



P802.1DP Monitoring for FRER | Mar 2023

P802.1DP Monitoring for *Frame Replication and Elimination for Reliability*

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Objective



- ***Review approach to monitoring and management for DP***
- ***Discuss required monitoring objects for FRER***

Reference:

- ***P802.1DP Monitoring and Management, Jan 2023 Interim Session***
<https://www.ieee802.org/1/files/public/docs2023/dp-jabbar-monitoring-0123-v01.pdf>
- ***IEEE Std 802.1CB-2017***

Managed Objects for TSN Features – Aerospace Approach



- IEEE/IETF defines management objects for end stations and bridges, which can be categorized in to following categories (IMHO):
 - 1. Identity and capability: information on the device attributes
e.g. bridgeName, bridgeType, supportedListMax, supportedCycleMax
Defined offline via device datasheet
 - 2. Configuration: configure and/or query current configuration
e.g. gateEnabled, adminControlList, operControlList
Abstracted via configuration models;
Config query useful in design phase
 - 3. Operational: status/statistics derived from operating conditions
 - a. Status/health (capturing both normal and erroneous conditions)
e.g. isSynched, GateClosedDueToOctetsExceeded,
Applicable during operation (flight)
Required to meet DAL certification
 - b. Statistics (capturing both normal and erroneous behavior)
e.g. passingFrameCount, notPassingSDUCount, redFramesCount
DP should mandate specific ones

Side Discussion – IEEE conformance



- Conformance in clause 5, often (not always) mandates the support of the entire set of management objects
- Does that mean compliant devices should support all of the MIBs. In practice, devices on the market often support a partial set.
- Can DP make optional the objects related to identity, capability, and configuration when the base 802.1Q standard conformance clause makes them mandatory?
 - Although a caveat is that the management objects should simply be “supported”, but the manner in which they are exposed is left to the implementation. In that case, DP can provide guidance to make all but the operational metrics accessible via the configuration models so that they can be accessed during data loading phase and **not** during operation/flight

P802.1DP Specified Functions



Functions	Profile Specification	Monitoring Objects Review Status
Time Synchronization	802.1AS-2020*	
Egress Traffic Shaping	Credit Based Shaper Time Aware Shaper*	Complete
Redundancy	Frame Replication and Elimination	Today's contribution
Ingress Policing	Per-Stream Filtering and Policing	Complete
Stream Separation	Stream identification, transformation, and separation	Today's contribution
Configuration	Fully centralized, Yang models	
Forwarding	Per-stream forwarding	
Management and Monitoring	Required error, fault, and performance metrics	

