EX4200 Ethernet Switches

With Virtual Chassis Technology

Product Overview

High-performance businesses demand high-performance networking solutions. These solutions include a new class of secure, scalable and always-on enterprise switch that advances the economics of networking by enabling businesses to deploy innovative new technologies that increase revenue and improve productivity. The Juniper Networks EX4200 line of Ethernet switches with Virtual Chassis technology combine the compact, pay-as-you-grow economics and low power and cooling requirements of stackable switches with the performance, availability, operational ease and port densities of chassis-based platforms to meet the demands of today's high-performance enterprises.

Product Description

The Juniper Networks® EX4200 line of Ethernet switches with Virtual Chassis technology combine the high availability (HA) and carrier-class reliability of modular systems with the economics and flexibility of stackable platforms, delivering a high-performance, scalable solution for data center, campus and branch office environments.

Offering a full suite of Layer 2 and Layer 3 switching capabilities as part of the base software, the EX4200 satisfies a variety of high-performance applications, including branch, campus and data center access deployments as well as Gigabit Ethernet (GbE) aggregation deployments. A single 24-port or 48-port switch can be deployed initially; as requirements grow, Juniper Networks Virtual Chassis technology allows up to 10 EX4200 switches to be interconnected over a 128 gigabit-per-second (Gbps) backplane and managed as a single device, delivering a scalable, pay-as-you-grow solution for expanding network environments. Flexible Gigabit Ethernet (GbE) and 10-Gigabit Ethernet (10GbE) uplink options enable high-speed connectivity to aggregation- or core-layer switches which connect multiple floors or buildings.

All EX4200 switches include HA features such as redundant, hot-swappable internal power supplies and field-replaceable, multi-blower fan trays to ensure maximum uptime. In addition, the base EX4200 partial PoE switch models offer Class 3 Power over Ethernet (PoE), delivering up to 18.6 watts on the first eight ports to support networked devices such as telephones, video cameras and wireless LAN (WLAN) access points for low-density converged networks. Full PoE options delivering up to 18.6 watts on all 24 or 48 ports are also available, making them ideal for high-density IP telephony deployments. Furthermore, PoE+ models deliver up to 30 watts of standards-based 802.3at PoE+ on 24 or 48 ports making them ideal for all PoE applications including campus deployments with 802.11n wireless access points.

Juniper Networks Virtual Chassis Technology: Chassis-like Switch Features in a Stackable Form Factor

- Redundant, internal hot-swappable power supplies
- Hot-swappable fan tray with redundant blowers
- Consistent modular Juniper Networks Junos® operating system control plane feature implementation
- Dual Route Engines with Graceful Routing Engine Switchover (GRES)
- Single management interface
- Easy, centralized software upgrades
- Scales from 24 to 480 ports with up to 20 10GbE uplinks

Each EX4200 switch includes an integrated application-specific integrated circuit (ASIC)-based Packet Forwarding Engine, the EX-PFE, while an integrated Routing Engine (RE) delivers all control plane functionality. Based on field-proven Juniper Networks technology, the Route Engine brings the same level of carrier-class performance and reliability to the EX4200 line of Ethernet switches that Juniper Networks routers bring to the world's largest service provider networks.

The EX4200 also leverages the same modular Juniper Networks Junos OS as Juniper Networks router products, ensuring a consistent implementation and operation of each control plane feature across an entire Juniper Networks infrastructure.

Architecture and Key Components

The EX4200 switches are single rack-unit devices that deliver a compact solution for crowded wiring closets and access switch locations where space and power are at a premium. Each EX4200 supports optional front-panel uplink modules offering either four GbE ports or two 10GbE ports for high-speed backbone or link-aggregation connections between wiring closets and upstream aggregation switches. Uplink modules can be installed without powering down the switch, enabling users to add high-speed connectivity at any time or migrate from one uplink type to the other to deliver the ultimate in flexible, high-performance interconnectivity.

The EX4200 also features a front-panel LCD that offers a flexible interface for performing device bring-up and configuration rollbacks, reporting switch alarm and LED status, or restoring the switch to its default settings. The LCD also displays a Virtual Chassis member switch's chassis "slot number" and Route Engine status for rapid identification and problem resolution.

Dual rear-panel Virtual Chassis ports enable EX4200 switches to be interconnected over the 128 Gbps virtual backplane. Switches deployed in close proximity, such as wiring closets or top-of-rack data center applications, can be securely connected using a Virtual Chassis cable and cable lock supplied by Juniper Networks.

In addition, a dedicated rear-panel RJ-45 port is available for out-of-band management, while a rear-panel USB port can be used to easily upload Junos OS and configuration files.

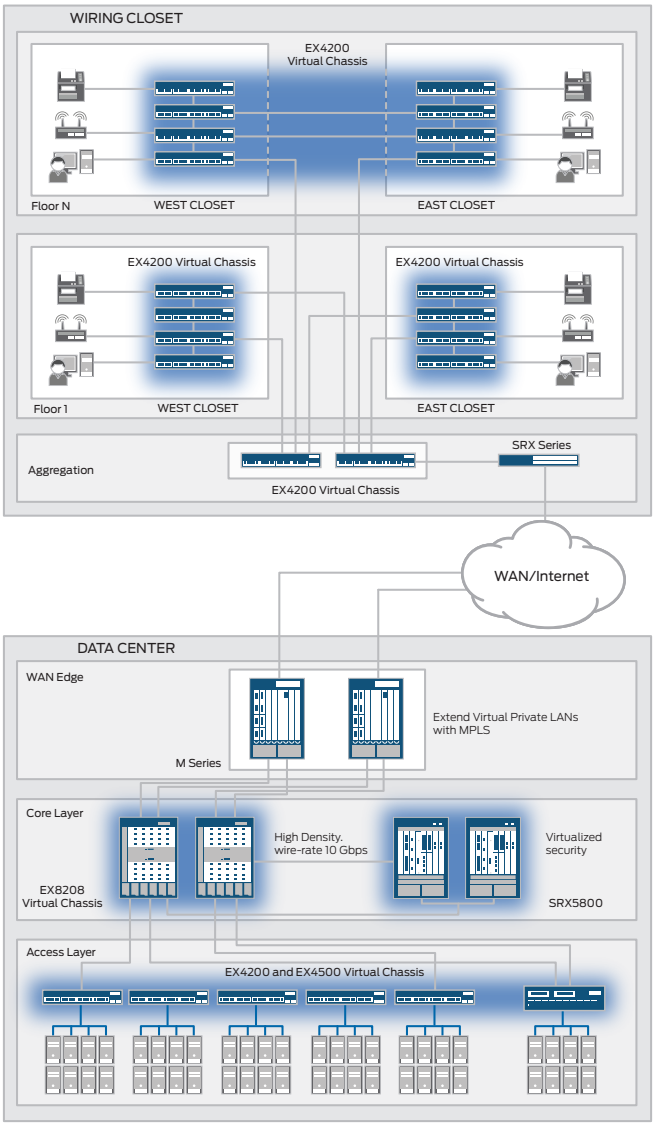

Figure 1: The EX4200 Ethernet switch with Virtual Chassis technology delivers a high-performance, scalable and highly reliable solution for data center, branch and campus environments.

