1 GHz per CPU with 64 GB memory, base bundle for MX2008  |
| REMX2K-X8-64G-R                    | Routing Engine and control board, 8 Core 2.3 GHz per CPU with 64 GB memory, redundant for MX2010 and MX2020                                |
| REMX2K-X8-64G-S                    | Routing Engine and control board, 8 Core 2.3 GHz per CPU with 64 GB memory, spare for MX2010 and MX2020                                    |
| REMX2008-X8-64G-R                  | Routing Engine and Control Board, 8 Core, 2.1 GHz per CPU with 64 GB memory, redundant for MX2008  |
| REMX2008-X8-64G-S                  | Routing Engine and Control Board, 8 Core, 2.1 GHz per CPU with 64 GB memory, spare for MX2008  |
| REMX2008-X8-64G-LT                 | Routing Engine and Control Board, 8 Core, 2.1 GHz per CPU with 64 GB memory, limited encryption version, spare for MX2008                  |
| REMX2K-X8-64G-LT-B                 | Routing Engine and control board, 8 Core 2.3 GHz per CPU with 64 GB memory, limited encryption version, base bundle, for MX2010 and MX2020 |
| REMX2K-X8-64G-LT-R                 | Routing Engine and control board, 8 Core 2.3 GHz per CPU with 64 GB memory, limited encryption version, redundant, for MX2010 and MX2020   |
| REMX2K-X8-64G-LT-S                 | Routing Engine and control board, 8 Core 2.3 GHz per CPU with 64 GB memory, limited encryption version, spare, for MX2010 and MX2020       |
| REMX2008X864GLT-BB                 | Routing Engine and Control Board, 8 Core, 2.1 GHz per CPU with 64 GB memory, limited encryption version, base bundle for MX2008            |
| REMX2008X864GLT-R                  | Routing Engine and Control Board, 8 Core, 2.1 GHz per CPU with 64 GB memory, limited encryption version, redundant for MX2008              |
| REMX2008-X8-128G                   | Routing Engine and Control Board, 8 Core, 2.1 GHz per CPU with 128 GB memory, spare for MX2008   |
| REMX2008-X8-128G-BB                | Routing Engine and Control Board, 8 Core, 2.1 GHz per CPU with 128 GB memory, base bundle for MX2008                                       |
| REMX2008-X8-128G-R                 | Routing Engine and Control Board, 8 Core, 2.1 GHz per CPU with 128 GB memory, redundant for MX2008   |
| REMX2K-1800-32G-BB                 | Routing Engine and control board, Quad Core 1.8 GHz with 32 GB memory, base bundle for MX2010 and MX2020                                   |
| REMX2K-1800-32G-R                  | Routing Engine and control board, Quad Core 1.8 GHz with 32 GB memory, redundant option for MX2010 and MX2020                              |
| REMX2K-1800-32G-S                  | Routing Engine and control board, Quad Core 1.8 GHz with 32 GB memory, spare for MX2010 and MX2020   |
| REMX2K-1800-32G-WB                 | Routing Engine and control board, Quad Core 1.8 GHz with 32 GB memory, worldwide version, base bundle for MX2010 and MX2020                |
| REMX2K-1800-32G-WR                 | Routing Engine and control board, Quad Core 1.8 GHz with 32 GB memory, worldwide version, redundant for MX2010 and MX2020                  |
| REMX2K-1800-32G-WS                 | Routing Engine and control board, Quad Core 1.8 GHz with 32 GB memory, worldwide version, spare for MX2010 and MX2020                      |
| RE-MX2000-1800x4-S                 | Routing Engine and control board, Quad Core 1.8 GHz with 16 GB memory, spare for MX2010 and MX2020   |
| RE-MX2000-1800x4-BB                | Routing Engine and control board, Quad Core 1.8GHz with 16 GB memory, base bundle for MX2010 and MX2020                                    |
| RE-MX2000-1800x4-R                 | Routing Engine and control board, Quad Core 1.8 GHz with 16 GB memory, redundant option for MX2010 and MX2020                              |
| RE-MX2000-1800x4-WW-S              | Routing Engine and control board, Quad Core 1.8 GHz with 16 GB memory, worldwide version, spare for MX2010 and MX2020                      |
| <b>Switch Fabric Boards (SFBs)</b> |  |
| MX2000-SFB3-BB                     | Enhanced switch fabric board, base bundle for MX2010 and MX2020  |