FRER – Overview

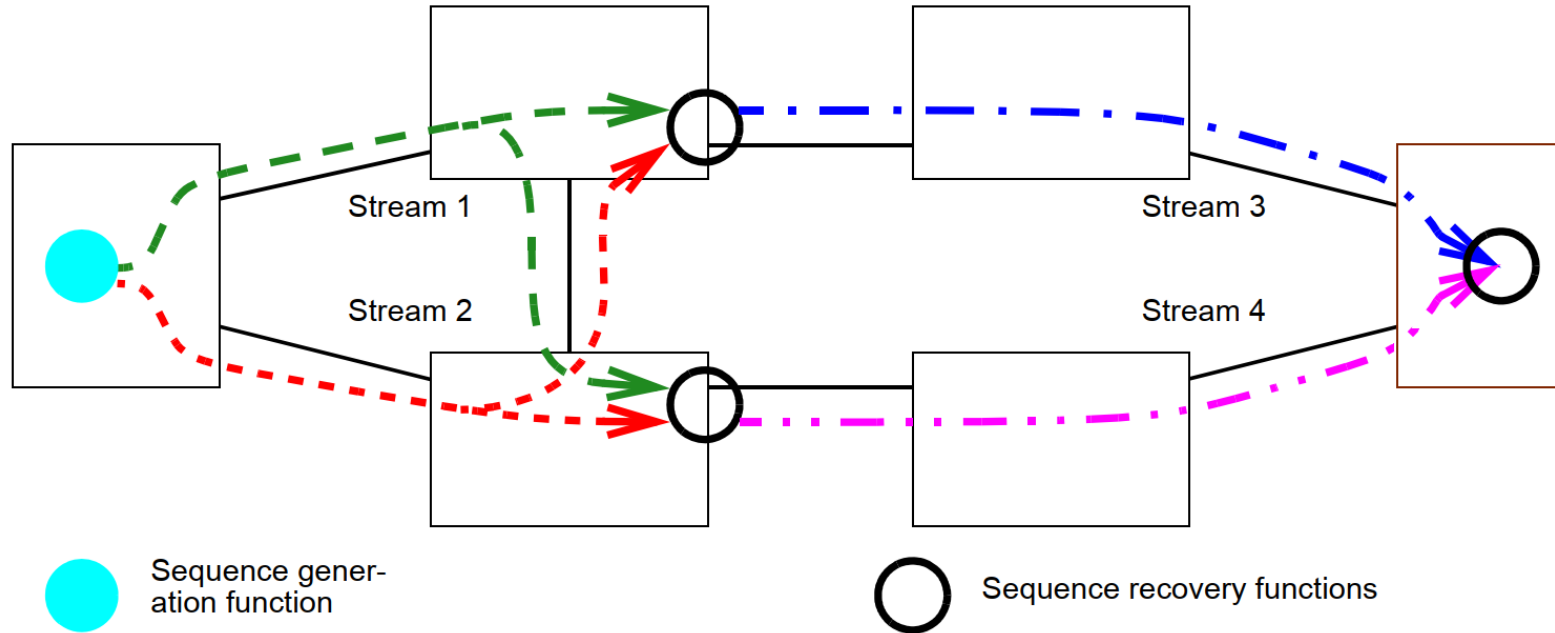


Figure 7-1—Compound Stream built from four Member Streams

Management Objects are defined in two clauses:

Clause 9. Stream Identification Management

Clause 10. Frame Replication and Elimination for Reliability management

Stream Identification Management



The description of the managed objects that control Stream identification are described in the following subclauses:

- a) The Stream identity table (9.1) assigns packets a `stream_handle` (6.1);

- b) The per-port, per-Stream packet counters that are kept by Stream identification functions for inspection by network management entities are described in 9.2, and the per-port (totaled over all Streams) counters in 9.3

Notes:

- a) is covered by required YANG model support in p802.1DP*
- b) Shall be required to be supported and exposed for inflight network monitoring and health management*

Stream Identification Management



9.2 Operational per-port per-Stream Stream identification counters

The following counters are instantiated for each port on which the Stream identification function (6.2) is configured. The counters are indexed by port number, facing (in-facing or out-facing), and stream_handle value (tsnStreamIdHandle, 9.1.1.1). All counters are unsigned integers. If used on links faster than 650 000 000 bits per second, they shall be 64 bits in length to ensure against excessively short wrap times.

9.2.1 tsnCpsSidInputPackets

The tsnCpsSidInputPackets counter is incremented once for each packet identified by the Stream identification function (6.2).

9.2.2 tsnCpsSidOutputPackets

The tsnCpsSidOutputPackets counter is incremented once for each packet passed down the stack by the Stream identification function (6.2).

Notes: DP compliant device shall make these two operational metrics available for monitoring inflight

Stream Identification Management



9.3 Operational per-port Stream identification counters

9.3.1 tsnCpSidInputPackets

The tsnCpSidInputPackets counter is incremented once for each packet identified by any Stream identification function (6.2) on this port. Its value equals the sum (modulo the size of the counters) of all of the tsnCpsSidInputPackets (9.2.1) counters on this same port.

9.3.2 tsnCpSidOutputPackets

The tsnCpSidOutputPackets counter is incremented once for each packet passed down the stack by any Stream identification function (6.2) on this port. Its value equals the sum (modulo the size of the counters) of all of the tsnCpsSidOutputPackets (9.2.2) counters on this same port.

