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A YANG model for Multicast Protocol for Low power and lossy Networks
(MPL)
draft-ietf-roll-mpl-yang-01

Abstract

This document defines a YANG data model for management of Multicast Protocol for Low power and lossy Networks (MPL) implementations. The data model includes configuration data and state data.

Note

Discussion and suggestions for improvement are requested, and should be sent to roll@ietf.org.

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1. Introduction

This document defines a YANG [RFC6020] data model for management of Multicast Protocol for Low power and lossy Networks (MPL) [RFC7731] implementations. The data model covers configuration of MPL parameters per interface. It also provides information about which Multicast addresses are operationally used, and the seeds of the forwarded packets.

1.1. 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 data model
- o data node

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

Terms like message, domain, seed, I, k, c are defined in [RFC7731].

Mutiple copies of a message can be received or sent by a node.

1.1.1. Tree Diagrams

A simplified graphical representation of the data model is used in the YANG modules specified in this document. The meaning of the symbols in these diagrams is as follows:

Brackets "[" and "]" enclose list keys.

Abbreviations before data node names: "rw" means configuration data (read-write) and "ro" state data (read-only).

Symbols after data node names: "?" means an optional node, "!" means a presence container, and "*" denotes a list and leaf-list.

Parentheses enclose choice and case nodes, and case nodes are also marked with a colon (":").

Ellipsis ("...") stands for contents of subtrees that are not shown.

2. MPL model

This document defines the YANG module "ietf-yang-mpl", which specifies a data model for MPL servers. The model is separated into four modules which can be loaded independently to accommodate the storage space to the wanted functionality. The model consists of the following parts: (1) a "mpl-domain" part that describes the MPL-domains and associated Multicast addresses and the interfaces on which the Multicast addresses are enabled, (2) a "mpl-op" part that describes the parameters settings per seed, (3) a "mpl-seeds" part that describes the MPL buffer contents and the Trickle timer values, and (4) a "mpl-statistics" part that describes the number of lost and

correctly forwarded messages. The data model, divided in four modules, has the following structure for MPL configuration per node:

```

module: ietf-yang-mpl-domain
  +--rw domain
    +--rw (single)?
      +--:(mpl-domain)
        |   +--rw mpl-domain
        |   |   +--rw domains* [domainID]
        |   |   |   +--rw domainID      uint16
        |   |   |   +--rw MClist*       inet:ipv6-address
        |   |   +--rw addresses* [MCaddress]
        |   |   |   +--rw MCaddress      inet:ipv6-address
        |   |   +--rw interfaces*      string
        |   +--:(mpl-single)
        |   |   +--rw mpl-single
        |   |   |   +--rw MCaddresses*   inet:ipv6-address
        |   |
        |   +--rw SE_LIFETIME?           uint16
        |   +--rw PROACTIVE_FORWARDING?  boolean
        |   +--rw SEED_SET_ENTRY_LIFETIME? uint64
        |   +--rw mpl-parameter* [domainID]
        |   |   +--rw domainID              uint16
        |   |   +--rw DATA_MESSAGE_IMIN?   uint16
        |   |   +--rw DATA_MESSAGE_IMAX?   uint16
        |   |   +--rw DATA_MESSAGE_K?      uint16
        |   |   +--rw DATA_MESSAGE_TIMER_EXPIRATIONS? uint16
        |   |   +--rw CONTROL_MESSAGE_IMIN? uint16
        |   |   +--rw CONTROL_MESSAGE_IMAX? uint16
        |   |   +--rw CONTROL_MESSAGE_K?    uint16
        |   |   +--rw CONTROL_MESSAGE_TIMER_EXPIRATIONS? uint16
        |
        +--ro mpl-seeds* [seedID domainID]
          +--ro seedID      uint64
          +--ro domainID    uint16
          +--ro local?      boolean
          +--ro generate-seqno? uint8
          +--ro life-time?  uint64
          +--ro min-seqno?  uint8
          +--ro data-number? uint8
          +--ro control-number? uint8
          +--ro buffered-messages* [seqno]
            +--ro seqno      uint8
            +--ro I?         uint8

