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Generic YANG Data Model for Operations, Administration, and Maintenance
(OAM) Performance Management
[draft-wang-lime-yang-pm-01](#)

Abstract

This document presents a YANG Data model for OAM Performance management support. The YANG Model presented in this document extends the Generic YANG Data Model for OAM with Loss Measurement and Delay measurement to support OAM Performance management.

Status of This Memo

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[1.](#) Introduction

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](#)] with Loss Measurement and Delay measurement to support OAM Performance management. Details are provided in [section 4](#) below.

[2.](#) Conventions and Terminology

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 [[RFC2119](#)].

The following terms are defined in [[RFC6241](#)] and are not redefined here:

- o client

- o configuration data
- o server
- o state data

The following terms are defined in [[RFC6020](#)] and are not redefined here:

- o augment
- o data model
- o data node

The terminology for describing YANG data models is found in [[RFC6020](#)].

[2.1.](#) Terminology

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](#)]

DMM – Delay Measurement Message

1SL – One-way Synthetic Loss Measurement message

1DM - One-way Delay Measurement message

DMR - Delay Measurement Reply

PM - Performance Monitoring

SLM - Synthetic Loss Measurement Message

SLR - Synthetic Loss Measurement Reply

[3.](#) YANG Extension

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

[3.1.](#) MEP Configuration Extension

[3.1.1.](#) Loss Measurement Configuration

This section describes a set of data definitions for Loss Measurement configuration. This set of data definitions augment the MEP configuration defined in the Generic YANG OAM model with parameters related to Loss Measurement and define the role of MEP and measurement method of the loss measurement.

```
module: ietf-gen-oam-pm
```

```
/*This set of data definitions defines the role of MEP.*/
```

```
  augment /goam:domains/goam:domain/goam:MA/goam:MEP:
    +--rw loss-responder? Boolean
```

```
/*This set of data definitions defines loss measurement configuration*/
```

```
  augment /goam:domains/goam:domain/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
|   +---rw slm?                   boolean
|   +---rw pm_1sl?                boolean
+---rw enabled-counters
|   +---rw availability-forward-high-loss?      boolean
|   +---rw availability-forward-availables?     boolean
|   +---rw availability-forward-unavailable?    boolean
|   +---rw availability-backward-high-loss?     boolean
|   +---rw availability-backward-consecutive-high-loss? boolean
|   +---rw availability-backward-available?     boolean
|   +---rw available-backward-unavailable?      boolean
+---rw message-period?              uint32
+---rw data-pattern?                enumeration
+---rw measurement-interval?        uint32
+---rw number-intervals-stored?     uint32
+---rw availability-measurement-interval? uint32
+---rw availability-consecutive-intervals-number? unit32
+---rw session-type?                enumeration

```

```

+---rw thresholds* [id]
|   +---rw id                      uint32
|   +---rw enabled-threshold
|   |   +---rw forward-unavailable-count?  boolean
|   |   +---rw backward-unavailable-count? boolean
|   |   +---rw forward-available-ratio?    boolean
|   |   +---rw backward-available-ratio?   boolean
|   +---rw forward-unavailable-count uint32
|   +---rw backward-unavailable-count uint32
|   +---rw forward-available-ratio?  uint32
|   +---rw backward-available-ratio? uint32
+---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 availability-forward-status      enumeration
+---rw availability-backward-status      enumeration
+---rw current-stats
|   +---rw start-time?      yang:date-and-time
|   +---rw elapsed-time?      uint32
|   +---rw suspect-status?      boolean
|   +---rw forward-available?      yang:gauge32
|   +---rw backward-available?      yang:gauge32
|   +---rw forward-unavailable?      yang:gauge32
|   +---rw backward-unavailable?      yang:gauge32
+---rw history-stats* [id]
    +---rw id      uint32
    +---rw start-time?      yang:date-and-time
    +---rw elapsed-time?      uint32
    +---rw suspect-status?      Boolean
    +---rw forward-available?      yang:gauge32
    +---rw backward-available?      yang:gauge32
    +---rw forward-unavailable?      yang:gauge32
    +---rw backward-unavailable?      yang:gauge32

