

# Standards and Protocol Support

---

## Standards Compliance

IEEE 802.1ab-REV/D3 Station and Media Access Control Connectivity Discovery  
IEEE 802.1d Bridging  
IEEE 802.1p/Q VLAN Tagging  
IEEE 802.1s Multiple Spanning Tree  
IEEE 802.1w Rapid Spanning Tree Protocol  
IEEE 802.1x Port Based Network Access Control  
IEEE 802.1ad Provider Bridges  
IEEE 802.1ah Provider Backbone Bridges  
IEEE 802.1ag Service Layer OAM  
IEEE 802.3ah Ethernet in the First Mile  
IEEE 802.1ak Multiple MAC Registration Protocol  
IEEE 802.3 10BaseT  
IEEE 802.3ad Link Aggregation  
IEEE 802.3ae 10Gbps Ethernet  
IEEE 802.3ah Ethernet OAM  
IEEE 802.3x Flow Control  
IEEE 802.3z 1000BaseSX/LX  
ITU-T Y.1731 OAM functions and mechanisms for Ethernet based networks  
ITU-T G.8031 Ethernet linear protection switching  
ITU-T G.8032 Ethernet Ring Protection Switching (version 2)

## Protocol Support

### OSPF

RFC 1765 OSPF Database Overflow  
RFC 2328 OSPF Version 2  
RFC 2370 Opaque LSA Support  
RFC 2740 OSPF for IPv6 (OSPFv3)  
draft-ietf-ospf-ospfv3-update-14.txt  
RFC 3101 OSPF NSSA Option  
RFC 3137 OSPF Stub Router Advertisement  
RFC 3623 Graceful OSPF Restart – GR helper

RFC 3630 Traffic Engineering (TE) Extensions to OSPF Version 2  
RFC 4203 - OSPF Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS) - (support of Link Local/Remote Identifiers and SRLG sub-TLVs)  
RFC 5185 OSPF Multi-Area Adjacency  
RFC 3623 Graceful OSPF Restart — GR helper  
RFC 3630 Traffic Engineering (TE) Extensions to OSPF Version 2  
RFC 4203 for Shared Risk Link Group (SRLG) sub-TLV

### BGP

RFC 1397 BGP Default Route Advertisement  
RFC 1772 Application of BGP in the Internet  
RFC 1965 Confederations for BGP  
RFC 1997 BGP Communities Attribute  
RFC 2385 Protection of BGP Sessions via MD5  
RFC 2439 BGP Route Flap Dampening  
RFC 2558 Multiprotocol Extensions for BGP-4  
RFC 2918 Route Refresh Capability for BGP-4  
RFC 3107 Carrying Label Information in BGP-4  
RFC 3392 Capabilities Advertisement with BGP4  
RFC 4271 BGP-4 (previously RFC 1771)  
RFC 4360 BGP Extended Communities Attribute  
RFC 4364 BGP/MPLS IP Virtual Private Networks (VPNs) (previously RFC 2547bis BGP/MPLS VPNs)  
RFC 4456 BGP Route Reflection: Alternative to Full-mesh IBGP (previously RFC 1966 & 2796)  
RFC 4486 Subcodes for BGP Cease Notification Message  
RFC 4577 OSPF as the Provider/Customer Edge Protocol for BGP/

MPLS IP Virtual Private Networks (VPNs)

RFC 4659 BGP/MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN  
RFC 4684 Constrained Route Distribution for Border Gateway Protocol/MultiProtocol Label Switching (BGP/MPLS) Internet Protocol (IP) Virtual Private Networks (VPNs)  
RFC 4724 Graceful Restart Mechanism for BGP – GR helper  
RFC 4760 Multi-protocol Extensions for BGP  
RFC 4798 Connecting IPv6 Islands over IPv4 MPLS Using IPv6 Provider Edge Routers (6PE)  
RFC 4893 BGP Support for Four-octet AS Number Space  
RFC 5004 Avoid BGP Best Path Transitions from One External to Another  
RFC 5065 Confederations for BGP (obsoletes 3065)  
RFC 5291 Outbound Route Filtering Capability for BGP-4  
RFC 5575 Dissemination of Flow Specification Rules  
RFC 5668 4-Octet AS Specific BGP Extended Community  
draft-ietf-idr-add-paths  
draft-ietf-idr-best-external

