1:1 Linear Protection Switching for PBB-TE

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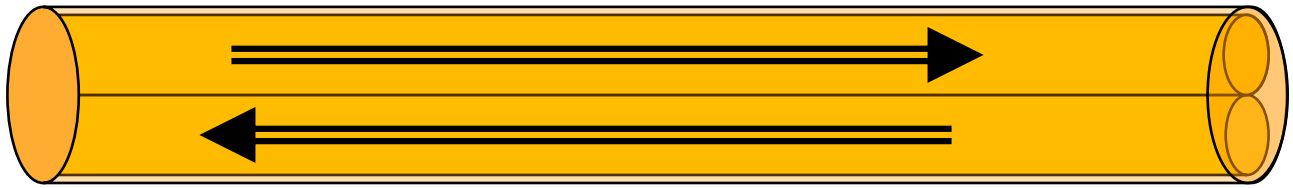
Definitions

- Ethernet Switched Path (ESP) - a provisioned unidirectional path across the PBBN between two CBPs.
- PBB-TE Trunk – a pair of unidirectional ESPs between the same pair of CBPs, one on each direction



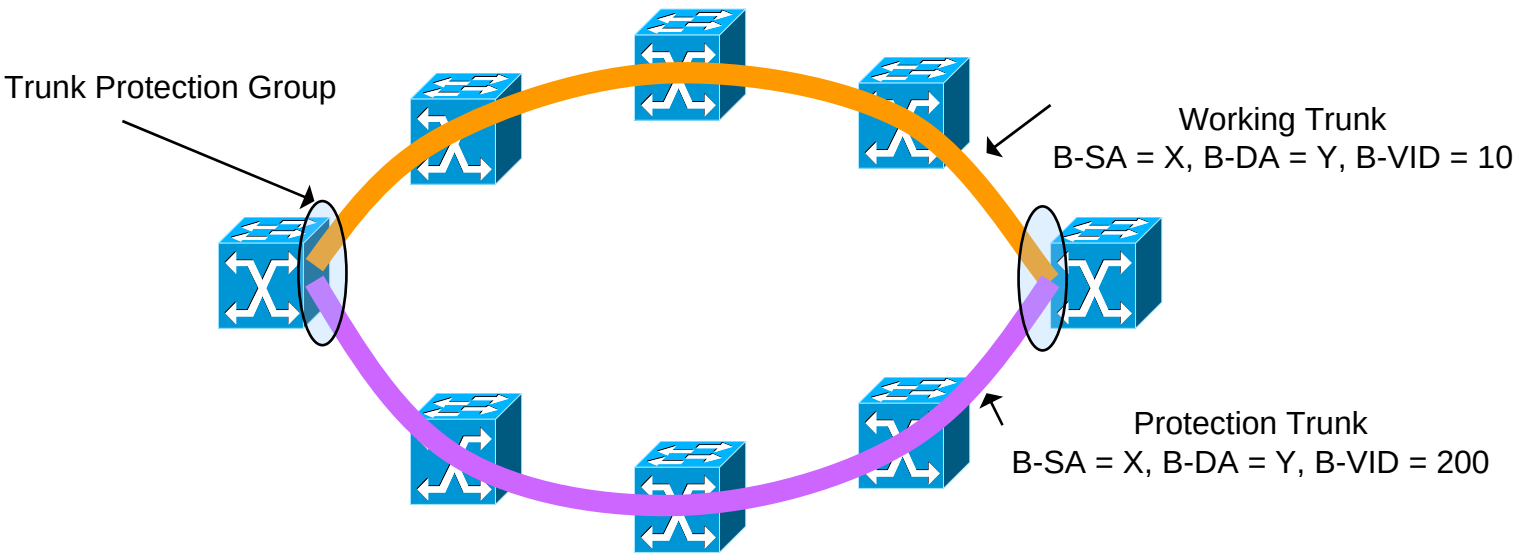
- Trunk Protection Group (TPG) is used to protect a PBB-TE trunk. A TPG consists of the following entities:
  - a working PBB-TE trunk which is provisioned to transfer traffic in normal conditions
  - a protection PBB-TE trunk which is provisioned to protect the working trunk

Definitions (cont'd.)