```

[3.2.](#) Delay Measurement Configuration

This section describes data definition for Delay Measurement configuration. This data definition augments the MEP configuration defined in the Generic YANG OAM model with parameters related to

Delay Measurement and defines the role of MEP and measurement method of the delay measurement.

module: ietf-gen-oam-pm

/*This set of data definitions defines the role of MEP.*/

augment /goam:domains/goam:domain/goam:MA/goam:MA/goam:MEP:
 +--rw delay-responder? Boolean

/*This set of data definitions defines delay measurement configuration*/

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
  |   +---rw dmm?                boolean
  |   +---rw dm1-transmitted?    boolean
  |   +---rw dm1-received?       boolean
+---rw measurement-enable
+---rw message-period?          uint32
+---rw data-pattern?            enumeration
+---rw measurement-interval?    uint32
+---rw number-intervals-stored? uint32
+---rw session-type?            Enumeration
+---rw thresholds* [id]
  |   +---rw id                  uint32
  |   +---rw enabled-thresholds? bits
+---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 current-stats
  |   +---rw start-time?          yang:date-and-time
  |   +---rw elapsed-time?        uint32
  |   +---rw suspect-status?      boolean
+---rw history-stats* [id]
  +---rw id                      uint32
  +---rw start-time?             yang:date-and-time
  +---rw elapsed-time?           uint32
  +---rw suspect-status?         boolean

```

[3.3.](#) rpc definitions

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.

Configuration data in the [Section 3.2](#) and [Section 3.1.1](#) provides input extension for Delay and Loss measurement RPCs.

[3.3.1.](#) create-loss-measurement

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

[3.3.2.](#) abort-loss-measurement

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

[3.3.3.](#) create-delay-measurement

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

[3.3.4.](#) abort-delay-measurement

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

[4.](#) PM data hierarchy

The complete data hierarchy related to the OAM PM 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: ietf-gen-oam-pm

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

 +--rw delay-responder? Boolean

 +--rw loss-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

 | +--rw dmm? boolean

 | +--rw dm1-transmitted? boolean

 | +--rw dm1-received? boolean

 +--rw measurement-enable

+++rw message-period?	uint32
+++rw data-pattern?	enumeration

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+++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 current-stats	
+++rw start-time?	yang:date-and-time
+++rw elapsed-time?	uint32
+++rw suspect-status?	Boolean
+++rw history-stats* [id]	
+++rw id	uint32
+++rw start-time?	yang:date-and-time
+++rw elapsed-time?	uint32
+++rw suspect-status?	boolean

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	
+++rw slm?	boolean
+++rw pm_1sl?	boolean
+++rw enabled-counters	
+++rw availability-forward-high-loss?	boolean
+++rw availability-forward-availables?	boolean
+++rw availability-forward-unavailable?	boolean
+++rw availability-backward-high-loss?	Boolean

```

|   +---rw availability-backward-consecutive-high-loss? boolean
|   +---rw availability-backward-available?                boolean
|   +---rw available-backward-unavailable?                 boolean
+---rw message-period?                                    uint32
+---rw data-pattern?                                       enumeration
+---rw measurement-interval?                               uint32
+---rw number-intervals-stored?                            uint32
+---rw availability-measurement-interval? uint32
+---rw availability-consecutive-intervals-number? unit32

```

