

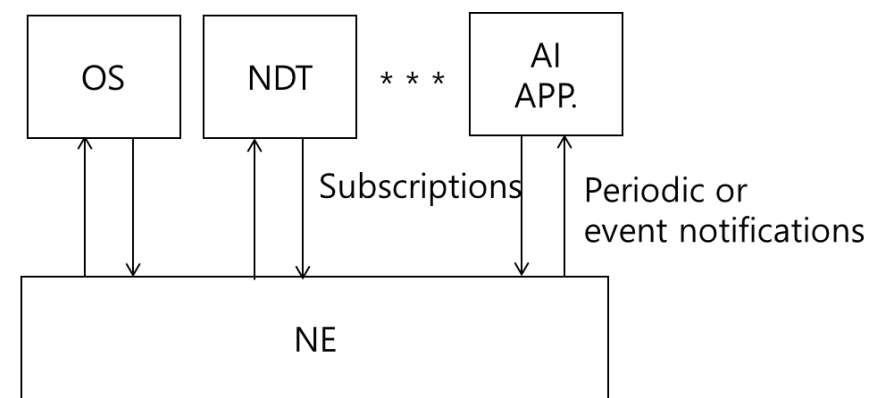
A YANG Data Model of Performance Management Streaming

[draft-yoon-ccamp-pm-streaming](#)

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Motivations

- ITU-T G.7710 provides a foundational framework for managing transport network elements with FCAPS,
 - Addressing requirements, types of parameters, and measurement methods for performance management
- To support PM streaming, various IETF protocols (RFC8639, RFC8640, RFC8641) can be utilized
- This document provides a YANG data model for PM streaming based on ITU-T G.7710, demonstrating how to subscribe to the YANG model using the IETF push model



* OS: Operation System, NDT: Network Digital Twins

Three Groups of PM Parameters (G.7710)

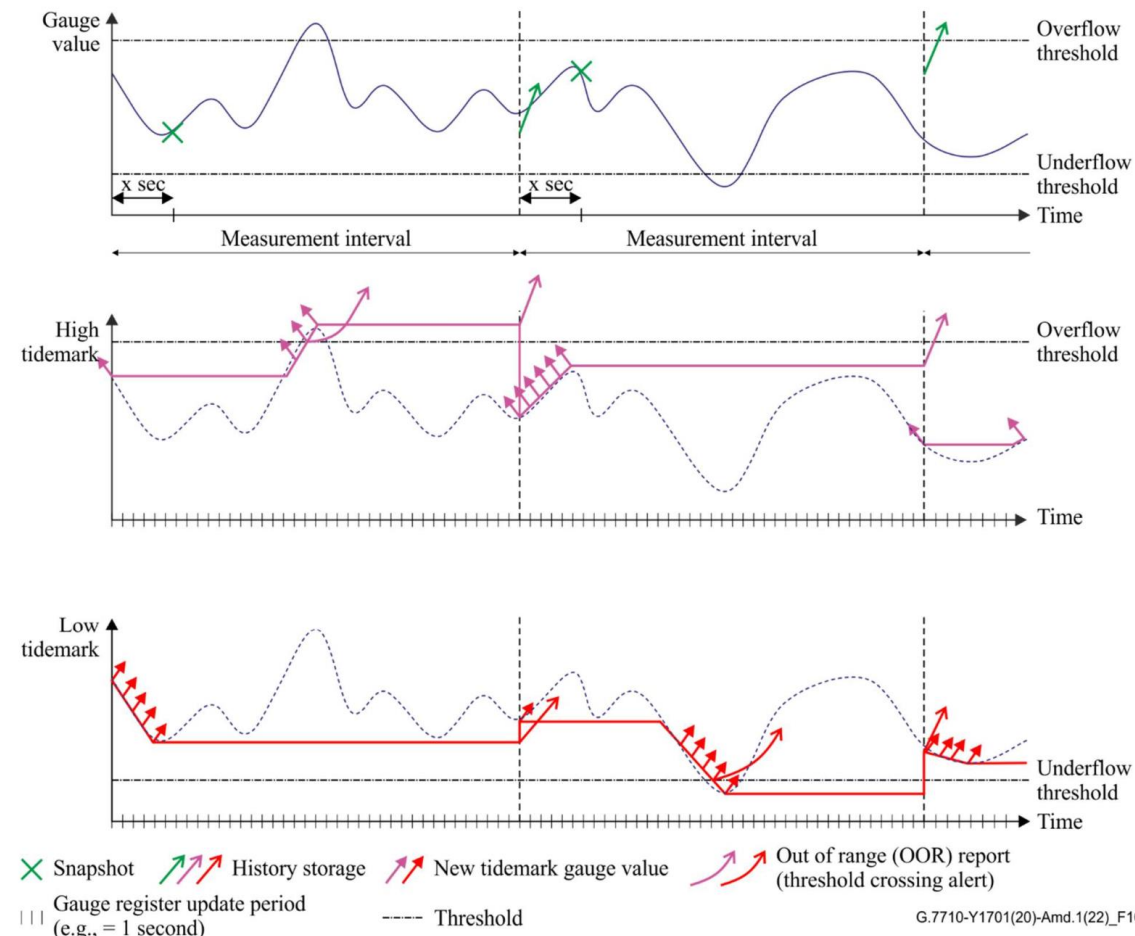
- Maintenance vs. QoS monitoring purposes
 - (Maintenance: Unidirectional) Identifying physical layer issues, equipment malfunctions, or any performance degradation such as error counts and signal degradation
 - (QoS: Bidirectional) Ensuring the quality of services such as latency, packet delay variation, and packet loss.
- Time intervals
 - 15 minutes: short-term issues (such as spikes in latency or packet loss)
 - 24 hours: long-term issues (overall network health)