Virtual Chassis Technology

Up to 10 EX4200 switches can be interconnected using Virtual Chassis technology to create a single logical device supporting up to 480 10/100/1000BASE-T ports or 240 100/1000BASE-X ports, plus an additional 40 GbE or 20 10GbE uplink ports. Additionally, EX4200s can be interconnected in a Virtual Chassis configuration that also includes EX4500s, creating a single logical switch that offers a variety of port and density options for mixed server environments.

In a Virtual Chassis configuration, all switches are monitored and managed as a single device, enabling enterprises to separate physical topology from logical groupings of endpoints and allowing more efficient resource utilization. Highly resilient topologies can also be created using the GbE or 10GbE uplink ports to extend the Virtual Chassis configuration across long distances spanning multiple wiring closets, floors or even buildings.

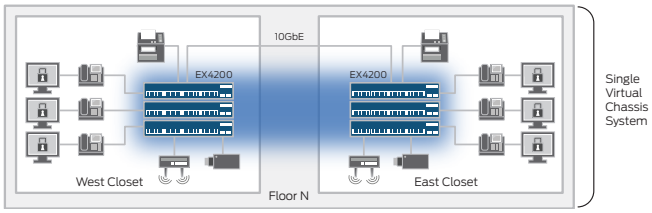

Figure 2: Using Virtual Chassis technology, up to 10 EX4200 switches can be interconnected to create a single logical device spanning multiple wiring closets, floors or even buildings.

Features and Benefits

Chassis-Class Availability

The EX4200 line of Ethernet switches deliver the same HA functionality and support many of the same failover capabilities as other Juniper chassis-based systems.

Each EX4200 switch is capable of functioning as a Route Engine. When two or more EX4200 switches are interconnected, they share a single control plane among all Virtual Chassis member switches. When two EX4200 switches are interconnected, Junos OS automatically initiates an election process to assign a master (active) and backup (hot-standby) Route Engine. An integrated Layer 2 and Layer 3 Graceful Route Engine Switchover (GRES) feature maintains uninterrupted access to applications, services and IP communications in the unlikely event of a primary RE failure.

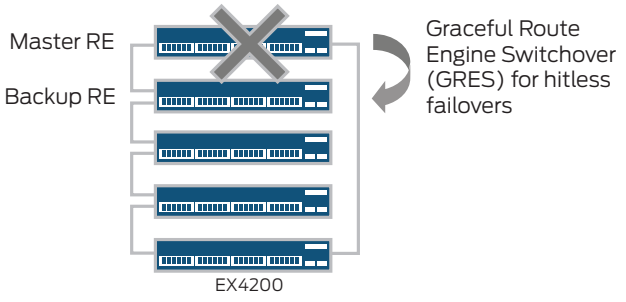

Figure 3: Support for Graceful Route Engine Switchover (GRES) ensures a smooth and seamless transfer of control plane functions following a master Route Engine failure.

When more than two switches are interconnected in a Virtual Chassis configuration, the remaining switch elements act as line cards and are available to assume the backup RE position should the designated master fail. Master, backup and line card priority status can be assigned by the network operations team to dictate the order of ascension; this N+1 RE redundancy, coupled with the GRES, nonstop routing (NSR) and nonstop bridging (NSB) capabilities of the Junos OS, assures a smooth transfer of control plane functions following unexpected failures.

The EX4200 implements the same slot/module/port numbering schema as other Juniper Networks chassis-based products when numbering Virtual Chassis ports, providing true chassis-like operations. By utilizing a consistent operating system and a single configuration file, all switches in a Virtual Chassis configuration are treated as a single device, simplifying overall system maintenance and management.

Individually, the EX4200 offers a number of HA features that are typically associated with modular chassis-based switches. When combined with the field-proven Junos OS and L2/L3 failover capabilities, these features provide the EX4200 with true carrier-class reliability.

- **Redundant power supplies:** The EX4200 line of Ethernet switches support internal redundant, load-sharing, hot-swappable and field-replaceable AC and DC power supplies to maintain uninterrupted operations. Thanks to their compact footprint, the EX4200 requires significantly less power than chassis-based switches delivering equivalent port densities.
- **Hot-swappable fan tray with multiple blowers:** The EX4200 includes a hot-swappable, field-replaceable fan tray with three blowers, providing sufficient cooling even if one of the blowers were to fail.
- **Redundant Trunk Group (RTG):** To avoid the complexities of the Spanning Tree Protocol (STP) without sacrificing network resiliency, the EX4200 employs redundant trunk groups to provide the necessary port redundancy and simplify switch configuration.
- **Cross-member link aggregation:** Cross-member link aggregation allows redundant link aggregation connections between devices in a single Virtual Chassis configuration, providing an additional level of reliability and availability.
- **Carrier-class hardware:** The EX4200 leverages a purpose-built packet forwarding engine ASIC, the EX-PFE, which integrates much of the same intellectual property used in Juniper Networks carrier routers. As a result, the EX4200 delivers the same predictable, scalable functionality found in the world's largest networks.
- **Non-Stop Bridging (NSB) and Non-Stop Routing (NSR):** NSB and NSR on the EX4200 ensure control plane protocols, states and tables are synchronized between Master and Standby REs to prevent protocol flaps or convergence issues following a Routing Engine failover.

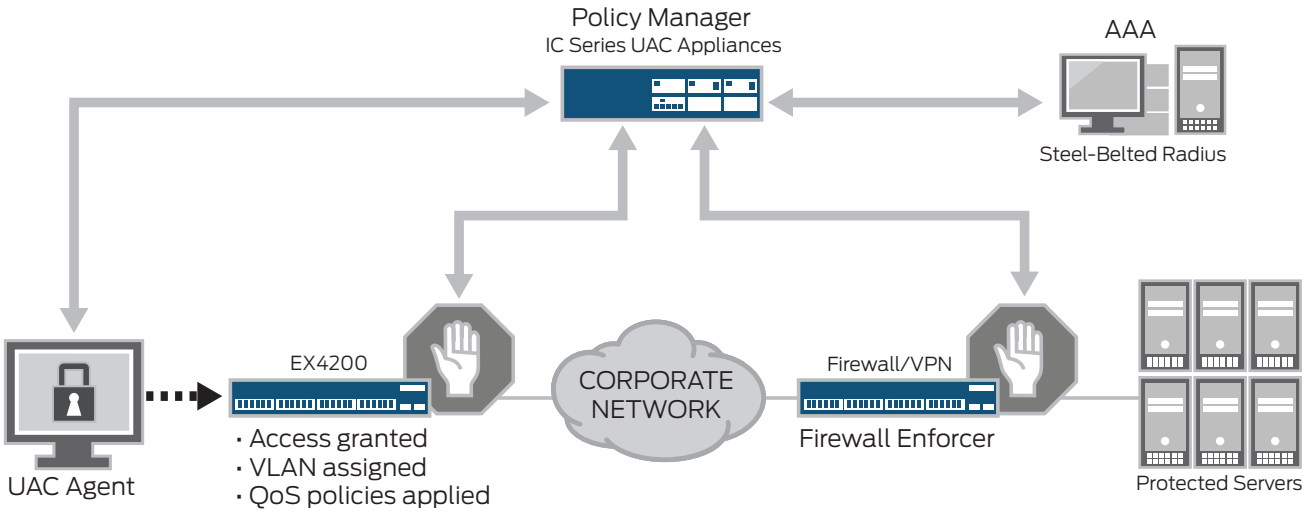

Figure 4: The EX4200 works with the Juniper Networks UAC to enforce access control down to the individual port level.

