

802.1CB Improvements



FRER

Improvements of Replication and Elimination Functions

IEEE 802.1 TSN TG
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Topics



- Proposal
 - Improvements of Replication and Elimination functions
- Background
 - Replication specific scenarios
 - Elimination specific scenarios

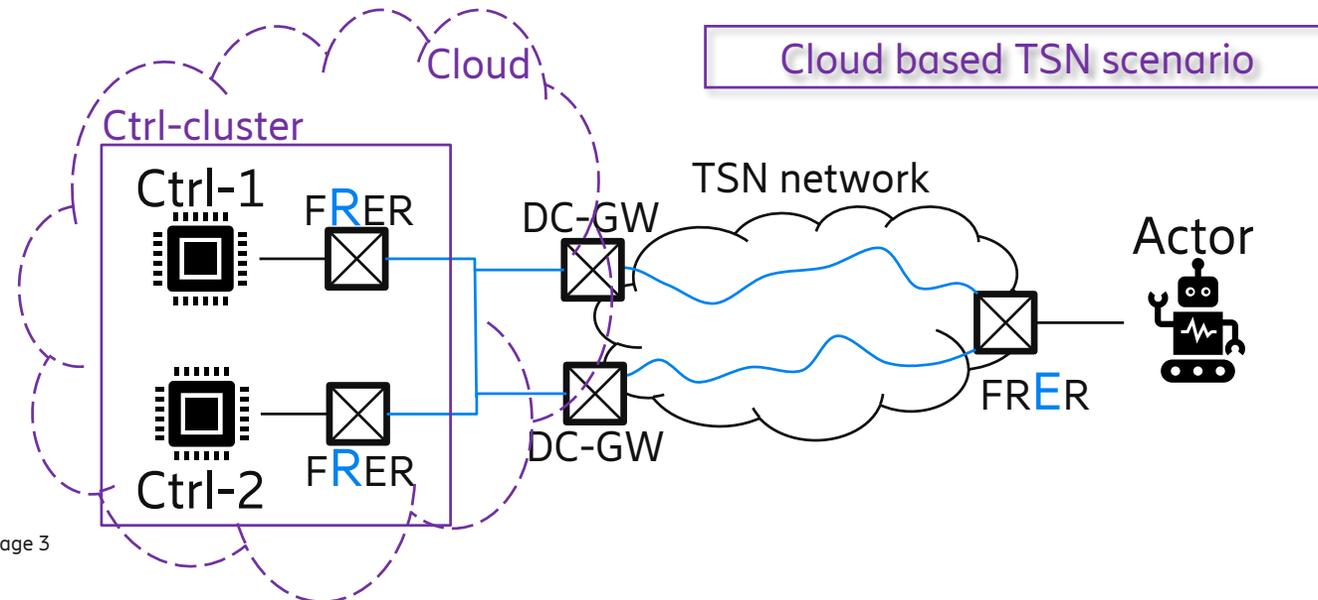
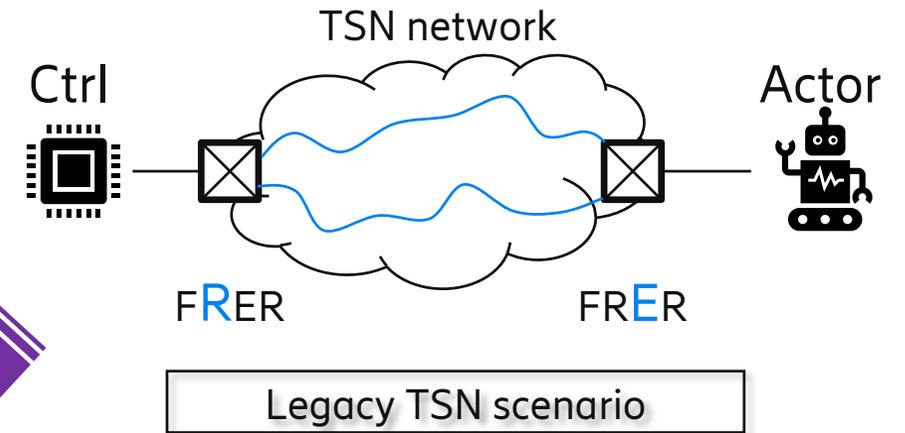
Moving towards Virtualized Environments

Using FRER in a cloud-based scenario



Scenario: Moving a Talker/Listener to the Cloud

- TSN functions must go with the endpoints
 - FRER must work inside Cloud ...
 - FRER can be an instance in a Ctrl-cluster ...
- Typical Cloud actions
 - Run multiple VMs/instances
 - Create a VM/instance
 - Move a VM/instance
 - Reset a function
 - Remove a VM/instance
 - Etc.



