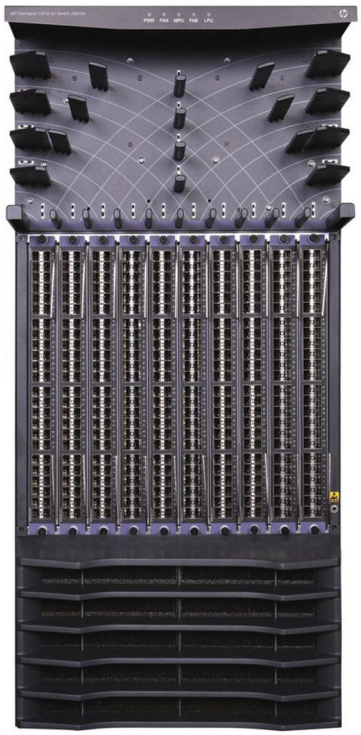
Data sheet

HP FlexFabric 12900 Switch Series



Key features

- Nonblocking, lossless Clos architecture
- VxLAN, IRF, and TRILL support for virtualized and cloud deployments
- High 10GbE, 40GbE, and 100GbE density across 36 Tb/s switch fabric
- Enhanced modularity with control and data plane separation
- SDN enabled with OpenFlow 1.3 support

Product overview

The HP FlexFabric 12900 Switch Series is a next-generation modular data center core switch designed to support virtualized data centers and the evolving needs of private and public cloud deployments.

The HP FlexFabric 12900 Switch Series delivers unprecedented levels of performance, buffering, scale, and availability with high density 10GbE, 40GbE, and 100GbE. The HP FlexFabric 12900 Switch Series includes 10-slot and 16-slot chassis.

Software-defined networking (SDN) enabled with OpenFlow 1.3, the switch supports full Layer 2 and 3 features, including advanced features such as Virtual Extensible LAN (VxLAN), TRansparent Interconnection of Lots of Links (TRILL) and Intelligent Resilient Framework (IRF), which provide the ability to build large, resilient switching fabrics. The HP FlexFabric 12900 Switch Series also supports fully redundant and hot-swappable components to complement its other enterprise-class capabilities.

Features and benefits

Product architecture

- Modern scalable system architecture

  Provides nonblocking, lossless Clos architecture with VOQs and large buffers with the flexibility and scalability for future growth

- Distributed architecture with separation of data and control planes

  Delivers enhanced fault tolerance and facilitates continuous operation and zero service disruption during planned or unplanned control-plane events

- Advanced Comware modular operating system

  Brings native high stability, independent process monitoring, and restart through the modular design and multiple processes of HP Comware v7 software; supports enhanced serviceability functions

- In-Service Software Upgrade (ISSU)

  Provides an upgrade of the entire chassis, or an individual task or process, with zero packet loss

- Multitenant Device Context (MDC)

  Virtualizes a physical switch into multiple logical devices, with each logical switch having its own processes, configuration, and administration

Performance

- High-performance fully distributed architecture

  Delivers up to 30.7 Tb/s switching capacity and 19.2 Bpps throughput with nonblocking wirespeed performance

- High-density 1/10/40 and 100GbE interface connectivity

  Offers up to 16 interface module slots to scale up to 768 1GbE/10GbE, 384 40GbE ports, and 128 100GbE ports

- Distributed scalable fabric architecture

  Offers up to six fabric modules to deliver more than 2 Tb per slot bandwidth

Data center optimized

- Virtual Extensible LAN (VxLAN)

  VxLAN Routing/Bridging to provide wire-rate support to build overlay networks enabling virtual machine mobility and cloud deployments

- Scalable Layer 2 fabrics

  Builds flexible, resilient, and scalable Layer 2 fabrics with TRILL and HP IRF

- HP Ethernet Virtual Interconnect (EVI)

  Is an HP Virtual Application Network innovation that provides a Layer 2 extension across the data center to simplify the interconnectivity of geographically disperse data centers

- Edge Virtual Bridging (EVB) with Virtual Ethernet Port Aggregator (VEPA)

  Provides connectivity into the virtualization-ready data center environment

- Data Center Bridging (DCB) protocols

  Provides support for IEEE 802.1Qaz Data Center Bridging Exchange (DCBX), Enhanced Transmission Selection (ETS), and IEEE 802.1Qbb Priority Flow Control (PFC) for converged fabrics

- Fibre Channel over Ethernet (FCoE) features

  Deliver support for FCoE, including expansion, fabric, trunk VF and N ports, and aggregation of E-port and N-port virtualization

- Front-to-back airflow design

  Accommodates deployment in data centers utilizing hot-cold deliver support for FCoE, including expansion, fabric, trunk VF and N ports, and aggregation of E-port and N-port virtualization

Resiliency and high availability

- Intelligent Resilient Framework (IRF)

