

FASTIRON EDGE X SERIES



INTELLIGENT PRODUCTS TO DELIVER 10-GbE
FROM EDGE TO CORE

FEATURES

- ▶ Includes 1-port or 2-port 10-Gigabit Ethernet (10-GbE) module that uses hot-pluggable, state-of-the-art, low-cost, and removable “10-Gigabit Small Form Factor Pluggable” (XFP) optics to support SR, LR, ER, ZR, and ZRD optics—orderable or field upgradeable
- ▶ The all-fiber model features Ethernet in the First Mile optics—the industry’s first product to support 100/1000 SFP with 10-GbE uplinks
- ▶ Raises the VoIP convergence bar with the first product to combine 10/100/1000 POE, 10-GbE, and redundant, removable power in a compact form
- ▶ IronWare™—Foundry’s intelligent embedded software—includes advanced Layer 2 features such as Metro Ring Protocol, Virtual Switch Redundancy Protocol, and IronShield™—for wire-speed security network protection. Software upgradeable to full Layer 3, including support for IP routing protocols such as RIPv1/v2, OSPF, BGP, and support for multicast routing, including PIM-SM, PIM-DM, and DVMRP.
- ▶ Embedded sFlow™—the industry standard for network traffic monitoring—delivers hardware-based and real-time network traffic monitoring and inline intrusion detection and prevention
- ▶ Protection against Denial of Service attacks comes from IronShield™ security with wire-speed extended Access Control Lists, Secure Shell, Secure Copy, SNMP v3, and authentication with AAA, 802.1x, RADIUS, and TACACS+.
- ▶ Load-balanced, hot-swappable, and redundant power supply units ensure network reliability for Enterprises and Metro Service Providers

Overview

Foundry’s FastIron® Edge Switch X-series (FESX) products—the FastIron Edge X Series 424 (FESX424), the FastIron Edge X Series 448 (FESX448), the FastIron Edge X Series 424HF (FESX424HF), and the FastIron Edge X Series 424 Power Over Ethernet (FESX424-POE)—provide greater flexibility, higher reliability, enhanced security, extensive redundancy, and a new level of high performance by combining 10/100/1000, 10/100/1000 with POE, 100/1000 SFP, and 10-Gigabit Ethernet (10-GbE). The FastIron Edge X Series increases a network’s return on investment (ROI) and decreases total cost of ownership (TCO) by offering improved functionality, advanced technology, and security in a compact (1.5 Rack Units) form factor at industry-leading prices. The FastIron Edge X Series is the ideal networking platform to deliver 10-Gigabit Ethernet from the edge to the core.

The FastIron Edge X Series establishes the next benchmark in delivering the most adaptable feature set, combined with the highest density 10/100/1000, 10/100/1000 with POE, and 100/1000 SFP with 10-GbE upgradeability in a compact form factor. Specifically, the FastIron Edge X Series establishes the industry’s leading price-performance value for fixed Ethernet solutions with the addition of removable, replaceable, load-sharing power supply and 10-GbE modules in a 1.5 Rack Unit (RU) form factor. The FastIron Edge X Series can be initially installed using “Small Form Pluggable” (SFP) Gigabit Ethernet ports and then later field-upgraded to support one or two “10-Gigabit Small Form Factor Pluggable” (XFP) modules, extending the usability of the product.

To meet existing and emerging network requirements, the FastIron Edge X Series comes standard with advanced Layer 2 features, such as Metro Ring Protocol and Base Layer 3 routing capabilities, complete quality of service (QoS) controls including prioritization and rate limiting, and Foundry's IronShield™ for denial of service protection. The FastIron Edge X Series is also

software upgradeable to full Layer 3 to support advanced routing protocol such as BGP4. The extensive feature set supports network requirements ranging from basic connectivity to multicast-based streaming audio/video applications for converged services including Voice over IP (VoIP), using a software upgrade to full Layer 3.

System Summary



FEATURES	FESX424	FESX448	FESX424HF	FESX424-POE
Switching Performance	88 Gbps	136 Gbps	88 Gbps	88 Gbps
Forwarding Performance	65 Mpps	101 Mpps	65 Mpps	65 Mpps
Layer 2 Table Size in Hardware	16,000	16,000	16,000	16,000
Layer 3 Table Size in Hardware	100,000	100,000	100,000	100,000
Maximum BGP Routes	100,000	100,000	100,000	100,000
10/100/1000 Port Density	24 with 4-port Combo	48 with 4-port Combo	4-port Combo	24 with 4-port Combo
10/100/1000 POE Density with 15.4W each	0	0	0	24 Using one Power Supply
100/1000 SFP Port Density	4 Combo (1000 only)	4 Combo (1000 only)	20 100/1000 SFP	4 Combo (1000 only)
100 Mbps Ethernet Optics	Not Applicable	Not Applicable	100FX and 100Base-BX	Not Applicable
Gigabit Ethernet Optics	SX, SX2, LX, LHA, LHB, 1000Base-BX, and CWDM	SX, SX2, LX, LHA, LHB, 1000Base-BX, and CWDM	SX, SX2, LX, LHA, LHB, 1000Base-BX, and CWDM	SX, SX2, LX, LHA, LHB, 1000Base-BX, and CWDM
10-Gigabit Ethernet	1 or 2-port XFP Module (Optional)	1 or 2-port XFP Module (Optional)	1 or 2-port XFP Module (Optional)	1 or 2-port XFP Module (Optional)
10-Gigabit Ethernet Optics	SR, LR, ER, ZR and ZRD	SR, LR, ER, ZR and ZRD	SR, LR, ER, ZR and ZRD	SR, LR, ER, ZR and ZRD
Support for AC and DC Power Supply	Y	Y	Y	Y
Power Supply Redundancy	1+1 for System	1+1 for System	1+1 for System	1+1 for System 1+1 for POE