- **Non-Stop Software Upgrade (NSSU):** With NSSU, all members of a Virtual Chassis system can be upgraded with a single command. Mission-critical traffic can be configured as a link aggregate across multiple Virtual Chassis switch members, ensuring minimal disruption during the upgrade process.
- **IPv4 and IPv6 routing support:** IPv4 and IPv6 Layer 3 routing (OSPF and PIM) is available in the base license, enabling highly resilient networks.

Carrier-Class Operating System

The EX4200 runs on Junos OS, the same operating system software used by Juniper Networks routers to power the world's largest and most complex networks.

By utilizing a common operating system, Juniper delivers a consistent implementation and operation of control-plane features across all products. To maintain that consistency, Junos OS adheres to a highly disciplined development process that utilizes a single source code, follows a single quarterly release train, and employs a highly available modular architecture that prevents isolated failures from bringing an entire system down.

These attributes are fundamental to the core value of the software, enabling all products powered by Junos OS to be updated simultaneously with the same software release. All features are fully regression-tested, making each new release a true superset of the previous version; customers can deploy the software with complete confidence that all existing capabilities will be maintained and operate in the same way.

Converged Networks

The EX4200 line of Ethernet switches provide the highest levels of availability for the most demanding converged data, voice and video environments, delivering the most reliable platform for unifying enterprise communications.

By providing Class 3 PoE with 15.4 watts on some or all ports to power voice over IP (VoIP) telephones, closed-circuit security cameras, wireless access points, and other IP-enabled devices, the EX4200 delivers a future-proofed solution for converging disparate networks onto a single IP infrastructure. Furthermore, any PoE port can provide up to 18.6 watts to power wireless access points and other PoE powered devices requiring more than Class 3, 15.4 watts of PoE. EX4200 PoE+ switches also support 802.3at standards-based PoE+ for powering networked devices like multiple radio IEEE 802.11n wireless access points, and video phones that may require more power than available with IEEE 802.3af.

LLDP-MED-based granular PoE management allows the EX4200 to negotiate PoE usage down to a fraction of a watt on powered devices, enabling more efficient PoE utilization across the switch.

To ease deployment, the EX4200 supports the industry-standard Link Layer Discovery Protocol (LLDP) and LLDP-Media Endpoint Discovery (LLDP-MED), which enable the switches to automatically discover Ethernet-enabled devices, determine their power requirements and assign virtual LAN (VLAN) parameters.

In addition, the EX4200 supports rich quality of service (QoS) functionality for prioritizing data, voice and video traffic. The switches support eight QoS queues on every port, enabling them to maintain multi-level, end-to-end traffic prioritizations. The EX4200 also supports a wide range of policy options, including priority and shaped deficit weighted round-robin (SDWRR) queuing.

Security

The EX4200 line of Ethernet switches fully integrate with the Juniper Networks Unified Access Control (UAC), which consolidates all aspects of a user's identity, device and location, enabling administrators to enforce access control and security down to the individual port or user levels.

Policy orchestration, enabled via Juniper UAC Enhancement Protocol (JUEP), enables the EX4200 to construct dynamic ACLs on a port-by-port basis by associating role/resource access policies with authorization table entries. This allows the switch to dynamically create thousands of ACLs or role-based access policies in a scaled environment.

Additionally, a captive portal redirection feature redirects URLs from the EX4200 to the Infranet Controller (IC) for user authentication and authorization, making the IC a "single source of truth" for user and device authentication and for enforcing role-based security policies.

Working as an enforcement point within the UAC, the EX4200 provides both standards-based 802.1X port-level access control as well as Layer 2–4 policy enforcement based on user identity, location and/or device. A user's identity, device type, machine posture check and location can be used to determine whether access should be granted and for how long. If access is granted, the switch assigns the user to a specific VLAN based on authorization levels. The switch can also apply QoS policies or mirror user traffic to a central location for logging, monitoring or threat detection by intrusion prevention systems.

The EX4200 also provides a full complement of port security features including DHCP (Dynamic Host Configuration Protocol) snooping, DAI (dynamic ARP inspection) and MAC limiting (per port and per VLAN) to defend against internal and external spoofing, man-in-the-middle and denial-of-service (DoS) attacks.

MACsec on the EX4200

A MACsec software license enables the EX4200 to provide near line-rate hardware-based encryption of user traffic on a dual-speed 2x10GbE or 4x1GbE SFP+ MACsec uplink module.

Defined by IEEE 802.1AE, MACsec provides secure, encrypted communication at the link layer that is capable of identifying and preventing threats from denial of service (DoS) and intrusion attacks, as well as man-in-the-middle, masquerading, passive wiretapping and playback attacks launched from behind the firewall. When MACsec is deployed on switch ports, all traffic is encrypted on the wire but traffic inside the switch is not. This allows the switch to apply all network policies such as Quality of Service (QoS), deep packet inspection and sFlow to each packet without compromising the security of packets on the wire.

Hop-by-hop encryption enables MACsec to secure communications while maintaining network intelligence. In addition, Ethernet-based WAN networks can use MACsec to provide link security over long-haul connections. MACsec is transparent to Layer 3 and higher-layer protocols and is not limited to IP traffic; it works with any type of traffic carried over Ethernet links.

Simplified Management and Operations

When employing Virtual Chassis technology, the EX4200 dramatically simplifies network management. Up to 10 interconnected EX4200 switches can be managed as a single device. Each Virtual Chassis group utilizes a single Junos OS image file and a single configuration file, reducing the overall number of units to monitor and manage. When Junos OS is upgraded on the master switch in a Virtual Chassis configuration, the software is automatically upgraded on all other member switches at the same time.