  Creates virtual resilient switching fabrics, where two switches perform as a single L2 switch and L3 router; switches do not have to be co-located and can be part of a disaster-recovery system; servers or switches can be attached using standard LACP for automatic load balancing and high availability; can eliminate the need for complex protocols like Spanning Tree Protocol, Equal-Cost Multipath (ECMP), or VRRP, thereby simplifying network operation

- Redundant/load-sharing fabrics, management, fan assemblies, and power supplies

  Increase total performance and power availability while providing hitless, stateful failover

- Hot-swappable modules

  Allows replacement of modules without any impact on other modules

- Graceful restart

  Allows routers to indicate to others their capability to maintain a routing table during a temporary shutdown, which significantly reduces convergence times upon recovery; supports OSPF, BGP, and IS-IS

- Virtual Router Redundancy Protocol (VRRP)

  Allows groups of two routers to dynamically back each other up to create highly available routed environments

- Device Link Detection Protocol (DLDP)

  Monitors link connectivity and shuts down ports at both ends if unidirectional traffic is detected, preventing loops in STP-based networks

- Hitless patch upgrades

  Allows patches and new service features to be installed without restarting the equipment, increasing network uptime and facilitating maintenance

- IEEE 802.3ad Link Aggregation Control Protocol (LACP)

  Supports up to 1024 trunk groups and up to 16 members per trunk; supports static or dynamic groups and a user-selectable hashing algorithm

- Passive design system

  Delivers increased system reliability as the backplane has no active components

- Ultrafast protocol convergence (subsecond) with standard-based failure detection—Bidirectional Forwarding Detection (BFD)

  Enables link connectivity Monitoring and reduces network convergence time for RIP, OSPF, BGP, IS-IS, VRRP, MPLS, and IRF

Layer 2 switching

- VLAN

  Supports up to 4,094 port-based or IEEE 802.1Q-based VLANs

- Bridge Protocol Data Unit (BPDU) tunneling

  Transmits Spanning Tree Protocol (STP) BPDUs transparently, allowing correct tree calculations across service providers, WANs, or MANs

- Port mirroring

  Duplicates port traffic (ingress and egress) to a local or remote monitoring port; supports four mirroring groups, with an unlimited number of ports per group

- Port isolation

  Increases security by isolating ports within a VLAN while still allowing them to communicate with other VLANs

- Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) protocol snooping

  Controls and manages the flooding of multicast packets in a Layer 2 network

- STP

  Supports standard IEEE 802.1D STP, IEEE 802.1w Rapid Spanning Tree Protocol (RSTP) for faster convergence, and IEEE 802.1s Multiple Spanning Tree Protocol (MSTP)

- IEEE 802.1ad QinQ and selective QinQ

  Increase the scalability of an Ethernet network by providing a hierarchical structure; connect multiple LANs on a high-speed campus or metro network

Layer 3 routing

- Open shortest path first (OSPF)

  Delivers faster convergence; uses this link-state routing Interior Gateway Protocol (IGP), which supports ECMP, NSSA, and MD5 authentication for increased security and graceful restart for faster failure recovery

- Intermediate system to intermediate system (IS-IS)

  Uses a path vector IGP, which is defined by the ISO organization for IS-IS routing and extended by IETF RFC 1195 to operate in both TCP/IP and the OSI reference model (Integrated IS-IS)

- Border Gateway Protocol 4 (BGP-4)

  Delivers an implementation of the Exterior Gateway Protocol (EGP) utilizing path vectors; uses TCP for enhanced reliability for the route discovery process; reduces bandwidth consumption by advertising only incremental updates; supports extensive policies for increased flexibility; scales to very large networks

- Multiprotocol Label Switching (MPLS)

  Uses BGP to advertise routes across Label Switched Paths (LSPs), but uses simple labels to forward packets from any Layer 2 or Layer 3 protocol, which reduces complexity and increases performance; supports graceful restart for reduced failure impact; supports LSP tunneling and multilevel stacks

- Dual IP stack

  Maintains separate stacks for IPv4 and IPv6 to ease the transition from an IPv4-only network to an IPv6-only network design

- Equal-Cost Multipath (ECMP)

  Enables multiple equal-cost links in a routing environment to increase link redundancy and scale bandwidth

- Policy-based routing

  Makes routing decisions based on policies set by the network administrator

- Static IPv4 routing

  Provides simple manually configured IPv4 routing

- Routing Information Protocol (RIP)

  Uses a distance vector algorithm with UDP packets for route determination; supports RIPv1 and RIPv2 routing; includes loop protection

- IP performance optimization

  Provides a set of tools to improve the performance of IPv4 networks; includes directed broadcasts, customization of TCP parameters, support of ICNP error packets, and extensive display capabilities

- Unicast Reverse Path Forwarding (uRPF)

  Limits erroneous or malicious traffic in accordance with RFC 3074

- Static IPv6 routing

  Provides simple manually configured IPv6 routing

- Routing Information Protocol next generation (RIPng)