| Product Number                  | Description  |
|---------------------------------|--|
| MX2000-SFB3-R                   | Enhanced switch fabric board, redundant option for MX2010 and MX2020   |
| MX2000-SFB3-S                   | Enhanced switch fabric board, spare for MX2010 and MX2020  |
| MX2000-SFB2-BB                  | Enhanced switch fabric board, base bundle for MX2010 and MX2020  |
| MX2000-SFB2-R                   | Enhanced switch fabric board, redundant option for MX2010 and MX2020   |
| MX2000-SFB2-S                   | Enhanced switch fabric board, spare for MX2010 and MX2020  |
| MX2008-SFB2-BB                  | Enhanced switch fabric board, base bundle for MX2008   |
| MX2008-SFB2-R                   | Enhanced switch fabric board, redundant option for MX2008  |
| MX2000-SFB-BB                   | Switch fabric board, base bundle for MX2010 and MX2020   |
| MX2000-SFB-R                    | Switch fabric board, redundant option for MX2010 and MX2020  |
| MX2000-SFB-S                    | Switch fabric board, spare for MX2010 and MX2020   |
| <b>MPCs</b>                     |  |
| MX2K-MPC11E-BASE                | Multirate line card supporting 10/40/100/400GbE interfaces. Requires Flex Advanced or Premium license.   |
| MX2K-MPC9E                      | 2-slot modular line card; includes full-scale L2/L2.5 and reduced scale L3 features. Interface cards sold separately.  |
| MX2K-MPC9E-RB                   | 2-slot modular line card bundle; includes full-scale L3, L2 and L2.5 features. Interface cards sold separately.  |
| MX2K-MPC9E-IRB                  | 2-slot modular line card bundle; includes full-scale L2/L2.5 and L3 features and up to 16 L3VPN instances per card. Interface cards sold separately.   |
| MX2K-MPC9EQ-B                   | 2-slot modular line card bundle; includes full-scale L2/L2.5 and reduced scale L3 features, full scale per-VLAN queuing, and H-QoS. Interface cards sold separately.                         |
| MX2K-MPC9EQ-RB                  | 2-slot modular line card bundle; includes full-scale L3, L2 and L2.5 features, full scale per-VLAN queuing, and H-QoS. Interface cards sold separately.                                      |
| MX2K-MPC9EQ-IRB                 | 2-slot modular line card bundle; includes full-scale L2/L2.5 and L3 features and up to 16 L3VPN instances per card, full-scale per-VLAN queuing, and H-QoS. Interface cards sold separately. |
| MX2K-MPC8E                      | 2-slot modular line card; includes full-scale L2/L2.5 and reduced scale L3 features. Interface cards sold separately.  |
| MX2K-MPC8E-RB                   | 2-slot modular line card bundle; includes full-scale L3, L2 and L2.5 features. Interface cards sold separately.  |
| MX2K-MPC8E-IRB                  | 2-slot modular line card bundle; includes full-scale L2/L2.5 and L3 features and up to 16 L3VPN instances per card. Interface cards sold separately.   |
| MX2K-MPC8EQ-B                   | 2-slot modular line card bundle; includes full-scale L2/L2.5 and reduced scale L3 features, full scale per-VLAN queuing, and H-QoS. Interface cards sold separately.                         |
| MX2K-MPC8EQ-RB                  | 2-slot modular line card bundle; includes full-scale L3, L2 and L2.5 features, full-scale per-VLAN queuing, and H-QoS. Interface cards sold separately.                                      |
| MX2K-MPC8EQ-IRB                 | 2-slot modular line card bundle; includes full-scale L2/L2.5 and L3 features and up to 16 L3VPN instances per card, full-scale per-VLAN queuing, and H-QoS. Interface cards sold separately. |
| MX2K-MPC6E                      | MPC6E, supports any two MIC6 cards.  |
| MX2K-MPC6E-IRB                  | MPC6E line card bundle supports any two MIC6 cards with full-scale L2/L2.5, L3 features and up to 16 L3VPN instances.  |
| MX2K-MPC6E-RB                   | MPC6E line card bundle supports any two MIC6 cards with full-scale L2/L2.5, L3 features and L3VPN features.  |
| <b>MX2000 Line Adapter Card</b> |  |
| MX2000-LC-ADAPTER               | MPC adapter, required when using MPC1s through MPC5s, MPC7s and MS-MPC ins MX2000  |

