January 2022

Link Monitoring Of Service Access Port Over SPB

Sudhindra Charya
ALE USA Inc.

Abhishek Sinha
ALE USA Inc.

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Contributors
Sudhindra Charya
Abhishek Sinha

Abstract
SPB (shortest path bridging) as an overlay network technology that enables extension of the customer L2 networks over a provider/aggregation layer L2 network. Through SPB overlay, the network is able to provide an E-LAN and E-Line service support for the customer traffic by encapsulating the customer traffic into different services (ISID) and then transporting the traffic over an overlay network (B-VLANs). One challenge that is inherent in this solution, is that all the adjacencies between the end customer switches (BEBs) are virtual. Any technical glitch on local edge switch (BEB) such as link failures on one of the customer SAPs (service access port) or the failure of the service on the BEB (backbone edge bridge) are not immediately notified to the remote end. The following is a method to communicate link fault failure occurring in a BEB across the SPB network.

Docket Number	**IN82021002**
Date	**January 18, 2022**
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SPB (shortest path bridging) is an overlay network technology that enables extension of the customer L2 networks over a provider/aggregation layer L2 network. Through SPB overlay, the network is able to provide an E-LAN and E-Line service support for the customer traffic by encapsulating the customer traffic into different services and then transporting the traffic over an overlay network. One challenge that is inherent in this solution, is that all the adjacencies between the end customer switches are virtual. Any technical glitch on local edge switch (BEB) such as link failures on one of the customer SAPs (service access port) or the failure of the service on the BEB (backbone edge bridge) are not immediately notified to the remote end. The following is a method to communicate link fault failure occurring in a BEB across the SPB network.

Introduction

Shortest Path Bridging (SPB) is an overlay network technology that enables extension of the customer L2 networks over a provider/aggregation layer L2 network. Through an SPB overlay, the network is able to provide an E-LAN and E-Line service support for the customer traffic by encapsulating the customer traffic into different services that are identified by an Instance Service Identifier (ISID) and then transporting the traffic over an overlay network of backbone VLANs (B-VLANs).

One challenge that is inherent in the current SPB technical solutions is that all the adjacencies between the end customer switches known as backbone edge bridges (BEBs) are virtual. Thus, any technical glitch on local edge switch (BEB) such as a link failures on one of the customer facing ports or the complete failure of the service providing the service access points (SAPs) on the BEB, is not immediately notified to the remote end. As of now there is no mechanism defined to propagate link fault information from one customer facing BEB SAP to another customer facing BEB SAP over the SPB network.

The limitation mentioned above could lead to network disruption as the BEB where customer traffic is entering the SPB backbone would not get any notification about a remote service disruption and hence would continue to send traffic towards a broken service path until a higher level mechanism such as MAC aging/flooding or ISIS routing establishes an alternate path. This would lead to slow recovery of the network.

In case of dual homed networks, the preferred behavior would be for the traffic to immediately switch over to an alternate path as soon as the problem occurs on the remote BEB.

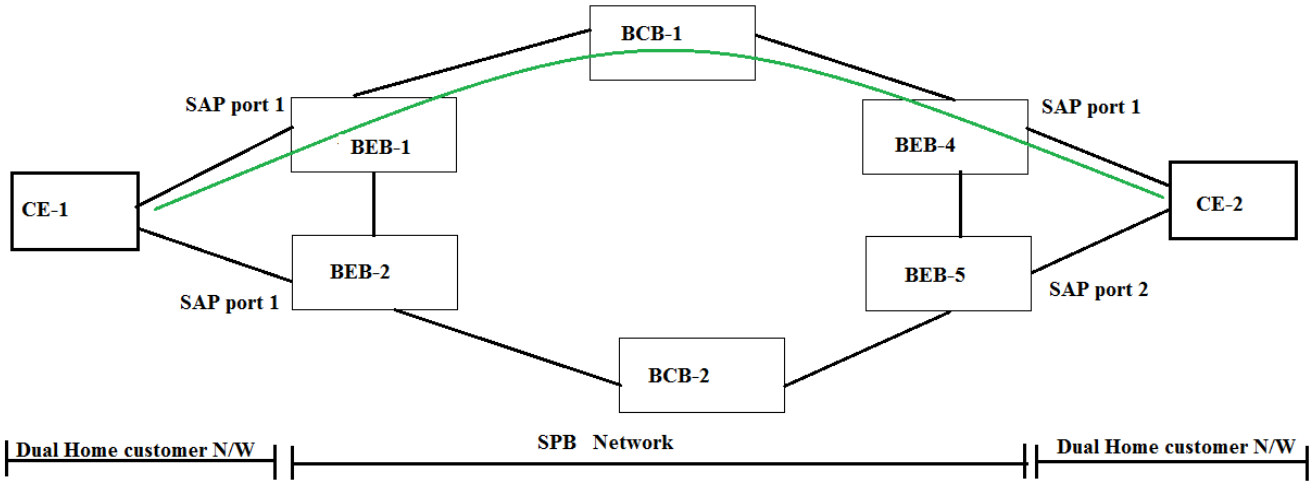
We propose a solution using Ethernet OAM communicate a remote fault indication across the SPB background. This mechanism could be applied to other overlay network solutions such as VxLAN.