  Extends RIPv2 to support IPv6 addressing

- OSPFv3

  Provides OSPF support for IPv6

- IS-IS for IPv6

  Extends IS-IS to support IPv6 addressing

- BGP+

  Extends BGP-4 to support Multiprotocol BGP (MBGP), including support for IPv6 addressing

- MPLS Layer 3 VPN

  Allows Layer 3 VPNs across a provider network; uses MP-BGP to establish private routes for increased security; supports RFC 2547bis multiple autonomous system VPNs for added flexibility

• MPLS Layer 2 VPN

Establishes simple Layer 2 point-to-point VPNs across a provider network using only MPLS Label Distribution Protocol (LDP); requires no routing and therefore decreases complexity, increases performance, and allows VPNs of non-routable protocols; uses no routing information for increased security; supports Circuit Cross Connect (CCC), Static Virtual Circuits (SVCs), Martini draft, and Kompella-draft technologies

• Virtual Private LAN Service (VPLS)

Establishes point-to-multipoint Layer 2 VPNs across a provider network

• IPv6 tunneling

Provides an important element for the transition from IPv4 to IPv6; allows IPv6 packets to traverse IPv4-only networks by encapsulating the IPv6 packet into a standard IPv4 packet; supports manually configured, 6to4, Intra-Site Automatic Tunnel Addressing Protocol (ISATAP) tunnels, and IPv6 on VPN to Provider Edge (6VPE) router tunnel

Quality of Service (QoS)

• IEEE 802.1p prioritization

Delivers data to devices based on the priority and type of traffic

• Flexible classification

Creates traffic classes based on access control lists (ACLs), IEEE 802.1p precedence, IP, and DSCP or Type of Service (ToS) precedence; supports filter, redirect, mirror, remark, and logging

• Bandwidth shaping

– Port-based rate limiting

Provides per-port ingress-/egress-enforced increased bandwidth

– Classifier-based rate limiting

Uses an ACL to enforce increased bandwidth for ingress traffic on each port

– Reduced bandwidth

Provides per-port, per-queue egress-based reduced bandwidth

• Broad QoS feature set

Provides support for Strict Priority Queuing (SP), Weighted Fair Queuing (WFQ), Weighted Deficit Round Robin (WDRR), SP+WDRR together, configurable buffers, Explicit Congestion Notification (ECN), and Weighted Random Early Detection (WRED)

• Traffic policing

Supports Committed Access Rate (CAR) and line rate

Layer 3 services

• Address Resolution Protocol (ARP)

Determines the MAC address of another IP host in the same subnet; supports static ARPs; gratuitous ARP allows detection of duplicate IP addresses; proxy ARP allows normal ARP operation between subnets or when subnets are separated by a Layer 2 network

• User Datagram Protocol (UDP) helper

Redirects UDP broadcasts to specific IP subnets to prevent server spoofing

• Dynamic Host Configuration Protocol (DHCP)

Simplifies the management of large IP networks and supports client and server; DHCP Relay enables DHCP operation across subnets

Management

• Management interface control

Enables or disables each of the following interfaces depending on security preferences: console port, telnet port, or reset button

• Industry-standard CLI with a hierarchical structure

Reduces training time and expenses, and increases productivity in multivendor installations

• SNMPv1, v2, and v3

Provide complete support of SNMP; provide full support of industry-standard Management Information Base (MIB) plus private extensions; SNMPv3 supports increased security using encryption

• sFlow® (RFC 3176)

Provides scalable ASIC-based wirespeed network monitoring and accounting with no impact on network performance; this allows network operators to gather a variety of sophisticated network statistics and information for capacity planning and real-time network monitoring purposes

• Remote monitoring (RMON)

Uses standard SNMP to monitor essential network functions; supports events, alarm, history, and statistics group plus a private alarm extension group

• Debug and sampler utility

Supports ping and traceroute for both IPv4 and IPv6

• Network Time Protocol (NTP)

Synchronizes timekeeping among distributed time servers and clients; keeps timekeeping consistent among all clock-dependent devices within the network so that the devices can provide diverse applications based on the consistent time

• Network Quality Analyzer (NQA)

Analyzes network performance and service quality by sending test packets, and provides network performance and service quality parameters such as jitter, TCP, or FTP connection delays and file transfer rates; allows a network manager to determine overall network performance and to diagnose and locate network congestion points or failures

• Information center

Provides a central repository for system and network information; aggregates all logs, traps, and debugging information generated by the system and maintains them in order of severity; outputs the network information to multiple channels based on user-defined rules

• IEEE 802.1AB Link Layer Discovery Protocol (LLDP)

Advertises and receives management information from adjacent devices on a network, facilitating easy mapping by network management applications

Connectivity

- Jumbo frames

  Allows high-performance backups and disaster-recovery systems with a maximum frame size of 9K bytes

