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**Information technology —
Telecommunications and information
exchange between systems — Local and
metropolitan area networks — Specific
requirements —**

**Part 1Q:
Bridges and bridged networks**

*Technologies de l'information — Télécommunications et échange
d'information entre systèmes — Réseaux locaux et métropolitains —
Exigences spécifiques*

Partie 1Q: Ponts et réseaux pontés



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- *Part 1: Overview of Local Area Network Standards*
- *Part 2: Logical link control*
- *Part 5: Token ring access method and physical layer specifications*
- *Part 11: Wireless LAN medium access control (MAC) and physical layer (PHY) specifications*
- *Part 1X: Port-based network access control*
- *Part 1AB: Station and media access control connectivity discovery*

- *Part 1AE: Media access control (MAC) security*
- *Part 1AR: Secure device identity*
- *Part 1AS: Timing and synchronization for time-sensitive applications in bridged local area networks*
- *Part 15-4: Wireless medium access control (MAC) and physical layer (PHY) specifications for low-rate wireless personal area networks (WPANs)*

IEEE Standard for Local and metropolitan area networks— Bridges and Bridged Networks

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IEEE Std 802.1Q™-2014
(Revision of
IEEE Std 802.1Q-2011)

IEEE Std 802.1Q™-2014

(Revision of
IEEE Std 802.1Q-2011)

**IEEE Standard for
Local and metropolitan area networks—**

Bridges and Bridged Networks

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Approved 3 November 2014

IEEE-SA Standards Board

Abstract: This standard specifies how the Media Access Control (MAC) Service is supported by Bridged Networks, the principles of operation of those networks, and the operation of MAC Bridges and VLAN Bridges, including management, protocols, and algorithms

Keywords: Bridged Network, IEEE 802.1Q™, LAN, local area network, MAC Bridge, metropolitan area networks, MSTP, Multiple Spanning Tree Protocol, Rapid Spanning Tree Protocol, RSTP, PBN, Provider Bridged Network, Shortest Path Bridging Protocol, SPB Protocol, Virtual Bridged Network, virtual LAN, VLAN Bridge

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Introduction

This introduction is not part of IEEE Std 802.1Q-2014, IEEE Standard for Local and metropolitan area networks—Bridges and Bridged Networks.

IEEE Std 802.1Q-2014 incorporates the text of the following amendments into IEEE Std 802.1Q-2011.

IEEE Std 802.1Qbe™-2011	Multiple I-SID Registration Protocol
IEEE Std 802.1Qbc™-2011	Provider Bridging—Remote Customer Service Interfaces
IEEE Std 802.1Qbb™-2011	Priority-based Flow Control
IEEE Std 802.1Qaz™-2011	Enhanced Transmission Selection for Bandwidth Sharing Between Traffic Classes
IEEE Std 802.1Qbf™-2011	PBB-TE Infrastructure Segment Protection
IEEE Std 802.1Qbg™-2012	Edge Virtual Bridging
IEEE Std 802.1aq™-2012	Shortest Path Bridging
IEEE Std 802.1Q-2011/Cor 2-2012	Technical and editorial corrections
IEEE Std 802.1Qbp™-2014	Equal Cost Multiple Paths (ECMP)

The 2011 revision of this standard incorporated the text of the following amendments into IEEE Std 802.1Q-2005.

IEEE Std 802.1ad™-2005	Provider Bridges
IEEE Std 802.1ak™-2007	Multiple Registration Protocol
IEEE Std 802.1ag™-2007	Connectivity Fault Management
IEEE Std 802.1ah™-2008	Provider Backbone Bridges
IEEE Std 802-1Q-2005/Cor-1-2008	Corrections to the Multiple Registration Protocol
IEEE Std 802.1ap™-2008	Management Information Base (MIB) Definitions for VLAN Bridges
IEEE Std 802.1Qaw™-2009	Management of Data Driven and Data Dependent Connectivity Faults
IEEE Std 802.1Qay™-2009	Provider Backbone Bridge Traffic Engineering
IEEE Std 802.1aj™-2009	Two-Port Media Access Control (MAC) Relay
IEEE Std 802.1Qav™-2009	Forwarding and Queuing Enhancements for Time-Sensitive Streams
IEEE Std 802.1Qau™-2010	Congestion Notification
IEEE Std 802.1Qaf™-2010	Stream Reservation Protocol

Clause 13 of IEEE Std 802.1Q-2011 was also revised to include an updated specification of the Rapid Spanning Tree Algorithm and Protocol (RSTP), superseding references to IEEE Std 802.1D™-2004 [B10].^a

The 2005 revision of this standard incorporated the text of the following amendments into IEEE Std 802.1Q-1998.

IEEE Std 802.1u™-2001	Technical and Editorial Corrections
IEEE Std 802.1v™-2001	VLAN Classification by Protocol and Port
IEEE Std 802.1s™-2002	Multiple Spanning Trees

This standard was first published as IEEE Std 802.1Q-1998, making use of the concepts and mechanisms of LAN Bridging that were introduced by IEEE Std 802.1D and defining additional mechanisms to allow the implementation of Virtual Bridged Networks.

^aNumbers in brackets correspond to the numbers in the bibliography in Annex Q.

For an introduction to this standard that details each of the provisions introduced by amendments and revisions throughout its development, refer to 1.3.

This standard contains state-of-the-art material. The area covered by this standard is undergoing evolution. Revisions are anticipated within the next few years to clarify existing material, to correct possible errors, and to incorporate new related material. Information on the current revision state of this and other IEEE 802 standards may be obtained from

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Contents

1.	Overview.....	1
1.1	Scope.....	2
1.2	Purpose.....	2
1.3	Introduction.....	2
2.	Normative references.....	9
3.	Definitions.....	12
4.	Abbreviations.....	32
5.	Conformance.....	37
5.1	Requirements terminology.....	37
5.2	Conformant components and equipment.....	37
5.3	Protocol Implementation Conformance Statement (PICS).....	38
5.4	VLAN Bridge component requirements.....	38
5.4.1	VLAN Bridge component options.....	39
5.4.2	Multiple VLAN Registration Protocol (MVRP) requirements.....	43
5.4.3	VLAN Bridge requirements for congestion notification.....	44
5.4.4	Multiple Stream Registration Protocol (MSRP) requirements.....	44
5.4.5	Shortest Path Bridging (SPB) operation (optional).....	45
5.5	C-VLAN component conformance.....	46
5.5.1	C-VLAN component options.....	46
5.6	S-VLAN component conformance.....	46
5.6.1	S-VLAN component options.....	47
5.6.2	S-VLAN component requirements for Provider Backbone Bridge Traffic Engineering (PBB-TE).....	47
5.6.3	S-VLAN component requirements for PBB-TE IPS.....	47
5.6.4	S-VLAN component requirements for ECMP with flow filtering.....	48
5.7	I-component conformance.....	48
5.7.1	I-component options.....	48
5.8	B-component conformance.....	48
5.8.1	B-component options.....	49
5.8.2	B-component requirements for PBB-TE.....	49
5.8.3	B-component requirements for PBB-TE IPS.....	49
5.8.4	B-component requirements for ECMP with flow filtering.....	50
5.9	C-VLAN Bridge conformance.....	50
5.9.1	C-VLAN Bridge options.....	50
5.10	Provider Bridge conformance.....	50
5.10.1	S-VLAN Bridge conformance.....	50
5.10.2	Provider Edge Bridge conformance.....	51
5.11	System requirements for Priority-based Flow Control (PFC).....	51
5.12	Backbone Edge Bridge (BEB) conformance.....	51
5.12.1	BEB requirements for PBB-TE.....	52
5.13	MAC Bridge component requirements.....	52
5.13.1	MAC Bridge component options.....	52
5.14	MAC Bridge conformance.....	53
5.14.1	MAC Bridge options.....	53
5.15	TPMR component conformance.....	53
5.15.1	TPMR component options.....	53

5.16	TPMR conformance.....	54
5.16.1	TPMR options	54
5.17	T-component conformance	54
5.17.1	T-component options	54
5.18	End station requirements for MMRP, MVRP, and MSRP	54
5.18.1	MMRP requirements and options	55
5.18.2	MVRP requirements and options	55
5.18.3	MSRP requirements and options	56
5.19	VLAN-aware end station requirements for CFM	56
5.20	End station requirements—FQTSS.....	57
5.21	End station requirements for congestion notification	57
5.22	MAC-specific bridging methods.....	58
5.23	EVB Bridge requirements.....	58
5.24	EVB station requirements.....	59
5.24.1	Edge relay (ER) requirements	59
6.	Support of the MAC Service.....	61
6.1	Basic architectural concepts and terms	62
6.2	Provision of the MAC Service	62
6.2.1	Point-to-point, multipoint-to-multipoint, and rooted-multipoint connectivity	63
6.3	Support of the MAC Service.....	63
6.4	Preservation of the MAC Service	64
6.5	Quality of service (QoS) maintenance.....	64
6.5.1	Service availability	64
6.5.2	Frame loss	65
6.5.3	Frame misordering	65
6.5.4	Frame duplication	66
6.5.5	Transit delay	67
6.5.6	Frame lifetime	68
6.5.7	Undetected frame error rate	68
6.5.8	Maximum Service Data Unit Size	68
6.5.9	Priority	68
6.5.10	Throughput	69
6.6	Internal Sublayer Service (ISS)	70
6.6.1	Control primitives and parameters	70
6.7	Support of the ISS by specific MAC procedures.....	70
6.7.1	Support of the ISS by IEEE Std 802.3 (Ethernet)	70
6.8	Enhanced Internal Sublayer Service (EISS)	70
6.8.1	Service primitives	71
6.8.2	Status parameters	72
6.8.3	Point-to-point parameters	72
6.8.4	Control primitives and parameters	72
6.9	Support of the EISS	72
6.9.1	Data indications	74
6.9.2	Data requests	75
6.9.3	Priority Code Point encoding	75
6.9.4	Regenerating priority	77
6.10	Support of the ISS/EISS by PIPs	78
6.10.1	Data indications	80
6.10.2	Data requests	81
6.10.3	Priority Code Point encoding	81
6.11	Support of the EISS by CBPs	82
6.11.1	Data indications	83

6.11.2	Data requests	84
6.11.3	Priority Code Point decoding	85
6.11.4	Regenerating priority	85
6.12	Protocol VLAN classification	85
6.12.1	Protocol Templates	87
6.12.2	Protocol Group Identifiers	87
6.12.3	Protocol Group Database	87
6.13	Support of the ISS for attachment to a PBN	88
6.13.1	Data requests	89
6.13.2	Data indications	90
6.14	Support of the ISS within a system	90
6.15	Support of the ISS by additional technologies	90
6.16	Filtering services in Bridged Networks	91
6.16.1	Purpose(s) of filtering service provision	91
6.16.2	Goals of filtering service provision	91
6.16.3	Users of filtering services	91
6.16.4	Basis of service	92
6.16.5	Categories of service	92
6.16.6	Service configuration	92
6.16.7	Service definition for Extended Filtering Services	93
6.17	EISS Multiplex Entity	94
6.18	Backbone Service Instance Multiplex Entity	95
6.18.1	Demultiplexing direction	96
6.18.2	Multiplexing direction	97
6.18.3	Priority Code Point encoding	98
6.18.4	Status parameters	98
6.19	TESI Multiplex Entity	98
6.20	Support of the ISS with signaled priority	99
6.20.1	Data indications	100
6.20.2	Data requests	100
6.21	Infrastructure Segment Multiplex Entity	100
7.	Principles of Virtual Bridged Network operation	102
7.1	Network overview	102
7.2	Use of VLANs	103
7.3	Active topology	103
7.4	VLAN topology	104
7.5	Locating end stations	105
7.6	Ingress, forwarding, and egress rules	105
8.	Principles of Bridge operation	107
8.1	Bridge operation	107
8.1.1	Relay	107
8.1.2	Filtering and relaying information	108
8.1.3	Duplicate frame prevention	108
8.1.4	Traffic segregation	108
8.1.5	Traffic reduction	109
8.1.6	Traffic expediting	109
8.1.7	Conversion of frame formats	109
8.2	Bridge architecture	110
8.3	Model of operation	112
8.4	Active topologies, learning, and forwarding	115
8.5	Bridge Port Transmit and Receive	117

8.5.1	Bridge Port connectivity	117
8.5.2	TPMR Port connectivity	118
8.5.3	Support of Higher Layer Entities	118
8.6	The Forwarding Process	119
8.6.1	Active topology enforcement	120
8.6.2	Ingress filtering	121
8.6.3	Frame filtering	121
8.6.4	Egress filtering	124
8.6.5	Flow classification and metering	124
8.6.6	Queuing frames	125
8.6.7	Queue management	126
8.6.8	Transmission selection	127
8.7	The Learning Process.....	129
8.7.1	Default filtering utility criteria	130
8.7.2	Enhanced filtering utility criteria	130
8.7.3	Ageing of Dynamic Filtering Entries	130
8.8	The Filtering Database (FDB)	131
8.8.1	Static Filtering Entries	134
8.8.2	Static VLAN Registration Entries	135
8.8.3	Dynamic Filtering Entries	136
8.8.4	MAC Address Registration Entries	136
8.8.5	Dynamic VLAN Registration Entries	137
8.8.6	Default Group filtering behavior	137
8.8.7	Dynamic Reservation Entries	139
8.8.8	Allocation of VIDs to FIDs	139
8.8.9	Querying the FDB	140
8.8.10	Determination of the member set for a VID	143
8.8.11	Permanent Database	144
8.8.12	Connection_Identifier	144
8.9	MST, SPB, and ESP configuration information	144
8.9.1	MST Configuration Table	145
8.9.2	MST configuration identification	146
8.9.3	FID to MSTI Allocation Table	146
8.9.4	SPT Configuration Identification	146
8.10	Spanning Tree Protocol Entity.....	147
8.11	MRP entities	147
8.12	Bridge Management Entity.....	147
8.13	Addressing	148
8.13.1	End stations	148
8.13.2	Bridge Ports	148
8.13.3	Use of LLC by Spanning Tree Protocol Entities	148
8.13.4	Reserved MAC addresses	149
8.13.5	Group MAC addresses for spanning tree entity	149
8.13.6	Group MAC addresses for MRP Applications	151
8.13.7	Bridge Management Entities	151
8.13.8	Unique identification of a Bridge	152
8.13.9	Points of attachment and connectivity for Higher Layer Entities	152
8.13.10	VLAN attachment and connectivity for Higher Layer Entities	155
8.13.11	CFM entities	156
9.	Tagged frame format.....	158
9.1	Purpose of tagging	158
9.2	Representation and encoding of tag fields	158