Purpose-Built Features for Enterprise and Service Provider

IRONSHIELD™ SECURITY—COMPLETE NETWORK PROTECTION

The FastIron Edge X Series supports configurable levels of user-selectable security starting with support for MAC address lockdown. The network administrator can assign a single MAC address or a group of addresses to an individual port in order to prevent unauthorized users from plugging into open RJ45 wall outlets. For more complex networking environments using Remote Authentication Dial-In User Service (RADIUS) authentication servers, the network manager can enable 802.1x port-based authentication—ensuring that the FastIron Edge X Series first authenticates the user before allowing the port to transmit data onto the network. This also grants users secure mobility while maintaining the integrity and security of the network against unwarranted breaches.

Once the port is operational, the network administrator can use both regular and extended ACLs to control access to and through the network, enabling control policies that can permit or deny traffic based on a wide variety of identification characteristics, such as source/destination MAC addresses, source/destination IP addresses, and TCP/UDP ports/sockets or well-known port numbers—further protecting and restricting network access from malicious users. The FastIron Edge X Series implements ACL lookups in hardware so that providing security and protection for the network does not adversely affect switching or routing performance.

By deploying the FastIron Edge X Series, network managers can provide layered levels of access to the management console. Multilevel access security on the console and web-based management interface prevent unauthorized users from accessing or changing the switch configuration. By using Terminal Access Controller Access Control Systems (TACACS/TACACS+) as well as RADIUS authentication, the network administrator can enable considerable centralized control and restrict unauthorized users from altering network configurations. The FastIron Edge X Series also supports Secure Shell and SNMPv3 to further restrict and encrypt communications to the management interface and system, thereby assuring highly secure network management access. For an added level of protection, the network administrator can use ACLs and provide fine-tuned access and control to the system by binding the ACL to TELNET, Web-Management, and SNMP interfaces.

To protect the network against Denial of Service (DoS) attacks, the network manager can disable the forwarding of ICMP messages and also enable the option to rate limit ICMP and TCP SYN packets. The FastIron Edge X Series can monitor, throttle, and lock out ICMP and TCP SYN traffic both to the management address of the switch and for traffic transiting the system. Enabling this feature can secure and protect the network from suffering a user-generated DoS attack or aiding one.

POWER OVER ETHERNET—SUPPORT FOR VOIP, WLAN, AND IP VIDEO SECURITY

The FastIron Edge X Series includes the FastIron Edge X Series 424-POE, which delivers Power over Ethernet (POE) based on the IEEE 802.3af standard. With a total of 480 watts dedicated to POE from a single power supply, the FastIron Edge X Series 424-POE is capable of delivering the maximum power requirement of 15.4W per port for all 24-port. The addition of another power supply gives the FastIron Edge X Series 424-POE N+1 redundancy for power, which is a critical requirement for a VoIP phone or WiFi access points.

The FastIron Edge X Series 424-POE is the first product in the industry that combines 10/100/1000 with POE, 10-Gigabit Ethernet, and redundant power in a compact form. The FastIron Edge X Series 424-POE comes with the following:

- ▶ 24-port 10/100/1000 with 4-port Combo that supports SFP optics such as SX, SX2, LX, LHA, LHB, and CWDM
- ▶ 802.3af-compliant for all 24-port 10/100/1000 with support for 15.4W in each port for all 24-ports using one power supply (Adding another power supply gives N+1 redundancy.)
- ▶ Optional 1- or 2-port 10-Gigabit Ethernet module for use with XFP optics, which can be an SR, an LR, an ER, an ZR, or an ZRD optics
- ▶ Software upgradeable to full Layer 3 that includes BGP4 to support up to 100K routes
- ▶ Support for redundant removable, load sharing, AC or DC power supply

The FastIron Edge X Series 424-POE is an ideal platform for mission-critical applications that require centralized power supply and management. By consolidating power into the wiring closet (switch port), network managers can deliver increased power reliability with centralized Uninterruptible Power Supplies (UPS), for devices that are deployed at user locations. Advanced features, including auto-detection and automatic VLAN assignment for VoIP phones removes administration required for moves, adds, and changes.

LEGACY DEVICE ¹	FIRMWARE VERSION
Cisco IP Phone 7910, 7940, 7960, and 7970 Series	Cisco Call Manager version 3.1
Cisco Aironet 350 and 1200 Series Access Point	EnterpriseAP version 12.0
Intel PRO/Wireless 5000 LAN Access Point and PRO/Wireless 5000 Dual Access Point	Version 1.2
Sony SNC-VL10N Video Network Color Camera	Version 1.4.6

▶ *Table 1: Legacy Devices Supported*

sFLOW—“ALWAYS-ON” WIRE-SPEED NETWORK MONITORING

All versions of the FastIron Edge X Series support sFlow™—Foundry’s unique solution to simplifying network management. Deploying switches in a networking infrastructure increases overall network performance but essentially eliminates the network administrator’s ability to receive a total picture of network capacity, bandwidth consumption, utilization, and overall network health. sFlow delivers real-time, complete network visibility, enabling network managers to completely manage every network transaction flowing throughout the network. sFlow uses the built-in capability of the FastIron Edge X Series ASICs to collect and aggregate details on traffic flows from Layer 2 through Layer 4, and automatically delivers that information to the IronView Network Management station—a Java-based network-configuration and management tool that displays, in detail and graphically, network- and application-level traffic information. With the resulting insight, the network manager can quickly and accurately review overall networking operations, zero in on hot spots, and quickly diagnose and troubleshoot difficulties before they develop into widespread problems. sFlow also automatically delivers accurate SNMP/RMON statistics to reduce the administrative burden normally associated with proactive network management, design, and capacity planning.