| Product Number   | Description  | Product Number         | Description   |
|--|--|------------------------|---|
| <b>MX Series MPCs (require MX2000-LC-ADAPTER card for use in MX2000)</b> |  |                        |   |
| MPC7E-10G  | 40x10GbE SFP+ port line card. Price includes full-scale L2/L2.5 and reduced scale L3 features. Optics sold separately.   | MPC4E-3D-2CGE-8XGE-IRB | Fixed 2x 100GbE and 8x 10GbE line card bundle with full scale L2/L2.5, L3 features, up to 16 L3VPNs   |
| MPC7E-10G-RB   | 40x10GbE SFP+ port line card bundle. Price includes full-scale L3, L2 and L2.5 features. Optics sold separately.   | MPC4E-3D-32XGE-IRB     | Fixed 32x 10GbE SFPP line card bundle with full scale L2/L2.5, L3 features, up to 16 L3VPNs   |
| MPC7E-10G-IRB  | 40x10GbE SFP+ port line card bundle. Price includes full-scale L2/L2.5 and L3 features and up to 16 L3VPN instances per card. Optics sold separately.  | MPC4E-3D-2CGE8XGE-RB   | Fixed 2x 100GbE and 8x 10GbE line card bundle with full scale L2/L2.5, L3 and L3VPN features  |
| MPC7EQ-10G-B   | 40x10GbE SFP+ port line card bundle. Price includes full-scale L2/L2.5 and reduced-scale L3 features, full-scale per-VLAN queuing and H-QoS. Optics sold separately.                                     | MPC4E-3D-32XGE-RB      | Fixed 32x GbE SFPP line card bundle with full scale L2/L2.5, L3 and L3VPN features  |
| MPC7EQ-10G-RB  | 40x10GbE SFP+ port line card bundle. Price includes full-scale L3, L2 and L2.5 features, full-scale per-VLAN queuing and H-QoS. Optics sold separately.  | MX-MPC3E-3D            | MPC3 with support for 100GbE, 40GbE, and 10GbE interfaces, L2.5 features, optics sold separately  |
| MPC7EQ-10G-IRB   | 40x10GbE SFP+ port line card bundle. Price includes full-scale L2/L2.5 and L3 features and up to 16 L3VPN instances per card, full scale per-VLAN queuing and H-QoS. Optics sold separately.             | MX-MPC3E-3D-R-B        | MPC3E with support for 100GbE, 40GbE, and 10GbE interfaces, includes full scale L2, L3, L3VPN features, optics sold separately  |
| MPC7E-MRATE-RB   | 12xQSFP+/QSFP28 multirate port line card bundle. Price includes full-scale L3, L2 and L2.5 features. Optics sold separately.   | MPC3E-3D-NG            | Next-generation MPC3E with upgraded CPU and memory. Offers full feature parity with MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5 and reduced scale L3 features. Flexible queuing option enables hierarchical QoS support with up to 32,000 total queues. Supports all MICs supported by MPC1E, MPC2E, and MPC3E.  |
| MPC7EQ-MRATE-B   | 12xQSFP+/QSFP28 multirate port line card bundle. Price includes full-scale L2/L2.5 and reduced scale L3 features, full-scale per-VLAN queuing and H-QoS. Optics sold separately.                         | MPC3E-3D-NG-IR-B       | Next-generation MPC3E line card bundle with upgraded CPU and memory. Offers full feature parity with the MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5 and L3 features and up to 16 L3VPNs per MPC. Flexible queuing option enables hierarchical QoS support with up to 32,000 total queues. Supports all MICs supported by the MPC1E, MPC2E, and MPC3E. |
| MPC7EQ-MRATE-RB  | 12xQSFP+/QSFP28 multirate port line card bundle. Price includes full-scale L3, L2 and L2.5 features, full-scale per-VLAN queuing and H-QoS. Optics sold separately.                                      | MPC3E-3D-NG-R-B        | Next-generation MPC3E line card bundle with upgraded CPU and memory. Offers full feature parity with the MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5, L3 and L3VPN features. Flexible queuing option enables hierarchical QoS support with up to 32,000 total queues. Supports all MICs supported by the MPC1E, MPC2E, and MPC3E.                      |
| MPC7EQ-MRATE-IRB   | 12xQSFP+/QSFP28 multirate port line card bundle. Price includes full-scale L2/L2.5 and L3 features and up to 16 L3VPN instances per card, full-scale per-VLAN queuing and H-QoS. Optics sold separately. | MPC3E-3D-NG-Q          | Next-generation MPC3E with upgraded CPU and memory. Offers full feature parity with the MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5 features, reduced scale L3 features, and hierarchical QoS with up to 512,000 queues per slot. Supports all MICs supported by the MPC1E, MPC2E, and MPC3E.  |
