Ethernet service characteristics

Recommendation ITU-T G.8011/Y.1307

ITU-T G-SERIES RECOMMENDATIONS

TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

INTERNATIONAL TELEPHONE CONNECTIONS AND CIRCUITS	G.100–G.199
GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER-TRANSMISSION SYSTEMS	G.200–G.299
INDIVIDUAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON METALLIC LINES	G.300–G.399
GENERAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON RADIO-RELAY OR SATELLITE LINKS AND INTERCONNECTION WITH METALLIC LINES	G.400–G.449
COORDINATION OF RADIOTELEPHONY AND LINE TELEPHONY	G.450–G.499
TRANSMISSION MEDIA AND OPTICAL SYSTEMS CHARACTERISTICS	G.600–G.699
DIGITAL TERMINAL EQUIPMENTS	G.700–G.799
DIGITAL NETWORKS	G.800–G.899
DIGITAL SECTIONS AND DIGITAL LINE SYSTEM	G.900–G.999
MULTIMEDIA QUALITY OF SERVICE AND PERFORMANCE – GENERIC AND USER-RELATED ASPECTS	G.1000–G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000–G.6999
DATA OVER TRANSPORT – GENERIC ASPECTS	G.7000–G.7999
PACKET OVER TRANSPORT ASPECTS	G.8000–G.8999
Ethernet over Transport aspects	**G.8000–G.8099**
MPLS over Transport aspects	G.8100–G.8199
Synchronization, quality and availability targets	G.8200–G.8299
Service Management	G.8600–G.8699
ACCESS NETWORKS	G.9000–G.9999

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T G.8011/Y.1307

Ethernet service characteristics

Summary

Recommendation ITU-T G.8011/Y.1307 describes a framework for defining network-oriented characteristics of Ethernet services based on Metro Ethernet Forum (MEF) specifications. The framework is supported by the modelling of Ethernet layer networks described in ITU-T and MEF. The service definition, service attributes and operation, administration and maintenance (OAM) introduced in this framework are used to create numerous specific Ethernet services.

This Recommendation supersedes Recommendations ITU-T G.8011.1/Y.1307.1 (2013), ITU-T G.8011.2/Y.1307.2 (2013), ITU-T G.8011.3/Y.1307.3 (2013), ITU-T G.8011.4/Y.1307.4 (2013) and ITU-T G.8011.5/Y.1307.5 (2013).

History

Edition	Recommendation	Approval	Study Group	Unique ID[*]
1.0	ITU-T G.8011/Y.1307	2004-08-22	15	11.1002/1000/7358
1.1	ITU-T G.8011/Y.1307 (2004) Cor. 1	2005-06-29	15	11.1002/1000/8530
1.2	ITU-T G.8011/Y.1307 (2004) Amd. 1	2005-08-22	15	11.1002/1000/7359
2.0	ITU-T G.8011/Y.1307	2009-01-13	15	11.1002/1000/9660
3.0	ITU-T G.8011/Y.1307	2012-10-29	15	11.1002/1000/11782
3.1	ITU-T G.8011/Y.1307 (2012) Cor. 1	2013-08-29	15	11.1002/1000/12002
4.0	ITU-T G.8011/Y.1307	2015-01-13	15	11.1002/1000/12380

Keywords

Ethernet, Ethernet connection, Ethernet service, framework, network-to-network interface, user-to-network interface.

---

[*] To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at http://www.itu.int/ITU-T/ipr/.

Table of Contents

Recommendation ITU-T G.8011/Y.1307

Ethernet service characteristics

1 Scope

This Recommendation defines a framework to describe Ethernet services based on Metro Ethernet Forum (MEF) specifications. The framework consists of a set of service definitions, service attributes and operation, administration and maintenance (OAM) for each Ethernet virtual connection (EVC), operator virtual connection (OVC), Ethernet connection (EC), Ethernet user-to-network interface (UNI) and Ethernet external network-to-network interface (ENNI). The resulting services that can be defined do not refer to a particular network technology implementation and are supported by ITU-T and MEF Ethernet layer architecture models.

2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T G.8001]   Recommendation ITU-T G.8001/Y.1354 (2013), *Terms and definitions for Ethernet frames over transport*.

[ITU-T G.8010]   Recommendation ITU-T G.8010/Y.1306 (2004), *Architecture of Ethernet layer networks*, plus Amendment 1 (2006), Amendment 2 (2010), Erratum 1 (2007) and Erratum 2 (2007).

[ITU-T G.8013]   Recommendation ITU-T G.8013/Y.1731 (2013), *OAM functions and mechanisms for Ethernet based networks*, plus Amendment 1 (2015).

