CFM in PBB-TE

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- PBB and PBB-TE SAP frames and parameters
- PBB and PBB-TE I-BEB and B-BEB port functions
- ITU-T Recommendation URLs (free download)
MAC address scope in PBB and PBB-TE

PBB

I-BEB

VIP

VIP

PIP

CBP

B-BEB

PBP

PBP

BCB

PBP

PBP

B-BEB

PBP

CBP

I-BEB

VIP

VIP

PIP

B-MAC scope

PBB-TE (a)

I-BEB-TE

VIP-TE

VIP-TE

PIP-TE

CBP-TE

B-BEB-TE

PBP-TE

PBP-TE

PBP-TE

BCB-TE

CBP-TE

B-BEB-TE

PBP-TE

CBP-TE

PBP-TE

VIP-TE

VIP-TE

IB-BEB-TE

VIP-TE

VIP-TE

PBP-TE

BCB-TE

PBP-TE

PBP-TE

IB-BEB-TE

CB

VIP-TE

T-MAC scope

T-MAC

PBB-TE (b)

IB-BEB-TE

VIP-TE

VIP-TE

PIP-TE

BCB-TE

PBP-TE

PBP-TE

IB-BEB-TE

CB

VIP-TE

T-MAC

T-MAC

T-MAC

T-MAC

T-MAC

B-MAC
PBB-TE CFM extensions and modifications

- Inclusion of frame loss measurement fields in the CCM (as per Y.1731 and G.8021)
- Addition of on-demand LMM/LMR OAM PDUs (based on Y.1731 and G.8021)
- Addition of on-demand DMM/DMR OAM PDUs (based on Y.1731 and G.8021)
- Addition of APS OAM PDU (based on Y.1731, G.8021 and G.8031)
- Addition of AIS OAM PDU (based on Y.1731 and G.8021)
  - Upgrade Provider Backbone Ports (PBP) to support the generation of PBB-TE AIS on a per PBB-TE trunk instance
  - PBP ports in B-BEB and BCB nodes must be able to store the PBB-TE trunk instance identifying triple <B-VID,T-DA,T-SA> for every active PBB-TE trunk instance passing through the PBP
- Modify the LBM/LBR OAM PDU frame format defined in 802.1ag/Y.1731 to support loopback in PBB-TE MIPs
  - T-DA fields in B-LAN frames can not be used to carry the PBB-TE trunk MIP address
  - There is no DA field present in PBB-TE service instance to carry PBB-TE service MIP address
  - Additional Target MEP/MIP address field to be added into LBM OAM PDU frame
- Modify the “EISS Multiplex Entity” function operation such that every triple <vlan_identifier,destination_address,source_address> is assigned to some "multiplexed SAP“ associated with PBB-TE trunk instances
PBB-TE LBM frame (PBB-TE Service and Trunk Instances)

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| TYPE (CFM) | MDL | Version | OpCode |
| Flags | TLV Offset | Transaction ID/Sequence Number |
| Transaction ID/Sequence Number | Target MEP/MIP MAC address |
| Target MEP/MIP MAC address | Source MEP MAC address |
| Source MEP MAC address | optional TLVs start here |
| | | End TLV |

Additional source identifier field
Additional MIP (or MEP) identifier field
### AIS frame (PBB-TE Service and Trunk Instances)

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| **TYPE (CFM)** | **MDL** | **Version** | **OpCode (AIS)** |
| Flags | TLV Offset | End TLV |

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**Diagram Notes**:
- The diagram illustrates the flow of AIS frames through various instances of PBB-TE, including I-BEB-TE, B-BEB-TE, VIP-TE, PIP-TE, CBP-TE, and PBP-TE.
- Key elements include source (SA) and destination (DA) addresses, VIDs, and ISIDs.
- The diagram highlights the path taken by one AIS frame through the network instances.

