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Which sequence number relationship should be used for CB

sequence number relationship

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Aim of this presentation

This presentation should

- **Repeat the usage of the sequence number in CB**

- **Compare the requirements of two example applications**

- **Show possible Relations for the sequence number**

- **Show possible benefits when using streams and CB**

- **Start a discuss about L3** (and tagging)

Basic principle:

1. Every frame of a redundant connection (TSN: stream, identified by its stream destination MAC 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
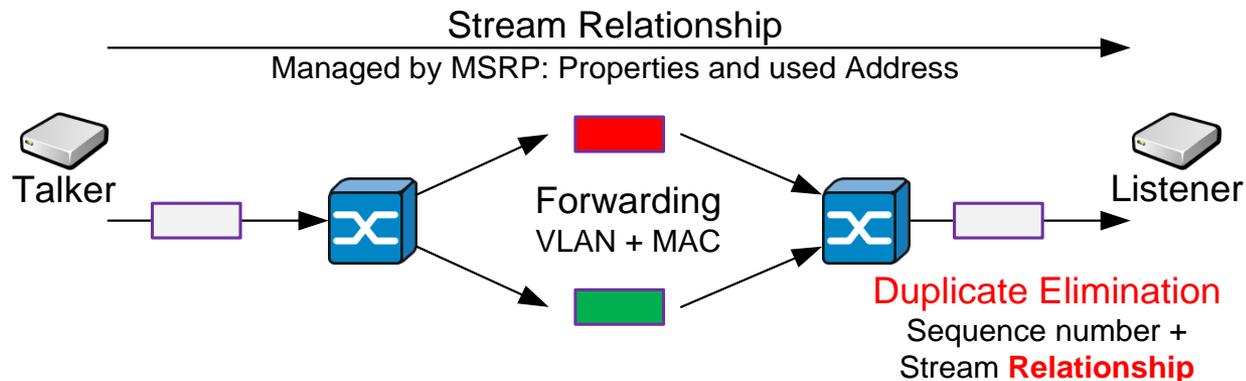
Path A

Path B

Talker

Original

Path ...

Primary

Listener

Duplicates

TSN network
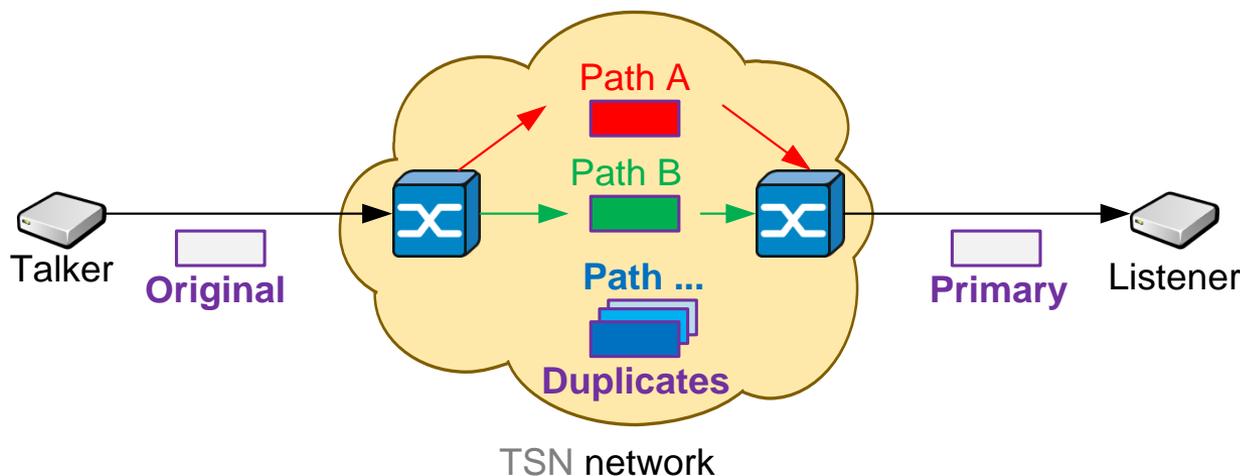
The focus of this presentation is on the relationship of the sequence number to the transmitted data (streams in case of TSN)

Recap: Forwarding of Frames
In this example: redundant **TSN Streams**

1. Streams describe a connection between one Talker and one/multiple Listener
2. The unique Stream Destination MAC Address is used inside every frame
3. Replication: Different VLAN ID for every Redundancy level (K)
4. Forwarding: Stream Destination MAC Address and VLAN (L2 Mechanisms)