- Trunk operational state – the trunk can be in operational state up or down.
- Trunk forwarding state – the trunk can be in active forwarding state (if the trunk is enabled to forward traffic), or in standby forwarding state.
- Linear Protection Switching (LPS) - a new shim that performs the functionality of protection switching

1:1 Bi-directional Linear Protection Switching

- Two PBB-TE trunks are pre-provisioned:
  1. Working trunk – over which traffic is transmitted in normal conditions
  2. Protection trunk – over which traffic is switched following an event (a trunk failure notification or management request)
- The working and protection trunks constitute a 1:1 PBB-TE Trunk Protection Group (TPG).

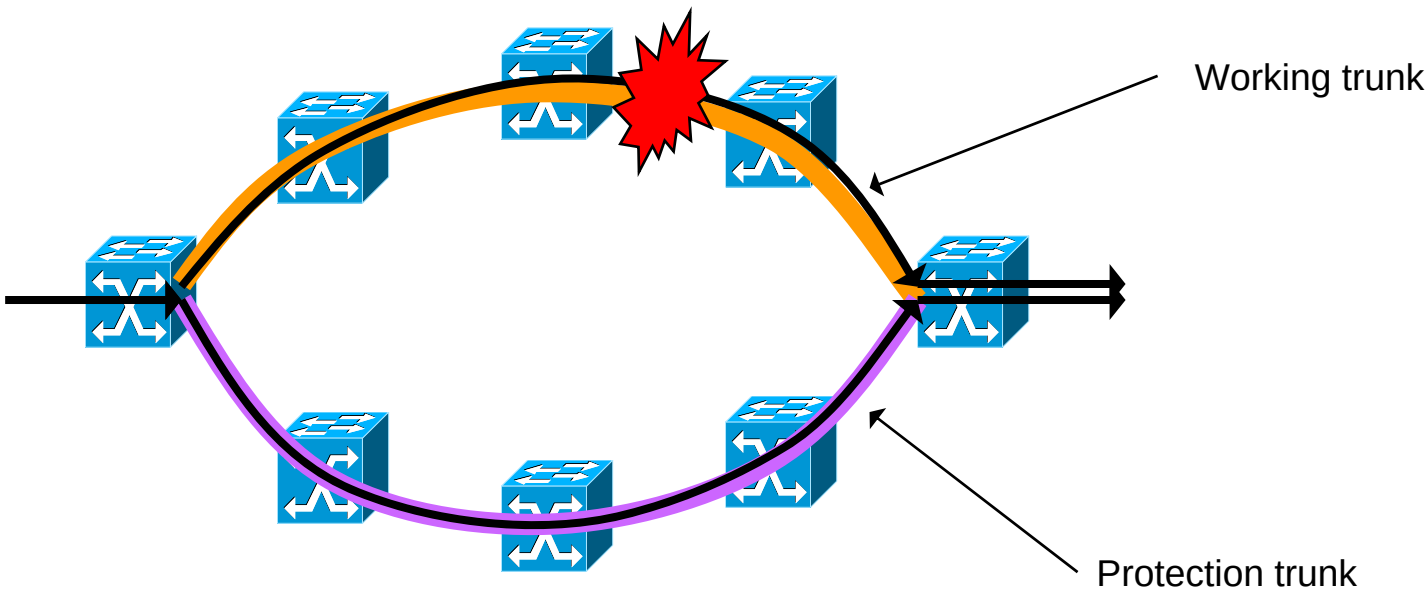


Assumptions

- Both the working trunk and the protection trunk are pre-provisioned.
  - Both trunks have the same B-SA and the B-DA.
  - The trunks differ only in their B-VID.
  - No restriction on the path that trunk traverses in both direction, but it is advised to have the same path.
- Protection switching is bi-directional, i.e. both ends of the trunk switch simultaneously.
- Trunks are perceived as interfaces on the CBP.