```

+---rw session-type?                                     enumeration
+---rw thresholds* [id]
|   +---rw id                                           uint32
|   +---rw enabled-threshold
|   |   +---rw forward-unavailable-count? boolean
|   |   +---rw backward-unavailable-count? boolean
|   |   +---rw forward-available-ratio?    boolean
|   |   +---rw backward-available-ratio?   boolean
|   +---rw forward-unavailable-count uint32
|   +---rw backward-unavailable-count uint32
|   +---rw forward-available-ratio?    uint32
|   +---rw backward-available-ratio?   uint32
+---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 current-stats
|   +---rw start-time?                                     yang:date-and-time
|   +---rw elapsed-time?                                   uint32
|   +---rw suspect-status?                                Boolean
|   +---rw forward-available?                             yang:gauge32
|   +---rw backward-available?                             yang:gauge32
|   +---rw forward-unavailable?                           yang:gauge32
|   +---rw backward-unavailable?                           yang:gauge32

```

```

    +---rw history-stats* [id]
        +---rw id                               uint32
        +---rw start-time?                       yang:date-and-time
        +---rw elapsed-time?                     uint32
        +---rw suspect-status?                   boolean
        +---rw forward-available?                yang:gauge32
        +---rw backward-available?               yang:gauge32
        +---rw forward-unavailable?              yang:gauge32
        +---rw backward-unavailable?             yang:gauge32
rpcs:
    +---x create-loss-measurement
    |   +---ro input
    |   |   +---rw measurement-type
    |   |   |   +---rw slm?                     boolean
    |   |   |   +---rw pm_1sl?                  boolean
    |   |   +---rw enabled-counters

```

```

    |   |   +---rw availability-forward-high-loss?           boolean
    |   |   +---rw availability-forward-availables?         boolean
    |   |   +---rw availability-forward-unavailable?         boolean
    |   |   +---rw availability-backward-high-loss?         boolean
    |   |   +---rw availability-backward-consecutive-high-loss? boolean
    |   |   +---rw availability-backward-available?         boolean
    |   |   +---rw available-backward-unavailable?         boolean
    |   +---ro message-period?                               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)?
| | | | | +--:(MEP-ID-int)
| | | | | | +--ro MEP-ID-int? int32
| | | | +--ro MEP-ID-format? identityref
| | +--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)?
| | | | | +--:(MEP-ID-int)
| | | | | | +--ro MEP-ID-int? int32
| | | | +--ro MEP-ID-format? identityref
| | | +--ro session-id uint32
+---x create-delay-measurement
| | +--ro input
| | | +--ro measurement-type
| | | | +--ro dmm? boolean
| | | | +--ro dm1-transmitted? boolean
| | | | +--ro dm1-received? boolean
| | | +--ro measurement-enable
| | | +--ro message-period? 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)?
| | | | +---:(MEP-ID-int)
| | | | | +---ro MEP-ID-int?       int32
| | | +---ro MEP-ID-format?         identityref
| | +---ro (flow-entropy)?
| | | +---:(flow-entropy-null)
| | | | +---ro flow-entropy-null    empty
| +---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)?
| | | +--:(MEP-ID-int)
| | | +--ro MEP-ID-int?      int32
| | +--ro MEP-ID-format?     identityref
+--ro session-id              uint32

```

data hierarchy of PM

5. PM YANG Module

<CODE BEGINS> file "ietf-gen-oam-pm.yang"

```

module ietf-gen-oam-pm {
  namespace "urn:ietf:params:xml:ns:yang:ietf-gen-oam-pm";
  prefix goampm;

  import ietf-gen-oam {
    prefix goam;
  }
  import ietf-yang-types {
    prefix yang;
  }

  organization
    "IETF LIME (Layer Independent OAM Management in Multi-Layer
    Environment) Working Group";

  contact
    "zitao wang: wangzitao@huawei.com";

  description
    "This YANG module defines generic loss measurement and
    delay measurement configuration for multi-layer OAM

```

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management to be used within IETF in a protocol independent manner.";

revision 2015-01-07 {


```

    description
        "Initial revision.";
    reference "draft-wang-lime-yang-pm";
}

/* features */
feature loss-measurements {
    description
        "This feature indicates that the server supports
        configuration of loss measurement that is used by some OAM
        protocols.

