BESS Working Group   R. Singh
INTERNET-DRAFT   K. Kompella
Intended Status: Proposed Standard   Juniper Networks
                                                   S. Palislamovic
                                                    Alcatel-Lucent
Expires: March 14, 2016   September 11, 2015

           Updated processing of control flags for BGP VPLS
                draft-singh-bess-bgp-vpls-control-flags-01

Abstract

   This document updates the meaning of the "control flags" fields
   inside the "layer2 info extended community" used for BGP-VPLS NLRI.

Status of this Memo

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   provisions of BCP 78 and BCP 79.

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1 Introduction

[RFC4761] describes the concepts and signaling for using BGP to setup a VPLS. It specifies the BGP VPLS NLRI that a PE may require other PEs in the same VPLS to include (or not) control-word and sequencing information in VPLS frames sent to this PE.

The use of control word (CW) helps prevent mis-ordering of IPv4 or IPv6 PW traffic over ECMP-paths/LAG-bundles. [RFC4385] describes the format for control-word that may be used over point-2-point PWs and over a VPLS. It along with [RFC3985] also describes sequencing of frames.

However, [RFC4761] does not specify the behavior of PEs in a mixed environment where some PEs support control-word/sequencing and others do not.

1.1 Terminology

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].

2 Problem

[RFC4761] specifies the use of a VPLS BGP NLRI by which a given PE advertises the required behavior off multiple PEs participating in the same VPLS. The behavior required off the multiple PEs identified by the NLRI indicates the VPLS label they should use in the VPLS traffic being forwarded to this PE. Additionally, by using the "control flags" this PE specifies whether the other PEs (in the same VPLS) should use control-word or sequenced-delivery for frames forwarded to this PE. These are respectively indicated by the C and the S bits in the "control flags" as specified in section 3.2.4 in [RFC4761].

[RFC4761] requires that if the advertising PE sets the C and S bits, the receiving PE MUST honor the same by inserting control word (CW) and by including sequence numbers respectively.

However, in a BGP VPLS deployment there would often be cases where a PE receiving the VPLS BGP NLRI may not have the ability to insert a CW or include sequencing information inside PW frames. Thus, the behavior of BGP VPLS needs to be further specified.

This document updates the meaning of the control flags in layer2 extended community in the BGP VPLS NLRI and specifies the resulting forwarding behavior for a mixed mode environment where not every PE

   in a VPLS has the ability or the configuration to honor the control
   flags received from the PE advertising the BGP NLRI.

**[3](#) Updated meaning of control flags in the layer2 info extended
   community**

   Current specification does not allow for the CW setting to be
   negotiated. Rather, if a PE sets the C-bit, it expects to receive
   VPLS frames with a control word, and will send frames the same way.
   If the PEs at both ends of a pseudowire do not agree on the setting
   of the C-bit, the PW does not come up. The expected behavior is
   similar for the S-bit.

   This memo updates the meaning of the C-bit and the S-bit in the
   control flags.

[3.1](#) Control word (C-bit)

   If a PE sets the C-bit in its NLRI, it means that the PE has ability
   to send and receive frames with a control word. If the PEs at both
   ends of a PW set the C-bit, control words MUST be used in both
   directions of the PW. If both PEs send a C-bit of 0, control words
   MUST not be used on the PW. These two cases behave as before.

   However, if the PEs don't agree on the setting of the C-bit, control
   words MUST not be used on that PW but the PW MUST NOT be prevented
   from coming up due to this mismatch. So, the PW MUST still come up.
   This behavior is new; the old behavior was that the PW doesn't come
   up.

[3.2](#) Sequence flag (S-bit)

   Current BGP VPLS implementation do not allow for S-bit setting to be
   negotiated either. If the PE sets the S-bit, it expects to receive
   VPLS frames with sequence numbers, and will send the frames with the
   sequence numbers as well. This memo further specifies the existing
   behavior. If the PEs on the both ends of the PW set the S-bit, then
   both PEs MUST include the PW sequence numbers. If the PEs at both
   ends of the PW do not agree on the setting of the S-bit, the PW
   SHOULD NOT come up at all.