Protection Switching

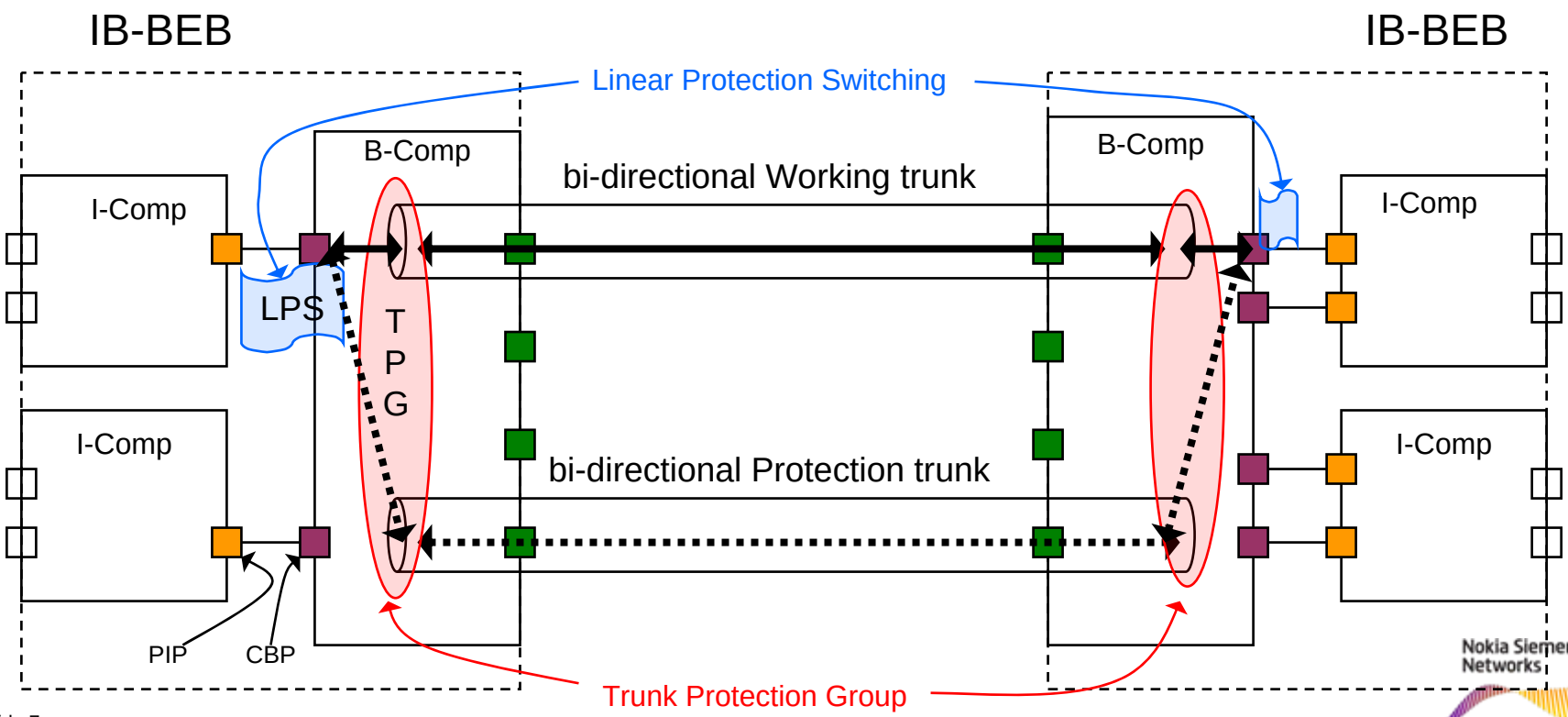
- The state of the working and protection trunks is constantly monitored using unicast 802.1ag CCM.
- Traffic is sent over the working trunk.



- When a failure is detected in the active working trunk, traffic is switched to the standby protection trunk.