        Servers that do not advertise this feature will not
        configure loss measurement";
}

feature delay-measurements {
    description
        "This feature indicates that the server supports
        configuration of delay measurement that is used by some OAM
        protocols.

        Servers that do not advertise this feature will not
        configure delay measurement";
}

feature create-loss-measurement{
    description
        "This feature indicates that the server supports executing
        the create-loss-measurement OAM command and returning a
        response. Servers that do not advertise this feature will
        not support execution of the create-loss-measurement command
        or the RPC model for the create-loss-measurement command.";
}

feature abort-loss-measurement{
    description
        "This feature indicates that the server supports executing
        the abort-loss-measurement OAM command and returning a
        response. Servers that do not advertise this feature will
        not support execution of the abort-loss-measurement command
        or the RPC model for the abort-loss-measurement command.";
}

```

```
feature create-delay-measurement{
  description
    "This feature indicates that the server supports executing
    the create-delay-measurement OAM command and returning a
    response. Servers that do not advertise this feature will
    not support execution of the create-delay-measurement
    command or the RPC model for the create-delay-measurement
    command.";
}
```

```
feature abort-delay-measurement{
  description
    "This feature indicates that the server supports executing
    the abort-delay-measurement OAM command and returning a
    response. Servers that do not advertise this feature will
    not support execution of the abort-delay-measurement
    command or the RPC model for the abort-delay-measurement
    command.";
}
```

```
grouping loss-measurement-configuration-group {
  description
    "This grouping includes configuration objects for the loss
    measurement function defined in GEN-PM.";
  reference
    "draft-wang-lime-yang-pm";
```

```
  container measurement-type {
    leaf slm {
      type boolean;
      description
        "If true, generate PM SLM Messages and correlate with
        received SLR responses.";
    }
    leaf pm_1sl{
      type boolean;
      description
        "If true, generate PM 1SL Messages.";
    }
    description
      "This object specifies what type of loss measurement
      will be performed.";
  }
}
```

```
  container enabled-counters {
    leaf availability-forward-high-loss {
```

type boolean;

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```
    default "false";
    description
        "Enable (true) or disable availability-forward-high-loss
        counters found in the current-stats and history-stats.";
}
leaf availability-forward-available {
    type boolean;
    default "false";
    description
        "Enable (true) or disable availability-forward-available
        counters found in the current-stats and history-stats ";
}
leaf availability-forward-unavailable {
    type boolean;
    default "false";
    description
        "Enable (true) or disable
        availability-forward-unavailable counters found in the
        current-stats and history-stats ";
}
leaf availability-backward-high-loss {
    type boolean;
    default "false";
    description
        "Enable (true) or disable availability-backward-high-loss
        counters found in the current-stats and history-stats ";
}
leaf availability-backward-consecutive-high-loss {
    type boolean;
    default "false";
    description
        "Enable (true) or disable
        availability-backward-consecutive-high-loss counters
        found in the current-stats and history-stats ";
}
leaf availability-backward-available {
    type boolean;
    default "false";
    description
        "Enable (true) or disable availability-backward-available
```

```

        counters found in the current-stats and history-stats ";
    }
    leaf availability-backward-unavailable {
        type boolean;
        default "false";
        description
            "Enable (true) or disable available-backward-unavailable

```

```

        counters found in the current-stats and history-stats ";
    }
    description
        "Indicates the types of PM loss measurement counters found
        in the current-stats and history-stats that are enabled.

        Not all counters are supported for all PM Loss Measurement
        types.";
    }
    /* This terminates the enabled-counters clause */

    leaf message-period {
        type uint32;
        units "ms";
        default 1000;
        description
            "This object specifies the interval between loss
            measurement OAM message transmissions.";
    }

    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 loss measurement data pattern
            included in the OAM Message.";
    }

