TRILL Working Group INTERNET-DRAFT Donald Eastlake Zhenbin Li Shunwan Zhuang Haibo Wang Huawei Technologies

Intended status: Proposed Standard Expires: March 4, 2019

September 5, 2018

EVPN All Active Usage Enhancement

<draft-eastlake-bess-enhance-evpn-all-active-01.txt>

Abstract

A principal feature of EVPN is the ability to support multihoming from a customer equipment (CE) to multiple provider edge equipment (PE) active with all-active links. This draft specifies an improvement to load balancing such links.

Status of This Memo

This Internet-Draft is submitted to IETF in full conformance with the provisions of <u>BCP 78</u> and <u>BCP 79</u>.

Distribution of this document is unlimited. Comments should be sent to the BESS working group mailing list <bess@ietf.org>.

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

The list of current Internet-Drafts can be accessed at http://www.ietf.org/lid-abstracts.html. The list of Internet-Draft Shadow Directories can be accessed at http://www.ietf.org/shadow.html.

[Page 1]

1. Introduction
<pre>2. Improved Load Balancing5 2.1 Problem 1: Traffic Bypassing5 2.2 Problem 2: VID Encapsulation Confusion6</pre>
<u>3</u> . VLAN-Redirect-Extended Community Attribute7
4. Operation
<u>5</u> . IANA Considerations <u>9</u> <u>6</u> . Security Considerations <u>9</u>
Normative References <u>10</u> Informative References <u>10</u>
Acknowledgements <u>10</u> Authors' Addresses <u>11</u>

[Page 2]

1. Introduction

A principal feature of EVPN (Ethernet VPN [RFC7432]) is the ability to support multihoming from a customer equipment (CE) to multiple provider edge equipment (PE) with links used in an all-active redundancy mode. That mode is where a device is multihomed to a group of two or more PEs and where all PEs in such redundancy group can forward traffic to/from the multihomed device or network for a given VLAN [RFC7209]. This draft specifies an improvement in load balancing such PE to CE all-active multi-homing links.

In the case where a CE is multihomed to multiple PE nodes, using a Link Aggregation Group (LAG) with All-Active redundancy, it is possible that only a single PE learns a set of the MAC addresses associated with traffic transmitted by the CE. This leads to a situation where remote PE nodes receive MAC/IP Advertisement routes for these addresses from a single PE, even though multiple PEs are connected to the multihomed segment.

To address this issue, EVPN introduces the concept of "aliasing", which is the ability of a PE to signal that it has reachability to an EVPN instance (EVI) on a given Ethernet segment (ES) even when it has learned no MAC addresses from that EVI/ES. The Ethernet A-D per EVI route is used for this purpose. A remote PE that receives a MAC/IP Advertisement route with a non-reserved ESI SHOULD consider the advertised MAC address to be reachable via all PEs that have advertised reachability to that MAC address's EVI/ES via the combination of an Ethernet A-D per EVI route for that EVI/ES (and Ethernet tag, if applicable) AND Ethernet A-D per ES routes for that ES with the "Single-Active" bit in the flags of the ESI Label extended community set to 0.

<u>1.1</u> Terminology and Acronyms

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in <u>BCP</u> <u>14</u> [<u>RFC2119</u>] [<u>RFC8174</u>] when, and only when, they appear in all capitals, as shown here.

This document uses the following acronyms and terms:

A-D - Auto Discovery.

All-Active Redundancy Mode - When a device is multihomed to a group of two or more PEs and when all PEs in such redundancy group can forward traffic to/from the multihomed device or network for a given VLAN.

D. Eastlake, et al

[Page 3]

- CE Customer Edge equipment.
- ES Ethernet Segment.
- ESI Ethernet Segment Identifier.
- EVI EVPN Instance.
- EVPN Ethernet VPN [RFC7432].
- FRR Fast ReRoute.
- MAC Media Access Control.
- PE Provider Edge equipment.
- Single-Active Redundancy Mode When a device or a network is multihomed to a group of two or more PEs and when only a single PE in such a redundancy group can forward traffic to/from the multihomed device or network for a given VLAN.

VPN - Virtual Private Network.

[Page 4]

2. Improved Load Balancing

Consider the example in Figure 1. CE1 is multihomed to PE1 and PE2. CE1 typically uses a hash algorithm to determine whether to send a particular traffic to PE1 or to PE2. Thus, if such traffic from CE1 is only sent to PE1, then PE1 will learn CE1's MAC address(es) and that PE2 will not.