9.3	Tag format.....	159
9.4	TPID formats	159
9.5	Tag Protocol identification	159
9.6	VLAN Tag Control Information (TCI).....	160
9.7	Backbone Service Instance Tag Control Information (I-TAG TCI).....	161
10.	Multiple Registration Protocol (MRP) and Multiple MAC Registration Protocol (MMRP)	163
10.1	MRP overview	163
10.2	MRP architecture	166
10.3	MRP Attribute Propagation (MAP).....	167
10.3.1	MAP Context	168
10.4	Requirements to be met by MRP	169
10.5	Requirements for interoperability between MRP Participants	170
10.6	Protocol operation.....	171
10.7	Protocol specification.....	175
10.7.1	Notational conventions and abbreviations	176
10.7.2	Registrar Administrative Controls	178
10.7.3	Applicant Administrative Controls	178
10.7.4	Protocol timers	178
10.7.5	Protocol event definitions	179
10.7.6	Protocol Action definitions	182
10.7.7	Applicant state machine	184
10.7.8	Registrar state machine	185
10.7.9	LeaveAll state machine	185
10.7.10	PeriodicTransmission state machine	186
10.7.11	Timer values	186
10.7.12	Operational reporting and statistics	187
10.7.13	Interoperability considerations	187
10.8	Structure and encoding of Multiple Registration Protocol Data Units (MRPDUs).....	188
10.8.1	Structure	188
10.8.2	Encoding of MRPDU parameters	190
10.8.3	Packing and parsing MRPDUs	193
10.9	Multiple MAC Registration Protocol (MMRP)—Purpose	195
10.10	Model of operation.....	196
10.10.1	Propagation of Group Membership information	197
10.10.2	Propagation of Group service requirement information	198
10.10.3	Source pruning	198
10.10.4	Use of Group service requirement registration by end stations	198
10.11	Default Group filtering behavior and MMRP propagation.....	198
10.12	Definition of the MMRP application	200
10.12.1	Definition of MRP elements	200
10.12.2	Provision and support of Extended Filtering Services	202
10.12.3	Use of “new” declaration capability	204
10.12.4	Attribute value support requirements	204
10.12.5	Registrar Administrative Controls	205
11.	VLAN topology management.....	206
11.1	Static and dynamic VLAN configuration	206
11.2	Multiple VLAN Registration Protocol (MVRP).....	207
11.2.1	MVRP overview	207
11.2.2	VLAN registration service definition	209
11.2.3	Definition of the MVRP application	210
11.2.4	VID translation table	213

11.2.5	Use of “new” declaration capability	213
11.2.6	New-Only Participant and Registrar Administrative Controls	213
11.2.7	Attribute value support requirements	213
12.	Bridge management	214
12.1	Management functions	214
12.1.1	Configuration Management	214
12.1.2	Fault Management	215
12.1.3	Performance Management	215
12.1.4	Security Management	215
12.1.5	Accounting Management	215
12.2	VLAN Bridge objects	215
12.3	Data types	216
12.4	Bridge Management Entity	217
12.4.1	Bridge Configuration	217
12.4.2	Port configuration	220
12.5	MAC entities	222
12.5.1	ISS Port Number table managed object (optional)	222
12.6	Forwarding process	222
12.6.1	The Port Counters	223
12.6.2	Priority handling	223
12.6.3	Traffic Class Table	231
12.7	Filtering Database (FDB)	232
12.7.1	The Filtering Database object	232
12.7.2	A Static Filtering Entry object	233
12.7.3	A Dynamic Filtering Entry object	234
12.7.4	A MAC Address Registration Entry object	234
12.7.5	A VLAN Registration Entry object	234
12.7.6	Permanent Database object	234
12.7.7	General FDB operations	235
12.8	Bridge Protocol Entity	237
12.8.1	The Protocol Entity	237
12.8.2	Bridge Port	240
12.9	MRP Entities	244
12.9.1	The MRP Timer object	244
12.9.2	The MRP Attribute Type object	245
12.9.3	Periodic state machine objects	246
12.10	Bridge VLAN managed objects	247
12.10.1	Bridge VLAN Configuration managed object	247
12.10.2	VLAN Configuration managed object	252
12.10.3	The VID to FID allocation managed object	254
12.11	MMRP entities	256
12.11.1	MMRP Configuration managed object	256
12.12	MST configuration entities	258
12.12.1	The MSTI List	258
12.12.2	The FID to MSTID Allocation Table	259
12.12.3	The MST Configuration Table	260
12.13	Provider Bridge management	262
12.13.1	Provider Bridge Port Type managed object	263
12.13.2	Customer Edge Port Configuration managed object	264
12.13.3	Remote Customer Access Port Configuration managed object	267
12.14	CFM entities	269
12.14.1	Maintenance Domain list managed object	270

12.14.2	CFM Stack managed object	272
12.14.3	Default MD Level managed object	272
12.14.4	Configuration Error List managed object	274
12.14.5	Maintenance Domain managed object	274
12.14.6	Maintenance Association managed object	277
12.14.7	Maintenance association Endpoint managed object	279
12.15	Backbone Core Bridge (BCB) management.....	286
12.16	Backbone Edge Bridge (BEB) management.....	286
12.16.1	BEB configuration managed object	288
12.16.2	BEB/PB/VLAN Bridge Port configuration managed object	291
12.16.3	VIP configuration managed object	292
12.16.4	PIP configuration managed object	293
12.16.5	CBP Configuration managed object	300
12.17	DDCFM entities.....	302
12.17.1	DDCFM Stack managed object	303
12.17.2	Reflection Responder managed object	303
12.17.3	RFM Receiver managed object	307
12.17.4	Decapsulator Responder managed object	308
12.17.5	SFM Originator managed object	310
12.18	PBB-TE Protection Switching managed objects	313
12.18.1	TE protection group list managed object	313
12.18.2	TE protection group managed object	314
12.19	TPMR managed objects.....	316
12.19.1	TPMR management entity	317
12.19.2	MAC and PHY entities	319
12.19.3	Forwarding Process	319
12.19.4	MAC Status Propagation Entity (MSPE)	324
12.20	Management entities for FQTS	326
12.20.1	The Bandwidth Availability Parameter Table	326
12.20.2	The Transmission Selection Algorithm Table	327
12.20.3	The Priority Regeneration Override Table	327
12.21	Congestion Notification managed objects	327
12.21.1	CN component managed object	328
12.21.2	CN component priority managed object	328
12.21.3	CN Port priority managed object	329
12.21.4	Congestion Point managed object	330
12.21.5	Reaction Point port priority managed object	331
12.21.6	Reaction Point group managed object	331
12.22	Stream Reservation Protocol (SRP) entities	332
12.22.1	SRP Bridge Base Table	332
12.22.2	SRP Bridge Port Table	332
12.22.3	SRP Latency Parameter Table	333
12.22.4	SRP Stream Table	333
12.22.5	SRP Reservations Table	333
12.23	Priority-based Flow Control objects	334
12.24	1:1 PBB-TE IPS managed objects	335
12.24.1	IPG list managed object	335
12.24.2	IPG managed object	336
12.25	Shortest Path Bridging managed objects	339
12.25.1	The SPB System managed object	340
12.25.2	The SPB MTID Static managed object	342
12.25.3	The SPB Topology Instance Dynamic managed object	343
12.25.4	The SPB ECT Static Entry managed object	344
12.25.5	The SPB ECT Dynamic Entry managed object	345

12.25.6	The SPB Adjacency Static Entry managed object	346
12.25.7	The SPB Adjacency Dynamic Entry managed object	347
12.25.8	The SPBM BSI Static Entry managed object	348
12.25.9	The SPB Topology Node Table managed object	349
12.25.10	The SPB Topology ECT Table managed object	350
12.25.11	The SPB Topology Edge Table managed object	351
12.25.12	The SPBM Topology Service Table managed object	352
12.25.13	The SPBV Topology Service Table managed object	353
12.25.14	The ECMP ECT Static Entry managed object	354
12.26	Edge Virtual Bridging (EVB) management.....	355
12.26.1	EVB system base table	358
12.26.2	SBP table entry	360
12.26.3	VSI table entry	361
12.26.4	S-channel configuration and management	363
12.26.5	ER management	366
12.27	Edge Control Protocol (ECP) management.....	367
12.27.1	ECP table entry	367
13.	Spanning tree protocols.....	368
13.1	Protocol design requirements.....	369
13.2	Protocol support requirements	370
13.2.1	MSTP support requirements	370
13.2.2	SPB support requirements	370
13.3	Protocol design goals	371
13.4	RSTP overview	371
13.4.1	Computation of the active topology	372
13.4.2	Example topologies	373
13.5	MSTP overview	376
13.5.1	Example topologies	377
13.5.2	Relationship of MSTP to RSTP	380
13.5.3	Modeling an MST or SPT Region as a single Bridge	380
13.6	SPB overview.....	381
13.7	Compatibility and interoperability.....	382
13.7.1	Designated Port selection	382
13.7.2	Force Protocol Version	382
13.8	MST Configuration Identifier (MCID).....	383
13.9	Spanning tree priority vectors.....	384
13.10	CIST Priority Vector calculations.....	386
13.11	MST Priority Vector calculations	388
13.12	Port Role assignments.....	390
13.13	Stable connectivity.....	391
13.14	Communicating spanning tree information	392
13.15	Changing spanning tree information.....	393
13.16	Changing Port States with RSTP or MSTP	394
13.16.1	Subtree connectivity and priority vectors	395
13.16.2	Root Port transition to Forwarding	395
13.16.3	Designated Port transition to Forwarding	395
13.16.4	Master Port transition to Forwarding	397
13.17	Changing Port States with SPB	399
13.17.1	Agreement Digest	402
13.18	Managing spanning tree topologies	402
13.19	Updating learned station location information	403
13.20	Managing reconfiguration.....	405

13.21	Partial and disputed connectivity	406
13.22	In-service upgrades	406
13.23	Fragile Bridges	408
13.24	Spanning tree protocol state machines	408
13.25	State machine timers	410
13.25.1	edgeDelayWhile	411
13.25.2	fdWhile	411
13.25.3	helloWhen	411
13.25.4	mdelayWhile	411
13.25.5	rbWhile	411
13.25.6	rcvdInfoWhile	411
13.25.7	rrWhile	412
13.25.8	tcDetected	412
13.25.9	tcWhile	412
13.25.10	pseudoInfoHelloWhen	412
13.26	Per Bridge variables	412
13.26.1	agreementDigest	413
13.26.2	BridgeIdentifier	413
13.26.3	BridgePriority	413
13.26.4	BridgeTimes	413
13.26.5	ForceProtocolVersion	414
13.26.6	MigrateTime	414
13.26.7	MstConfigId	414
13.26.8	AuxMstConfigId	414
13.26.9	rootPortId	414
13.26.10	rootPriority	414
13.26.11	rootTimes	414
13.26.12	TxHoldCount	414
13.27	Per port variables	414
13.27.1	AdminEdge	417
13.27.2	ageingTime	417
13.27.3	agree	417
13.27.4	agreed	417
13.27.5	agreedAbove	417
13.27.6	agreedDigest	417
13.27.7	agreedDigestValid	417
13.27.8	agreeDigest	417
13.27.9	agreeDigestValid	417
13.27.10	agreedMisorder	418
13.27.11	agreedN	418
13.27.12	agreedND	418
13.27.13	agreedPriority	418
13.27.14	agreedTopology	418
13.27.15	agreementOutstanding	418
13.27.16	agreeN	418
13.27.17	agreeND	418
13.27.18	AutoEdge	418
13.27.19	AutoIsolate	419
13.27.20	designatedPriority	419
13.27.21	designatedTimes	419
13.27.22	disputed	419
13.27.23	enableBPDUrx	419
13.27.24	enableBPDUtx	419
13.27.25	ExternalPortPathCost	419

13.27.26	isL2gp	419
13.27.27	isolate	420
13.27.28	fdbFlush	420
13.27.29	forward	420
13.27.30	forwarding	420
13.27.31	infoInternal	420
13.27.32	infoIs	420
13.27.33	InternalPortPathCost	420
13.27.34	learn	421
13.27.35	learning	421
13.27.36	master	421
13.27.37	mastered	421
13.27.38	mcheck	421
13.27.39	msgPriority	421
13.27.40	msgTimes	421
13.27.41	neighbourPriority	422
13.27.42	newInfo	422
13.27.43	newInfoMsti	422
13.27.44	operEdge	422
13.27.45	portEnabled	422
13.27.46	portId	422
13.27.47	portPriority	422
13.27.48	portTimes	423
13.27.49	proposed	423
13.27.50	proposing	423
13.27.51	pseudoRootId	423
13.27.52	rcvdBPDU	423
13.27.53	rcvdInfo	423
13.27.54	rcvdInternal	423
13.27.55	rcvdMsg	423
13.27.56	rcvdRSTP	423
13.27.57	rcvdSTP	423
13.27.58	rcvdTc	423
13.27.59	rcvdTcAck	423
13.27.60	rcvdTen	424
13.27.61	reRoot	424
13.27.62	reselect	424
13.27.63	restrictedDomainRole	424
13.27.64	restrictedRole	424
13.27.65	restrictedTcn	424
13.27.66	role	424
13.27.67	selected	424
13.27.68	selectedRole	424
13.27.69	sendRSTP	425
13.27.70	sync	425
13.27.71	synced	425
13.27.72	tcAck	425
13.27.73	tcProp	425
13.27.74	tick	425
13.27.75	txCount	425
13.27.76	updtInfo	425
13.28	State machine conditions and parameters	425
13.28.1	allSptAgree	426
13.28.2	allSynced	426