[IEEE 802.1Q]   IEEE 802.1Q (2014), *IEEE standard for Local and metropolitan area networks – Bridges and Bridged Networks*.

[IEEE 802.1AX]   IEEE 802.1AX (2014), *IEEE Standard for Local and metropolitan area networks – Link Aggregation*.

[IEEE 802.3]   IEEE 802.3 (2012), *IEEE Standard for Ethernet*.

[MEF 6.2]   MEF 6.2 (2014), *EVC Ethernet Services Definitions Phase 3*.

[MEF 10.3]   MEF 10.3 (2013), *Ethernet Services Attributes Phase 3*.

[MEF 12.2]   MEF 12.2 (2014), *Carrier Ethernet Network Architecture Framework Part 2: Ethernet Services Layer*.

[MEF 13]   MEF 13 (2005), *User Network Interface (UNI) Type 1 Implementation Agreement*.

[MEF 20]   MEF 20 (2008), *User Network Interface (UNI) Type 2 Implementation Agreement*.

[MEF 22.1]   MEF 22.1 (2012), *Mobile Backhaul Phase 2,* plus Amendment MEF 22.1.1 (2014), *Mobile Backhaul Phase 2 Amendment 1 –Small Cells*.

[MEF 23.1]   MEF 23.1 (2012), *Carrier Ethernet Class of Service – Phase 2*.

[MEF 26.1]	MEF 26.1 (2012), *External Network Network Interface (ENNI) – Phase 2*.
[MEF 28]	MEF 28 (2010), *External Network Network Interface (ENNI) Support for UNI Tunnel Access and Virtual UNI*.
[MEF 30.1]	MEF 30.1 (2013), *Service OAM Fault Management Implementation Agreement: Phase 2*, plus Amendment MEF 30.1.1 (2014), *Correction to Requirement*.
[MEF 33]	MEF 33(2012), *Ethernet Access Services Definition*.
[MEF 35]	MEF 35 (2012), *Service OAM Performance Monitoring Implementation Agreement*, plus Amendments MEF 35.0.1 (2013), *SOAM PM Implementation Agreement Amendment 1* and MEF 35.0.2 (2014), *Service OAM Performance Monitoring Implementation Agreement Amendment 2*.
[MEF 45]	MEF 45 (2014), *Multi-CEN L2CP*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 customer: [ITU-T G.8001]

3.1.2 Ethernet service: [ITU-T G.8001]

3.1.3 Ethernet virtual connection (EVC): [MEF 10.3]

3.1.4 external NNI (ENNI): [MEF 26.1]

3.1.5 NNI: [ITU-T G.8001]

3.1.6 operator virtual connection (OVC): [MEF 26.1]

3.1.7 service frame: [MEF 10.3]

3.1.8 UNI: [ITU-T G.8001]

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

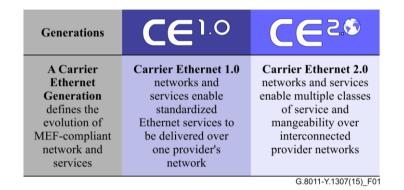|	
AP	Access Provider
APP	Application
CE	Carrier Ethernet
CEN	Carrier Ethernet Network
CoS	Class of Service
E-Access	Ethernet Access
EC	Ethernet Connection
EFD	Ethernet Flow Domain
E-LAN	Ethernet LAN
E-Line	Ethernet Line

E-LMI	Ethernet Link Management Interface
ENNI	External Network-to-Network Interface
EPL	Ethernet Private Line
EP-tree	Ethernet Private tree
ETH	Ethernet MAC layer network
E-Tree	Ethernet Tree
EVC	Ethernet Virtual Connection
EVPL	Ethernet Virtual Private Line
EVPLAN	Ethernet Virtual Private LAN
EVP-tree	Ethernet Virtual Private tree
FM	Fault Management
FP	Flow Point
GARP	Generic Attribute Registration Protocol
GVRP	GARP VLAN Registration Protocol
IA	Implementation Agreement
LAN	Local Area Network
L2CP	Layer 2 Control Protocol
MAC	Media Access Control
MEF	Metro Ethernet Forum
MEG	Maintenance Entity Group
MEN	Metro Ethernet Network
MPLS	Multi-Protocol Label Switching
MSTP	Multiple Spanning Tree Protocol
OAM	Operation, Administration and Maintenance
OTH	Optical Transport Hierarchy
OVC	Operator Virtual Connection
PM	Performance Monitoring
RSTP	Rapid Spanning Tree Protocol
S-EC	Subscriber EC
SDH	Synchronous Digital Hierarchy
SLA	Service Level Agreement
SOAM	Service OAM
SONET	Synchronous Optical Network
SP	Service Provider
TFP	Termination Flow Point
TRAN	Transport Layer
UNI	User-to-Network Interface

