



# EX4500 ETHERNET SWITCH

## With Virtual Chassis Technology

### Product Overview

The Juniper Networks EX4500 line of Ethernet switches delivers a scalable, high-performance platform for supporting high-density 1 gigabit per second (Gbps) and 10 Gbps data center top-of-rack as well as data center, campus, and service provider aggregation deployments.

### Product Description

Featuring up to 48 wire-speed 10-Gigabit Ethernet (10GbE) ports in a two rack unit (2U) platform, the Juniper Networks® EX4500 Ethernet Switch delivers Layer 2 and Layer 3 connectivity to networked devices such as servers and other switches. The EX4500 base switch provides 40 fixed 10GbE pluggable ports that can also support GbE connectors for added flexibility. Two optional high-speed uplink modules offer four additional 10GbE small form-factor pluggable transceiver (SFP+) ports each for connecting to upstream devices.

By targeting high-density 10GbE top-of-rack and aggregation deployments in the data center, campus, and service provider environments, EX4500 switches perfectly complement the Juniper Networks EX Series Ethernet Switch product family: the Juniper Networks EX2200 line and EX3200 line designed for low-density access deployments; the EX4200 line designed for data center and campus GbE access and aggregation deployments; and the EX8200 line of Ethernet switches designed for data center and campus core and aggregation environments.

### Virtual Chassis Technology

The EX4500 supports Juniper Networks' unique Virtual Chassis technology, which enables multiple interconnected switches to operate as a single, logical device with a single IP address. When deployed in a Virtual Chassis configuration, the EX4500 switches are connected over a 128 Gbps backplane using Virtual Chassis interconnect cables. EX4500 switches can also be interconnected using a link aggregation (LAG) of up to eight SFP+ 10 GbE line-rate links, allowing switches to reside in different locations. Interconnected 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.

In the data center, using Virtual Chassis technology at the top of rack or end of row to aggregate servers provides flexibility in the deployment of uplinks. Rather than requiring redundant links for each physical switch to ensure high availability, redundant links are only needed for each Virtual Chassis group. EX4500 and EX4200 switches may be combined within a single Virtual Chassis configuration to support environments where both GbE and 10GbE servers are present.

