

Internet Draft

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**YANG Data Model for TRILL Operations, Administration, and  
Maintenance (OAM) Performance Management**  
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#### Abstract

This document presents YANG Data model for TRILL OAM PM[TRILLOAMPM]. It extends Yang Data Model for TRILL OAM [[TRILLOAMYANG](#)] with trill Performance Monitoring technology specifics.

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**[1.](#) Introduction**

Fault Management for TRILL is defined in [TRILLOAMFM]. TRILL Fault Management utilizes the [8021Q] CFM model and extends CFM with technology specific details. Those technology specific extensions are flow-entropy for multipath support, MEP addressing on TRILL identifiers, and so on. The extensions are explained in detail in [TRILLOAMFM].

Performance Management for TRILL is defined in [TRILLOAMPM]. TRILL Performance Management utilizes the [Y.1731-2013/G.8013] and extends it with Loss Measurement and Delay measurement.

Generic OAM Yang model [[GENYANGOAM](#)] presents Generic Yang data model for all OAM technologies.

In this document we extend the YANG model defined in [[GENYANGOAM](#)] for TRILL OAM Performance management.

**[2.](#) Conventions used in this document**



The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC-2119](#) [[RFC2119](#)].

## **2.1. Terminology**

ECMP - Equal Cost Multipath

MP - Maintenance Point [[8021Q](#)]

MEP - Maintenance End Point [[RFC7174](#)] [[8021Q](#)] [[RFC6371](#)]

MIP - Maintenance Intermediate Point [[RFC7174](#)] [[8021Q](#)] [[RFC6371](#)]

MA - Maintenance Association [[8021Q](#)] [[RFC7174](#)]

MD - Maintenance Domain [[8021Q](#)]

OAM - Operations, Administration, and Maintenance [[RFC6291](#)]

TRILL - Transparent Interconnection of Lots of Links [[RFC6325](#)]

DMM - Delay Measurement Message

1SL - One-way Synthetic Loss Measurement message

1DM - One-way Delay Measurement message

DMR - Delay Measurement Reply

OAM - Operations, Administration, and Maintenance [OAM]

PM - Performance Monitoring

SLM - Synthetic Loss Measurement Message

SLR - Synthetic Loss Measurement Reply

TLV - Type, Length, and Value

## **3. Architecture of OAM YANG Model and Relationship to TRILL OAM PM**

```
+---+---+---+
|  Gen   |
|OAM YANG|
```



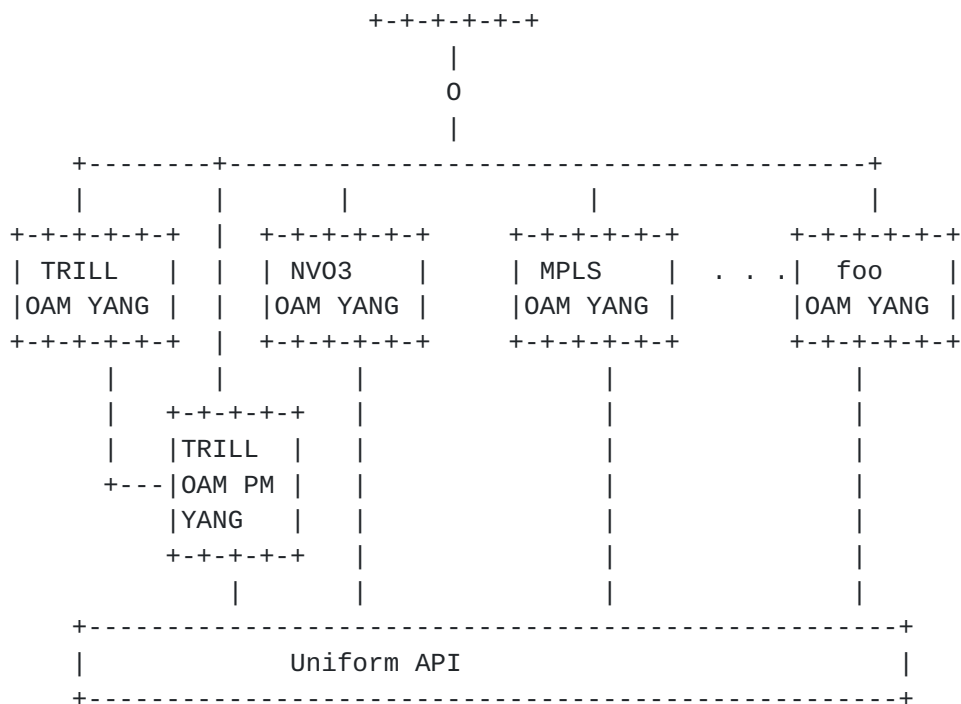


Figure 1 Relationship of TRILL OAM PM Yang model to Generic OAM YANG model

#### 4. YANG Extension

MEP Addressing is defined in Generic OAM YANG model[GENOAMYANG]. TRILL OAM PM Yang is extended to augment MEP Configuration with Performance Management configuration and statistics for Delay Measurement and Performance Measurement.

```
identity trill {      base goam:technology-types;      description
    "trill pm type";  }
```

### 4.1 MEP Address

As defined in TRILL OAM Yang[TRILLOAMYANG] model. TRILL OAM Yang is referenced.