| MPC5E-100G10G  | Fixed 2x 100GbE and 4x 10GbE line card bundle with full scale L2/L2.5 and reduced scale L3 features, optional license permits up to 32,000 queues with HQoS.   | MPC3E-3D-NG-Q-IR-B     | Next-generation MPC3E line card bundle with upgraded CPU and memory. Offers full feature parity with the MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5, L3 and up to 16 L3VPN features, and hierarchical QoS with up to 512,000 queues per slot. Supports all MICs supported by the MPC1E, MPC2E, and MPC3E.   |
| MPC5E-100G10G-IRB  | Fixed 2x 100GbE and 4x 10GbE line card bundle with full scale L2/L2.5, L3 features and up to 16 L3VPN instances, optional license permits up to 32,000 queues with HQoS.                                 | MPC3E-3D-NG-Q-R-B      | Next-generation MPC3E line card bundle with upgraded CPU and memory. Offers full feature parity with the MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5 features, L3 features, and hierarchical QoS with up to 512,000 queues per slot. Supports all MICs supported by the MPC1E, MPC2E, and MPC3E.   |
| MPC5E-100G10G-RB   | Fixed 2x 100GbE and 4x 10GbE line card bundle with full scale L2/L2.5, L3 and L3VPN features, optional license permits up to 32,000 queues with HQoS.  | MPC3E-3D-NG-Q-R-B      | Next-generation MPC3E line card bundle with upgraded CPU and memory. Offers full feature parity with the MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5 features, L3 features, and hierarchical QoS with up to 512,000 queues per slot. Supports all MICs supported by the MPC1E, MPC2E, and MPC3E.   |
| MPC5E-40G10G   | Fixed 6x 40GbE or 24x 10GbE line card bundle with full scale L2/L2.5 and reduced scale L3 features, optional license permits up to 32,000 queues with HQoS.  | MPC3D-16XGE-SFPP       | Fixed 16x 10GbE line card bundle with L2.5 features   |
| MPC5E-40G10G-IRB   | Fixed 6x 40GbE or 24x 10GbE line card bundle with full scale L2/L2.5, L3 features and up to 16 L3VPN instances, optional license permits up to 32,000 queues with HQoS.                                  | MPC3D-16XGE-SFPP-R-B   | Fixed 16x 10GbE GbE line card bundle with full scale L2/L2.5 and L3 features  |
| MPC5EQ-100G10G   | Fixed 2x 100GbE and 4x 10GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full scale L2/L2.5 and reduced scale L3 features.                                      | MPC2E-3D-NG            | Next-generation MPC2E with upgraded CPU and memory. Offers full feature parity with the MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5 and reduced scale L3 features. Flexible queuing option enables hierarchical QoS support with up to 32,000 total queues. Supports all MICs supported by MPC1E and MPC2E.  |
| MPC5EQ-100G10G-IRB   | Fixed 2x 100GbE and 4x 10GbE GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full scale L2/L2.5, L3 features and up to 16 L3VPN instances.                      | MPC2E-3D-NG-IR-B       | Next-generation MPC2E line card bundle with upgraded CPU and memory. Offers full feature parity with MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5, L3 features and up to 16 L3VPNs per MPC. Flexible queuing option enables hierarchical QoS support with up to 32,000 total queues. Supports all MICs supported by MPC1E and MPC2E.                    |
| MPC5EQ-100G10G-RB  | Fixed 2x 100GbE and 4x 10GbE GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full scale L2/L2.5, L3 and L3VPN features.   | MPC2E-3D-NG-R-B        | Next-generation MPC2E line card bundle with upgraded CPU and memory. Offers full feature parity with MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5, L3 and L3VPN features. Flexible queuing option enables hierarchical QoS support with up to 32,000 total queues. Supports all MICs supported by MPC1E and MPC2E.                                      |
| MPC5EQ-40G10G  | Fixed 6x 40GbE or 24x 10GbE GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full scale L2/L2.5 and reduced scale L3 features.                                   |                        |   |
| MPC5EQ-40G10G-IRB  | Fixed 6x 40GbE or 24x 10GbE GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full scale L2/L2.5, L3 features and up to 16 L3VPN instances.                       |                        |   |
| MPC5EQ-40G10G-RB   | Fixed 6x 40GbE or 24x 10GbE GbE line card bundle with HQoS; supports 1 million queues and 128,000 sessions; includes full scale L2/L2.5, L3 and L3VPN features.  |                        |   |
| MPC4E-3D-2GE   | Fixed 2x 100GbE and 8x 10GbE line card bundle with full scale L2/L2.5 and reduced scale L3 features  |                        |   |