- Loopback

  Supports internal loopback testing for maintenance purposes and an increase in availability; loopback detection protects against incorrect cabling or network configurations and can be enabled on a per-port or per-VLAN basis for added flexibility

- Ethernet operations, administration and maintenance (OAM)

  Detects data link layer problems that occurred in the "last mile" using the IEEE 802.3ah OAM standard; monitors the status of the link between two devices

- Monitor link

  Collects statistics on performance and errors on physical links, increasing system availability

- Packet storm protection

  Protects against unknown broadcast, unknown multicast, or unicast storms with user-defined thresholds

- Flow control

  Provides back pressure using standard IEEE 802.3x, reducing congestion in heavy traffic situations

Security

- ACL

  Supports powerful ACLs for both IPv4 and IPv6; ACLs are used for filtering traffic to prevent unauthorized users from accessing the network, or for controlling network traffic to save resources; rules can either deny or permit traffic to be forwarded; rules can be based on a Layer 2 header or a Layer 3 protocol header; rules can be set to operate on specific dates or times

- Remote Authentication Dial-In User Service (RADIUS)

  Eases switch security access administration by using a password authentication server

- Terminal Access Controller Access-Control System (TACACS+)

  Delivers an authentication tool using TCP with encryption of the full authentication request, providing additional security

- Secure shell (SSHv2)

  Uses external servers to securely log in to a remote device; with authentication and encryption, it protects against IP spoofing and plain-text password interception; increases the security of Secure FTP (SFTP) transfers

- DHCP snooping

  Helps ensure that DHCP clients receive IP addresses from authorized DHCP servers and maintain a list of DHCP entries for trusted ports; prevents reception of fake IP addresses and reduces ARP attacks, improving security

- IP Source Guard

  Filters packets on a per-port basis, which prevents illegal packets from being forwarded

• ARP attack protection

Protects against attacks that use a large number of ARP requests, using a host-specific, user-selectable threshold

• Port security

Allows access only to specified MAC addresses, which can be learned or specified by the administrator

Multicast support

• IGMP

Utilizes Any-Source Multicast (ASM) or Source-Specific Multicast (SSM) to manage IPv4 multicast networks; supports IGMPv1, v2, and v3

• Protocol Independent Multicast (PIM)

Defines modes of Internet IPv4 and IPv6 multicasting to allow one-to-many and many-to-many transmission of information; PIM Dense Mode (DM), Sparse Mode (SM), and Source-Specific Mode (SSM) are supported

Warranty and support

• 1-year warranty

Advance hardware replacement with 10-calendar-day delivery (available in most countries)

• Electronic and telephone support

Limited electronic and business-hours telephone support is available from HP for the entire warranty period; to reach our support centers, refer to hp.com/networking/contact-support; for details on the duration of support provided with your product purchase, refer to hp.com/networking/warrantysummary.

• Software releases

To find software for your product, refer to hp.com/networking/support; for details on the software releases available with your product purchase, refer to hp.com/networking/warrantysummary.

HP FlexFabric 12900 Switch Series

Specifications

	HP FlexFabric 12916 Switch AC Chassis (JG632A)	HP FlexFabric 12910 Switch AC Chassis (JG619A)
I/O ports and slots	16 I/O module slots Supports a maximum of 768 Gigabit Ethernet ports or 768 1/10GbE ports or 768 1/10GBASE-T ports or 384 40GbE ports or 128 100GbE ports, or a combination	10 I/O module slots Supports a maximum of 480 Gigabit Ethernet ports or 480 1/10GbE ports or 480 1/10GBASE-T ports or 240 40GbE ports or 80 100GbE ports, or a combination
Additional ports and slots	2 MPU (for management modules) slots 6 switch fabric slots	2 MPU (for management modules) slots 6 switch fabric slots
Power supplies	12 power supply slots 1 minimum power supply required (ordered separately)	8 power supply slots 1 minimum power supply required (ordered separately)
Fan tray	Includes: 1 x JG637A 2 fan tray slots	Includes: 2 x JG631A 2 fan tray slots
Physical characteristics		
Dimensions	17.32(w) x 32.68(d) x 40.08(h) in. (44 x 83 x 101.8 cm) (23U height)	17.32(w) x 32.68(d) x 36.61(h) in. (43.99 x 83 x 92.99 cm) (21U height)
Weight	163.69 lb (74.25 kg) chassis only (no fan tray or power supplies)	187.46 lb (85.03 kg) chassis only (no fan tray or power supplies)
Full configuration weight	570.15 lb (258.62 kg)	474.45 lb (215.21 kg)
Memory and processor		
Management module	Quad Core MIPS64 @ 1.2 GHz, 1 GB flash, 8 GB DDR2 SDRAM	Quad Core MIPS64 @ 1.2 GHz, 1 GB flash, 8 GB DDR2 SDRAM
Mounting and enclosure	Mounts in an EIA standard 19-inch rack or other equipment cabinet (hardware included); horizontal surface mounting only	Mounts in an EIA standard 19-inch rack or other equipment cabinet (hardware included); horizontal surface mounting only
Performance		
Throughput	19.2 Bpps (64-byte packets)	12 Bpps (64-byte packets)
Switching capacity	30.7 Tb/s	19.2 Tb/s
Routing table size	524288 entries (IPv4), 131072 entries (IPv6)	524288 entries (IPv4), 131072 entries (IPv6)
MAC address table size	262144 entries	262144 entries