#### 4.1 MEP Configuration Extension

```
module: trill-oam-pm
augment /goam:domains/goam:domain/goam:MAS/goam:MA/goam:MEP:
```

## 4.2 Flow Entropy





As defined in TRILL OAM Yang[TRILLOAMYANG] model.

#### **4.3 Context-id**

As defined in TRILL OAM Yang[TRILLOAMYANG] model.

#### **4.4 RPC definition**

The rpc model facilitates issuing commands to a NETCONF server (in this case to the device that needs to execute the OAM command) and obtaining a response.

Grouping Statements 1. loss-measurement-configuration-group 2. measurement-timing-group 3. delay-measurement-configuration-group

defines input extension for Delay and Loss measurement.

##### **4.4.1 create-loss-measurement**

RPC allows scheduling of one-way or two-way on-demand or proactive performance monitoring loss measurement session.

##### **4.4.2 abort-loss-measurement**

RPC allow aborting of currently running or scheduled loss measurement session.

##### **4.4.3 create-delay-measurement**

RPC allow scheduling of one-way or two-way on-demand or proactive performance monitoring delay measurement session.

##### **4.4.4 abort-delay-measurement RPC allow aborting of currently running or scheduled delay measurement session.**

#### **4. TRILL PM data hierarchy** The complete data hierarchy related to the OAM YANG is presented below. The following notations are used within the tree and carry the meaning as noted below. Each node is printed as:

<status> <flags> <name> <opts> <type>

<status> is one of:

- + for current
- x for deprecated
- o for obsolete

<flags> is one of:



rw for configuration data  
ro for non-configuration data  
-x for rpcs  
-n for notifications

<name> is the name of the node

If the node is augmented into the tree from another module, its name is printed as <prefix>:<name>.

<opts> is one of:

? for an optional leaf or choice  
! for a presence container  
\* for a leaf-list or list  
[<keys>] for a list's keys

<type> is the name of the type for leafs and leaf-lists

```
module: trill-oam-pm
augment /goam:domains/goam:domain/goam:MA/goam:MA/goam:MEP:
  +--rw delay-responder?   boolean
augment /goam:domains/goam:domain/goam:MA/goam:MA/goam:MEP:
  +--rw delay-measurements
    +--ro delay-measurements* [session-cookie]
      | +--ro session-cookie   uint32
      | +--ro id?              string
      | +--ro status?          boolean
    +--rw measurement-type?          enumeration
    +--rw measurement-enable?         bits
    +--rw message-period?             uint32
    +--rw frame-size?                 uint32
    +--rw data-pattern?               enumeration
    +--rw measurement-interval?       uint32
    +--rw number-intervals-stored?    uint32
    +--rw ifdv-selection-offset?      uint32
    +--rw session-type?               enumeration
    +--rw start-time
      | +--rw (start-time)?
      |   +--:(immediate)
      |     | +--rw immediate!
      |     +--:(absolute)
      |       +--rw absolute?   yang:date-and-time
    +--rw stop-time
```



```

| +--rw (stop-time)?
|   +--:(none)
|   | +--rw none!
|   +--:(absolute)
|     +--rw absolute?    yang:date-and-time
+--rw destination-mep
| +--rw (mp-address)?
| | +--:(mac-address)
| | | +--rw mac-address?    yang:mac-address
| | +--:(ipv4-address)
| | | +--rw ipv4-address?    inet:ipv4-address
| | +--:(ipv6-address)
| | | +--rw ipv6-address?    inet:ipv6-address
| +--rw mep-id?            toam:tril-rb-nickname
+--rw frame-delay-two-way?          yang:gauge32
+--rw frame-delay-forward?          yang:gauge32
+--rw frame-delay-backward?        yang:gauge32
+--rw inter-frame-delay-variation-two-way?    yang:gauge32
+--rw inter-frame-delay-variation-forward?    yang:gauge32
+--rw inter-frame-delay-variation-backward?    yang:gauge32
+--rw current-stats
| +--rw start-time?                yang:date-and-time
| +--rw elapsed-time?              uint32
| +--rw suspect-status?            boolean
| +--rw frame-delay-two-way-min?    uint32
| +--rw frame-delay-two-way-max?    uint32
| +--rw frame-delay-two-way-average?    uint32
| +--rw frame-delay-forward-min?    uint32
| +--rw frame-delay-forward-average?    uint32
| +--rw frame-delay-forward-max?    uint32
| +--rw frame-delay-backward-min?    uint32
| +--rw frame-delay-backward-max?    uint32
| +--rw frame-delay-backward-average?    uint32
| +--rw frame-delay-variation-backward-min?    uint32
| +--rw frame-delay-variation-backward-max?    uint32
| +--rw frame-delay-variation-backward-average?    uint32
| +--rw frame-delay-variation-forward-min?    uint32
| +--rw frame-delay-variation-forward-average?    uint32
| +--rw frame-delay-variation-forward-max?    uint32
| +--rw frame-delay-variation-two-way-min?    uint32
| +--rw frame-delay-variation-two-way-average?    uint32
| +--rw frame-delay-variation-two-way-max?    uint32
+--rw history-stats* [id]
|   +--rw id                      uint32
|   +--rw start-time?              yang:date-and-time
|   +--rw elapsed-time?            uint32
|   +--rw suspect-status?          boolean
|   +--rw frame-delay-two-way-min?    uint32