UNI-C	Customer side of UNI
UNI-N	Network side of UNI
UTA	UNI Tunnel Access
VLAN	Virtual LAN
VoIP	Voice over IP
VUNI	Virtual UNI

5 Summary of Carrier Ethernet

Carrier Ethernet (CE) services are enabling service provider (SP) evolution of legacy services as well as supporting enterprise business communications, cloud computing and mobility services. CE 2.0, which was launched February 2012, adds five new services to CE 1.0, bringing the total number of services to eight. These eight services encompass both the port-based and virtual LAN (VLAN)-based Ethernet line (E-Line), Ethernet LAN (E-LAN), Ethernet tree (E-Tree) and Ethernet access (E-Access) services.

CE 2.0 is founded on three specific tenets: multiple classes of service (Multi-CoS), interconnectedness and manageability.

Figure 1 – MEF generations framework

Figure 1 provides a summary of the MEF's generations framework for Carrier Ethernet. CE 1.0 focused on standardized Ethernet services within a single provider's network.

CE 2.0 enhances the work of CE 1.0 by extending the specifications to address multiple classes of service, standards for delivering CE services across multiple, interconnected networks and overall service management of CE services, in particular over multi-provider networks. The multi-CoS, management and interconnected features apply to each of the eight services.

Multi-CoS

Multi-CoS defines standardized performance objectives across geographically defined performance tiers such that long haul services have different target objectives when compared to metro-based services given the derived propagation delay inherent in the distances covered by each performance tier. In addition, MEF specifications have compiled data from a number of public resources to provide specific application performance requirements and per application type (e.g., voice over IP (VoIP), interactive video, point-of-sale).

Interconnectedness

Just as the success of the telephone voice system was based on standards enabling the interconnectivity of public switched telephone networks, so too is the success of Carrier Ethernet based on standards enabling interconnectivity of Carrier Ethernet networks so that one service can be

delivered across multiple operator's networks without compromising its features such as multi-CoS and manageability.

Manageability[1]

Finally, manageability ensures standards for both fault management (FM) and performance monitoring (PM) of any CE 2.0 service whether they are provided by a single operator or traverse multiple operator's networks. Manageability is critical in delivering an assured service that meets its objectives for availability and performance. Furthermore, these features support service providers in differentiating their services to their end customers, providing the necessary service level agreement (SLA) reporting, maintaining their own service level objectives and minimizing operations costs involved in the troubleshooting and maintenance of CE 2.0 services (e.g., truck rolls).

5.1   MEF Carrier Ethernet service definition

Carrier Ethernet service is defined in [MEF 6.2]. As depicted in Figure 2, the MEF network reference model defines Ethernet services that transport subscriber Ethernet frames across a service provider's Carrier Ethernet network (CEN). The service provider is responsible for the performance and availability of the service between the user-to-network interface (UNI) demarcation points.

Ethernet service frames are transported across the CEN through virtual connections. [MEF 6.2] defines three service types: an E-Line, which is a point-to-point Ethernet virtual connection (EVC), an E-LAN, which is a multipoint-to-multipoint EVC and an E-Tree, which uses a rooted multipoint EVC. The MEF's service definition is built on virtual connections, as specified in [IEEE 802.1Q], established over lower-layer transport services. Therefore, Ethernet service frames, as specified in [IEEE 802.3], can be transported over a variety of different technologies such as synchronous optical network (SONET)/synchronous digital hierarchy (SDH), multi-protocol label switching (MPLS), bundled-copper and fibre. The underlying transport mechanisms may vary on a link-by-link basis. Thus, service providers can offer CE services independent of the underlying transport technology.
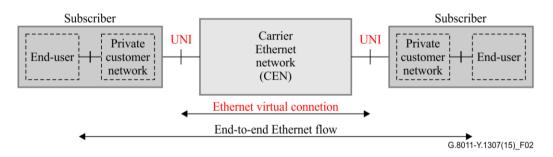

Figure 2 – Basic MEF framework reference model

Building on the basic reference model illustrated in Figure 2, SPs needed the capability to extend service delivery outside of their franchise. To enable this connectivity, the MEF created a UNI tunnelled access [MEF 28] and an E-Access service definition [MEF 33]. Figure 3 illustrates a CE service using an E-Access service [MEF 33]. As the SP does not have the facilities to deliver CE service end-to-end, it uses an access provider (AP) from an external network-to-network interface (ENNI) to the end subscriber. By connecting together two operator virtual connections (OVCs), they can deliver the end-to-end service.

---

[1] The term manageability in the MEF CE 2.0 context includes network management (generic information models and protocol specific models), as well as fault management and performance monitoring OAM protocols. For clarity, and since only the latter aspects are included, this is referred to as OAM in the rest of this Recommendation.