| Product Number      | Description   |
|---------------------|---|
| MPC2E-3D-NG-Q       | Next-generation MPC2E with upgraded CPU and memory. Offers full feature parity with MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5, and reduced scale L3 features, and hierarchical QoS with up to 512,000 queues per slot. Supports all MICs supported by MPC1E and MPC2E.                   |
| MPC2E-3D-NG-Q-IR-B  | Next-generation MPC2E line card bundle with upgraded CPU and memory. Offers full feature parity with MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5, L3 and up to 16 L3VPN features, and hierarchical QoS with up to 512,000 queues per slot. Supports all MICs supported by MPC1E and MPC2E. |
| MPC2E-3D-NG-Q-R-B   | Next-generation MPC2E line card bundle with upgraded CPU and memory. Offers full feature parity with MPC1E, MPC2E, and MPC3E. Includes full scale L2/L2.5, L3 features, and hierarchical QoS with up to 512,000 queues per slot. Supports all MICs supported by MPC1E and MPC2E.                    |
| MX-MPC2-3D          | MPC2 with port queuing; includes full scale L2/L2.5 and reduced scale L3 features   |
| MX-MPC2-3D-EQ       | MPC2 line card bundle with per-IFL HQoS, 512,000 queues; includes full scale L2/L2.5 and reduced scale L3 features  |
| MX-MPC2-3D-EQ-R-B   | MPC2 line card bundle with per-IFL HQoS, 512,000 queues; includes full scale L3, L2 and L2.5 features   |
| MX-MPC2-3D-Q        | MPC2 line card bundle with per-IFL HQoS, 256,000 queues (max 128,000 egress); includes full scale L2/L2.5 and reduced scale L3 features   |
| MX-MPC2-3D-Q-R-B    | MPC2 line card bundle; includes full scale L3, L2, and L2.5 features  |
| MX-MPC2-3D-R-B      | MPC2 line card bundle; includes full scale L3, L2, and L2.5 features  |
| MX-MPC2E-3D         | Enhanced MPC2 with port queuing; includes full scale L2/L2.5 and reduced scale L3 features  |
| MX-MPC2E-3D-EQ      | Enhanced MPC2 with per-IFL HQoS, 512,000 queues; includes full scale L2/L2.5 and reduced scale L3 features  |
| MX-MPC2E-3D-EQ-R-B  | Enhanced MPC2 line card bundle; includes full scale L3, L2, and L2.5 features   |
| MX-MPC2E-3D-P       | Enhanced MPC2 with 1588v2, port queuing; includes full scale L2/L2.5 and reduced scale L3 features  |
| MX-MPC2E-3D-P-Q-B   | Enhanced MPC2 line card bundle; includes 1588v2, per-IFL HQoS, 256,000 queues (maximum 128,000 egress), full scale L2/L2.5 and reduced scale L3 features  |
| MX-MPC2E-3D-P-Q-R-B | Enhanced MPC2 line card bundle; includes 1588v2, per-IFL HQoS, 256,000 queues (maximum 128,000 egress), full scale L3, L2, and L2.5 features  |
| MX-MPC2E-3D-P-R-B   | Enhanced MPC2 line card bundle; includes 1588v2, full scale L3, L2, and L2.5 features   |
| MX-MPC2E-3D-Q       | Enhanced MPC2 line card bundle, includes per-IFL HQoS, 256,000 queues (maximum 128,000 egress); includes full scale L2/L2.5 and reduced scale L3 features   |
| MX-MPC2E-3D-Q-R-B   | Enhanced MPC2E line card bundle; includes per-IFL HQoS, 256,000 queues (maximum 128,000 egress), full scale L3, L2, and L2.5 features   |
| MX-MPC1-3D          | MPC1 with port queuing; includes full scale L2/L2.5 and reduced scale L3 features   |
| MX-MPC1-3D-Q        | MPC1 with per-IFL HQoS, 128,000 queues (maximum 64,000 egress); includes full scale L2/L2.5 and reduced scale L3 features   |
| MX-MPC1-3D-Q-R-B    | MPC1 line card bundle; includes full scale L3, L2, and L2.5 features  |
| MX-MPC1-3D-R-B      | MPC1 line card bundle; includes full scale L3, L2, and L2.5 features  |
| MX-MPC1E-3D         | Enhanced MPC1 with port queuing; includes full scale L2/L2.5 and reduced scale L3 features  |
| MX-MPC1E-3D-Q       | Enhanced MPC1 with per-IFL HQoS, 128,000 queues (max 64,000 egress); includes full scale L2/L2.5 and reduced scale L3 features  |

