Network Working Group
Internet Draft
Category: Standard Track

R. Ram, Orckit-Corrigent
D. Cohn, Orckit-Corrigent
R. Key, Telstra
P. Agarwal, Broadcom

Expires: November 18, 2011

May 18, 2011

Extension to LDP-VPLS for E-Tree Using Two PW
draft-ram-l2vpn-ldp-vpls-etree-2pw-02.txt

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Abstract

This document proposes a solution for Metro Ethernet Forum (MEF) Ethernet Tree (E-Tree) support in Virtual Private LAN Service using LDP Signaling (LDP-VPLS) [RFC4762]. The proposed solution is characterized by the use of two PWs between a pair of PEs. This solution is applicable for both VPLS and H-VPLS.

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1. Introduction

This document proposes a solution for Metro Ethernet Forum (MEF) Tree (E-Tree) support in Virtual Private LAN Service using LDP Signaling (LDP-VPLS) [RFC4762].

[Draft ETree VPLS Req] is used as requirement specification.

The proposed solution is characterized by the use of two PWs between a pair of PEs, which requires extension to the current VPLS standard [RFC4762].

This solution is applicable for both VPLS and H-VPLS.

The proposed solution is composed of three main components:

- Current standard LDP-VPLS [RFC4762]
- Extension to LDP-VPLS specified in this document
- PE local split horizon mechanism

2. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC-2119 [RFC2119].

In this document, these words will appear with that interpretation only when in ALL CAPS. Lower case uses of these words are not to be interpreted as carrying RFC-2119 significance.

3. The Problem

[Draft ETree VPLS Req] identifies the problem when there are two or more PEs with both Root AC and Leaf AC.

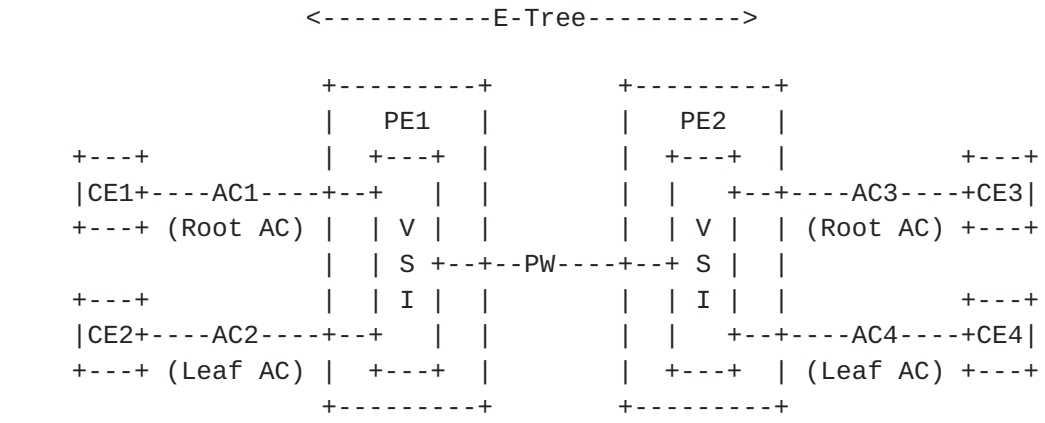


Figure 1: Problem Scenario for Leaf-to-Leaf Communication Restriction

When PE2 receives a frame from PE1 via the Ethernet PW,
- PE2 does not know whether the ingress AC is a Leaf AC or not
- PE2 does not have sufficient information to enforce the Leaf-to-Leaf communication restriction

4. The 2-PW Solution

A simple fix is to carry additional information with each frame on the PW, indicating whether the frame is originated from a Leaf AC or a Root AC on the ingress PE.

The proposed solution uses a pair of PWs to interconnect two VPLS PEs:

- First PW is used for frames originated from Root ACs
- Second PW is used for frames originated from Leaf ACs

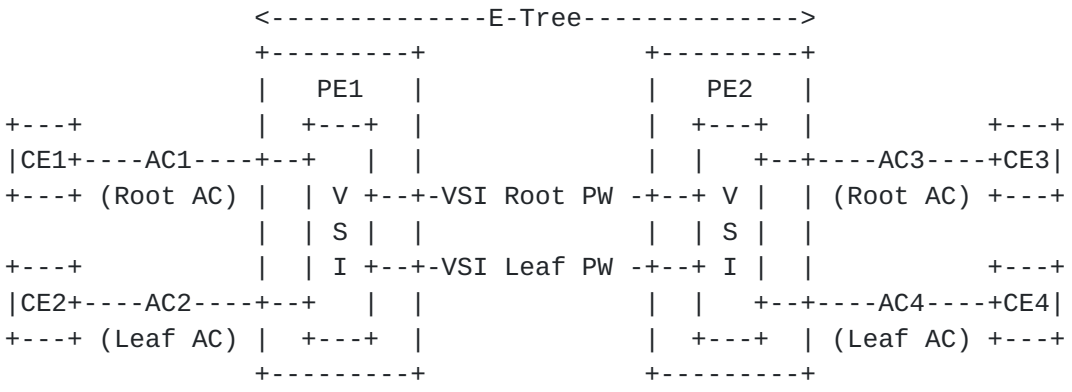


Figure 2: Two-PW Solution for Leaf-to-Leaf Communication Restriction

Extension to current VPLS standard [RFC4762] is required.