Stream Relationship
Managed by MSRP: Properties and used Address

Talker

Forwarding
VLAN + MAC

Listener

Duplicate Elimination
Sequence number +
Stream **Relationship**

5. Duplicate Elimination: Sequence number and connection
   (Frames belonging to a connection are identified by there Stream Destination MAC Address)

Requirements for the sequence number
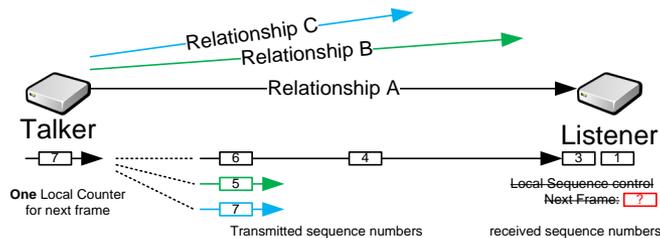## Example of Applications

The requirements for the sequence number are application dependent:

- Audio Streaming / Measurement
  - Lossless transport of information
  - Linear sequence number without gaps to detect missing frames
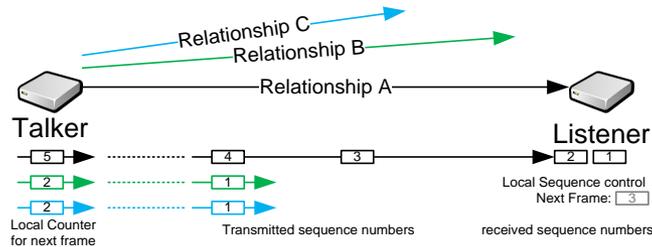
- **Some** Control Applications
  - Use newest received data
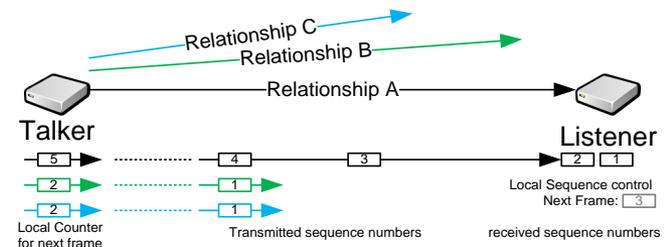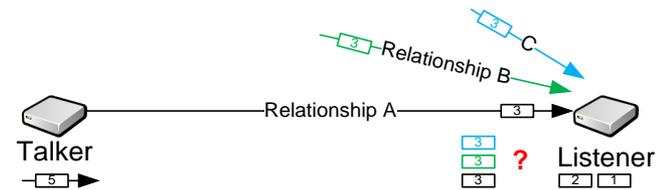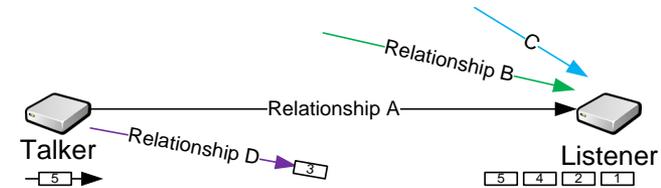 - Simple generation of the sequence number in Talker

How to Identify the Redundant Relationship
Relation of the sequence number

Different Options to identify a **Connection**:

- **Source Address**
  - only 1 counter in the Talker
  - No Sequence Control

- **Destination Address** (*For TSN Streams see next slide*)
  - Sequence Control possible
  - Only one Relationship per Destination (Or **loss of frames**!)

- **Source and Destination Address**
  - 1 counter per Relationship
  - Sequence Control possible
  - Long fields for matching

- **Connection ID in the Redundancy tag**
 - More information in the tag

How to Identify the Redundant Relationship
Relation of the sequence number

Different Options to identify a **Connection**:

- Use of **TSN Stream** properties
  - Streams have one Talker and one or more Listener
  - Unique Stream ID for Relationship (Management of Properties done by MSRP)
  - Stream Destination MAC Address is unique per stream for forwarding in the AVB/TSN network
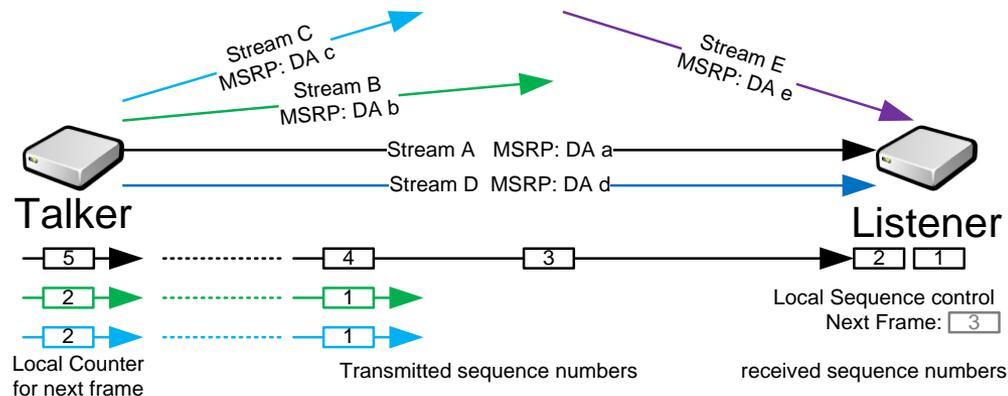

- Frames of a Stream can be identified using there mapped Stream Destination MAC Address
- Relation between sequence number and Stream by Stream Destination MAC Address possible

How to Identify the Redundant Relationship
Usage of IP and changed L2 address in frames

IP Addresses can be used to identify an IP Stream

L2 Addresses are changed from Routers

http://www.ieee802.org/1/files/public/docs2013/new-tsn-kiessling-Streams-for-L2-and-L3.pdf
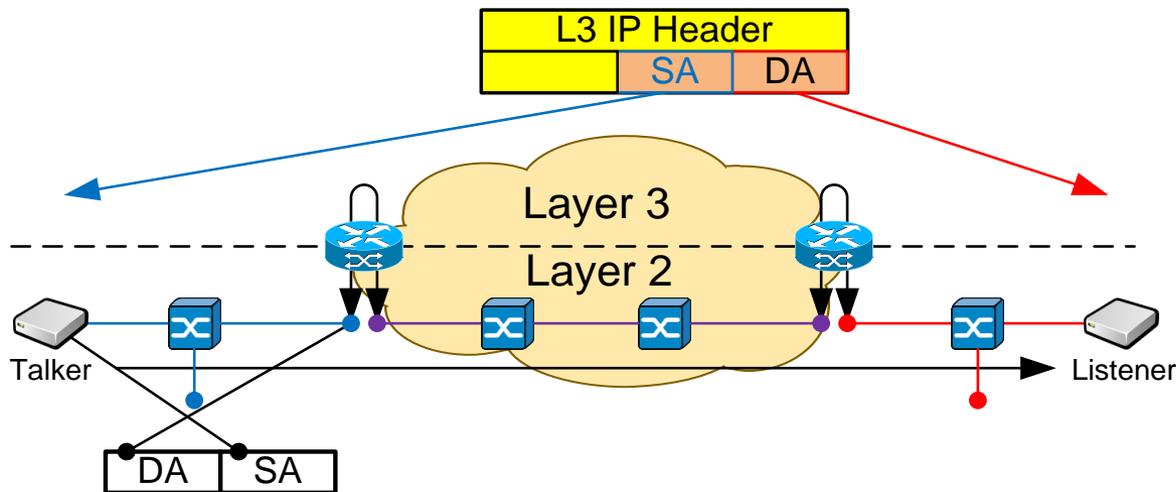
What is with L2 tags (VLAN, CB) ?

But: Management from End to End between Talker and Listener

Frames can be still identified if the connection is established

How to Identify the Redundant Relationship
Mapping of IP Multicast to L2 Multicast Addresses

IP Addresses can be used to identify an IP Relationship (L3-Stream)

Multicast IP is mapped to L2 MAC Addresses (01-00-5E-…)
But: AVB/TSN need a unique Address for forwarding and correct shaping

Suggestion: Use a mapping inside Routers – Control by Management
        L2 forwarding from Talker/Router to Router/Listener (inside the L2 network)
        "L3" mapping for Stream Destination MAC Addresses

