JUNIPER
NETWORKS

EX8200 ETHERNET LINE CARDS

Product Overview

Juniper Networks EX8200 Ethernet line cards offer a variety of interfaces for supporting high-density 100 Mbps, Gigabit and 10 Gigabit Ethernet (GbE) deployments. Working with the Juniper Networks EX8208 eight-slot and EX8216 16-slot modular Ethernet switch chassis, the EX8200 Ethernet line cards offer flexible, high-density interfaces for high-performance data center and campus aggregation and core environments.

Product Description

The Juniper Networks® EX8200 line of Ethernet switches offer powerful, modular platforms that deliver the performance, scalability, and carrier-class reliability required for today's high-density enterprise data center access and core and campus aggregation and core environments, as well as high-performance service provider interconnects.

EX8200 Ethernet line cards are specifically designed to optimize enterprise applications. Each EX8200 Ethernet line card includes either two or four on-board Packet Forwarding Engines—the EX-PFE2—that are equipped with two purpose-built, application-specific integrated circuits (ASICs), one to perform wire-speed packet processing at line rates, and another to perform internal deep packet queuing and buffering while providing a high-speed interface to the chassis switch fabric. In addition, each line card contains a local processor which provides scalable local control and status processing.

Four versions of the EX8200 Ethernet line cards are available, each of which supports a consistent set of features and capabilities: the EX8200-48T, the EX8200-48F, the EX8200-8XS and the EX8200-40XS.

EX8200-48T: The EX8200-48T Ethernet line card offers wire-rate 48 10/100/1000BASE-T ports with RJ-45 copper connectors. Designed for data center end-of-row server access, or campus applications where high densities, high performance, and high availability over copper links of up to 100 m are required, the EX8200-48T enables up to 384 line-rate ports in a single EX8208 chassis, or 768 ports in an EX8216 chassis.

EX8200-48F: The EX8200-48F is a 48-port wire-rate 100BASE-FX/1000BASE-X line card with modular small form-factor pluggable transceiver (SFP) interfaces for supporting a wide range of 100 Mbps or Gigabit Ethernet optical connections over multimode fiber, single-mode fiber, or copper cabling. Designed for high-performance enterprise and service provider distribution applications, the EX8200-48F also enables up to 384 line-rate ports in an EX8208 chassis, and 768 ports in an EX8216 chassis.

EX8200-8XS: The EX8200-8XS is an eight-port 10GBASE-X line card with compact, modular SFP+ fiber optic interfaces, enabling up to 64 line-rate 10-Gigabit Ethernet ports in an EX8208 chassis and 128 ports in an EX8216 chassis. The EX8200-8XS is ideal for enterprise applications such as campus or data center uplink aggregation, core and backbone interconnects, and for service provider deployments requiring high-

density, wire-speed 10-Gigabit Ethernet interconnects in metro area networks, Internet exchange points, and points of presence (POPs). The 10-Gigabit Ethernet port densities afforded by the EX8200-8XS line cards also enable EX8200 switches to consolidate aggregation and core layers in the data center, simplifying the network architecture and reducing power, space, and cooling requirements while lowering total cost of ownership (TCO).

EX8200-40XS: The EX8200-40XS is a 40-port oversubscribed 10GbE solution for data center end-of-row and middle-of-row server access, as well as for data center blade switch and top-of-rack or campus uplink aggregation deployments. Optimized for data center networks migrating from GbE to 10GbE interfaces where simultaneous line-rate performance is not required on all ports, the EX8200-40XS supports a wide range of both SFP (GbE) and SFP+ (10 GbE) modular optical interfaces for connecting over multimode fiber, single-mode fiber, and copper cabling.

The 40 SFP/SFP+ ports on the EX8200-40XS are divided into 8 independent groups of 5 ports each. Because port groups are independent of one another, each group can have its own oversubscription ratio, providing customers with maximum deployment flexibility. Each group dedicates 10 gigabits per second (Gbps) of switching bandwidth to be dynamically shared among the ports; queues are allocated within a 1MB oversubscription buffer based on the number of active ports in a group and the types of interfaces installed. Users simply connect the cables and the EX8200-40XS automatically provisions each port group accordingly. No manual configuration is required.