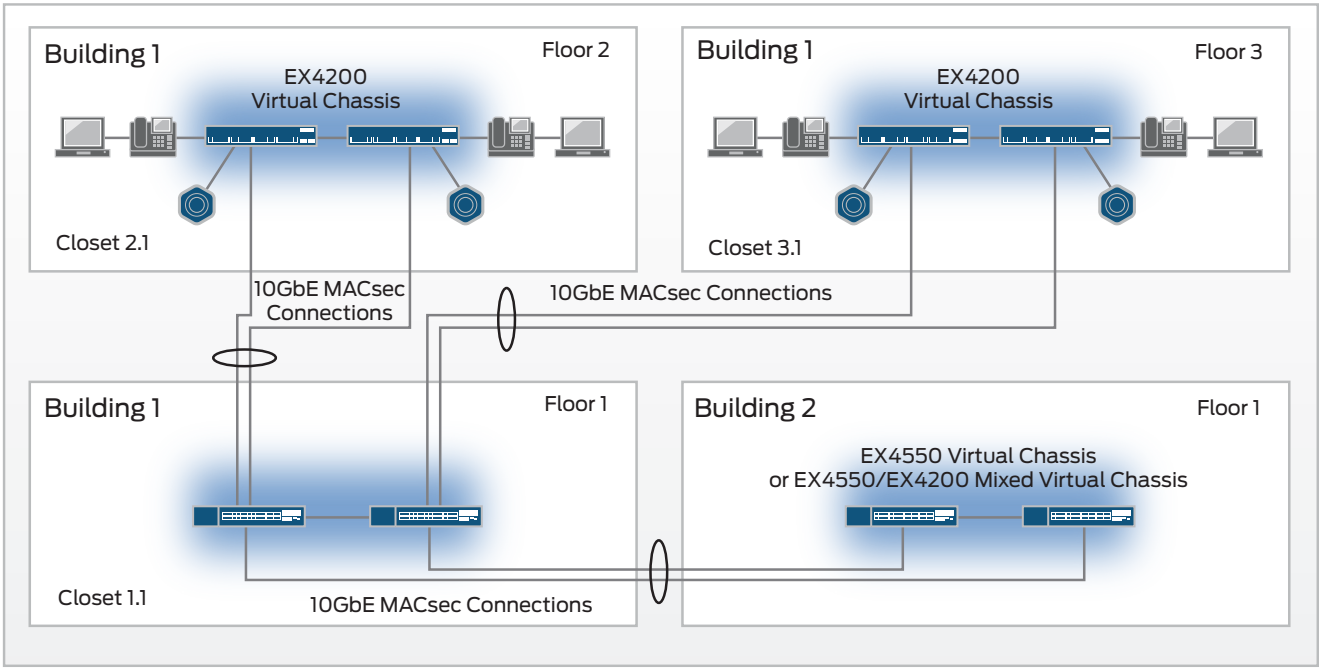

Figure 5: MACsec deployment with EX4200 and EX4550 switches.

The EX4200 also includes port profiles that allow network administrators to automatically configure ports with security, QoS and other parameters based on the type of device connected to the port. Six preconfigured profiles are available, including default, desktop, desktop plus IP phone, wireless access point, routed uplink and Layer 2 uplink. Users can select from the existing profiles or create their own and apply them through the command line interface (CLI), Junos Web interface or management system.

An EZ touchless provisioning feature allows a DHCP server to push configuration details and software images to multiple switches at bootup.

Four system management options are available for the EX4200. The standard Junos OS CLI management interface offers the same granular capabilities and scripting parameters found in any device powered by Junos OS. The EX4200 also includes the integrated Junos Web management tool, an embedded device manager that allows users to configure, monitor, troubleshoot and perform system maintenance on individual switches via a browser-based graphical interface.

When managing a group of EX4200 switches, the Juniper Networks Network and Security Manager (NSM) provides system-level management across all Juniper switches in the network, from a single console.

Finally, the EX4200 switch system, performance and fault data can be exported to leading third-party management systems such as HP OpenView, IBM Tivoli and Computer Associates Unicenter software, to provide a complete, consolidated view of network operations.

Warranty

For warranty information, please visit www.juniper.net/support/warranty/.

Junos SDK

Juniper offers a Junos Software Developer's Kit (SDK) that enables users to create, deploy and validate innovative custom applications that run on top of the Junos operating system on EX Series switches, confirming the company's commitment to software innovation through network programmability. Junos SDK simplifies the development and reuse of components for collaboration while the underlying Junos OS provides security, robustness and resiliency, creating a widespread platform for running network applications.

Product Options

Eight EX4200 switch models are available (see Table 1 below).

Table 1: EX4200 Line of Ethernet Switches

Product	Access Port Configuration	PoE Ports*	Height	POE Budget	Power Supply Rating
EX4200-24T**	24-port 10/100/1000BASE-T	8 PoE	1 RU	130 W	320 W AC
EX4200-24PX	24-port 10/100/1000BASE-T	24 PoE+	1 RU	740 W	930 W AC
EX4200-48T**	48-port 10/100/1000BASE-T	8 PoE	1 RU	130 W	320 W AC
EX4200-48PX	48-port 10/100/1000BASE-T	48 PoE+	1 RU	740 W	930 W AC
EX4200-24F**	24-port 100/1000BASE-X (SFP)	N/A	1 RU	N/A	320 W AC
EX4200-24T-DC**	24-port 10/100/1000BASE-T	0	1 RU	N/A	190 W DC
EX4200-48T-DC**	48-port 10/100/1000BASE-T	0	1 RU	N/A	190 W DC
EX4200-24F-DC**	24-port 100/1000BASE-X (SFP)	N/A	1 RU	N/A	190 W DC

* All PoE ports 802.3af-compliant @ 15.4W. All PoE+ ports on EX4200-24PX/48PX models 802.3at compliant @ 30 W subject to maximum PoE budget.

** NEBS certified

EX4200-24F

EX4200-24P/24PX

EX4200-24T

EX4200-48T

EX4200-48P/48PX

EX4200 Specifications

Physical Specifications

- Backplane: 128 Gbps Virtual Chassis interconnect to combine up to 10 units as a single logical device
- Uplink module options:
  - 4-port GbE module with pluggable SFP optics
  - 2-port 10GbE module with pluggable XFP optics
  - Dual-mode 2-port 10GbE SFP+ / 4-port GbE SFP module with pluggable SFP+/SFP optics
  - Dual-mode 2-port 10GbE SFP+ / 4-port GbE SFP module with pluggable SFP+/SFP optics and MACsec support

Power Options

- Power supplies: Autosensing; 100-120 V / 200-240 V; AC 320 W, 600 W and 930 W dual load-sharing hot-swappable internal redundant power supplies
- Maximum current inrush: 50 amps
- DC power supply: 190 W DC, input voltage range 36 V - 72 V, dual input feed, dual load-sharing hot-swappable internal redundant power supplies
- Minimum number of PSUs required for fully loaded chassis: 1 per switch

Dimensions (W x H x D)

- 17.41 x 1.72 x 16.43 in (44.21 x 4.32 x 41.73 cm)
- [1] Desktop installation width noted above, rack-mount width is 17.5 in (44.5 cm)
- [2] Height: 1 RU
- [3] Depth with 320 W AC PSU and 190 W DC PSU noted above, 18.8 in (47.8 cm) with 600/930 W AC PSU

System Weight

- EX4200-24T with 320 W AC PSU: 16.5 lb (7.5 kg)
- EX4200-24P with 600 W AC PSU: 17.2 lb (7.8 kg)
- EX4200-24PX with 930 W AC PSU: 18 lb (8.16 kg)
- EX4200-48T with 320 W AC PSU: 17.1 lb (7.8 kg)
- EX4200-48P with 930 W AC PSU: 18.2 lb (8.3 kg)
- EX4200-48PX with 930 W AC PSU: 19 lb (8.61 kg)
- EX4200-24F with 320 W AC PSU: 16.1 lb (7.3 kg)
- EX4200-24T-DC with 190 W DC PSU: 16.5 lb (7.5 kg)
- EX4200-48T-DC with 190 W DC PSU: 17.1 lb (7.8 kg)
- EX4200-24F-DC with 190 W DC PSU: 16.1 lb (7.3 kg)