13.28.3	allTransmitReady	426
13.28.4	BestAgreementPriority	426
13.28.5	cist	426
13.28.6	cistRootPort	426
13.28.7	cistDesignatedPort	427
13.28.8	EdgeDelay	427
13.28.9	forwardDelay	427
13.28.10	FwdDelay	427
13.28.11	HelloTime	427
13.28.12	MaxAge	427
13.28.13	msti	427
13.28.14	mstiDesignatedOrTCpropagatingRootPort	427
13.28.15	mstiMasterPort	427
13.28.16	operPointToPoint	427
13.28.17	rcvdAnyMsg	427
13.28.18	rcvdCistMsg	427
13.28.19	rcvdMstiMsg	428
13.28.20	reRooted	428
13.28.21	rstpVersion	428
13.28.22	spt	428
13.28.23	stpVersion	428
13.28.24	updtCistInfo	428
13.28.25	updtMstiInfo	428
13.29	State machine procedures	428
13.29.1	betterorsameInfo(newInfoIs)	429
13.29.2	clearAllRcvdMsgs()	429
13.29.3	clearReselectTree()	429
13.29.4	disableForwarding()	430
13.29.5	disableLearning()	430
13.29.6	enableForwarding()	430
13.29.7	enableLearning()	430
13.29.8	fromSameRegion()	430
13.29.9	newTcDetected()	430
13.29.10	newTcWhile()	430
13.29.11	pseudoRcvMsgs()	431
13.29.12	rcvInfo()	431
13.29.13	rcvMsgs()	432
13.29.14	rcvAgreements()	432
13.29.15	recordAgreement()	432
13.29.16	recordDispute()	433
13.29.17	recordMastered()	433
13.29.18	recordPriority()	433
13.29.19	recordProposal()	433
13.29.20	recordTimes()	433
13.29.21	setReRootTree()	434
13.29.22	setSelectedTree()	434
13.29.23	setSyncTree()	434
13.29.24	setTcFlags()	434
13.29.25	setTcPropTree()	434
13.29.26	syncMaster()	434
13.29.27	txConfig()	434
13.29.28	txRstp()	435
13.29.29	txTcn()	435
13.29.30	updtAgreement()	435

13.29.31	updtBPDUVersion()	436
13.29.32	updtDigest()	436
13.29.33	updtRcvdInfoWhile()	437
13.29.34	updtRolesTree()	438
13.29.35	uptRolesDisabledTree()	439
13.30	The Port Timers state machine	440
13.31	Port Receive state machine	440
13.32	Port Protocol Migration state machine	441
13.33	Bridge Detection state machine	441
13.34	Port Transmit state machine	442
13.35	Port Information state machine	443
13.36	Port Role Selection state machine	444
13.37	Port Role Transitions state machine	444
13.38	Port State Transition state machine	449
13.38.1	Port State transitions for the CIST and MSTIs	450
13.38.2	Port State transitions for SPTs	450
13.39	Topology Change state machine	451
13.40	Layer 2 Gateway Port Receive state machine	452
13.41	CEP spanning tree operation	452
13.41.1	PEP operPointToPointMAC and operEdge	452
13.41.2	updtRolesTree()	453
13.41.3	setReRootTree(), setSyncTree(), setTcPropTree()	453
13.41.4	allSynced, reRooted	453
13.41.5	Configuration parameters	453
13.42	Virtual Instance Port (VIP) spanning tree operation	454
14.	Encoding of Bridge Protocol Data Units (BPDUs)	455
14.1	BPDUs Structure	455
14.1.1	Transmission and representation of octets	455
14.1.2	Common BPDUs fields	457
14.2	Encoding of parameter types	457
14.2.1	Encoding of Protocol Identifiers	457
14.2.2	Encoding of Protocol Version Identifiers	457
14.2.3	Encoding of BPDUs types	457
14.2.4	Encoding of flags	457
14.2.5	Encoding of Bridge Identifiers	457
14.2.6	Encoding of External Root Path Cost and Internal Root Path Cost	458
14.2.7	Encoding of Port Identifiers	458
14.2.8	Encoding of Timer Values	459
14.2.9	Encoding of Port Role values	459
14.2.10	Encoding of Length Values	459
14.2.11	Encoding of Hop Counts	459
14.3	Transmission of BPDUs	459
14.4	Encoding and decoding of STP Configuration, RST, MST, and SPT BPDUs	460
14.4.1	MSTI Configuration Messages	461
14.5	Validation of received BPDUs	462
14.6	Validation and interoperability	463
15.	Support of the MAC Service by PBNs	465
15.1	Service transparency	465
15.2	Customer service interfaces	466
15.3	Port-based service interface	466
15.4	C-tagged service interface	467

15.5	S-tagged service interface	468
15.6	Remote customer service interfaces (RCSIs)	469
15.7	Service instance segregation	472
15.8	Service instance selection and identification	472
15.9	Service priority selection	473
15.10	Service access protection	474
16.	Principles of Provider Bridged Network (PBN) operation	475
16.1	PBN overview	475
16.2	Provider Bridged Network (PBN)	476
16.3	Service instance connectivity	479
16.4	Service provider learning of customer end station addresses	480
16.5	Detection of connectivity loops through attached networks	480
16.6	Network management	481
17.	Management Information Base (MIB)	482
17.1	Internet Standard Management Framework	482
17.2	Structure of the MIB	482
17.2.1	Structure of the IEEE8021-TC-MIB	483
17.2.2	Structure of the IEEE8021-BRIDGE-MIB	485
17.2.3	Structure of the IEEE8021-SPANNING-TREE MIB	490
17.2.4	Structure of the IEEE8021-Q-BRIDGE-MIB	492
17.2.5	Structure of the IEEE8021-PB-MIB	499
17.2.6	Structure of the IEEE8021-MSTP-MIB	500
17.2.7	Structure of the IEEE8021-CFM-MIB	503
17.2.8	Structure of the IEEE8021-PBB-MIB	509
17.2.9	Structure of the IEEE8021-DDCFM-MIBs	512
17.2.10	Structure of the IEEE8021-PBBTE-MIB	514
17.2.11	Structure of the TPMR MIB	517
17.2.12	Structure of the IEEE8021-FQTSS-MIB	519
17.2.13	Structure of the Congestion Notification MIB	520
17.2.14	Structure of the IEEE8021-SRP-MIB	522
17.2.15	Structure of the MVRP extension MIB	524
17.2.16	Structure of the MIRP MIB	524
17.2.17	Structure of the PFC MIB	525
17.2.18	Structure of the IEEE80221-TEIPS MIB	525
17.2.19	Structure of the IEEE8021-SPB-MIB	527
17.2.20	Structure of the IEEE8021-EVB-MIB	531
17.2.21	Structure of the IEEE8021-ECMP-MIB	534
17.3	Relationship to other MIBs	535
17.3.1	Relationship of the IEEE8021-TC-MIB to other MIB modules	535
17.3.2	Relationship of the IEEE8021-BRIDGE-MIB to other MIB modules	536
17.3.3	Relationship of the IEEE8021-RSTP MIB to other MIB modules	538
17.3.4	Relationship of the IEEE8021-Q-BRIDGE-MIB to other MIB modules	538
17.3.5	Relationship of the IEEE8021-PB-BRIDGE MIB to other MIB modules	540
17.3.6	Relationship of the IEEE8021-MSTP-MIB to other MIB modules	540
17.3.7	Relationship of the IEEE8021-CFM-MIB to other MIB modules	540
17.3.8	Relationship of the IEEE8021-PBB-MIB to other MIB modules	541
17.3.9	Relationship of the IEEE8021-DDCFM to other MIB modules	543
17.3.10	Relationship of the IEEE8021-PBBTE-MIB to other MIB modules	543
17.3.11	Relationship of the TPMR MIB to other MIB modules	543
17.3.12	Relationship of the IEEE8021-FQTSS-MIB to other MIB modules	544
17.3.13	Relationship of the IEEE802-CN-MIB to other MIB modules	544

17.3.14	Relationship of the IEEE8021-SRP-MIB to other MIB modules	544
17.3.15	Relationship of the IEEE8021-MVRPX-MIB to other MIB modules	544
17.3.16	Relationship of the IEEE8021-MIRP-MIB to other MIB modules	545
17.3.17	Relationship of the PFC MIB to other MIB modules	545
17.3.18	Relationship of the IEEE8021-TEIPS-MIB to other MIB modules	545
17.3.19	Relationship of the of the IEEE8021-SPB-MIB to other MIB modules	545
17.3.20	Relationship of the IEEE8021-EVB-MIB to other MIB modules	545
17.3.21	Relationship of the of the IEEE8021-ECMP-MIB to other MIB modules	545
17.4	Security considerations	546
17.4.1	Security considerations of the IEEE8021-TC-MIB	546
17.4.2	Security considerations of the IEEE8021-BRIDGE-MIB	546
17.4.3	Security considerations of the IEEE8021-SPANNING-TREE MIB	547
17.4.4	Security considerations of the IEEE8021-Q-BRIDGE-MIB	548
17.4.5	Security considerations of the IEEE8021-PB-MIB	549
17.4.6	Security considerations of the IEEE8021-MSTP-MIB	549
17.4.7	Security considerations of the IEEE8021-CFM-MIB	549
17.4.8	Security considerations of the IEEE8021-PBB-MIB	552
17.4.9	Security considerations of the IEEE8021-DDCFM-MIB	552
17.4.10	Security considerations of the IEEE8021-PBBTE-MIB	553
17.4.11	Security considerations of the TMR MIB	554
17.4.12	Security considerations of the IEEE8021-FQTSS-MIB	554
17.4.13	Security considerations of the Congestion Notification MIB	555
17.4.14	Security considerations of the IEEE8021-SRP-MIB	556
17.4.15	Security considerations of the IEEE8021-MVRPX-MIB	557
17.4.16	Security considerations of the IEEE8021-MIRP-MIB	557
17.4.17	Security considerations for the PFC MIB	558
17.4.18	Security considerations of the IEEE8021-TEIPS-MIB	558
17.4.19	Security considerations of the IEEE8021-SPB-MIB	558
17.4.20	Security considerations of the IEEE8021-EVB-MIB	559
17.4.21	Security considerations of the IEEE8021-ECMP-MIB	560
17.5	Dynamic component and Port creation.....	561
17.5.1	Overview of the dynamically created Bridge entities	561
17.5.2	Component creation	562
17.5.3	Port creation	563
17.6	MIB operations for service interface configuration.....	573
17.6.1	Provisioning PBN service interfaces	573
17.6.2	Provisioning Backbone Bridged Network service interfaces	576
17.7	MIB modules,	582
17.7.1	Definitions for the IEEE8021-TC-MIB module	582
17.7.2	Definitions for the IEEE8021-BRIDGE-MIB module	593
17.7.3	Definitions for the IEEE8021-SPANNING-TREE-MIB module	633
17.7.4	Definitions for the IEEE8021-Q-BRIDGE-MIB module	651
17.7.5	Definitions for the IEEE8021-PB-MIB module	697
17.7.6	Definitions for the IEEE8021-MSTP-MIB module	715
17.7.7	Definitions for the CFM MIB modules	744
17.7.8	Definitions for the IEEE8021-PBB-MIB module	826
17.7.9	Definitions for the IEEE8021-DDCFM-MIB module	849
17.7.10	Definitions for the IEEE8021-PBBTE-MIB module	867
17.7.11	Definitions for the IEEE8021-TMR-MIB module	884
17.7.12	Definitions for the IEEE8021-FQTSS-MIB module	898
17.7.13	Definitions for the IEEE8021-CN-MIB module	909
17.7.14	Definitions for the IEEE8021-SRP-MIB module	945
17.7.15	Definitions for the IEEE8021-MVRPX-MIB module	961
17.7.16	Definitions for the IEEE8021-MIRP-MIB module	966

17.7.17	Definitions for the IEEE8021-PFC-MIB module	972
17.7.18	Definitions for the IEEE8021-TEIPS-V2-MIB module	976
17.7.19	Definitions for the IEEE8021-SPB-MIB module	990
17.7.20	Definitions for the IEEE8021-EVB-MIB module	1027
17.7.21	Definitions for the IEEE8021-ECMP-MIB module	1056
18.	Principles of Connectivity Fault Management operation	1064
18.1	Maintenance Domains and DoSAPs	1065
18.2	Service instances and MAs	1067
18.3	Maintenance Domain Levels	1068
19.	CFM entity operation	1072
19.1	Maintenance Points	1072
19.2	MA Endpoints (MEPs)	1073
19.2.1	MEP identification	1073
19.2.2	MEP functions	1074
19.2.3	MEP architecture	1074
19.2.4	MP Type Demultiplexer	1076
19.2.5	MP Multiplexer	1076
19.2.6	MP Level Demultiplexer	1076
19.2.7	MP OpCode Demultiplexer	1076
19.2.8	MEP Continuity Check Receiver	1077
19.2.9	MEP Continuity Check Initiator	1077
19.2.10	MP Loopback Responder	1078
19.2.11	MEP Loopback Initiator	1078
19.2.12	MEP Linktrace Initiator	1078
19.2.13	MEP LTI SAP	1078
19.2.14	MEP Linktrace SAP	1078
19.2.15	MEP CCM Database	1078
19.2.16	MEP Fault Notification Generator	1078
19.2.17	MEP Decapsulator Responder (DR)	1079
19.2.18	MEP RFM Receiver	1079
19.3	MIP Half Function	1079
19.3.1	MHF identification	1079
19.3.2	MHF functions	1079
19.3.3	MHF architecture	1080
19.3.4	MHF Level Demultiplexer	1080
19.3.5	MHF Type Demultiplexer	1080
19.3.6	MHF OpCode Demultiplexer	1080
19.3.7	MHF Multiplexer	1080
19.3.8	MHF Loopback Responder	1080
19.3.9	MHF Continuity Check Receiver	1081
19.3.10	MIP CCM Database	1081
19.3.11	MHF Linktrace SAP	1082
19.3.12	MHF DR	1082
19.3.13	MHF RFM Receiver	1082
19.4	MP addressing	1082
19.5	Linktrace Output Multiplexer (LOM)	1083
19.6	Linktrace Responder	1083
20.	CFM protocols	1085
20.1	Continuity Check protocol	1086

20.1.1	MAC status reporting in the CCM	1088
20.1.2	Defects and Fault Alarms	1088
20.1.3	CCM reception	1089
20.2	Loopback protocol	1089
20.2.1	LBM transmission	1090
20.2.2	LBM reception and LBR transmission	1090
20.2.3	LBR reception	1091
20.3	Linktrace protocol	1091
20.3.1	LTM origination	1092
20.3.2	LTM reception, forwarding, and replying	1093
20.3.3	LTR reception	1094
20.4	CFM state machines	1095
20.5	CFM state machine timers	1095
20.5.1	LTFwhile	1097
20.5.2	CCIwhile	1097
20.5.3	errorCCMwhile	1097
20.5.4	xconCCMwhile	1097
20.5.5	LBIwhile	1097
20.5.6	FNGwhile	1097
20.5.7	mmCCMwhile	1097
20.5.8	mmLocwhile	1097
20.5.9	mmFNGwhile	1097
20.5.10	rMEPwhile	1097
20.6	CFM procedures	1098
20.6.1	CCMtime()	1098
20.7	Maintenance Domain variable	1098
20.7.1	mdLevel	1098
20.8	MA variables	1098
20.8.1	CCMinterval	1098
20.9	MEP variables	1098
20.9.1	MEPactive	1099
20.9.2	enableRmepDefect	1099
20.9.3	MAdefectIndication	1100
20.9.4	allRMEPsDead	1100
20.9.5	lowestAlarmPri	1100
20.9.6	presentRDI	1100
20.9.7	MEPprimaryVID	1100
20.9.8	presentTraffic	1100
20.9.9	presentmmLoc	1100
20.9.10	ISpresentTraffic	1101
20.9.11	ISpresentmmLoc	1101
20.9.12	EpMEP	1101
20.10	MEP Continuity Check Initiator variables	1101
20.10.1	CCIenabled	1101
20.10.2	CCIsentCCMs	1101
20.10.3	MACstatusChanged	1101
20.10.4	Npaths	1101
20.10.5	flowHash[]	1102
20.10.6	pathN	1102
20.10.7	CCMcnt	1102
20.11	MEP Continuity Check Initiator procedures	1102
20.11.1	xmitCCM()	1102
20.12	MEP Continuity Check Initiator state machine	1103
20.13	MHF Continuity Check Receiver variables	1103