Notes: DP compliant device shall make these two operational metrics available for monitoring in flight

Frame Replication and Elimination for Reliability management



The managed objects that control FRER are:

- b) The various tables of managed objects that can manage, in detail, each individual Stream (sequence generation table, sequence recovery table, sequence identification table, and stream split table)
- c) The managed objects that support the automatic configuration, upon receipt of a packet, of entries in the first four of the preceding tables (10.2 through 10.5), are described in the subclause on Autoconfiguration (10.7).
- d) The per-port, per-Stream packet counters that are kept by FRER functions for inspection by network management entities are described in 10.8, and the per-port (totaled over all Streams) counters in 10.9.

Notes:

b) is covered by required YANG model support in p802.1DP

c) Is out of scope for p802.1DP

d) Shall be required to be supported and exposed for inflight network monitoring and health management

FRER Management



10.8 Operational per-port and per-Stream FRER counters

10.8.2 frerCpsSeqGenResets counter is incremented each time the SequenceGenerationReset function (7.4.1.3) is called.

10.8.3 frerCpsSeqRcvyOutOfOrderPackets: counter is incremented once for each packet accepted out-of-order (not one more than previous) by the VectorRecoveryAlgorithm or MatchRecoveryAlgorithm

10.8.4 frerCpsSeqRcvyRoguePackets: counter is incremented once for each packet discarded by the VectorRecoveryAlgorithm because its sequence_number subparameter is more than frerSeqRcvyHistoryLength from RecovSeqNum

10.8.5 frerCpsSeqRcvyPassedPackets: counter is incremented once for each packet passed up the stack by the VectorRecoveryAlgorithm or MatchRecoveryAlgorithm

10.8.6 frerCpsSeqRcvyDiscardedPackets: counter is incremented once for each packet discarded due to a duplicate sequence number by the VectorRecoveryAlgorithm or MatchRecoveryAlgorithm

10.8.7 frerCpsSeqRcvyLostPackets: counter is incremented once for each packet lost by the VectorRecoveryAlgorithm. A packet is counted as lost if its sequence number is not received on any ingress port.

10.8.8 frerCpsSeqRcvyTaglessPackets: counter is incremented once for each packet received by the VectorRecoveryAlgorithm that has no sequence_number subparameter

10.8.9 frerCpsSeqRcvyResets: counter is incremented once each time the SequenceRecoveryReset function is called.

10.8.10 frerCpsSeqRcvyLatentErrorResets: counter is incremented once each time the LatentErrorReset function is called.

10.8.11 frerCpsSeqEncErroredPackets: counter is incremented once each time the Sequence encode/decode function receives a packet that it is unable to decode successfully

Notes: DP compliant device shall make these 10 operational metrics available for monitoring in flight

FRER Management



10.9 Operational per-port FRER counters

10.9.1 frerCpSeqRcvyPassedPackets:

The frerCpSeqRcvyPassedPackets counter is incremented once for each packet passed up the stack by the VectorRecoveryAlgorithm or MatchRecoveryAlgorithm. Its value equals the sum (modulo the size of the counters) of all of the frerCpsSeqRcvyPassedPackets (10.8.5) counters on this same port.

10.9.2 frerCpSeqRcvyDiscardPackets

The frerCpSeqRcvyDiscardPackets counter is incremented once for each packet discarded due to a duplicate sequence number or for being a rogue packet by any VectorRecoveryAlgorithm or MatchRecoveryAlgorithm on this port. Its value equals the sum (modulo the size of the counters) of all of the frerCpsSeqRcvyRoguePackets (10.8.4) and frerCpsSeqRcvyDiscardedPackets (10.8.6) counters on this same port.

10.9.3 frerCpSeqEncErroredPackets

The frerCpSeqEncErroredPackets counter is incremented once each time the Sequence encode/decode function (7.6) receives a packet that it is unable to decode successfully. Its value equals the sum (modulo the size of the counters) of all of the frerCpsSeqEncErroredPackets (10.8.11) counters on this same port.

Notes: DP compliant device shall make these 3 operational metrics available for monitoring in flight

Summary



- Presented operational monitoring objects for FRER as per 802.1 CB-2017
- Proposal is to make per-port and per-stream counters mandatory for in flight network monitoring