Environmental Ranges

- Operating temperature: 32º to 113º F (0º to 45º C)
- Storage temperature: -40º to 158º F (-40º to 70º C)
- Operating altitude: up to 10,000 ft (3,049 m)
- Non-operating altitude: up to 16,000 ft (4,877 m)
- Relative humidity operating: 10% to 85% (noncondensing)
- Relative humidity non-operating: 0% to 95% (noncondensing)

Cooling

- Field-replaceable fan tray with multiple blowers (3)
- Switch remains operational even if one blower fails
- Airflow: 20.3 cfm

Hardware Specifications

- Switching Engine Model: Store and forward
- DRAM – 1 GB with ECC
- Flash – 1 GB
- CPU – 1 GHz PowerPC CPU
- GbE port density per system:
  - 24P/24T/24F: 28 (24 host ports + four-port GbE uplink module)
  - 48P/48T: 52 (48 host ports + four-port GbE uplink module)
- 10GbE port density per system (all models): 2 (uplink module)

Optics

- 100 Mbps optic/connector type: LC SFP fiber supporting 100BASE-FX SFP (multimode), LX (single-mode) and BX (single-strand)
- 10/100/1000BASE-T connector type: RJ-45
- GbE SFP optic/connector type: RJ-45 or LC SFP fiber supporting 1000BASE-T SFP, SX (multimode), LX (single-mode), LH/ZX (single-mode) and BX (single strand)

- 10GbE XFP optic/connector type: 10GE XFP LC connector, SR (multimode), LR (single-mode), ER (single-mode) or ZR (single-mode)
- 10GbE SFP+ optic/connector type: 10GE SFP+ LC connector, SR (multimode), USR (multimode), LR (single-mode), ER (single-mode), LRM (multimode) and DAC (direct-attach copper)

Physical Layer

- Time Domain Reflectometry (TDR) for detecting cable breaks and shorts: 24P/24T and 48P/48T only
- Auto MDI/MDIX support: 24P/24T and 48P/48T only (all ports)
- Port speed downshift/setting max advertised speed on 10/100/1000BASE-T ports: 24P/24T and 48P/48T only, on all ports
- Digital optical monitoring for optical ports

Packet Switching Capacities (Maximum with 64 Byte Packets)

- 24P/24T: 88 Gbps
- 48P/48T: 136 Gbps
- 24F: 88 Gbps

Aggregate Switch Capacities (Maximum with 64 Byte Packets)

- 24P/24T/24F: 216 Gbps
- 48P/48T: 264 Gbps

Layer 2/Layer 3 Throughput (Mpps) (Maximum with 64 Byte Packets)

- 24P/24T: 65 Mpps (wire speed)
- 48P/48T: 101 Mpps (wire speed)
- 24F: 65 Mpps (wire speed)

Layer 2 Switching

- Max MAC addresses per system: 32,000
- Jumbo frames: 9216 Bytes
- Number of VLANs: 4,096
- VST instances: 253
- Port-based VLAN
- MAC-based VLAN
- GVRP
- Voice VLAN
- Physical port redundancy: Redundant trunk group (RTG)
- Compatible with PVST+
- RVI (Routed VLAN Interface)
- Multicast VLAN Registration (MVR)
- IEEE 802.1ak Multiple VLAN Registration Protocol (MVRP)
- IEEE 802.1AB: Link Layer Discovery Protocol (LLDP)
- LLDP-MED with VoIP integration
- IEEE 802.1D: Spanning Tree Protocol
- IEEE 802.1p: CoS prioritization
- IEEE 802.1Q: VLAN tagging
- IEEE 802.1s: Multiple instances of Spanning Tree Protocol (MSTP)
- Number of MST instances supported: 64
- Number of VSTP instances supported: 253
- IEEE 802.1w: Rapid reconfiguration of Spanning Tree Protocol
- IEEE 802.1X: Port Access Control
- IEEE 802.1ak: Multiple Registration Protocol
- IEEE 802.3: 10BASE-T
- IEEE 802.3u: 100BASE-T
- IEEE 802.3ab: 1000BASE-T
- IEEE 802.3z: 1000BASE-X
- IEEE 802.3ae: 10 Gigabit Ethernet
- IEEE 802.3af: Power over Ethernet
- IEEE 802.3x: Pause Frames/Flow Control
- IEEE 802.3ad: Link Aggregation Control Protocol
- IEEE 802.3ah: Ethernet in the First Mile
- Metro
  - PVLAN support
  - IEEE 802.1ag connectivity fault management
  - ITU-T G803.2
  - ITU-T Y.1731
  - IEEE 802.1ad Q-in-Q
  - Multicast VLAN routing

Layer 3 Features: IPv4

- Max number of ARP entries: 16,000
- Max number of IPv4 unicast routes in hardware: 16,000
- Max number of IPv4 multicast routes in hardware: 8,000
- Routing protocols: RIPv1/v2, OSPF, BGP, IS-IS
- Static routing
- Routing policy
- Bidirectional Forwarding Detection
- Layer 3 redundancy: VRRP
- IPv4/v6 GRE tunneling

Layer 3 Features: IPv6

- Max number of Neighbor Discovery (ND) entries: 16,000 (shared with IPv4)
- Max number of IPv6 unicast routes in hardware: 4,000
- Max number of IPv6 multicast routes in hardware: 2,000
- Routing protocols: RIPng, OSPFv3, IPv6, ISIS, BGP4+, PIM, MLD, MLDv2
- Static routing

MPLS

- Circuit Cross Connect (CCC)
- Multicast snooping MLD v1/v2
- VRF-Lite

Supported RFCs

- RFC 768 UDP
- RFC 783 TFTP
- RFC 791 IP
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 854 Telnet client and server
- RFC 894 IP over Ethernet
- RFC 903 RARP
- RFC 906 TFTP Bootstrap
- RFC 951, 1542 BootP
- RFC 1027 Proxy ARP