The EX8200-40XS line card can satisfy either 10GbE or GbE applications within each port group independently, providing the perfect migration vehicle for customers transitioning to higher-speed connectivity.

Features and Benefits

The EX8200 PFE2 complex is comprised of two ASICs: the packet processor and the switch fabric interface. The hardware pipeline on the packet processor ASIC supports approximately 960 Mpps of Layer 2 and Layer 3 IPv4 and IPv6 traffic in the EX8208, and more than 1900 Mpps in the EX8216. Wire-speed performance is maintained regardless of packet size, from 64- to 9216-byte jumbo frames across both L2 and L3 interfaces. Firewall (access control list) filtering, marking, and rate limiting also occur at wire rate, with up to 64,000 entries across L2-L4 packet headers that can be applied per port, per VLAN, and per routed interface.

The packet processor ASIC also supports generic routing encapsulation (GRE) tunneling and two-label MPLS in hardware at line rate . Additional packet processor ASIC capabilities include multiple queues for CPU-bound control traffic to protect the Routing Engine from denial of service (DoS) attacks, and support for up to seven mirrored analyzer sessions directed to individual ports, VLANs, or tunneled interfaces.

The switch fabric interface ASIC of the EX-PFE2 manages the large ingress and egress buffers that provide congestion avoidance and traffic prioritization. On ingress, each switch fabric interface queues packets based on destination using dedicated high- and low-priority buffers for each wire-speed, 10-Gigabit Ethernet egress port, or each group of 12 Gigabit Ethernet ports in the system. These weighted random early detection (WRED) virtual output queues—up to 8,192 in an EX8216 chassis—prevent "head-of-line blocking" among ports on the same line card, ensuring complete independence of traffic flows among all 10-Gigabit Ethernet ports in the system.

The switch fabric interface also manages the transfer of data across the distributed, single-tier crossbar switch fabric. Data is evenly distributed across the fabric to balance traffic load and ensure graceful degradation of performance in the event of a non-redundant switch fabric failure. Multicast traffic is also balanced across the system using the same line-rate, binary-tree replication process as the Juniper Networks T Series Core Routers and the Juniper Networks MX Series 3D Universal Edge Routers, minimizing fabric congestion while reducing latency.

On egress, the switch fabric interface provides eight dedicated queues per port, mapped according to class of service (CoS) or DiffServ code point (DSCP) values. A WRED scheduler is used for congestion avoidance within each queue, while administrator-configured strict and weighted round-robin priority options are available between queues on a single port. Multicast traffic is managed independent of unicast traffic.

Total buffer size is 512 MB on each EX8200-8XS 10-Gigabit Ethernet port or each EX8200-40XS port group, and 42 MB on each EX8200-48T and EX8200-48F Gigabit Ethernet port, providing 50-100 ms of bandwidth delay buffering. These deep buffers and ingress and egress queuing mechanisms are critical to managing mission-critical data, handling bursty traffic, and limiting TCP/IP retries at the application level to free up bandwidth, reduce latency and allow a higher quantity of both unicast and multicast application flows across the network.

All packets pass through the entire EX-PFE2 ingress pipeline, the switch fabric, and the EX-PFE2 egress pipeline. This consistency of packet processing ensures that the EX-PFE2 is capable of delivering port-to-port latencies of under 10 µs, regardless of ingress or egress port location.

Up to 255 link aggregation groups (LAGs) are supported, ensuring that the large number of high-density Gigabit Ethernet LAGs found in campus and data center core and aggregation deployments can be accommodated. Up to 12 ports may be bundled into a single LAG, allowing 120 Gbps logical interfaces to be created using a full L2-L4 hash algorithm for optimal load balancing. Ports in a LAG may be distributed across line cards within an EX8200 switch for an added level of resiliency. Automatic detection, recovery, and redistribution of LAG traffic in the event of a port, link, or line card failure is supported for highly reliable connections.

Each line card contains a local CPU that is connected to the chassis' redundant Routing Engines over dedicated internal gigabit control-plane links. This CPU manages the local line card components, distributes forwarding table and other control plane data from the Routing Engine to the local EX-PFE2 ASICs, and returns line card status and CPU-directed control plane packets to the Routing Engine. A second processor resident on each line card aggregates flow-based statistics and analyzes sampled packets without impacting control plane performance. Finally, hot insertion and removal of all line cards is supported for online maintenance and support.