### IS-IS

RFC 1142 OSI IS-IS Intra-domain Routing Protocol (ISO 10589)  
RFC 1195 Use of OSI IS-IS for routing in TCP/IP & dual environments  
RFC 2763 Dynamic Hostname Exchange for IS-IS  
RFC 2966 Domain-wide Prefix Distribution with Two-Level IS-IS  
RFC 2973 IS-IS Mesh Groups  
RFC 3567 Intermediate System to Intermediate System (ISIS) Cryptographic Authentication

## Standards and Protocols

RFC 3719 Recommendations for Interoperable Networks using IS-IS  
RFC 3784 Intermediate System to Intermediate System (IS-IS) Extensions for Traffic Engineering (TE)  
RFC 3787 Recommendations for Interoperable IP Networks  
RFC 3847 Restart Signaling for IS-IS – GR helper  
draft-ietf-isis-igp-p2p-over-lan-05.txt  
RFC 5303 Three-Way Handshake for Intermediate System to Intermediate System (IS-IS) Point-to-Point Adjacencies  
RFC 5305 IS-IS Extensions for Traffic Engineering  
RFC 5307 IS-IS Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS) – (support of Link Local/Remote Identifiers and SRLG sub-TLVs)

### IPSec

RFC 2401 Security Architecture for the Internet Protocol

### IPv6

RFC 1981 Path MTU Discovery for IPv6  
RFC 2375 IPv6 Multicast Address Assignments  
RFC 2460 Internet Protocol, Version 6 (IPv6) Specification  
RFC 2461 Neighbor Discovery for IPv6  
RFC 2462 IPv6 Stateless Address Auto configuration  
RFC 2463 Internet Control Message Protocol (ICMPv6) for the Internet Protocol Version 6 Specification  
RFC 2464 Transmission of IPv6 Packets over Ethernet Networks  
RFC 2529 Transmission of IPv6 over IPv4 Domains without Explicit Tunnels  
RFC 2545 Use of BGP-4 Multiprotocol Extension for IPv6 Inter-Domain Routing  
RFC 2710 Multicast Listener Discovery (MLD) for IPv6  
RFC 2740 OSPF for IPv6  
RFC 3306 Unicast-Prefix-based IPv6 Multicast Addresses  
RFC 3315 Dynamic Host Configuration Protocol for IPv6

RFC 3587 IPv6 Global Unicast Address Format  
RFC3590 Source Address Selection for the Multicast Listener Discovery (MLD) Protocol  
RFC 3810 Multicast Listener Discovery Version 2 (MLDv2) for IPv6  
RFC 4007 IPv6 Scoped Address Architecture  
RFC 4193 Unique Local IPv6 Unicast Addresses  
RFC 4291 IPv6 Addressing Architecture  
RFC 4552 Authentication/Confidentiality for OSPFv3  
RFC 4659 BGP-MPLS IP Virtual Private Network (VPN) Extension for IPv6 VPN  
RFC 5072 IP Version 6 over PPP  
RFC 5095 Deprecation of Type 0 Routing Headers in IPv6  
draft-ietf-isis-ipv6-05  
draft-ietf-isis-wg-multi-topology-xx.txt