20.13.1	MHFrcvdCCM	1104
20.13.2	MHFCCMPDU	1104
20.14	MHF Continuity Check Receiver procedures	1104
20.14.1	MHFprocessCCM()	1104
20.15	MHF Continuity Check Receiver state machine	1104
20.16	MEP Continuity Check Receiver variables	1104
20.16.1	CCMreceivedEqual	1105
20.16.2	CCMequalPDU	1105
20.16.3	CCMreceivedLow	1105
20.16.4	CCMlowPDU	1105
20.16.5	rcvdMacAddress	1105
20.16.6	rcvdRDI	1105
20.16.7	rcvdInterval	1105
20.16.8	rcvdPortState	1106
20.16.9	rcvdInterfaceStatus	1106
20.16.10	rcvdSenderId	1106
20.16.11	rcvdFrame	1106
20.16.12	CCMsequenceErrors	1106
20.16.13	rcvdTrafficBit	1106
20.17	MEP Continuity Check Receiver procedures	1106
20.17.1	MEPprocessEqualCCM()	1106
20.17.2	MEPprocessLowCCM()	1107
20.18	MEP Continuity Check Receiver state machine	1107
20.19	Remote MEP variables	1108
20.19.1	rMEPCCMdefect	1108
20.19.2	rMEPlastRDI and rMEPlastRDI[i]	1108
20.19.3	rMEPlastPortState	1109
20.19.4	rMEPlastInterfaceStatus	1109
20.19.5	rMEPlastSenderId	1109
20.19.6	rCCMreceived	1109
20.19.7	rMEPmacAddress	1109
20.19.8	rMEPportStatusDefect	1109
20.19.9	rMEPinterfaceStatusDefect	1109
20.19.10	lastPathN	1109
20.20	Remote MEP state machine	1110
20.21	Remote MEP Error variables	1110
20.21.1	errorCCMreceived	1111
20.21.2	errorCCMlastFailure	1111
20.21.3	errorCCMdefect	1111
20.22	Remote MEP Error state machine	1111
20.23	MEP Cross Connect variables	1111
20.23.1	xconCCMreceived	1112
20.23.2	xconCCMlastFailure	1112
20.23.3	xconCCMdefect	1112
20.24	MEP Cross Connect state machine	1112
20.25	MEP Mismatch variables	1113
20.25.1	mmCCMreceived	1113
20.25.2	mmCCMdefect	1113
20.25.3	mmCCMTime	1113
20.25.4	disableLocdefect	1113
20.25.5	mmLocdefect	1113
20.26	MEP Mismatch state machines	1114
20.27	MP Loopback Responder variables	1115
20.27.1	LBMreceived	1115

20.27.2	LBMPDU	1115
20.28	MP Loopback Responder procedures	1115
20.28.1	ProcessLBM()	1115
20.28.2	xmitLBR()	1116
20.29	MP Loopback Responder state machine	1116
20.30	MEP Loopback Initiator variables	1117
20.30.1	LBMstosend	1117
20.30.2	nextLBMtransID	1117
20.30.3	expectedLBRtransID	1117
20.30.4	LBIactive	1117
20.30.5	xmitReady	1117
20.30.6	LBRreceived	1117
20.30.7	LBRPDU	1117
20.31	MEP Loopback Initiator transmit procedures	1118
20.31.1	xmitLBM()	1118
20.32	MEP Loopback Initiator transmit state machine	1119
20.33	MEP Loopback Initiator receive procedures	1119
20.33.1	ProcessLBR()	1119
20.34	MEP Loopback Initiator receive state machine	1120
20.35	MEP Fault Notification Generator variables	1120
20.35.1	fngPriority	1120
20.35.2	fngDefect	1121
20.35.3	fngAlarmTime	1121
20.35.4	fngResetTime	1121
20.35.5	someRMEPCCMdefect	1121
20.35.6	someMACstatusDefect	1121
20.35.7	someRDId defect	1121
20.35.8	highestDefectPri	1121
20.35.9	highestDefect	1121
20.36	MEP Fault Notification Generator procedures	1122
20.36.1	xmitFaultAlarm()	1122
20.37	MEP Fault Notification Generator state machine	1122
20.38	MEP Mismatch Fault Notification Generator variables	1123
20.38.1	mfngAllowed	1123
20.38.2	mmdefectIndication	1123
20.38.3	mfngAlarmTime	1123
20.38.4	mfngResetTime	1123
20.39	MEP Mismatch Fault Notification Generator procedures	1123
20.39.1	xmitFaultAlarm()	1123
20.40	MEP Mismatch Fault Notification Generator state machine	1124
20.41	MEP Linktrace Initiator variables	1124
20.41.1	nextLTMtransID	1124
20.41.2	ltmReplyList	1125
20.42	MEP Linktrace Initiator procedures	1126
20.42.1	xmitLTM()	1127
20.43	MEP Linktrace Initiator receive variables	1127
20.43.1	LTRreceived	1127
20.43.2	LTRPDU	1128
20.44	MEP Linktrace Initiator receive procedures	1128
20.44.1	ProcessLTR()	1128
20.45	MEP Linktrace Initiator receive state machine	1128
20.46	Linktrace Responder variables	1129
20.46.1	nPendingLTRs	1129
20.46.2	LTMreceived	1129

20.46.3	LTMPDU	1129
20.47	LTM Receiver procedures	1129
20.47.1	ProcessLTM()	1129
20.47.2	clearPendingLTRs()	1133
20.47.3	ForwardLTM()	1134
20.47.4	enqueLTR()	1134
20.48	LTM Receiver state machine	1136
20.49	LTR Transmitter procedure	1136
20.49.1	xmitOldestLTR()	1136
20.50	LTR Transmitter state machine	1136
20.51	CFM PDU validation and versioning	1137
20.51.1	Goals of CFM PDU versioning	1137
20.51.2	PDU transmission	1137
20.51.3	PDU validation	1138
20.51.4	Validation pass	1138
20.51.5	Execution pass	1139
20.51.6	Future extensions	1140
20.52	PDU identification	1140
20.53	Use of transaction IDs and sequence numbers	1141
21.	Encoding of CFM PDUs	1142
21.1	Structure, representation, and encoding	1142
21.2	CFM encapsulation	1142
21.3	CFM request and indication parameters	1143
21.3.1	destination_address parameter	1143
21.3.2	source_address parameter	1143
21.4	Common CFM Header	1144
21.4.1	MD Level	1144
21.4.2	Version	1144
21.4.3	OpCode	1144
21.4.4	Flags	1145
21.4.5	First TLV Offset	1145
21.5	TLV format	1145
21.5.1	General format for CFM TLVs	1145
21.5.2	Organization-Specific TLV	1146
21.5.3	Sender ID TLV	1147
21.5.4	Port Status TLV	1149
21.5.5	Interface Status TLV	1149
21.5.6	Data TLV	1150
21.5.7	End TLV	1150
21.6	CCM format	1151
21.6.1	Flags	1151
21.6.2	First TLV Offset	1152
21.6.3	Sequence Number	1152
21.6.4	Maintenance association Endpoint Identifier	1153
21.6.5	Maintenance Association Identifier	1153
21.6.6	Defined by ITU-T Y.1731 (02/2008)	1155
21.6.7	Optional CCM TLVs	1155
21.7	LBM and LBR formats	1156
21.7.1	Flags	1156
21.7.2	First TLV Offset	1156
21.7.3	Loopback Transaction Identifier	1156
21.7.4	Additional LBM/LBR TLVs	1156

21.7.5	PBB-TE MIP TLV	1157
21.8	LTM format	1158
21.8.1	Flags	1158
21.8.2	First TLV Offset	1158
21.8.3	LTM Transaction Identifier	1158
21.8.4	LTM TTL	1159
21.8.5	Original MAC Address	1159
21.8.6	Target MAC Address	1159
21.8.7	Additional LTM TLVs	1159
21.8.8	LTM Egress Identifier TLV	1159
21.9	LTR format	1160
21.9.1	Flags	1160
21.9.2	First TLV Offset	1161
21.9.3	LTR Transaction Identifier	1161
21.9.4	Reply TTL	1161
21.9.5	Relay Action	1161
21.9.6	Additional LTR TLVs	1161
21.9.7	LTR Egress Identifier TLV	1162
21.9.8	Reply Ingress TLV	1162
21.9.9	Reply Egress TLV	1163
22.	CFM in systems	1166
22.1	CFM shims in Bridges	1166
22.1.1	Preliminary positioning of MPs	1166
22.1.2	CFM and the Forwarding Process	1167
22.1.3	Up/Down separation of MPs	1169
22.1.4	Service instances over multiple Bridges	1171
22.1.5	Multiple VID service instances	1173
22.1.6	Untagged CFM PDUs	1173
22.1.7	MPs and non-VLAN aware Bridges	1173
22.1.8	MPs and other standards	1174
22.1.9	CFM and IEEE 802.3-2012 Clause 57 OAM	1176
22.2	Maintenance Entity creation	1176
22.2.1	Creating Maintenance Domains and MAs	1177
22.2.2	Creating MEPS	1177
22.2.3	Creating MIPs	1179
22.2.4	CFM configuration errors	1180
22.3	MPs, Ports, and MD Level assignment.....	1181
22.4	Stations and CFM	1181
22.5	Scalability of CFM.....	1182
22.6	CFM in Provider Bridges.....	1183
22.6.1	MPs and C-VLAN components	1183
22.6.2	Maintenance C-VLAN on a Port-based service interface	1184
22.6.3	Maintenance C-VLAN on a C-tagged service interface	1185
22.6.4	MPs and Port-mapping S-VLAN components	1185
22.7	Management Port MEPS and CFM in the enterprise environment.....	1187
22.8	Implementing CFM on Bridges that implement earlier revisions of IEEE Std 802.1Q	1188
23.	MAC status propagation	1190
23.1	Model of operation.....	1191
23.1.1	MAC Status Shim (MSS)	1192
23.1.2	Relationship of CFM to the MSS	1193
23.2	MAC Status Protocol (MSP) overview.....	1193

23.3	MSP state machines	1198
23.4	State machine timers	1199
23.4.1	linkNotifyWhen	1199
23.4.2	linkNotifyWhile	1199
23.4.3	macNotifyWhile	1199
23.4.4	macRecoverWhile	1199
23.5	MSP performance parameters	1199
23.5.1	LinkNotify	1200
23.5.2	LinkNotifyWait	1200
23.5.3	LinkNotifyRetry	1200
23.5.4	MACNotify	1200
23.5.5	MACNotifyTime	1200
23.5.6	MACRecoverTime	1200
23.6	State machine variables	1200
23.6.1	BEGIN	1200
23.6.2	addConfirmed	1200
23.6.3	disableMAC	1200
23.6.4	disabledMAC	1200
23.6.5	disableMSS	1201
23.6.6	lossConfirmed	1201
23.6.7	macOperational	1201
23.6.8	mssOperational	1201
23.6.9	prop	1201
23.6.10	rxAck	1201
23.6.11	rxAdd	1201
23.6.12	rxAddConfirm	1201
23.6.13	rxLoss	1201
23.6.14	rxLossConfirm	1201
23.6.15	txAck	1201
23.6.16	txAdd	1201
23.6.17	txAddConfirm	1202
23.6.18	txLoss	1202
23.6.19	txLossConfirm	1202
23.7	State machine procedures	1202
23.8	Status Transition state machine (STM)	1202
23.9	Status Notification state machine (SNM)	1203
23.10	Receive Process	1203
23.11	Transmit Process	1203
23.12	Management of MSP	1203
23.13	MSPDU transmission, addressing, and protocol identification	1204
23.13.1	Destination MAC Address	1204
23.13.2	Source MAC Address	1204
23.13.3	Priority	1205
23.13.4	EtherType use and encoding	1205
23.14	Representation and encoding of octets	1205
23.15	MSPDU structure	1205
23.15.1	Protocol Version	1206
23.15.2	Packet Type	1206
23.16	Validation of received MSPDUs	1206
23.17	Other MSP participants	1206
24.	Bridge performance	1207
24.1	Guaranteed Port Filtering Rate	1207

24.2	Guaranteed Bridge Relaying Rate	1207
24.3	RSTP performance requirements	1207
25.	Support of the MAC Service by PBBNs.....	1209
25.1	Service transparency	1211
25.2	Customer service interface.....	1211
25.3	Port-based service interface	1212
25.4	S-tagged service interface	1213
25.5	I-tagged service interface.....	1215
25.6	Service instance segregation	1217
25.7	Service instance selection and identification	1217
25.8	Service priority and drop eligibility selection.....	1218
25.9	Service access protection	1218
25.9.1	Class II redundant LANs access protection	1220
25.9.2	Class III simple redundant LANs and nodes access protection	1221
25.10	Support of the MAC Service by a PBB-TE Region	1222
25.10.1	Provisioning TESIs	1223
25.10.2	ESP forwarding behavior	1224
25.11	Transparent service interface	1225
26.	Principles of Provider Backbone Bridged Network (PBBN) operation	1227
26.1	PBBN overview	1227
26.2	PBBN example.....	1228
26.3	B-VLAN connectivity.....	1230
26.4	Backbone addressing	1231
26.4.1	Learning individual backbone addresses at a PIP	1232
26.4.2	Translating backbone destination addresses at a CBP	1232
26.4.3	Backbone addressing considerations for CFM MPs	1233
26.5	Detection of connectivity loops through attached networks.....	1233
26.6	Scaling of PBBs	1233
26.6.1	Hierarchal PBBNs	1234
26.6.2	Peer PBBNs	1234
26.7	Network management	1234
26.8	CFM in PBBs.....	1235
26.8.1	CFM over Port-based and S-tagged service interfaces	1240
26.8.2	CFM over I-tagged Service Interfaces	1241
26.8.3	CFM over hierarchal E-NNI	1241
26.8.4	CFM over peer E-NNI	1241
26.9	CFM in a PBB-TE Region.....	1242
26.9.1	Addressing PBB-TE MEPs	1242
26.9.2	TESI identification	1243
26.9.3	PBB-TE MEP placement in a Bridge Port	1243
26.9.4	PBB-TE MIP placement in a Bridge Port	1243
26.9.5	TESI Maintenance Domains	1243
26.9.6	PBB-TE enhancements of the CFM protocols	1244
26.9.7	Addressing Infrastructure Segment MEPs	1246
26.9.8	Infrastructure Segment identification	1246
26.9.9	Infrastructure Segment MEP placement in a Bridge Port	1247
26.9.10	Infrastructure Segment Maintenance Domains	1247
26.9.11	IPS extensions to Continuity Check operation	1247
26.10	Protection switching for point-to-point TESIs.....	1249
26.10.1	Introduction	1249
26.10.2	1:1 point-to-point TESI protection switching	1250