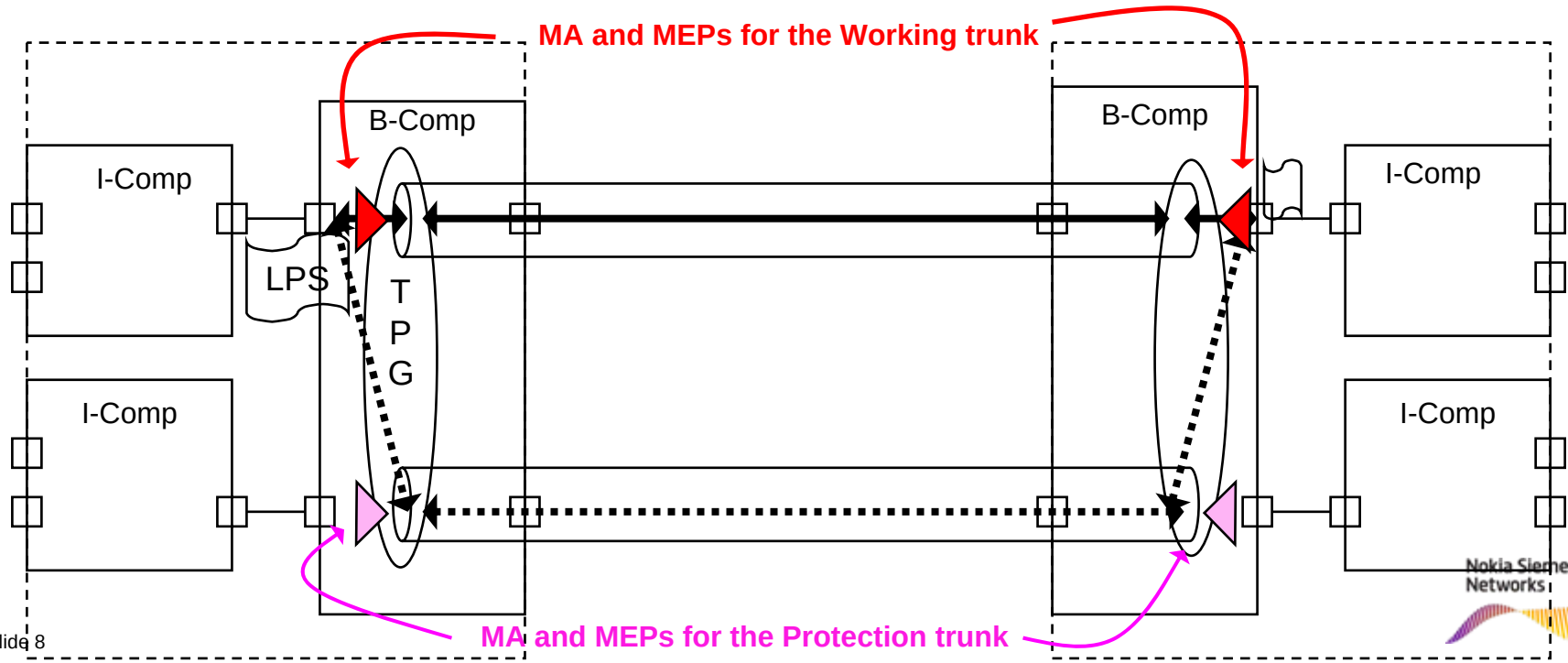
Protection Switching (cont'd.)

- Protection switching functionality is performed on the CBP.
- A Trunk Protection Group (TPG) is defined on the CBP for each protected trunk.
- A new Linear Protection Switching shim (LPS) is defined to implement protection switching.



CFM Usage for Protection Switching

- An MA is created for each trunk in the Trunk Protection Group, one for the working trunk and another for the protection trunk.
- Two Up MEPs are configured on each MA – one MEP on the CBP of each trunk edge.
- Unicast CCMs are generated by the trunk's MEPs and are sent inband.

