Telcordia Technologies

Performance from Experience

RPR Fault and Performance Monitoring Primitives and Parameters

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Agenda

- **Performance Monitoring (background)**
- **Performance Monitoring in a Service Provider's Network**
- **Service Provider vs. Enterprise Networks**
- **Fault and Performance Primitives**
- **Lower Layer Failure**
- **RPR Primitives**
- **RPR Performance Monitoring Parameters**
- **Proposed Motions**

Performance Monitoring (1)

- Signal impairments are realized in the form of *performance primitives,* and give rise to the various performance parameters.

- Primitives are grouped into *anomalies* and *defect*s
  - Anomaly is the discrepancy between the actual and desired characteristics of an item.
  - Defect is a limited interruption in the ability of an item to perform a required function.
  - A persistent defect results in a *failure.*

- *Performance parameters* are raw counts derived by the processing of performance primitives within 1-second time intervals

Performance Monitoring (2)

- Network Elements (NEs) accumulate various PM parameters based on performance primitives that they detect in the incoming bit stream

  – Corrupted packets (e.g., CRC errors), packets discarded, etc.

- PM is performed at each layer independent of the other layers

  – However, layers pass maintenance signals (e.g., AIS, SSF) to higher layers upon detecting defects

  – Defects and failures that occur at a lower layer affect PM parameters at higher layers.

PM in a Service Provider's Network

- Performance Monitoring Applications Include
  - Trouble Detection/Identification (e.g., signal degradation may be caused by a defect in one component)
  - Fault Location (e.g. monitoring of CRC errors at each node will help localize a fault to a particular span on the ring)
  - Service Objective Verification (e.g., SLA monitoring: packets dropped, packets corrupted, etc.)
  - Service Restoration (e.g., protection switching based on signal degradation)

Service Provider vs. Enterprise Networks

- Different environments lead to different needs
  - There is no need to support/guarantee SLAs in an enterprise environment
  - Service provider are very large therefore need enhanced PM for fault localization
- RPR is going to be used in the Service Provider network
- RPR Needs to Support Service Provider's OAM&P
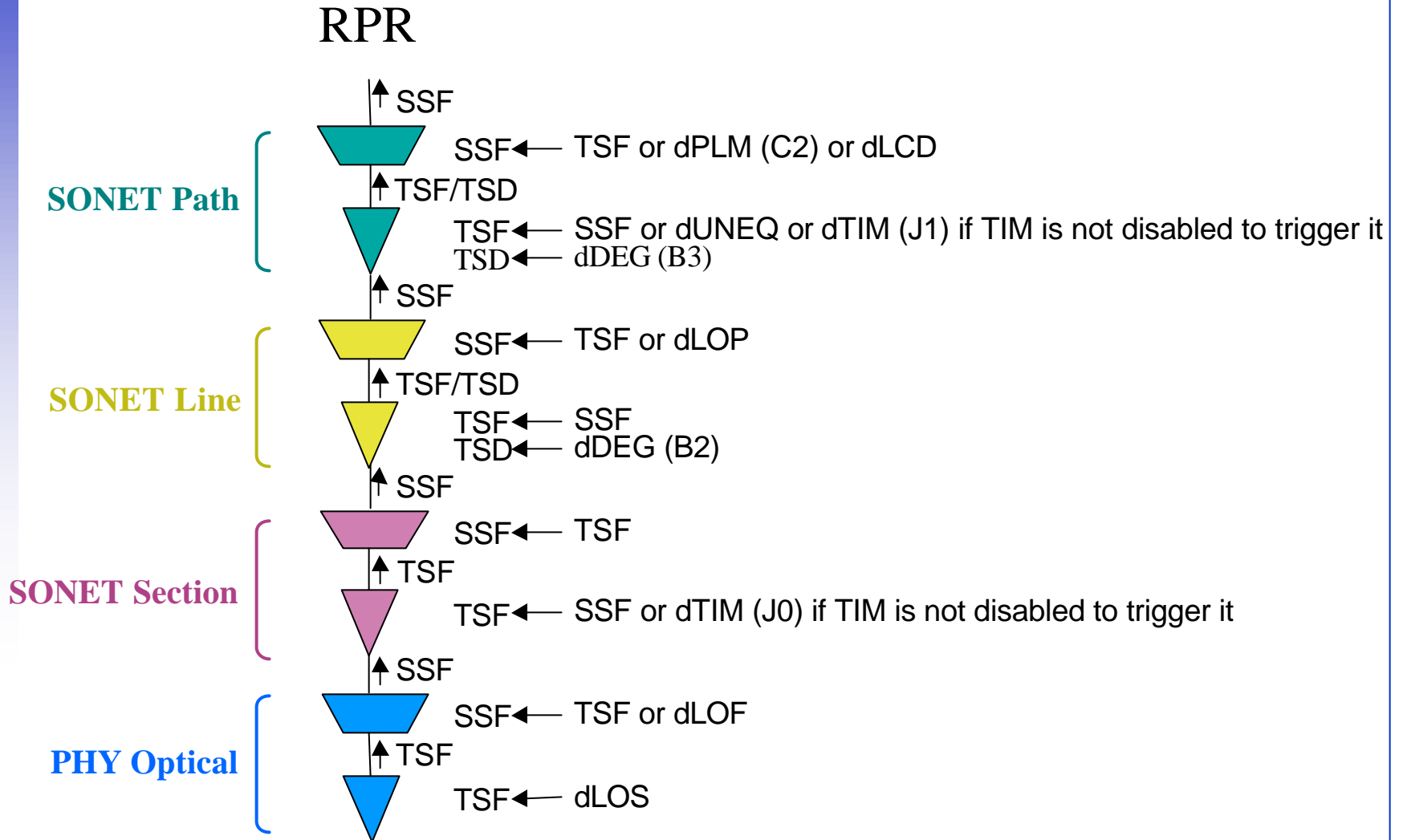 - Parameters and Data Collection Vehicles Must Be Provided