### Multicast

RFC 1112 Host Extensions for IP Multicasting (Snooping)  
RFC 2236 Internet Group Management Protocol, (Snooping)  
RFC 3376 Internet Group Management Protocol, Version 3 (Snooping)  
RFC 2362 Protocol Independent Multicast-Sparse Mode (PIMSM)  
RFC 3618 Multicast Source Discovery Protocol (MSDP)  
RFC 3446 Anycast Rendezvous Point (RP) mechanism using Protocol Independent Multicast (PIM) and Multicast Source Discovery Protocol (MSDP)  
RFC 4601 Protocol Independent Multicast - Sparse Mode (PIM-SM): Protocol Specification (Revised)  
RFC 4604 Using IGMPv3 and MLDv2 for Source-Specific Multicast  
RFC 4607 Source-Specific Multicast for IP  
RFC 4608 Source-Specific Protocol Independent Multicast in 232/8  
RFC 4610 Anycast-RP Using Protocol Independent Multicast (PIM)  
RFC 5186, Internet Group Management Protocol Version 3 (IGMPv3)/ Multicast Listener Discovery

Version 2 (MLDv2) and Multicast Routing Protocol Interaction  
draft-ietf-pim-sm-bsr-06.txt  
draft-rosen-vpn-mcast-15.txt Multicast in MPLS/BGP IP VPNs  
draft-ietf-mboned-msdp-mib-01.txt  
draft-ietf-l3vpn-2547bis-mcast-07: Multicast in MPLS/BGP IP VPNs  
draft-ietf-l3vpn-2547bis-mcast-bgp-05: BGP Encodings and Procedures for Multicast in MPLS/BGP IP VPNs  
RFC 3956: Embedding the Rendezvous Point (RP) Address in an IPv6 Multicast Address

### MPLS — General

RFC 2430 A Provider Architecture DiffServ & TE  
RFC 2474 Definition of the DS Field the IPv4 and IPv6 Headers (Rev)  
RFC 2597 Assured Forwarding PHB Group (rev3260)  
RFC 2598 An Expedited Forwarding PHB  
RFC 3031 MPLS Architecture  
RFC 3032 MPLS Label Stack Encoding  
RFC 3443 Time To Live (TTL) Processing in Multi-Protocol Label Switching (MPLS) Networks  
RFC 4182 Removing a Restriction on the use of MPLS Explicit NULL  
RFC 3140 Per-Hop Behavior Identification Codes  
RFC 4905, Encapsulation methods for transport of layer 2 frames over MPLS  
RFC 5332 MPLS Multicast Encapsulations

### MPLS — LDP

RFC 3037 LDP Applicability  
RFC 3478 Graceful Restart Mechanism for LDP – GR helper  
RFC 5036 LDP Specification  
RFC 5283 LDP extension for Inter-Area LSP  
RFC 5443 LDP IGP Synchronization  
RFC 6388 Extensions for Point-to-Multipoint and Multipoint-to-Multipoint LSP  
RFC 6388 Multipoint LDP in-band signaling for Point-to-Multipoint

and Multipoint-to-Multipoint Label Switched Paths  
draft-pdutta-mpls-tldp-hello-reduce-04.txt, Targeted LDP Hello Reduction

**MPLS/RSVP-TE**

RFC 2702 Requirements for Traffic Engineering over MPLS  
RFC2747 RSVP Cryptographic Authentication  
RFC 2961 RSVP Refresh Overhead Reduction Extensions  
RFC3097 RSVP Cryptographic Authentication - Updated Message Type Value  
RFC 3209 Extensions to RSVP for Tunnels  
RFC 3473 Generalized Multi-Protocol Label Switching (GMPLS) Signaling  
Resource Reservation Protocol-Traffic Engineering (RSVP-TE) Extensions – (support of of IF\_ID RSVP\_HOP object with unnumbered interface and RSVP-TE Graceful Restart Helper Procedures)  
RFC 3477 Signalling Unnumbered Links in Resource ReSerVation Protocol - Traffic Engineering (RSVP-TE)  
RFC 3564 Requirements for Diff-Serv-aware TE  
RFC 3906 Calculating Interior Gateway Protocol (IGP) Routes Over Traffic Engineering Tunnels  
RFC 4090 Fast reroute Extensions to RSVP-TE for LSP Tunnels  
RFC 4124 Protocol Extensions for Support of Diffserv-aware MPLS Traffic Engineering  
RFC 4125 Maximum Allocation Bandwidth Constraints Model for Diffserv-aware MPLS Traffic Engineering  
RFC 4127 Russian Dolls Bandwidth Constraints Model for Diffserv-aware MPLS Traffic Engineering  
draft-newton-mpls-te-dynamic-overbooking-00 A Diffserv-TE Implementation Model to dynamically change booking factors during failure events  
RFC 4561 Definition of a RRO Node-Id Sub-Object