EX8200 Ethernet Line Card Features at a Glance

| FEATURES	
High availability	• Hardware designed for continuous operation: - Secure, modular architecture to isolate faults - Separate control and forwarding planes to enhance scalability and resiliency - Transparent failover and network recovery - Graceful Route Engine Switchover (GRES) - Nonstop Routing (NSR)
Layer 2 features	• Jumbo frames (9216 byte) • 4,096 VLANs • VLAN Registration Protocol (GVRP) • 802.3ad – Link Aggregation Control Protocol (LACP) • 802.1D – Spanning Tree Protocol (STP) • 802.1w – Rapid Spanning Tree (RSTP) • 802.1s – Multiple Instance Spanning Tree (MSTP) • Redundant Trunk Group (RTG) • VLAN Spanning Tree Protocol (VSTP)
Layer 3 features	• Static routing • RIP v1/v2 • OSPF v2 • Filter-based forwarding • Virtual Router Redundancy Protocol (VRRP) • BGP (Advanced Feature license) • IS-IS (Advanced Feature license) • IPv6 (Advanced Feature license) • Bidirectional Forwarding Detection protocol (BFD)
Hardware tunneling	• GRE tunnels (Advanced feature license*) • MPLS capabilities (Advanced feature license*)
Multicast	• Internet Group Management Protocol (IGMP) v1/v2/v3 • IGMP snooping • Protocol Independent Multicast PIM-SM, PIM-SSM, PIM-DM, MSDP
Firewall filters	• Ingress and egress L2-L4 access control lists (ACLs): – Port ACLs – VLAN ACLs – Routed ACLs • Control plane denial of service (DoS) protection
QoS	• 2,000 policers • 8 egress queues per port • Weighted Random Early Drop (WRED) scheduling • Scheduled Deficit Weighted Round Robin (SDWRR) queuing • Strict Priority queuing • Egress per port and per queue shaping • Multi-field classification (L2 – L4) for scheduling and rewrite
Convergence	• Full support for standards-based CEE / DCB (EX8200-40XS only)*

* Roadmap
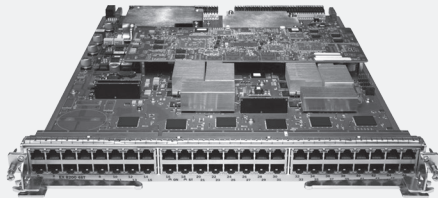
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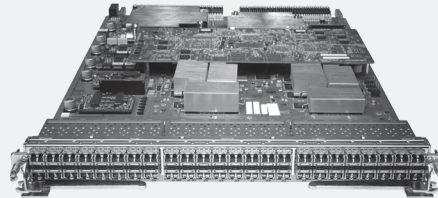
EX8200-48F
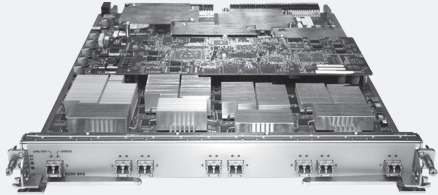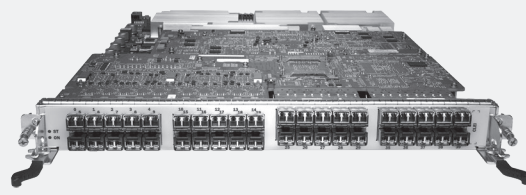
EX8200-8XS