```

```

        +---ro c?          uint8
        +---ro e?          uint8
        +---ro t?          uint8

module: ietf-yang-mpl-statistics
  +---ro mpl-statistics* [seedID domainID]
    +---ro seedID          uint64
    +---ro domainID        uint16
    +---ro c-too-high?     uint64
    +---ro nr-forwarded?   uint64
    +---ro nr-of-messages-received? uint64
    +---ro nr-of-copies-received?   uint64
    +---ro nr-of-messages-forwarded? uint64
    +---ro nr-of-copies-forwarded?   uint64
    +---ro nr-of-refused?   uint64
    +---ro nr-of-missed?    uint64
    +---ro nr-of-notreceived? uint64
    +---ro nr-of-inconsistent-data?  uint64
    +---ro nr-of-consistent-data?    uint64
    +---ro nr-of-consistent-control?  uint64
    +---ro nr-of-inconsistent-control? uint64
    +---ro statistics-interval?       uint64
    +---x reset-statistics

```

3. SID file generation

SID are allocated to the identifiers specified in the four modules. Their values are:

SID	Assigned to
1004050	module ietf-yang-mpl-domain
1004051	data /ietf-yang-mpl-domain:domain
1004052	data /ietf-yang-mpl-domain:domain/mpl-domain
1004053	data /ietf-yang-mpl-domain:domain/mpl-domain/addresses
1004054	data /ietf-yang-mpl-domain:domain/mpl-domain /addresses/MCaddress
1004055	data /ietf-yang-mpl-domain:domain/mpl-domain /addresses/interfaces
1004056	data /ietf-yang-mpl-domain:domain/mpl-domain/domains
1004057	data /ietf-yang-mpl-domain:domain/mpl-domain /domains/MClist
1004058	data /ietf-yang-mpl-domain:domain/mpl-domain /domains/domainID
1004059	data /ietf-yang-mpl-domain:domain/mpl-single
1004060	data /ietf-yang-mpl-domain:domain/mpl-single

/MCaddresses

File ietf-yang-mpl-domain@2018-03-29.sid created

Number of SIDs available : 50

Number of SIDs used : 11

SID	Assigned to
-----	-----
1004100	module ietf-yang-mpl-ops
1004101	data /ietf-yang-mpl-ops:mpl-ops
1004102	data /ietf-yang-mpl-ops:mpl-ops/PROACTIVE_FORWARDING
1004103	data /ietf-yang-mpl-ops:mpl-ops /SEED_SET_ENTRY_LIFETIME
1004104	data /ietf-yang-mpl-ops:mpl-ops/SE_LIFETIME
1004105	data /ietf-yang-mpl-ops:mpl-ops/mpl-parameter
1004106	data /ietf-yang-mpl-ops:mpl-ops/mpl-parameter /CONTROL_MESSAGE_IMAX
1004107	data /ietf-yang-mpl-ops:mpl-ops/mpl-parameter /CONTROL_MESSAGE_IMIN
1004108	data /ietf-yang-mpl-ops:mpl-ops/mpl-parameter /CONTROL_MESSAGE_K
1004109	data /ietf-yang-mpl-ops:mpl-ops/mpl-parameter /CONTROL_MESSAGE_TIMER_EXPIRATIONS
1004110	data /ietf-yang-mpl-ops:mpl-ops/mpl-parameter /DATA_MESSAGE_IMAX
1004111	data /ietf-yang-mpl-ops:mpl-ops/mpl-parameter /DATA_MESSAGE_IMIN
1004112	data /ietf-yang-mpl-ops:mpl-ops/mpl-parameter /DATA_MESSAGE_K
1004113	data /ietf-yang-mpl-ops:mpl-ops/mpl-parameter /DATA_MESSAGE_TIMER_EXPIRATIONS
1004114	data /ietf-yang-mpl-ops:mpl-ops/mpl-parameter/domainID