```



```

    +--rw frame-delay-two-way-max?                uint32
    +--rw frame-delay-two-way-average?            uint32
    +--rw frame-delay-forward-min?                uint32
    +--rw frame-delay-forward-average?            uint32
    +--rw frame-delay-forward-max?                uint32
    +--rw frame-delay-backward-min?                uint32
    +--rw frame-delay-backward-max?                uint32
    +--rw frame-delay-backward-average?            uint32
    +--rw frame-delay-variation-backward-min?      uint32
    +--rw frame-delay-variation-backward-max?      uint32
    +--rw frame-delay-variation-backward-average?  uint32
    +--rw frame-delay-variation-forward-min?        uint32
    +--rw frame-delay-variation-forward-average?    uint32
    +--rw frame-delay-variation-forward-max?        uint32
    +--rw frame-delay-variation-two-way-min?        uint32
    +--rw frame-delay-variation-two-way-average?    uint32
    +--rw frame-delay-variation-two-way-max?        uint32
augment /goam:domains/goam:domain/goam:MAS/goam:MA/goam:MEP:
  +--rw loss-measurements
    +--ro loss-measurements* [session-cookie]
      | +--ro session-cookie    uint32
      | +--ro id?               string
      | +--ro status?           boolean
    +--rw measurement-type?      enumeration
    +--rw enabled-counters?      bits
    +--rw message-period?        uint32
    +--rw frame-size?            uint32
    +--rw data-pattern?          enumeration
    +--rw measurement-interval?  uint32
    +--rw number-intervals-stored? uint32
    +--rw session-type?          enumeration
    +--rw start-time
      | +--rw (start-time)?
      |   +--:(immediate)
      |   | +--rw immediate!
      |   +--:(absolute)
      |     +--rw absolute?      yang:date-and-time
    +--rw stop-time
      | +--rw (stop-time)?
      |   +--:(none)
      |   | +--rw none!
      |   +--:(absolute)
      |     +--rw absolute?      yang:date-and-time
    +--rw destination-mep
      | +--rw (mp-address)?
      |   +--:(mac-address)
      |   | +--rw mac-address?    yang:mac-address
      |   +--:(ipv4-address)

```





```

| | | +--rw ipv4-address?  inet:ipv4-address
| | +--:(ipv6-address)
| |   +--rw ipv6-address?  inet:ipv6-address
| +--rw mep-id?            toam:tril-rb-nickname
+--rw measurement-forward-flr?  yang:gauge32
+--rw measurement-backward-flr? yang:gauge32
+--rw current-stats
| +--rw start-time?          yang:date-and-time
| +--rw elapsed-time?        uint32
| +--rw suspect-status?      boolean
| +--rw backward-transmitted-frames? yang:gauge32
| +--rw backward-received-frames?   yang:gauge32
| +--rw backward-min-frame-loss-ration? uint32
| +--rw backward-max-frame-loss-ration? uint32
| +--rw backward-average-frame-loss-ration? uint32
| +--rw forward-transmitted-frames?   yang:gauge32
| +--rw forward-received-frames?     yang:gauge32
| +--rw forward-min-frame-loss-ration? uint32
| +--rw forward-max-frame-loss-ration? uint32
| +--rw forward-average-frame-loss-ration? uint32
+--rw history-stats* [id]
| +--rw id                  uint32
| +--rw start-time?        yang:date-and-time
| +--rw elapsed-time?      uint32
| +--rw suspect-status?    boolean
| +--rw backward-transmitted-frames? yang:gauge32
| +--rw backward-received-frames?   yang:gauge32
| +--rw backward-min-frame-loss-ration? uint32
| +--rw backward-max-frame-loss-ration? uint32
| +--rw backward-average-frame-loss-ration? uint32
| +--rw forward-transmitted-frames?   yang:gauge32
| +--rw forward-received-frames?     yang:gauge32
| +--rw forward-min-frame-loss-ration? uint32
| +--rw forward-max-frame-loss-ration? uint32
| +--rw forward-average-frame-loss-ration? uint32

```

rpcs:

```

+---x create-loss-measurement
| +--ro input
| | +--ro measurement-type?      enumeration
| | +--ro enabled-counters?      bits
| | +--ro message-period?        uint32
| | +--ro frame-size?            uint32
| | +--ro data-pattern?          enumeration
| | +--ro measurement-interval?  uint32
| | +--ro number-intervals-stored? uint32
| | +--ro session-type?          enumeration
| | +--ro start-time
| | | +--ro (start-time)?