INCREASING NETWORK VALUE WITH CONVERGED (VOICE, VIDEO, AND DATA) DEPLOYMENTS

The FastIron Edge X Series establishes a high-performance platform on which to build converged voice, video, and data services that can easily adapt to changes and future technologies. Deployed in the wiring closet, the FastIron Edge X Series provides the capabilities and functionalities required for supporting robust telephony integration within existing networking infrastructures. Advanced QoS features can also be enabled to deliver the same level of reliability and availability that exist within existing legacy telephone and video systems. Coupling multiple levels of protocol redundancy with advanced QoS ensures a fault-tolerant network design and zero service disruption.

INTELLIGENT TRAFFIC CONTROL TO MANAGE QOS AND BANDWIDTH CONSUMPTION

The FastIron Edge X Series offers superior QoS features that enable network administrators to provide and ensure high-quality services throughout the network from end to end. Foundry’s QoS implementation uses the most efficient methodology to classify and prioritize network traffic to eliminate network congestion. The FastIron Edge X Series supports Dual-Mode operation to allow for both 802.1Q tagged and untagged data streams, and placement of these streams into assigned virtual LANs (VLANs). Dual-Mode operation enables network managers to properly assign priorities to various 802.1Q-tagged packets such as Voice over IP (VoIP) packets to eliminate latency and jitter.

¹Although Foundry has attempted to provide accurate information in these materials, Foundry assumes no legal responsibility for the accuracy or completeness of the information, and this does not guarantee that future software releases from legacy vendors will work with Foundry’s POE products.



ENHANCING QoS TO ENSURE HIGH AVAILABILITY AND SUPERIOR DATA TRAFFIC INTEGRITY

The FastIron Edge X Series can classify, re-classify, police, and mark the traffic prior to delivery. Network administrators can classify traffic, such as VoIP handsets or bandwidth-critical applications, to discriminate among various traffic flows and enforce bandwidth policies on Layer 2 and Layer 3 QoS fields. The FastIron Edge X Series can identify, classify, and reclassify traffic based on specific criteria such as port, source/destination Media Access Control (MAC) address, 802.1p priority bit, source/destination IP address, Type of Service (ToS) or Differentiated Services Control Point (DSCP) fields, or the Transmission Control Protocol/User Datagram Protocol (TCP/UDP) port.

Once classified, the traffic is queued and scheduled for delivery—the network administrator has complete control over how the system services the queues: Weighted, adjustable Round Robin (WRR) queuing ensures that all packets can be delivered and ensures that lower-priority packets are not starved for bandwidth; Strict Priority (SP) queuing ensures that highest-priority traffic always gets serviced first, ahead of all other traffic (which could result in lower-priority bandwidth starvation); combined SP with WRR guarantees highest-priority traffic delivery while equally servicing the lower priority queues.

The FastIron Edge X Series is capable of performing rate-limiting to give a network administrator the granular control needed to regulate how end users consume bandwidth. Using rate limiting together with the multiple queuing techniques enables the network manager to fairly balance, fine-tune, and control bandwidth consumption, providing the foundation for end-to-end QoS parameters to regulate traffic flows across the entire network. Voice, video, and high-speed data services can be combined and delivered throughout a unified network without suffering from reduced performance or negatively impacting the end-user experience.

INDUSTRY LEADING LAYER 2 FEATURES FOR METRO AND SERVICE PROVIDERS

By deploying the FastIron Edge X Series, Metro and Service Providers can extend high-speed networks at the edge, as well as closer to the core of access networks. Metro and Service Providers can begin to deliver Ethernet-based services, an alternative to TDM-based services, to support low-cost and high-speed services from 1 Mbps up to 10 Gbps. The following Layer 2 metro features ensure flexible, secure, and resilient Ethernet services:

- ▶ **Metro Ring Protocol (MRP)**—Offers an alternative to Spanning Tree-based designs and provides sub-second fault detection and failover specifically for Metro Ethernet ring topologies. MRP works in conjunction with VSRP and 802.3ad-based link aggregation to provide bandwidth scalability and SONET-like resiliency in Metro Ethernet networks.
- ▶ **Virtual Switch Redundancy Protocol (VSRP)**—Offers an alternative to Spanning Tree-based designs and provides sub-second fault detection and fail-over protocol for mesh topologies. VSRP works in conjunction with MRP to provide SONET-like resiliency required for critical Data Center and Metro Ethernet networks and protects against link or switch failures.

- ▶ **Rapid Spanning Tree Protocol based on IEEE 802.1w**—Dramatically improves the spanning tree convergence time to sub-seconds by automatically renegotiating port roles without relying on timers in case of a link failure.
- ▶ **Per VLAN Spanning Tree (PVST)**—Allows Metro service providers control over STP on an individual VLAN basis to provide traffic engineering.
- ▶ **Per VLAN Group Spanning Tree (PVGST)**—Allows Metro service providers dramatic improvements in STP and VLAN scalability by servicing up to 4,096 VLANs with 2 to 16 STP or Rapid STP instances. PVGST also provides VLAN load balancing for all 4,096 VLANs for efficient utilization of all fiber in a Metro network.
- ▶ **Topology Groups**—Goes beyond PVGST to scale all supported Layer 2 control protocols including STP, RSTP, MRP, and VSRP, while providing the ability to isolate the provider from any subscriber-influenced changes.
- ▶ **Super Aggregated VLANs (SAV)**—Allows service providers to decouple the provider VLAN domains from customer VLAN domains. SAV allows the provider to tunnel and preserve the subscriber VLANs by stacking VLAN tags.