Monitoring Purposes	Time Intervals	PM Parameters
Maintenance	15minutes	ES, SES, BBE, BBC, UAS
	24 hours (extended)	ES, SES, BBE, BBC, UAS, PJE
QoS	15minutes	-
	24 hours	ES, SES, BBE, BBC, UAS, SEP

Measurement Methods (G.7710)

Aspects	Count Measurement	Gauge Measurements
Periodic reporting	<ul style="list-style-type: none"> Measures the total number of events over a period 	<ul style="list-style-type: none"> Measures the state of the network at a specific moment (Snapshots) Gauge value at uniform time (Tidemarks) highest and lowest values
Threshold Event reporting	<ul style="list-style-type: none"> Transient and standing threshold events 	<ul style="list-style-type: none"> Overflow and underflow threshold events
Limitation	<ul style="list-style-type: none"> Cannot capture real-time performance issues 	<ul style="list-style-type: none"> Cannot track total network usage over time

Gauge measurement



G.7710-Y1701(20)-Amd.1(22)_F10-5

Types of Reporting (G.7710)

- Periodic PM reporting
 - Counts, snapshots, tidesmarks
- Threshold event reporting
 - Periodic threshold events
 - Counts: transient, standing
 - Snapshots: High and low OOR (Overflow and underflow)
 - Tidesmarks: High and low tidesmark OOR
 - Non-periodic threshold events
 - BUT (Begin Unavailable Time)
 - EUT (End Unavailable Time)
 - CSES (Consecutive Severely Errored Seconds)

Comparisons

Aspects	ITU-T G.7710	draft-yoon-ccamp-pm-streaming-00
Summary	<ul style="list-style-type: none">• PM functional requirements for transport equipment	<ul style="list-style-type: none">• PM YANG data model
Common Features	<ul style="list-style-type: none">• Three types of PM parameters (maintenance, maintenance-extended, QoS)• Periodic reporting (Counts, snapshots, tidesmarks, 15min/24hr)• Threshold event reporting<ul style="list-style-type: none">• Periodic threshold reporting (transient, standing, OOR)• Non-periodic threshold reporting (BUT, EUT, CSES)	
Reporting Methods	<ul style="list-style-type: none">• No specific reporting method: (polling or streaming possible)• PM data stored in 16 registers	<ul style="list-style-type: none">• Streaming based on IETF push model using subscriptions and notifications with periodic and on-change
Clients	Single client: OS	Multiple clients: OS, AI app., NDT, etc.

YANG Model (Periodic PM reporting)

- Three groups of PM parameters defined as grouping statements
- Each parameter of the group has three containers for three measurement methods
- Each measurement method has their own metric nodes

```
module: ietf-pm-streaming
  +--rw pm-periodic-measurement
    +--rw measurement-interval? uint32
    +--rw maintenance-15min
      +--rw pm-parameter* [parameter-name]
        +--rw parameter-name maintenance-parameters
        +--rw count-measurement
          +--ro count-value? uint32
          +--ro count-unit? parameter-unit
          +--rw transient-condition-config
            +--rw high-oor-threshold? uint32
            +--rw low-oor-threshold? uint32
          +--rw standing-condition-config
            +--rw standing-threshold? uint32
            +--rw standing-reset-threshold? uint32
        +--rw snapshot-measurement
          +--rw uniform-time? uint32
          +--ro snapshot-value? uint32
          +--ro snapshot-unit? parameter-unit
          +--rw high-oor-threshold? uint32
          +--rw low-oor-threshold? uint32
        +--rw tidemark-maintenance
          +--ro high-tide-value? uint32
          +--ro high-tide-unit? parameter-unit
          +--ro low-tide-value? uint32
          +--ro low-tide-unit? parameter-unit
          +--rw high-oor-threshold? uint32
          +--rw low-oor-threshold? uint32
    +--rw maintenance-24hr
    +--rw qos-24hr
```