Another mean to deliver end-to-end connectivity is achieved by using a UNI tunnelled access [MEF 28], which resembles an E-Access service but has the AP UNI functionality located at both ENNI and remote UNI.
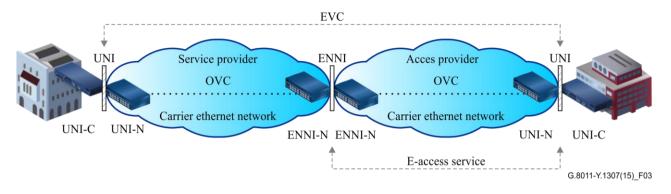

Figure 3 – E-Access service example

The application of this service definition to mobile backhaul is described in [MEF 22.1]. The mobile backhaul application defines the addition of resiliency, availability and synchronization to the service definition.

5.2 MEF Carrier Ethernet service attributes

As demonstrated in Figure 2, an EVC connects two UNIs together to deliver CE services. The service attributes and parameters for this service are defined in [MEF 10.3]. The attributes detailing the interaction of layer 2 control protocols in multi-CEN environments are defined in [MEF 45]. The resulting service attributes are categorized per UNI, per EVC per UNI and per EVC, as shown in Table 1.

Table 1 – Ethernet service attributes

UNI service attributes	EVC per UNI service attributes	EVC service attributes
UNI identifier	UNI EVC ID	EVC type
Physical layer	CoS identifiers	EVC ID
Synchronous mode	Ingress bandwidth profile per EVC	UNI list
Number of links	Ingress bandwidth profile per CoS identifier	Maximum number of UNIs
Service frame format	Egress bandwidth profile per EVC	EVC maximum service frame size
UNI maximum service frame size	Egress bandwidth profile per egress equivalence identifier	CE-VLAN ID preservation
Service multiplexing	Egress equivalence class identifier	CE-VLAN CoS preservation
Bundling	Colour identifier	Unicast data service frame delivery
All to one bundling	Source media access control (MAC) address limit	Multicast data service frame delivery
CE-VLAN ID for untagged and priority tagged service frames	Test maintenance entity group (MEG)	Broadcast data service frame delivery
Maximum number of EVCs	Subscriber MEG	Layer 2 control protocol processing

Table 1 – Ethernet service attributes

UNI service attributes	EVC per UNI service attributes	EVC service attributes
Ingress bandwidth profile per UNI		EVC performance
Egress bandwidth profile per UNI		
Layer 2 control protocols Processing		
CE-VLAN ID/EVC map		
Link OAM		
UNI MEG		
Ethernet link management interface (E-LMI)		
UNI resiliency		

As demonstrated in Figure 3, CE services can be delivered by connecting together OVCs through an ENNI, therefore using different operator CENs. OVC service attributes are defined in [MEF 26.1].

MEF has defined a set of three standardized classes of service (CoS) in [MEF 23.1], as well as a fourth for synchronization in [MEF 22.1]. As well, CoS performance objectives for a number of defined metrics are specified and grouped into performance tiers.

Link aggregation [IEEE 802.1AX] is used for UNI resiliency.

5.3 MEF Carrier Ethernet service architecture

The MEF has defined a Carrier Ethernet architecture in [MEF 12.2]. This work is aligned with and builds on the topological constructs of the Ethernet layer architecture model in [ITU-T G.8010]. Figure 4 shows a base model of an Ethernet service and the relationship between the EVC, the OVC, as well as the underlying ECs including end points and flow points (FPs).

In addition, MEF has further detailed two modes of operation for configuration of the customer side of UNI (UNI-C) and the network side of UNI (UNI-N). These are UNI type 1 [MEF 13] and UNI type 2 [MEF 20].
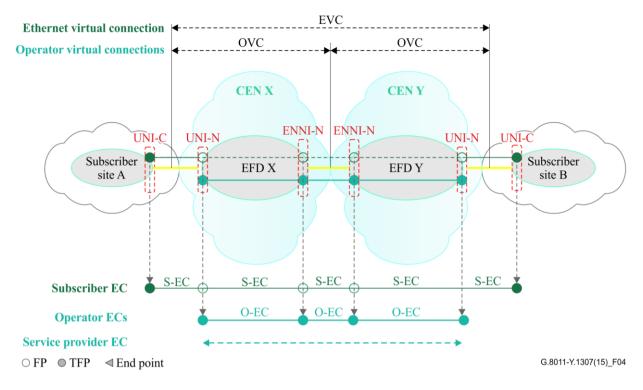
Figure 4 – Base MEF architecture

5.4 MEF Carrier Ethernet OAM

Connectivity monitoring can be achieved via Ethernet OAM mechanisms defined in [ITU-T G.8013]. Additional specifications on the use of service OAM (SOAM) for fault management and performance monitoring are defined in [MEF 30.1] and [MEF 35] respectively.

