

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[TRILL-PM]. It extends the YANG model defined in [[GENYANGGOAM](#)] and [[TRILLOAMYANG](#)] for TRILL OAM Performance management technology specifics.

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[1.](#) Introduction

Fault Management for TRILL is defined in [[TRILL-FM](#)]. 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 [[TRILL-FM](#)].

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

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

In this document we extend the YANG model defined in [[GENYANGGOAM](#)] and [[TRILLOAMYANG](#)] for TRILL OAM Performance management. Details are provided in [section 4](#) below.

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## [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 [8021.Q]

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

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

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

MD - Maintenance Domain [8021.Q]

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

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

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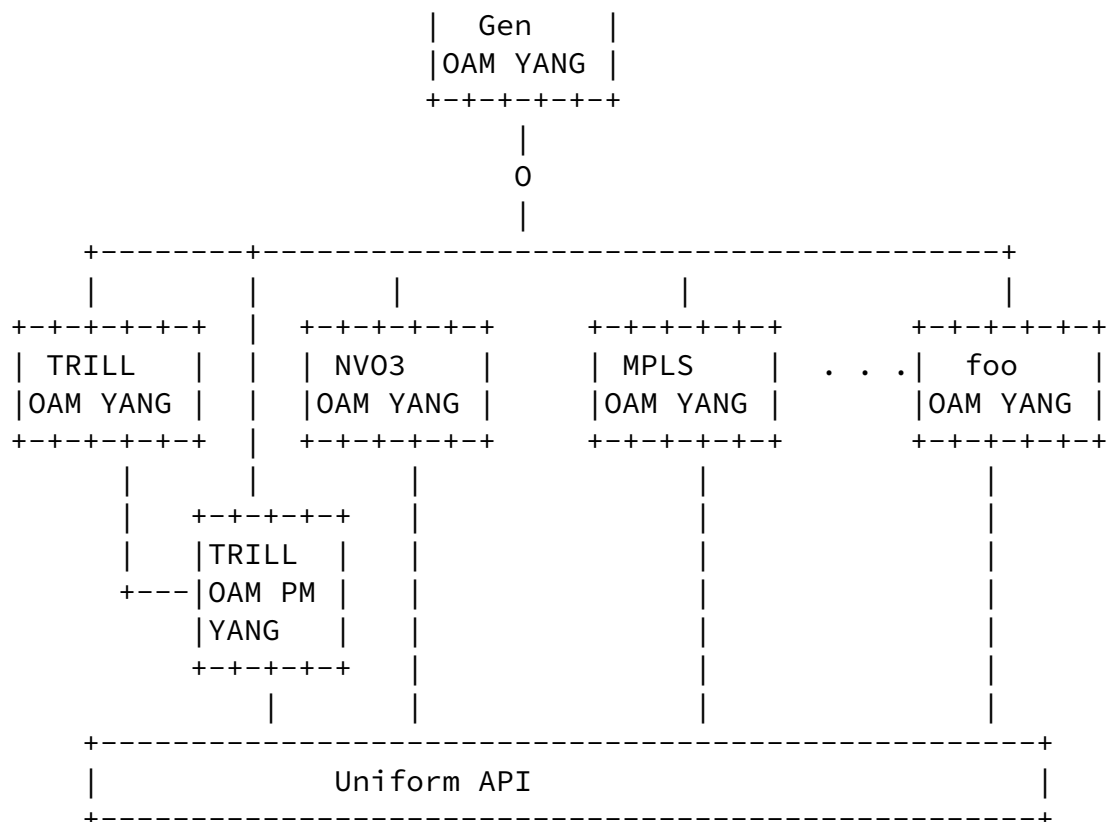


Figure 1 Relationship of TRILL OAM PM Yang model to Generic OAM YANG model

#### [4. YANG Extension](#)

MEP Addressing is defined in Generic OAM YANG model[GENYANGGOAM]. In this draft we augment MEP Configuration with Performance Management configuration and statistics for Delay Measurement and Performance Measurement.

For technology specific we are re-using identify defined in [\[TRILLOAMYANG\]](#) model.

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

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```
augment /goam:domains/goam:domain/goam:MA/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 Grouping Statements loss-measurement-configuration-group, groups configuration objects for Frame Loss Measurement function defined in \[\\[TRILL-PM\\]\]\(#\).](#)

loss-stats-group, groups statistics object for [\[TRILL-PM\]](#) Loss measurement section.

measurement-timing-group, groups object used for proactive and on-demand scheduling of PM measurement sessions.

delay-measurement-configuration-group, groups configuration objects for Delay measurement function defined in [\[TRILL-PM\]](#)

delay-measurement-stats-group, groups statistics objects for a TRILL Delay measurement sessions.

#### [4.5](#) 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 loss-measurement-configuration-group, measurement-timing-group, and delay-measurement-configuration-group defines input extension for Delay and Loss measurement RPCs.