	HP FlexFabric 12916 Switch AC Chassis (JG632A)	HP FlexFabric 12910 Switch AC Chassis (JG619A)
Reliability		
Availability	99.999%	99.999%
Environment		
Operating temperature	32°F to 113°F (0°C to 45°C)	32°F to 113°F (0°C to 45°C)
Operating relative humidity	10% to 95%, noncondensing	10% to 95%, noncondensing
Nonoperating/Storage temperature	-40°F to 158°F (-40°C to 70°C)	-40°F to 158°F (-40°C to 70°C)
Nonoperating/Storage relative humidity	5% to 95%, noncondensing	5% to 95%, noncondensing
Altitude	up to 13,123 ft (4 km)	up to 13,123 ft (4 km)
Acoustic	Low-speed fan: 60.2 dB, High-speed fan: 86.3 dB	Low-speed fan: 60.2 dB, High-speed fan: 83.9 dB
Electrical characteristics		
Frequency	50/60 Hz	50/60 Hz
AC voltage	100–120/200–240 VAC	100–120/200–240 VAC
Current	16/60 A	16/60 A
Power output	2000 W	2000 W
	Notes	
	Based on a common power supply of 2,000 W (AC)	Based on a common power supply of 2,000 W (AC)
Safety	UL 60950-1; CAN/CSA 22.2 No. 60950-1; IEC 60950-1; EN 60950-1; FDA 21 CFR Subchapter J; AS/NZS 60950-1; RoHS Compliance EN 50581	UL 60950-1; CAN/CSA 22.2 No. 60950-1; IEC 60950-1; EN 60950-1; FDA 21 CFR Subchapter J; AS/NZS 60950-1; RoHS Compliance EN 50581
Emissions	VCCI Class A; EN 55022 Class A; CISPR 22 Class A; IEC/EN 61000-3-2; IEC/EN 61000-3-3; ICES-003 Class A; AS/NZS CISPR 22 Class A; FCC (CFR 47, Part 15) Class A; ETSI EN 300 386	VCCI Class A; EN 55022 Class A; CISPR 22 Class A; IEC/EN 61000-3-2; IEC/EN 61000-3-3; ICES-003 Class A; AS/NZS CISPR 22 Class A; FCC (CFR 47, Part 15) Class A; ETSI EN 300 386
Immunity		
Generic	EN 55024	EN 55024
Management	IMC—Intelligent Management Center; command-line interface; out-of-band management (serial RS-232C); SNMP Manager; Telnet; terminal interface (serial RS-232C); modem interface; IEEE 802.3 Ethernet MIB; Ethernet Interface MIB	IMC—Intelligent Management Center; command-line interface; out-of-band management (serial RS-232C); SNMP Manager; Telnet; terminal interface (serial RS-232C); modem interface; IEEE 802.3 Ethernet MIB; Ethernet Interface MIB
Services	Refer to the HP website at hp.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local HP sales office.	Refer to the HP website at hp.com/networking/services for details on the service-level descriptions and product numbers. For details about services and response times in your area, please contact your local HP sales office.

Standards and protocols
(applies to all products in series)