Appendix I

Summary of MEF specifications

(This appendix does not form an integral part of this Recommendation.)

Table I.1 lists the MEF specifications that are included by reference in this Recommendation. They are listed sequentially and grouped according to the parts in clause 5.

This set of MEF specifications is based on CE 2.0, but there are variations to include the latest specification revisions and also to exclude information modelling and data model specifications.

Table I.1 – Table of reference to MEF specifications

MEF	MEF specification title	Group name
6.2 [MEF 6.2]	EVC Ethernet Services Definitions Phase 3	Service definition
10.3 [MEF 10.3]	Ethernet Services Attributes Phase 3	Service attributes
12.2 [MEF 12.2]	Carrier Ethernet Network Architecture Framework Part 2: Ethernet Services Layer	Architecture
13 [MEF 13]	User Network Interface (UNI) Type 1 Implementation Agreement	Architecture
20 [MEF 20]	User Network Interface (UNI) Type 2 Implementation Agreement	Architecture
22.1 [MEF 22.1]	Mobile Backhaul – Phase 2	Service definition
22.1.1 [MEF 22.1]	Mobile Backhaul – Phase 2 – Amendment 1 – Small Cells	Service definition
23.1 [MEF 23.1]	Carrier Ethernet Class of Service – Phase 2	Service attributes
26.1 [MEF 26.1]	External Network Network Interface (ENNI) – Phase 2	Service attributes
28 [MEF 28]	External Network Network Interface (ENNI) Support for UNI Tunnel Access and Virtual UNI	Service definition
30.1 [MEF 30.1]	Service OAM Fault Management Implementation Agreement: Phase 2	OAM
30.1.1 [MEF 30.1]	Amendment to MEF 30.1 – Correction to Requirement	OAM
33 [MEF 33]	Ethernet Access Services Definition	Service definition
35 [MEF 35]	Service OAM Performance Monitoring Implementation Agreement	OAM
35.0.1 [MEF 35]	SOAM PM Implementation Agreement Amendment 1	OAM
35.0.2 [MEF 35]	Service OAM Performance Monitoring Implementation Agreement Amendment 2	OAM
45 [MEF 45]	Multi-CEN L2CP	Service attributes

The following clauses provide a brief summary of the content of the referenced MEF specifications.

I.1   Architecture documents

MEF 12.2 – Carrier Ethernet Network Architecture Framework Part 2: Ethernet Services Layer

[MEF 12.2] provides the architecture framework to model the Ethernet services layer of MEF compliant Carrier Ethernet networks. The Ethernet service layer architecture framework describes

the high-level topological and functional constructs used to model the various architectural components of the Ethernet service subscriber and provider networks, their associated functional elements and their interconnect relationships. The architecture framework also describes the relationship between Ethernet services layer interfaces, functional elements and their reference points, and other architectural elements in the transport layer (TRAN) and application (APP) layers of the [b-MEF 4].

MEF 13 – User Network Interface (UNI) Type 1 Implementation Agreement

The main objective of [MEF 13] is to specify the MEF UNI characteristics and operation in manual configuration mode. This allows existing Ethernet devices (e.g., switch, router, work-station) acting as CEs to be instantly compliant to [MEF 13] with no additional software or hardware upgrades. The main functionality of [MEF 13] is to allow data-plane Ethernet connectivity between the UNI-C and UNI-N. [MEF 13] references MEF UNI requirements and framework for all concepts, constructs and terminology. The UNI type 1 mode provides the minimum data-plane connectivity services with no control-plane or management-plane capabilities.

MEF 20 – User Network Interface (UNI) Type 2 Implementation Agreement

[MEF 20] adds new functionalities to MEF UNI type 1 [MEF 13], such as E-LMI based on [MEF 16], link OAM based on clause 57 of [IEEE 802.3], service OAM based on [ITU-T Y.1731] and [b-IEEE 802.1ag] and protection using link aggregation based on clause 43 of [IEEE 802.3].

I.2   Service attribute documents

MEF 10.3 – Ethernet Services Attributes Phase 3

[MEF 10.3] defines the attributes of Ethernet services observable at a UNI and from user-to-network interface to user-to-network interface (UNI to UNI). In addition, a framework for defining specific instances of Ethernet services is also described.