##### [4.5.1](#) create-loss-measurement

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

##### [4.5.2](#) abort-loss-measurement

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

##### [4.5.3](#) 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.

5. 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:MAS/goam:MA/goam:MEP:
  +---rw delay-responder?   boolean
```

```
augment /goam:domains/goam:domain/goam:MAS/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

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```
+-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-ratio? uint32
| +-rw backward-max-frame-loss-ratio? uint32
| +-rw backward-average-frame-loss-ratio? uint32
| +-rw forward-transmitted-frames? yang:gauge32
| +-rw forward-received-frames?   yang:gauge32
```

```

|   +---rw forward-min-frame-loss-ratio?          uint32
|   +---rw forward-max-frame-loss-ratio?          uint32
|   +---rw forward-average-frame-loss-ratio?      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

```

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```

+---rw backward-received-frames?                yang:gauge32
+---rw backward-min-frame-loss-ratio?            uint32
+---rw backward-max-frame-loss-ratio?            uint32
+---rw backward-average-frame-loss-ratio?        uint32
+---rw forward-transmitted-frames?               yang:gauge32
+---rw forward-received-frames?                  yang:gauge32
+---rw forward-min-frame-loss-ratio?             uint32
+---rw forward-max-frame-loss-ratio?             uint32
+---rw forward-average-frame-loss-ratio?         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 context-type? boolean
| | +--ro context-id-vlan? toam:vlan
| | +--ro context-id-fgl? toam:fgl
| +--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

```

<CODE BEGINS> file "ietf-trill-oam-pm.yang"
module ietf-trill-oam-pm {
    namespace "urn:ietf:params:xml:ns:yang:ietf-trill-oam-pm";
    prefix trilloampm;

    import ietf-gen-oam {
        prefix goam;
    }
    import ietf-trill-oam {
        prefix toam;
    }
    import ietf-yang-types {
        prefix yang;
    }
    organization "IETF TRILL Working Group";
    contact
        "Deepak Kumar dekkumar@cisco.com";
    description
        "This YANG module defines the configuration for TRILL,

```

```

        OAM Performance Management statistics and rpc";

    revision 2015-01-11 {
        description
            "Initial revision.";
        reference "RFC 7456";
    }

    identity trill {
        base goam:technology-types;
        description

```

```

        "trill type";
    }

    grouping context-id-group {
        leaf context-type {
            type boolean;
            description
                "context Identifier";
        }
    }
    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;
            description
                "context Identifier vlan.";
        }
        leaf context-id-fgl {
            type toam:fgl;
            description
                "context Identifier Fine Grain label.";
        }
    }
}

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

    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
    TRILL-PM;
}

leaf enabled-counters {
    type bits {
        bit forward-min-flr {
            description
                "Forward minimum Frame Loss Ratio.";
        }
        bit forward-max-flr {
            description
                "Forward maximum Frame Loss Ratio.";
        }
        bit forward-average-flr {
            description
                "Forward average Frame Loss Ratio.";
        }
        bit backward-min-flr {
            description
                "Backward Minimum Frame Loss Ratio.";
        }
        bit backward-max-flr {
            description
                "Backward Maximum Frame Loss Ratio.";
        }
        bit backward-average-flr {
            description
                "Backward Average Frame Loss Ratio.";
        }
        bit TRILL-PM-pdus-sent {
            description
                "TRILL PM Packets sent.";
        }
        bit TRILL-PM-pdus-received {
            description

```

```
        "TRILL PM Packets received.";
    }
}
default " ";

description
    "A vector of bits that indicates the type of TRILL-PM 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
    TRILL-PM 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 TRILL-PM.
        ";
}

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

}

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```
        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 TRILL-PM SLM and ISL 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 TRILL-PM SLM and ISL frames.";
  }

  leaf backward-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 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-ratio {

```

```

    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-ratio {
    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 TRILL-PM 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 TRILL-PM SLM and 1SL frames.";
    }

    leaf forward-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 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-ration {
        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-ration {
        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.";
                description
                "Immediate start time.";
            }

            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.";
            description
            "None.";
        }

```



```

    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 TRILL-PM.";
    reference
        "TRILL-PM.";

    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.";
            }
        }
        description
            "Measurement type.";
    }

    leaf measurement-enable {
        type bits {
            bit toam-sent {
                description
                    "Trill oam sent.";
            }
        }
    }
}

```

