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Infrastructure of audiovisual services – Communication
procedures

**Gateway control protocol: Packages for virtual
private network support**

ITU-T Recommendation H.248.56



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ITU-T Recommendation H.248.56

Gateway control protocol: Packages for virtual private network support

Summary

ITU-T Recommendation H.248.56 defines H.248 packages for virtual private network (VPN) support and focuses on Ethernet-based virtual local area networks, representing a network-based layer 2 VPN type.

Source

ITU-T Recommendation H.248.56 was approved on 29 August 2007 by ITU-T Study Group 16 (2005-2008) under the ITU-T Recommendation A.8 procedure.

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ITU-T Recommendation H.248.56

Gateway control protocol: Packages for virtual private network support

1 Scope

1.1 General

H.248 media gateways (MG) may be located at the boundary of virtual private networks (VPNs). At this connection point, H.248 ephemeral terminations would be involved in VPN services. In order to bound the scope from a H.248 point of view, the separation in client/server VPNs is detailed in [ITU-T Y.1314], [ITU-T Y.1311]:

- Client/server VPNs have a two-layer hierarchy in which a VPN server layer network is used to support one or more VPN client layer networks. [ITU-T Y.1311] describes client/server VPNs in terms of VPN service types and VPN transport types, where the term VPN service type refers to the VPN client layer and the term VPN transport type refers to the VPN server layer. The different VPN service (client) and transport (server) types are classified in [ITU-T Y.1311] as described below in Table 1.

Table 1 – Y.1311 service types

Service type	Description
Layer 1	Provides a physical layer service between customer sites belonging to the same VPN. Connections can be based on physical ports, optical wavelengths, SDH/SONET VCs, frequency channels, or timeslots.
Layer 2	Provides a data link layer service between customer nodes belonging to the VPN. Forwarding of user data packets is based on information in the packets' data link layer headers (e.g., DLCI, ATM VCI/VPI, or MAC addresses).
Layer 3	Provides a network layer service between customer nodes belonging to the VPN. Forwarding of user data packets based on information in the layer 3 header (e.g., IPv4 or IPv6 destination address).

In scope of H.248.56 are network-based VPNs (NB VPN) only, and only virtual transport networks because the H.248 MG is only involved in the network transport infrastructure. The types of VPNs could be further limited to layer 2 and layer 3 VPNs (L2VPN, L3VPN) only. This is because the bearer connection endpoint behind H.248 ephemeral terminations is basically a bearer technology from layer 2/3.

VPN support for H.248 physical terminations is in principle possible with H.248 (see, e.g., ITU-T Rec. H.248.21), but out of scope of this Recommendation because e.g., there is not any explicit VPN-ID on bearer level.

The edge of a VPN could be further distributed in customer edge (CE) and provider edge (PE) VPN network elements, see clause 5.2.1 of [ITU-T Y.1311] (or [ITU-T G.8011.2/Y.1307.2] for Ethernet-based VPNs). The H.248 MG may provide a "customer" edge VPN function, but also a collapsed CE/PE VPN edge function.

1.2 NB layer 2 VPN

1.2.1 Ethernet VLAN

This Recommendation supports Ethernet VLANs as NB layer 2 VPN type by the H.248 *vlan* package (see clause 6). Clause 6.3 of [ITU-T Y.1314] provides an overview about Ethernet VLANs:

- [IEEE 802.1Q] defines the operation of virtual LAN (VLAN) bridges that permit the definition, operation and administration of virtual LAN topologies within a bridged LAN infrastructure. VLANs allow end-stations (*here H.248 MGs*) on multiple physical LAN segments to communicate as if they were connected to the same LAN segment. End users (*here H.248 MGs*) and hubs/switches can be moved to different VLANs by changing the VLAN configuration on the port/interface on the 802.1Q-compliant switching device that the end-station or hub/switch connects to.
- Traffic separation for frames belonging to different VLANs across a shared infrastructure is achieved by inserting a tag with a VLAN identifier (VID) into each frame. A VID must be assigned for each VLAN (1 to 4096) and must be globally unique within the same physical infrastructure. One of the drawbacks to this approach is that customers also use VLANs within their own network, which introduces VID allocation and limitation issues. To solve this problem, a second IEEE 802.1Q-tag can be appended to customer IEEE 802.1Q-tagged packets that enter the providers' network (Q-in-Q as defined in [IEEE 802.1ad]). This separates the providers' VLAN space from the customers' VLAN space and allows customers to use whatever VIDs they want.