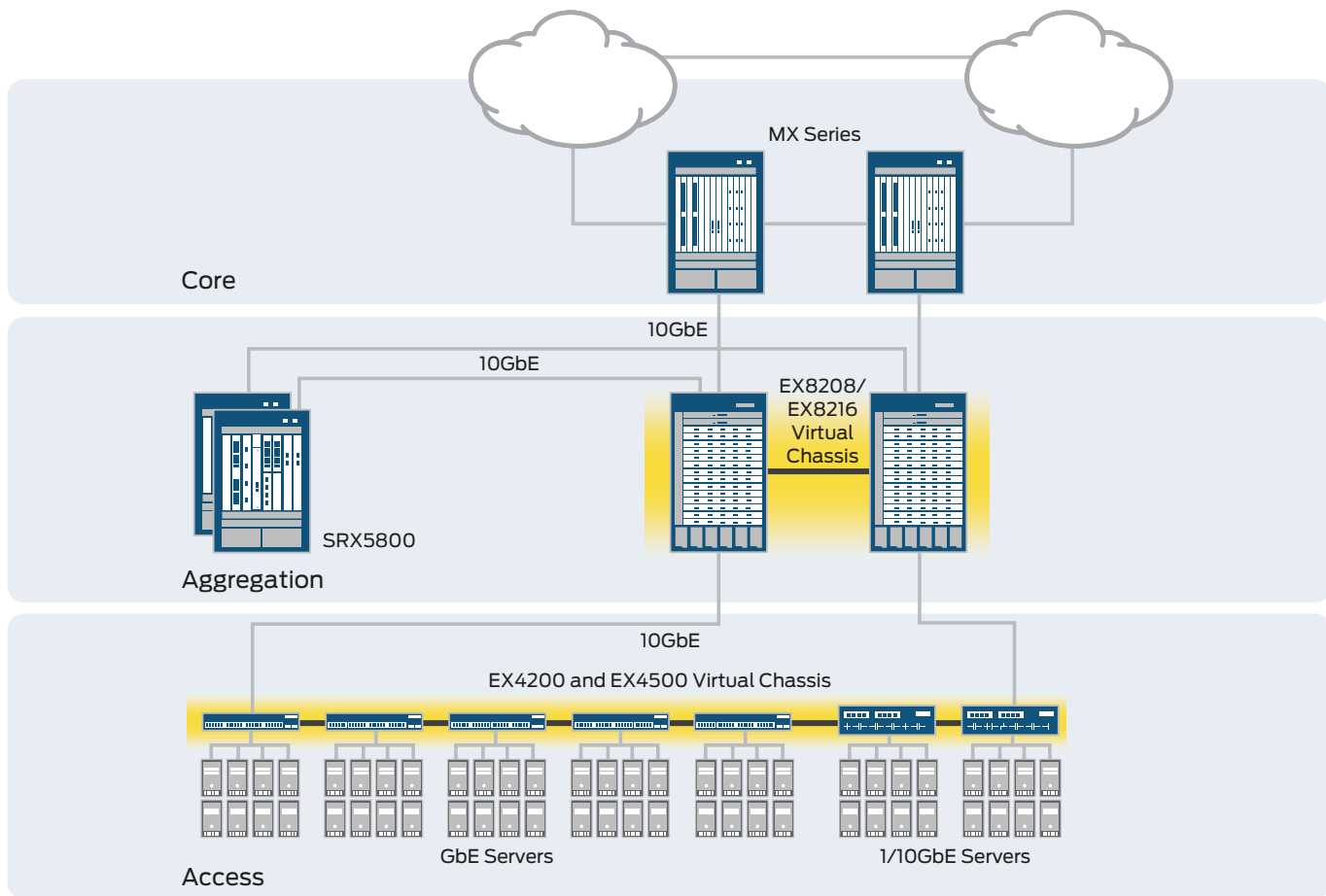


Figure 1: The EX4500 provides 10GbE server access in the data center.

## Data Center and Campus Advantages

The EX4500 is an ideal switch for both data center and campus aggregation deployments. It offers an economical, power efficient and compact solution for aggregating 10GbE uplinks. Its feature set provides simplicity, scalability, availability, adaptability and modularity to your network.

### Simple

Virtual Chassis on the EX4500 brings important simplification features to the campus aggregation layer. It eliminates the need for Spanning Tree, VRRP, complex routing, or VLAN configuration, therefore simplifying the management of the network. The EX4500 with Virtual Chassis reduces the number of virtual devices to manage and can even lead to a reduction in the number of network tiers. A single Virtual Chassis configuration can also span multiple nodes, reducing the need for uplinks and limiting the need for larger and more expensive nodes on superior tiers.

### Scalable

With Juniper Networks Junos® operating system shared across the entire EX Series platform and the EX4500 positioned in the top-of-rack and campus aggregation, the short learning curve enables you to quickly manage a complete architecture from one common set of instructions and one pane of glass. In addition, a single EX4500 can support up to 48 10GbE ports at line rate, enabling you to scale even in the most demanding environments.

In addition, Virtual Chassis technology makes it easy to scale while reducing the complexity of managing a larger network; by adding switches to a Virtual Chassis configuration, it is possible to increase the number of ports without increasing the number of devices to manage.

### Available

The EX4500 offers redundant cooling and is available with redundant power supplies. A Virtual Chassis configuration – with several EX4500 switches – provides redundant routing engines and a network fabric. In addition, the EX4500 offers many other features that increase the availability of your network, including Open Shortest Path First (OSPF), Equal-cost multipath (ECMP), link aggregation group (LAG), links distributed across multiple slots, Graceful Routing Engine switchover (GRES), graceful protocol restart, and Quality of Service (QoS) to prioritize time-sensitive data.

### Adaptable and Modular

As your business grows, your needs change and your network needs to evolve. With its small form factor (2RU) and complete switch features (with a supervisor, up to 48 10GbE ports, available in one box), the EX4500 can be easily redeployed in different environments and physical layouts. The dual-speed interfaces of the EX4500 enable you to transition your environments from GbE to 10GbE. The capacity of your EX4500 switch can easily be virtually increased by