802.1CB Improvements

Overview



- **Target: integration of FRER and Virtualized domain (Cloud) specific redundancy technologies**
- How: via free modification of the "GenSeqNum" parameter
 - Replication node
 - modification of the "GenSeqNum" parameter to any valid value during "BEGIN" event and "SEQUENCE_CHANGE" event
- **Target: avoid unnecessary drops during Elimination**
- How: via explicit notification
 - Replication node
 - send a new flag "SeqResetFlag"
 - Elimination node
 - interpret the new flag "SeqResetFlag"
 - trigger the "SequenceRecoveryReset" function based on the notification

Replication Related Improvements





Target and Solutions at-a-glance

Allow free modification of the “GenSeqNum” parameter

- Target: allow usage of FRER within virtualized environments.
- Problem: Existing 802.1CB specification does NOT allow free
 1. modification of the “GenSeqNum” value during the sequence decode reset (i.e., “SequenceGenerationReset” as per section 7.4.1.3 of IEEE 802.1CB) routine
 2. change of “GenSeqNum” value without packets processed (i.e., DATA_REQUEST event as per section 7.4.1.1 of IEEE 802.1CB).
- Solution: allow modification of the “GenSeqNum” parameter to any valid value
 - A. during start of FRER functions (i.e., the “BEGIN” event)
 - B. during state synchronization of “sequence generation” functions belonging to other virtualized FRER entities (i.e., the new “SEQUENCE_CHANGE” event)
- **Impact: these improvements are essential for extending FRER usage inside virtualized domains. They allow integration of Transport (i.e., FRER) and Virtualized domain specific redundancy technologies.**

Modification of "GenSeqNum" Handling During "BEGIN" and "SEQUENCE_CHANGE" events



- Current: IEEE802.1CB changes the "GenSeqNum" parameter
 - whenever the "BEGIN" event occurs or via management intervention: "GenSeqNum" value is reset.
 - whenever the "DATA_REQUEST" event occurs: "GenSeqNum" is incremented by one.
- Solution: modification of the "GenSeqNum" parameter to ANY value (within 0 to (GenSeqSpace – 1))
 - A. "BEGIN" event: the global event that resets all FRER functions.
 - B. "SEQUENCE_CHANGE" event: the event that may occur anytime and changes the "GenSeqNum" to a defined value.
- "SEQUENCE_CHANGE" event is a new event. This event can be triggered via external entities or via management intervention. In such cases "GenSeqNum" is to be set to a specific provided value.



802.1CB Impact

What needs to be changed/added ...

- Replication node
 - defining "SEQUENCE_CHANGE" event
 - modification of the "GenSeqNum" parameter to any valid value during
 - "BEGIN" event and
 - "SEQUENCE_CHANGE" event

Elimination Related Improvements





Target and Solutions at-a-glance

Avoid unnecessary drops during Elimination

- Target: Avoid dropping frames unnecessarily due to replication function reset
- Solution: Use new trigger events to reset the sequence recovery function.
Explicit notification:
It is based on a new flag included in the R-TAG, namely the “SeqResetFlag”. This flag is set by the Replication function, when it was reset, so such resets can be recognized easily by Elimination functions.
- **Impact: these improvement can ensure much faster adaptation to failure scenarios and protects again unnecessary packet drops.**

Explicit Notification

To signal the reset of sequence generation function



- Method of explicit notification
 - a new flag included in the R-TAG, namely the “SeqResetFlag”

- Possible options to encode the “SeqResetFlag” in the R-TAG

- a) in the reserved field (2nd and 3rd byte of the R-TAG).
- b) using one bit of the Sequence Number field of the R-TAG.

“GenSeqSpace” and “RecovSeqSpace” variables may be used to limit the range of values used in the “Sequence Number” field. Setting their values to 32768 (or lower) means that only 15 bits of the “Sequence Number” field is needed to encode the “sequence_number” sub-parameter.

- c) using special value(s) of the Sequence Number field in the R-TAG.

“GenSeqSpace” and “RecovSeqSpace” variables may be used to limit the range of valid “sequence_number” values. “Sequence Number” field values out of the range can be used as special meaning values, like indicating a set “SeqResetFlag”.

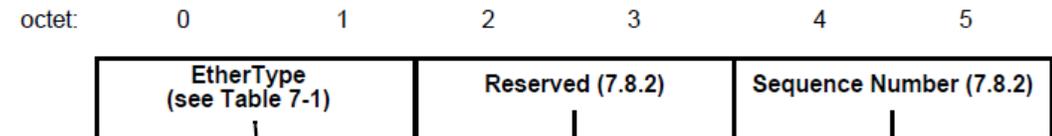


Figure 7-4—R-TAG format



802.1CB Impact

What needs to be changed/added ...

- Replication node
 - send the new flag “SeqResetFlag”
- Elimination node
 - interpret the new flag “SeqResetFlag”
 - trigger the “SequenceRecoveryReset” function based on the explicit notification



Questions ...