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  
- IEEE Std 802.1CB-2017
IEEE/IETF defines management objects for end stations and bridges, which can be categorized into the following categories (IMHO):

1. **Identity and capability**: information on the device attributes
   - *e.g.* `bridgeName`, `bridgeType`, `supportedListMax`, `supportedCycleMax`

2. **Configuration**: configure and/or query current configuration
   - *e.g.* `gateEnabled`, `adminControlList`, `operControlList`

3. **Operational**: status/statistics derived from operating conditions
   a. **Status/health** (capturing both normal and erroneous conditions)
      - *e.g.* `isSynched`, `GateClosedDueToOctetsExceeded`
   b. **Statistics** (capturing both normal and erroneous behavior)
      - *e.g.* `passingFrameCount`, `notPassingSDUCount`, `redFramesCount`
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

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* Only applicable to Synchronous profile
Management Objects are defined in two clauses:

Clause 9. Stream Identification Management
Clause 10. Frame Replication and Elimination for Reliability 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.
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
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
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.
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