```



```

| | | +--:(immediate)
| | | | +--ro immediate!
| | | +--:(absolute)
| | | | +--ro absolute? yang:date-and-time
| | +--ro stop-time
| | | +--ro (stop-time)?
| | | +--:(none)
| | | | +--ro none!
| | | +--:(absolute)
| | | | +--ro absolute? yang:date-and-time
| | +--ro destination-mep
| | | +--ro (mp-address)?
| | | | +--:(mac-address)
| | | | | +--ro mac-address? yang:mac-address
| | | | +--:(ipv4-address)
| | | | | +--ro ipv4-address? inet:ipv4-address
| | | | +--:(ipv6-address)
| | | | | +--ro ipv6-address? inet:ipv6-address
| | | +--ro mep-id? toam:tril-rb-nickname
| | +--ro flow-entropy? toam:flow-entropy-trill
| +--ro output
| | +--ro session-id uint32
+---x abort-loss-measurement
| +--ro input
| | +--ro technology identityref
| | +--ro MD-name-string MD-name-string
| | +--ro MA-name-string? MA-name-string
| | +--ro destination-mep
| | | +--ro (mp-address)?
| | | | +--:(mac-address)
| | | | | +--ro mac-address? yang:mac-address
| | | | +--:(ipv4-address)
| | | | | +--ro ipv4-address? inet:ipv4-address
| | | | +--:(ipv6-address)
| | | | | +--ro ipv6-address? inet:ipv6-address
| | | +--ro mep-id? toam:tril-rb-nickname
| | +--ro session-id uint32
+---x create-delay-measurement
| +--ro input
| | +--ro measurement-type? enumeration
| | +--ro measurement-enable? bits
| | +--ro message-period? uint32
| | +--ro frame-size? uint32
| | +--ro data-pattern? enumeration
| | +--ro measurement-interval? uint32
| | +--ro number-intervals-stored? uint32
| | +--ro ifdv-selection-offset? uint32
| | +--ro session-type? enumeration

```



```

| | +--ro start-time
| | | +--ro (start-time)?
| | |   +--:(immediate)
| | |     | +--ro immediate!
| | |     +--:(absolute)
| | |       +--ro absolute?   yang:date-and-time
| | +--ro stop-time
| | | +--ro (stop-time)?
| | |   +--:(none)
| | |     | +--ro none!
| | |     +--:(absolute)
| | |       +--ro absolute?   yang:date-and-time
| | +--ro destination-mep
| | | +--ro (mp-address)?
| | |   +--:(mac-address)
| | |     | +--ro mac-address?   yang:mac-address
| | |     +--:(ipv4-address)
| | |       | +--ro ipv4-address?   inet:ipv4-address
| | |       +--:(ipv6-address)
| | |         +--ro ipv6-address?   inet:ipv6-address
| | |   +--ro mep-id?               toam:tril-rb-nickname
| | +--ro flow-entropy?             toam:flow-entropy-trill
| | +--ro context-type?             boolean
| | +--ro context-id-vlan?          toam:vlan
| | +--ro context-id-fgl?           toam:fgl
| +--ro output
|   +--ro session-id               uint32
+---x abort-delay-measurement
  +--ro input
    +--ro technology                 identityref
    +--ro MD-name-string             MD-name-string
    +--ro MA-name-string?            MA-name-string
    +--ro destination-mep
    | +--ro (mp-address)?
    | | +--:(mac-address)
    | | | +--ro mac-address?        yang:mac-address
    | | +--:(ipv4-address)
    | | | +--ro ipv4-address?       inet:ipv4-address
    | | +--:(ipv6-address)
    | | | +--ro ipv6-address?       inet:ipv6-address
    | +--ro mep-id?                 toam:tril-rb-nickname
    +--ro context-type?              boolean
    +--ro context-id-vlan?            toam:vlan
    +--ro context-id-fgl?             toam:fgl
    +--ro session-id                  uint32