26.10.3	Protection Switching state machines	1253
26.11	IPS in PBB-TE Region	1258
26.11.1	Infrastructure Segment monitoring	1259
26.11.2	1:1 IPS	1260
26.11.3	IPS Control entity	1263
26.11.4	1:1 IPS state machines	1264
26.11.5	M:1 IPS	1264
26.12	Mismatch defect.....	1270
26.13	Signaling VLAN registrations among I-components	1271
27.	Shortest Path Bridging (SPB)	1272
27.1	Protocol design requirements.....	1274
27.2	Protocol support	1275
27.3	Protocol design goals	1276
27.4	ISIS-SPB VLAN configuration	1276
27.4.1	SPT Region and ISIS-SPB adjacency determination	1278
27.5	ISIS-SPB information	1279
27.6	Calculating CIST connectivity.....	1280
27.7	Connectivity between regions in the same domain.....	1281
27.8	Calculating SPT connectivity	1281
27.8.1	ISIS-SPB overload	1282
27.9	Loop prevention	1282
27.10	SPVID and SPSourceID allocation.....	1283
27.11	Allocation of VIDs to FIDs.....	1284
27.12	SPBV SPVID translation	1285
27.13	VLAN topology management.....	1285
27.14	Individual addresses and SPBM	1286
27.14.1	Loop mitigation	1287
27.14.2	Loop prevention	1287
27.15	SPBM group addressing	1288
27.16	Backbone service instance topology management	1289
27.17	Equal cost shortest paths, ECTs, and load spreading.....	1290
27.18	Connectivity Fault Management for SPBM	1290
27.18.1	SPBM MA types	1291
27.18.2	SPBM MEP placement in a Bridge Port	1291
27.18.3	SPBM MIP placement in a Bridge Port	1291
27.18.4	SPBM modifications of the CFM protocols	1292
27.19	Using SPBV and SPBM modes	1293
27.19.1	Shortest Path Bridging—VID	1293
27.19.2	Shortest Path Bridging—MAC	1295
27.20	Security considerations	1297
28.	ISIS-SPB Link State Protocol.....	1298
28.1	ISIS-SPB control plane MAC.....	1298
28.2	Formation and maintenance of ISIS-SPB adjacencies.....	1299
28.3	Loop prevention	1300
28.4	The Agreement Digest	1300
28.4.1	Agreement Digest Format Identifier	1301
28.4.2	Agreement Digest Format Capabilities	1301
28.4.3	Agreement Digest Convention Identifier	1301
28.4.4	Agreement Digest Convention Capabilities	1302
28.4.5	Agreement Digest Edge Count	1302
28.4.6	The Computed Topology Digest	1302

28.5	Symmetric shortest path tie breaking.....	1303
28.6	Symmetric ECT framework.....	1304
28.7	Symmetric ECT	1305
28.8	ECT Algorithm details.....	1306
28.9	ECT Migration.....	1307
28.9.1	Use of a new ECT Algorithm in SPBV	1308
28.9.2	Use of a new ECT Algorithm in SPBM	1308
28.10	MAC address registration.....	1309
28.11	Circuit IDs and Port Identifiers.....	1309
28.12	ISIS-SPB TLVs.....	1310
28.12.1	MT-Capability TLV	1310
28.12.2	SPB MCID sub-TLV	1311
28.12.3	SPB Digest sub-TLV	1311
28.12.4	SPB Base VLAN-Identifiers sub-TLV	1312
28.12.5	SPB Instance sub-TLV	1313
28.12.6	SPB Instance Opaque ECT Algorithm sub-TLV	1315
28.12.7	SPB Link Metric sub-TLV	1316
28.12.8	SPB Adjacency Opaque ECT Algorithm sub-TLV	1317
28.12.9	SPBV MAC address sub-TLV	1317
28.12.10	SPBM Service Identifier and Unicast Address (ISID-ADDR) sub-TLV	1319
29.	DDCFM operations and protocols.....	1322
29.1	Principles of DDCFM operation.....	1322
29.1.1	Data-driven and data-dependent faults (DDFs)	1322
29.1.2	Basic principle to diagnose and isolate DDFs	1322
29.2	DDCFM Entity operation	1325
29.2.1	DDCFM implementation	1325
29.2.2	FPT RR	1326
29.2.3	RR-related parameters	1327
29.2.4	Reflection Target and RFM Receiver	1328
29.2.5	RPT-related parameters	1328
29.2.6	Decapsulator Responder (DR)	1329
29.2.7	SFM Originator	1330
29.3	DDCFM protocols	1330
29.3.1	RR variables	1330
29.3.2	RR Filter procedures	1332
29.3.3	RR Encapsulation procedures	1333
29.3.4	RR Transmit procedure	1334
29.3.5	RR-related state machines	1335
29.3.6	RFM Receiver variables	1337
29.3.7	RFM Receiver procedure	1337
29.3.8	DR variables	1338
29.3.9	DR procedures	1339
29.3.10	Decapsulator Responder state machine	1340
29.4	Encoding of DDCFM PDUs.....	1340
29.4.1	RFM and SFM Header	1340
29.4.2	RFM format	1341
29.4.3	SFM format	1342
30.	Principles of congestion notification	1344
30.1	Congestion notification design requirements	1344
30.2	Quantized Congestion Notification protocol (QCN)	1346
30.2.1	The CP algorithm	1347

30.2.2	Basic RP algorithm	1348
30.2.3	RP algorithm with timer	1349
30.3	Congestion Controlled Flow (CCF)	1350
30.4	Congestion Notification Priority Value (CNPV)	1351
30.5	Congestion Notification tag (CN-TAG)	1351
30.6	Congestion Notification Domain (CND)	1351
30.7	Multicast data	1352
30.8	Congestion notification and additional tags	1352
31.	Congestion notification entity operation	1354
31.1	Congestion aware Bridge Forwarding Process	1354
31.1.1	Congestion Point (CP)	1355
31.1.2	CP ingress multiplexer	1355
31.2	Congestion aware end station functions	1355
31.2.1	Output flow segregation	1356
31.2.2	Per-CNPV station function	1357
31.2.3	Flow Select Database	1359
31.2.4	Flow multiplexer	1359
31.2.5	CNM demultiplexer	1359
31.2.6	Input flow segregation	1359
31.2.7	End station input queue	1360
31.2.8	Reception selection	1360
32.	Congestion notification protocol	1361
32.1	CND operations	1361
32.1.1	CND defense	1361
32.1.2	Automatic CND recognition	1363
32.1.3	Variables controlling CND defense	1363
32.2	CN component variables	1364
32.2.1	cngMasterEnable	1365
32.2.2	cngCnmTransmitPriority	1365
32.2.3	cngDiscardedFrames	1365
32.2.4	cngErroredPortList	1365
32.3	Congestion notification per-CNPV variables	1365
32.3.1	cncpDefModeChoice	1365
32.3.2	cncpAlternatePriority	1366
32.3.3	cncpAutoAltPri	1366
32.3.4	cncpAdminDefenseMode	1366
32.3.5	cncpCreation	1366
32.3.6	cncpLldpInstanceChoice	1366
32.3.7	cncpLldpInstanceSelector	1366
32.4	CND defense per-Port per-CNPV variables	1367
32.4.1	cnpdDefModeChoice	1367
32.4.2	cnpdAdminDefenseMode	1367
32.4.3	cnpdAutoDefenseMode	1368
32.4.4	cnpdLldpInstanceChoice	1368
32.4.5	cnpdLldpInstanceSelector	1368
32.4.6	cnpdAlternatePriority	1368
32.4.7	cnpdXmitCnpvCapable	1368
32.4.8	cnpdXmitReady	1368
32.4.9	cncpDoesEdge	1369
32.4.10	cnpdAcceptsCnTag	1369
32.4.11	cnpdRcvdCnpv	1369

32.4.12	cnpdRcvdReady	1369
32.4.13	cnpdIsAdminDefMode	1369
32.4.14	cnpdDefenseMode	1370
32.5	CND defense procedures	1370
32.5.1	DisableCnpvRemapping()	1370
32.5.2	TurnOnCnDefenses()	1370
32.5.3	TurnOffCnDefenses()	1370
32.6	CND defense state machine	1370
32.7	Congestion notification protocol	1371
32.8	CP variables	1372
32.8.1	cpMacAddress	1373
32.8.2	cpId	1373
32.8.3	cpQSp	1373
32.8.4	cpQLen	1373
32.8.5	cpQLenOld	1373
32.8.6	cpW	1373
32.8.7	cpQOffset	1373
32.8.8	cpQDelta	1373
32.8.9	cpFb	1373
32.8.10	cpEnqued	1374
32.8.11	cpSampleBase	1374
32.8.12	cpDiscardedFrames	1374
32.8.13	cpTransmittedFrames	1374
32.8.14	cpTransmittedCnms	1374
32.8.15	cpMinHeaderOctets	1374
32.9	CP procedures	1374
32.9.1	Random	1374
32.9.2	NewCpSampleBase()	1374
32.9.3	EM_UNITDATA.request (parameters)	1375
32.9.4	GenerateCnmPdu()	1375
32.10	RP per-Port per-CNPV variables	1376
32.10.1	rpppMaxRps	1376
32.10.2	rpppCreatedRps	1376
32.10.3	rpppRpCentiseconds	1377
32.11	RP group variables	1377
32.11.1	rpgEnable	1377
32.11.2	rpgTimeReset	1377
32.11.3	rpgByteReset	1377
32.11.4	rpgThreshold	1378
32.11.5	rpgMaxRate	1378
32.11.6	rpgAiRate	1378
32.11.7	rpgHaiRate	1378
32.11.8	rpgGd	1378
32.11.9	rpgMinDecFac	1378
32.11.10	rpgMinRate	1378
32.12	RP timer	1378
32.12.1	RpWhile	1379
32.13	RP variables	1379
32.13.1	rpEnabled	1379
32.13.2	rpByteCount	1379
32.13.3	rpByteStage	1379
32.13.4	rpTimeStage	1379
32.13.5	rpTargetRate	1379
32.13.6	rpCurrentRate	1380

32.13.7	rpFreeze	1380
32.13.8	rpLimiterRate	1380
32.13.9	rpFb	1380
32.14	RP procedures	1380
32.14.1	ResetCnm	1380
32.14.2	TestRpTerminate	1381
32.14.3	TransmitDataFrame	1381
32.14.4	ReceiveCnm	1381
32.14.5	ProcessCnm	1382
32.14.6	AdjustRates	1382
32.15	RP rate control state machine	1382
32.16	Congestion notification and encapsulation interworking function	1384
33.	Encoding of congestion notification PDUs	1386
33.1	Structure, representation, and encoding	1386
33.2	CN-TAG format	1386
33.2.1	Flow Identifier	1387
33.3	Congestion Notification Message (CNM)	1387
33.4	Congestion Notification Message PDU format	1388
33.4.1	Version	1388
33.4.2	ReservedV	1388
33.4.3	Quantized Feedback	1389
33.4.4	Congestion Point Identifier	1389
33.4.5	cnmQOffset	1389
33.4.6	cnmQDelta	1389
33.4.7	Encapsulated priority	1389
33.4.8	Encapsulated destination MAC address	1389
33.4.9	Encapsulated MSDU length	1389
33.4.10	Encapsulated MSDU	1389
33.4.11	CNM Validation	1390
34.	Forwarding and Queuing Enhancements for time-sensitive streams (FQTSS)	1391
34.1	Overview	1391
34.2	Detection of SRP domains	1391
34.3	The bandwidth availability parameters	1392
34.3.1	Relationships among bandwidth availability parameters	1392
34.3.2	Bandwidth availability parameter management	1393
34.4	Deriving actual bandwidth requirements from the size of the MSDU	1393
34.5	Mapping priorities to traffic classes for time-sensitive streams	1394
34.6	End station behavior	1396
34.6.1	Talker behavior	1396
34.6.2	Listener behavior	1397
35.	Stream Reservation Protocol (SRP)	1398
35.1	Multiple Stream Registration Protocol (MSRP)	1399
35.1.1	MSRP and Shared Media	1400
35.1.2	Behavior of end stations	1400
35.1.3	Behavior of Bridges	1402
35.1.4	SRP domains and status parameters	1402
35.2	Definition of the MSRP application	1402
35.2.1	Definition of internal state variables	1403
35.2.2	Definition of MRP elements	1405

35.2.3	Provision and support of Stream registration service	1415
35.2.4	MSRP Attribute Propagation	1419
35.2.5	Operational reporting and statistics	1424
35.2.6	Encoding	1424
35.2.7	Attribute value support requirements	1425
36.	Priority-based Flow Control (PFC)	1426
36.1	PFC operation	1426
36.1.1	Overview	1426
36.1.2	PFC primitives	1427
36.1.3	Detailed specification of PFC operation	1428
36.2	PFC aware system queue functions	1429
36.2.1	PFC Initiator	1430
36.2.2	PFC Receiver	1430
37.	Enhanced Transmission Selection (ETS).....	1432
37.1	Overview.....	1432
37.1.1	Relationship to other transmission selection algorithms	1432
37.2	ETS configuration parameters	1432
37.3	ETS algorithm.....	1432
37.4	Legacy configuration	1433
38.	Data Center Bridging eXchange protocol (DCBX).....	1434
38.1	Overview.....	1434
38.2	Goals	1434
38.3	Types of DCBX attributes	1434
38.3.1	Informational attributes	1434
38.4	DCBX and LLDP.....	1434
38.4.1	Asymmetric attribute passing	1435
38.4.2	Symmetric attribute passing	1436
39.	Multiple I-SID Registration Protocol (MIRP)	1438
39.1	MIRP overview	1438
39.1.1	Behavior of I-components	1440
39.1.2	Behavior of B-components	1440
39.2	Definition of the MIRP application	1440
39.2.1	Definition of MRP elements	1440
39.2.2	Alternate MIRP model for B-components	1443
39.2.3	Use of “new” declaration capability	1445
39.2.4	Attribute value support requirements	1445
39.2.5	MRP Message filtering	1445
40.	Edge Virtual Bridging (EVB)	1446
40.1	EVB architecture without S-channels.....	1447
40.2	EVB architecture with S-channels.....	1448
40.3	Asymmetric EVB architecture without S-channels	1450
40.4	EVB status parameters	1450
40.4.1	EVBMode = Not supported	1452
40.4.2	EVBMode = EVB Bridge	1452
40.4.3	EVBMode = EVB station	1452

