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Internet-Draft H.
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Intended status: Standards Track Huawei
Technologies
Expires: May 26, 2013 November 22,
2012

Pseudowire Redundancy on S-PE
draft-dong-pwe3-redundancy-spe-04

Abstract

This document describes Multi-Segment Pseudowire (MS-PW) protection scenarios in which the pseudowire redundancy is provided on the Switching-PE (S-PE). Operations of the S-PEs which provide PW redundancy are specified. Signaling of the preferential forwarding status as defined in [I-D.ietf-pwe3-redundancy-bit] is reused. This document does not require any change to the T-PEs of MS-PW.

Requirements Language

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].

Table of Contents

1. Introduction

[RFC6718] describes the framework and requirements for pseudowire (PW) redundancy, and [I-D.ietf-pwe3-redundancy-bit] specifies Pseudowire (PW) redundancy mechanism for scenarios where a set of redundant PWs is configured between provider edge (PE) nodes in single-segment pseudowire (SS-PW) [RFC3985]applications, or between terminating provider edge (T-PE) nodes in multi-segment pseudowire (MS-PW) [RFC5659] applications.

In some MS-PW scenarios, there are some benefits to provide PW redundancy on S-PEs, such as reducing the burden on the access T-PE nodes, and faster protection switching. This document describes some scenarios in which PW redundancy is provided on S-PEs, and specifies the operations of the S-PEs. Signaling of the preferential forwarding status as defined in [I-D.ietf-pwe3-redundancy-bit] is reused. This document does not require any change to the T-PEs of MS-PW.

2. PW Redundancy on S-PE

In some MS-PW deployment scenarios, there are some benefits to provide PW redundancy on S-PEs. This section gives some examples of PW redundancy on S-PE.

```
                                                +-----+
             +---+                 +-----+      |     |    +---+
             |   |                 |     |------|T-PE2|----|   |
             |   |    +-----+      |  ..PW-Seg2.......|    |   |
             |   |    |....PW-Seg1.....  |      +-----+    |   |
             |CE1|----|T-PE1|------|S-PE1|                 |CE2|
             |   |    |     |      |  .  |      +-----+    |   |
             |   |    +-----+      |  ..PW-Seg3.......|    |   |
             |   |                 |     |------|T-PE3|----|   |
             +---+                 +-----+      |     |    +---+
                                                +-----+
```

Figure 1.MS-PW Redundancy on S-PE

As illustrated in Figure 1, CE1 is connected to T-PE1 while CE2 is dual-homed to T-PE2 and T-PE3. T-PE1 is connected to S-PE1 only, and S-PE1 is connected to T-PE2 and T-PE3. The MS-PW is switched on S-PE1, and PW-Seg2 and PW-Seg3 provides resiliency on S-PE1 for failure of T-PE2 or T-PE3 or the connected ACs. PW-Seg2 is selected as primary PW segment, and PW-Seg3 is secondary PW segment.

MS-PW redundancy on S-PE is beneficial for the scenario in Figure 1 since T-PE1 as an access node may not be able to provide PW

redundancy, especially when the PW-Seg1 between T-PE1 and S-PE1 is statically configured. And with PW redundancy on S-PE, the number of PW segments needed between T-PE1 and S-PE1 is only half of the number of PW segments needed for end-to-end MS-PW redundancy. In addition, PW redundancy on S-PE could provide faster protection switching than end-to-end protection switching of MS-PW.

```
          +---+    +-----+      +-----+           +-----+
          |   |    |     |      |     |           |     |
          |   |    |......PW1-Seg1......PW1-Seg2........|
          |   |    |               .  |           |     |
          |CE1|----|T-PE1|------|S-PE1|-----------|T-PE2|
          |   |    |   . |      |  .  | PW1-Seg3  |     |    +---+
          |   |    +---.-+      |  .........      ......|----|   |
          |   |       |.        |     |    .     .|     |    |   |
          +---+       |.        +-----+     .   . +-----+    |   |
                      |.                     . .             |CE2|
                      |.                      ..             |   |
                      |.        +-----+      .  . +-----+    |   |
                      |.        |     |     .    .|     |----|   |
                      |...PW2-Seg1..........      ......|    +---+
                      |         |  .  | PW2-Seg2  |     |
                      ----------|S-PE2|-----------|T-PE3|
                                |  .  |           |     |
                                |  .....PW2-Seg3........|
                                |     |           |     |
                                +-----+           +-----+
```

Figure 2. MS-PW Redundancy on S-PE with S-PE protection

As illustrated in Figure 2, CE1 is connected to T-PE1 while CE2 is dual-homed to T-PE2 and T-PE3. T-PE1 is connected to S-PE1 and S-PE2, and both S-PE1 and S-PE2 are connected to T-PE2 and T-PE3. There are two MS-PWs which are switched at S-PE1 and S-PE2 respectively to provide S-PE node protection. For MS-PW1, the S-PE1 provides resiliency using PW1-Seg2 and PW1-Seg3. For MS-PW2, the S-PE2 provides resiliency using PW2-Seg2 and PW2-Seg3. MS-PW1 is the primary PW and PW1-Seg2 is the primary PW segment.

MS-PW redundancy on S-PE is beneficial for the scenario in Figure 2 since it reduces the number of end-to-end MS-PWs required for both T-PE and S-PE protection. In addition, PW redundancy on S-PE could provide faster protection switching than end-to-end protection switching of MS-PW.