BGP	RFC 1771 BGPv4 RFC 1772 Application of the BGP RFC 1997 BGP Communities Attribute RFC 1998 An Application of the BGP Community Attribute in Multi-home Routing RFC 2385 BGP Session Protection via TCP MD5 RFC 2439 BGP Route Flap Damping RFC 2796 BGP Route Reflection RFC 2858 BGP-4 Multi-Protocol Extensions RFC 2918 Route Refresh Capability	RFC 3065 Autonomous System Confederations for BGP RFC 3392 Capabilities Advertisement with BGP-4 RFC 4271 A Border Gateway Protocol 4 (BGP-4) RFC 4272 BGP Security Vulnerabilities Analysis RFC 4273 Definitions of Managed Objects for BGP-4 RFC 4274 BGP-4 Protocol Analysis RFC 4275 BGP-4 MIB Implementation Survey	RFC 4276 BGP-4 Implementation Report RFC 4277 Experience with the BGP-4 Protocol RFC 4360 BGP Extended Communities Attribute RFC 4456 BGP Route Reflection: An Alternative to Full Mesh Internal BGP (IBGP) RFC 5291 Outbound Route Filtering Capability for BGP-4 RFC 5292 Address-Prefix-Based Outbound Route Filter for BGP-4
Denial of service protection	Automatic filtering of well-known denial-of-service packets	CPU DoS Protection	Rate Limiting by ACLs
Device management	RFC 1157 SNMPv1/v2c RFC 1305 NTPv3 RFC 1902 (SNMPv2) RFC 2579 (SMIv2 Text Conventions)	RFC 2580 (SMIv2 Conformance) RFC 2819 (RMON groups Alarm, Event, History and Statistics only) HTTP, SSHv1, and Telnet Multiple Configuration Files	Multiple Software Images SSHv1/SSHv2 Secure Shell TACACS/TACACS+ Web UI
General protocols	IEEE 802.1ad Q-in-Q IEEE 802.1ag Service Layer OAM IEEE 802.1p Priority IEEE 802.1Q VLANs IEEE 802.1s Multiple Spanning Trees IEEE 802.1w Rapid Reconfiguration of Spanning Tree IEEE 802.3ab 1000BASE-T IEEE 802.3ac (VLAN Tagging Extension) IEEE 802.3ad Link Aggregation Control Protocol (LACP) IEEE 802.3ae 10-Gigabit Ethernet IEEE 802.3ah Ethernet in First Mile over Point to Point Fiber - EFMF IEEE 802.3ba 40 and 100 Gigabit Ethernet Architecture IEEE 802.3x Flow Control IEEE 802.3z 1000BASE-X RFC 768 UDP RFC 783 TFTP Protocol (revision 2) RFC 791 IP RFC 792 ICMP RFC 793 TCP RFC 826 ARP RFC 854 TELNET RFC 894 IP over Ethernet RFC 925 Multi-LAN Address Resolution RFC 950 Internet Standard Subnetting Procedure RFC 959 File Transfer Protocol (FTP) RFC 1027 Proxy ARP RFC 1035 Domain Implementation and Specification RFC 1042 IP Datagrams RFC 1058 RIPv1	RFC 1142 OSI IS-IS Intra-domain Routing Protocol RFC 1195 OSI ISIS for IP and Dual Environments RFC 1213 Management Information Base for Network Management of TCP/IP-based internets RFC 1293 Inverse Address Resolution Protocol RFC 1305 NTPv3 RFC 1350 TFTP Protocol (revision 2) RFC 1393 Traceroute Using an IP Option RFC 1519 CIDR RFC 1531 Dynamic Host Configuration Protocol RFC 1533 DHCP Options and BOOTP Vendor Extensions RFC 1591 DNS (client only) RFC 1624 Incremental Internet Checksum RFC 1701 Generic Routing Encapsulation RFC 1721 RIP-2 Analysis RFC 1723 RIP v2 RFC 1812 IPv4 Routing RFC 2082 RIP-2 MD5 Authentication RFC 2091 Trigger RIP RFC 2131 DHCP RFC 2138 Remote Authentication Dial In User Service (RADIUS) RFC 2236 IGMP Snooping RFC 2338 VRRP RFC 2453 RIPv2 RFC 2644 Directed Broadcast Control RFC 2763 Dynamic Name-to-System ID mapping support RFC 2784 Generic Routing Encapsulation (GRE)	RFC 2865 Remote Authentication Dial In User Service (RADIUS) RFC 2966 Domain-wide Prefix Distribution with Two-Level IS-IS RFC 2973 IS-IS Mesh Groups RFC 3022 Traditional IP Network Address Translator (Traditional NAT) RFC 3277 IS-IS Transient Blackhole Avoidance RFC 3567 Intermediate System to Intermediate System (IS-IS) Cryptographic Authentication RFC 3719 Recommendations for Interoperable Networks using Intermediate System to Intermediate System (IS-IS) RFC 3784 ISIS TE support RFC 3786 Extending the Number of IS-IS LSP Fragments Beyond the 256 Limit RFC 3787 Recommendations for Interoperable IP Networks using Intermediate System to Intermediate System (IS-IS) RFC 3847 Restart signaling for IS-IS RFC 4251 The Secure Shell (SSH) Protocol Architecture RFC 4486 Subcodes for BGP Cease Notification Message RFC 4884 Extended ICMP to Support Multi-Part Messages RFC 4941 Privacy Extensions for Stateless Address Autoconfiguration in IPv6 RFC 5130 A Policy Control Mechanism in IS-IS Using Administrative Tags

Standards and protocols
(applies to all products in series)