NOTE – Another option is to use a MAC-in-MAC approach (as defined in [IEEE 802.1ah]), in which a provider appends a second Ethernet header to the customers' packet. However, this option creates a client/server VPN rather than a peer-level VPN because the customers' frame is encapsulated inside a provider frame.

The *tags* property of the H.248 *vlan* package is a VPN-ID (called the VLAN identifier, VID; see clause 6.1.1) and is used to assign an H.248 stream of an Ethernet-based ephemeral termination to a particular VLAN.

1.2.1.1 Ethernet VLAN with traffic management extension

[IEEE 802.1p] is an extension of [IEEE 802.1Q]. [IEEE 802.1Q] specifies a tag that appends to an Ethernet MAC frame. The VLAN tag has two parts: The VLAN ID (12 bits) and prioritization (3 bits). The prioritization field was not defined and used in the 802.1Q VLAN standard. [IEEE 802.1p] defines this prioritization field. [IEEE 802.1p] establishes eight levels of priority.

The H.248 *vlan* package addresses [IEEE 802.1p] and [IEEE 802.1Q] by dedicated properties, see clause 6.1.1 and 6.1.2 respectively.

1.2.2 Other NB layer 2 VPNs

For further study.

1.3 NB layer 3 VPN

Support for NB L3 VPNs, e.g., like NB IP VPNs, is for further study.

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.8011.2] ITU-T Recommendation G.8011.2/Y.1307.2 (2005), *Ethernet virtual private line service*.
- [ITU-T H.248.1] ITU-T Recommendation H.248.1 (2005), *Gateway control protocol: Version 3*.
- [ITU-T Y.1311] ITU-T Recommendation Y.1311 (2002), *Network-based VPNs – Generic architecture and service requirements*.
- [ITU-T Y.1314] ITU-T Recommendation Y.1314 (2005), *Virtual private network functional decomposition*.
- [IEEE 802.1ad] IEEE 802.1ad (2005), *IEEE Standard for local and metropolitan area networks – Virtual Bridged Local Area Networks – Amendment 4: Provider Bridges*.
- [IEEE 802.1D] IEEE 802.1D (2004), *IEEE Standard for local and metropolitan area networks – Media Access Control (MAC) Bridges*.
- [IEEE 802.1p] IEEE 802.1p (2004), *LAN Layer 2 QoS/CoS Protocol For Traffic Prioritization* (see clause "Introduction" in [IEEE 802.1Q] on "Relationship between IEEE 802.1D and IEEE 802.1Q").
- [IEEE 802.1Q] IEEE 802.1Q (2005), *IEEE Standard for local and metropolitan area networks – Virtual bridged local area networks*.

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere.

- 3.1.1 NB layer 2 VPN:** See clause 3.3 of [ITU-T Y.1311].
- 3.1.2 NB layer 3 VPN:** See clause 3.4 of [ITU-T Y.1311].
- 3.1.3 NB IP VPN:** See clause 3.4.1 of [ITU-T Y.1311].
- 3.1.4 virtual services network (VSN):** See clause 3.5 of [ITU-T Y.1311].
- 3.1.5 virtual transport network:** See clause 3.6 of [ITU-T Y.1311].