3. S-PE Operations

For an S-PE which provides PW redundancy, it is important to

advertise proper preferential forwarding status to the PW segments on both sides and perform protection switching according to the received status. This section specifies the operations of S-PEs on which PW redundancy is provisioned. This document does not make any change to the T-PEs of MS-PW.

The S-PE SHOULD work as a Slave node for the single-connected side, and SHOULD work in Independent mode for the multi-connected side. The S-PE SHOULD pass the preferential forwarding status received from the single-connected side unchanged to the PW segments on the multi-connected side. The S-PE SHOULD advertise Standby status to the single-connected side if it receives Standby status from all the PW segments on the multi-connected side, and it SHOULD advertise Active status to the single-connected side if it receives Active status from any of the PW segments on the multi-connected side. For the single-connected side, the active PW segment is determined by the T-PE on this side, which works as the Master node. On the multi-connected side, the PW segment which has both local and remote Preferential Forwarding status as Active SHOULD be selected for traffic forwarding.

The Signaling of Preferential Forwarding bit defined in [I-D.ietf-pwe3-redundancy-bit] is reused in these scenarios.

For the scenario in Figure 1, assume the AC from CE2 to T-PE2 is active. In normal operation, S-PE1 would receive Active Preferential Forwarding status bit on the single-connected side from T-PE1, then it would advertise Active Preferential Forwarding status bit on both PW-Seg2 and PW-Seg3. T-PE2 and T-PE3 would advertise Active and Standby preferential status bit respectively to S-PE1, reflecting the forwarding state of the two ACs to CE2. By matching the local and remote Up/Down status and Preferential Forwarding status, PW-Seg2 would be used for traffic forwarding.

On failure of the AC between CE2 and T-PE2, the forwarding state of AC on T-PE3 is changed to Active. T-PE3 then advertises Active Preferential Status to S-PE1, and T-PE2 would advertise the Preferential Status bit of Standby to S-PE1. S-PE1 would perform the switchover according to the updated local and remote Preferential Forwarding status, and select PW-Seg3 for traffic forwarding. Since S-PE1 still connects to an Active PW segment on the multi-connected side, it will not advertise any change of the PW Preferential Forwarding status to T-PE1. T-PE1 would not be aware of the switchover on S-PE1.

For scenario of Figure 2, assume the AC from CE2 to T-PE2 is active. T-PE1 works in Master mode and it would advertise Active and Standby Preferential Forwarding status bit respectively to S-PE1 and S-PE2.

According to the received Preferential Forwarding status bit, S-PE1 would advertise Active Preferential Forwarding status bit to both T-PE2 and T-PE3, and S-PE2 would advertise Standby Preferential Forwarding status bit to both T-PE2 and T-PE3. T-PE2 would advertise Active Preferential Forwarding status bit to both S-PE1 and S-PE2, and T-PE3 would advertise Standby Preferential Forwarding status bit to both S-PE1 and S-PE2, reflecting the forwarding state of the two ACs to CE2. By matching the local and remote Up/Down Status and Preferential Forwarding status, PW1-Seg2 from S-PE1 to T-PE2 would be used for traffic forwarding. Since S-PE1 connects to the Active PW segment on the multi-connected side, it would advertise Active Preferential Forwarding status bit to T-PE1, and S-PE2 would advertise Standby Preferential Forwarding status bit to T-PE1 since it does not have any Active PW segment on the multi-connected side.

On failure of the AC between CE2 and T-PE2, the forwarding state of AC on T-PE3 is changed to Active. T-PE3 would then advertise Active Preferential Forwarding status bit to both S-PE1 and S-PE2, and T-PE2 would advertise Standby Preferential Forwarding status bit to both S-PE1 and S-PE2. S-PE1 would perform the switchover according to the updated local and remote Preferential Forwarding status, and select PW1-Seg3 for traffic forwarding. Since S-PE1 still has an Active PW segment on the multi-connected side, it would not advertise any change of the PW status to T-PE1. Thus T-PE1 would not be aware of the switchover on S-PE1.

If S-PE1 fails, T-PE1 would notice this through some detection mechanism and then advertise the Active Preferential Forwarding status bit to S-PE2, and PW2-Seg1 would be selected by T-PE1 for traffic forwarding. On receipt of the newly changed Preferential Forwarding status, S-PE2 would advertise the Active Preferential Forwarding status to both T-PE2 and T-PE3. T-PE2 and T-PE3 would also notice the failure of S-PE1 by some detection mechanism. Then by matching the local and remote Up/Down and Preferential Forwarding status, PW2-Seg2 would be selected for traffic forwarding.

4. VCCV Considerations

PW VCCV [RFC5085] CC type 1 "PW ACH" can be used with S-PE redundancy mechanism. VCCV CC type 2 "Router Alert Label" is not supported for MS-PW as specified in [RFC6073]. If VCCV CC type 3 "TTL Expiry" is to be used, the hop count from one T-PE to the remote T-PE needs to be obtained in advance. This can be achieved either by control plane SP-PE TLVs or through data plane tracing of the MS-PW.

5. IANA Considerations

This document makes no request of IANA.

6. Security Considerations

This document has the same security properties as in the PWE3 control protocol [RFC4447] and [I-D.ietf-pwe3-redundancy-bit].

7. Acknowledgements

The authors would like to thank Mach Chen, Lizhong Jin, Mustapha Aissaoui, Luca Martini, Matthew Bocci and Stewart Bryant for their comments and discussions.

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