Background

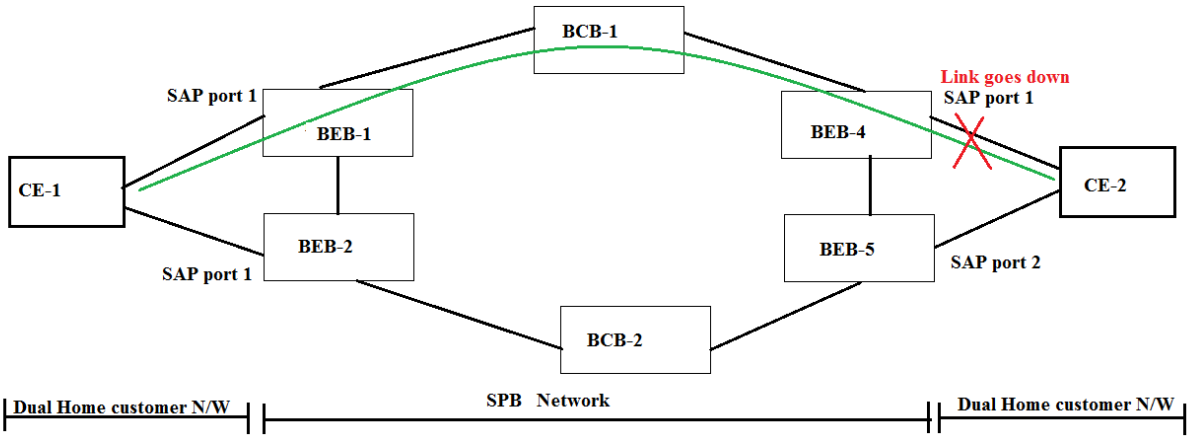
The problem that can occur in an SPB overlay network can be explained with the scenarios outlined below.

1) Example in dual home customer N/W

- CE1 and CE2 represent a dual home customer network and are communicating each other over SPB network.
- CE1 traffic enters into SAP port 1 on BEB-1 is sent to BCB-1 and finally to BEB-4 that is connected to CE2