3.2 Terms defined in this Recommendation

None.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CE	Customer Edge
EPL	Ethernet Private Line
ETH	Ethernet MAC layer network
LAN	Local Area Network
MAC	Medium Access Control
MG	Media Gateway

MGC	Media Gateway Controller
NB	Network Based
PE	Provider Edge
PPVPN	Provider Provisioned Virtual Private Network
TCI	Tag Control Information
VID	VLAN Identifier
VLAN	Virtual Local Area Network
VPN	Virtual Private Network
VPN-ID	VPN Identifier
VSN	Virtual Service Network
VTN	Virtual Transport Network

5 Conventions

None.

6 VLAN package for Ethernet VLANs

Package name:	VLAN package
PackageID:	vlan (0x0091) – value allocated by IANA.
Description:	This package enables up to two layer 2 VLAN tags (for "virtual LAN" support in [IEEE 802.1Q] and, additionally, support of "provider VLAN" based on "Q in Q" VLAN stacking in [IEEE 802.1ad]) to be passed to the MG. It also allows a layer 2 priority value (according to [IEEE 802.1p]) to be applied to the given Ethernet-based ephemeral termination.
Version:	1
Extends:	None

6.1 Properties

6.1.1 VLAN tags

Property name:	VLAN tags
PropertyID:	tags (0x0001)
Description:	This property corresponds to one or two VLAN tags. Where two VLAN tags are included, tag stacking (.1q in .1q) shall be implemented. The first tag in the Ethernet frame shall be set to the value of the first tag in the list. Each property list entry relates to a 12-bit <i>VLAN identifier</i> (VID). The VID is part of the IEEE 802.1Q <i>tag control information</i> (TCI) field.
Type:	Sublist of integer
Possible values:	0 to 4096
Default:	None (see also clause 6.6.5).
Defined in:	Local control
Characteristics:	Read/write

6.1.2 Ethernet priority

Property name:	Ethernet priority
PropertyID:	pri (0x0002)
Description:	This property identifies the priority of each VLAN tag. The first priority corresponds to the first VLAN tag, the second priority corresponds to the second VLAN tag.
Type:	Sublist of integer
Possible values:	0 to 7
Default:	None (see also clause 6.6.5).
Defined in:	Local control
Characteristics:	Read/write

6.2 Events

None.

6.3 Signals

None.

6.4 Statistics

None.

6.5 Error Codes

None.

6.6 Procedures

This package can be applied to ephemeral terminations where the MG is using an Ethernet encapsulation on the interface (compliant to [IEEE 802.1p], [IEEE 802.1Q] and [IEEE 802.1ad]). For terminations where the properties are set, the MG adds the given VLAN tag(s) and priorities to the Ethernet encapsulated media flow prior to sending it out of the context.

6.6.1 VPN identification

The MGC indicates a dedicated VLAN by signalling a correspondent *tags* value to the MG. A provisioned default value could be beneficial in case of a single VLAN, used for all Ethernet interfaces of the MG.

6.6.2 QoS marking

The MGC marks the priority of all egress Ethernet frames of an ephemeral termination by signalling a correspondent *priority* value to the MG.

NOTE – The function of QoS marking is possible for many packet-switched bearer technologies (see also *ds* package).

6.6.3 Coupling of both functions

The functions of VLAN tagging and priority setting are decoupled and may be independently applied.

6.6.4 Unsuccessful scenarios

This clause is relevant only when both package properties are used.

The Ethernet is either used as a flat or as a stacked VLAN. The sublist of possible values of both properties has then either one or two list items. The size of both sublists must be the same. Different sublist sizes identify an incorrect signalling of the property values. The MG shall reply with error code #454 ("No such parameter value in this package") in such a case.

6.6.5 Default values for properties

There are no default property values defined by this Recommendation. The primary reason is that a single MG could be connected to multiple VLANs, and every individual VLAN may use a different value range for VLAN tags and/or priorities.

Bibliography

[b-IETF RFC 2764] IETF RFC 2764 (2000), *A Framework for IP Based Virtual Private Networks*.

[b-ETSI TS 102 333] ETSI TS 102 333 (2004), *Gate control protocol*.

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