

ITU-T

G.8011.4/Y.1307.4

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

(08/2013)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA,
DIGITAL SYSTEMS AND NETWORKS

Packet over Transport aspects – Ethernet over Transport
aspects

SERIES Y: GLOBAL INFORMATION
INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS
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Internet protocol aspects – Transport

Ethernet virtual private rooted multipoint service

Recommendation ITU-T G.8011.4/Y.1307.4



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Recommendation ITU-T G.8011.4/Y.1307.4

Ethernet virtual private rooted multipoint service

Summary

Recommendation ITU-T G.8011.4/Y.1307.4 defines the service attributes and parameters for carrying Ethernet characteristic information over dedicated-bandwidth or shared-bandwidth, rooted multipoint connections, provided by synchronous digital hierarchy (SDH), plesiochronous digital hierarchy (PDH), asynchronous transfer mode (ATM), multi-protocol label switching (MPLS), optical transport hierarchy (OTH), Ethernet PHY layer network (ETY) or Ethernet MAC layer network (ETH) server layer networks. This type of service is referred to as Ethernet private tree (EP-Tree) and Ethernet virtual private tree services. This Recommendation is based on the Ethernet service framework as defined in Recommendation ITU-T G.8011/Y.1307.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T G.8011.4/Y.1307.4	2010-02-06	15	11.1002/1000/10425-en
2.0	ITU-T G.8011.4/Y.1307.4	2013-08-29	15	11.1002/1000/12027-en

* 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

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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

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As of the date of approval of this Recommendation, ITU had not 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/>.

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Recommendation ITU-T G.8011.4/Y.1307.4

Ethernet virtual private rooted multipoint service

1 Scope

This Recommendation defines the service attributes and parameters for carrying Ethernet characteristic information over dedicated-bandwidth or shared-bandwidth, rooted multipoint connections, provided by SDH, ATM, MPLS, PDH, ETY, OTH or ETH server layer networks. This type of service is referred to as Ethernet private tree (EP-Tree) and virtual private tree (EVP-Tree) services. The initial focus of this Recommendation will be on uni-root and bi-root EP-Tree and EVP-Tree services. This Recommendation is based on the Ethernet service framework as defined in [ITU-T G.8011] and is aligned with the EP-Tree and EVP-Tree services specified in [MEF 6.1].

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.809] Recommendation ITU-T G.809 (2003), *Functional architecture of connectionless layer networks*.
- [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*.
- [ITU-T G.8011] Recommendation ITU-T G.8011/Y.1307 (2012), *Ethernet service characteristics*.
- [ITU-T G.8012] Recommendation ITU-T G.8012/Y.1308 (2004), *Ethernet UNI and Ethernet NNI*.
- [ITU-T G.8012.1] Recommendation ITU-T G.8012.1/Y.1308.1 (2012), *Interfaces for the Ethernet transport network*.
- [ITU-T G.8013] Recommendation ITU-T G.8013/Y.1731 (2013), *OAM functions and mechanisms for Ethernet based networks*.
- [ITU-T G.8021] Recommendation ITU-T G.8021/Y.1341 (2010), *Characteristics of Ethernet transport network equipment functional blocks*.
- [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*.
- [IEEE 802.1AX] IEEE 802.1AX-2008, *IEEE Standard for Local and metropolitan area networks – Link Aggregation*.
- [IEEE 802.1Q] IEEE 802.1Q-2011, *IEEE standard for Local and metropolitan area networks – Media Access Control (MAC) Bridges and Virtual Bridged Local Area Networks*.

[IEEE 802.3]	IEEE 802.3-2012, <i>IEEE Standard for Ethernet</i> .
[MEF 6.1]	The Metro Ethernet Forum, Technical Specification MEF 6.1 (2008), <i>Ethernet Services Definitions – Phase 2</i> .
[MEF 6.1.1]	The Metro Ethernet Forum, Technical Specification MEF 6.1.1 (2012), <i>Layer 2 Control Protocol Handling Amendment to MEF 6.1</i> .
[MEF 10.2]	The Metro Ethernet Forum, Technical Specification MEF 10.2 (2009), <i>Ethernet Services Attributes – Phase 2</i> .
[MEF 12.1]	The Metro Ethernet Forum, Technical Specification MEF 12.1 (2010), <i>Ethernet Services Attributes Phase 2</i> .
[MEF 26.1]	The Metro Ethernet Forum, Technical Specification MEF 26.1 (2012), <i>External Network Network Interface (ENNI) – Phase 2</i> .
[MEF 30]	The Metro Ethernet Forum, Technical Specification MEF 30 (2011), <i>Service OAM Fault Management Implementation Agreement</i> .
[MEF 35]	The Metro Ethernet Forum, Technical Specification MEF 35 (2012), <i>Service OAM Performance Monitoring Implementation Agreement</i> .