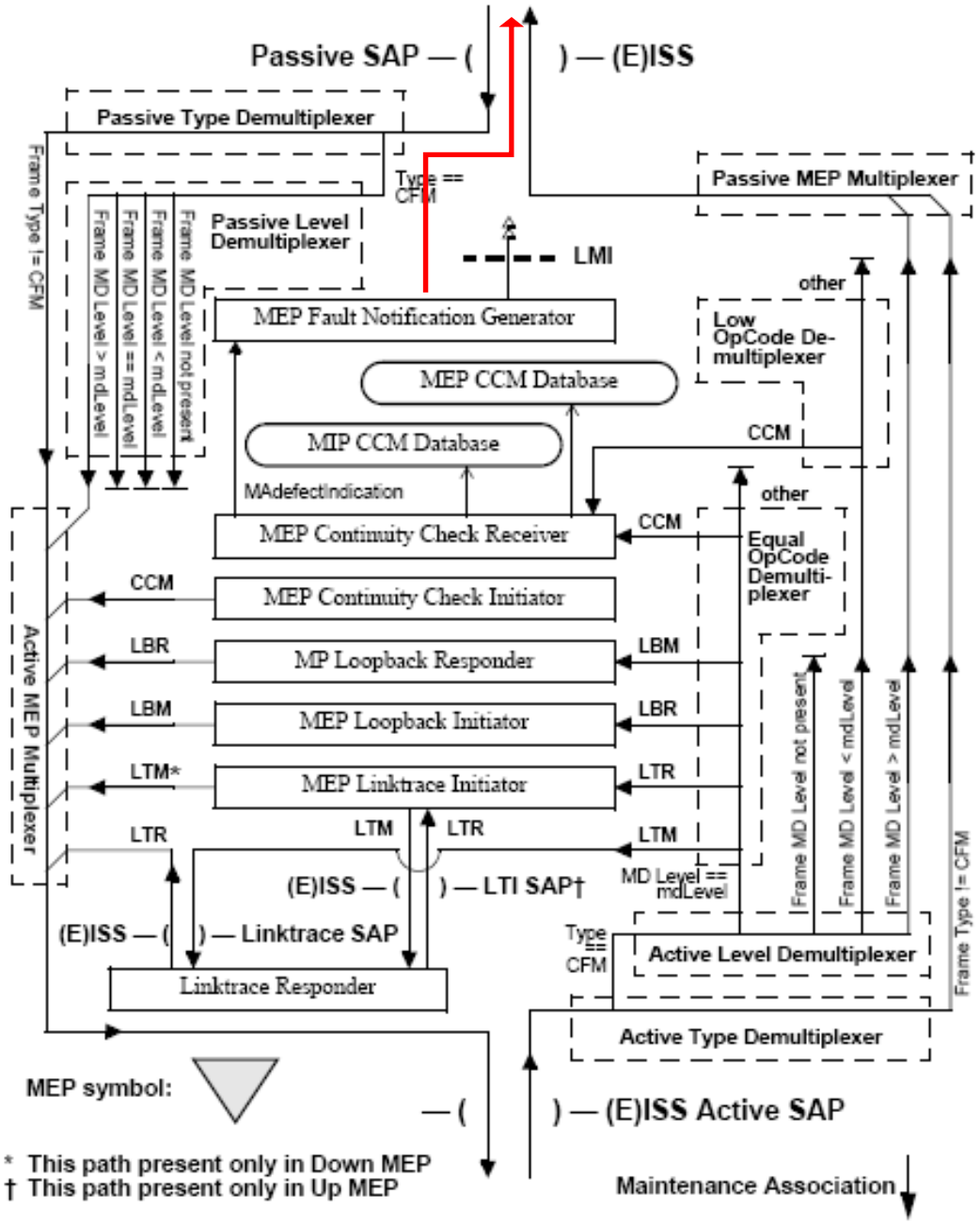


MEP Enhancement
Continuity Check Receiver Modifications

- The Continuity Check Receiver (c19.2.8, c20.17, c20.18) will have an additional interface to the LPS shim to indicate the trunk's operational state: up or down
  - Missing 3 consecutive CCMs – operational state = down
  - Received RDI – operational state = down
  - Received Port Status TLV or Interface Status TLV indicating failure in the remote port – operational state = down
  - Move to no faults state – operational state = up
- The trunk operational state will be reflected in the MAC-operational parameter

MEP Enhancement (cont'd.)