- RFC 1058 RIP v1
- RFC 1112 IGMP v1
- RFC 1122 Host Requirements
- RFC 1195 Use of OSI IS-IS for Routing in TCP/IP and Dual Environments (TCP/IP transport only)
- RFC 1256 IPv4 ICMP Router Discovery (IRDP)
- RFC 1492 TACACS+
- RFC 1519 CIDR
- RFC 1587 OSPF NSSA Option
- RFC 1591 DNS
- RFC 1745 BGP4/IDRP for IP-OSPF Interaction
- RFC 1771 Border Gateway Protocol 4
- RFC 1812 Requirements for IP Version 4 Routers
- RFC 1965 Autonomous System Confederations for BGP
- RFC 1981 Path MTU Discovery for IPv6
- RFC 1997 BGP Communities Attribute
- RFC 2030 SNTP, Simple Network Time Protocol
- RFC 2068 HTTP server
- RFC 2080 RIPng for IPv6
- RFC 2131 BOOTP/DHCP relay agent and DHCP server
- RFC 2138 RADIUS Authentication
- RFC 2139 RADIUS Accounting
- RFC 2154 OSPF w/Digital Signatures (Password, MD-5)
- RFC 2236 IGMP v2
- RFC 2267 Network Ingress Filtering
- RFC 2283 Multiprotocol Extensions for BGP-4
- RFC 2328 OSPF v2 (Edge-mode)
- RFC 2338 VRRP
- RFC 2362 PIM-SM (Edge-mode)
- RFC 2370 OSPF Opaque LSA Option
- RFC 2385 TCP MD5 Authentication for BGPv4
- RFC 2439 BGP Route Flap Damping
- RFC 2453 RIP v2
- RFC 2460 Internet Protocol, Version 6 (IPv6) Specification
- RFC 2461 Neighbor Discovery for IP Version 6 (IPv6)
- RFC 2463 Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 (IPv6) Specification
- RFC 2464 Transmission of IPv6 Packets over Ethernet Networks
- RFC 2474 DiffServ Precedence, including 8 queues/port
- RFC 2475 DiffServ Core and Edge Router Functions
- RFC 2526 Reserved IPv6 Subnet Anycast Addresses
- RFC 2545 Use of BGP-4 Multiprotocol Extensions for IPv6 Inter-Domain Routing
- RFC 2597 DiffServ Assured Forwarding (AF)
- RFC 2598 DiffServ Expedited Forwarding (EF)
- RFC 2740 OSPF for IPv6
- RFC 2784 Generic Routing Encapsulation (GRE)
- RFC 2796 BGP Route Reflection (supersedes RFC 1966)
- RFC 2796 Route Reflection
- RFC 2918 Route Refresh Capability for BGP-4
- RFC 2925 MIB for Remote Ping, Trace
- RFC 3176 sFlow
- RFC 3376 IGMP v3
- RFC 3392 Capabilities Advertisement with BGP-4
- RFC 3484 Default Address Selection for Internet Protocol Version 6 (IPv6)
- RFC 3513 Internet Protocol Version 6 (IPv6) Addressing Architecture
- RFC 3569 draft-ietf-ssm-arch-06.txt PIM-SSM PIM Source Specific Multicast
- RFC 3579 RADIUS EAP support for 802.1x
- RFC 3618 MSDP
- RFC 3623 OSPF Graceful Restart
- RFC 4213 Basic Transition Mechanisms for IPv6 Hosts and Routers
- RFC 4291 IP Version 6 Addressing Architecture
- RFC 4360 BGP Extended Communities Attribute
- RFC 4443 ICMPv6 for the IPv6 Specification
- RFC 4486 Subcodes for BGP Cease Notification message
- RFC 4541 IBMP and MLD snooping services
- RFC 4861 Neighbor Discovery for IPv6
- RFC 4862 IPv6 Stateless Address Autoconfiguration
- RFC 4915 MT-OSPF
- RFC 5176 Dynamic Authorization Extensions to RADIUS
- RFC 5798 VRRPv3 for IPv6
- Draft-ietf-bfd-base-05.txt Bidirectional Forwarding Detection
- Draft-ietf-idr-restart-10.txt Graceful Restart Mechanism for BGP
- Draft-ietf-isis-restart-02 Restart Signaling for IS-IS
- Draft-ietf-isis-wg-multi-topology-11 Multi Topology (MT) Routing in IS-IS
- Internet draft-ietf-isis-ipv6-06.txt, Routing IPv6 with IS-IS
- ITU-T Y.1731
- LLDP Media Endpoint Discovery (LLDP-MED), ANSI/TIA-1057, draft 08
- PIM-DM Draft IETF PIM Dense Mode draft-ietf-idmr-pim-dm-05. txt, draft-ietf-pim-dm-new-v2-04.txt

Security

- MAC limiting (per port and per VLAN)
- Allowed MAC addresses – configurable per port
- Dynamic ARP inspection (DAI)
- IP source guard
- Local proxy ARP
- Static ARP support
- DHCP snooping
- Captive Portal
- Persistent MAC address configurations
- DDoS protection (CPU control path flooding protection)

Access Control Lists (ACLs) (Junos OS firewall filters)

- Port-based ACL (PACL) – Ingress and Egress
- VLAN-based ACL (VACL) – Ingress and Egress
- Router-based ACL (RACL) – Ingress and Egress
- ACL entries (ACE) in hardware per system: 7,000
- ACL counter for denied packets

*Unless explicitly specified for any particular MIB table or variables, Junos OS does not support SNMP set operations.

- ACL counter for permitted packets
- Ability to add/remove/change ACL entries in middle of list (ACL editing)
- Layer 2 – L4 ACL
- 802.1X port-based
- 802.1X multiple supplicants
- 802.1X with VLAN assignment
- 802.1X with authentication bypass access (based on host MAC address)
- 802.1X with VoIP VLAN support
- 802.1X dynamic ACL based on RADIUS attributes
- 802.1X Supported EAP types: MD5, TLS, TTLS, PEAP
- TNC certified
- MAC Authentication (RADIUS)
- Control Plane DoS protection

High Availability

- Non-Stop Routing (NSR) - PIM, OSPF v2 and v3, RIP v2, RIPnG, BGP, BGPv6, ISIS, IGMP v1, v2, v3
- Non-Stop Software Upgrade (NSSU)
- Redundant, hot-swappable power supplies
- Redundant, field-replaceable, hot-swappable fans
- Graceful Route Engine Switchover (GRES) for Layer 2 hitless forwarding and Layer 3 protocols on RE failover
- Graceful protocol restart – OSPF, BGP
- Layer 2 hitless forwarding on RE failover
- Online insertion and removal (OIR) uplink module
- Non-Stop Bridging (NSB) - LACP

Link Aggregation

- 802.3ad (LACP) support:
- Number of LAGs supported: 64
- Max number of ports per LAG: 8
- LAG load-sharing algorithm – Bridged or Routed (Unicast or Multicast) Traffic:
- IP: S/D IP
- TCP/UDP: S/D IP, S/D Port
- Non-IP: S/D MAC
- Tagged ports support in LAG

QoS

- Layer 2 QoS
- Layer 3 QoS
- Ingress policing: 1 rate 2 color
- Hardware queues per port: 8
- Scheduling methods (egress): Strict priority (SP), Shaped Deficit Weighted Round-Robin (SDWRR)
- 802.1p, DSCP/IP Precedence trust and marking
- Layer 2-4 classification criteria: Interface, MAC address, Ethertype, 802.1p, VLAN, IP address, DSCP/IP Precedence, TCP/UDP port numbers, etc.
- Congestion avoidance capabilities: Tail Drop