[4](#) Using p2mp LSP as transport for BGP VPLS

   BGP VPLS can be used over point-2-point LSPs acting as transport
   between the VPLS PEs. Alternately, BGP VPLS may also be used over
   p2mp LSPs with the source of the p2mp LSP rooted at the PE
   advertising the VPLS BGP NLRI.

   In a network that uses p2mp LSPs as transport for BGP VPLS, in a
   given VPLS there may be some PEs that support control-word while
   others do not. Similarly, for sequencing of frames.

   In such a setup, a source PE that supports control-word should setup
   2 different p2mp LSPs such that:
   - one p2mp LSP will carry CW-marked frames to those PEs that
     advertised C-bit as 1, and
   - the other p2mp LSP will carry frames without CW to those PEs
     that advertised C-bit as 0.

   However, the set of leaves on the 2 p2mp LSPs (rooted at the given
   PE) MUST NOT contain any PEs that advertised a value for S-bit
   different from what this PE itself is advertising.

   Using 2 different p2mp LSPs to deliver frames with and without CW
   to different PEs ensures that this PE honors the C-bit advertised
   by the other PEs.

   By not having PEs that advertised their S-bit value differently
   (from what this PE advertised) on either of the p2mp LSPs, it is
   ensured that this PE is sending VPLS frames only to those PEs that
   agree on the setting of S-bit with this PE.

[5](#). Treatment of C and S bits in multi-homing scenarios

[5.1](#) Control word (C-bit)

   In multi-homed environment, different PEs may effectively represent
   the same service destination end point. It could be assumed that
   the end-to-end PW establishment process should follow the same
   rules when it comes to control word requirement, meaning setting
   the C-bit would be enforced equally toward both primary and backup
   designated forwarder together.

   However, it is to be noted that in the multi-homing case, each PW
   SHOULD be evaluated independently. Assuming the below specified
   network topology, there could be the case where PW between PE2 and
   PE1 could have control word signaled via extended community and
   would be used in the VPLS frame, while PE2 to PE4 PW would not

insert the control word in the VPLS frame due to C-bit mismatch.
The rest of PEs multi-homing behavior should simply follow the
rules specified in draft-ietf-bess-vpls-multihoming-00.

5.2 Sequence flag (S-bit)

In multi-homed environment, different PEs may effectively represent
the same service destination end point. In this case, the rules
for end-to-end PW establishment SHOULD follow the same rules when
it comes to sequence bit requirements. Consider the case below
with CE5 being multi-homed to PE4 and PE1. The PW behavior is
similar to the C-word scenario so that the insertion of S-bit
evaluation SHOULD be independent per PW. However, because S-bit
mismatch between two end-point PEs yields in no PW establishment,
in the case where PE4 doesn't support S-bit, only one PW would be
established, between PE1 and PE2. Thus, even though CE5 is
physically multi-homed, due to PE4's lack of support for S-bit, and
no PW between PE1 and PE4, CE5 would not be multi-homed any more.