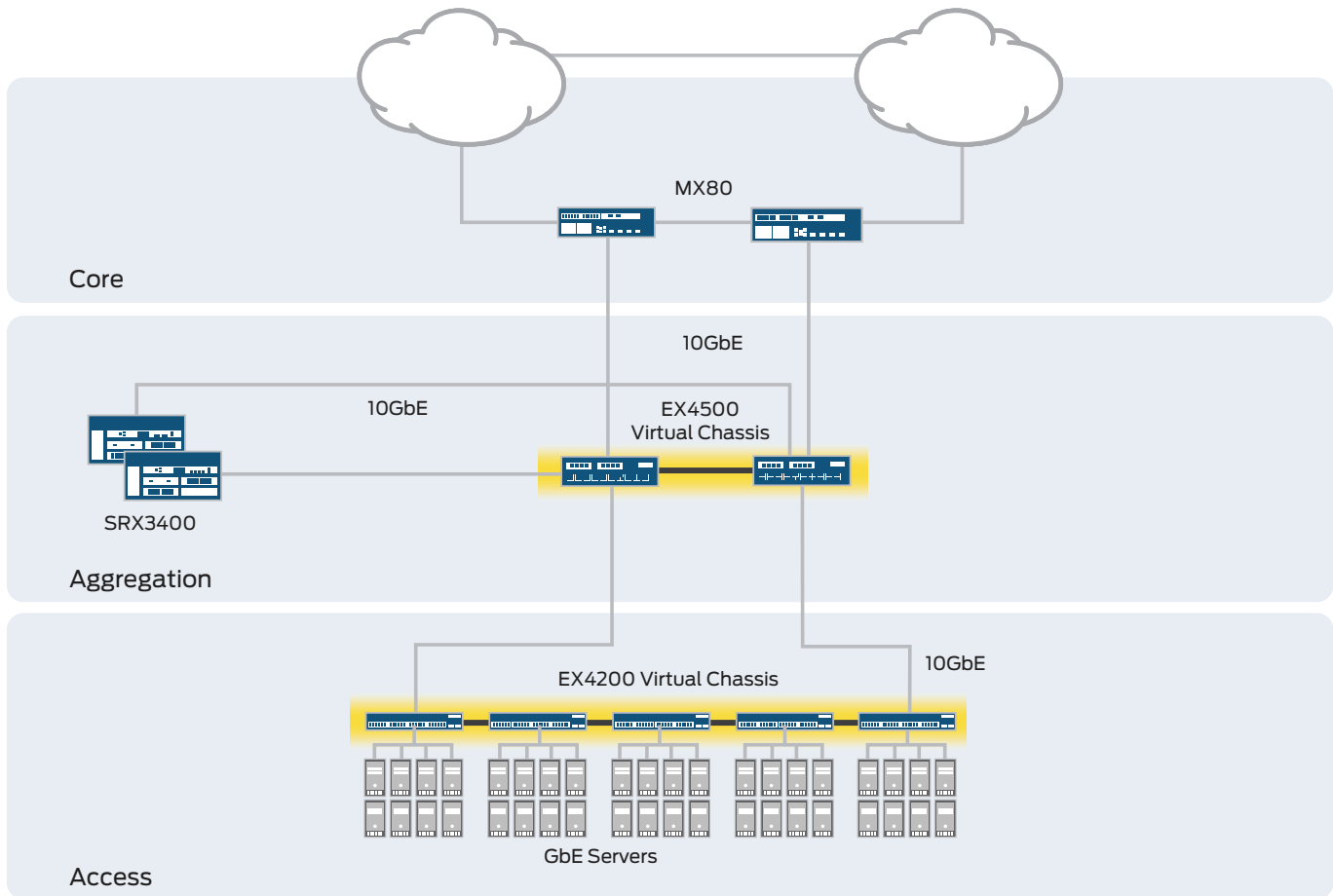


Figure 2: The EX4500 10GbE switch is ideal for small data center core deployments.