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

- 3.1.1 **ENNI**: [MEF 26.1].
- 3.1.2 **EP-tree service**: [ITU-T G.8001].
- 3.1.3 **ETH link**: See clause 6.6 of [ITU-T G.8010].
- 3.1.4 **Ethernet connection (EC)**: [ITU-T G.8001].
- 3.1.5 **Ethernet private tree (EP-Tree) service**: [ITU-T G.8001].
- 3.1.6 **Ethernet virtual connection**: (EVC) [ITU-T G.8001].
- 3.1.5 **Ethernet virtual private tree (EVP-Tree) service**: [ITU-T G.8001].
- 3.1.7 **EVP-tree type 1 service**: [ITU-T G.8001].
- 3.1.8 **EVP-tree type 2 service**: [ITU-T G.8001].
- 3.1.9 **EVP-tree type 3 service**: [ITU-T G.8001].
- 3.1.10 **flow point**: [ITU-T G.809].

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

APS	Automatic Protection Switching
ATM	Asynchronous Transfer Mode
CBS	Committed Burst Size
CCM	Continuity Check Message

CE	Customer Edge
CF	Coupling Flag
CFM	Connectivity Fault Management
CI	Characteristic Information
CIR	Committed Information Rate
CM	Colour Mode
CoS	Class of Service
DA	Destination Address
DM	Delay Measurement
DMM	Delay Measurement Message
DMR	Delay Measurement Reply
DSCP	Differentiated Services Code Point
EBS	Excess Burst Size
EC	Ethernet Connection
EFM	Ethernet in the First Mile
EIR	Excess Information Rate
E-LMI	Ethernet Local Management Interface
ENNI	External Network Network Interface
ETH	Ethernet MAC layer network
ETH_C	Ethernet Connection (function)
ETH_CI	Ethernet MAC Characteristic Information
ETH_FP	Ethernet flow point
ETH_SNC	Ethernet Subnetwork Connection
ETY	Ethernet PHY layer network
EVC	Ethernet Virtual Connection
EVP-Tree	Ethernet Virtual Private Tree
LACP	Link Aggregation Control Protocol
LBM	Loopback Message
LM	Loss Measurement
LTM	Link Trace Message
MAC	Media Access Control
MEG	Maintenance Entity Group
MEN	Metro Ethernet Network
MEP	MEG End Point
MIP	MEG Intermediate Point
MPLS	Multi-Protocol Label Switching
MTU	Maximum Transmission Unit

NNI	Network-to-Network Interface
OAM	Operation, Administration, Maintenance
OTH	Optical Transport Hierarchy
OTN	Optical Transport Network
OVC	Operator Virtual Connection
PDH	Plesiochronous Digital Hierarchy
PHY	PHYsical layer entity
RSTP	Rapid Spanning Tree Protocol
SA	Source Address
SDH	Synchronous Digital Hierarchy
STP	Spanning Tree Protocol
S-VLAN	Service VLAN
UNI	User Network Interface
UNI-C	Customer side of UNI
UNI-N	Network side of UNI
VLAN	Virtual Local Area Network

5 Conventions

In this Recommendation, the Ethernet connection (EC) is functionally equivalent to the EC defined in [MEF 12.1]. The EC is used to describe the network underlying the Ethernet private tree (EP-Tree) and Ethernet virtual private tree (EVP-Tree) services. To describe the EP-Tree and EVP-Tree services, this Recommendation uses the term Ethernet virtual connection (EVC) as equivalent to the EVC¹ as defined in [MEF 10.2].

In this Recommendation, the EP-Tree and EVP-Tree services are functionally equivalent to the EP-Tree and EVP-Tree services defined in [MEF 6.1].