6 Illustrative diagram

```
                                              -----
                                            /   A1  \
         ----                         ____CE1        |
        /    \        --------      --------  /    |        |
       |  A2 CE2-      /        \    /         PE1     \      /
        \   /   \    /          \___/          | \     -----
         ----      ---PE2                      |   \
                    |                          |    \  -----
                    | Service Provider Network |     \ /     \
                    |                          |       CE5   A5
                    |           ___            |    /  \     /
                     \         /    \          PE4_/     -----
                PE3          /       \        /
            |------/  \-------        -------
         ----   /   |    ----
        /    \/    \   /    \              CE = Customer Edge Device
       |  A3 CE3    --CE4 A4 |             PE = Provider Edge Router
        \    /        \    /
         ----          ----                A<n> = Customer site n
```
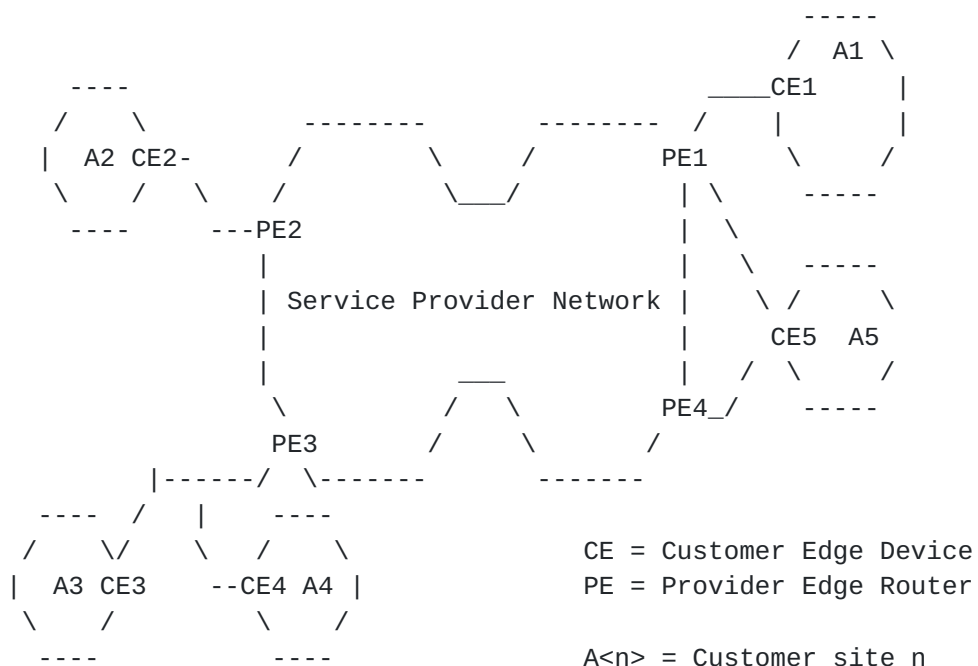
Figure 1: Example of a VPLS

In the above topology, let there be a VPLS configured with the PEs as
displayed. Let PE1 be the PE under consideration that is CW enabled.
Let PE2 and PE3 also be CW enabled. Let PE4 not be CW enabled. PE1

will advertise a VPLS BGP NLRI, containing the C/S bits marked as 1.
PE2 and PE3 on learning of NLRI from PE1, shall include the control
word in VPLS frames being forwarded to PE1. However, PE4 which does
not have the ability to include control-word.

As per [RFC4761], PE1 would have an expectation that all other PEs
forward traffic to it by including CW. That expectation cannot be met
by PE4 in this example. Thus, as per [RFC4761] the PW between PE1 and
PE4 does not come up.

However, this document addresses how to support the mixed-CW
environment as above. PE1 will bring up the PW with PE4 despite the
CW mismatch. Additionally, it will setup its data-plane such that it
will strip the control-word only for those VPLS frames that are
received from PEs that are themselves indicating their desire to
receive CW marked frames. So, PE1 will setup its data plane to strip-
off the CW only for VPLs frames received from PEs PE2 and PE3. PE1
will setup its data plane to not strip CW from frames received from
PE4.

7 Security Considerations

No new security issues.

8 IANA Considerations

None.

9 References

9.1 Normative References

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

[RFC4761]   Kompella, K., Y. Rekhter, Virtual Private LAN Service
             (VPLS) Using BGP for Auto-Discovery and Signaling,
             RFC 4761, January 2007.

[RFC4385]   Bryant, S., Swallow G., Martini L., D. McPherson,
             Pseudowire Emulation Edge-to-Edge (PWE3) Control Word,
             RFC 4385, February 2006.

[RFC3985]   Bryant, S., P. Pate, Pseudo Wire Emulation
             Edge-to-Edge (PWE3) Architecture, RFC3985, March 2005.

Authors' Addresses

        Ravi Singh
        Juniper Networks
        1194 N. Mathilda Ave.
        Sunnyvale, CA 94089
        US
        EMail: ravis@juniper.net

        Kireeti Kompella
        Juniper Networks
        1194 N. Mathilda Ave.
        Sunnyvale, CA 94089
        US
        EMail: kireeti@juniper.net

        Senad Palislamovic
        Alcatel-Lucent
        EMail: senad.palislamovic@alcatel-lucent.com