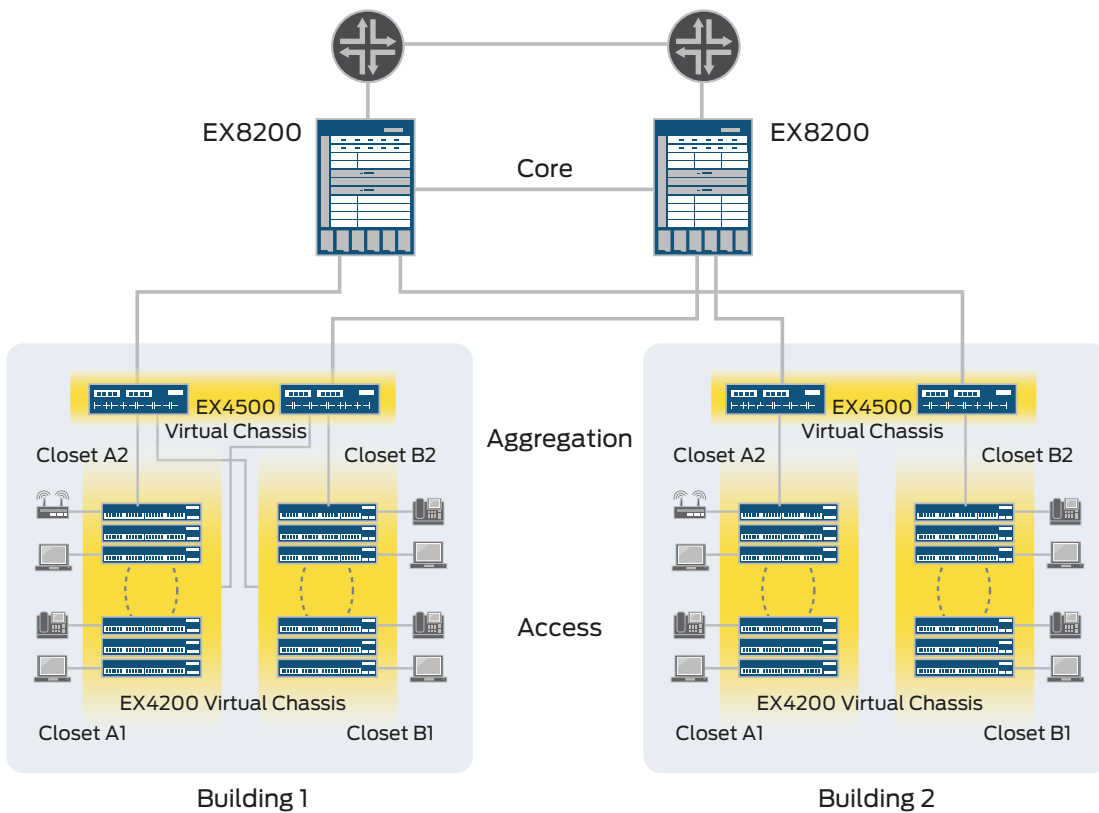


Figure 3: The EX4500 switch offers an economical, power-efficient, compact solution for campus aggregation deployments.

simply adding more switches to the Virtual Chassis configuration, without increasing the number of switches you have to manage. The modularity of an EX4500 with Virtual Chassis is clearly comparable to the adaptability of a modular switch.

## Campus Deployments

The EX4500 also offers an economical, power efficient and compact solution for aggregating 10GbE uplinks from access devices in building and campus deployments (see Figure 3). The switch's dual-speed interfaces also support environments transitioning from GbE to 10GbE.

The EX4500 easily meets enterprise core switch requirements, delivering wire-speed performance on every port, full device redundancy, support for Layer 3 dynamic routing protocols such as RIP and OSPF, and a comprehensive security and quality-of-service (QoS) feature set.

## Data Center Deployments

The EX4500 Ethernet Switch is designed for demanding data center applications where high performance, high availability, and energy efficiency are key requirements (see Figure 1). Operating at wire speed, the EX4500 switches deliver 714 Mpps throughput and a data rate of 960 Gbps (full duplex) for both Layer 2 and Layer 3 protocols. An industry first and only, EX4500s can be interconnected in a Virtual Chassis configuration that also includes EX4200s, creating a single logical switch that offers a variety of port and density options for mixed server environments.

Flexible deployment options enable the EX4500 to support back-to-front and front-to-back cooling, which ensures consistency with server designs for hot and cold aisle deployments. Front- and rear-facing configuration options ensure closer proximity to server ports, optimizing performance and keeping cable lengths short and manageable. The EX4500 is also very environmentally conscious, drawing less than eight watts per port under maximum load.

For small data centers, the EX4500, in a Virtual Chassis configuration, is ideally deployed as the aggregation/core switch, aggregating 10GbE uplinks from EX4200 Virtual Chassis configurations in the access layer (see Figure 2).

Customers introducing 10GbE into their racks will be able to use the EX4500 to add 10GbE-attached servers, iSCSI, and network-attached storage (NAS) with minimal impact to the current switching infrastructure.

The EX4500 also includes hardware support for the Data Center Bridging (DCB) feature set, also referred to as Converged Enhanced Ethernet (CEE). DCB is a collection of individual IEEE standards that allow for Ethernet-based I/O and network convergence, including support for FCoE.