INCREASING NETWORK RELIABILITY WITH LOAD-BALANCED AND REDUNDANT POWER

The FastIron Edge X Series includes power redundancy features, which are only available in a modular chassis. Every FastIron Edge X Series ships with a single AC power supply and adding one more power AC power supply enables 1+1 redundancy. These AC power supplies are hot-swappable and load-sharing AC power supplies, critical for delivering power redundancy and deployment flexibility.



▶ Figure 1: FastIron Edge Switch rear view—redundant slot for second power supply

ENHANCING NETWORK RESILIENCE WITH REDUNDANT UPLINK OPTIONS

The FastIron Edge X Series can be ordered (or field-upgraded later) with a 1-port or 2-port 10-GbE module that supports one or two XFP optics, allowing for a full breadth of networking interconnectivity, including 10-GbE-SR, 10-GbE-LR, and 10-GbE-ER for 10-GbE links up to 300m over Multimode Fiber (MMF), 10km over Single Mode Fiber (SMF), and 40km over Single Mode Fiber (SMF), respectively.

The FastIron Edge X Series comes built with 4-port SFP for use with 1000Base-X Gigabit Ethernet interfaces supporting a wide range of Gigabit Ethernet transceivers for the full breadth of networking interconnectivity including 1000Base-SX, 1000Base-LX, and 1000Base-LHA for Gigabit Ethernet links up to 550m over Multimode Fiber (MMF), 10km over Single Mode Fiber (SMF), and 120km over SMF, respectively.

Higher levels of link resilience can be implemented by deploying dual-homed and redundant 10-GbE uplinks enabled with 802.3ad, Per-VLAN Spanning Tree (PVST/PVST+), Protected-Link, Load-sharing 802.1Q trunks, or OSPF Equal Cost Multi Path (ECMP) data center connections. This unmatched selection of redundancy, quick recovery, and load balancing options grants the network administrator the widest range of implementation choices, making the FastIron Edge X Series the ideal intelligent enterprise switch to deliver 10-GbE from the edge to the core.

Enterprise Application

LOW COST 60C+ 10-GbE SOLUTION FOR THE ENTERPRISE CAMPUS

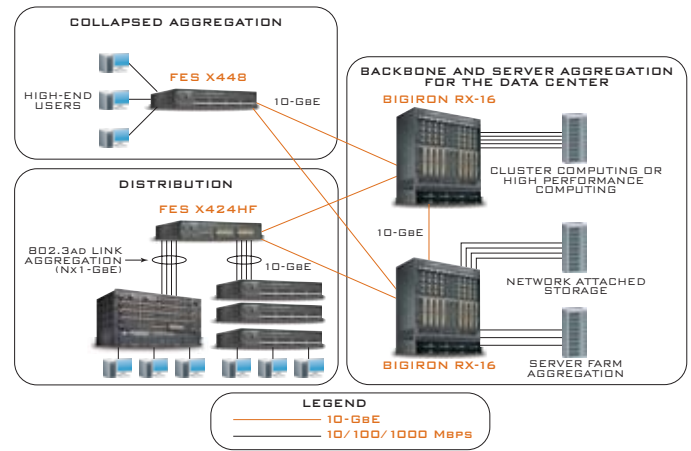
Foundry's FastIron Edge X Series is ideal for delivering high-density and low-cost 10/100/1000, and is a 10-GbE solution for the enterprise campus. The FESX424 and FESX448 can be fitted with 1-port or 2-port 10-GbE modules, which use the state-of-the-art "10-Gigabit small form factor pluggable" optics (XFP optics). With two ports of 10-GbE, network managers can easily build redundancy into their campus network and take advantage of low cost XFP optics priced much lower than XENPAK optics.

As shown in figure 2, the FastIron Edge X Series can be used to deliver to the desktop, high-density aggregation within the distribution layer, and connectivity for high-performance computing, grid-computing, and network-attached storage. Support for jumbo frames of up to 9,126 bytes ensures faster file transfer between high-end servers within the data center and assists in reducing server CPU load. The 10-GbE uplinks within the FastIron Edge X Series ensure that the data center can be easily connected to Foundry's BigIron MG8, enabling concurrent support for low-latency applications such as VoIP, mission-critical applications such as manufacturing-resource planning, and high-volume network traffic such as remote backup.

HIGH-CAPACITY 10-GbE SOLUTION FOR THE ENTERPRISE DISTRIBUTION AND DATA CENTER

Enterprise customers that demand high-capacity 10-GbE networking within the collapsed aggregation, distribution and data center can combine the FastIron Edge X Series with Foundry's BigIron MG8. The FastIron Edge X Series includes IronWare that comes with high-availability features such as Protected-Link or Metro Ring Protocol (MRP) to ensure resiliency from any network outages. In addition, enterprise customers can rely on the FastIron Edge X Series to deliver high-availability from any power outages for the collapse aggregation, distribution and the data center.

Foundry's FastIron Edge X Series can be installed in an enterprise's distribution layer to aggregate switches with its high-density connections, and its 4-port SFP enables connectivity to upper floors within a building. The FastIron Edge X Series can be configured with two load-sharing and redundant AC power supplies—a requirement for network equipment used to aggregate many switches. Most fixed Ethernet solutions



► Figure 2: FastIron Edge X Series delivers a low-cost and high-speed 10-GbE enterprise campus

offer an external power supply to deliver redundancy, but this solution becomes cumbersome because network managers now have two units to manage and the combined RU size of the two units impacts wiring closet space.