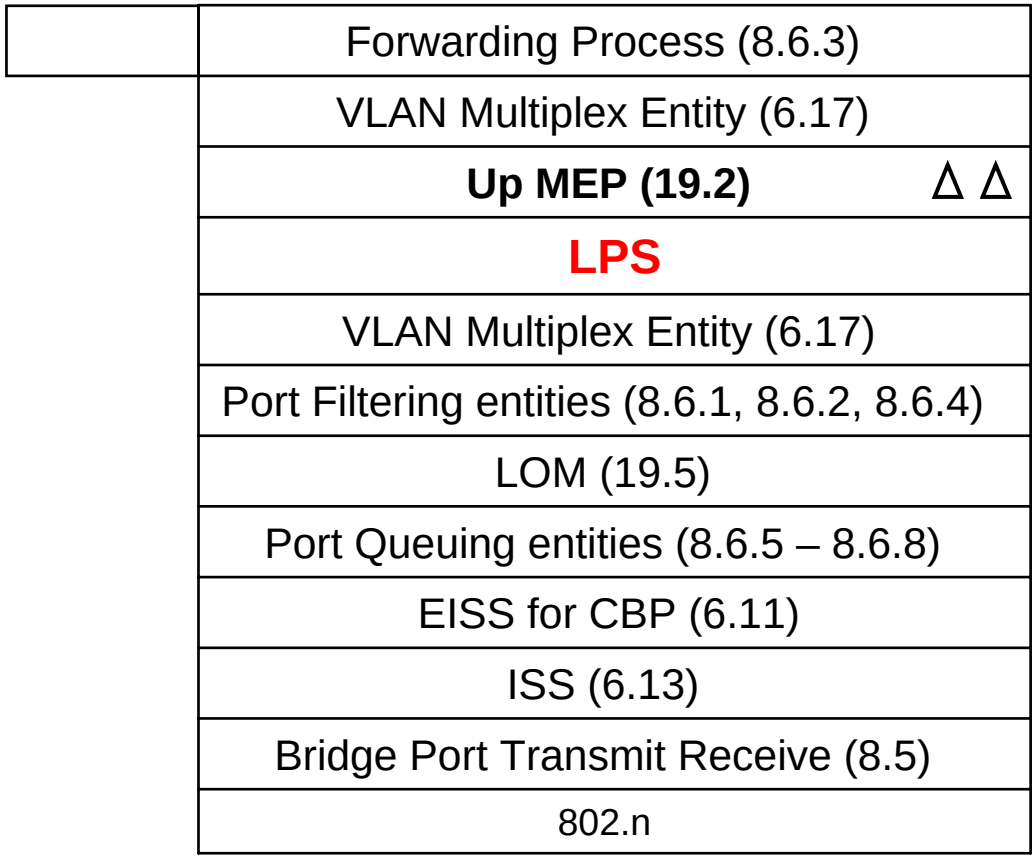
For PBB-TE VIDs, the trunk state is reflected by the MAC-operational parameter to the LPS shim



Note: The figure should be inverted to indicate the Up MEP such that the Passive SAP is below the Active SAP

LPS Shim Location

The LPS is located between the Up MEP and the VLAN Multiplex Entity on the CBP and performs the protection switching for traffic received from the I-Component