MEF 23.1 – Carrier Ethernet Class of Service – Phase 2

[MEF 23.1] (MEF CoS implementation agreement (IA)) specifies a set of class of service names called CoS labels that can be used by operators, service providers and their subscribers to indicate the performance expectations to be associated with a given set of frames that comprise a CoS frame set. The MEF CoS IA includes standards for CoS and colour identification as well as performance objectives and supporting requirements. The CoS labels are envisioned as a subset of all of the class of service names an operator may provide. The MEF CoS IA facilitates: Ethernet service interoperability and consistency between operators, the use of a common CoS label set for subscribers to utilize and the use of performance objectives that support key applications.

MEF 26.1 – External Network Network Interface (ENNI) – Phase 2

The metro Ethernet network (MEN) architecture framework specifies a reference point that is the interface between two MENs, where each operator MEN is under the control of a distinct administrative authority. This reference point is termed the external network-to-network interface or ENNI. The ENNI is intended to support the extension of Ethernet services across multiple operator MENs. [MEF 26.1] specifies the requirements at the ENNI reference point as well as the interface functionality in sufficient detail to ensure interoperability between two operator MENs including link OAM. [MEF 26.1] also defines the connectivity attributes UNI to UNI, UNI to ENNI, and ENNI to ENNI such that multiple operator MENs can be interconnected and the Ethernet services and attributes in [MEF 6.2] and [MEF 10.3] can be realized.

MEF 45 – Multi-CEN L2CP

[MEF 45] specifics the service attributes and requirements for handling layer 2 control protocol (L2CP) frames in a Carrier Ethernet network.

I.3 Service definition documents

MEF 6.2 – EVC Ethernet Services Definitions Phase 3

[MEF 6.2] defines three service constructs called Ethernet service types and six Ethernet services with service attributes and parameters as specified in [MEF 10.3] and in MEF (to be published), "Multi-CEN Layer 2 Control Protocol". These service types are used to create point-to-point, multipoint-to-multipoint, and rooted-multipoint Ethernet services that are either port or virtual LAN (VLAN) based.

MEF 28 – External Network Network Interface (ENNI) Support for UNI Tunnel Access and Virtual UNI

The external network-to-network interface (ENNI) is a reference point that describes the interface between two MENs and is intended to support the transparent extension of Ethernet services across multiple network operator MENs, where each network operator MEN is under the control of a distinct administrative authority. [MEF 28] extends the ENNI by defining the UNI tunnel access (UTA) which associates a virtual UNI (VUNI), a remote UNI and at least one supporting OVC.

MEF 33 – Ethernet Access Services Definition

[MEF 33] defines Ethernet access services, which are OVC-based Ethernet services in contrast to the EVC-based services which are defined in [MEF 6.2]. [MEF 33] uses the UNI service attributes and parameters options defined in the [MEF 6.2] and ENNI and OVC service attributes defined in [MEF 26.2] and applies them to create new Ethernet access services between a UNI and an ENNI. These new carrier-to-carrier Ethernet access services enable Ethernet service providers to reach out-of-franchise customer locations through an Ethernet access provider's network and deliver E-Line and E-LAN service types end-to-end. [MEF 33] defines the UNI, OVC, OVC per UNI, OVC end point per ENNI and ENNI requirements for point-to-point OVC-based Ethernet services. In addition, an informative appendix is provided showing use cases of some of the defined services.

MEF 22.1 – Mobile Backhaul Phase 2 Implementation Agreement

[MEF 22.1] identifies the requirements for MEF Ethernet services and MEF external interfaces (EIs such as UNIs) for use in mobile backhaul networks based on MEF specifications. In addition, new interface and service attributes have been specified where needed. The services and requirements in this IA are based on the services defined in [MEF 6.2] as well as the attributes in [MEF 10.3] and this IA. The aim is to be flexible to support a wide range of Ethernet service based mobile network deployments.

MEF 22.1.1 – Mobile Backhaul Phase 2 Amendment 1 – Small Cells

MEF 22.1.1 is an amendment to MEF 22.1 [MEF 22.1] that addresses the addition of technical content that may be required in certain small cells use cases.

I.4 OAM documents

MEF 30.1 – Service OAM Fault Management Implementation Agreement: Phase 2

[MEF 30.1] specifies an IA for SOAM that builds upon the framework and requirements specified by [b-MEF 17]. In particular, this IA specifies SOAM requirements for MEGs and for FM. SOAM in general and FM in particular are defined in [IEEE 802.1Q] and [ITU-T G.8013]. This IA details how to use these functions to achieve the MEF requirements of SOAM in general and SOAM FM in particular.

MEF 35 – Service OAM Performance Monitoring Implementation Agreement

[MEF 35] specifies an IA for SOAM that satisfies and extends the PM framework and requirements described in [b-MEF 17]. Existing PM functions are defined by [ITU-T G.8013] and

[b-ITU-T G.8021]. [MEF 35] details how to use these functions in order to achieve the requirements of MEF SOAM PM. MEF 35 is amended by MEF 35.0.1 – SOAM PM Implementation Agreement Amendment 1 (October 2013) for Dual-Ended Synthetic Loss and by MEF 35.0.2 – Service OAM Performance Monitoring Implementation Agreement (February 2014) for Threshold Crossing Alerts.