```

## 6. TRILL PM YANG module



```
module trill-oam-pm {
  namespace "urn:cisco:params:xml:ns:yang:tril-oam-pm";
  prefix trilloampm;

  import gen-oam {
    prefix goam;
  }
  import trill-oam {
    prefix toam;
  }
  import ietf-yang-types {
    prefix yang;
  }
  revision 2014-11-16 {
    description
      "Initial revision.";
  }

  identity trillpm {
    base goam:technology-types;
    description
      "trill pm type";
  }

  grouping context-id-group {
    leaf context-type {
      type boolean;
    }
  }
  description
    "If context-type is set then it's context-id-vlan, else
    it's context-id-fgl.";
  leaf context-id-vlan {
    type toam:vlan;
  }
  leaf context-id-fgl {
    type toam:fgl;
  }
}

grouping loss-measurement-configuration-group {
  description
    "This grouping includes configuration objects for Frame Loss
    Measurement function defined in TRILLPM.";
  reference
    TRILLPM;

  leaf measurement-type {
    type enumeration {
```





```
enum slm {
    description
        "TRILL PM SLM Frames generated and received SLR responses
        tracked.";
}

enum 1sl {
    description
        "TRILL PM 1SL Frames generated.";
}

default slm;

description
    "This object specifies what type of Loss Measurement will be
    performed.";

reference
    TRILLPM;
}

leaf enabled-counters {
    type bits {
        bit forward-min-flr;
        bit forward-max-flr;
        bit forward-average-flr;
        bit backward-min-flr;
        bit backward-max-flr;
        bit backward-average-flr;
        bit TRILLPM-pdus-sent;
        bit TRILLPM-pdus-received;
    }
    default " ";

description
    "A vector of bits that indicates the type of TRILLPM loss
    measurement counters found in the current-stats and
    history that are enabled.

    A present bit enables the specific counter. A not present
    bit disables the specific counter.

    Not all counters are supported for all TRILLPM
    Loss Measurement types.";
```



```
    }

    leaf message-period {
        type uint32;
        default 1000;

        description
            "This objects specifies the interval between Loss
            Measurement OAM message transmission. Default value is
            1 sec.";
    }

    leaf frame-size {
        type uint32 {
            range "64 .. 9600";
        }
        default 64;

        description
            "This object specifies the Loss Measurement OAM frame size.
            The adjustment of the frame size of the
            standard frame size is accomplished by addition
            of a Data TLV as mention in TRILLPM.
            ";
    }

    leaf data-pattern {
        type enumeration {
            enum zeroes {
                description "Indicates the Data TLV contains all 0s.";
            }
            enum ones {
                description "Indicates the Data TLV contains all 1s.";
            }
        }
        default zeroes;

        description
            "This object specifies the LM data pattern included in OAM
            frame.";
    }

    leaf measurement-interval {
        type uint32;
        units minutes;
        default 15;
```



```
        description
            "This object specifies a Measurement Interval in minutes.";
    }

    leaf number-intervals-stored {
        type uint32 {
            range "2..10";
        }
        default 10;
        description
            "This object specifies the number of completed measurement
            intervals to store in the history statistics table.";
    }

    leaf session-type {
        type enumeration {
            enum proactive {
                description
                    "The current session is 'proactive'.";
            }
            enum on-demand {
                description
                    "The current session is on-demand.";
            }
        }
        description
            "This object indicates whether the current session is defined
            to be proactive or on-demand.";
    }
}

grouping loss-stats-group {
    description
        "This grouping includes statistics object for TRILL PM Loss
        Measurement session.";
    leaf suspect-status {
        type boolean;
        description
            "if bit is set it means measurement interval statistics is
            not valid.";
    }
}

leaf backward-transmitted-frames {
    type yang:gauge32;

    description
        "This object contains the number of frames transmitted
        in the
```



```
        backward direction by this session.
        This is count of TRILLPM SLM and 1SL frames.";
    }
    leaf backward-received-frames {
        type yang:gauge32;

        description
            "This object contains the number of frames received
            in the
            backward direction by this session.
            This is count of TRILLPM SLM and 1SL frames.";
    }
    leaf backward-min-frame-loss-ration {
        type uint32 {
            range "0..100000";
        }
        units milli-percent;

        description
            "This object contains the minimum one-way frame loss
            ratio
            in the backward direction calculated by this MEP for
            the session
            in this Measurement Interval. The FLR value is a
            ratio that
            is expressed as a percent with a
            value 0 (ratio 0.00) through
            100000 (ration 1.00)";
    }
    leaf backward-max-frame-loss-ration {
        type uint32 {
            range "0..100000";
        }
        units milli-percent;

        description
            "This object contains the maximum one-way
            frame loss ratio
            in the backward direction calculated by this
            MEP for the session
            in this Measurement Interval. The FLR value is
            a ratio that
            is expressed as a percent with a
            value 0 (ratio 0.00) through
            100000 (ration 1.00)";
    }
    leaf backward-average-frame-loss-ration {
        type uint32 {
```





```
        range "0..100000";
    }
    units milli-percent;

    description
        "This object contains the average one-way frame
        loss ratio
        in the backward direction calculated by this MEP
        for the session
        in this Measurement Interval. The FLR value is
        a ratio that
        is expressed as a percent with a value
        0 (ratio 0.00) through
        100000 (ration 1.00)";
}

leaf forward-transmitted-frames {
    type yang:gauge32;

    description
        "This object contains the number of frames
        transmitted in the
        forward direction by this session.
        This is count of TRILLPM SLM and 1SL frames.";
}

leaf forward-received-frames {
    type yang:gauge32;

    description
        "This object contains the number of frames received
        in the
        forward direction by this session.