| Product Number                    | Description   |
|-----------------------------------|---|
| MX-MPC1E-3D-Q-R-B                 | Enhanced MPC1 with per-IFL HQoS, 128,000 queues (max 64,000 egress) line card bundle; includes full scale L3, L2, and L2.5 features   |
| MX-MPC1E-3D-R-B                   | Enhanced MPC1 line card bundle; includes full scale L3, L2, and L2.5 features   |
| MS-MPC                            | Multiservices MPC supports a variety of optionally licensed applications including Stateful firewall, Carrier-Grade NAT (CGN), and deep packet inspection (DPI); each purchased separately. |
| <b>MICs for MPC6E</b>             |   |
| MIC6-10G                          | 24x 10GbE MIC for MPC6 only   |
| MIC6-100G-CXP                     | 4x 100GbE CXP MIC for MPC6 only   |
| MIC6-10G-OTN                      | 24x 10GbE SFP OTN MIC for MPC6 only; requires S-MIC6-OPT-LIC  |
| MIC6-100G-CFP2                    | 2x 100GbE CFP2 OTN MIC for MPC6 only; requires S-MIC6-OPT-LIC; requires S-MIC6-OPT-LIC  |
| <b>MICs for MPC8E and MPC9E</b>   |   |
| MIC-MRATE                         | 12xQSFP+/QSFP28 multirate port interface card. Optics sold separately.  |
| MIC-MACSEC-MRATE                  | 12xQSFP+/QSFP28 multirate port interface card with built-in MACsec capability. Optics sold separately.  |
| <b>Licenses</b>                   |   |
| S-MIC6-OPT-LIC                    | OTN license for MIC6-10G-OTN and MIC6-100G-CFP2.  |
| <b>Cable Management</b>           |   |
| MX2000-CBL-TOP-S                  | MX2000 line front upper cable manager, spare  |
| MX2000-CBL-BTM-S                  | MX2000 line front lower cable manager, spare  |
| MX2000-CBL-MID-S                  | MX2000 line front middle cable manager, spare   |
| <b>Fan Trays</b>                  |   |
| MX2000-FANTRAY-S                  | MX2000 line fan tray, spare   |
| MX2000-FANTRAY-BB                 | MX2000 line fan tray, base bundle   |
| MX2000-FANTRAY-R                  | MX2000 line fan tray, redundant option  |
| <b>Air Filters</b>                |   |
| MX2020-FLTR-KIT-S                 | MX2020 filter set, containing 1 of each filter required   |
| MX2010-FLTR-KIT-S                 | MX2010 filter set, containing 1 of each filter required   |
| MX2008-FLTR-KIT-S                 | MX2008 filter set, containing 1 of each filter required   |
| <b>Craft Interface</b>            |   |
| MX2020-CRAFT-S                    | Craft interface panel, MX2020 chassis, spare  |
| MX2010-CRAFT-S                    | Craft interface panel, MX2010 chassis, spare  |
| MX2008-CRAFT-S                    | Craft interface panel, MX2008 chassis, spare  |
| <b>Power Distribution Modules</b> |   |
| MX2000-PDM-AC-WYE-S               | MX2000 line 3 phase AC Wye power distribution module, spare   |
| MX2000-PDM-AC-WYE-BB              | MX2000 line 3 phase AC power distribution module, base bundle   |
| MX2000-PDM-AC-WYE-R               | MX2000 line 3 phase AC power distribution module, redundant option  |
| MX2000-PDM-AC-DELTA-S             | MX2000 line 3 phase AC Delta power distribution module, spare   |
| MX2000-PDM-AC-DELTA-BB            | MX2000 line 3 phase AC Delta power distribution module, base bundle   |
| MX2000-PDM-AC-DELTA-R             | MX2000 line 3 phase AC Delta power distribution module, redundant option  |
| MX2000-PDM-DC-S                   | MX2000 line DC power 60 Amp distribution module, spare  |
| MX2000-PDM-DC-R                   | MX2000 line DC power 60 Amp distribution module, spare  |
| MX2K-PDM-AC-1PH-BB                | MX2000 line 1 phase AC power distribution module, base bundle   |
| MX2K-PDM-AC-1PH-S                 | MX2000 line 1 phase AC power distribution module, spare   |