```

```

}

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

    description
        "This object specifies a measurement interval in
        minutes. Measurements are accumulated in the current-stats
        counters for the duration of this interval, and then
        transferred to the history-stats counters.";
}

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 availability-measurement-interval {
    type uint32 {
        range "1..525600";
    }
    units minutes;
    default 15;
    description
        "This object specifies the availability measurement
        interval in minutes. Measurement interval of 15 minutes
        MUST be supported, other intervals can be supported.";
}

leaf availability-consecutive-intervals-number {
    type uint32 {
        range "1..1000";
    }
}

```

```

default 10;
description
    "This object specifies a configurable number of
    consecutive availability indicators to be used to
    determine a change in the availability status as
    indicated by MEF 10.2.1.

    This parameter is equivalent to the Availability
    parameter 'n' as specified by MEF 10.2.1. The number
    range of 1 through 10 MUST be supported. The number
    range of 1 through 1000 may be supported, but is not
    mandatory.";
}

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.";
}

list thresholds {
    key "id";
    description
        "This list contains the list of Loss Measurement
        configuration threshold values for LM Performance
        Monitoring. The main purpose of the threshold
        configuration list is to configure threshold alarm
        notifications indicating that a specific performance
        metric is not being met.";

    leaf id {

```

```

    type uint32;
    description
        "The index of the threshold number for the specific LM
        threshold entry. An index value of '1' MUST be
        supported. Other index values can also be supported.";
}

container enabled-thresholds {
    leaf forward-unavailable-count {
        type boolean;
        description
            "If true, indicates that the forward-unavailable-count
            is available.";
    }
    leaf forward-available-ratio {
        type boolean;
        description
            "If true, indicates that the forward-available-ratio
            is available.";
    }
    leaf backward-unavailable-count {
        type boolean;
        description
            "If true, indicates that the backward-unavailable-count
            is available.";
    }
    leaf backward-available-ratio {
        type boolean;
        description

```

```

        "If true, indicates that the backward-available-ratio
        is available.";
    }
    description
        "A container that indicates the type of OAM loss
        measurement threshold notifications that are enabled.";
}
/* Terminates container enabled-thresholds */

leaf forward-unavailable-count {
    type uint32;
    description

```

```

        "This object is used to set the forward unavailability
        threshold value that will be used to determine if a
        threshold notification is generated.";
    }
    leaf backward-unavailable-count {
        type uint32;
        description
            "This object is used to set the backward unavailability
            threshold value that will be used to determine if a
            threshold notification is generated.";
    }
    leaf forward-available-ratio {
        type uint32 {
            range "0..100000";
        }
        units milli-percent;
        default 0;

        description
            "This object is used to set the forward
            availability/total time ratio threshold value that will
            be used to determine if a threshold notification is
            generated if the ratio drops below the configured value.
            The ratio value is expressed as a percent with a value
            of 0 (ratio 0.00) through 100000 (ratio 1.00) Units are
            in milli-percent, where 1 indicates 0.001 percent.";
    }
    leaf backward-available-ratio {
        type uint32 {
            range "0..100000";
        }
        units milli-percent;
        default 0;
        description
            "This object is used to set the backward
            availability/total time ratio threshold value that will

```

be used to determine if a thresh-old notification is generated if the ratio drops below the configured value. The ratio value is expressed as a percent with a value of 0 (ratio 0.00) through 100000 (ratio 1.00) Units are in milli-percent, where 1 indicates 0.001 percent.";


```

    }
  }
  /* This terminates list thresholds */
}
/* This terminates loss-measurement-configuration-group */

grouping loss-stats-group {
  description
    "This grouping includes statistics objects for a loss
    measurement session.";
  leaf suspect-status {
    type boolean;
    description
      "true means statistics for this measurement interval are
      not valid.";
  }
}

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 session start time can be immediate,
        relative, or absolute.";

      container immediate {
        description
          "Start the measurement session immediately.";
      }

      leaf relative {
        type yang:timeticks;
        description
          "This object specifies the relative start time.";
      }
      leaf absolute {