        This is count of TRILLPM SLM and 1SL frames.";
}

leaf forward-min-frame-loss-ratio {
    type uint32 {
        range "0..100000";
    }
    units milli-percent;

    description
        "This object contains the minimum one-way frame
        loss ratio
        in the forward direction calculated by this
        MEP for the session
        in this Measurement Interval. The FLR value is
        a ratio that
        is expressed as a percent with a value 0
```



```
        (ratio 0.00) through
        100000 (ration 1.00)";
    }
    leaf forward-max-frame-loss-ratio {
        type uint32 {
            range "0..100000";
        }
        units milli-percent;

        description
            "This object contains the maximum one-way frame
            loss ratio
            in the forward direction calculated by this
            MEP for the session
            in this Measurement Interval. The FLR value
            is a ratio that
            is expressed as a percent with a value 0
            (ratio 0.00) through
            100000 (ration 1.00)";
    }
    leaf forward-average-frame-loss-ratio {
        type uint32 {
            range "0..100000";
        }
        units milli-percent;

        description
            "This object contains the average one-way frame
            loss ratio
            in the forward direction calculated by this MEP
            for the session
            in this Measurement Interval. The FLR value is a
            ratio that
            is expressed as a percent with a value
            0 (ratio 0.00) through
            100000 (ration 1.00)";
    }
}

grouping measurement-timing-group {
    description
        "This grouping includes objects used for
        proactive and on-demand
        scheduling of PM measurement sessions.";
}

container start-time {
    description
```



```
"This container defines the session start time.";

choice start-time {
  description
    "Measurement sessions tart time can be immediate, relative, or
    absolute.";

  container immediate {
    presence "Start the measurement session immediately.";
  }
  leaf absolute {
    type yang:date-and-time;

    description
      "This objects specifies the scheduled start time
      to perform the on-demand monitoring operations.";
  }
}

}

container stop-time {
  description
    "This container defines the session stop time.";

  choice stop-time {
    description
      "Measurement session stop time can be none, or absolute.";

    container none {
      presence "Never end the measurement session.";
    }

    leaf absolute {
      type yang:date-and-time;

      description
        "This objects specifies the scheduled stop time
        to perform the on-demand monitoring operations.";
    }
  }
}

}

grouping delay-measurement-configuration-group {
```



```
description
  "This grouping includes configuration objects for Delay
  Measurement function defined in TRILLPM.";
reference
  "TRILLPM.";

leaf measurement-type {
  type enumeration {
    enum dmm {
      description
        "DMM PDU generated, DMR responses received.";
    }
    enum dm1-transmitted {
      description
        "1DM PDU generated.";
    }
    enum dm1-received {
      description
        "1DM PDU received and measurement generated.";
    }
  }
}

leaf measurement-enable {
  type bits {
    bit toam-sent;
    bit toam-received;
    bit frame-delay-two-way-min;
    bit frame-delay-two-way-max;
    bit frame-delay-two-way-average;
    bit frame-delay-forward-min;
    bit frame-delay-forward-max;
    bit frame-delay-forward-average;
    bit frame-delay-backward-min;
    bit frame-delay-backward-max;
    bit frame-delay-backward-average;
    bit inter-frame-delay-variation-forward-min;
    bit inter-frame-delay-variation-forward-max;
    bit inter-frame-delay-variation-forward-average;
    bit inter-frame-delay-variation-backward-min;
    bit inter-frame-delay-variation-backward-max;
    bit inter-frame-delay-variation-backward-average;
    bit inter-frame-delay-variation-two-way-min;
    bit inter-frame-delay-variation-two-way-max;
    bit inter-frame-delay-variation-two-way-average;
  }
  default " ";
}
```





```
    description
      "A vector of bits that indicates the type of DM counters
       that are enabled. A set bit enables the specific DM
       counter. A clear bit disables the specific DM counter.
       Not all DM counters are supported for all DM types.";
  }
leaf message-period {
  type uint32;
  default 100;

  description
    "This objects specifies the interval between Delay
     Measurement OAM message transmission. Default value is
     100ms.";
}

leaf frame-size {
  type uint32 {
    range "64 .. 9600";
  }
  default 64;

  description
    "This object specifies the Delay Measurement OAM frame size.
     The adjustment of the frame size of the standard
     frame size is
     accomplished by addition of a Data TLV as mention in TRILLPM.
     ";
}

leaf data-pattern {
  type enumeration {
    enum zeroes {
      description "Indicates the Data TLV contains all 0s.";
    }
    enum ones {
      description "Indicates the Data TLV contains all 1s.";
    }
  }
  default zeroes;

  description
    "This object specifies the DM data pattern included in OAM
     frame.";
}

leaf measurement-interval {
  type uint32;
```



```
    units minutes;
    default 15;

    description
        "This object specifies a Measurement Interval in minutes.";
}

leaf number-intervals-stored {
    type uint32 {
        range "2..10";
    }
    default 10;
    description
        "This object specifies the number of completed measurement
        intervals to store in the history statistics table.";
}

leaf ifdv-selection-offset {
    type uint32 {
        range "1..10";
    }
    default 1;
    description
        "This object specifies the selection offset for Inter
        Frame Delay variation measurements. If this value is set
        to n, then the IFDV is calculated by taking the difference in
        frame delay between frame F and frame (F+n).";
}

leaf session-type {
    type enumeration {
        enum proactive {
            description
                "The current session is 'proactive'.";
        }
        enum on-demand {
            description
                "The current session is on-demand.";
        }
    }
    description
        "This object indicates whether the current session is defined
        to be proactive or on-demand.";
}

}

grouping delay-measurement-stats-group {
```



```
description
  "This grouping includes statistics objects for a TRILL PM
  Delay Measurement session.";

leaf suspect-status {
  type boolean;
  description
    "if bit is set it means measurement interval statistics is
    not valid.";
}

leaf frame-delay-two-way-min {
  type uint32;
  units microseconds;
}
leaf frame-delay-two-way-max {
  type uint32;
  units microseconds;