41.	VSI Discovery and Configuration Protocol (VDP)	1453
41.1	VSI manager ID TLV definition	1453
41.1.1	TLV type	1453
41.1.2	TLV information string length	1453
41.1.3	VSI Manager ID	1454
41.2	VDP association TLV definitions	1454
41.2.1	TLV type	1454
41.2.2	TLV information string length	1455
41.2.3	Status	1455
41.2.4	VSI Type ID (VTID)	1456
41.2.5	VSI Type Version	1456
41.2.6	VSIIID format	1456
41.2.7	VSIIID	1456
41.2.8	Filter Info format	1457
41.2.9	Filter Info field	1457
41.2.10	VDP TLV type and Status semantics	1459
41.3	Organizationally defined TLV definitions	1460
41.3.1	TLV type	1461
41.3.2	TLV information string length	1461
41.3.3	Organizationally unique identifier (OUI) or Company ID (CID)	1461
41.3.4	Organizationally defined information	1461
41.4	Validation rules for VDP TLVs	1461
41.5	VDP state machines	1461
41.5.1	State machine conventions	1461
41.5.2	Bridge VDP state machine	1462
41.5.3	Station VDP state machine	1463
41.5.4	VDP state machine timers	1464
41.5.5	VDP state machine variables and parameters	1464
41.5.6	Command-Response TLV field references in state machines	1467
41.5.7	VDP state machine procedures	1467
42.	S-Channel Discovery and Configuration Protocol (CDCP)	1469
42.1	CDCP discovery and configuration	1469
42.2	CDCP state machine overview	1469
42.3	CDCP configuration state machine	1470
42.4	CDCP configuration variables	1471
42.4.1	AdminChnCap	1471
42.4.2	AdminRole	1472
42.4.3	AdminSVIDWants	1472
42.4.4	LastLocalSVIDPool	1472
42.4.5	LastRemoteSVIDList	1472
42.4.6	LastSVIDWants	1472
42.4.7	LocalSVIDPool	1472
42.4.8	OperChnCap	1472
42.4.9	OperRole	1472
42.4.10	OperSVIDList	1473
42.4.11	RemoteChnCap	1473
42.4.12	RemoteRole	1473
42.4.13	RemoteSVIDList	1473
42.4.14	schState	1473
42.5	CDCP configuration procedures	1473
42.5.1	SetSVIDRequest (OperRole, AdminSVIDWants, OperSVIDList)	1473
42.5.2	RxSVIDConfig (OperSVIDList, LastRemoteSVIDList)	1474

42.5.3	TxSVIDConfig (OperChnCap, RemoteChnCap, LastLocalSVIDPool, RemoteSVIDList, OperSVIDList)	1474
43.	Edge Control Protocol (ECP)	1475
43.1	ECP operation	1475
43.2	Edge Control Sublayer Service (ECSS)	1476
43.3	ECP state machines	1476
43.3.1	State machine conventions	1476
43.3.2	Overview	1476
43.3.3	Edge Control Protocol Data Unit (ECPDU)	1477
43.3.4	ECP transmit state machine	1478
43.3.5	ECP receive state machine	1479
43.3.6	ECP state machine timers	1479
43.3.7	ECP state machine variables and parameters	1480
43.3.8	ECP state machine procedures	1481
44.	Equal Cost Multiple Paths (ECMP)	1482
44.1	SPBM ECMP	1482
44.1.1	ECMP Operation	1482
44.1.2	ECMP ECT Algorithm	1483
44.1.3	Loop prevention for ECMP	1485
44.2	Support for Flow Filtering	1485
44.2.1	Flow filtering tag (F-TAG)	1486
44.2.2	F-TAG processing	1487
44.2.3	Forwarding process extension for flow filtering	1488
44.2.4	TTL Loop mitigation	1489
44.2.5	CFM for ECMP with flow filtering	1489
44.2.6	Operation with selective support for flow filtering	1491
	Annex A (normative) PICS proforma—Bridge implementations	1492
	Annex B (normative) PICS proforma—End station implementations	1553
	Annex C (normative) Designated MSRP Node (DMN) Implementations	1567
	Annex D (normative) IEEE 802.1 Organizationally Specific TLVs	1584
	Annex E (normative) Notational conventions used in state diagrams	1692
	Annex F (informative) Shared and Independent VLAN Learning (SVL and IVL)	1694
	Annex G (informative) MAC method-dependent aspects of VLAN support	1703
	Annex H (informative) Interoperability considerations	1705
	Annex I (informative) Priority and drop precedence	1711
	Annex J (informative) CFM protocol design and use	1719
	Annex K (informative) TPMR use cases	1727
	Annex L (informative) Operation of the credit-based shaper algorithm	1732

Annex M (normative) Support for PFC in link layers without MAC Control.....	1749
Annex N (informative) Buffer requirements for PFC.....	1750
Annex O (informative) Preserving the integrity of FCS fields in MAC Bridges	1755
Annex P (informative) Frame duplication and misordering	1762
Annex Q (informative) Bibliography.....	1765

Figures

Figure 6-1—Internal organization of the MAC sublayer	61
Figure 6-2—Provider Instance Ports (PIPs)	79
Figure 6-3—B-Component CBP	82
Figure 6-4—Example of operation of Port-and-Protocol-based classification	86
Figure 6-5—Service access priority selection	88
Figure 6-6—Two back-to-back EISS Multiplex Entities	94
Figure 6-7—Two back-to-back Backbone Service Instance Multiplex Entities	95
Figure 6-8—Backbone Service Instance Multiplex Entities with example CFM shims	95
Figure 6-9—Two back-to-back Up and Down TESI Multiplex Entities	98
Figure 6-10—Supporting the ISS with signaled priority	99
Figure 6-11—Two back-to-back Up and Down Infrastructure Segment Multiplex Entities	100
Figure 7-1—VLAN Bridging overview	103
Figure 8-1—A Bridged Network	108
Figure 8-2—VLAN Bridge architecture	110
Figure 8-3—MAC Bridge architecture	111
Figure 8-4—Relaying MAC frames	113
Figure 8-5—Observation of network traffic	113
Figure 8-6—Operation of Spanning Tree Protocol Entity	113
Figure 8-7—Operation of MRP	114
Figure 8-8—Management Port transmission and reception	114
Figure 8-8—Infrastructure Segment MEP placement in a PNP	115
Figure 8-9—Bridge Port Transmit and Receive	117
Figure 8-10—TPMR Port Transmit and Receive	118
Figure 8-11—Forwarding Process functions	119
Figure 8-12—Logical points of attachment of the Higher Layer and Relay Entities	152
Figure 8-13—Effect of control information on the forwarding path	153
Figure 8-14—Per-Port points of attachment	153
Figure 8-15—Single point of attachment—relay permitted	154
Figure 8-16—Single point of attachment—relay not permitted	154
Figure 8-17—Effect of Port State	155
Figure 8-18—Controlled and Uncontrolled Port connectivity	155
Figure 8-19—Ingress/egress control information in the forwarding path	156
Figure 9-1—VLAN TCI format	160
Figure 9-2—I-TAG TCI format	161
Figure 10-1—Example—Attribute value propagation from one station	164
Figure 10-2—Example—Attribute value propagation from two stations	165
Figure 10-3—Example—Registrations as pointers to the sources of declarations	165
Figure 10-4—MRP architecture	167
Figure 10-5—Format of the major components of an MRPDU	190
Figure 10-6—Operation of MMRP for a single VLAN Context	196
Figure 10-7—Example Directed Graph	197
Figure 10-8—Example of MMRP propagation in a VLAN Context	199
Figure 11-1—Operation of MVRP	208
Figure 12-1—Relationships among CFM managed objects	270
Figure 12-2—Relationship among BEB managed objects	287
Figure 12-3—SPB managed objects (MOs)	339
Figure 12-4—Relationships among EVB Bridge managed objects	355
Figure 12-5—Relationship among EVB station managed objects	356
Figure 13-1—Diagrammatic conventions for spanning tree topologies	373
Figure 13-2—Physical topology and active topology	374
Figure 13-3—Port Roles and Port States	374

Figure 13-4—A Backup Port	375
Figure 13-5—“Ring Backbone” example	375
Figure 13-6—An MST Bridge network	377
Figure 13-7—CIST Priority Vectors, Port Roles, and MST Regions	378
Figure 13-8—MSTI Active Topology in Region 2	379
Figure 13-9—CIST and MSTI active topologies in Region 1 of the example network	392
Figure 13-10—Agreements and Proposals	396
Figure 13-11—CIST and MSTI Active Topologies in Region 2 of Figure 13-6	397
Figure 13-12—Enhanced Agreements	398
Figure 13-13—Spanning tree protocol state machines—overview and relationships	409
Figure 13-14—MSTP overview notation	410
Figure 13-15—Port Timers state machine	440
Figure 13-16—Port Receive state machine	440
Figure 13-17—Port Protocol Migration state machine	441
Figure 13-18—Bridge Detection state machine	441
Figure 13-19—Port Transmit state machine	442
Figure 13-20—Port Information state machine	443
Figure 13-21—Port Role Selection state machine	444
Figure 13-22—Disabled Port role transitions	445
Figure 13-23—Port Role Transitions state machine—MasterPort	446
Figure 13-24—Port Role Transitions state machine—RootPort	447
Figure 13-25—Port Role Transitions state machine—DesignatedPort	448
Figure 13-26—Port Role Transitions state machine—AlternatePort and BackupPort	449
Figure 13-27—Port State Transition state machine	449
Figure 13-28—Topology Change state machine	451
Figure 13-29—L2 Gateway Port Receive state machine	452
Figure 14-1—RST, MST, SPT, and STP Configuration BPDU format	456
Figure 14-2—STP TCN BPDU format	456
Figure 14-3—MSTI Configuration Message parameters and format	462
Figure 15-1—Internal organization of the MAC sublayer in a PBN	465
Figure 15-2—Port-based service interface to a PBN	466
Figure 15-3—Port-based service interface to a PBN	467
Figure 15-4—C-tagged service interface to a PBN	467
Figure 15-5—C-tagged service interface to a PBN	467
Figure 15-6—Customer Edge Ports (CEPs)	468
Figure 15-7—S-tagged service interface to a PBN	468
Figure 15-8—S-tagged interface to a PBN	469
Figure 15-9—RCSIs to a PBN	469
Figure 15-10—Remote Customer Access Ports (RCAPs)	470
Figure 15-11—C-tagged RCSI to a PBN	471
Figure 15-12—Port-based RCSI to a PBN	471
Figure 15-13—Provider Network Port (PNP) interface	472
Figure 16-1—PBN with interface examples	476
Figure 16-2—Examples of remote customer service access via a second PBN	478
Figure 16-3—Access service separation and “Hairpin Switching”	479
Figure 17-1—C-VLAN component internal LAN managed system	538
Figure 17-2—I/B-component internal LAN managed system	542
Figure 18-1—One Maintenance Domain: operator’s view	1066
Figure 18-2—One service instance: operator’s view	1067
Figure 18-3—One service instance: customer’s view	1067
Figure 18-4—MEP and MIP Symbols	1068
Figure 18-5—MAs: one service instance in a provider network	1069
Figure 18-6—MAs: Expansion of Figure 18-5	1070
Figure 18-7—MEPs, MIPs, and MD Levels	1071

Figure 19-1—CFM Protocol shims	1072
Figure 19-2—MA Endpoint (MEP)	1075
Figure 19-3—MIP Half Function (MHF)	1081
Figure 19-4—LOM shim	1083
Figure 19-5—LOM architecture	1083
Figure 20-1—MEP state machines—overview and relationships	1096
Figure 20-2—MEP Continuity Check Initiator state machine	1103
Figure 20-3—MHF Continuity Check Receiver state machine	1104
Figure 20-4—MEP Continuity Check Receiver state machine	1108
Figure 20-5—Remote MEP state machine	1110
Figure 20-6—Remote MEP Error state machine	1111
Figure 20-7—MEP Cross Connect state machine	1112
Figure 20-8—MEP Traffic Field Mismatch state machine	1114
Figure 20-9—MEP Local Mismatch state machine	1114
Figure 20-10—MP Loopback Responder state machine	1116
Figure 20-11—MEP Loopback Initiator transmit state machine	1119
Figure 20-12—MEP Loopback Initiator receive state machine	1120
Figure 20-13—MEP Fault Notification Generator state machine	1122
Figure 20-14—MEP Mismatch Fault Notification Generator state machine	1124
Figure 20-15—MEP Linktrace Initiator receive state machine	1128
Figure 20-16—Linktrace Responder, MEPs, MHFs, and LOMs	1130
Figure 20-17—LTM Receiver state machine	1136
Figure 20-18—LTR Transmitter state machine	1137
Figure 22-1—MEPs and MIPs distinguished by VID (incomplete picture)	1167
Figure 22-2—Alternate view of Forwarding process	1168
Figure 22-3—Combining per-VLAN MPs into two shims	1169
Figure 22-4—More complete picture of MP placement in a Bridge Port	1170
Figure 22-5—Service instance spanning two Bridges protected by Up MPs	1172
Figure 22-6—Service instance spanning two Bridges protected by Down MPs	1172
Figure 22-7—MP placement in a non-VLAN aware Bridge Port	1174
Figure 22-8—MP placement relative to other standards	1175
Figure 22-9—Creating MEPs and MIPs	1178
Figure 22-10—CFM in a Provider Edge Bridge C-tagged service interface	1184
Figure 22-11—CFM in a Provider Edge Bridge C-tagged RCSI	1186
Figure 22-12—Up MEPs in a Management Port	1187
Figure 22-13—CFM in the enterprise environment	1188
Figure 22-14—CFM on a Bridge that implements IEEE Std 802.1Q-2005	1189
Figure 23-1—TPMR connecting two Bridge Ports	1190
Figure 23-2—TPMR chain connecting Bridge Ports	1190
Figure 23-3—MSSs and the MSPE	1192
Figure 23-4—Adding connectivity	1194
Figure 23-5—Losing connectivity	1195
Figure 23-6—TPMR recovery	1196
Figure 23-7—Notification from one end of the link to the other	1197
Figure 23-8—Immediate MAC status notification at the end of a link	1197
Figure 23-9—MSPE state machine overview	1198
Figure 23-10—Status Transition state machine (STM)	1202
Figure 23-11—Status Notification state machine (SNM)	1203
Figure 23-12—MSPDU structure	1205
Figure 25-1—Internal organization of the MAC sublayer in a PBBN	1209
Figure 25-2—PBB terminology	1210
Figure 25-3—Customer service interface types	1211
Figure 25-4—Port-based service interface	1212
Figure 25-5—Port-based interface equipment	1213