File ietf-yang-mpl-ops@2018-03-29.sid created

Number of SIDs available : 50

Number of SIDs used : 15

SID	Assigned to
-----	-----
1004150	module ietf-yang-mpl-seeds
1004151	data /ietf-yang-mpl-seeds:mpl-seeds
1004152	data /ietf-yang-mpl-seeds:mpl-seeds/buffered-messages
1004153	data /ietf-yang-mpl-seeds:mpl-seeds /buffered-messages/I
1004154	data /ietf-yang-mpl-seeds:mpl-seeds /buffered-messages/c
1004155	data /ietf-yang-mpl-seeds:mpl-seeds /buffered-messages/e

```

1004156  data /ietf-yang-mpl-seeds:mpl-seeds
          /buffered-messages/seqno
1004157  data /ietf-yang-mpl-seeds:mpl-seeds
          /buffered-messages/t
1004158  data /ietf-yang-mpl-seeds:mpl-seeds/control-number
1004159  data /ietf-yang-mpl-seeds:mpl-seeds/data-number
1004160  data /ietf-yang-mpl-seeds:mpl-seeds/domainID
1004161  data /ietf-yang-mpl-seeds:mpl-seeds/generate-seqno
1004162  data /ietf-yang-mpl-seeds:mpl-seeds/life-time
1004163  data /ietf-yang-mpl-seeds:mpl-seeds/local
1004164  data /ietf-yang-mpl-seeds:mpl-seeds/min-seqno
1004165  data /ietf-yang-mpl-seeds:mpl-seeds/seedID

```

File ietf-yang-mpl-seeds@2018-03-29.sid created

Number of SIDs available : 50

Number of SIDs used : 16

SID	Assigned to
1004200	module ietf-yang-mpl-statistics
1004201	data /ietf-yang-mpl-statistics:mpl-statistics
1004202	data /ietf-yang-mpl-statistics:mpl-statistics /c-too-high
1004203	data /ietf-yang-mpl-statistics:mpl-statistics /domainID
1004204	data /ietf-yang-mpl-statistics:mpl-statistics /nr-forwarded
1004205	data /ietf-yang-mpl-statistics:mpl-statistics /nr-of-consistent-control
1004206	data /ietf-yang-mpl-statistics:mpl-statistics /nr-of-consistent-data
1004207	data /ietf-yang-mpl-statistics:mpl-statistics /nr-of-copies-forwarded
1004208	data /ietf-yang-mpl-statistics:mpl-statistics /nr-of-copies-received
1004209	data /ietf-yang-mpl-statistics:mpl-statistics /nr-of-inconsistent-control
1004210	data /ietf-yang-mpl-statistics:mpl-statistics /nr-of-inconsistent-data
1004211	data /ietf-yang-mpl-statistics:mpl-statistics /nr-of-messages-forwarded
1004212	data /ietf-yang-mpl-statistics:mpl-statistics /nr-of-messages-received
1004213	data /ietf-yang-mpl-statistics:mpl-statistics /nr-of-missed
1004214	data /ietf-yang-mpl-statistics:mpl-statistics /nr-of-notreceived
1004215	data /ietf-yang-mpl-statistics:mpl-statistics

```
1004216      data /ietf-yang-mpl-statistics:mpl-statistics
                                     /nr-of-refused
                                     /reset-statistics
1004217      data /ietf-yang-mpl-statistics:mpl-statistics/seedID
1004218      data /ietf-yang-mpl-statistics:mpl-statistics
                                     /statistics-interval
```

```
File ietf-yang-mpl-statistics@2018-03-29.sid created
Number of SIDs available : 50
Number of SIDs used : 19
```

4. yang-mpl modules

This section describes four yang modules. The model is based on the MPL specification published in [RFC7731] and the specification of [RFC6206]. The identification of the interfaces follows the specification of ietf-interfaces of [RFC7223].

