IEC/IEEE 60802
Loop Prevention in Required Topologies

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Requirements

1. Topologies as described in the 60802 use cases: line, ring, star, redundant networks (e.g. redundantly interconnected rings)

2. Connectivity after network bootstrapping with automatic loop prevention

3. Connectivity to Plug and Produce with automatic loop prevention

4. Support of Stream-VLANs with (see 60802 D1.2: 6.6.1):
   – Individual FDBs,
   – Learning disabled, and
   – Discarding of frames addressed to unregistered DAs.
   – No blocked ports.

5. Support of Non-Stream-VLANs with (see 60802 D1.2: 6.6.2):
   – Shared VLAN Learning, and
   – Flooding of frames addressed to unregistered DAs.
A Topology of TSN-Domains – with loops

Loops may occur:
1. within a TSN-Domain,
2. by inter domain connections.

What are IEEE 802.1Q means to deal with these loops?
### IEEE 802.1Qcc-2017: Stream reservation remote management

| 5.4.1.10 | A VLAN-aware Bridge component implementation that conforms to the provisions of this standard for Stream reservation remote management shall ...
| | c) Support **TE-MSTID** (5.5.2). **[BUT: support for PBB-TE is not required]** |
| 5.5.2 | A C-VLAN component implementation that conforms to the provisions of this standard for **TE-MSTID** shall ...
| | a) Disable learning ...
| | b) Discard frames with unregistered destination addresses ...
| 12.32.3.1 | A VLAN ID is allocated to the **TE-MSTID** in the MST Configuration Table if it is not under control of either a spanning tree protocol or IS-IS. |

- **TE-MSTID** fulfills the requirements for Stream-VLANs.
- **TE-MSTID** requires support of the MST Configuration Table.

→ A TSN Domain should be a MST Region, which is described in a MST Configuration Table (identified by an MST Configuration Identifier - MCID).
A network of TSN-Domains as MST Regions
(IEEE 802.1Q-2018 3.164)

- Each TSN-Domain is also a MST Region.
- Each MST Region calculates an **Internal Spanning Tree** (IST) – default: RSTP.
- All MST Regions are connected by the **Common Spanning Tree** (CST), which is calculated by RSTP, treating each MST Region as a single Bridge.
- CST and IST together build the **Common and Internal Spanning Tree** (CIST).

→ Connectivity with loop prevention for Non-Stream traffic is provided by the RSTP based CIST.
Physical, Active and VLAN Topologies in a 60802 TSN Domain

See IEEE 802.1Q-2018
7. Principles of Virtual Bridged Network operation

Figure 7-1—VLAN Bridging overview
IEEE802.1Q Configuration of a MST Bridge with a single Spanning Tree (IST)

See IEEE 802.1Q-2018 8.9 MST, SPB, and ESP configuration information
“The combination of the VID to FID allocations (8.8.8) and the FID to MSTI allocations (8.9.3) defines a mapping of VIDs to spanning trees, MSTIDs, represented by the MST Configuration Table (8.9.1).”

- All Non-Stream VIDs are assigned to the IST.
- All Stream VIDs are assigned to the TE-MSTID

→ No further MSTP support required – as long as no further active topologies are requested.

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Summary and Implications

→ Support of TE-MSTID and RSTP based CIST fulfill all requirements.

− Stream connectivity is per se restricted to a TSN Domain / MST Region. Stream connectivity to other TSN Domains / MST Regions requires additional mechanisms and management -> Inter TSN Domain Communication.

− The Internal Spanning Tree (IST) can optionally be calculated by e.g. IEC-DLR or IEC-MRP. In this case MST Region boundary ports must support RSTP in a way so that the MST Region is treated as a single Bridge.
Profile Conformance

Bridges shall support:

• At least 8 VIDs: 4 Stream VIDs + 4 Non-Stream VIDs.
• At least 5 FIDs: 4 Steam-VID FIDs + 1 Non-Stream FID.
• MST Configuration with 2 MSTIDs:
  – TE-MSTID (0xFFE) for the Traffic Engineered Stream-VIDs,
  – IST (0) for the Non-Stream VIDs.
• RSTP:
  – for the calculation of the Common Spanning Tree (CST),
  – as default Internal Spanning Tree (IST) calculation algorithm.

→ These requirements should be added to the Common Bridge Requirements 5.7.1
Questions?