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[1]; every minute of every day, more than 300 hours of video are uploaded to YouTube[2]; and analysts expect 26 billion Internet of Things (IoT) devices to be in use by 2020—more than a tenfold increase from 2015[3].

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 32 Tbps-capable MX2020 and the 16 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. Starting in Q1 2018, the MX2000 platforms ship with 40GbE and 100GbE MACsec enabled on the MACsec-capable MIC-MACSEC-MRATE pluggable MIC for the MPC8E and MPC9E line cards. The 10GbE MACsec capability has been available on the MPC7E-10G line card since 2016.

[1] Source: Digital Business, Rethinking Fundamentals, Bill McNee, Founder and CEO, Saugatuck Technology
[2] Source: YouTube Statistics, www.youtube.com/yt/press/statistics.html
[3] Source: Gartner Says the Internet of Things Installed Base Will Grow to 26 Billion Units By 2020; http://www.gartner.com/newsroom/id/2636073

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 1.6 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 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[4] allows the use of the MPC1 through MPC5, as well as the MPC7E, in the MX2000 line, protecting existing MPC investments. The MX2000 platforms also provide per-port line-rate MACsec encryption and decryption at 10GbE, 40GbE, and 100GbE speeds with no fragmentation impact. This feature provides an inexpensive and simple mechanism to secure L2 communications. The MX2K-MPC9E line card with the MIC-MACSEC-MRATE pluggable MIC delivers 1.6 Tbps per slot throughput and can be selectively enabled on each interface at 10GbE, 40GbE, or 100GbE speeds. The MIC-MACSEC-MRATE is also compatible with the MX2K-MPC8E line card. 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/

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	1.6 Tbps	1.6 Tbps	1.6 Tbps
System throughput	16 Tbps	16 Tbps	32 Tbps

The MPC9E, powered by the programmable Trio chipset, takes advantage of the MX2000 line's high system capacity and throughput to provide industry-leading 10GbE, 40GbE, and 100GbE density (see Table 2). Leveraging the MPC9E, the MX2020 is the highest capacity, highest density full-featured single chassis edge router available today.

[4] 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.

Table 2. MX2000 Maximum Line-Rate Port Density

Interface	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.

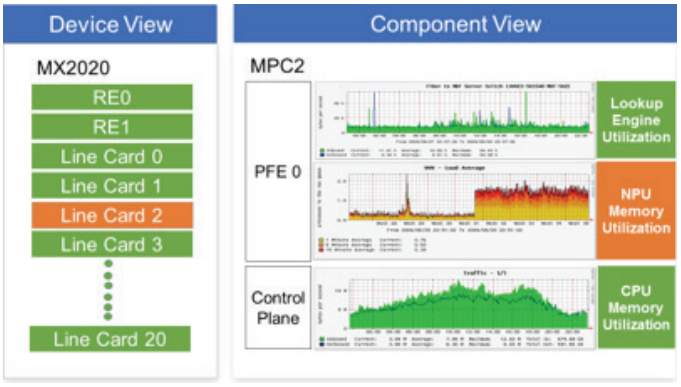

Figure 1. Visualized analytics derived from an MX2020 router and MPCs.

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.

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/

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 .6W/GbE; this means the MX2020 consumes just six-tenths 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 100GbE 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.

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/

Table 3. MX2020, MX2010 and MX2008 Physical Specifications

Specification	MX2020	MX2010	MX2008
Physical dimensions (H x D x W)	78.75 x 36.2 x 17.5 in (200 x 91.95 x 44.45 cm)	59.5 x 36.2 x 17.5 in (151.1 x 91.95 x 44.45 cm)	42 x 34.5 x 17.37 in (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 (680.39 kg)	1,000 lbs (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.

Ordering Information

Product Number	Description
Premium and Base Units, Spares	
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
Routing Engines (REs)	
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

Product Number	Description
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

Product Number	Description
Switch Fabric Boards (SFBs)	
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
MPCs	
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.

Product Number	Description
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.
MX2000 Line Adapter Card	
MX2000-LC-ADAPTER	MPC adapter, required when using MPC1s through MPC5s, MPC7s and MS-MPC ins MX2000
MX Series MPCs (require MX2000-LC-ADAPTER card for use in MX2000)	
MPC7E-10G	40x10GbE SFP+ port line card. Price includes full-scale L2/L2.5 and reduced scale L3 features. Optics sold separately.
MPC7E-10G-RB	40x10GbE SFP+ port line card bundle. Price includes full-scale L3, L2 and L2.5 features. Optics sold separately.
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.
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.
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.
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.
MPC7E-MRATE-RB	12xQSFP+/QSFP28 multirate port line card bundle. Price includes full-scale L3, L2 and L2.5 features. Optics sold separately.
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.
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.
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.
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.
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.
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.

Product Number	Description
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.
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.
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.
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.
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.
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
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
MPC4E-3D-32XGE-IRB	Fixed 32x 10GbE SFPP line card bundle with full scale L2/L2.5, L3 features, up to 16 L3VPNs
MPC4E-3D-2CGE8XGE-RB	Fixed 2x 100GbE and 8x 10GbE line card bundle with full scale L2/L2.5, L3 and L3VPN features
MPC4E-3D-32XGE-RB	Fixed 32x GbE SFPP line card bundle with full scale L2/L2.5, L3 and L3VPN features
MX-MPC3E-3D	MPC3 with support for 100GbE, 40GbE, and 10GbE interfaces, L2.5 features, 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
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.
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.

Product Number	Description
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.
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.
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
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.
MPC-3D-16XGE-SFPP	Fixed 16x 10GbE line card bundle with L2.5 features
MPC-3D-16XGE-SFPP-R-B	Fixed 16x 10GbE GbE line card bundle with full scale L2/L2.5 and 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.
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.
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.
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.

Product Number	Description
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 64000 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.
MICs for MPC6E	
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
MICs for MPC8E and MPC9E	
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.
Licenses	
S-MIC6-OPT-LIC	OTN license for MIC6-10G-OTN and MIC6-100G-CFP2.
Cable Management	
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
Fan Trays	
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
Air Filters	
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
Craft Interface	
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
Power Distribution Modules	
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

Product Number	Description
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
MX2K-PDM-AC-1PH-S	MX200 line 1 phase AC power distribution module, spare
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-WW

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[6]	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 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[7]	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[8] and are bound to one chassis[9].

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

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 96,0000 to 128,000 subscribers
S-SA-UP-256K	Subscriber scale upgrade, from 128,000 to 256,000 subscribers

[8] Based on concurrent subscriber sessions per chassis. Session types include DHCP, DHCP, dual stack, PPPoE, PPPoE dual stack, L2TP LAC, and LNS.

[9] In the case of Virtual Chassis configurations, subscriber scale licenses are applied per Virtual Chassis cluster

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.

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