5. Extension to VPLS for E-Tree

5.1. AC E-Tree Type

Each AC connected to a specific VPLS instance on a PE MUST have an AC E-Tree Type attribute, either Leaf AC or Root AC. For backward compatibility, the default AC E-Tree Type MUST be Root.

This AC E-Tree Type is locally configured on a PE and no signaling is required between PEs.

5.2. VSI E-Tree Type and Identifier

Two new PW interface parameters (as defined in section 5.5 of [RFC4447]) are defined for use in E-Tree VPLS: VSI E-Tree type and VSI E-Tree identifier.

VSI E-Tree type can be either root or leaf and identifies VSI root PW and VSI leaf PW respectively, as defined in section 4.

VSI E-tree identifier is a number that is used to identify a pair of root and leaf PW as part of the same logical VSI interface.

On reception, the two PWs SHALL be handled as the same logical VSI interface with respect to MAC address learning/forwarding, e.g. traffic SHALL NOT be forwarded between such PWs and MAC addresses arriving at one of the PWs SHALL be learned with a common logical VSI interface.

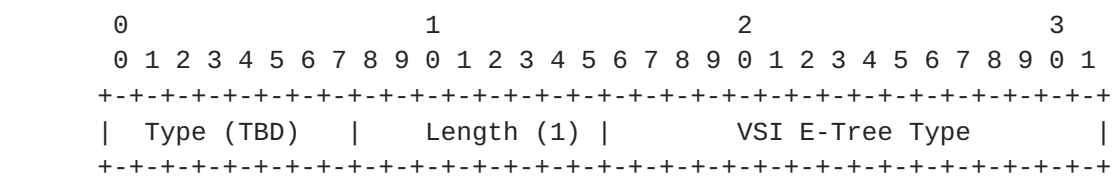
On transmission, the VPLS processing entity SHALL send root-originated traffic via the root PW, and SHALL send leaf-originated traffic via the leaf PW.

The <VSI E-Tree type, VSI E-Tree identifier> pair SHALL be unique in PWs connecting a pair of VPLS PEs.

5.2.1. VSI E-Tree Type Encoding

The VSI E-Tree type field is encoded as an interface parameters sub-TLV (as defined in section 5.5 of [RFC4447]).

The field structure is defined as follows:



VSI E-tree Type can take the following values:

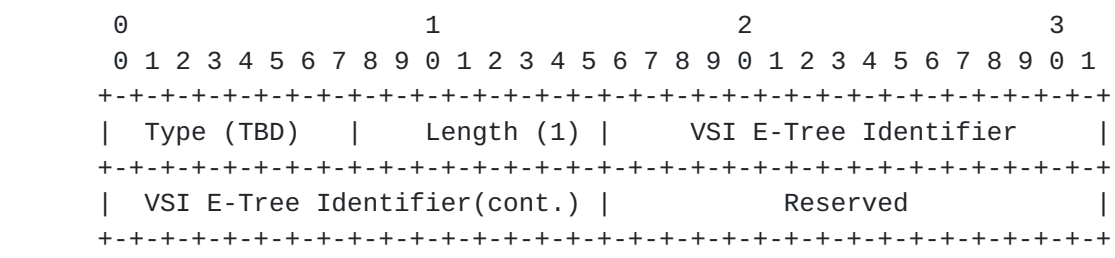
0 E-Tree Root VSI

1 E-Tree Leaf VSI

5.2.2. VSI E-Tree Identifier Encoding

The VSI E-Tree identifier field is encoded as an interface parameters sub-TLV (as defined in section 5.5 of [RFC4447]).

The field structure is defined as follows:



VSI E-tree Identifier is a 32-bit number that is used to identify a pair of root and leaf PW as part of the same logical VSI interface, in the context of a pair of VPLS PEs.

The reserved field SHALL be set to zero.

5.3. Additional Filtering in Data Forwarding

An egress PE SHALL NOT deliver a frame originated at a leaf AC to another leaf AC.

The following specifies how AC E-Tree type per frame is determined:

- A frame received from a root PW indicates that the frame was originated from a root AC

- A frame received from a leaf PW indicates that the frame was originated from a leaf AC.

- For the case where both ingress AC and egress AC are on the same PE, local split horizon implementation on the PE will be sufficient, and is not further discussed in this document.

5.4. Root/Leaf PWs Signaling

Signaling of root and leaf PWs is required only when two PWs are used for interconnecting between pair of VSIs. As explained in section . 5.2. :

- Root VSI E-Tree type SHALL be used to signal a root PW.
- Leaf VSI E-Tree type be used to signal a leaf PW.

PW type signaling rules remain as defined in [RFC4447].

5.5. Supporting Remote AC

When PW is used to interconnect between VSI and a remote AC (e.g. the PW1, PW2 in Figure 3), an Ethernet Raw or Ethernet tagged PW types SHALL be used as defined in [RFC4762].