```
    }
bit toam-received {
    description
        "Trill oam received.";
}
bit frame-delay-two-way-min {
    description
        "Frame Delay Two Way Minimum.";
}
bit frame-delay-two-way-max {
    description
        "Frame Delay Two way Maximum.";
}
bit frame-delay-two-way-average {
    description
        "Frame Delay Two way Average.";
}
bit frame-delay-forward-min {
    description
        "Frame Delay Forward Minimum.";
}
bit frame-delay-forward-max {
    description
        "Frame Delay forward Maximum.";
}
bit frame-delay-forward-average {
    description
        "Frame Delay forward Average.";
}
bit frame-delay-backward-min {
    description
        "Frame Delay backward minimum.";
}
bit frame-delay-backward-max {
    description
        "Frame Delay backward maximum.";
}
bit frame-delay-backward-average {
    description
        "Frame Delay backward average.";
}
bit inter-frame-delay-variation-forward-min {
    description
        "Inter Frame Delay variation forward minimum.";
}
bit inter-frame-delay-variation-forward-max {
    description
        "Inter Frame delay variation forward maximum.";
```

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```
    }
    bit inter-frame-delay-variation-forward-average {
        description
            "Inter Frame delay variation forward average.";
    }
    bit inter-frame-delay-variation-backward-min {
        description
            "Inter frame delay variation backward minimum.";
    }
    bit inter-frame-delay-variation-backward-max {
        description
            "Inter Frame Delay variation backward maximum.";
    }
    bit inter-frame-delay-variation-backward-average {
        description
            "Inter Frame delay variation backward average.";
    }
    bit inter-frame-delay-variation-two-way-min {
        description
            "Inter Frame delay variation two way minimum.";
    }
    bit inter-frame-delay-variation-two-way-max {
        description
            "Inter Frame delay variation two way maximum.";
    }
    bit inter-frame-delay-variation-two-way-average {
        description
            "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 TRILL-PM.
        ";
}

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;
        description

```

```

        "Frame delay two way minimum.";
    }
    leaf frame-delay-two-way-max {
        type uint32;
        units microseconds;
        description
            "Frame delay two way maximum.";
    }

    leaf frame-delay-two-way-average {
        type uint32;
        units microseconds;
        description
            "Frame delay two way average.";
    }

    leaf frame-delay-forward-min {
        type uint32;
        units microseconds;
        description
            "Frame delay forward direction minimum.";
    }

```

```

}
leaf frame-delay-forward-average {
    type uint32;
    units microseconds;
    description
        "Frame delay forward direction average.";
}
leaf frame-delay-forward-max {
    type uint32;
    units microseconds;
    description
        "Frame delay forward direction maximum.";
}
leaf frame-delay-backward-min {
    type uint32;
    units microseconds;
    description
        "Frame delay backward direction minimum.";
}
leaf frame-delay-backward-max {
    type uint32;
    units microseconds;
    description
        "Frame delay backward direction maximum.";
}
leaf frame-delay-backward-average {
    type uint32;

```

```

    units microseconds;
    description
        "Frame delay backward direction average..";
}
leaf frame-delay-variation-backward-min {
    type uint32;
    units microseconds;
    description
        "Frame delay variation backward minimum.";
}
leaf frame-delay-variation-backward-max {
    type uint32;
    units microseconds;
    description

```

```

        "Frame delay variation backward maximum.";
    }
    leaf frame-delay-variation-backward-average {
        type uint32;
        units microseconds;
        description
            "Frame delay variation backward average.";
    }
    leaf frame-delay-variation-forward-min {
        type uint32;
        units microseconds;
        description
            "Frame delay variation forward minimum.";
    }
    leaf frame-delay-variation-forward-average {
        type uint32;
        units microseconds;
        description
            "Frame delay variation forward average.";
    }
    leaf frame-delay-variation-forward-max {
        type uint32;
        units microseconds;
        description
            "Frame delay variation forward maximum.";
    }
    leaf frame-delay-variation-two-way-min {
        type uint32;
        units microseconds;
        description
            "Frame delay variation two way minimum.";
    }
    leaf frame-delay-variation-two-way-average {
        type uint32;

```

```

        units microseconds;
        description
            "Frame delay variation two way average.";
    }
    leaf frame-delay-variation-two-way-max {
        type uint32;
        units microseconds;

```



```

        description
            "Frame delay variation two way maximum.";
    }
}

augment "/goam:domains/goam:domain/goam:MAS/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 TRILL-PM.";

        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 {
    type uint32;
    config false;
    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;
            description
                "MEP Identifier.";
        }
        description
            "Delay Measurement configuration group";
    }

    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 TRILL-PM frame.
            This object is undefined if
            measurement-type is dm1.";
    }
}

```

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```
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
    TRILL-PM 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
    TRILL-PM 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 TRILL-PM 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 TRILL-PM session.";

    leaf id {
        type uint32;
        description
            "Identifier";
    }

    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:MAS/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 TRILL-PM.";

        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 {
    type uint32;
    config false;
    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;
        description
            "Trill Rbridge Nickname MP address";
    }
    description
        "Destination MEP";
    }
    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 TRILL-PM 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 TRILL-PM session.";

    leaf id {
        type uint32;
        description
            "Identifier.";
    }
}

```

```

    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;
            description
                "MEP Id.";
        }
        description
            "";
        }
    leaf flow-entropy {
        type toam:flow-entropy-trill;

```

description

```

        "";
    }
    uses context-id-group;
}
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;
            description
                "MEP Identifier.";
        }
        description
            "";
        }
        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;
      description
        "MEP Identifier.";
    }
    description
      "Destination MEP.";
    }
    leaf flow-entropy {
      type toam:flow-entropy-trill;
      description
        "Flow Entropy";
    }
  }
  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;
                description
                    "MEP Identifier.";
            }
            description
                "Destination MEP.";
        }
        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
}
```

<CODE ENDS>

## [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.

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## [9.](#) References

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