The data model allows to set values to the parameters of the MPL algorithm. This approach requires an active manager process to set the values without use of DHCP as described in: [RFC7774].

The names of the four modules are: yang-mpl-domain, yang-mpl-ops, yang-mpl-seeds, and yang-mpl-statistics, described in subsections with the same name.

4.1. yang-mpl-domain module

This module describes (1) the MPL domains and the associated multicast addresses, and (2) the interfaces and the multicast addresses for which they are enabled.

The model features a choice such that for constrained devices with only one "single" interface and only one "single" domain, the model specifies a list of MC addresses for which the single interface is enabled.

```
<CODE BEGINS>file "ietf-yang-mpl-domain@2018-03-29.yang"
```

```
module ietf-yang-mpl-domain {
  yang-version 1.1;
  namespace
    "urn:ietf:params:xml:ns:yang:ietf-yang-mpl-domain";
```



```
prefix mpl;

import ietf-inet-types{
  prefix inet;
}

organization
  "IETF ROLL (Routing Over Low power and lossy networks)
  Working Group";

contact
  "WG Web:   http://tools.ietf.org/wg/roll/
  WG List:  mailto:roll@ietf.org

  WG Chair: Peter van der Stok
            mailto:consultancy@vanderstok.org

  WG Chair: Ines Robles
            mailto:maria.ines.robles@ericsson.com

  Editor:   Peter van der Stok
            mailto:consultancy@vanderstok.org";

description
  "This module contains information about the state of the MPL domain.

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  This version of this YANG module is part of RFC XXXX; see
  the RFC itself for full legal notices.";

revision "2018-03-29" {
  description "Initial revision.";
  reference
    "I-D:draft-ietf-roll-mpl-yang: A YANG model for Multicast
    Protocol for Low power and lossy Networks (MPL)";
}

container domain {
  description
    "High level container containing the choice statement.";
```

```
choice single {
  description
    "A choice between single domain/interface and multiple
    domains and interfaces.";
  container mpl-domain {
    description
      "The entries describe the MPL domains, the associated
      Multicast addresses and interfaces.";

    list domains {
      key domainID;
      description
        "The entries describe a given domain identified with
        domainID and the associated Multicast addresses.";

      leaf domainID {
        type uint16;
        description
          "Entry uniquely identifies the domain in the
          forwarder.";
      }

      leaf-list Mclist{
        type inet:ipv6-address;
        description
          "List of associated IPv6 Addresses.";
      }
    } // domains list

    list addresses {
      key MCaddress;
      description
        "The entries describe the interfaces enabled
        with the specified MC address.";

      leaf MCaddress {
        type inet:ipv6-address;
        description
          "MC address belonging to a MPL domain.";
      }

      leaf-list interfaces {
        type string;
        description
          "List of names of interfaces enabled for this
          Multicast address. Interface name is defined in [RFC6206].";
      }
    } // addresses list
  }
}
```

```
    } // container mpl-domain
    container mpl-single {
        description
            "For small devices list of MC addresses for single
            interface and domain.";
        leaf-list MCaddresses{
            type inet:ipv6-address;
            description
                "list of MC addresses belonging to one single
                domain and interface.";
        }
    } // container mpl-simple
} // choice simple
} // container module
} //module ietf-yang-mpl-domain
```

<CODE ENDS>

4.2. yang-mpl-ops module

This module models the operational aspects of MPL. Per domain MPL specifies four parameters I_MAX, I_MIN, K, and TIMER_EXPIRATIONS for data and control messages. The value of the MPL intervals are expressed in TUNIT. The entry SE_LIFETIME taken over from [RFC7774] fixes TUNIT to milliseconds. For very constrained devices with only one domain there can be only one instance of mpl-parameter list.

```
<CODE BEGINS>file "ietf-yang-mpl-ops@2018-03-29.yang"

module ietf-yang-mpl-ops {

    yang-version 1.1;

    namespace
        "urn:ietf:params:xml:ns:yang:ietf-yang-mpl-ops";

    prefix mpl;

    organization
        "IETF ROLL (Routing over Low power and lossy networks)
        Working Group";

    contact
        "WG Web:  http://tools.ietf.org/wg/roll/
        WG List:  mailto:roll@ietf.org"
```