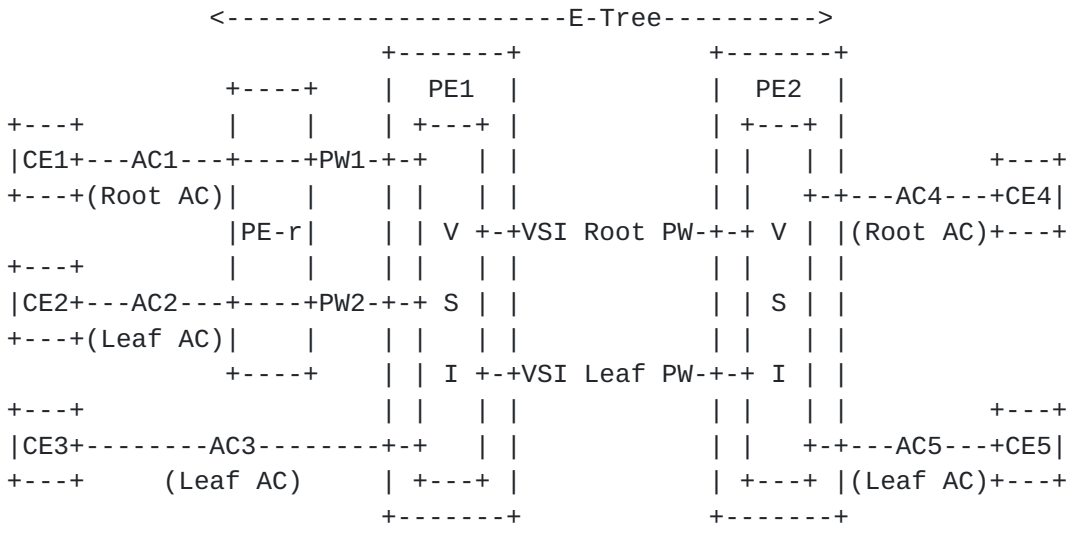


Figure 3: VPLS with Remote AC Connectivity

In addition, the AC type i.e. Root or leaf, SHALL be locally provisioned on the VSI side to specify the remote AC E-Tree Type per PW. Moreover, such PWs that are used for interconnecting between a remote AC and a VSI SHALL considered as separate logical VSI interfaces with respect to MAC address learning/forwarding e.g. traffic forwarding between such PWs is allowed as long as they are not both defined as Leaf.

In Figure 3, AC1 is remotely interconnected to the VPLS service via PW1, and AC2 is remotely interconnected to the VPLS service via PW2.

AC1 is a Root AC and therefore the local type for PW1 in PE1 SHALL be Root.

AC2 is a Leaf AC and therefore the local type for PW2 in PE1 SHALL be Leaf.

6. Backward Compatibility

Root or leaf VSI E-Tree type and identifier parameters SHALL be used only in cases where both PEs are VPLS capable and both support E-Tree root/leaf.

In a case where one of the peers do not support E-Tree, VSI E-Tree type and identifier parameters SHALL NOT be used.

7. Compliance with Requirements

This refers to [Draft ETree VPLS Req] Section 5. Requirements.

The solution prohibits communication between any two Leaf ACs in a VPLS instance.

The solution allows multiple Root ACs in a VPLS instance.

The solution allows Root AC and Leaf AC of a VPLS instance co-exist on any PE.

The solution is applicable to LDP-VPLS [RFC4762].

The solution is applicable to Case 1: Single technology "VPLS Only".

8. Security Considerations

This will be added in later version.

9. IANA Considerations

Additional assignments will be required for the new interface parameter sub-TLV types introduced in Section 4.2. Details will be added in a later version.

10. Acknowledgements

The authors wish to acknowledge the contributions of Luca Martini and Amir Halperin.

11. References

11.1. Normative References

[RFC2119] Bradner, S., Key words for use in RFCs to Indicate Requirement Levels, BCP 14, RFC 2119, March 1997.

[RFC4447] Martini, L., and al, Pseudowire Setup and Maintenance Using the Label Distribution Protocol (LDP), April 2006

[RFC4762] Lasserre & Kompella, Virtual Private LAN Service (VPLS) Using Label Distribution Protocol (LDP) Signaling, January 2007

11.2. Informative References

[Draft VPLS ETree Req] Key, et al., Requirements for MEF E-Tree Support in VPLS, draft-key-l2vpn-vpls-etree-reqt-01.txt, September 2010

Authors' Addresses

Rafi Ram
Orckit-Corrigent
126 Yigal Alon st.
Tel Aviv, Israel
Email: rafir@orckit.com

Daniel Cohn
Orckit-Corrigent
126 Yigal Alon st.
Tel Aviv, Israel
Email: danielc@orckit.com

Raymond Key
Telstra
242 Exhibition Street, Melbourne
VIC 3000, Australia
Email: raymond.key@team.telstra.com

Puneet Agarwal
Broadcom
3151 Zanker Road
San Jose, CA 95134
Email: pagarwal@broadcom.com