EX8200-40XS

EX8200 Ethernet Line Card Specifications

	EX8200-48T	EX8200-48F	EX8200-8XS	EX8200-40XS
Port quantity	48	48	8	40
Port type	RJ-45	SFP	SFP+	SFP/SFP+
Port speed	10/100/1000 Mbps	100/1000 Mbps	10 Gbps	1 Gbps/10Gbps
Max ports per system	384 (EX8208); 768 (EX8216)	384 (EX8208); 768 (EX8216)	64 (EX8208); 128 (EX8216)	320 (EX8208); 640 (EX8216)
Forwarding rate	71 Mpps	71 Mpps	119 Mpps	119 Mpps
Data rate	48 Gbps	48 Gbps	80 Gbps	80 Gbps
Fabric connection	80 Gbps (160 Gbps full duplex)	80 Gbps (160 Gbps full duplex)	160 Gbps (320 Gbps full duplex)	160 Gbps (320 Gbps full duplex)
Queues per port	8 per port	8 per port	8 per port	Ingress: 6 per port group Egress: 8 per port and 8 per port group
Policers	2,000	2,000	2,000	3,000
Total buffer size	42 MB per port	42 MB per port	512 MB per port	1 MB per port group 512 MB per port group within the PFE
Scheduler	WRED, SDWRR	WRED, SDWRR	WRED, SDWRR	SDWRR per port group at ingress; WRED, SDWRR
Jumbo frames	9216 bytes	9216 bytes	9216 bytes	9216 bytes
LAG (ports/groups)	12/255	12/255	12/255	12/255
MAC addresses	160,000	160,000	160,000	160,000
IPv4 unicast routes*	500,000	500,000	500,000	500,000
IPv4 multicast routes*	128,000	128,000	128,000	256,000
IPv6 unicast routes*	256,000	256,000	256,000	128,000
IPv6 multicast routes*	128,000	128,000	128,000	64,000
VLANs	4,096	4,096	4,096	4,096
Firewall filters (ACLs)	54,000 entries	54,000 entries	54,000 entries	54,000 entries
ARP entries	100,000	100,000	100,000	100,000
L3 next hops	220,000	220,000	220,000	220,000
Number of multicast groups	16,000	16,000	16,000	16,000
Analyzer sessions	7 (local or remote)	7 (local or remote)	7 (local or remote)	7 (local or remote)
Max. power consumption	350 W	330 W	450 W	550 W
Typical power consumption	194 W	185 W	299 W	427 W

*Shared—total route capacity depends on prefix distribution

Specifications

Physical Specifications

Dimensions (W x H x D):
- 14.40 x 1.59 x 20.51 in (36.58 x 4.04 x 52.09 cm)

Weight:
- EX8200-48T: 11.26 lb (5.11 kg)
- EX8200-48F: 13.26 lb (6.01 kg)
- EX8200-8XS: 15.30 lb (6.94 kg)
- EX8200-40XS: 15.30 lb (6.94 kg)

Layer 2 Switching
- GVRP
- Physical port redundancy: Redundant trunk group (RTG)
- STP/RSTP (802.1D-2004)
- VSTP (Compatible with PVST+)
- STP enable/disable per port
- MSTP (802.1Q-2003)
- Number of MST instances supported: 64
- LLDP
- RVI (Routed VLAN Interface)
- FCoE- and CEE-capable (EX8200-40XS)*

Layer 3 Features: IPv4
- Routing protocols: RIPv1/v2, OSPF, BGP, IS-IS
- Static routing
- Routing policy
- Bidirectional Forwarding Detection
- Layer 3 redundancy: VRRP
- Layer 3 sub-interfaces
- IP directed broadcast

Layer 3 Features: IPv6
- Routing protocols: RIPng, OSPFv3, BGP, IS-IS, PIM, MLD
- Static routing
- Routing policy
- Bidirectional Forwarding Detection
- Layer 3 redundancy: VRRPv6
- Layer 3 sub-interfaces
- IP directed broadcast

Access Control Lists (ACLs) (Junos® firewall filters)
- Port-based ACL (PACL) – Ingress and Egress
- VLAN-based ACL (VACL) – Ingress and Egress
- Router-based ACL (RACL) – Ingress and Egress
- ACL counters
- Layer 2-4 classification criteria: Interface, MAC address, Ethertype, 802.1p, VLAN, IP address, DSCP/IP Precedence, TCP/UDP port numbers, etc.
- Control Plane DoS protection

Link Aggregation
- 802.3ad (LACP) support:
  - Number of LAGs supported: 255
  - Max number of ports per LAG: 12
- LAG load-sharing algorithm:
  - IP: S/D MAC, S/D IP
  - TCP/UDP: S/D MAC, S/D IP, S/D Port
  - Non-IP: S/D MAC
- Tagged ports support in LAG