Appendix II

Summary of changes from ITU-T G.8011/Y.1307 (2012)

(This appendix does not form an integral part of this Recommendation.)

This appendix provides a brief summary of the changes from the previous edition of ITU-T G.8011/Y.1307.

It should be noted, that this edition of ITU-T G.8011/Y.1307 has been prepared in cooperation with MEF. The intent is that this edition of ITU-T G.8011/Y.1307 is a CE summary Recommendation that introduces CE, provides normative references to an appropriate set of MEF specifications from CE 2.0, and retains any information specific to ITU-T from the ITU-T G.8011/Y.1307 series.

II.1   ITU-T G.8011/Y.1307 comparison

The structure of the previous edition of ITU-T G.8011/Y.1307 is not retained in this edition. The intent is that all of the details of description and definition of Ethernet service characteristics are contained in the referenced MEF specifications. The table below summarizes where to find the equivalent content.

Topic in ITU-T G.8011/Y.1307-2012 (clause)	Reference
Ethernet services (6)	MEF 10.3
Ethernet service views (6.3)	MEF 12.2
EVC service attributes (7)	MEF 10.3
EC service attributes (7.2) Link type survivability	No explicit, but the concepts exist MEF 12.2 Ethernet MAC layer network (ETH) connection MEF 10.3 Resiliency performance MEF 22.1 MEN resiliency[2]
UNI service attributes (8)	MEF 10.3
ENNI attributes (9)	MEF 26.1, ITU-T G.8012, ITU-T G.8012.1
Connectivity Monitoring (10)	MEF 30.1, MEF 35
Extended UNI (Annex A)	MEF 12.2
ITU-T G.8010 & EC topology (Appendix I)	MEF 12.2

II.2   ITU-T G.8011.x/Y.1307.x comparison

The structure of Recommendations ITU-T G.8011.1/Y.1307.1 (2013), ITU-T G.8011.2/Y.1307.2 (2013), ITU-T G.8011.3/Y.1307.3 (2013), ITU-T G.8011.4/Y.1307.4 (2013) and ITU-T G.8011.5/Y.1307.5 (2013) (i.e., one Recommendation per Ethernet service) is not retained in

---

[2] The mechanisms though are out of scope for MEF and not listed. These could include:
  • ITU-T G.8031 – Ethernet linear protection
  • ITU-T G.8032 – Ethernet ring protection
  • IEEE 802.1AX – Link aggregation
  • IEEE 802.1Q (Rapid spanning tree protocol (RSTP), multiple spanning tree protocol (MSTP), GVRP, MVRP) – spanning tree restoration
  • IEEE 802.1aq – Shortest path bridging
  • other SDH, optical transport hierarchy (OTH), Ethernet or MPLS restoration schemes

this edition. As a result, these Recommendations are superseded by this edition of ITU-T G.8011/Y.1307. The intent is that all of the details of description and definition of Ethernet service characteristics are contained in the referenced MEF specifications. In the case of the functional models, most of these are examples of the implementation of the service. The base functional model still exists in the noted references, but the examples are not. The tables below summarize where to find the equivalent content that is not already indicated in the previous table.

Topic in ITU-T G.8011.1/Y.1307.1-2013	Reference
Ethernet private line (EPL) EVC & UNI service attributes	MEF 6.2
EPL ENNI attributes	MEF 26.1
EPL type 1 – options 1 & 2	MEF 6.2, MEF 12.2, MEF 45 EPL options 1 & 2
EPL type 2	ITU-T G.8001, ITU-T G.707, ITU-T G.709

Topic in ITU-T G.8011.2/Y.1307.2-2013	Reference
Ethernet virtual private line (EVPL) EVC & UNI service attributes	MEF 6.2
EVPL ENNI attributes	MEF 26.1
EVPL type 1, 2 & 3	MEF 6.2, MEF 12.2, MEF 45 Service multiplexing

Topic in ITU-T G.8011.3/Y.1307.3-2013	Reference
Ethernet virtual private LAN (EVPLAN) EVC & UNI service attributes	MEF 6.2
EVPLAN ENNI attributes	MEF 26.1
EVPLAN type 1, 2 & 3	MEF 6.2, MEF 12.2, MEF 45 Service multiplexing
Loop prevention – split horizon, spanning tree	IEEE 802.1Q, ITU-T G.8021, ITU-T G.8021.1, ITU-T G.8032