YANG Model (Periodic Threshold Events)

- Counts
 - Transient event
 - Standing event
- Snapshots
 - High or low OOR (out of range)
- Tidemarks
 - High tidemark or low tidemark OOR (out of range)

```
notifications:
  +---n threshold-events
    +--ro periodic-threshold-events
      +--ro maintenance-15min
        +--ro pm-parameter* [parameter-name]
          +--ro parameter-name maintenance-parameters
          +--ro count-transient-event
            +--ro event-type? enumeration
            +--ro event-occurred? boolean
            +--ro event-time? yang:date-and-time
          +--ro count-standing-event
            +--ro event-type? enumeration
            +--ro event-occurred? boolean
            +--ro event-time? yang:date-and-time
          +--ro snapshot-event
            +--ro event-type? enumeration
            +--ro event-occurred? boolean
            +--ro event-time? yang:date-and-time
          +--ro tidemark-event
            +--ro event-type? enumeration
            +--ro event-occurred? boolean
            +--ro event-time? yang:date-and-time
      +--ro maintenance-24hr
      +--ro qos-24hr
```


YANG Model (Non-periodic Threshold Events)

- BUT
 - Occurrence
 - Event time
- EUT
 - Occurrence
 - Event time
 - Total unavailable time
- CSES
 - Occurrence
 - Begin time
 - End time

```
+--ro non-periodic-threshold-events
  +--ro BUT-event
    | +--ro event-occurred?    boolean
    | +--ro event-time?       yang:date-and-time
  +--ro EUT-event
    | +--ro event-occurred?    boolean
    | +--ro event-time?       yang:date-and-time
    | +--ro total-unavailable-time?  uint32
  +--ro CSES-event
    +--ro event-occurred?    boolean
    +--ro begin-time?       yang:date-and-time
```

Example of Periodic Subscription

- Subscribe to "SES" with the following conditions
 - Purpose: Maintenance for link = 'x'
 - Reporting interval: 15 minutes
 - Target PM parameter: SES
 - Metric values: count-value, count-unit
 - Start time of streaming
 - End time of streaming

```
<rpc message-id="101"
  xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <establish-subscription
    xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-push:1.0">
    <filter type="subtree">
      <pm-periodic-measurement
        xmlns="urn:ietf:params:xml:ns:yang:ietf-pm-streaming">
        <maintenance-15min>
          <pm-parameter>
            <parameter-name>ses</parameter-name>
            <count-measurement>
              <count-value/>
              <count-unit/>
            </count-measurement>
          </pm-parameter>
        </maintenance-15min>
      </pm-periodic-measurement>
    </filter>
    <period>900</period> <!-- Every 15 minutes -->
    <encoding>encode-xml</encoding>
    <start-time>2024-10-20T10:00:00Z</start-time>
    <stop-time>2024-10-20T16:00:00Z</stop-time>
    <!-- Optional: Limits the subscription duration -->
  </establish-subscription>
</rpc>
```

Example of Threshold Event Subscription

- Subscribe to BUT-event
 - Target parameter: BUT
 - Target metrics: event occurrence, event time

```
<rpc message-id="103"
  xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <establish-subscription
    xmlns="urn:ietf:params:xml:ns:yang:
      ietf-subscribed-notifications">
    <stream>ietf-push</stream>
    <encoding>encode-xml</encoding>
    <filter type="subtree">
      <pm-periodic-measurement xmlns="urn:ietf:params:xml:ns:yang:
        ietf-pm-streaming">
        <BUT-event>
          <event-occurred/>
          <event-time/>
        </BUT-event>
      </pm-periodic-measurement>
    </filter>
  </establish-subscription>
</rpc>
```

Future Works

- G.7710 being revised in ITU-T SG15 (April 2025) should be aligned
 - Current fixed time intervals (15min., 24hr.) will change to variable time intervals
 - Streaming functional requirements will be added to support the push model with subscriptions and notifications
- More PM parameters should be added to support packet networks as well as circuit networks
- Update YANG data model

Side Meeting Summary

- Attendees: Italo et al 8
- Date & time: 05.11.2024, 16:00~17:30
- Key outcomes: Separate the content into two documents
 - Document 1 (**Technology agnostic**)
 - Make a framework of PM streaming with the YANG data model
 - Employ XPath filters to identify parameters while ensuring technology-agnostic
 - Submit to OPSAWG
 - Document 2 (**Technology specific**)
 - Define the PM parameters after classifying them into categories such as OTN, MPLS-TP, etc
 - Augment the YANG data model in the document 1 for the PM streaming
 - Submit to CCAMP