QoS
- Ingress policing: single 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, classification, and marking
- Layer 2-4 classification criteria: Interface, MAC address, Ethertype, 802.1p, VLAN, IP address, DSCP/IP Precedence, TCP/UDP port numbers, etc.
- Egress WRED: Per queue per CoS threshold
- CoS-based fabric ingress and egress queuing

Environmental Ranges
- Operating temperature: 32º to 104º F (0º to 40º C)
- Storage temperature: -40º to 158º F (-40º to 70º 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: 5% to 90% (non-condensing)
- Relative humidity non-operating: 0% to 95% (non-condensing)

Safety and Compliance
- CSA 60950-1 (2003) Safety of Information Technology Equipment
- UL 60950-1 (2003) Safety of Information Technology Equipment
- EN 60950-1 (2001) Safety of Information Technology Equipment
- IEC 60950-1 (2001) Safety of Information Technology Equipment (with country deviations)
- EN 60825-1 +A1+A2 (1994) Safety of Laser Products—Part 1: Equipment Classification
- EN 60825-2 (2000) Safety of Laser Products—Part 2: Safety of Optical Fiber Comm. Systems
- 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
- CE

Electromagnetic Compatibility (EMC)
- EN 300 386 V1.3.3 (2005) Telecom Network Equipment— EMC requirements
- FCC Part 15 Class A (2007) USA Radiated Emissions
- EN 55022 Class A (2006) European Radiated Emissions
- VCCI Class A (2007) Japanese Radiated Emissions
- ICES-003 Class A
- AS/NZS CISPR 22 Class A
- CISPR 22 Class A

Immunity
- EN 55024 +A1+A2 (1998) Information Technology Equipment Immunity Characteristics
- EN-61000-3-2 (2006) Power Line Harmonics
- EN-61000-3-3 +A1 +A2 +A3 (1995) Power Line Voltage Fluctuations
- EN-61000-4-2 +A1 +A2 (1995) Electrostatic Discharge
- EN-61000-4-3 +A1+A2 (2002) Radiated Immunity
- EN-61000-4-4 (2004) Electrical Fast Transients
- EN-61000-4-5 (2006) Surge
- EN-61000-4-6 (2007) Immunity to Conducted Disturbances
- EN-61000-4-11 (2004) Voltage Dips and Sags

*Roadmap

Specifications (continued)

Customer-Specific Requirements

- GR-63-Core (2006) Network Equipment, Building Systems (NEBS) Physical Protection
- GR-1089-Core (2006) EMC and Electrical Safety for Network Telecommunications Equipment
- SR-3580 (1995) NEBS Criteria Levels (Level 3) (pending)

Environmental

- Reduction of Hazardous Substances (ROHS) 5/6

Telco

- Common Language Equipment Identifier (CLEI) code

Juniper Networks Services and Support

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

Ordering Information

MODEL NUMBER	DESCRIPTION
Hardware	
EX8200-48T	48-port 10/100/1000BASE-T RJ-45 line card
EX8200-48F	48-port 100FX/1000BASE-X SFP line card; requires SFP optics sold separately
EX8200-8XS	8-port 10GbE SFP+ line card; requires SFP+ optics sold separately
EX8200-40XS	40-port GbE/10GbE SFP/SFP+ line card; requires SFP/SFP+ optics sold separately
Pluggable Optics	
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-1GE-LX40K	SFP 1000BASE-LX; LC connector; 1310nm; 40km reach on single-mode fiber
EX-SFP-1GE-LH	SFP 1000BASE-LH; LC connector; 1550nm; 70km reach on single-mode fiber
EX-SFP-1GE-T	SFP 10/100/1000BASE-T copper; 100m reach on UTP
EX-SFP-1FE-FX	SFP 100BASE-FX; LC connector; 1310nm; 2km reach on multimode 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-ER	SFP+ 10GBASE-ER; LC connector; 1550nm; 40km reach on single-mode fiber

About Juniper Networks

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

To purchase Juniper Networks solutions, please contact your Juniper Networks representative at 1-866-298-6428 or authorized reseller.

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