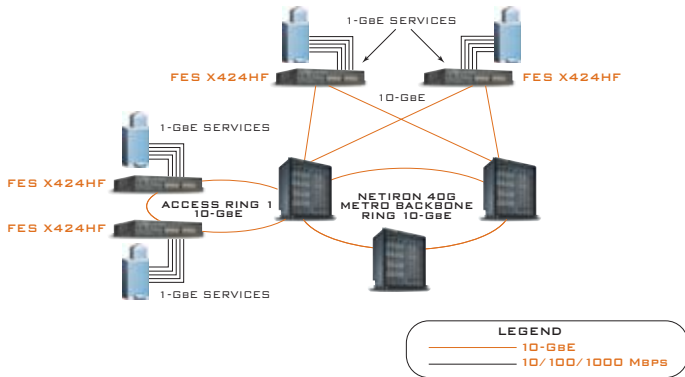
Aside from power-supply redundancy to deliver zero network downtime, the FastIron Edge X Series comes installed with Foundry's time-tested and proven IronWare software. IronWare software, tested and used by thousands of Foundry customers including the U.S. Department of Defense, includes IronShield to protect the network and the equipment against any denial of service. In addition, IronWare comes with standard Layer 2 features such as 802.3ad and 802.1w and Layer-3 features, such as OSPF with ECMP or VRRP-E, that assure protocol redundancy.

Metro Service Provider Application

HIGH-PERFORMANCE, HIGH-AVAILABILITY, AND COST-EFFECTIVE METRO ACCESS SOLUTION

Foundry's FastIron Edge X Series comes installed with IronWare, which includes metro features like Metro Ring Protocol, Virtual Switch Redundancy Protocol, Super Aggregated VLAN, and Protected-Link. The FastIron Edge X Series includes support for jumbo frames up to 9,216 bytes, required for metro providers wanting to offer high-speed and high-value Ethernet services for storage and high-performance networking.

As shown in figure 3, the FastIron Edge X Series is ideal for 1-GbE service delivery within a 10-GbE metro access infrastructure. The FastIron Edge X Series can be equipped with a 2-port 10-GbE module that can be populated with one (1) or two (2) XFP optics capable of reaching distances of up to 40km, allowing Metro Service Providers to connect various point-of-presence with 10-GbE. This solution optimizes the use of their fiber infrastructure and allows for the delivery of high-speed service offerings such as remote backup or remote data-center facilities.

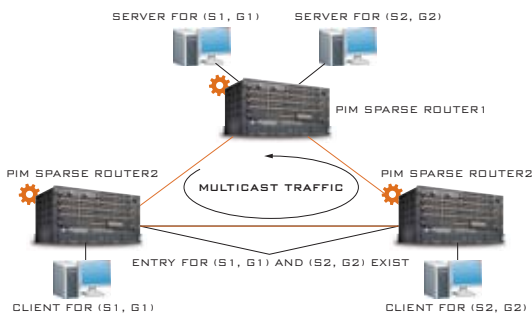


► **Figure 3: FastIron Edge X Series for use within a metro service provider's access network**

The FastIron Edge X Series includes sFlow (RFC 3176)—an industry standard to deliver networkwide visibility for management and control. sFlow can be used by Metro Service Providers to deliver scalable end-user network accounting and billing and capacity planning. sFlow coupled with SNORT—a leading, open-source intrusion detection system—delivers an almost zero-cost security solution. Metro Service Providers can make high-end services such as detailed end-user billing and network-intrusion prevention available to their customers.

IDEAL INFRASTRUCTURE TO DELIVER IPTV AND VIDEO ON-DEMAND SOLUTION

Multicast is used to deliver IP-TV services or On-Demand video services because it offers an efficient method for broadcasting traffic to many subscribers. Service and metro providers, who have transit networks and want to offer high-end services such as IPTV or Video On-Demand services, rely on multicast routing to distribute multicast traffic.



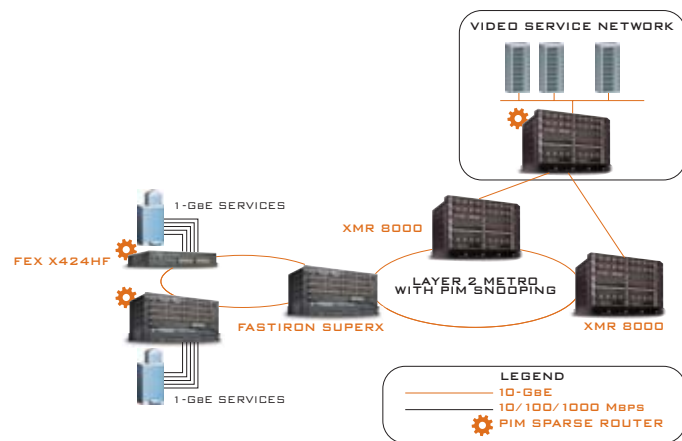
► **Figure 4(a): Simple network for IPTV**

Figure 4(a) shows a simple network that supports IPTV services. Subscribers for video services can exist in PIM Sparse Router 2 and PIM Sparse Router 3. To ensure that subscribers can immediately acquire any video service, a route entry must be created for each video service in each PIM Sparse Router. The creation of a route entry for a video service, which has no subscriber, removes impact to the CPU and is done by enabling Passive Multicast Route Insertion.