```

```

        type yang:date-and-time;
        description
            "This object 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 {
            description
                "Never end the measurement session.";
        }

        leaf absolute {
            type yang:date-and-time;
            description
                "This object specifies the scheduled stop time
                to perform the on-demand monitoring operations.";
        }
    }
}

/* End of measurement-timing-group */

grouping delay-measurement-configuration-group {
    description
        "This grouping includes configuration objects for Delay
        Measurement function defined in PM.";
    reference
        "draft-wang-lime-yang-pm";

    container measurement-type {
        description
            "This container defines the measurement type.";

        leaf dmm {
            type boolean;
            description
                "If true, generate DMM Message, correlate with DMR

```

```
        responses.";
    }
    leaf dm1-transmitted {
        type boolean;
        description
            "If true, generate 1DM Message.";
    }
    leaf dm1-received {
        type boolean;
        description
            "Receive 1DM PDU and generate measurement.";
    }
}

container measurement-enable {
    description
        "Indicates the types of DM counters that are enabled. Not
        all DM counters are supported for all DM types.";
}

leaf message-period {
    type uint32;
    default 100;
    description
        "This object specifies the interval between delay
        measurement OAM message transmissions.";
}

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 delay measurement data pattern
        included in the OAM packet.";
}
```

```
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.";
  }
}

/* End of delay-measurement-configuration-group */

grouping delay-measurement-stats-group {
  description
    "This grouping includes statistics objects for a delay
```

```

        measurement session.";

    leaf suspect-status {
        type boolean;
        description
            "true means statistics for this measurement interval are
            not valid.";
    }
}
/* End of delay-measurement-stats-group */

/*This set of data definitions defines the role of MEP.*/
augment "/goam:domains/goam:domain"

```

```

+ "/goam:MAAs/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.";
    }
    leaf loss-responder {
        type boolean;
        default true;
        description
            "This object specifies whether Loss Measurement (LMM)
            single ended Responder is enabled. The value 'false'
            indicates the Loss measurement responder is disabled and
            received LMM will be discarded.";
    }
}

/*This set of data definitions defines performance measurement */
/*configuration.*/

```

```

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 regard to delay measurements.";

  container delay-measurements {
    if-feature delay-measurements;
    description
      "This container contains a collection of data
      definitions related to Delay Measurements as defined
      in 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.";
    }
}
/* End of list delay-measurements */

uses delay-measurement-configuration-group;
uses measurement-timing-group;

container current-stats {
    description
        "This container contains result of the current
        Measurement Interval in a 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;
        units "tens of ms";
        description
            "Elapsed time for current measurement interval in
            0.01 seconds.";
    }
}

```

```

    }

    uses delay-measurement-stats-group;
}
/* End of current-stats */

list history-stats {
    key id;
    description
        "This list contains the result for historic measurement
        intervals for performance measurement session.";

    leaf id {
        type uint32;
    }
}

```

```

        description
            "This id can be used to identify different history
            stats.";
    }

    leaf start-time {
        type yang:date-and-time;
        description
            "Start time for measurement interval.";
    }

    leaf elapsed-time {
        type uint32;
        units "tens of ms";
        description
            "Elapsed time for measurement interval in 0.01
            seconds.";
    }

    uses delay-measurement-stats-group;
}
/* End of history-stats */
}
/* End of container delay-measurements */
}
/* End of augment clause */

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 {

```

```

    if-feature loss-measurements;
    description
        "This container contains a collection of data definitions
        related to loss measurements as defined in this document.";

    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 loss measurement session status,
        true means active, false means not active.";
}
}
/* End of list loss-measurements */

uses loss-measurement-configuration-group;
uses measurement-timing-group;

leaf availability-forward-status {
    type enumeration {
        enum available {
            description
                "Indicates the MEP is available.";
        }
        enum unavailable {
            description