Topic in ITU-T G.8011.4/Y.1307.4-2013	Reference
Ethernet virtual private tree (EVP-tree) & Ethernet private tree (EP-tree) EVC & UNI service attributes	MEF 6.2
EVP-tree ENNI attributes	MEF 26.1
EVP-tree type 1, 2 & 3	MEF 6.2, MEF 12.2, MEF 45 Service multiplexing
EVP-tree protection	MEF 12.2, ITU-T G.8021, ITU-T G.8021.1

Topic in ITU-T G.8011.5/Y.1307.5-2013	Reference
EPLAN EVC & UNI service attributes	MEF 6.2
EPLAN ENNI attributes	MEF 26.1
EPLAN type 1 & 2 Flow port group, spanning tree	MEF 6.2, MEF 12.2, IEEE 802.1Q, ITU-T G.8021, ITU-T G.8021.1, ITU-T G.8032

Bibliography

[b-ITU-T G.707]   Recommendation ITU-T G.707/Y.1322 (2007), *Network node interface for the synchronous digital hierarchy (SDH)*.

[b-ITU-T G.709]   Recommendation ITU-T G.709/Y.1331 (2012), *Interfaces for the optical transport network*.

[b-ITU-T G.8021]   Recommendation ITU-T G.8021/Y.1341 (2012) *Characteristics of Ethernet transport network equipment functional blocks*; Amendment 1 (2012).

[b-ITU-T G.8021.1]   Recommendation ITU-T G.8021.1/Y.1341.1 (2012), *Types and characteristics of Ethernet transport network equipment*.

[b- ITU-T G.8031]   Recommendation ITU-T G.8031/Y.1342 (2015), *Ethernet linear protection switching*.

[b-ITU-T G.8032]   Recommendation ITU-T G.8032/Y.1344 (2012), *Ethernet ring protection switching*.

[b-IEEE 802.1ag]   IEEE 802.1ag (2007), *IEEE Standard for Local and Metropolitan Area Networks Virtual Bridged Local Area Networks Amendment 5: Connectivity Fault Management*.

[b-IEEE 802.1aq]   IEEE 802.1aq (2012), *IEEE Standard for Local and metropolitan area networks – Media Access Control (MAC) Bridges and Virtual Bridged Local Area Networks – Amendment 20: Shortest Path Bridging*.

[b-MEF 4]   MEF 4 (2004), *Metro Ethernet Network Architecture Framework – Part 1: Generic Framework*.

[b-MEF 17]   MEF 17 (2007), *Service OAM Requirements & Framework – Phase 1*.

ITU-T Y-SERIES RECOMMENDATIONS

GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

GLOBAL INFORMATION INFRASTRUCTURE	
General	Y.100–Y.199
Services, applications and middleware	Y.200–Y.299
Network aspects	Y.300–Y.399
Interfaces and protocols	Y.400–Y.499
Numbering, addressing and naming	Y.500–Y.599
Operation, administration and maintenance	Y.600–Y.699
Security	Y.700–Y.799
Performances	Y.800–Y.899
INTERNET PROTOCOL ASPECTS	
General	Y.1000–Y.1099
Services and applications	Y.1100–Y.1199
Architecture, access, network capabilities and resource management	Y.1200–Y.1299
Transport	**Y.1300–Y.1399**
Interworking	Y.1400–Y.1499
Quality of service and network performance	Y.1500–Y.1599
Signalling	Y.1600–Y.1699
Operation, administration and maintenance	Y.1700–Y.1799
Charging	Y.1800–Y.1899
IPTV over NGN	Y.1900–Y.1999
NEXT GENERATION NETWORKS	
Frameworks and functional architecture models	Y.2000–Y.2099
Quality of Service and performance	Y.2100–Y.2199
Service aspects: Service capabilities and service architecture	Y.2200–Y.2249
Service aspects: Interoperability of services and networks in NGN	Y.2250–Y.2299
Enhancements to NGN	Y.2300–Y.2399
Network management	Y.2400–Y.2499
Network control architectures and protocols	Y.2500–Y.2599
Packet-based Networks	Y.2600–Y.2699
Security	Y.2700–Y.2799
Generalized mobility	Y.2800–Y.2899
Carrier grade open environment	Y.2900–Y.2999
FUTURE NETWORKS	Y.3000–Y.3499
CLOUD COMPUTING	Y.3500–Y.3999

For further details, please refer to the list of ITU-T Recommendations.

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	**Transmission systems and media, digital systems and networks**
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Environment and ICTs, climate change, e-waste, energy efficiency; construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Terminals and subjective and objective assessment methods
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	Global information infrastructure, Internet protocol aspects and next-generation networks
Series Z	Languages and general software aspects for telecommunication systems