| Product Number    | Description   |
|-------------------|---|
| MX2K-PDM-OP-AC-BB | MX2000 line optimized AC power distribution module, base bundle |
| MX2K-PDM-OP-AC-S  | MX2000 line optimized AC power distribution module, spare       |
| MX2K-PDM-OP-DC-BB | MX2000 line optimized DC power distribution module, base bundle |
| MX2K-PDM-OP-DC-S  | MX2000 line optimized DC power distribution module, spare       |

#### Power Supply Modules

|                  |  |
|------------------|--|
| MX2000-PSM-AC-S  | MX2000 line AC power supply module, spare            |
| MX2000-PSM-AC-BB | MX2000 line power supply module, base bundle         |
| MX2000-PSM-AC-R  | MX2000 line power supply module, redundant option    |
| MX2000-PSM-DC-S  | MX2000 line DC power supply module, spare            |
| MX2000-PSM-DC-BB | MX2000 line DC power supply module, base bundle      |
| MX2000-PSM-DC-R  | MX2000 line DC power supply module, redundant option |

#### Shipping Containers and Miscellaneous

|                   |   |
|-------------------|---|
| MX2020-CHAS-PKG-S | MX2020 20 slot chassis shipping container, spare          |
| MX2010-CHAS-PKG-S | MX2010 10 slot chassis shipping container, spare          |
| MX2008-CHAS-PKG-S | MX2008 10 slot chassis shipping container, spare          |
| MX2020-LC-PKG-S   | MX2020 line card bulk shipping container, spare           |
| MX2020-PSM-PKG-S  | MX2020 power supply module bulk shipping container, spare |

#### Power Cable Manager

|                     |   |
|---------------------|---|
| MX2020-DC-CBL-MGR-S | MX2020 cable manager for DC power cables, spare |
|---------------------|---|

#### Mounting Tray

|                     |                                    |
|---------------------|------------------------------------|
| MX2000-MOUNT-TRAY-S | MX2000 line rack mount tray, spare |
|---------------------|------------------------------------|

#### Lug Kits

|                     |                                      |
|---------------------|--------------------------------------|
| MX2000-DCLUG-4AWG-S | MX2000 line DC 4AWG terminal lug kit |
| MX2000-DCLUG-6AWG-S | MX2000 line DC 6AWG terminal lug kit |

#### Junos OS

|           |          |
|-----------|----------|
| USA       | Junos OS |
| Worldwide | Junos-VW |

## Broadband Network Gateway (BNG) Licensing

### Subscriber Access Feature Pack Licenses

One Subscriber Access (SA) license is required per chassis, and provides:

- Per-subscriber RADIUS accounting (time- and volume-based)
- RADIUS-based authentication and authorization
- Subscriber configuration via client profiles at subscriber login RADIUS and/or SDX-based address (pool) management
- Static and dynamic IP management
- Dynamic auto-sensed VLANs

| Product Number | Description  |
|----------------|--|
| S-SA-FP        | Subscriber Access Feature Pack License for MX240, MX480, MX960, MX2010, and MX2020 |

### Subscriber Services Management Feature Pack Licenses

Subscriber Services Management licenses are optional additions to Subscriber Access licenses that offer:

- Per-service RADIUS accounting (time- and volume-based)
- Service profile activation/deactivation at subscriber login via RADIUS grants/access accepts (services activation/deactivation VSAs) or to change existing sessions via RADIUS COA/RID, or SRC
- Parameterization of service profiles
- ANCP QoS adjustment based on sync rate via ANCP

Other optional Subscriber Services Management licenses support (excluding the MPC11E) Inline L2TP LNS Tunneling, Subscriber-Based Lawful Intercept, Virtual Chassis, and interface with policy management systems, as indicated in the table below.

| Product Number | Description  |
|----------------|--|
| S-SSM-FP       | Subscriber Service Management Feature Pack License (RADIUS/SRC-based service activation/deactivation); per-service accounting features for subscribers for MX240, MX480, MX960, MX2010, and MX2020 |
| S-SSP-FP       | Subscriber Traffic Lawful Intercept Feature Pack License for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020  |
| S-BB-NASREQ    | Junos Broadband Policy Enforcement feature license for dynamic subscriber authentication and authorization using NASREQ for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020                   |
| S-BB-GX        | Junos Broadband Policy Enforcement feature license for PCRF communications using 3GPP Gx and Gx+ for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020  |
| S-BB-GY        | Junos Broadband Policy Enforcement feature license for online charging using 3GPP Gy interface for MX80, MX104, MX240, MX480, MX960, MX2010, and MX2020  |
| S-LNS-IN       | Software license for Inline L2TP LNS for MX240, MX480, MX960, MX2010, and MX2020   |
| S-VCR          | Software license for single member of an MX Series Virtual Chassis   |