RFC 4875 Extensions to Resource Reservation Protocol - Traffic Engineering (RSVP-TE) for Point-to-Multipoint TE Label Switched Paths (LSPs)  
RFC 5151 Inter-domain MPLS and GMPLS Traffic Engineering – RSVP-TE Extensions  
RFC 5712 MPLS Traffic Engineering Soft Preemption  
RFC 5817 Graceful Shutdown in GMPLS Traffic Engineering Networks

**MPLS — OAM**

RFC 4379 Detecting Multi-Protocol Label Switched (MPLS) Data Plane Failures  
RFC 6425 Detecting Data Plane Failures in Point-to-Multipoint Multiprotocol Label Switching (MPLS) - Extensions to LSP Ping

**MPLS-TP (7750/7450 only)**

RFC 5586 MPLS Generic Associated Channel  
RFC 5921 A Framework for MPLS in Transport Networks  
RFC 5960 MPLS Transport Profile Data Plane Architecture  
RFC 6370 MPLS-TP Identifiers  
RFC 6378 MPLS-TP Linear Protection  
RFC 6428 Proactive Connectivity Verification, Continuity Check and Remote Defect indication for MPLS Transport Profile  
RFC 6426 MPLS On-Demand Connectivity and Route Tracing  
RFC 6478 Pseudowire Status for Static Pseudowires  
draft-ietf-mpls-tp-ethernet-addressing-02 MPLS-TP Next-Hop Ethernet Addressing

**RIP**

RFC 1058 RIP Version 1  
RFC 2082 RIP-2 MD5 Authentication  
RFC 2453 RIP Version 2

**TCP/IP**

RFC 768 UDP  
RFC 1350 The TFTP Protocol (Rev.  
RFC 791 IP  
RFC 792 ICMP

RFC 793 TCP  
RFC 826 ARP  
RFC 854 Telnet  
RFC 951 BootP (rev)  
RFC 1519 CIDR  
RFC 1542 Clarifications and Extensions for the Bootstrap Protocol  
RFC 1812 Requirements for IPv4 Routers  
RFC 2347 TFTP option Extension  
RFC 2328 TFTP Blocksize Option  
RFC 2349 TFTP Timeout Interval and Transfer Size option  
RFC 2401 Security Architecture for Internet Protocol  
RFC 2428 FTP Extensions for IPv6 and NATs  
RFC 3596 DNS Extensions to Support IP version 6  
draft-ietf-bfd-mib-00.txt Bidirectional Forwarding Detection Management Information Base  
RFC 5880 Bidirectional Forwarding Detection  
RFC 5881 BFD IPv4 and IPv6 (Single Hop)  
RFC 5883 BFD for Multihop Paths  
RFC 5286 Basic Specification for IP Fast Reroute: Loop-Free Alternates

**VRRP**

RFC 2787 Definitions of Managed Objects for the Virtual Router Redundancy Protocol  
RFC 3768 Virtual Router Redundancy Protocol  
RFC 5798, Virtual Router Redundancy Protocol Version 3 for IPv4 and IPv6

**DHCP**

RFC 2131 Dynamic Host Configuration Protocol (REV)  
RFC 3046 DHCP Relay Agent Information Option (Option 82)  
RFC 1534 Interoperation between DHCP and BOOTP

**VPLS**

RFC 4762 Virtual Private LAN Services Using LDP  
RFC 5501: Requirements for Multicast Support in Virtual Private LAN

## Standards and Protocols

Services (previously draft-ietf-l2vpn-vpls-mcast-reqts-04)  
RFC 6074: Provisioning, Auto-Discovery, and Signaling in Layer 2 Virtual Private Networks (L2VPNs) (previously draft-ietf-l2vpn-signaling-08)  
draft-ietf-l2vpn-vpls-mcast-13.txt  
Multicast in VPLS