## Junos Operating System

The EX4500 runs the same Juniper Networks Junos operating system that is used by other EX Series Ethernet Switches, as well as all Juniper Networks routers and Juniper Networks SRX Series Services Gateways. By utilizing a common operating system, Juniper Networks delivers a consistent implementation

\* Roadmap

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

These attributes are fundamental to the core value of the software, enabling all Junos OS-powered products 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.

## Management Options

Up to four different system management options are available for the EX4500 Ethernet switches.

1. The standard Junos OS command-line interface (CLI) offers the same granular management capabilities and scripting parameters found in any router powered by the Junos OS.
2. The EX4500 also includes the integrated Juniper Networks J-Web Software, an embedded web-based device manager that allows users to configure, monitor, troubleshoot, and perform system maintenance on individual switches via a browser-based graphical interface.
3. EX4500 performance, configuration, and fault data can also be exported to leading third-party management systems such as HP OpenView, IBM Tivoli, and Computer Associates Unicenter software, providing a complete, consolidated view of network operations.
4. The EX4500 is also supported by Juniper Networks Junos® Space\*, an open, programmable application platform for hosting a comprehensive suite of network operational application tools that provide a smart, simple, and open approach for automating the deployment and operation of a Juniper infrastructure.

Explicitly designed to allow partners and customers to build and deploy smart, simple, and easy-to-use applications, Junos Space provides multiple management and infrastructure applications for managing Juniper resources and assets, including inventory management, device and interface configuration, automated software management and deployment, and event-driven fault management. These Junos Space applications offer predefined automation schemes and best practice templates to enable rapid and accurate deployments.

## Features and Benefits

The EX4500 Ethernet switches include the following key features and benefits.

### High Performance

Each EX4500 supports 480 Gbps of bandwidth with 48 line-rate 10 Gbps ports at all packet sizes or 14.88 Mpps per port at the minimum Ethernet frame size.

## High Availability

The EX4500 switches offer dual internal load sharing AC power supplies, and redundant variable-speed fans as standard features, protecting the switch from a single power supply or fan failure. DC power options will be available in the future.

## Energy Efficient

Consuming less than eight watts per 10GbE interface, the EX4500 offers a low power solution for 10GbE top-of-rack, end-of-row, and aggregation deployments. The EX4500 switches also improve cooling efficiency with redundant variable-speed fans that automatically adjust their speed based on existing conditions to reduce power consumption.

## Small Footprint

The EX4500 supports up to 48 wire-speed 10GbE ports in a single 2U platform.

## Additional Features

- System status LEDs
- LCD status display
- Versatile two- and four-post rack mounting options
- Front-to-back and back-to-front airflow options
- AC and DC power supply options
- Support for Jumbo frames (9,000)
- Quality of service (IEEE 802.1p marking)
- Multicast (IGMP v1/v2/v3 snooping)
- Layer 2 features including support for 4,096 VLAN IDs, Spanning Tree (802.1s and 802.1w), bridge protocol data unit (BPDU) guard, 802.3as Link Aggregation
- Management features including Telnet and SSH v1/v2, SNMP v1-v3, RADIUS, TACACS+, and RMON

Table 1: EX4500 Power Consumption

CONFIGURATION	POWER CONSUMPTION
No uplinks installed; 40 USR ports in base, all ports forwarding (line rate)	328 W
One uplink module (4 x 10GbE SFP+ ports) installed; 40 USR ports in base, all ports forwarding (line rate)	346 W
Two uplink modules (8 x 10GbE SFP+ ports) installed; 40 USR ports in base, all ports forwarding (line rate)	364 W



EX4500 with two uplink modules (4 x 10GbE SFP+ ports)



EX4500 with Virtual Chassis module and dual redundant power supplies

## EX4500 10GbE Ethernet Switch Specifications

### Hardware

#### Interface Options

- 40 GbE/10GbE small form-factor pluggable transceiver (SFP/SFP+) fiber connectors
- Eight 10GbE SFP+ uplink ports (via two optional four-port uplink modules)
- 1 x 10/100/1000 Ethernet RJ-45 ports for management
- Console port for management
- 128 Gbps Virtual Chassis module with 2 x 64 Gbps ports