Multicast

- IGMP: v1, v2, v3
- IGMP snooping
- PIM-SM, PIM-SSM, PIM-DM

Services and Manageability

- Junos OS CLI
- Web interface
- Out-of-band management: Serial; 10/100/1000BASE-T Ethernet
- ASCII configuration
- Rescue configuration
- Configuration rollback
- Image rollback
- LCD management
- Element management tools: Network and Security Manager (NSM)
- Remote performance monitoring
- Junos SDK
- Proactive services support via Advanced Insight Solutions (AIS)
- SNMP: v1, v2c, v3
- RMON (RFC 2819) Groups 1, 2, 3, 9
- NTP
- DHCP server
- DHCP client and DHCP proxy
- DHCP relay and helper
- DHCP local server support
- RADIUS
- Service Now for automated fault detection, simplified trouble ticket management and streamlined operations
- TACACS+
- SSHv2
- Secure copy
- HTTP/HTTPs
- DNS resolver
- Syslog logging
- Temperature sensor
- Config-backup via FTP / secure copy
- Interface range specification
- Port profile associations

Supported MIBs*

- RFC 1155 SMI
- RFC 1157 SNMPv1
- RFC 1212, RFC 1213, RFC 1215 MIB-II, Ethernet-Like MIB & TRAPs
- RFC 1493 Bridge MIB
- RFC 1643 Ethernet MIB
- RFC 1657 BGP-4 MIB
- RFC 1724 RIPv2 MIB
- RFC 1850 OSPFv2 MIB
- RFC 1905 RFC 1907 SNMP v2c, SMIv2 and Revised MIB-II
- RFC 2011 SNMPv2 for internet protocol using SMIv2
- RFC 2012 SNMPv2 for transmission control protocol using SMIv2

- RFC 2013 SNMPv2 for user datagram protocol suing SMIv2
- RFC 2096 IPv4 Forwarding Table MIB
- RFC 2287 System Application Packages MIB
- RFC 2570 – 2575 SNMPv3, user based security, encryption and authentication
- RFC 2576 Coexistence between SNMP Version 1, Version 2 and Version 3
- RFC 2578 SNMP Structure of Management Information MIB
- RFC 2579 SNMP Textual Conventions for SMIv2
- RFC 2665 Ethernet-like interface MIB
- RFC 2787 VRRP MIB
- RFC 2819 RMON MIB
- RFC 2863 Interface Group MIB
- RFC 2863 Interface MIB
- RFC 2922 LLDP MIB
- RFC 2925 Ping/Traceroute MIB
- RFC 2932 IPv4 Multicast MIB
- RFC 3413 SNMP Application MIB
- RFC 3414 User-based Security model for SNMPv3
- RFC 3415 View-based Access Control Model for SNMP
- RFC 3621 PoE-MIB (PoE switches only)
- RFC 4188 STP & Extensions MIB
- RFC 4363 Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering and VLAN extensions
- RFC 5643 OSPF v3 MIB support
- Draft – blumenthal – aes – usm - 08
- Draft – reeder - snmpv3 – usm - 3desede -00
- Draft-ietf-bfd-mib-02.txt
- Draft-ietf-idmr-igmp-mib-13
- Draft-ietf-idmr-pim-mib-09
- Draft-ietf-idr-bgp4-mibv2-02.txt – Enhanced BGP-4 MIB
- Draft-ietf-isis-wg-mib-07

Troubleshooting

- Debugging: CLI via console, Telnet or SSH
- Diagnostics: Show and debug cmd, statistics
- Traffic mirroring (port)
- Traffic mirroring (VLAN)
- ACL-based mirroring
- Mirroring destination ports per system: 1
- LAG port monitoring
- Multiple destination ports monitored to 1 mirror (N:1)
- Max number of mirroring sessions: 1
- Mirroring to remote destination (over L2): 1 destination VLAN
- IP tools: Extended ping & trace
- Juniper Networks commit and rollback

Safety and Compliance

Safety Certifications

- UL-UL60950-1(First Edition)
- C-UL to CAN/CSA 22.2 No. 60950-1 (First Edition)
- TUV/GS to EN 60950-1, Amendment A1-A4, A11
- CB-IEC60950-1, all country deviations

Electromagnetic Compatibility Certifications

- FCC 47CFR Part 15 Class A
- EN 55022 Class A
- ICES-003 Class A
- VCCI Class A
- AS/NZS CISPR 22 Class A
- CISPR 22 Class A
- EN 55024
- EN 300386
- CE

NEBS

- GR-63-Core: NEBS, Physical Protection
- GR-1089-Core: EMC and Electrical Safety for Network Telecommunications Equipment
- All models except EX4200-24P and EX4200-48P

Environmental

- Reduction of Hazardous Substances (ROHS) 5

Telco

- CLEI code

Joint Interoperability Test Command (JITC)

- Department of Defense (DoD) Unified Capabilities (UC) Approved Products List (APL)

Common Criteria

- CC-EAL3

Metro Ethernet Forum

- MEF 9

Telecom Quality Management

- TL9000

Trusted Network Connect

- TNC IF-PEP

FIPS

- FIPS 140-2 Level 1

Noise Specifications

Noise measurements based on operational tests taken from bystander position (front) and performed at 23º C in compliance with ISO 7779.

Product	Power Supply Rating	Acoustic Noise in dBA
EX4200-24T	320 W AC	51.6
EX4200-24P	600 W AC	53.2
EX4200-24PX	930 W AC	39.9
EX4200-24F	320 W AC	50.8
EX4200-48T	320 W AC	51.6
EX4200-48P	930 W AC	54.0
EX4200-48PX	930 W AC	45.6
EX4200-24T-DC	190 W DC	48.0
EX4200-48T-DC	190 W DC	48.3
EX4200-24F-DC	190 W DC	46.7

Juniper Networks Service 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
Switches*	
EX4200-24T	24-port 10/100/1000BASE-T (8 PoE ports) + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24P	24-port 10/100/1000BASE-T (24 PoE ports) + 600 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24PX	24-port 10/100/1000BASE-T (24 PoE+ ports) + 930 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48T	48-port 10/100/1000BASE-T (8 PoE ports) + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48P	48-port 10/100/1000BASE-T (48 PoE ports) + 930 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48PX	48-port 10/100/1000BASE-T (48 PoE+ ports) + 930 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24F	24-port 100/1000BASE-X SFP + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24T-DC	24-port 10/100/1000BASE-T + 190 W DC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48T-DC	48-port 10/100/1000BASE-T + 190 W DC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24F-DC	24-port 100/1000BASE-X SFP + 190 W DC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24T-TAA	Trade Agreement Act-compliant 24-port 10/100/1000BASE-T (8 PoE ports) + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24P-TAA	Trade Agreement Act-compliant 24-port 10/100/1000BASE-T (24 PoE ports) + 600 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48T-TAA	Trade Agreement Act-compliant 48-port 10/100/1000BASE-T (8 PoE ports) + 320 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-48P-TAA	Trade Agreement Act-compliant 48-port 10/100/1000BASE-T (48 PoE ports) + 930 W AC PSU. Includes 50cm Virtual Chassis cable.
EX4200-24F-TAA	Trade Agreement Act-compliant 24-port 100BASE-FX/1000BASE-X SFP + 320 W AC PSU. Includes 50cm Virtual Chassis cable.

* Each switch comes with one power supply, RJ-45 cable, RJ-45-to-DB-9 serial port adapter, 19" rack-mount kit, and Virtual Chassis cable and connector retainer. Each system also ships with a power cord for the country to which it is being shipped. The EX4200-24F also comes with fiber port dust covers.