PE3 and PE4 can do aliasing [RFC7432] because PE1 and PE2 will be advertising the same ESI. Thus PE3 and PE4 will expect that a MAC address reachable from PE1 will also be reachable from PE2. This aliasing will cause PE3 and PE4 to load balance to CE1's MAC(s), sending some traffic to PE1 and some to PE2.

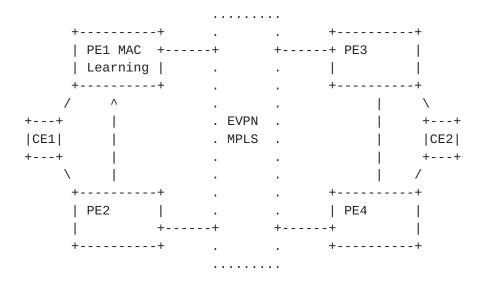


Figure 1. Current Situation

There are two problems associated with this situation that are described in the subsections below. <u>Section 3</u> describes the mechanism to address these problems.

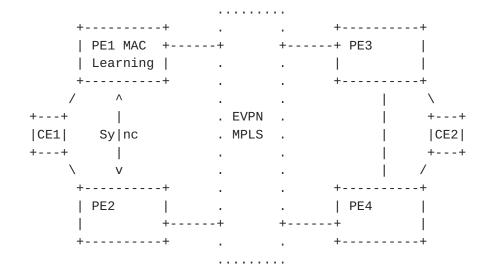
2.1 Problem 1: Traffic Bypassing

Since PE2 has not learning CE1's MAC(s), the MAC lookup at PE2 will find that MAC address associated with PE1. PE2 will then tunnel the traffic to PE1.

As an enhancement that solves this problem, PE1 can send MAC address(es) with VLAN and ESI information. PE2 will then receive the MAC address(es) and VLAN that PE1 associates with the ESI and PE2 can use this to update its forwarding tables (see Figure 2). As a result, when traffic addressed to a CE1 MAC arrives at PE2, it can send it on the appropriate local interface and VLAN. This avoids the unnecessary

D. Eastlake, et al

[Page 5]



extra hop through PE1 for such traffic arriving at PE2.

Figure 2. With Enhancement

<u>2.2</u> Problem 2: VID Encapsulation Confusion

If CE1 is connected through a VLAN and has only one VLAN under the EVPN instance of PE2, the unicast traffic can be directly sent to the appropriate interface and encapsulated with the appropriate VID and forwarded to CE1.

However, there may be multiple ways for CE1 to connect to PE1 and PE2, including Ethernet Tag, Ethernet Tag termination, and Q-in-Q. PE2 cannot always obtain the appropriate VLANs and in such cases PE2 is missing the information needed to forward the unicast traffic to CE1 directly.

[Page 6]

INTERNET-DRAFT

3. VLAN-Redirect-Extended Community Attribute

This document defines a new BGP extended community attribute called the VLAN-Redirect-Extended Community attribute as shown in Figure 3.

0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 4 5 6 7 8 8 7

Figure 3. VLAN-Redirect-Extended Community Attribute

Where:

0x06: EVPN Extended Community Type field.

- Sub-Type: Sub-Type field indicating that the extended community attribute is a VLAN-Redirect-Extended Community attribute, and the value is TBA as assigned by the IANA.
- Flags: 8 bits of identification information. Bit 0 set to 0 indicates that the action is redirected to the VLANs in this community

Reserved: Not used. MUST be sent as zero and ignored on receipt.

S-VLAN: Outer VLAN information, can not be 0, 0 is illegal value

C-VLAN: Inner VLAN information. When 0, it means there is no C-VLAN.

[Page 7]

4. Operation

Operation with the solution specified in <u>Section 3</u> and the topology shown in Figure 2 is described below.