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**Legend**:
- PBB-TE (a) indicates the initial point of the frame.
- X marks the point of divergence or termination.
CCM frame with frame loss measurement fields

**MAID (48 octets)**

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**End TLV**
APS frame

1:1 protection of PBB-TE Service Instances with load sharing; protected and unprotected service instances

PBB-TE TI APS

PBB-TE TI APS

| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 |
| TYPE (CFM) | MDL | Version | OpCode (APS) |
| Flags | TLV Offset | Request/State | Protection Type | Requested Signal |
| Bridged Signal | Reserved (0) | End TLV |
## LMM and LMR frames

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PBB-TE Trunk Instance EISS Multiplex Entity

An EISS Multiplex Entity has one EISS SAP, and a number of multiplexed SAPs, each either an ISS SAP or an EISS SAP. Each multiplexed ISS SAP is assigned to a single vlan_identifier value. Each multiplexed EISS SAP is assigned to one or more vlan_identifier values. Every vlan_identifier is assigned to some multiplexed SAP. Upon receiving a Request or Indication from its single EISS SAP, the EISS Multiplex Entity uses the vlan_identifier and canonical_format_indicator to select the corresponding one of its multiplexed SAPs to present the Request or Indication. Similarly, any Request or Indication received from a multiplexed SAP is presented to the single EISS SAP; the vlan_identifier and canonical_format_indicator parameters presented on the single EISS SAP are the ones associated with the multiplexed ISS SAP, or the ones obtained from the multiplexed EISS SAP.

<\texttt{vlan\_identifier,destination\_address,source\_address}> triple
PBB-TE interoperability with PBB and T-MPLS

- Operators are minimizing the number of layers in their networks
  - packet transport network can be built with one service instance and one trunk instance layer
- PBB-TE nodes will be added in a network containing already PBB and T-MPLS nodes/networks
- T-MPLS is able to peer with PBB via stateless “service interworking”
  - keeping number of layers in the network unchanged (no proliferation of layers)
  - creating hybrid “T-MPLS PW ⇔ PBB Service Instance” connections (p2p, p2mp)
  - continuing PBB Service Instances (mp2mp, rooted mp) in T-MPLS
    - PBB Service Instance identified by PW label in T-MPLS network (instead of I-Tag)
- PBB-TE should not introduce additional layers in the network
  - keeping number of layers in the network unchanged (no proliferation of layers)
- PBB-TE should be able to peer with PBB and T-MPLS via “service interworking”
  - creating hybrid “T-MPLS PW ⇔ PBB-TE Service Instance” connections (p2p)
  - creating hybrid “PBB Service Instance ⇔ PBB-TE Service Instance” connections (p2p)
  - PBB-TE OAM should be common look and feel with PBB OAM and T-MPLS OAM
Additional material
PBB SAP frames and parameters

PBB I-LAN frame

PBB-SI SAP parameters

PBB-TI SAP parameters

PBB-LI SAP parameters

PBB B-LAN frame

SI: Service Instance
TI: Trunk Instance
LI: Link Instance
PBB-TE (a) SAP frames and parameters

PBB-TE I-LAN frame

M_SDU

C-SA

C-DA

PBB-TE-SI SAP parameters

Type?

I-TCI

I-TPID

B-TCI?

B-TPID?

T-SA

T-DA

PBB-TE I-LAN frame

M_SDU

C-SA

C-DA

PBB-TE-TI SAP parameters

Type?

I-TCI

I-TPID

B-TCI

B-TPID

T-SA

T-DA

PBB-TE B-LAN frame

M_SDU

C-SA

C-DA

PBB-TE-LI SAP parameters

Type?

I-TCI

I-TPID

B-TCI

B-TPID

T-SA

T-DA

SI: Service Instance
TI: Trunk Instance
LI: Link Instance
B-MAC scope is VIP-to-VIP
- VIP inserts B-DA and B-SA parameters
PBB-TE PIP, CBP and PBP on I- and B-Components

- **T-MAC** scope is LIP-TE-to-LIP-TE
  - connection_identifier scope is TIP-TE-to-TIP-TE
  - connection_identifier represents <B-VID,T-DA,T-SA> triple
- **B-VID/T-DA/T-SA** translation not supported
  - keeps T-DA/T-SA values fixed between two TIP-TE functions

VIP: Virtual Instance Port
TIP: Trunk Instance Port
LIP: Link Instance Port
ITU-T Recommendations free downloads

- General: [http://www.itu.int/rec/T-REC/e](http://www.itu.int/rec/T-REC/e)
  - G.8021 amendment (OAM processing): under development
  - G.8032: under development
  - G.eot-mgmt: under development