For example, assume (S1, G1) is movie1 and (S2, G2) is movie2. A subscriber in PIM Sparse Router2 subscribes to movie1. PMRI assures that a route entry pointing to a null client for movie2 is created in PIM Sparse Router2, in order to give any new client quick access to movie2. PMRI also assures that all video streams, including those without any subscriber, continuously traverse the network without any impact to the network equipment's CPU.

Figure 4(b) combines PIM Snooping and PMRI to ensure multicast distribution can be made in an Ethernet-based network or Layer 2 network. Foundry switches with PIM Snooping enabled acquire multicast routes by listening to PIM Sparse join-and-prune messages, and IGMP group membership reports. Learning multicast route information enables Foundry switches to intelligently switch multicast traffic and not broadcast multicast traffic, which is the default behavior of any Layer 2 switch.

Combining PIM Snooping and PMRI gives service and metro providers a solution to deliver video services, aside from voice and data services, using a Layer 2 switch, which is more cost-effective over MPLS switches.



► **Figure 4(b): PIM Snooping and PMRI**

Technical Specifications

STANDARDS COMPLIANCE

- 802.1d Bridging
- 802.1D-1998
- 802.1q/p VLAN Tagging and Priority
- 802.1w Rapid Spanning Tree
- 802.1X Port-based Authentication, Dynamic VLAN, ACL, and MAC Filter Group Assignment
- 802.3 10Base-T
- 802.3 Ethernet Like MIB
- 802.3ad Link Aggregation (Dynamic and Static) and Trunk Groups
- 802.3u 100Base-TX
- 802.3z 1000Base-SX/LX/T
- 802.3ae 10 Gigabit Ethernet

LAYER 2 FEATURES

- 4,096 VLANs
- 16,000 MAC Addresses
- Protocol VLAN (802.1v), Private VLAN, Subnet VLAN
- Port Security (MAC Address Locking)
- Layer 2 ACLs
- Dual Mode VLANs
- Fast Port Span
- Protected-link
- Generic VLAN Registration Protocol
- MAC-Layer Filtering
- Mirror/Monitor Ports
- Per VLAN STP (PVST/PVST+)
- VLAN Groups
- Single-instance Spanning Tree
- Metro Ring Protocol (MRP)
- Virtual Switch Redundancy Protocol (VSRP)
- Uni-Directional Link Detection (UDLD)

LAYER 3 ENHANCEMENTS

- 4,000 IP Routes for Base L3
- 128,000 IP Routes
- Layer 3 IP ACLs

PROTOCOL SUPPORT

- DNS Client
- IP (RFC 1812)
- VRRP (RFC 2338)
- VRRPE (Foundry VRRP Enhanced)

BGP4

- RFC 1771 BGPv4
- RFC 1745 OSPF interactions
- RFC 1997 Communities & Attributes
- RFC 2439 route flap dampening
- RFC 2796 route reflection
- RFC 1965 BGP4 confederations
- RFC 2842 Capability Advertisement
- RFC 2918 Route Refresh Capability
- RFC 1269 Managed Objects for BGP
- RFC 2385 BGP Session Protection via TCP MD5

OSPF

- RFC 1583 OSPF v2
- RFC 2328 OSPF v2
- RFC 1587 OSPF NSSA
- RFC 1745 OSPF Interactions
- RFC 1765 OSPF Database Overflow
- RFC 1850 OSPF Traps
- RFC 2154 OSPF w/Digital Signatures (Password, MD-5)
- RFC 1850 OSPF v2 MIB

RIP

- RFC 1058 RIP v1
- RFC 1723 RIP v2
- RFC 1812 RIP Requirements

IP MULTICAST

- DVMRP Host Requirements (RFC 1122)
- DVMRPv2
- IGMP Snooping
- IGMPv1 (RFC 1112)
- IGMPv2 (RFC 2236)
- PIM-DM (draft-ietf-v2-dm-03)
- PIM-SM (RFC 2362)

QUALITY OF SERVICE

- 802.1p Mapping to Priority Queue
- MAC Address Mapping to Priority Queue
- ACL Mapping to Priority Queue
- ACL Mapping to ToS/DSCP
- ACL Mapping and Marking of ToS/DSCP
- DiffServ Support
- QoS Queue Management Using Weighted Round Robin (WRR), Strict Priority (SP), and a combination of WRR and SP

MANAGEMENT AND CONTROL

- Virtual Cable Tester
- 802.3 MAU MIB (RFC 2239)
- Architecture for Describing SNMP Framework (RFC 2571)
- BootP (RFC 951 & RFC 1542)
- BootP/DHCP Relay (RFC 2131)
- Bridge MIB (RFC 1493)
- Configuration Logging
- Ethernet Interface MIB (RFC 1643)
- Ethernet MIB (RFC 1643)
- HTTP (RFC 2068)
- ICMP Router Discovery Protocol (RFC 1256)
- Industry Standard Command Line Interface (CLI)
- Integration with HP OpenView for Sun Solaris, HP-UX, IBM's AIX, and Windows NT Standalone Windows NT
- IP Forwarding Table MIB (RFC 1354)
- IronView Network Manager (INM) Web based graphical user interface
- Embedded Web Management
- sFlow (RFC 3176)
- MIB-II (RFC 1213)
- Repeater MIB (RFC 1516)
- RIPv2 MIB (RFC 1724)
- RMON MIB (RFC 1757)
- SNMP Message Processing and Dispatching (RFC 2572)
- SNMP MIB II (RFC 1573)
- SNMP View-based Access Control Model SNMP (RFC 2575)
- SNMPv1/v2c (RFC 1157)
- SNMPv3 Applications (RFC 2573)
- SNMPv3 Intro to Framework (RFC 2570)
- SNMPv3 User-based Security Model (RFC 2574)
- Support for Multiple syslog Servers
- TELNET (RFC 854)
- TFTP (RFC 783)