WG Chair: Peter van der Stok
mailto:consultancy@vanderstok.org

WG Chair: Ines Robles
mailto:maria.ines.robles@ericsson.com

Editor: Peter van der Stok
mailto:consultancy@vanderstok.org";

description

"This module contains information about the operation of the MPL protocol.

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```
revision "2018-03-29" {  
  description "Initial revision.";  
  reference  
    "I-D:draft-ietf-roll-mpl-yang: A YANG model for Multicast  
    Protocol for Low power and lossy Networks (MPL)";  
}
```

```
container mpl-ops {  
  description  
    "Parameter settings for each MPL server and for each  
    individual domain of the server.";
```

```
  leaf SE_LIFETIME {  
    type uint16;  
    description  
      "lifetime in milliseconds/(mpl timer units),  
      equivalent to SEED_SET_ENTRY_LIFETIME/TUNIT as  
      specified in RFC7774.";  
  }
```

```
leaf PROACTIVE_FORWARDING {
  type boolean;
  description
    "The boolean value indicates whether the MPL forwarder
    schedules MPL data message transmission after
    receiving them for the first time.";
}

leaf SEED_SET_ENTRY_LIFETIME {
  type uint64;
  description
    "The value indicates the minimum lifetime for an entry
    in the Seed set expressed in seconds. Default value
    is 30 minutes.";
}

list mpl-parameter{
  key domainID;
  description
    "Each domain has a set of MPL forwarding parameters
    which regulate the forwarding operation.";

  leaf domainID{
    type uint16;
    description
      "Each domainID must be present in
mpl-parameter list.";
  }

  leaf DATA_MESSAGE_IMIN{
    type uint16;
    description
      "The minimum Trickle timer interval, as defined in
      [RFC6206], for MPL Data Message transmissions.";
  }

  leaf DATA_MESSAGE_IMAX{
    type uint16;
    description
      "The maximum Trickle timer interval, as defined in
      [RFC6206], for MPL Data Message transmissions.";
  }

  leaf DATA_MESSAGE_K{
    type uint16;
    default 1;
    description
      "The redundancy constant, as defined in [RFC6206], for
```

```
        MPL Data Message transmissions.";
    }

    leaf DATA_MESSAGE_TIMER_EXPIRATIONS{
        type uint16;
        default 3;
        description
            "The number of Trickle timer expirations, as defined
            in [RFC7731], that occur
            before terminating the Trickle algorithm's
            retransmission of a given MPL Data Message.";
    }

    leaf CONTROL_MESSAGE_IMIN{
        type uint16;
        description
            "The minimum Trickle timer interval, as defined
            in [RFC6206], for MPL Control Message
            transmissions.";
    }

    leaf CONTROL_MESSAGE_IMAX{
        type uint16;
        description
            "The maximum Trickle timer interval, as defined
            in [RFC6206], for MPL Control Message
            transmissions.";
    }

    leaf CONTROL_MESSAGE_K{
        type uint16;
        default 1;
        description
            "The redundancy constant, as defined in [RFC6206],
            for MPL Control Message transmissions.";
    }

    leaf CONTROL_MESSAGE_TIMER_EXPIRATIONS{
        type uint16;
        default 10;
        description
            "The number of Trickle time expirations,
            as defined in [RFC7731], that occur
            before terminating the Trickle algorithm
            for MPL Control Message transmissions.";
    }
} // list MPL-parameter
```

```
    } // container MPL-ops  
  } // module ietf-yang-mpl-ops
```

```
<CODE ENDS>
```

4.3. yang-mpl-seeds module

This module specifies the current values of the operation of the MPL forwarder. The values are acquired by the client and set by the server. The module specifies a set of message buffers, with a buffer per seed and domain. In constrained devices there will be only one domain, but probably multiple seeds.

The message buffer contains a set of messages where each message is uniquely identified by its sequence number and seed. The associated I, c, e, and t values indicate the progress of MPL with respect to this message, as specified in [RFC7731]. A forwarder sends and receives multiple copies of a message. When a forwarder has sent (received) a copy of a message, the forwarder has sent (received) that message.

For forwarders which are seeds, local has value true and seqno is the sequence number of the next message to send.