### Subscriber Access Scale Licenses

These tiered licenses support from 4,000 to 256,000 sessions<sup>5</sup> and are bound to one chassis<sup>6</sup> and do not apply to the MPC11E.

| Product Number | Description   |
|----------------|---|
| S-SA-4K        | Subscriber scale license, up to 4,000 subscribers   |
| S-SA-8K        | Subscriber scale license, up to 8,000 subscribers   |
| S-SA-16K       | Subscriber scale license, up to 16,000 subscribers  |
| S-SA-32K       | Subscriber scale license, up to 32,000 subscribers  |
| S-SA-64K       | Subscriber scale license, up to 64,000 subscribers  |
| S-SA-128K      | Subscriber scale license, up to 128,000 subscribers |
| S-SA-256K      | Subscriber scale license, up to 256,000 subscribers |

<sup>5</sup> Based on concurrent subscriber sessions per chassis. Session types include DHCP, DHCP, dual stack, PPPoE, PPPoE dual stack, L2TP LAC, and LNS.

<sup>6</sup> In the case of Virtual Chassis configurations, subscriber scale licenses are applied per Virtual Chassis cluster

## Subscriber Access Scale Upgrade Licenses

These tiered licenses support from 4,000 to 256,000 sessions and are bound to one chassis.

| Product Number | Description   |
|----------------|---|
| S-SA-UP-8K     | Subscriber scale upgrade, from 4,000 to 8,000 subscribers     |
| S-SA-UP-16K    | Subscriber scale upgrade, from 8,000 to 16,000 subscribers    |
| S-SA-UP-32K    | Subscriber scale upgrade, from 16,000 to 32,000 subscribers   |
| S-SA-UP-64K    | Subscriber scale upgrade, from 32,000 to 64,000 subscribers   |
| S-SA-UP-96K    | Subscriber scale upgrade, from 64,000 to 96,000 subscribers   |
| S-SA-UP-128K   | Subscriber scale upgrade, from 96,000 to 128,000 subscribers  |
| S-SA-UP-256K   | Subscriber scale upgrade, from 128,000 to 256,000 subscribers |

## MPC Flex Licenses

The Flex license on the MPC11E allows a customer to only pay for features they intend to use. These licenses are as shown in the table below.

| Product Number | Description   |
|----------------|---|
| S-MX-40C-A1-1  | MX Series Advanced software feature subscription license for 1-year term; software support included; valid for subscription renewals only |
| S-MX-40C-A1-3  | MX Series Advanced software feature subscription license for 3-year term; software support included                                       |
| S-MX-40C-A1-5  | MX Series Advanced software feature subscription license for 5-year term; software support included                                       |
| S-MX-40C-A1-P  | MX Series Advanced software feature perpetual license; software support not included  |
| S-MX-40C-P1-1  | MX Series Premium software feature subscription license for 1-year term; software support included; valid for subscription renewals only  |
| S-MX-40C-P1-3  | MX Series Premium software feature subscription license for 3-year term; software support included  |
| S-MX-40C-P1-5  | MX Series Premium software feature subscription license for 5-year term; software support included  |
| S-MX-40C-P1-P  | MX Series Premium software feature perpetual license; software support not included   |

## About Juniper Networks

Juniper Networks brings simplicity to networking with products, solutions and services that connect the world. Through engineering innovation, we remove the constraints and complexities of networking in the cloud era to solve the toughest challenges our customers and partners face daily. At Juniper Networks, we believe that the network is a resource for sharing knowledge and human advancement that changes the world. We are committed to imagining groundbreaking ways to deliver automated, scalable and secure networks to move at the speed of business.

### Corporate and Sales Headquarters

Juniper Networks, Inc.  
1133 Innovation Way  
Sunnyvale, CA 94089 USA

**Phone: 888.JUNIPER (888.586.4737)**

**or +1.408.745.2000**

**[www.juniper.net](http://www.juniper.net)**

### APAC and EMEA Headquarters

Juniper Networks International B.V. Boeing  
Avenue 240 1119 PZ Schiphol-Rijk  
Amsterdam, The Netherlands

**Phone: +31.0.207.125.700**