### PSEUDOWIRE

RFC 3985 Pseudo Wire Emulation Edge-to-Edge (PWE3)  
RFC 4385 Pseudo Wire Emulation Edge-to-Edge (PWE3) Control Word for Use over an MPLS PSN  
RFC 3916 Requirements for Pseudo-Wire Emulation Edge-to-Edge (PWE3)  
RFC 4717 Encapsulation Methods for Transport ATM over MPLS Networks (draft-ietf-pwe3-atm-encap-10.txt)  
RFC 4816 PWE3 ATM Transparent Cell Transport Service (draft-ietf-pwe3-cell-transport-04.txt)  
RFC 4448 Encapsulation Methods for Transport of Ethernet over MPLS Networks (draft-ietf-pwe3-ethernet-encap-11.txt)  
RFC 4619 Encapsulation Methods for Transport of Frame Relay over MPLS Networks (draft-ietf-pwe3-frame-relay-07.txt)  
RFC 4446 IANA Allocations for PWE3  
RFC 4447 Pseudowire Setup and Maintenance Using LDP (draft-ietf-pwe3-control-protocol-17.txt)  
RFC 5085, Pseudowire Virtual Circuit Connectivity Verification (VCCV): A Control Channel for Pseudowires  
RFC 5659 An Architecture for Multi-Segment Pseudowire Emulation Edge-to-Edge  
draft-ietf-l2vpn-vpws-iw-oam-03.txt, OAM Procedures for VPWS Interworking  
draft-ietf-pwe3-mpls-eth-oam-iwk-07.txt, MPLS and Ethernet OAM Interworking  
RFC 6073 Segmented Pseudowire  
draft-ietf-pwe3-dynamic-ms-pw-16.txt, Dynamic Placement of Multi Segment Pseudo Wires

RFC 6310 Pseudowire (PW) OAM Message Mapping  
RFC 6391 Flow Aware Transport of Pseudowires over an MPLS PSN  
RFC 6575 ARP Mediation for IP Interworking of Layer 2 VPN  
RFC 6718draft-ietf-pwe3-redundancy-06.txt, Pseudowire (PW) Redundancy  
RFC 6870, Pseudowire Preferential Forwarding Status bit

### ANCP/L2CP

RFC 5851 ANCP framework  
draft-ietf-ancp-protocol-02.txt ANCP Protocol

### Voice /Video Performance

ITU-T G.107 The E Model- A computational model for use in planning.  
ETSI TS 101 329-5 Annex E extensions- QoS Measurement for VoIP - Method for determining an Equipment Impairment Factor using Passive Monitoring  
ITU-T Rec. P.564 - Conformance testing for voice over IP transmission quality assessment models  
ITU-T G.1020 - Appendix I - Performance Parameter Definitions for Quality of Speech and other Voiceband Applications Utilizing IP Networks- Mean Absolute Packet Delay Variation & Markov Models.  
RFC 3550 Appendix A.8- RTP: A Transport Protocol for Real-Time Applications- Estimating the Interarrival Jitter

### Circuit Emulation

RFC 4553 Structure-Agnostic Time Division Multiplexing (TDM) over Packet (SAToP)  
RFC 5086 Structure-Aware Time Division Multiplexed (TDM) Circuit Emulation Service over Packet Switched Network (CESoPSN)  
MEF-8 Implementation Agreement for the Emulation of PDH Circuits over Metro Ethernet Networks, October 2004  
RFC 5287 Control Protocol Extensions for the Setup of Time-Division

Multiplexing (TDM) Pseudowires in MPLS Networks

### SONET/SDH

ITU-G.841 Telecommunication Standardization Section of ITU, Types and Characteristics of SDH Networks Protection Architecture, issued in October 1998 and as augmented by Corrigendum1 issued in July 2002