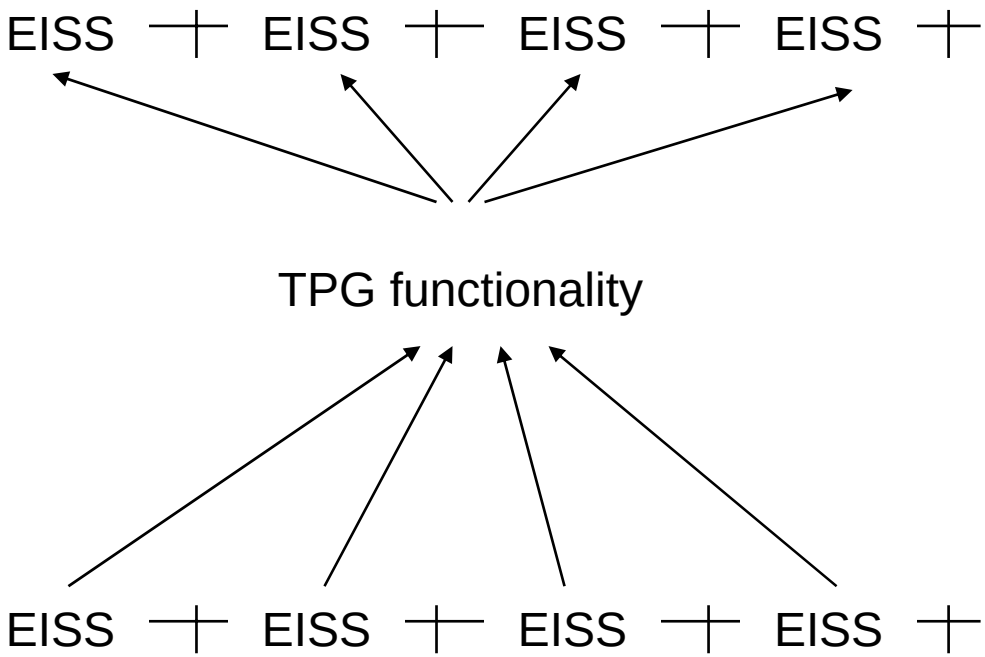


LPS Shim on CBP

- Operates on PBB-TE B-VLANs only
- Receives requests from the Up MEP to update the trunk operational state according to the MAC-operational parameter and updates the TPG database accordingly
- Map the services to the active trunk

LPS Shim on CBP (cont'd.)

- Implements a back to back Multiplex Entity.
- Upon receiving an indication the LPS assigns the appropriate vlan_idenitifier in the EM_UNITDATA according to the forwarding state of the trunks in the TPG database



LPS Shim TPG Database

The TPG (Trunk Protection Group) database contains the following information per protected trunk:

- Source B-MAC
- Destination B-MAC
- Working trunk B-VID
- Working trunk forwarding state – active / standby
- Working trunk operational state – up / down
- Protection trunk B-VID
- Protection trunk forwarding state – active / standby
- Protection trunk operational state – up / down
- Administrative request – none / lockout-protection / switch-to-working / switch to protection
- Revertive mode – revertive / non-revertive

LPS Functionality
TPG – state transition table

Current State			Event	State Change			
Forwarding State	Operational state			Forwarding State		Operational state	
Working	Working	Protection		Working	Protection	Working	Protection
active	Up	Up	Working Down	standby	active	Down	
			Protection Down				Down
		Down	Working Down			Down	
			Protection Up				Up
	Down	Down	Working Up			Up	
			Protection Up	standby	active		Up
Standby *	Up	Up	Working Down			Down	
			Protection Down	active	standby		Down
standby	Down	Up	Working Up	active **	standby**	Up	
			Protection Down				Down
		Down	Working Up	active	standby	Up	
			Protection Up				Up

* This forwarding state with these operational states can happen only in non rerevertive mode

** This state change happen only in revertive mode

Note: the situation where the working is active and down and the protection is standby and up, and the situation where the working is standby and up and the protection is active and down are not applicable

LPS Functionality
Update of EM-UNITDATA

Working Trunk forwarding **state**	**Protection Trunk** forwarding **state**	**EM-UNITDATA Update**
Active	**standby**	**-----**
Standby	**active**	**vlan_identifier → Protection B-VID**

LPS Functionality (cont'd.)
Management Requests

- Administrative management requests are directed to the LPS shim.
- The CBPs on both edges of the trunk should synchronize administrative management requests. This can be achieved by using the CCM Interface Status TLV, with the following new values:
  - Lockout protection
  - Switch to working
  - Switch to protection

LPS Functionality (cont'd.)
Administrative Management Commands

- **Lockout protection** – the protection group is inactive, i.e. traffic should not be switched to the protection trunk:
  - interface status = LockoutProtection.
- **Force switch to working / protection** – traffic will be switched without checking the trunk's operational state:
  - interface status = SwitchToWorking / SwitchToProtection.
- **Manual switch to working / protection** – traffic will be switched only if the trunk's operational state is up:
  - interface status = SwitchToWorking / SwitchToProtection.
- **Clear** – clear the management request:
  - interface status = up.

Thank You

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