}

leaf frame-delay-two-way-average {
  type uint32;
  units microseconds;
}

leaf frame-delay-forward-min {
  type uint32;
  units microseconds;
}
leaf frame-delay-forward-average {
  type uint32;
  units microseconds;
}
leaf frame-delay-forward-max {
  type uint32;
  units microseconds;
}
leaf frame-delay-backward-min {
  type uint32;
  units microseconds;
}
leaf frame-delay-backward-max {
  type uint32;
  units microseconds;
}
leaf frame-delay-backward-average {
```



```
        type uint32;
        units microseconds;
    }
    leaf frame-delay-variation-backward-min {
        type uint32;
        units microseconds;
    }
    leaf frame-delay-variation-backward-max {
        type uint32;
        units microseconds;
    }
    leaf frame-delay-variation-backward-average {
        type uint32;
        units microseconds;
    }
    leaf frame-delay-variation-forward-min {
        type uint32;
        units microseconds;
    }
    leaf frame-delay-variation-forward-average {
        type uint32;
        units microseconds;
    }
    leaf frame-delay-variation-forward-max {
        type uint32;
        units microseconds;
    }
    leaf frame-delay-variation-two-way-min {
        type uint32;
        units microseconds;
    }
    leaf frame-delay-variation-two-way-average {
        type uint32;
        units microseconds;
    }
    leaf frame-delay-variation-two-way-max {
        type uint32;
        units microseconds;
    }
}

augment "/goam:domains/goam:domain/goam:MA/goam:MA/goam:MEP" {
    description
        "This set of data definitions extends the MEP as described
        in goam";

    leaf delay-responder {
        type boolean;
    }
}
```





```
    default true;

    description
      "This object specifies whether Delay Measurement
      (DMM) single ended
      Responder is enabled.
      The value 'false' indicates the Delay measurement
      responder is disabled
      and received DMM will be discarded.";
  }
}

augment "/goam:domains/goam:domain/goam:MAS/goam:MA/goam:MEP" {
  description
    "This set of data definitions extends the MEP as described
    in goam, specially with regards to Delay Measurements.";

  container delay-measurements {
    description
      "This container contains a collection of data definitions
      related to Delay Measurements as defined in TRILLPM.";

    list delay-measurements {
      key "session-cookie";
      config false;
      description
        "List of Delay Measurement PM Sessions where each
        instance is uniquely identified by an session-cookie
        attribute.";

      leaf session-cookie {
        config false;
        type uint32;
        description
          "cookie to identify Delay Measurement session.";
      }

      leaf id {
        type string;

        description
          "This object uniquely identifies a scheduled measurement
          time.";
      }

      leaf status {
        type boolean;
      }
    }
  }
}
```



```
    config false;
    description
      "This object indicates DM session status, true means
        Active, false means not-active.";
  }
}

uses delay-measurement-configuration-group;
  uses measurement-timing-group;
  container destination-mep {
    uses goam:mp-address;
    leaf mep-id {
      type toam:tril-rb-nickname;
    }
  }
}

leaf frame-delay-two-way {
  type yang:gauge32;
  units microseconds;
  description
    "This object contains the frame delay
      calculated by this MEP from the last received
      TRILLPM frame.
      This object is undefined if measurement-type is
      dm1.";
}

leaf frame-delay-forward {
  type yang:gauge32;
  units microseconds;
  description
    "This object contains the frame delay in the forward
      direction
      calculated by this MEP from the last received
      TRILLPM frame.
      One way Delay require sufficiently precise clock
      Synchronization.
      This object is undefined if it's dm1-transmitted.";
}

leaf frame-delay-backward {
  type yang:gauge32;
  units microseconds;
  description
    "This object contains the frame delay in the
      backward direction
      calculated by this MEP from the last received
      TRILLPM frame.
      One way Delay require sufficiently precise clock
```



```
        Synchronization.
        This object is undefined if it's dm1-transmitted or
        dm1-received.";
    }
    leaf inter-frame-delay-variation-two-way {
        type yang:gauge32;
        units microseconds;

        description
            "This object contains the last two-way inter-frame
            delay
            interval calculated by this MEP.

            The value of this object is undefined when
            measurement-type
            is dm1-transmitted or dm1-received.";
    }
    leaf inter-frame-delay-variation-forward {
        type yang:gauge32;
        units microseconds;

        description
            "This object contains the last one-way
            inter-frame delay in
            the forward direction calculated by this MEP.

            The value of this object is undefined when
            measurement-type
            is dm1-transmitted.";
    }
    leaf inter-frame-delay-variation-backward {
        type yang:gauge32;
        units microseconds;

        description
            "This object contains the last one-way inter-frame
            delay in
            the backward direction calculated by this MEP.

            The value of this object is undefined when
            measurement-type
            is dm1-transmitted or dm-received.";
    }
    container current-stats {
        description
            "This container contains result of the current
            Measurement
```



```
Interval in a TRILLPM Delay measurement session
gathered
during the interval indicated by
measurement-interval.";

leaf start-time {
    type yang:date-and-time;

    description
        "Start time for current measurement interval.";
}

leaf elapsed-time {
    type uint32;

    description
        "Elapsed time for current measurement interval in
        0.01 seconds.";
}
uses delay-measurement-stats-group;
}

list history-stats {
    key id;

    description
        "This list contains the result for historic
        Measurement
        Interval for TRILLPM session.";

    leaf id {
        type uint32;
    }

    leaf start-time {
        type yang:date-and-time;

        description
            "Start time for measurement interval.";
    }

    leaf elapsed-time {
        type uint32;

        description
            "Elapsed time for measurement interval in 0.01
            seconds.";
    }
}
```





```
        uses delay-measurement-stats-group;
    }
}

augment "/goam:domains/goam:domain/goam:MA/goam:MA/goam:MEP" {

    description
        "This set of data definitions extends the MEP as described
        in goam, specially with regards to Loss Measurements.";