Product Number	Description
Accessories	
EX-CBL-VCP-50CM	Virtual Chassis Port cable 0.5 M length
EX-CBL-VCP-1M	Virtual Chassis Port cable 1 M length
EX-CBL-VCP-3M	Virtual Chassis Port cable 3 M length
EX-CBL-VCP-5M	Virtual Chassis Port cable 5 M length
Mounting Options	
EX-4PST-RMK	Adjustable 4-post rack-mount kit for EX4200 and EX3200
EX-RMK	Rack-mount kit for EX2200, EX3200, EX4200 and EX4550
EX-WMK	EX4200 and EX3200 wall-mount kit
EX4200 Feature Licenses**	
EX-24-AFL	Advanced Feature License for EX4200-24T, EX4200-24T-DC, EX4200-24P, EX4200-24F and EX4200-24F-DC switches
EX-48-AFL	Advanced Feature License for EX4200-48T, EX4200-48T-DC and EX4200-48P switches
EX-QFX-MACSEC-ACC†	MACsec Software License for EX4200 access switches
Uplink Modules	
EX-UM-2XFP	2-port 10GbE XFP Uplink Module
EX-UM-4SFP	4-port GbE SFP Uplink Module
EX-UM-2X4SFP	2-port 10GbE SFP+ / 4-port GbE SFP Uplink Module
EX-UM-2X4SFP-M†	2-port 10GbE SFP+ / 4-port GbE SFP Uplink Module with MACsec Support
Power Supplies	
EX-PWR-320-AC	320 W AC Power Supply Unit (PSU)
EX-PWR-600-AC	600 W AC Power Supply Unit (PSU)
EX-PWR3-930-AC	930 W PoE+ AC Power Supply Unit (PSU)
EX-PWR-190-DC	190 W DC Power Supply Unit (PSU)
Spare Chassis	
EX4200-24F-S	Spare chassis, 24-port 100/1000BASE-X SFP. Includes 50cm Virtual Chassis cable.
EX4200-48T-S	Spare chassis, 48-port 10/100/1000BASE-T (8 PoE ports). Includes 50cm Virtual Chassis cable.
Pluggable Optics	
EX-SFP-1FE-FX	SFP 100BASE-FX; LC connector; 1310nm; 2km reach on multimode fiber
EX-SFP-1FE-LX	SFP 100BASE-LX; LC connector; 1310nm; 10km reach on single-mode fiber
EX-SFP-1FE-LX40K	SFP 100BASE-LX; LC connector; 1310nm; 40km reach on single-mode fiber

** AFL includes licenses for IS-IS, BGP and MPLS.

† Not available in Russia and CIS countries.

Product Number	Description
EX-SFP-1FE-LH	SFP 100BASE-LX; LC connector; 1310nm; 80km reach on single-mode fiber
EX-SFP-FE20KT13R15	SFP 100BASE-BX; LC connector; TX 1310nm/RX 1550nm; 20km reach on single-strand, single-mode fiber
EX-SFP-FE20KT15R13	SFP 100BASE-BX; LC connector; TX 1550nm/RX 1310nm; 20km reach on single-strand, single-mode fiber
EX-SFP-1GE-T	SFP 10/100/1000BASE-T copper; RJ-45 connector; 100m reach on UTP
EX-SFP-1GE-SX	SFP 1000BASE-SX; LC connector; 850nm; 550m reach on multimode fiber
EX-SFP-1GE-LX	SFP 1000BASE-LX; LC connector; 1310nm; 10km reach on single-mode fiber
EX-SFP-GE10KT13R14	SFP 1000BASE-BX; Tx 1310nm/Rx 1490nm for 10km transmission on single-strand, single-mode fiber
EX-SFP-GE10KT13R15	SFP 1000BASE-BX; Tx 1310nm/Rx 1550nm for 10km transmission on single-strand, single-mode fiber
EX-SFP-GE10KT14R13	SFP 1000BASE-BX; Tx 1490nm/Rx 1310nm for 10km transmission on single-strand, single-mode fiber
EX-SFP-GE10KT15R13	SFP 1000BASE-BX; Tx 1550nm/Rx 1310nm for 10km transmission on single-strand, single-mode fiber
EX-SFP-1GE-LX40K	SFP 1000BASE-LX; LC connector; 1310nm; 40km reach on single-mode fiber
EX-SFP-GE40KT13R15	SFP 1000BASE-BX; Tx 1310nm/Rx 1550nm for 40km transmission on single-strand, single-mode fiber
EX-SFP-GE40KT15R13	SFP 1000BASE-BX; Tx 1550nm/Rx 1310nm for 40km transmission on single-strand, single-mode fiber
EX-SFP-1GE-LH	SFP 1000BASE-LH; LC connector; 1550nm; 70km reach on single-mode fiber
EX-XFP-10GE-SR	XFP 10GBASE-SR; LC connector; 850nm; 300m reach on 50 microns multimode fiber; 33m on 62.5 microns multimode fiber
EX-XFP-10GE-LR	XFP 10GBASE-LR; LC connector; 1310nm; 10km reach on single-mode fiber

Product Number	Description
EX-XFP-10GE-ER	XFP 10GBASE-ER; LC connector; 1550nm; 40km reach on single-mode fiber
EX-XFP-10GE-ZR	XFP 10GBASE-ZR; LC connector; 1550nm; 80km reach on single-mode fiber
EX-SFP-10GE-SR	SFP+ 10GBASE-SR; LC connector; 850nm; 300m reach on 50 microns multimode fiber; 33m on 62.5 microns multimode fiber
EX-SFP-10GE-LRM	SFP+ 10GBASE-LRM; LC connector; 1310nm; 220m reach on multimode fiber
EX-SFP-10GE-LR	SFP+ 10GBASE-LR; LC connector; 1310nm; 10km reach on single-mode fiber
EX-SFP-10GE-DAC-xM	SFP+ 10 Gigabit Ethernet Direct Attach Copper (twinax copper cable), where "x" denotes 1, 3, 5 or 7 meter lengths
EX-SFP-10GE-ER	SFP+ 10GBASE-ER 10 Gigabit Ethernet Optics, 1550nm for 40km transmission on single-mode fiber
EX-SFP-10GE-USR	SFP+ 10 Gigabit Ethernet Ultra Short Reach Optics, 850 nm for 10m on OM1, 20m on OM2, 100m on OM3 multimode fiber
EX-XFP-10GE80KDWDM	XFP 10GBASE DWDM, LC connector, tunable across C-band 50 GHz channel spacing (compliant with ITU-T G.698.1); 80km reach on single-mode fiber
EX-SFP-GE80KCWxxxx	SFP Gigabit Ethernet CWDM, LC connector; xxxx nm where xxxx represents 1470, 1490, 1510, 1530, 1550, 1570, 1590 or 1610; 80km reach on single-mode fiber

About Juniper Networks

Juniper Networks challenges the status quo with products, solutions and services that transform the economics of networking. Our team co-innovates with customers and partners to deliver automated, scalable and secure networks with agility, performance and value. Additional information can be found at Juniper Networks or connect with Juniper on Twitter and Facebook.

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