Figure 25-6—Encapsulated service frames at ISS	1214
Figure 25-7—S-tagged service interface	1214
Figure 25-8—S-tagged service interface equipment	1215
Figure 25-9—I-tagged service interface	1216
Figure 25-10—I-tagged service interface equipment	1216
Figure 25-11—S-tagged and Port-based service interface access classifications	1219
Figure 25-12—I-tagged service interface access protection classifications	1220
Figure 25-13—Internal organization of the MAC sublayer in a PBB-TE Region	1222
Figure 25-14—PBB-TE Region	1224
Figure 25-15—Transparent service interface	1226
Figure 25-16—Transparent service interface equipment	1226
Figure 26-1—PBBN example	1228
Figure 26-2—CFM shim model	1235
Figure 26-3—CFM example applied to a Port-based and S-tagged service interface	1236
Figure 26-4—CFM example applied to an I-tagged Service Interface	1237
Figure 26-5—CFM example applied to a hierarchal E-NNI, CBP-PIP Demarc	1238
Figure 26-6—CFM example applied to a peer E-NNI, CBP-PIP	1239
Figure 26-7—Independent ESPs using the same ESP-DAs and ESP-VIDs	1243
Figure 26-8—PBB-TE MEP placement in a CBP	1244
Figure 26-9—Independent Infrastructure Segments distinguished by SMP-SA	1247
Figure 26-10—Infrastructure Segment MEP placement in a PNP	1248
Figure 26-11—Protection switching architecture	1249
Figure 26-12—PBB-TE point-to-point protection switching	1251
Figure 26-13—Mapping data traffic to the protection entity	1252
Figure 26-14—Relationships of the Protection switching state machines—overview	1253
Figure 26-15—Hold-off state machine	1257
Figure 26-16—Clear Manual Switch state machine	1257
Figure 26-17—Service Mapping state machine	1258
Figure 26-18—Segment terminology and properties	1259
Figure 26-19—Infrastructure Segment monitoring	1260
Figure 26-20—Working Segment and Protection Segment	1260
Figure 26-21—Nested IPGs	1261
Figure 26-22—IPS Control entity	1263
Figure 26-23—M:1 IPS	1265
Figure 26-24—M:1 IPS state machines	1266
Figure 26-25—M:1 Hold-off state machine	1269
Figure 26-26—Protection Segment Selection state machine	1270
Figure 27-1—Configuring VLAN support in an SPT Region (example)	1277
Figure 27-2—SPBM group MAC address—general format	1288
Figure 27-3—SPBM group MAC addresses—source rooted SPT	1289
Figure 27-4—SPBM group MAC addresses—shared tree	1289
Figure 27-5—SPBM MEP placement in a CBP	1292
Figure 27-6—SPBV campus network example	1294
Figure 27-7—SPT Bridge Network using SPBM example	1296
Figure 28-1—Agreement Digest field format	1301
Figure 28-2—MT-Capability TLV	1310
Figure 28-3—SPB MCID sub-TLV	1311
Figure 28-4—SPB Digest sub-TLV	1311
Figure 28-5—SPB Base VLAN-Identifiers sub-TLV	1312
Figure 28-6—SPB Instance sub-TLV	1313
Figure 28-7—SPB Instance Opaque ECT-ALGORITHM sub-TLV	1315
Figure 28-8—ECMP ECT-ALGORITHM sub-TLV	1316
Figure 28-9—SPB Link Metric sub-TLV	1316
Figure 28-10—SPB Adjacency Opaque ECT-ALGORITHM sub-TLV	1317

Figure 28-11—SPBV MAC Address sub-TLV	1318
Figure 28-12—SPBM Service Identifier and Unicast Address sub-TLV	1319
Figure 29-1—Forward path test (FPT)	1323
Figure 29-2—Return path test (RPT)	1324
Figure 29-3—Combination of FPT and RPT	1325
Figure 29-4—Detailed functions of RR	1326
Figure 29-5—RFM Receiver on an non-MP	1329
Figure 29-6—Return Path DR	1330
Figure 29-7—RR Filter state machine	1335
Figure 29-8—RR Encapsulation state machine	1336
Figure 29-9—RR Transmit state machine	1336
Figure 29-10—RFM Receiver state machine	1338
Figure 29-11—Decapsulator Responder state machine	1340
Figure 30-1—Congestion detection in QCN CP	1347
Figure 30-2—Sampling (reflection) probability in QCN CP as a function of $ F_b $	1347
Figure 30-3—QCN RP operation	1348
Figure 30-4—Byte Counter and Timer interaction with Rate Limiter	1350
Figure 30-5—CP–RP peering in VLAN Bridged Network	1352
Figure 30-6—CP–RP peering in PBBN	1353
Figure 31-1—CPs and congestion aware queues in a Bridge	1354
Figure 31-2—Congestion aware queue functions in an end station	1356
Figure 31-3—Per-CNPV station function	1358
Figure 32-1—CND defense state machine	1371
Figure 32-2—RP rate control state machine	1383
Figure 32-3—CP–RP peering in any hierarchical Bridged Network	1384
Figure 34-1—Queuing model for a Talker station	1396
Figure 35-1—Operation of MSRP	1399
Figure 35-2—Format of the components of the reservation FirstValue fields	1409
Figure 35-3—Format of the components of the Domain FirstValue	1414
Figure 36-1—PFC peering	1426
Figure 36-2—PFC Receiver state diagram for priority n	1428
Figure 36-3—PFC aware system queue functions	1430
Figure 36-4—PFC aware system queue functions with Link Aggregation	1431
Figure 38-1—DCBX Asymmetric State Machine	1436
Figure 38-2—Symmetric State Machine	1437
Figure 39-1—Operation of MIRP in an I-component	1439
Figure 39-2—Operation of MIRP in a B-component	1439
Figure 39-3—Alternate model for MIRP in a B-component	1444
Figure 40-1—EVB architecture overview	1446
Figure 40-2—EVB architecture without S-channels	1448
Figure 40-3—EVB architecture with S-channel	1448
Figure 40-4—EVB components and internal LANs with S-channels	1449
Figure 40-5—EVB architecture without S-channels, with EVB Bridge S-VLAN component	1451
Figure 40-6—EVB architecture without S-channels, with EVB station S-VLAN component	1451
Figure 41-1—VSI manager ID TLV	1453
Figure 41-2—VDP association TLV	1454
Figure 41-3—VID Filter Info format	1458
Figure 41-4—MAC/VID filter format	1458
Figure 41-5—GroupID/VID filter format	1459
Figure 41-6—GroupID/MAC/VID filter format	1459
Figure 41-7—Organizationally defined TLV	1461
Figure 41-8—Bridge VDP state machine	1462
Figure 41-9—Station VDP state machine	1463
Figure 42-1—CDCP state machine—Station role	1470

Figure 42-2—CDCP state machine—Bridge role	1471
Figure 43-1—Example ECP exchange	1475
Figure 43-2—ECPDU structure	1477
Figure 43-3—ECP transmit state machine	1478
Figure 43-4—ECP receive state machine	1479
Figure 44-1—Flow FilteringTCI format	1486
Figure 44-2—SPBM VID MEP and ECMP path MEP placement in a CBP	1490
Figure C-1—CSN backbone	1567
Figure C-2—Bridge’s CSN model for bandwidth reservation	1568
Figure C-3—Talker MSRPDU flow	1569
Figure C-4—Listener MSRPDU flow	1569
Figure C-5—IEEE DMN Device Attribute IE	1571
Figure C-6—DMN Confirmation Transaction	1573
Figure C-7—Bandwidth reservation—bridge model for IEEE 802.11 BSS (STA downstream Port)	1576
Figure C-8—Bandwidth reservation—bridge model for IEEE 802.11 BSS (STA upstream Port)	1576
Figure C-9—Bandwidth reservation—bridge model for IEEE 802.11 BSS (direct link setup)	1577
Figure C-10—MSRP/IEEE 802.11 query flows	1577
Figure C-11—MSRP/802.11 Talker STA to Listener STA reservation flows	1578
Figure C-12—MSRP/802.11 “Bridged” Listener to Talker STA reservation flows	1579
Figure C-13—MSRP/802.11 Listener STA to “Bridged” Talker reservation flows	1579
Figure D-1—Port VLAN ID TLV format	1585
Figure D-2—Port And Protocol VLAN ID TLV format	1585
Figure D-3—VLAN Name TLV format	1586
Figure D-4—Protocol Identity TLV format	1587
Figure D-5—VID Usage Digest TLV format	1588
Figure D-6—Management VID TLV format	1588
Figure D-7—Link Aggregation TLV format	1589
Figure D-8—Congestion Notification TLV format	1590
Figure D-9—ETS Configuration TLV format	1591
Figure D-10—ETS Recommendation TLV format	1593
Figure D-11—Priority-based Flow Control Configuration TLV format	1594
Figure D-12—Application Priority TLV format	1595
Figure D-13—EVB TLV format	1597
Figure D-14—CDCP TLV structure	1600
Figure F-1—Connecting independent VLANs—1	1695
Figure F-2—Connecting independent VLANs—2	1696
Figure F-3—Duplicate MAC addresses	1696
Figure F-4—Asymmetric VID use: “multi-netted server”	1697
Figure F-5—Asymmetric VLAN use: “Rooted-Multipoint”	1699
Figure F-6—Rooted-Multipoint with tagged interfaces	1700
Figure F-7—SPBV VLAN Shared Learning and VID Translation	1701
Figure G-1—Example of IEEE 802.3 MAC frame format	1703
Figure H-1—Static filtering inconsistency	1707
Figure H-2—Interoperability with MAC Bridges: example 1	1708
Figure H-3—Interoperability with MAC Bridges: example 2	1709
Figure H-4—Interoperability between Port-based and Port-and-Protocol-based classification	1710
Figure J-1—Up MPs in a CFM Port	1724
Figure K-1—TPMR as UNI demarcation device	1727
Figure K-2—TPMRs with aggregated links	1728
Figure K-3—Multiple TPMRs	1728
Figure K-4—Recovery at the end of a chain	1729
Figure K-5—Near simultaneous recoveries	1730
Figure K-6—Near simultaneous failure and recovery	1730
Figure K-7—Loss with quick recovery	1731

Figure L-1—Credit-based shaper operation—no conflicting traffic	1734
Figure L-2—Credit-based shaper operation—conflicting traffic	1735
Figure L-3—Credit-based shaper operation—burst traffic	1736
Figure L-4—Interference and latency	1740
Figure L-5—Burst behavior and credit	1740
Figure L-6—Fan-in scenario	1744
Figure L-7—Permanent delay scenario	1745
Figure L-8—Building up buffer occupancy—1	1746
Figure L-9—Building up buffer occupancy—2	1746
Figure L-10—Building up buffer occupancy—3	1747
Figure L-11—Building up buffer occupancy—4	1747
Figure M-1—PFC PDU format	1749
Figure N-1—PFC delays	1750
Figure N-2—Delay model	1751
Figure N-3—Worst-case delay	1752
Figure O-1—Converting a CRC to an FCS	1757
Figure O-2—Detection Lossless Circuit	1757
Figure O-3—Field change adjustment	1759
Figure O-4—Field insertion adjustment	1760
Figure P-1—Frame duplication scenario	1763
Figure P-2—Frame misordering scenario	1764

Tables

Table 6-1—Bridge transit delay	68
Table 6-2—Priority Code Point encoding	76
Table 6-3—Priority Code Point decoding	76
Table 6-4—Priority regeneration	77
Table 6-5—Default SRP domain boundary port priority regeneration override values	78
Table 6-6—Service Access Priority	89
Table 6-7—Encapsulated Addresses EtherType	96
Table 8-1—C-VLAN and MAC Bridge component Reserved addresses	122
Table 8-2—S-VLAN component Reserved addresses	123
Table 8-3—TPMR component Reserved addresses	123
Table 8-4—Recommended priority to traffic class mappings	126
Table 8-5—Transmission selection algorithm identifiers	128
Table 8-6—Ageing time parameter value	131
Table 8-7—Combining Static and Dynamic Filtering Entries for an individual MAC address	140
Table 8-8—Combining Static Filtering Entry and MAC Address Registration Entry for “All Group Addresses” and “All Unregistered Group Addresses”	141
Table 8-9—Forwarding or Filtering for specific group MAC addresses	142
Table 8-10—Forwarding or Filtering with Dynamic Reservation Entries	143
Table 8-11—Determination of whether a Port is in a VID’s member set	144
Table 8-12—Standard LLC address assignment	148
Table 8-13—ISIS-SPB reserved addresses	150
Table 8-14—ISIS-SPB Recommended Address Usage	151
Table 8-15—CCM group destination MAC addresses	157
Table 8-16—LTM group destination MAC addresses	157
Table 9-1—IEEE 802.1Q EtherType allocations	160
Table 9-2—Reserved VID values	160
Table 9-3—Reserved I-SID values	162
Table 10-1—MRP application addresses	170
Table 10-2—MRP EtherType values	171
Table 10-3—Applicant state table	184
Table 10-4—Registrar state table	185
Table 10-6—PeriodicTransmission state table	186
Table 10-5—LeaveAll state table	186
Table 10-7—MRP timer parameter values	187
Table 12-1—Component table entry managed object	220
Table 12-2—Port table entry	221
Table 12-3—ISS Port Number table entry	222
Table 12-4—Bandwidth Availability Parameter Table row elements	326
Table 12-5—Transmission Selection Algorithm Table row elements	327
Table 12-6—Priority Regeneration Override Table row elements	327
Table 12-7—CN component managed object row elements	328
Table 12-8—CN component priority managed object row elements	329
Table 12-10—Congestion Point managed object row elements	330
Table 12-9—CN Port priority managed object row elements	330
Table 12-11—Reaction Point port priority managed object row elements	331
Table 12-12—Reaction Point group managed object row elements	331
Table 12-13—SRP Bridge Base Table row elements	332
Table 12-14—SRP Bridge Port Table row elements	332
Table 12-15—SRP Latency Parameter Table row elements	333
Table 12-16—SRP Stream Table row elements	333
Table 12-17—SRP Reservations Table row elements	334