    container loss-measurements {
        description
            "This container contains a collection of data definitions
            related to Loss Measurements as defined in TRILLPM.";

        list loss-measurements {
            key "session-cookie";
            config false;
            description
                "List of Loss Measurement PM Sessions where each
                instance is uniquely identified by an session-cookie
                attribute.";

            leaf session-cookie {
                config false;
                type uint32;
                description
                    "cookie to identify Loss Measurement session.";
            }

            leaf id {
                type string;

                description
                    "This object uniquely identifies a scheduled measurement
                    time.";
            }

            leaf status {
                type boolean;
                config false;
                description
                    "This object indicates DM session status, true means
                    Active, false means not-active.";
            }
        }
    }
}
```



```
    uses loss-measurement-configuration-group;
    uses measurement-timing-group;
    container destination-mep {
        uses goam:mp-address;
        leaf mep-id {
            type toam:tril-rb-nickname;
        }
    }
    leaf measurement-forward-flr {
        type yang:gauge32 {
            range "0..100000";
        }
        units milli-percent;

        description
            "This object contains the Frame loss Ratio in forward
            direction.";
    }
    leaf measurement-backward-flr {
        type yang:gauge32 {
            range "0..100000";
        }
        units milli-percent;

        description
            "This object contains the Frame loss Ratio in
            backward direction.";
    }
    container current-stats {
        description
            "This container contains result of the current
            Measurement
            Interval in a TRILLPM Loss measurement session
            gathered
            during the interval indicated by
            measurement-interval.";

        leaf start-time {
            type yang:date-and-time;

            description
                "Start time for current measurement interval.";
        }

        leaf elapsed-time {
            type uint32;

            description
```



```
        "Elapsed time for current measurement
        interval in 0.01
        seconds.";
    }
    uses loss-stats-group;
}

list history-stats {
    key id;

    description
        "This list contains the result for
        historic Measurement
        Interval for TRILLPM session.";

    leaf id {
        type uint32;
    }

    leaf start-time {
        type yang:date-and-time;

        description
            "Start time for measurement interval.";
    }

    leaf elapsed-time {
        type uint32;

        description
            "Elapsed time for measurement interval in 0.01
            seconds.";
    }
    uses loss-stats-group;
}
}
}

//RPCs related to TRILLOAM PM

rpc create-loss-measurement {
    description
        "Schedule a one-way and two-way on-demand or proactive
        performance
        monitoring loss measurements on a specific MEP and Flow.

        A list entry associated with the newly created session will
        be
```



```
        created in the loss-measurements container and the assigned
        session identifier will be returned in the output
        parameter.";

    input {
        uses loss-measurement-configuration-group;
        uses measurement-timing-group;
        container destination-mep {
            uses goam:mp-address;
            leaf mep-id {
                type toam:tril-rb-nickname;
            }
        }
        leaf flow-entropy {
            type toam:flow-entropy-trill;
        }
    }
    output {
        leaf session-id {
            type uint32;
            mandatory true;

            description
                "The session identifier of the newly created loss
                measurement
                session.";
        }
    }
} //end of rpc

rpc abort-loss-measurement {
    description
        "Abort a currently running or scheduled single-ended
        on-demand TRILL
        PM function.";

    input {
        uses goam:maintenance-domain-id;
        uses goam:ma-identifier;
        container destination-mep {
            uses goam:mp-address;
            leaf mep-id {
                type toam:tril-rb-nickname;
            }
        }
        leaf session-id {
            type uint32;
        }
    }
}
```





```
        mandatory true;
        description
            "The session Id of the measurement session to be
            aborted.";
    }

}

} //end of RPC

rpc create-delay-measurement {
    description
        "Schedule a one-way and two-way on-demand or proactive
        performance
        monitoring delay measurements on a specific MEP and Flow.

        A list entry associated with the newly created session will
        be
        created in the delay-measurements container and the
        assigned
        session identifier will be returned in the output
        parameter.";

    input {
        uses delay-measurement-configuration-group;
        uses measurement-timing-group;
        container destination-mep {
            uses goam:mp-address;
            leaf mep-id {
                type toam:tril-rb-nickname;
            }
        }
    }
    leaf flow-entropy {
        type toam:flow-entropy-trill;
    }
    uses context-id-group;
}
    output {
        leaf session-id {
            type uint32;
            mandatory true;

            description
                "The session identifier of the newly created delay
                measurement
                session.";
        }
    }
}
```



```
    } //end of rpc

    rpc abort-delay-measurement {
      description
        "Abort a currently running or scheduled single-ended
        on-demand TRILL
        PM function.";

      input {
        uses goam:maintenance-domain-id;
        uses goam:ma-identifier;
        container destination-mep {
          uses goam:mp-address;
          leaf mep-id {
            type toam:tril-rb-nickname;
          }
        }
        uses context-id-group;
        leaf session-id {
          type uint32;

          mandatory true;
          description
            "The session Id of the measurement session to be
            aborted.";
        }
      }
    } //end of RP
  }
```

## **7. Security Considerations**

There are no security considerations relevant to this document.

## **8. IANA Considerations**

No actions are required from IANA as result of the publication of this document.



## **9. References**

### **9.1. Normative References**

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