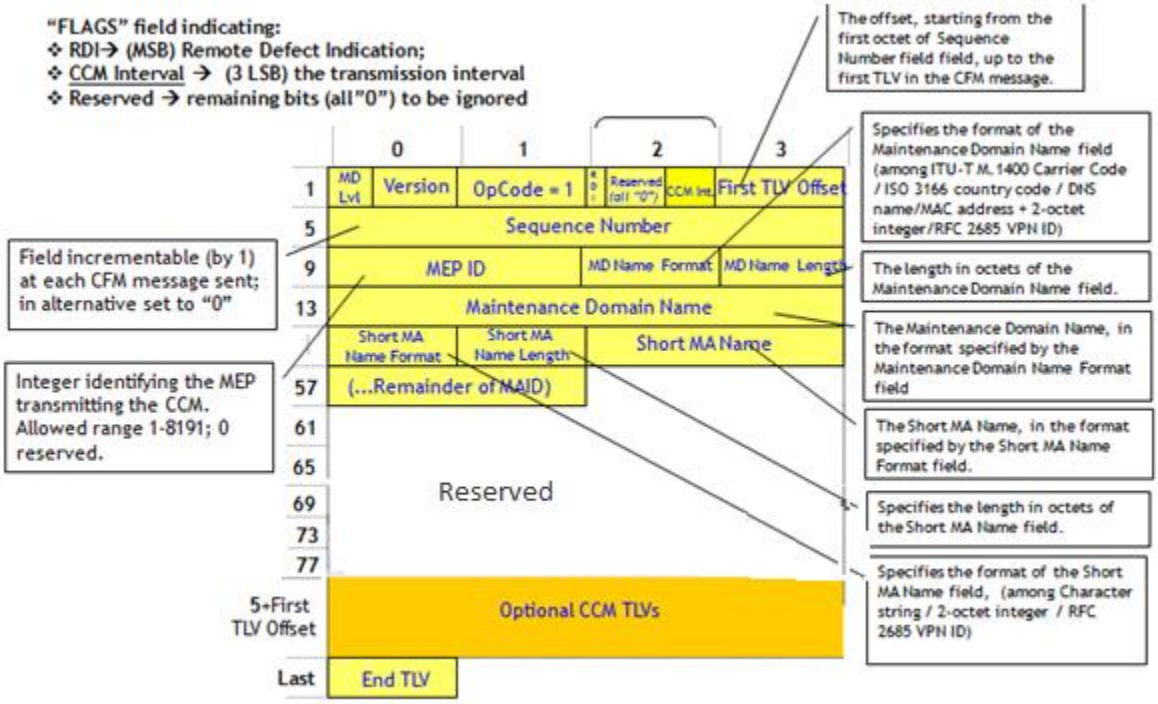
- When SAP port between BEB-4 and CE-2 goes down (as shown below), there is no way to know the link fault information on CE-1 or SAP port 1 of BEB-1 side.
- In the current implementation, CE-1 continues to send traffic to BEB-1, then to BCB-1, and to BEB-4 where the traffic will be dropped.



The invention

Our proposed solution is to introduce a mechanism to deal with remote fault indication leveraging the Ethernet operations, administration, and maintenance (OAM) protocol. Ethernet OAM is an IEEE standard protocol which CCMs (**C**ontinuity **C**heck **M**essages) to detect loss of connectivity in the network. CCMs convey information about the status of the BEB and will help to detect loss of network connectivity more quickly. CCM packets can be sent as multicast or unicast packets; by default it is a multicast packet.

CCM packets consist of fixed field length fieldsds and variable length fields using optional organizationally unique identifier (OUI) TLVs. The CCM packet payload is shown below.



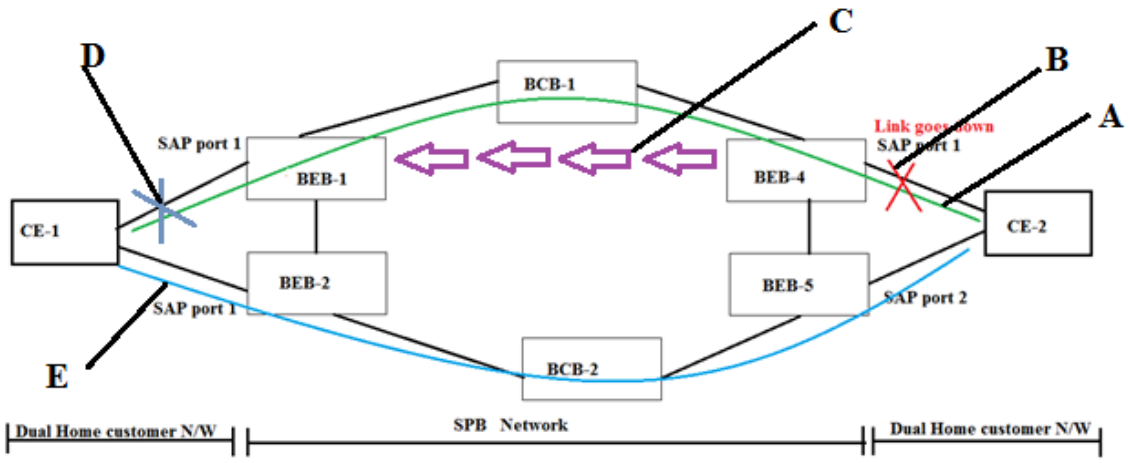
We propose to extend the CCM frames sent by BEBs with TLVs that convey the status of services and links on the BEB. The new OUI TLVs sent between BEBs would include fields that identify the service ISID and its SAP port status.