ELEMENT SECURITY OPTIONS

- Authentication, Authorization, & Accounting (AAA)
- Bi-level Access Mode (Standard and EXEC Level)
- Protection for Denial of Service attacks
- RADIUS
- Secure Copy (SCP)
- Secure Shell
- TACACS/TACACS+
- Username/Password

PERFORMANCE

- FESX424:
 - Switching Capacity 88 Gbps
 - Forwarding Rate 65 Mpps
- FESX448:
 - Switching Capacity 136 Gbps
 - Forwarding Rate 101 Mpps
- FESX424HF:
 - Switching Capacity 88 Gbps
 - Forwarding Rate 65 Mpps
- FESX424-POE:
 - Switching Capacity 88 Gbps
 - Forwarding Rate 65 Mpps

PHYSICAL DIMENSIONS

- FESX424:
 - 2.63" (H) x 17.5" (W) x 19.6" (D)
 - 6.68cm (H) x 44.45cm (W) x 49.78cm (D)
- FESX448:
 - 2.63" (H) x 17.5" (W) x 19.6" (D)
 - 6.68cm (H) x 44.45cm (W) x 49.78cm (D)
- FESX424HF:
 - 2.63" (H) x 17.5" (W) x 19.6" (D)
 - 6.68cm (H) x 44.45cm (W) x 49.78cm (D)
- FESX424-POE:
 - 2.63" (H) x 17.5" (W) x 19.6" (D)
 - 6.68cm (H) x 44.45cm (W) x 49.78cm (D)

WEIGHT

- FESX424:
 - 25 lbs (11.36 kg) Fully Loaded including dual redundant power
 - 17.5 lbs (7.95 kg) Empty
- FESX448:
 - 29 lbs (11.36 kg) Fully Loaded including dual redundant power
 - 17.5 lbs (7.95 kg) Empty
- FESX424HF:
 - 25 lbs (11.36 kg) Fully Loaded including dual redundant power
 - 17.5 lbs (7.95 kg) Empty
- FESX424-POE:
 - 25 lbs (11.36 kg) Fully Loaded including dual redundant power
 - 17.5 lbs (7.95 kg) Empty

ENVIRONMENTAL RANGES

- Acoustic: 47dB
- Operating temperature: 32° to 104°F (0° to 40°C)
- Relative Humidity: 5% to 90%, non-condensing
- Storage temperature: -23° to 158°F (-25° to 70°C)
- Maximum Watts:
 - 220W (750 BTU/Hr) per supply for the FESX424 and FESX424HF
 - 600W (2,047 BTU/Hr) per supply for the FESX448 and the FESX424-POE
- Storage altitude: 10,000ft (3,000m) maximum

POWER REQUIREMENTS

- FESX424 AC input voltage: 100vAC @ 3.5A MAX, 240vAC @ 1.5A MAX, 50-60Hz per auto-sensing, auto-switching power supply
- FESX448 AC input voltage: 100vAC @ 6A MAX, 240vAC @ 2.5A MAX, 50-60Hz per auto-sensing, auto-switching power supply
- FESX424HF AC input voltage: 100vAC @ 3.5A MAX, 240vAC @ 1.5A MAX, 50-60Hz per auto-sensing, auto-switching power supply
- FESX424-POE AC input voltage: 100vAC @ 6A MAX, 240vAC @ 2.5A MAX, 50-60Hz per auto-sensing, auto-switching power supply

SAFETY CERTIFICATIONS

- EN 60950
 - CAN/CS-C22.2 No. 60950-00
 - EN 60825-1 Safety of Laser Products - Part 1
 - EN 60825-2 Safety of Laser Products - Part 2
- IEC 950
- UL 1950 Third Edition
- CSA 950