IP multicast	RFC 2236 IGMPv2 RFC 2283 Multiprotocol Extensions for BGP-4 RFC 2362 PIM Sparse Mode RFC 3376 IGMPv3 RFC 3446 Anycast Rendezvous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP)	RFC 4601 PIM Sparse Mode RFC 3973 PIM Dense Mode RFC 4541 Considerations for Internet Group Management Protocol (IGMP) and Multicast Listener Discovery (MLD) Snooping Switches	RFC 4604 Using Internet Group Management Protocol Version 3 (IGMPv3) and Multicast Listener Discovery Protocol Version 2 (MLDv2) for Source-Specific Multicast RFC 4605 IGMP/MLD Proxying RFC 4607 Source-Specific Multicast for IP RFC 5059 Bootstrap Router (BSR) Mechanism for Protocol Independent Multicast (PIM)
IPv6	RFC 1886 DNS Extension for IPv6 RFC 1887 IPv6 Unicast Address Allocation Architecture RFC 1981 IPv6 Path MTU Discovery RFC 2080 RIPng for IPv6 RFC 2081 RIPng Protocol Applicability Statement RFC 2292 Advanced Sockets API for IPv6 RFC 2373 IPv6 Addressing Architecture RFC 2375 IPv6 Multicast Address Assignments RFC 2460 IPv6 Specification Autoconfiguration RFC 2461 IPv6 Neighbor Discovery RFC 2462 IPv6 Stateless Address Autoconfiguration RFC 2463 ICMPv6	RFC 2464 Transmission of IPv6 over Ethernet Networks RFC 2473 Generic Packet Tunneling in IPv6 RFC 2526 Reserved IPv6 Subnet Anycast Addresses RFC 2529 Transmission of IPv6 Packets over IPv4 RFC 2545 Use of MP-BGP-4 for IPv6 RFC 2553 Basic Socket Interface Extensions for IPv6 RFC 2710 Multicast Listener Discovery (MLD) for IPv6 RFC 2740 OSPFv3 for IPv6 RFC 2767 Dual stacks IPv46 & IPv6 RFC 2893 Transition Mechanisms for IPv6 Hosts and Routers	RFC 3056 Connection of IPv6 Domains via IPv4 Clouds RFC 3307 IPv6 Multicast Address Allocation RFC 3315 DHCPv6 (client and relay) RFC 3484 Default Address Selection for IPv6 RFC 3513 IPv6 Addressing Architecture RFC 3736 Stateless Dynamic Host Configuration Protocol (DHCP) Service for IPv6 RFC 3810 MLDv2 for IPv6 RFC 4214 Intra-Site Automatic Tunnel Addressing Protocol (ISATAP) RFC 4861 IPv6 Neighbor Discovery RFC 4862 IPv6 Stateless Address Autoconfiguration
MIBs	RFC 1156 (TCP/IP MIB) RFC 1157 A Simple Network Management Protocol (SNMP) RFC 1215 A Convention for Defining Traps for use with the SNMP RFC 1229 Interface MIB Extensions RFC 1493 Bridge MIB RFC 1573 SNMP MIB II RFC 1643 Ethernet MIB RFC 1657 BGP-4 MIB RFC 1724 RIPv2 MIB RFC 1907 SNMPv2 MIB RFC 2011 SNMPv2 MIB for IP RFC 2012 SNMPv2 MIB for TCP RFC 2013 SNMPv2 MIB for UDP RFC 2096 IP Forwarding Table MIB RFC 2233 Interface MIB RFC 2452 IPV6-TCP-MIB RFC 2454 IPV6-UDP-MIB RFC 2465 IPv6 MIB	RFC 2466 ICMPv6 MIB RFC 2571 SNMP Framework MIB RFC 2572 SNMP-MPD MIB RFC 2573 SNMP-Notification MIB RFC 2573 SNMP-Target MIB RFC 2578 Structure of Management Information Version 2 (SMIv2) RFC 2580 Conformance Statements for SMIv2 RFC 2618 RADIUS Client MIB RFC 2620 RADIUS Accounting MIB RFC 2665 Ethernet-Like-MIB RFC 2668 802.3 MAU MIB RFC 2674 802.1p and IEEE 802.1Q Bridge MIB RFC 2787 VRRP MIB RFC 2819 RMON MIB RFC 2925 Ping MIB RFC 2932IP (Multicast Routing MIB)	RFC 2933 IGMP MIB RFC 2934 Protocol Independent Multicast MIB for IPv4 RFC 3414 SNMP-User based-SM MIB RFC 3415 SNMP-View based-ACM MIB RFC 3417 Simple Network Management Protocol (SNMP) over IEEE 802 Networks RFC 3418 MIB for SNMPv3 RFC 3595 Textual Conventions for IPv6 Flow Label RFC 3621 Power Ethernet MIB RFC 3813 MPLS LSR MIB RFC 3814 MPLS FTN MIB RFC 3815 MPLS LDP MIB RFC 3826 AES for SNMP's USM MIB RFC 4133 Entity MIB (Version 3) RFC 4444 Management Information Base for Intermediate System to Intermediate System (IS-IS)

Standards and protocols
(applies to all products in series)

