“How to separate multiple copies of one stream?”

CB Seamless Failover

IEEE 802.3 Plenary Session – Dallas
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Goal of this presentation

This presentation shows two possibilities to separate two streams and their problems

• multiple VLAN IDs for one stream

• multiple Stream Destination Addresses for one stream
Definitions used inside this presentation

Frame Replication

Redundancy level
= number of different paths

Duplicate Elimination

TSN network

Path A

Path B

Path ...
Basic principle:

1. Every frame of a stream (stream is identified by its stream destination address) has a sequence number (part of the redundancy tag) to be able to identify **Duplicates**
2. Duplicates are forwarded in the network on multiple (most-) disjoint paths
3. Duplicates are eliminated at a Duplicate Elimination Point

The focus of this presentation is on forwarding of duplicates within a network on multiple (most-) disjoint paths
**Recap: Identification of streams**

**AVB** Gen 1 specifies to use a unique Stream Destination Address to identify frames of the stream

- One unique Stream Destination Multicast Address to serve multiple Listener
- One unique Stream Destination Unicast Address to serve one Listener
- **MSRP** controls the FDB for successful forwarding of reserved streams

**TSN Goal:** support **multiple paths** for one stream.

- **Qca** defines explicit path control to enable non-shortest redundant paths
- **CB** defines the “Frame Replication and Elimination for High Reliability”
- Every frame of a stream and its duplicates must be distinguishable (to be able to forward it on its path and for duplicate elimination)

Two possible ways to achieve this:
1. Use one stream destination address with **different VIDs** (one VID for each replication)
2. Use **multiple stream destination addresses** with different forwarding paths (one stream destination address for each replication)
Principle operation of CB
Forwarding of primary frames

Primaries have to change the “Path” when CB is used in concatenation:
Coupled rings

Two possible ways to do this:
1) Using VIDs -> change the VLAN ID
   -> look only at one stream destination address and eliminate duplicates with same sequence number (but different VLAN ID)
   **change the VLAN ID** of forwarded primary frames
2) Using different stream addresses
   -> look at multiple stream destination addresses and eliminate duplicates with same sequence number (but different stream destination address)
   **change the stream destination address** of forwarded primary frames
CB with VLAN IDs

Previously presented idea with VLAN IDs:

How is the forwarding process with VLAN IDs?

Wished behavior:
The forwarding decision (set of destination ports) should be defined by the MAC + VLAN ID (VLAN is part of the address in the FDB) from the FDB

Simple Use-Case:

The Forwarding Process takes filtering decisions, i.e., reduces the set of potential transmission Ports (8.6.1), for each received frame on the basis of:

a) Destination MAC Address;
b) VID;
c) The information contained in the Filtering Database for that MAC Address and VID;
d) The default Group filtering behavior for the potential transmission Port (8.8.6);

How is the forwarding process with VLAN IDs?

Forwarding inside the Bridge:
All ports belong to both VIDs (the TSN VLAN)
VIDs of Duplicates differ (Path A or Path B)

How is the mechanism for Frame filtering specified in IEEE 802.1-Q Rev2013?

<table>
<thead>
<tr>
<th>MAC</th>
<th>VLAN ID</th>
<th>Forwarding Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td>All – receive port</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>only registered ports</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>only VLAN member ports</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>Group default – forward / delete</td>
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For CB wished:

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How is the forwarding process with VLAN IDs?

Forwarding inside the Bridge:

One Stream Destination Address

2 VIDs – Active Topology for VID is the complete network

=> Forwarding must be defined for MAC Address and VID combination
VIDs needs to change if the used Path change:

During Replication inside the first bridge with multiple paths

During Duplicate Elimination (CB in concatenation for high availability of substructures)
Can the “VID translation table” be used to change the VID for redundant streams?

Needed behavior:
Primary without VID / with VID A or B
Relay VID defined by Ingress VID + MAC

Used VID for forwarding depend on the Stream and the indented forwarding path (Ingress VID) for this stream!

Function of the VLAN port Translation table:
(IEEE802-1Q-REV-2013-d1-3 6.9 Support of the EISS)
Value for a Port – used for mapping of VLAN IDs
-> “a symmetric one-to-one translation”

Combined with Egress VID translation table:
-> “asymmetric and one-to-many translations”
How many VLAN IDs are needed?

Wished: Only one VLAN ID per redundancy level – used for every stream

Primary's of a stream should be forwarded with a specified VLAN ID

Originals can get a VID during Replication

Duplicates should be forwarded unchanged in the network

Example shows multiple Streams

Only 2 VIDs to be able to setup 2 disjoint paths for every stream (→ redundancy level = 2)

More than 2 VIDs if multiple (>2) paths are used
(only two disjoint path in one ring possible)