#### Supported Optics

- 10GbE SFP+ LC connector type: short reach (SR) (multimode), long reach (LR) (single mode), ultra short reach (USR) (multimode), extended reach (ER) (single mode)
- 10GbE SFP+ copper: Direct-attached copper (1/3/7 m)
- 1 GbE SFP LC connector type: LX (single mode), SX (multi mode), 1000BASE-T (only 1,000 M supported)

#### Dimensions

- Height: 3.5 in (8.9 cm); 2U
- Width: 17.25 in (43.8 cm)
- Depth: 21.1 in (53.6 cm)
- Weight: 37 lbs (17 kg) with one AC and DC power supply

#### Rack Installation Kit

- Versatile two- and four-post mounting options for 19-in server rack or datacom rack

#### LEDs

- System LEDs that indicate status

#### Airflow

- Front-to-back or back-to-front cooling
- Redundant variable-speed fans reduce power draw

#### CPU

- 1.5 GHz PowerPC

#### Power

- Dual hot-swappable load sharing AC and DC power supplies

### Software

#### Security

- RADIUS
- TACACS+
- Access control lists (ACLs): Allow and deny
- SSH v1, v2
- Secure interface login and password
- Local proxy Address Resolution Protocol (ARP)
- Static ARP support

#### Layer 2 Switching

- Maximum media access control (MAC) addresses per system: 24,000
- Static MAC entries: 24,000
- Jumbo frames: 9,216 bytes
- Number of VLANs: 4,096
- Port-based VLAN
- 4,096 VLAN IDs supported
- Routed VLAN interface (RVI)

### Link Aggregation

- 802.3ad support
  - Number of Link Aggregation Groups (LAGs) supported: 64
  - Maximum 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

### Spanning Tree

- RSTP and VSTP running concurrently
- Spanning Tree Protocol (802.1D)
- Multiple Spanning Tree Protocol (MSTP) (802.1s)
- Rapid Spanning Tree Protocol (RSTP) (802.1w)
- VSTP - VLAN Spanning Tree
- BPDU protect
- Loop protect
- Root protect

### Quality of Service (QoS)

- EZQoS
- CoS on L3 VLAN
- Per interface rewrite
- Per interface classification
- Policer mark down action
- Remarking of bridged packets
- Layer 2 QoS
- Layer 3 QoS
- Rate Limiting:
  - Ingress policing: 1 rate 2 color
  - Egress shaping: per-queue, per-port
- Eight hardware queues per port
- Scheduling methods (egress): Strict priority (SP), shaped deficit weighted round-robin (SDWRR)
- 802.1p remarking
- 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: Weighted tail drop eight queues

### Layer 3 Features: IPv4

- VRF-lite (ISIS, RIP, OSPF, BGP, BGP, ISIS)
- IP directed broadcast traffic forwarding
- Routing protocols: RIPv1/v2, OSPF, BGP, ISIS
- Max number of IPv4 unicast routes in hardware: 10,000
- Max number of IPv4 multicast routes in hardware: 4,000
- Static routing
- Routing policy
- Virtual Router Redundancy Protocol (VRRP)
- Bidirectional Forwarding Detection (BFD) protocol

### Layer 3 Features: IPv6

- Max number of Neighbor Discovery (ND) entries: 1,000
- Max number of IPv6 unicast routes in hardware: 1,000
- Max number of IPv6 multicast routes in hardware: 1,000
- Routing protocols: RIPng, OSPFv3, IPv6, BGP, MLDv2
- Static routing

### Multicast

- VRF-lite (PIM, IGMP)
- IGMP static
- Internet Group Management Protocol (IGMP): v1, v2, v3
- IGMP snooping
- PIM-SM, PIM-SSM
- Multicast Source Directory Protocol (MSDP)

### 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: 1,500
- ACL counter for denied packets
- ACL counter for permitted packets
- Ability to add/remove/change ACL entries in middle of list (ACL editing)
- Layer 2-L4 ACL
- Trusted Network Connect (TNC) certified
- MAC authentication (RADIUS)
- Control plane denial-of-service (DoS) protection