Table 12-15—Priority-based Flow Control objects	334
Table 12-17—EVB system base table	358
Table 12-18—EVB system parameter defaults	360
Table 12-20—VSI table entry	361
Table 12-19—SBP table entry	361
Table 12-21—VSI MAC/VLAN table entry	363
Table 12-22—UAP table entry	364
Table 12-23—UAP table entry parameters	364
Table 12-24—S-channel interface table entry	365
Table 12-25—URP table entry	366
Table 12-26—ECP table entry	367
Table 13-1—Configuration Digest Signature Key	383
Table 13-2—Sample Configuration Digest Signature Keys	384
Table 13-3—Bridge and Port Priority values	402
Table 13-4—Port Path Cost values	403
Table 13-5—Timer and related parameter values	411
Table 17-1—Structure of the MIB modules	482
Table 17-2—IEEE8021-TC-MIB Structure	484
Table 17-3—IEEE8021-BRIDGE-MIB structure and relationship to IETF RFC 4188 and this standard	485
Table 17-4—IEEE 802.1D objects not in the IEEE8021-BRIDGE-MIB	490
Table 17-5—IEEE8021-SPANNING-TREE MIB structure and relationship to IETF RFC 4318 and this standard	490
Table 17-6—Clause 12 objects not in the IEEE8021-SPANNING-TREE MIB	492
Table 17-7—IEEE8021-QBRIDGE MIB structure and relationship to IETF RFC 4363 and this standard	493
Table 17-8—Clause 12 management not in IEEE8021-Q-BRIDGE-MIB	498
Table 17-9—IEEE8021-PB-MIB structure and relationship to this standard	499
Table 17-10—IEEE8021-MSTP-MIB structure and relationship to this standard	501
Table 17-11—IEEE8021-CFM-MIB correspondence between variables, managed objects, and MIB objects	503
Table 17-12—IEEE8021-CFM-V2-MIB correspondence between variables, managed objects, and MIB objects	507
Table 17-13—IEEE8021-PBB-MIB structure and relationship to this standard	509
Table 17-14—IEEE8021-DDCFM-MIB structure and relationship to this standard	512
Table 17-15—IEEE8021-PBBTE-MIB Structure and relationship to this standard	514
Table 17-16—Example of ieee8021PbbTeTeSiEspTable	516
Table 17-17—IEEE8021-TPMR-MIB Structure and relationship to this standard	517
Table 17-18—FQTSS MIB structure and object cross reference	519
Table 17-19—Variables, managed object tables, and MIB objects	520
Table 17-20—SRP MIB structure and object cross reference	522
Table 17-21—IEEE8021-MVRPX-MIB structure and relationship to this standard	524
Table 17-22—IEEE8021-MIRP-MIB structure and relationship to this standard	524
Table 17-23—Variables, managed object tables, and MIB objects	525
Table 17-24—IEEE8021-TE IPS MIB Structure and relationship to this standard	525
Table 17-25—IEEE8021-SPB-MIB structure and relationship to this standard	527
Table 17-26—EVB MIB structure and object cross reference	531
Table 17-27—IEEE8021-ECMP-MIB structure and relationship to this standard	534
Table 17-28—PBB-TE required MIB compliances	543
Table 17-30—Sensitive managed objects: variables in dot1agCfmMdTable	551
Table 17-29—Sensitive managed objects: tables and notifications	551
Table 17-32—Sensitive managed objects (of DDCFM) for read	553
Table 17-31—Sensitive managed objects (of DDCFM): tables and notifications	553

Table 17-33—Sensitive managed objects (of EVB): tables and notifications	560
Table 17-34—Sensitive managed objects (of EVB) for read	560
Table 17-35—Provider Bridge service interface parameters	574
Table 17-36—PBB service interface parameters	577
Table 19-1—Actions taken by MP OpCode Demultiplexers	1077
Table 19-2—SAP use for LTMs and LTRs	1084
Table 20-1—Fault Alarm defects and priorities	1089
Table 20-2—Deriving enableRmepDefect and Port Status TLV in a Bridge	1099
Table 21-1—CFM PDU Encapsulation: Length/Type Media	1143
Table 21-2—CFM PDU Encapsulation: LLC Media	1143
Table 21-3—Common CFM Header format	1144
Table 21-4—OpCode Field range assignments	1144
Table 21-5—TLV format	1145
Table 21-6—Type Field values	1146
Table 21-8—Sender ID TLV format	1147
Table 21-7—Organization-Specific TLV format	1147
Table 21-9—Port Status TLV format	1149
Table 21-10—Port Status TLV values	1149
Table 21-11—Interface Status TLV format	1149
Table 21-13—Data TLV format	1150
Table 21-14—End TLV format	1150
Table 21-12—Interface Status TLV values	1150
Table 21-15—CCM format	1151
Table 21-16—CCM Interval field encoding	1152
Table 21-17—CCM Maintenance Association Identifier field format: Maintenance Domain present	1153
Table 21-18—CCM Maintenance Association Identifier field format: Maintenance Domain not present	1153
Table 21-19—Maintenance Domain Name Format	1154
Table 21-20—Short MA Name Format	1154
Table 21-21—LBM and LBR formats	1156
Table 21-22—PBB-TE MIP TLV format	1157
Table 21-23—LTM format	1158
Table 21-24—LTM Flags field	1158
Table 21-26—LTR format	1160
Table 21-27—LTR Flags field	1160
Table 21-25—LTM Egress Identifier TLV format	1160
Table 21-28—Relay Action field values	1161
Table 21-29—LTR Egress Identifier TLV format	1162
Table 21-30—Reply Ingress TLV format	1162
Table 21-31—Ingress Action field values	1163
Table 21-33—Egress Action field values	1164
Table 21-32—Reply Egress TLV format	1164
Table 22-1—MEP creation	1178
Table 22-2—MIP creation	1179
Table 22-3—Bandwidth required for CCMs for 1 MA	1182
Table 22-4—Bandwidth required for CCMs for 1000 MAs	1183
Table 23-1—Time sequence diagram symbols	1193
Table 23-2—MSP performance parameters	1199
Table 23-3—MSP EtherType assignment	1205
Table 23-4—MSP Packet Types	1206
Table 24-1—Transmission and reception delays	1208
Table 26-1—Backbone Service Instance Group address OUI	1231
Table 26-8—Protection Requests Hierarchy	1254
Table 27-1—Allocation of VIDs to FIDs and FIDs to MSTIDs in an SPT Region (example)	1277

Table 28-1—Bridge Priority Masking	1306
Table 29-1—RFM format	1341
Table 29-2—SFM format	1342
Table 32-1—LLDP instance selection managed object overrides	1364
Table 32-2—CND defense mode selection managed object overrides	1364
Table 32-3—Determining cnpdIsAdminDefMode and cnpdDefenseMode	1370
Table 32-4—Correspondence of QCN and CCF message fields	1372
Table 32-5—NewCpSampleBase() return value as a function of cpFb	1375
Table 33-3—CNM Encapsulation: Length/Type Media	1387
Table 33-1—CN-TAG Encapsulation: Length/Type Media	1387
Table 33-2—CN-TAG Encapsulation: LLC Media	1387
Table 33-5—Congestion Notification Message PDU	1388
Table 33-4—CNM Encapsulation: LLC Media	1388
Table 34-1—Recommended priority to traffic class mappings for SR classes A and B	1395
Table 34-2—Recommended priority to traffic class mappings for SR class B only	1395
Table 35-1—AttributeType Values	1405
Table 35-2—AttributeLength Values	1406
Table 35-4—MSRP FirstValue NumberOfValues example	1407
Table 35-3—FourPackedEvent Values	1407
Table 35-5—TSPEC components examples	1411
Table 35-6—Reservation Failure Codes	1413
Table 35-7—SR class ID	1414
Table 35-8—Summary of Talker primitives	1416
Table 35-9—Summary of Listener primitives	1416
Table 35-11—Incoming Listener attribute propagation per port	1421
Table 35-10—Talker attribute propagation per port	1421
Table 35-12—Updating Dynamic Reservation Entries	1422
Table 35-14—Listener Declaration Type Summation	1423
Table 35-13—Updating operIdleSlope(N)	1423
Table 41-1—VDP TLV types	1454
Table 41-2—Flag values in VDP requests	1455
Table 41-3—Error types in VDP responses	1455
Table 41-5—VSIID format values	1456
Table 41-4—Flag values in VDP responses	1456
Table 41-6—Filter Info format values	1457
Table 43-1—ECP subtypes	1477
Table 44-1—ECMP ECT-ALGORITHM values	1485
Table 44-2—F-TAG EtherType	1486
Table C-1—SRP to MoCA PQoS Transaction mapping	1574
Table C-2—SRP TSPEC to MoCA TSPEC mapping	1575
Table C-3—SRP StreamID to MoCA PQoS Flow transaction mapping	1575
Table C-4—SRP to MLME QoS Services mapping	1581
Table C-5—EDCA-AC for AV Streams	1582
Table C-6—HCCA for AV Streams	1583
Table D-1—IEEE 802.1 Organizationally Specific TLVs specified in this standard	1584
Table D-2—Port and protocol capability/status	1586
Table D-3—Link Aggregation capability/status	1589
Table D-4—Priority assignment table	1591
Table D-5—Traffic class bandwidth assignment table	1592
Table D-6—TSA Assignment Table	1592
Table D-7—PFC Enable bit vector	1595
Table D-8—Application Priority Table	1596
Table D-9—Sel field values	1596
Table D-10—RRSAT flag values and meanings	1598

Table D-11—EVB Mode values	1599
Table D-12—IEEE 802.1 extension MIB object group conformance requirements	1607
Table D-13—IEEE 802.1/LLDP extension MIB object cross reference	1608
Table E-1—State machine symbols	1693
Table I-1—Traffic type to traffic class mapping	1712
Table I-2—Traffic type acronyms	1714
Table I-3—Defining traffic types	1715
Table I-5—Defining traffic types—Credit-based shaper support of SR classes A and B	1716
Table I-4—Defining traffic types—Credit-based shaper support of SR class B only	1716
Table I-6—Priority Code Point encoding	1718
Table I-7—Priority Code Point decoding	1718
Table J-1—Provider MD Level allocation	1720
Table J-2—IEEE / ITU-T terminology differences	1720
Table N-1—IEEE 802.3 Interface Delays	1753

IEEE Standard for Local and metropolitan area networks—

Bridges and Bridged Networks

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1. Overview

IEEE 802[®] Local Area Networks (LANs, 3.93)¹ of all types can be connected together with Media Access Control (MAC) Bridges (3.130) or Virtual Local Area Network (VLAN) Bridges (3.259), collectively known as Bridges (3.22). This standard defines the operation of Bridges and Bridged Networks. VLANs facilitate the administration of logical groups of stations. Stations in the same VLAN communicate as if they were on the same LAN, while traffic between VLANs is restricted. Management of VLAN Bridges and stations allows stations to be added to, removed from, or moved between VLANs.

This standard further extends the specification of VLAN Bridges to enable a service provider organization to use a common infrastructure of Bridges and LANs to offer the equivalent of separate LANs, Bridged, or Virtual Bridged Networks to independent customer organizations.

This standard specifies protocols and protocol entities within the architecture of Bridges that provide capabilities for detecting, verifying, and isolating connectivity failures in Bridged Networks. These capabilities can be used in networks operated by multiple independent organizations, each with restricted management access to each other’s equipment.

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1.1 Scope

This standard specifies Bridges that interconnect individual LANs, each supporting the IEEE 802 MAC Service using a different or identical media access control method, to provide Bridged Networks and VLANs.

1.2 Purpose

Bridges, as specified by this standard, allow the compatible interconnection of information technology equipment attached to separate individual LANs.

1.3 Introduction

For the purpose of compatible interconnection of information technology equipment using the IEEE 802 MAC Service supported by interconnected IEEE 802 standard LANs using different or identical media access control methods, this standard specifies the operation of MAC Bridges and VLAN Bridges. To this end, it

- a) Positions the support of VLANs within an architectural description of the MAC Sublayer.
- b) Defines the principles of operation of the MAC Bridge and VLAN Bridge in terms of the support and preservation of the MAC Service, and the maintenance of quality of service (QoS).
- c) Specifies an Enhanced Internal Sublayer Service (EISS) provided to the Media Access-Independent functions that provide frame relay in a VLAN Bridge.
- d) Establishes the principles and a model of Virtual Bridged Network operation.
- e) Identifies the functions to be performed by Bridges, and provides an architectural model of the operation of a Bridge in terms of processes and entities that provide those functions.
- f) Specifies a frame format that allows a VLAN Identifier (VID) and priority information to be carried by VLAN-tagged user data frames.
- g) Specifies the rules that govern the addition or removal of VLAN tags to and from user data frames.
- h) Establishes the requirements for automatic configuration of VLAN topology.
- i) Establishes the requirements for VLAN Bridge Management in a Virtual Bridged Network, identifying managed objects and defining management operations.
- j) Defines SMIv2 (IETF STD 58) Management Information Based (MIB) modules for the management of VLAN Bridge capabilities including spanning tree protocols and Provider Bridges.
- k) Defines the operation of the Multiple Spanning Tree Algorithm and Protocol (MSTP).
- l) Describes the protocols and procedures necessary to support interoperation between Multiple Spanning Tree (MST) and Single Spanning Tree (SST) Bridges in the same Virtual Bridged Networks.
- m) Specifies the requirements to be satisfied by equipment claiming conformance to this standard.

To enable a service provider to use a Virtual Bridged Network to provide separate instances of the IEEE 802 MAC Service, MAC Internal Sublayer Service (ISS), and EISS to multiple independent customers, in a manner that does not require cooperation among the customers and that requires a minimum of cooperation between the customers and the provider of the MAC Service, this standard further specifies the operation of Provider Bridges. To this end, it

- n) Differentiates Customer VLANs (C-VLANs) that are under the administrative control of a single customer of a service provider, from the Service VLANs (S-VLANs) that are used by a service provider to support different customers.
- o) Specifies VLAN tag formats for both C-VLANs and S-VLANs, allowing each to be distinguished and separately applied and administered by customers and by a service provider.