### RADIUS

RFC 2865 Remote Authentication Dial In User Service  
RFC 2866 RADIUS Accounting

### SSH

RFC 4250 The Secure Shell (SSH) Protocol Assigned Numbers  
RFC 4251 The Secure Shell (SSH) Protocol Architecture  
RFC 4252 The Secure Shell (SSH) Authentication Protocol  
RFC 4253 The Secure Shell (SSH) Transport Layer Protocol [ssh-rsa key only]  
RFC 4254 The Secure Shell (SSH) Connection Protocol  
RFC 4256 Generic Message Exchange Authentication for the Secure Shell Protocol (SSH)

### Timing

GR-253-CORE SONET Transport Systems: Common Generic Criteria. Issue 3, September 2000  
ITU-T G.781 Telecommunication Standardization Section of ITU, Synchronization layer functions, issued 09/2008  
ITU-T G.813 Telecommunication Standardization Section of ITU, Timing characteristics of SDH equipment slave clocks (SEC), issued 03/2003.  
GR-1244-CORE Clocks for the Synchronized Network: Common Generic Criteria, Issue 3, May 2005  
ITU-T G.8261 Telecommunication Standardization Section of ITU, Timing and synchronization aspects in packet networks, issued 04/2008.



- ITU-T G.8262 Telecommunication Standardization Section of ITU, Timing characteristics of synchronous Ethernet equipment slave clock (EEC), issued 08/2007.
- ITU-T G.8264 Telecommunication Standardization Section of ITU, Distribution of timing information through packet networks, issued 10/2008.
- ITU-T G.8265.1 Telecommunication Standardization Section of ITU, Precision time protocol telecom profile for frequency synchronization, issued 10/2010
- IEEE Std 1588tm-2008, IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems, July 2008
- NETWORK MANAGEMENT**
- ITU-T X.721: Information technology- OSI-Structure of Management Information
- ITU-T X.734: Information technology- OSI-Systems Management: Event Report Management Function
- M.3100/3120 Equipment and Connection Models
- TMF 509/613 Network Connectivity Model
- RFC 1157 SNMPv1
- RFC 1215 A Convention for Defining Traps for use with the SNMP
- RFC 1657 BGP4-MIB
- RFC 1724 RIPv2-MIB
- RFC 1850 OSPF-MIB
- RFC 1907 SNMPv2-MIB
- RFC 2011 IP-MIB
- RFC 2138 RADIUS
- RFC 2206 RSVP-MIB
- RFC 2452 IPv6 Management Information Base for the Transmission Control Protocol
- RFC 2465 Management Information Base for IPv6: Textual Conventions and General Group
- RFC 2558 SONET-MIB
- RFC 2571 SNMP-Framework MIB
- RFC 2572 SNMP-MPD-MIB
- RFC 2573 SNMP-Target-&-notification-MIB
- RFC 2574 SNMP-User-based-SMMIB
- RFC 2575 SNMP-View-based ACM-MIB
- RFC 2576 SNMP-Community-MIB
- RFC 2578 Structure of Management Information Version 2 (SMIv2)
- RFC 2665 EtherLike-MIB
- RFC 2819 RMON-MIB
- RFC 2863 IF-MIB
- RFC 2864 Inverted-stack-MIB
- RFC 2987 VRRP-MIB
- RFC 3014 Notification-log MIB
- RFC 3019 IP Version 6 Management Information Base for The Multicast Listener Discovery Protocol
- RFC 3164 Syslog
- RFC 3273 HCRMON-MIB
- RFC 3411 An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks
- RFC 3412 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
- RFC 3413 Simple Network Management Protocol (SNMP) Applications
- RFC 3414 User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)
- RFC 3418 SNMP MIB
- RFC 3826 The Advanced Encryption Standard (AES) Cipher Algorithm in the SNMP User-based Security Model
- RFC 4113 Management Information Base for the User Datagram Protocol (UDP)
- RFC 4292 IP-Forward-MIB
- RFC 4293 MIB for the Internet Protocol
- RFC 5101 Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information
- RFC 6242 Using the NETCONF Protocol over Secure Shell (SSH)