### Supported RFCs

- RFC 2925 MIB for Remote Ping, Trace
- RFC 1122 Host Requirements
- RFC 768 UDP
- RFC 791 IP
- RFC 783 Trivial File Transfer Protocol (TFTP)
- RFC 792 ICMP
- RFC 793 TCP
- RFC 826 ARP
- RFC 894 IP over Ethernet
- RFC 903 RARP
- RFC 906 TFTP Bootstrap
- RFC 1027 Proxy ARP
- RFC 2068 HTTP server
- RFC 1812 Requirements for IP Version 4 Routers
- RFC 1519 Classless Interdomain Routing (CIDR)
- RFC 1256 IPv4 ICMP Router Discovery (IRDP)
- RFC 1058 RIP v1
- RFC 2453 RIP v2
- RFC 1112 IGMP v1
- RFC 2236 IGMP v2
- RFC 3618 MSDP
- RFC 4915 MT-OSPF
- RFC 3376 IGMP v3
- RFC 1492 TACACS+
- RFC 2138 RADIUS Authentication
- RFC 2139 RADIUS Accounting
- RFC 3579 RADIUS EAP support for 802.1x
- RFC 5176 Dynamic Authorization Extensions to RADIUS
- RFC 2267 Network Ingress Filtering
- RFC 2030 SNTP, Simple Network Time Protocol
- RFC 854 Telnet client and server
- RFC 951, 1542 BootP
- RFC 2131 BOOTP/DHCP relay agent and Dynamic Host Configuration Protocol (DHCP) server
- RFC 1591 Domain Name System (DNS)
- RFC 2338 VRRP
- RFC 2328 OSPF v2 (edge mode)

## Supported RFCs (continued)

- RFC 1587 OSPF not-so-stubby area (NSSA) Option
- RFC 2154 OSPF w/Digital Signatures (Password, MD-5)
- RFC 2370 OSPF Opaque link-state advertisement (LSA) Option
- RFC 3623 OSPF Graceful Restart
- RFC 2362 PIM-SM (edge mode)
- RFC 3569 draft-ietf-ssm-arch-06.txt PIM-SSM PIM Source Specific Multicast
- RFC 2474 DiffServ Precedence, including 8 queues/port
- RFC 2598 DiffServ Expedited Forwarding (EF)
- RFC 2597 DiffServ Assured Forwarding (AF)
- RFC 2475 DiffServ Core and Edge Router Functions
- 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
- Draft-ietf-bfd-base-05.txt Bidirectional Forwarding Detection

## Supported MIBs

- RFC 1155 SMI
- RFC 1157 SNMPv1
- RFC 1905 RFC 1907 SNMP v2c, SMIv2 and Revised MIB-II
- RFC 2570 – 2575 SNMPv3, user based security, encryption and authentication
- RFC 2576 Coexistence between SNMP Version 1, Version 2, and Version 3
- RFC 1212, RFC 1213, RFC 1215 MIB-II, Ethernet-Like MIB and TRAPs
- RFC 2578 SNMP Structure of Management Information MIB
- RFC 2579 SNMP Textual Conventions for SMIv2
- RFC 2925 Ping/Traceroute MIB
- RFC 2665 Ethernet-like interface MIB
- RFC 1643 Ethernet MIB
- RFC 1493 Bridge MIB
- RFC 2096 IPv4 Forwarding Table MIB
- RFC 2011 SNMPv2 for Internet protocol using SMIv2
- RFC 2012 SNMPv2 for transmission control protocol using SMIv2
- RFC 2013 SNMPv2 for user datagram protocol using SMIv2
- RFC 2863 Interface MIB
- RFC 3413 SNMP Application MIB
- RFC 3414 User-based Security Model for SNMPv3
- RFC 3415 View-based Access Control Model for SNMP
- RFC 1724 RIPv2 MIB
- RFC 2863 Interface Group MIB
- RFC 2932 IPv4 Multicast MIB
- RFC 2787 VRRP MIB
- RFC 1850 OSPFv2 MIB
- RFC 2819 RMON MIB
- RFC 2287 System Application Packages MIB
- RFC 4188 STP and Extensions MIB
- RFC 4363 Definitions of Managed Objects for Bridges with Traffic Classes, Multicast Filtering, and VLAN extensions
- RFC 2922 LLDP MIB
- Draft – blumenthal – aes – usm - 08
- Draft – reeder - snmpv3 – usm - 3desede -00
- Draft – ietf-idmr-igmp-mib-13
- Draft – ietf-idmr-pim-mib-09
- Draft – ietf-bfd-mib-02.txt

## Troubleshooting

- Debugging: CLI via console, Telnet, or SSH
- Diagnostics: Show and debug command, statistics
- Traffic monitoring/mirroring (port, VLAN)
- IP tools: Extended ping and trace
- Junos OS commit and rollback

