PBB-TE (802.1Qay) CFM

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Agenda

- CFM scope in PBB-TE
- CFM enhancements needed in 802.1Qay
- Proposed Solution(s)
PBB-TE CFM Scope
PBB-TE Overview

- PBB-TE supports active topology via provisioned Ethernet Switched Paths (ESPs) in a PBBN
- For B-VIDs allocated to PBB-TE, the MAC learning is turned off and frames with unknown destination address are discarded and not flooded
- ESPs can be identified by <B-DA, B-SA, B-VID1, B-VID2> where B-VID1 and B-VID2 may be same or different in either direction and belong to VID set reserved for PBB-TE
PBB-TE CFM Requirements

- 802.1Qay/D0.0 Scope (c1.1) implies requirements to support Continuity Check and Loopback protocols of CFM
- Support for CCM and LBM/LBR does not necessarily imply the need for MIPs for PBB-TE ESPs

Question: Are MIPs for PBB-TE ESPs required?
PBB-TE CFM Requirements (cont’d)

- If PBB-TE ESP MIPs are required, support for Linktrace protocol can also be considered
  - Linktrace protocol support is not precluded but not explicitly stated in D0.0

- Question: Assuming that MIPs in PBB-TE ESPs are required, is Linktrace protocol support a requirement?
PBB-TE CFM Requirements (cont’d)

- If support for Linktrace protocol is considered to be a requirement, LTM/LTR support does mandate that paths for an ESP are co-routed in either direction
- Co-routing of paths for an ESP in either direction is implied even otherwise in Annex M; seems to be intended choice

- Question: Assuming that Linktrace protocol support is a requirement, is there any issue with requirement that paths of ESP are co-routed in either direction?
PBB-TE CFM Enhancements
PBB-TE CFM Enhancements – Set 1

- The first set of enhancements are identified for CFM support between PBB-TE MEPs
- CFM protocols between PBB-TE ESP MEPs
  - Continuity Check
  - Loopback
  - Linktrace not really needed between PBB-TE MEPs
Continuity Check Enhancements

- Continuity Check across PBB-TE ESP requires **Unicast CCMs** where the Unicast address is same as B-DA in the direction of ESP
  - This is such that forwarding along the path is based on same <B-DA, B-VID> tuple as any data path frame as required by PBB-TE ESP
- Unicast CCMs are already supported in Y.1731 and is not precluded in 802.1ag
- For explicit support, update will be needed to text from .1ag/D8.1 c3.2, c8.13.11, c18 etc.
- **Enhancement#1: Support Unicast CCMs**
Loopback Enhancements

- Loopback across PBB-TE ESP MEPs works fine without any issues if same B-VID is used in either direction of ESP path.
- However, when different B-VIDs are used in either direction, a more general case, enhancement is needed to additionally change VID value in LBR.
- Enhancement#2: Support change in VID value in LBR at the loopback point.
PBB-TE CFM Enhancements – Set 2

- The second set of enhancements are identified assuming need to support PBB-TE MIPs
- CFM protocols between PBB-TE ESP MEPs and MIPs
  - Loopback
  - Linktrace
Loopback MIP Enhancements

Loopback to a PBB-TE ESP MIP requires enhancement since:

- If DA in LBM identifies MIP’s MAC, MIP MAC may not be provisioned in filtering databases associated with PBB-TE ESP VIDs, meaning that LBM frame may be discarded since flooding is not allowed
- If DA in LBM is same as B-DA, MIP may not selectively intercept LBMs intended for it

Enhancement#3:

- PBB-TE ESP MIPs should be able to intercept LBMs intended for it
- PBB-TE ESP MIPs should be able to ignore LBMs not intended for it
Linktrace MIP Enhancements

- Linktrace in a PBB-TE requires enhancement since:
  - If DA in LTM is a multicast MAC as per Table 8-10/802.1ag/D8.1:
    - a static entry for this group MAC address will need to be added in all devices apriori
  - since VID can be reused across different PBB-TE ESPs, LTM would not be bounded to only PBB-TE ESP path
  - Since target MAC may not be provisioned in filtering databases associated with PBB-TE ESP VIDs, MIP would have no means to determine whether or not they are in the path of ESP for that VID
  - If DA in LTM is same as B-DA, MIP may not intercept LTMs

- Enhancement#4:
  - PBB-TE ESP MIPs should be able to intercept LTMs for specific ESP
PBB-TE CFM Enhancements – Proposed Solutions
Enhancement#1 – Unicast CCM