ELECTROMAGNETIC EMISSION CERTIFICATIONS

- FCC Class A (Part 15)
- EN 55022/CISPR-22 Class A
- VCCI Class A

IMMUNITY

- Generic: EN 50082-1

WARRANTY

- 5-Year Limited Lifetime Hardware Warranty
- 90-days Software



Ordering Information

PART NUMBER	DESCRIPTION
FESX424	FastIron Edge X424 with Base L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45) and 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), and one AC power supply.
FESX424+1XG	FastIron Edge X424 with Base L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 1-slot XFP 10-GbE module and one AC power supply.
FESX424+2XG	FastIron Edge X424 with Base L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 2-slot XFP 10-GbE module and one AC power supply.
FESX424-PREM	FastIron Edge X424 with full L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), and one AC power supply.
FESX424+1XG-PREM	FastIron Edge X424 with full L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 1-slot XFP 10-GbE module and one AC power supply.
FESX424+2XG-PREM	FastIron Edge X424 with full L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 2-slot XFP 10-GbE module and one AC power supply.
FESX424-DC	FastIron Edge X424 with Base L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), and one DC power supply.
FESX424+1XG-DC	FastIron Edge X424 with Base L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 1-slot XFP 10-GbE module and one DC power supply.
FESX424+2XG-DC	FastIron Edge X424 with Base L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 2-slot XFP 10-GbE module and one DC power supply.
FESX424-PREM-DC	FastIron Edge X424 with full L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), and one DC power supply.
FESX424+1XG-PREM-DC	FastIron Edge X424 with full L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 1-slot XFP 10-GbE module and one DC power supply.
FESX424+2XG-PREM-DC	FastIron Edge X424 with full L3 SW. Includes 20-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 2-slot XFP 10-GbE module and one DC power supply.
FESX424HF	FastIron Edge X424HF with Base L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, and one AC power supply.
FESX424HF+1XG	FastIron Edge X424HF with Base L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, 1-slot XFP 10-GbE module and one AC power supply.
FESX424HF+2XG	FastIron Edge X424HF with Base L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, 2-slot XFP 10-GbE module and one AC power supply.
FESX424HF-PREM	FastIron Edge X424HF with full L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, and one AC power supply.
FESX424HF+1XG-PREM	FastIron Edge X424HF with full L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, 1-slot XFP 10-GbE module and one AC power supply.
FESX424HF+2XG-PREM	FastIron Edge X424HF with full L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, 2-slot XFP 10-GbE module and one AC power supply.
FESX424HF-DC	FastIron Edge X424HF with Base L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, and one DC power supply.
FESX424HF+1XG-DC	FastIron Edge X424HF with Base L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, 1-slot XFP 10-GbE module and one DC power supply.
FESX424HF+2XG-DC	FastIron Edge X424HF with Base L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, 2-slot XFP 10-GbE module and one DC power supply.
FESX424HF-PREM-DC	FastIron Edge X424HF with full L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, and one DC power supply.
FESX424HF+1XG-PREM-DC	FastIron Edge X424HF with full Enterprise L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, 1-slot XFP 10-GbE module and one DC power supply.
FESX424HF+2XG-PREM-DC	FastIron Edge X424HF with full Enterprise L3 SW. Includes 20-port 100/1000 SFP, 4-port Combo to support 10/100/1000 Mbps (RJ45) or 100/1000 SFP, 2-slot XFP 10-GbE module and one DC power supply.
FESX424-POE	FastIron Edge X424-POE includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, and one AC power supply.
FESX424-POE-PREM	FastIron Edge X424-POE-PREM premium (PREM) includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, and one AC power supply.
FESX424-POE-DC	FastIron Edge X424-POE-DC includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, and one DC power supply.
FESX424-POE-PREM-DC	FastIron Edge X424-POE-PREM-DC premium (PREM) includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, and one DC power supply.
FESX424-POE+1XG	FastIron Edge X424-POE+1XG includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, 1-port XFP 10-Gigabit Ethernet, and one AC power supply.
FESX424-POE+1XG-PREM	FastIron Edge X424-POE+1XG-PREM premium (PREM) includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, 1-port XFP 10-Gigabit Ethernet, and one AC power supply.
FESX424-POE+1XG-DC	FastIron Edge X424-POE+1XG-DC includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, 1-port XFP 10-Gigabit Ethernet, and one DC power supply.
FESX424-POE+1XG-PREM-DC	FastIron Edge X424-POE+1XG-PREM-DC premium (PREM) includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, 1-port XFP 10-Gigabit Ethernet, and one DC power supply.
FESX424-POE+2XG	FastIron Edge X424-POE+2XG includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, 2-port XFP 10-Gigabit Ethernet, and one AC power supply.
FESX424-POE+2XG-PREM	FastIron Edge X424-POE+2XG-PREM premium (PREM) includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, 2-port XFP 10-Gigabit Ethernet, and one AC power supply.
FESX424-POE+2XG-DC	FastIron Edge X424-POE+2XG-DC includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, 2-port XFP 10-Gigabit Ethernet, and one DC power supply.
FESX424-POE+2XG-PREM-DC	FastIron Edge X424-POE+2XG-PREM premium (PREM) includes 24-port 10/100/1000 802.3af with 4-port Combo copper/fiber Gigabit Ethernet ports 10/100/1000 Mbps (RJ45) or Gigabit Ethernet Fiber (SFP) connectivity per port, 2-port XFP 10-Gigabit Ethernet, and one DC power supply.
FESX448	FastIron Edge X448 with Base L3 SW. Includes 44-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), and one DC power supply.
FESX448+1XG	FastIron Edge X448 with Base L3 SW. Includes 44-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 1-slot XFP 10-GbE module, and one DC power supply.
FESX448+2XG	FastIron Edge X448 with Base L3 SW. Includes 44-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 2-slot XFP 10-GbE module, and one DC power supply.
FESX448-PREM	FastIron Edge X448 with full L3 SW. Includes 44-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), and one DC power supply.
FESX448+1XG-PREM	FastIron Edge X448 with full L3 SW. Includes 44-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 1-slot XFP 10-GbE module, and one DC power supply.
FESX448+2XG-PREM	FastIron Edge X448 with full L3 SW. Includes 44-port 10/100/1000 Mbps (RJ-45), 4-port Combo to support 10/100/1000 Mbps (RJ45) or Gigabit Ethernet fiber (SFP), 2-slot XFP 10-GbE module, and one DC power supply.
FESX424-L3U	Layer 3 upgrade for the FESX424 and FES424HF
FESX448-L3U	Layer 3 upgrade for the FES X448
X4-1XG	Field upgradeable 1-port 10-GbE XFP expansion module
X4-2XG	Field upgradeable 2-port 10-GbE XFP expansion module
10G-XFP-SR	10-GbE SR XFP optic, MMF, LC connector
10G-XFP-LR	10-GbE LR XFP optic, SMF, LC connector
10G-XFP-ER	10-GbE ER XFP optic, SMF, LC connector
RPS-X424	Redundant power supply (220W) for the FESX424 and the FESX424HF
RPSDC-X424	Redundant power supply (600W) for the FESX424
RPS-X448	Redundant power supply (600W) for the FESX448

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