## Traffic Mirroring

- Port-based
- VLAN-based
- ACL-based mirroring
- Mirroring destination ports per system: 1
- LAG port monitoring
- Multiple destination ports monitored to 1 mirror (N:1)
- Maximum number of mirroring sessions: 1
- Mirroring to remote destination (over L2): 1 destination VLAN

## 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

### Environmental

- Reduction of Hazardous Substances (ROHS) 5

### Telco

- CLEI code

### Environmental Ranges

- Operating temperature: 32° to 113° F (0° to 45° C)
- Storage temperature: -40° to 158° F (-40° to 70° C)
- Operating altitude: up to 10,000 ft (3,048 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)

### Telecom Quality Management

- TL9000

## Juniper Networks Services and Support

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

## Ordering Information

MODEL NUMBER	DESCRIPTION
<b>Base Unit*</b>	
EX4500-40F-FB-C	40-port GbE/10GbE SFP/SFP+ front-to-back airflow, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
EX4500-40F-BF-C	40-port GbE/10GbE SFP/SFP+ back-to-front airflow, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
EX4500-40F-DC-C	40-port GbE/10GbE SFP/SFP+ front-to-back airflow, 1200W DC, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
EX4500-40F-VC1-BF	40-port GbE/10GbE SFP/SFP+ back-to-front airflow, 128 Gbps Virtual Chassis Interconnect module, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
EX4500-40F-VC1-FB	40-port GbE/10GbE SFP/SFP+ front-to-back airflow, 128 Gbps Virtual Chassis Interconnect module, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues
EX4500-40F-VC1-DC	40-port GbE/10GbE SFP/SFP+ front-to-back airflow, 128 Gbps Virtual Chassis Interconnect module, 1200W DC power supply, hardware support for Data Center Bridging, and support for eight PFC (802.1Qbb) queues

### Advanced Feature Licenses

EX-48-AFL	Advanced Feature License for IS-IS, BGP, MPLS and IPv6 routing
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### Accessories

EX4500-PWR1-AC-FB	EX4500 1200 W AC (1000 W at 110 V) power supply – front-to-back airflow
EX4500-PWR1-AC-BF	EX4500 1200 W AC (1000 W at 110 V) power supply – back-to-front airflow
EX4500-UM-4XSFP	EX4500 4-Port 10GbE SFP+ uplink module (optics sold separately)
EX4500-PWR1-DC	EX4500 1200W DC power supply - front to back airflow (power cord needs to be ordered separately)
EX4500-VC1-128G	128 Gbps Virtual Chassis module
EX-CBL-VCP-50CM	Virtual Chassis Port cable 0.5M length
EX-CBL-VCP-1M	Virtual Chassis Port cable 1M length
EX-CBL-VCP-3M	Virtual Chassis Port cable 3M length
EX-CBL-VCP-5M	Virtual Chassis Port cable 5M length

MODEL NUMBER	DESCRIPTION
<b>Pluggable Optics</b>	
EX-SFP-1GE-T	SFP 1000BASE-T copper; RJ-45 connector; 100 m 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; 1310 nm; 10 km reach on single mode fiber
EX-SFP-10GE-SR	SFP+ 10GBASE-SR; LC connector; 850 nm; 300 m reach on 50 microns multimode fiber; 33 m on 62.5 microns multimode fiber
EX-SFP-10GE-LR	SFP+ 10GBASE-LR; LC connector; 1310 nm; 10 km reach on single mode fiber
EX-SFP-10GE-ER	SFP+ 10GBASE-ER 10 Gigabit Ethernet Optics, 1550nm for 40km transmission on single-mode fiber
EX-SFP-10GE-DAC-1M	SFP+ 10GbE Direct Attach Copper (twinax copper cable) 1 m
EX-SFP-10GE-DAC-3M	SFP+ 10GbE Direct Attach Copper (twinax copper cable) 3 m
EX-SFP-10GE-DAC-7M	SFP+ 10GbE (twinax copper cable) 7 m
EX-SFP-10GE-USR	10GbE Ultra Short Reach; 850 nm; 10 m on OM1, 30 m on OM2, 100 m on OM3 multimode fiber

\* EX4500 base unit includes chassis, fan tray, intraconnect module, AC power supply, power cord, power supply cover panel, and two uplink module cover panels

## About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at [www.juniper.net](http://www.juniper.net).

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