- **Enhancement#1: Support Unicast CCMs**
- As mentioned earlier, this is already supported in Y.1731 and not precluded from 802.1ag state machines

- **Updates Required:**
  - Different clauses in 802.1ag which specifically talk about multicast CCM transmission need update
Enhancement #2 – MEP LBM/LBR

- **Enhancement #2**: Support change in VID value in LBR at loopback point
- As mentioned earlier, this is needed in general case when VIDs in either direction of PBB-TE ESP are different
- **Different options:**
  - **Option 1**: Carry a TLV with reverse VID in LBM which is used by loopback point for VID value in LBR
    - Advantage: Makes processing in LBM sink generic, i.e. if a specific TLV present, use its value for LBR
  - **Option 2**: Since PBB-TE ESP MEP is expected to maintain association between forward and reverse VIDs, have loopback point perform this VID change
    - Advantage: Make LBM transmission point generic

**Proposed solution**: Option 1 since LBM sink becomes stateless
Enhancements – PBB-TE MIPs

- Discussion applies to Enhancement#3 and #4 which are needed only if PBB-TE MIPs are required.
- CFM frames, intended for PBB-TE MIPs should have DA corresponding to PBB-TE ESP i.e. same as B-DA.

- PBB-TE MIPs need to identify CFM frames intended for these MIPs, options include:
  - Option 1: New EtherType
  - Option 2: New OpCode
  - Option 3: New TLVs
Enhancements – PBB-TE MIPs (cont’d)

- **Option 1: New EtherType**
  - **Pros:**
    - facilitates datapath to differentiate between CFM frames for MEPs & MIPs
  - **Cons:**
    - means duplicate EtherTypes for same functionality – bad!
    - not a requirement for PBB-TE MEPs e.g. CCM, LBMs etc.
    - Every MIP along ESP path before destination will process frame

- **Option 2: New OpCode**
  - **Pros:**
    - facilitates datapath to differentiate between CFM frames for MEPs & MIPs
  - **Cons:**
    - means duplicate OpCodes for same functionality – bad!
    - not a requirement for PBB-TE MEPs e.g. CCM, LBMs etc.
    - Every MIP along ESP path before destination will process frame
Enhancements – PBB-TE MIPs (cont’d)

- Option 3: New TLV
  - Pros:
    - facilitates datapath to selectively differentiate between CFM frames for MEPs & MIPs
    - Does not lead to duplication of EtherType or OpCode
    - Consistent with current 802.1ag/Y.1731 design
  - Cons:
    - Requires packet inspection at MIPs datapath to support efficient usage
    - Not a requirement for PBB-TE MEPs CCM

- Proposed Solution: Use Option 3 (see subsequent slides)
Enhancement#3 – MIP LBM

- Enhancement#3:
  - PBB-TE ESP MIPs should be able to intercept LBMs intended for it
  - PBB-TE ESP MIPs should be able to ignore LBMs not intended for it

- Proposed solution:
  - A TLV to be used as first TLV to allow deterministic inspection at intermediate MIPs
  - As per current format, this would imply looking at 10-15 octets following OpCode
  - The first field in Value of TLV is MIP identifier i.e. MAC address, which allows MIPs to selectively intercept CFM frames intended for it
Enhancement#3 – MIP LBM (cont’d)

- Proposed TLV: PBB-TE ESP TLV

<table>
<thead>
<tr>
<th>Octets</th>
<th>Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Type = 9</td>
</tr>
<tr>
<td>2-3</td>
<td>Length</td>
</tr>
<tr>
<td>4-9</td>
<td>MIP MAC</td>
</tr>
<tr>
<td>10-11</td>
<td>Reverse VID</td>
</tr>
</tbody>
</table>

PBB-TE ESP TLV
Enhancement#4 – MIP LTM

- Enhancement#4:
  - PBB-TE ESP MIPs should be able to intercept LTM frames for specific ESP

- Proposed solution:
  - PBB-TE ESP TLV, introduced for Enhancement #3, can be used
  - It does not need to be the first TLV since all PBB-TE MIP need to intercept all LTM frames on the ESP
  - The reverse VID value is used to put the correct VID in LTR
Enhancement#2 – MEP LBM/LBR

- Proposed solution continuation for Option 1 TLV:
  - PBB-TE ESP TLV, introduced for Enhancement #3, can be used for proposed Option 1
  - The reverse VID value is used to put the correct VID in LBR