Fault and Performance Primitives

- We should start defining initial RPR primitives
  - what is considered an error?
  - How do we detect such errors?
- Mechanisms through which primitives are detected vary
  - depending on the particular digital signal
  - depending on the transmission technology
- Standardized approaches to PM are needed to operate networks containing RPR boxes from multiple vendors
  - Service providers want a consistent way of managing their multivendor network

Lower Layer Failure (1)

- RPR should start considering PHY Layer Defects
  - Server layer failures may affect RPR service
  - Can be used for service restoration, fault identification and correlation
- SONET/SDH generates Server Signal Fail (SSF) to communicate with higher layers
  - RPR should consider SSF as a failure indication
- Can 1/10 GbE provide such indication to higher layers?

Lower Layer Failure (2)

RPR

SSF

SONET Path

SSF ← TSF or dPLM (C2) or dLCD

TSF/TSD

TSF ← SSF or dUNEQ or dTIM (J1) if TIM is not disabled to trigger it
TSD ← dDEG (B3)

SSF

SONET Line

SSF ← TSF or dLOP

TSF/TSD

TSF ← SSF
TSD ← dDEG (B2)

SSF

SONET Section

SSF ← TSF

TSF

TSF ← SSF or dTIM (J0) if TIM is not disabled to trigger it

SSF

PHY Optical

SSF ← TSF or dLOF

TSF

TSF ← dLOS

Lower Layer Failure (3)

- RPR can receive an SSF from SONET/SDH Path Adaptation Function (ITU Recommendation G.783) due to:
  - Payload Label Mismatch (PLM)
  - Trail Signal Fail (TSF)
- Loss of Frame Delineation may generate SSF
  - Streams of bits have to be delineated before handed to RPR
  - GFP is being developed and can handle it
  - If RPR <u>does not</u> use GFP, delineation will have to be provided at RPR layer and a Loss of Frame Delineation would have to be detected by RPR directly

RPR Primitives (1)

- Cyclic Redundancy Check (CRC) code violation
  - Used for verifying SLAs and helping in span management
  - We need 2 CRCs: Header and Payload
- Unrecognizable packet header field value
  - Invalid numbers added before the CRC is generated, e.g., ring id, length, payload/protocol type, priority
  - protocol error or node misconfigured
- Unsupported packet header field value
  - Recognizable but not supported by the particular RPR node, e.g., L3 protocol type, or a currently unsupported function
  - protocol error or node misconfigured

RPR Primitives (2)

- SONET/SDH Server Signal Fail (SSF) Indication
  - SSF could have been generated due to lower layer defects (e.g., LOS, LOF, LOP, PLM, delineation, etc.)
  - Lower layer defects affect RPR service
  - SSF can be used for triggering protection switching at the RPR layer
- Continuity Check
  - Verify the integrity of the interface between the PHY and RPR layers
  - 3 possible reasons why the RPR layer may not receive packets from the PHY interface:
    - there may be a problem in the access point between the PHY layer and the RPR layer (failure we need to detect)
    - there is no packet in the medium (no problem)
    - there is a PHY layer failure (e.g., fiber cut), which would be indicated via a SSF [Does GbE generate a SSF-like indication at the PHY layer?]
  - A mechanism could be to transmit idle packets periodically to test the PHY/RPR interface

RPR Performance Monitoring Parameters (1)

- Based on the performance primitives detected in the incoming bit stream, NEs accumulate various PM parameters.

- Parameters we could use to generate PM data
  - Errored Header (Header CRC)
    - Span management
  - Errored payloads (payload CRC)
    - Span management
    - SLA monitoring (per customer basis)

RPR Performance Monitoring Parameters (2)

- More Parameters we could use to generate PM data
  - Unrecognizable/unsupported packet header field
    - Node fault detection due to either protocol error or misconfiguration
  - Errored Packets
    - Includes payload CRC and unrecognizable/unsupported header field errors
    - SLA monitoring
  - Transmitted Packets
    - SLA monitoring
  - Received Packets
    - SLA monitoring
- These are a preliminary set of PM Parameters
  - Further discussion is required to define the exact set to be used

Proposed Motions

- Motion 1: RPR should support Header CRC in support of span management

- Motion 2: RPR should support Payload CRC calculation in support of span management and SLA monitoring

- Motion 3: RPR should check for unrecognized/unsupported packet header field value in support of node fault detection and SLA monitoring

- Motion 4: RPR should be able to detect SSF indications from lower layers such as SONET/SDH in support of service restoration, fault identification and correlation.

- Motion 5: RPR should provide a mechanism for continuity check in support of detecting failures on the interface between the RPR and PHY layers

Questions?