MPLS	RFC 2205 Resource ReSerVation Protocol RFC 2209 Resource ReSerVation Protocol (RSVP) RFC 2702 Requirements for Traffic Engineering Over MPLS RFC 2858 Multiprotocol Extensions for BGP-4 RFC 2961 RSVP Refresh Overhead Reduction Extensions RFC 3031 Multiprotocol Label Switching Architecture RFC 3032 MPLS Label Stack Encoding RFC 3107 Carrying Label Information in BGP-4	RFC 3212 Constraint-Based LSP Setup using LDP RFC 3479 Fault Tolerance for the Label Distribution Protocol (LDP) RFC 3487 Graceful Restart Mechanism for LDP RFC 3564 Requirements for Support of Differentiated Service-aware MPLS Traffic Engineering RFC 4364 BGP/MPLS IP Virtual Private Networks (VPNs) RFC 4379 Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures RFC 4447 Pseudowire Setup and Maintenance Using LDP	RFC 4448 Encapsulation Methods for Transport of Ethernet over MPLS Networks RFC 4664 Framework for Layer 2 Virtual Private Networks RFC 4665 Service Requirements for Layer 2 Provider Provisioned Virtual Private Networks RFC 4761 Virtual Private LAN Service (VPLS) Using BGP for Auto-Discovery and Signaling RFC 4762 Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling RFC 5036 LDP Specification
Network management	IEEE 802.1AB Link Layer Discovery Protocol (LLDP) RFC 1155 Structure of Management Information RFC 1157 SNMPv1 RFC 1448 Protocol Operations for version 2 of the Simple Network Management Protocol (SNMPv2)	RFC 2211 Controlled-Load Network RFC 2819 Four groups of RMON: 1 (statistics), 2 (history), 3 (alarm) and 9 (events) RFC 3176 sFlow RFC 3411 SNMP Management Frameworks	RFC 3412 SNMPv3 Message Processing RFC 3414 SNMPv3 User-based Security Model (USM) RFC 3415 SNMPv3 View-based Access Control Model VACM) ANSI/TIA-1057 LLDP Media Endpoint Discovery (LLDP-MED)
OSPF	RFC 1245 OSPF protocol analysis RFC 1246 Experience with OSPF RFC 1765 OSPF Database Overflow RFC 1850 OSPFv2 Management Information Base (MIB), traps RFC 2154 OSPF w/Digital Signatures (Password, MD-5) RFC 2328 OSPFv2 RFC 2370 OSPF Opaque LSA Option RFC 3101 OSPF NSSA	RFC 3137 OSPF Stub Router Advertisement RFC 3623 Graceful OSPF Restart RFC 3630 Traffic Engineering Extensions to OSPFv2 RFC 4061 Benchmarking Basic OSPF Single Router Control Plane Convergence RFC 4062 OSPF Benchmarking Terminology and Concepts RFC 4063 Considerations When Using Basic OSPF Convergence Benchmarks	RFC 4222 Prioritized Treatment of Specific OSPF Version 2 Packets and Congestion Avoidance RFC 4577 OSPF as the Provider/Customer Edge Protocol for BGP/MPLS IP Virtual Private Networks (VPNs) RFC 4811 OSPF Out-of-Band LSDB Resynchronization RFC 4812 OSPF Restart Signaling RFC 4813 OSPF Link-Local Signaling RFC 4940 IANA Considerations for OSPF
QoS/CoS	IEEE 802.1P (CoS) RFC 1349 Type of Service in the Internet Protocol Suite	RFC 2211 Specification of the Controlled-Load Network Element Service RFC 2212 Guaranteed Quality of Service RFC 2474 DSCP DiffServ	RFC 2475 DiffServ Architecture RFC 2597 DiffServ Assured Forwarding (AF) RFC 2598 DiffServ Expedited Forwarding (EF)
Security	RFC 1321 The MD5 Message-Digest Algorithm RFC 1334 PPP Authentication Protocols (PAP) RFC 1492 TACACS+ RFC 1994 PPP Challenge Handshake Authentication Protocol (CHAP) RFC 2082 RIP-2 MD5 Authentication	RFC 2104 Keyed-Hashing for Message Authentication RFC 2408 Internet Security Association and Key Management Protocol (ISAKMP) RFC 2409 The Internet Key Exchange (IKE) RFC 2716 PPP EAP TLS Authentication Protocol	RFC 2865 RADIUS Authentication RFC 2866 RADIUS Accounting RFC 2868 RADIUS Attributes for Tunnel Protocol Support RFC 2869 RADIUS Extensions Access Control Lists (ACLs) Port Security SSHv1/SSHv2 Secure Shell
VPN	RFC 2403 - HMAC-MD5-96 RFC 2404 - HMAC-SHA1-96 RFC 2405 - DES-CBC Cipher algorithm	RFC 2407 - Domain of interpretation RFC 2547 BGP/MPLS VPNs RFC 2917 A Core MPLS IP VPN Architecture	RFC 4302 - IP Authentication Header (AH) RFC 4303 - IP Encapsulating Security Payload (ESP)

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