Stream Relationship

SA   L3 - IP
DA

Talker   L2 - MAC

Listener

Managed by MSRP
with StreamID
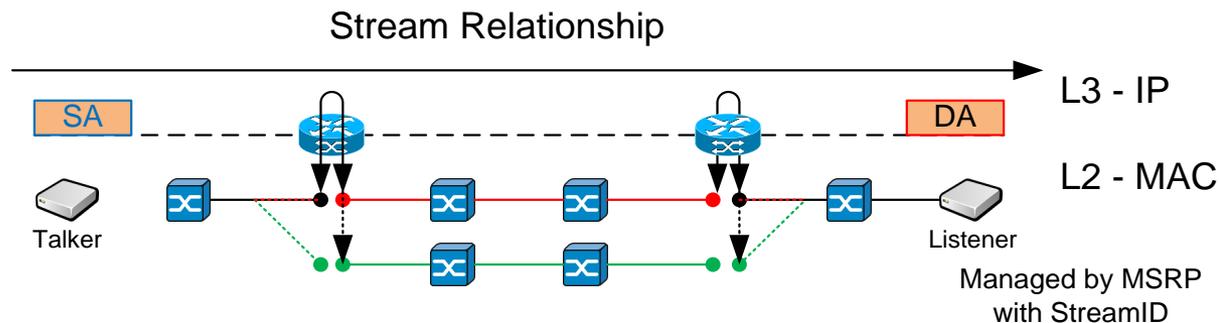
MSRP maps a connection / **Stream ID** to a Stream Destination MAC Address
Mapping between Talker and Listener for L2 **and L3**

How CB can work for IP
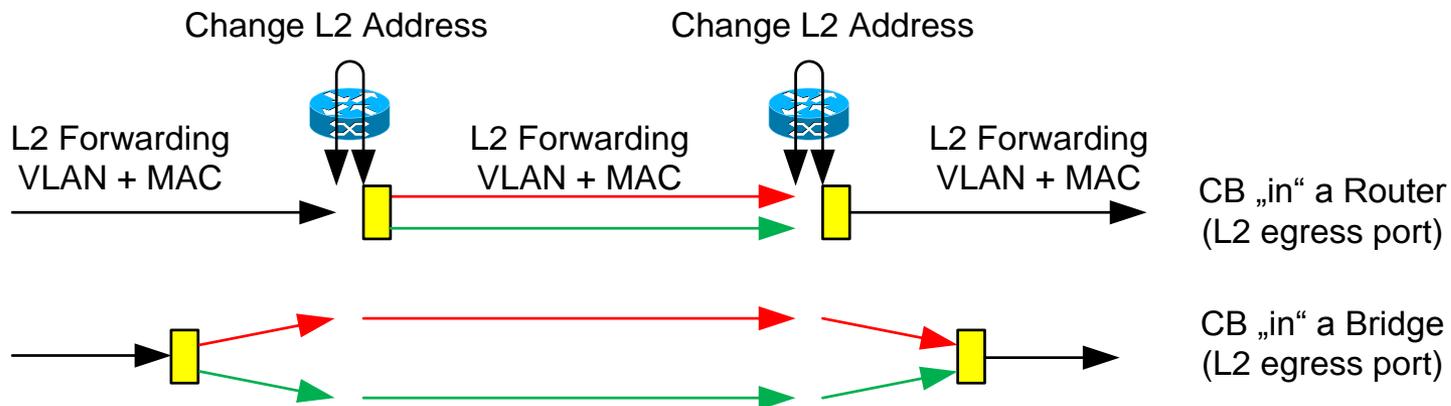## CB functionality as egress port function

A redundant connection must be known (End to End)

A belonging Frame must be identified

The Sequence number must be part of the frame

Redundant Duplicates can be eliminated on egress port

Stream Forwarding

Change L2 Address   Change L2 Address

L2 Forwarding   L2 Forwarding   L2 Forwarding
VLAN + MAC   VLAN + MAC   VLAN + MAC

CB „in" a Router
(L2 egress port)

CB „in" a Bridge
(L2 egress port)

Summary

Forwarding of Frames by MAC and VLAN

sequence number must be part of a frame to identify duplicates

(Redundancy TAG for duplicate frames)

Correlation between a frame to a redundant connection needed

CB can be considered as an egress port function

TSN/AVB has the Stream ID to identify connections with QoS requirements

Stream Relationship

Managed by MSRP: Properties and used Address

Talker

Forwarding
VLAN + MAC

Listener

Duplicate Elimination
Sequence number +
Stream **Relationship**