```

```

        "Indicates the MEP is unavailable.";
    }
    enum unknown {
        description
            "Indicates the availability is not known.";
    }
}
description
    "This object indicates the availability status in the
    forward direction.";
}
leaf availability-backward-status {
    type enumeration {
        enum available {
            description
                "Indicates the MEP is available.";
        }
        enum unavailable {
            description
                "Indicates the MEP is unavailable.";
        }
        enum unknown {
            description
                "Indicates the availability is not known.";
        }
    }
}
description
    "This object indicates the availability status
    in the backward direction.";
}

container current-stats {
    description
        "This container contains result of the current
        measurement interval in a 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;
        units "tens of ms";
        description

```

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```
        "Elapsed time for current measurement
          interval in 0.01 seconds.";
    }
    leaf forward-available {
        type yang:gauge32;
        description
            "The current value of forward-available for the
             referenced loss measurement session.";
    }
    leaf backward-available {
        type yang:gauge32;
        description
            "The current value of backward-available for the
             referenced loss measurement session.";
    }
    leaf forward-unavailable {
        type yang:gauge32;
        description
            "The current value of forward-unavailable for the
             referenced loss measurement session.";
    }
    leaf backward-unavailable {
        type yang:gauge32;
        description
            "The current value of backward-unavailable for the
             referenced loss measurement session.";
    }
    uses loss-stats-group;
}
/* End of container current-stats */

list history-stats {
    key id;
    description
        "This list contains the result for historic measurement
         intervals for PM loss measurement session.";

    leaf id {
        type uint32;
        description
            "This leaf can be used to select different
             history-stats intervals.";
    }
}
```

```
leaf start-time {
  type yang:date-and-time;
  description
    "Start time for measurement interval.";
```

```
    }

    leaf elapsed-time {
      type uint32;
      units "tens of ms";
      description
        "Elapsed time for measurement interval in 0.01
        seconds.";
    }
    leaf forward-available {
      type yang:gauge32;
      description
        "The value of forward-available for the
        referenced loss measurement session and interval.";
    }
    leaf backward-available {
      type yang:gauge32;
      description
        "The value of backward-available for the
        referenced loss measurement session and interval.";
    }
    leaf forward-unavailable {
      type yang:gauge32;
      description
        "The value of forward-unavailable for the
        referenced loss measurement session and interval.";
    }
    leaf backward-unavailable {
      type yang:gauge32;
      description
        "The value of backward-unavailable for the
        referenced loss measurement session and interval.";
    }
    uses loss-stats-group;
  }
}
/* End of list history-stats */
```

```

    }
    /* End of container loss-measurements */
}
/* End of augments clause */

//RPCs related to Generic PM
rpc create-loss-measurement {
  if-feature create-loss-measurement;
  description
    "Schedule a one-way or two-way on-demand or proactive
    performance monitoring loss measurement session 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;
    uses goam:MEP-ID;
    description
      "destination mep";
  }
}
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 {
  if-feature abort-delay-measurement;
  description

```

"Abort a currently running or scheduled single-ended on-demand PM loss measurement function.";

```
input {
  uses goam:maintenance-domain-id;
  uses goam:ma-identifier;

  container destination-mep {
    uses goam:mp-address;
    uses goam:MEP-ID;
    description
      "destination mep";
  }
  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 {
  if-feature create-delay-measurement;
  description
    "Schedule a one-way or two-way on-demand or proactive
     performance monitoring delay measurement session 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;
      uses goam:MEP-ID;
      description
```

```

        "description mep.";
    }
    uses goam:flow-entropy;
}

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

    input {
        uses goam:maintenance-domain-id;
        uses goam:ma-identifier;
    }
}

```

```

    container destination-mep {
        uses goam:mp-address;
        uses goam:MEP-ID;
        description
            "destination mep";
    }

    leaf session-id {

        type uint32;
        mandatory true;
        description
            "The session Id of the measurement session to
            be aborted.";
    }
}

```

```
    }  
  } //end of RPC  
}  
<CODE ENDS>
```

6. Security Considerations

TBD.

7. IANA Considerations

TBD.

8. References

8.1. Normative References

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