4.1 Establishment

- PE1 learns MAC addresses from CE1, advertises them to PE2, carries the ESI value as ES1 and the next hop as PE1, and carries the VLAN- Redirect-Extended Community attributes.
- PE2 receives the MAC route advertised by PE1 and finds the interface that connects to CE1 locally according to the ESI value. At the same time, PE2 fills in the VLAN information according to the VLAN-Redirect-Extended Community attributes
- 3. At the same time, PE2 generates a fast reroute (FRR) entry according to the next hop information (PE1) of the MAC route, that is, a MAC address entry on PE2, where the primary path points to the CE1 link and the standby path points to PE1
- 4. PE2 also sends the MAC as a local MAC route to PE1
- 5. PE1 receives the MAC route advertised by PE2 and generates the FRR entry with the MAC route learned by CE1, that is, the MAC address entry on PE1, with the primary path pointing to the CE1 link and the secondary path pointing to PE2

4.2 Handling Link Failure

- 1. When the link between PE1 and CE1 fails, PE1 withdraws the MAC address that advertised to PE2
- PE2 receives the MAC withdrawal from PE1, does not delete the MAC immediately, but starts an aging timer, and does not withdraw the MAC address that PE1 advertised to PE2.
- 3. When the aging timer expires, if PE2 cannot receive the traffic from CE1, then PE2 withdraws the MAC address that was advertised to PE2 by PE1 and deletes the MAC entry. If PE2 can communicate directly with CE1, it just eliminates the FRR standby path to PE1.

[Page 8]

<u>5</u>. IANA Considerations

IANA is requested to assign a new EVPN Extended Community SubType as follows:

Sub-Type Value	Name	Reference
TBA	VLAN-Redirect Extended Community	[this doc]

<u>6</u>. Security Considerations

TBD

For general EVPN Security Considerations, see [<u>RFC7432</u>].

[Page 9]

Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", <u>BCP 14</u>, <u>RFC 2119</u>, DOI 10.17487/RFC2119, March 1997, <<u>http://www.rfc-editor.org/info/rfc2119</u>>.
- [RFC7432] Sajassi, A., Ed., Aggarwal, R., Bitar, N., Isaac, A., Uttaro, J., Drake, J., and W. Henderickx, "BGP MPLS-Based Ethernet VPN", <u>RFC 7432</u>, DOI 10.17487/RFC7432, February 2015, <<u>https://www.rfc-editor.org/info/rfc7432</u>>.
- [RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in <u>RFC</u> 2119 Key Words", <u>BCP 14</u>, <u>RFC 8174</u>, DOI 10.17487/RFC8174, May 2017, <<u>https://www.rfc-editor.org/info/rfc8174</u>>.

Informative References

[RFC7209] - Sajassi, A., Aggarwal, R., Uttaro, J., Bitar, N., Henderickx, W., and A. Isaac, "Requirements for Ethernet VPN (EVPN)", <u>RFC 7209</u>, DOI 10.17487/RFC7209, May 2014, <<u>https://www.rfc-editor.org/info/rfc7209</u>>.

Acknowledgements

The authors of this document would like to thank the following for their comments and review of this document:

TBD

[Page 10]

Authors' Addresses

Donald E. Eastlake, 3rd Huawei Technologies 1424 Pro Shop Court Davenport, FL USA

Phone: +1-508-333-2270 Email: d3e3e3@gmail.com

Zhenbin Li Huawei Technologies Huawei Bldg., No. 156 Beiqing Road Beijing 100095 China

Email: lizhenbin@huawei.com

Shunwan Zhang Huawei Technologies Huawei Bldg., No. 156 Beiqing Road Beijing 100095 China

Email: zhuangshunwan@huawei.com

Haibo Wang Huawei Technologies Huawei Bldg., No. 156 Beiqing Road Beijing 100095 China

Email: rainsword.wang@huawei.com

[Page 11]

Copyright, Disclaimer, and Additional IPR Provisions

Copyright (c) 2018 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to <u>BCP 78</u> and the IETF Trust's Legal Provisions Relating to IETF Documents

(http://trustee.ietf.org/license-info) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License. The definitive version of an IETF Document is that published by, or under the auspices of, the IETF. Versions of IETF Documents that are published by third parties, including those that are translated into other languages, should not be considered to be definitive versions of IETF Documents. The definitive version of these Legal Provisions is that published by, or under the auspices of, the IETF. Versions of these Legal Provisions that are published by third parties, including those that are translated into other languages, should not be considered to be definitive versions of these Legal Provisions. For the avoidance of doubt, each Contributor to the IETF Standards Process licenses each Contribution that he or she makes as part of the IETF Standards Process to the IETF Trust pursuant to the provisions of RFC 5378. No language to the contrary, or terms, conditions or rights that differ from or are inconsistent with the rights and licenses granted under RFC 5378, shall have any effect and shall be null and void, whether published or posted by such Contributor, or included with or in such Contribution.

[Page 12]