6 EVP-Tree service

6.1 Description

An EVP-Tree service is an Ethernet service based upon a rooted-multipoint EVC as described in terms of "an Ethernet Tree Service type" in section 6.3 of [MEF 6.1]. A rooted-multipoint EVC is an EVC for which each UNI is designated either as root or leaf. Ingress service frames at a root UNI can be delivered to one or more of any of the leaf UNIs in the EVC. Ingress service frames at a leaf UNI can only be delivered to one or more root UNIs in the EVC.

For an EVP-Tree service, service multiplexing may occur at none, one, or more than one of the UNIs in the EVC.

¹ NOTE – The 2010 ITU-T G.8011.4 Ethernet Connection (EC) definition was based on the 2009 ITU-T G.8011 definition that made the EC and EVC essentially equivalent. However, additional clarifications from [MEF 12.1] Figure 10 align with the original (2004) ITU-T G.8011 that excluded the UNI-N from the EC. As a result, ITU-T G.8011 (2012), on which this Recommendation is based, reinstates the difference between EC and EVC. Exactly where the start of the EVC is located depends on the underlying server layer.

The EVP-Tree service with only one root (i.e., uni-root) is illustrated in Figure 6.1-1.

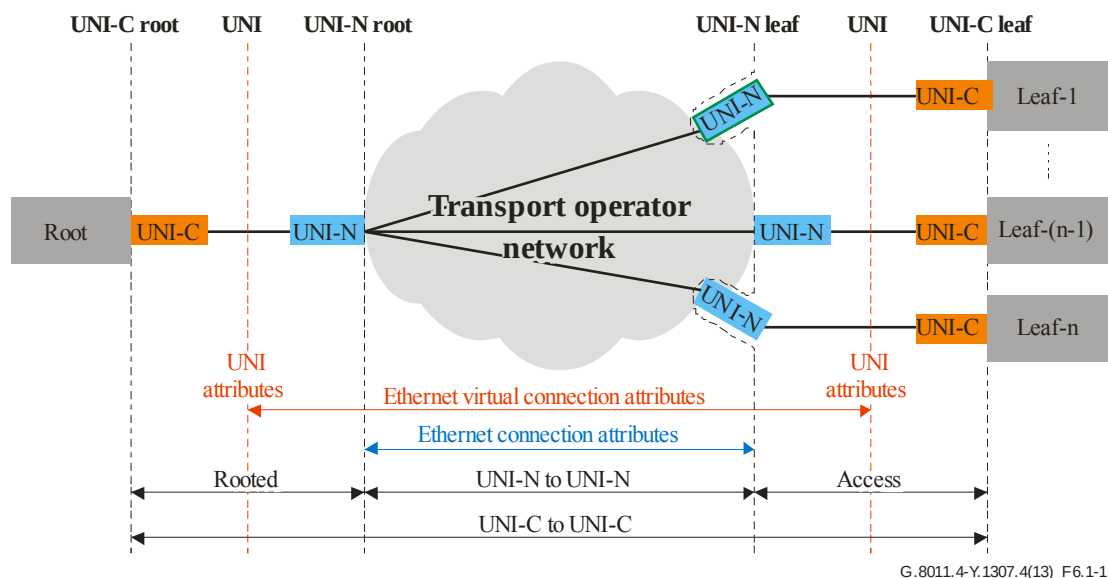


Figure 6.1-1 – Uni-root EVP-Tree service model

This is the "simplest form" of an EVP-Tree service as further described in terms of "an Ethernet Tree Service type" in section 6.3 of [MEF 6.1].

The EVP-Tree service with two roots (i.e., bi-root) is a possible multi-root EVP-Tree service as illustrated in Figure 6.1-2. This is an example of "more sophisticated forms" of an EVP-Tree service as described in terms of "an Ethernet Tree Service type" in section 6.3 of [MEF 6.1]. It should be noted that leaves would always behave as if there were a traditional unicast relationship from the leaf to the active root. There is no interaction among leaves, not even when they are redundantly attached to other roots; i.e., when they belong to multiple trees.