We also propose solution to generate an alarm when a CCM frame is received on a BEB with OUI TLVs that indicate a port failure on the remote BEB so that an administrator can take appropriate action to resolve the issue.

The examples below demonstrate how this the proposed method is used to address failures that could occur in an SPB overlay network.

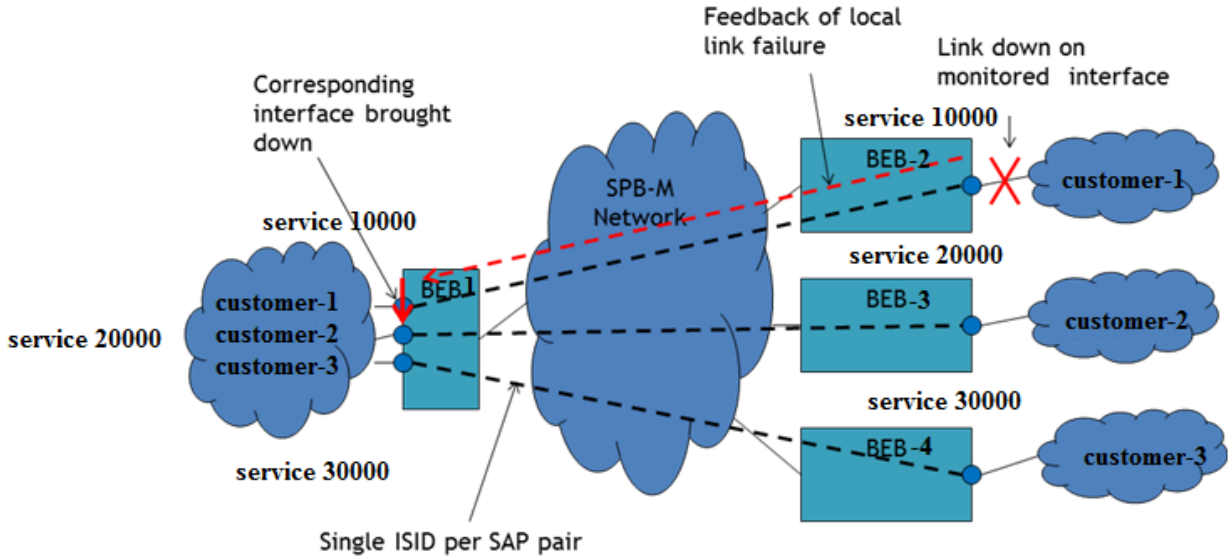
Enhanced scenarios

Scenario 1



- In the dual home customer network over SPB shown above, customer device CE-1 and customer device CE-2 are communicating via service 10000 **(A)**. Customer traffic from CE-1 flows via BEB-1, BCB-1, BEB-4 as shown in green.
- SAP port on BEB-4 connecting to CE-2 goes down (**B** shown in red). in the traditional design, traffic from CE-1 traffics continues to enter SAP port 1 and be forwarded to BEB-4 where the traffic is dropped.
- With our proposed solution, link entity information will be sent from BEB-4 to BEB-1 via the OUI TLV contained in the CCM messages **(C)**.
- When the OUI TLV is received at BEB-1 the corresponding SAP port connecting to CE-1 can be administratively shutdown **(D)**. As soon as SAP port 1 goes down, CE-1 will flush old entries and will switch over customer traffic to SAP port 2 connected to BEB2 **(E)**. The new data flow in shown in blue.
- An alarm will be also be sent by BEB-1 so that the network administrator can take appropriate action.

Scenario 2



- In the E-Line SPB network shown above, customer 1 devices are communicating via service 10000, customer 2 devices are communicating via service 20000, and customer 3 devices via service 30000.
- In the current technology, when the SAP port link on BEB-2 fails (shown in red), customer-1 traffic continues to enter the network via BEB-1 and flows to BEB-2 where it is dropped.
- With our proposed solution, link entity information will be sent to BEB-1 via the OUI TLV extensions in the CCM messages from BEB-2. When this OUI TLV is received at BEB-1, BEB-1 can put respective SAP port into shutdown so that traffic no longer traverses the network unnecessarily and BEB-1 can generate an so that the network administrator can take appropriate action.