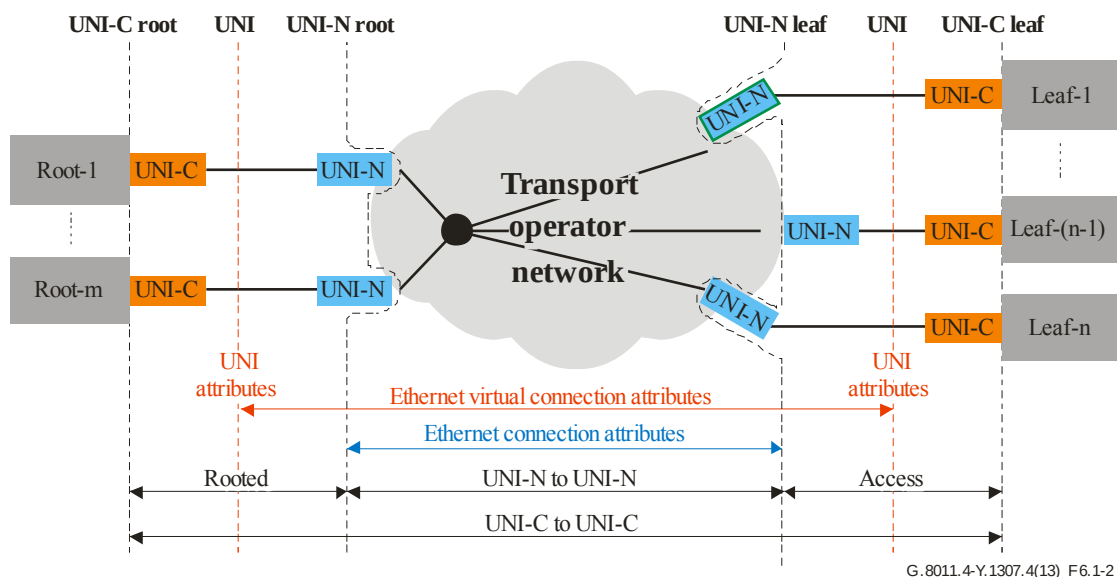


Figure 6.1-2 – Multi-root EVP-Tree service model

Load balancing and redundancy scenarios for multi-root EVP-Tree service are for further study.

More sophisticated cases such as hierarchical or cascaded EVP-Tree service architectures are also for further study.

6.2 EVP-Tree service architecture

EVP-Tree service supports multiplexed access and uses either a dedicated or a shared server layer, which leads to the three types of EVP-Tree services listed in Table 6.2-1:

Table 6.2-1 – EP-Tree service and EVP-Tree service types

Type	Shared server layer	Multiplexed access
EP-Tree service	N	N
EVP-Tree type 1 service	N	Y
EVP-Tree type 2 service	Y	N
EVP-Tree type 3 service	Y	Y

Annex A describes EP-Tree service.

Appendix I describes use cases for each type.

EVP-Tree type 1 and type 3 services can be further classified into three subtypes listed in Table 6.2-2 according to the position where multiplexed access occurs:

Table 6.2-2 – EVP-Tree service subtypes

Subtype	Multiplexed root access	Multiplexed leaf access
a	Y	N
b	N	Y
c	Y	Y

The basic architecture for EVP-Tree type 1 (1a, 1b and 1c), type 2 and type 3 (3a, 3b and 3c) services are described in clauses 6.2.1, 6.2.2 and 6.2.3, respectively.

6.2.1 EVP-Tree type 1 service

Figure 6.2-1 illustrates the basic architecture of a rooted-multipoint EC supporting EVP-Tree type 1 service. The ETY layer is terminated at the rooted UNI-N, and the multiplexed ETH frames are forwarded over single Ethernet flow points (ETH_FPs) to the dedicated server layer. The rooted UNI uses the VLAN tag for multiplexing at the demarcation point². Multiplexed access based on the service multiplexing ETH UNI service attribute (per clause 8.1 of [ITU-T G.8011]) indicates that multiple service instances exist across a single Ethernet UNI demarcation. Since multiplexed access is the principal feature of EVP-Tree type 1 service ingress, EVP-Tree type 1 service is also referred to as multiplexed access service.

EVP-Tree type 1 service can be further classified into the following three types, depending on whether multiplexing occurs at the root, the leaves or both:

- EVP-Tree type 1a service: Dedicated server layer; multiplexed root access (see Figure 6.2-1);
- EVP-Tree type 1b service: Dedicated server layer; multiplexed leaf access (see Figure 6.2-2);
- EVP-Tree type 1c service: Dedicated server layer; multiplexed root and leaf access (see Figure 6.2-3).

² Note that the choice of customer or provider VLAN tags depends on the agreement with the service provider.