```
<CODE BEGINS>file "ietf-yang-mpl-seeds@2018-03-29.yang"
```

```
module ietf-yang-mpl-seeds {  
  
  yang-version 1.1;  
  
  namespace  
    "urn:ietf:params:xml:ns:yang:ietf-yang-mpl-seeds";  
  
  prefix mpl;  
  
  organization  
    "IETF ROLL (Routing over Low power and lossy networks)  
    Working Group";  
  
  contact  
    "WG Web:  http://tools.ietf.org/wg/roll/  
    WG List:  mailto:roll@ietf.org  
  
    WG Chair: Peter van der Stok  
              mailto:consultancy@vanderstok.org"
```

WG Chair: Ines Robles
mailto:maria.ines.robles@ericsson.com

Editor: Peter van der Stok
mailto:consultancy@vanderstok.org";

description

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of the MPL protocol.

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```
revision "2018-03-29" {  
  description "Initial revision.";  
  reference  
    "I-D:draft-ietf-roll-mpl-yang: A YANG model for Multicast  
    Protocol for Low power and lossy Networks (MPL)";  
}
```

```
list mpl-seeds{  
  key "seedID domainID";  
  config false;  
  description  
    "List describes all seeds that are active in the server.  
    Seed information contains the message buffer contents and the  
    operational values of I, c, sequence number and the life-times  
    per message.";
```

```
  leaf seedID{  
    type uint64;  
    description  
      "value uniquely identifies the MPL Seed within a MPL  
      domain.";  
  }
```



```
    leaf domainID{
      type uint16;
      description
        "together with seedID uniquely identifies buffer set.";
    }

    leaf local {
      type boolean;
      description
        "When local == TRUE, seed originated in this forwarder.
        WHEN local == false, seed originated in different
        forwarder.";
    }

    leaf generate-seqno {
      type uint8;
      description
        "Sequence number of next message to be generated by
this local seed.";
    }

    leaf life-time {
      type uint64;
      description
        " Minimum remaining lifetime of the seed entry in
        SE_LIFETIME units.";
    }

    leaf min-seqno{
      type uint8;
      description
        "Lower bound sequence number in the buffer of the seed.";
    }

    leaf data-number{
      type uint8;
      description
        "Number of currently buffered data messages.";
    }

    leaf control-number{
      type uint8;
      description
        "Number of currently buffered control messages.";
    }

    list buffered-messages{
      key seqno;
```

```
    description
        " status of trickle intervals of the buffered message
identified by seqno. and seed/domain";

    leaf seqno{
        type uint8;
        description
            "Sequence number of message.";
    }

    leaf I{
        type uint8;
        description
            "Current Trickle timer interval size in SE-LIFETIME
units.";
    }

    leaf c{
        type uint8;
        description
            "number of times that a copy of this message has been
            received in this interval.";
    }

    leaf e{
        type uint8;
        description
            "number of Trickle time expirations since last
            Trickle timer reset.";
    }

    leaf t{
        type uint8;
        description
            " Time expressed in SE-LIFETIME units
            that message will be (is) forwarded";
    }
} // list seed-timers
} // list MPL-seeds
} // module ietf-yang-mpl-seeds
```

<CODE ENDS>

4.4. yang-mpl-statistics module

This module specifies the operation of the MPL forwarder expressed in number of messages and copies. The values are acquired by the client and set by the server. Statistics are specified per seed and domain. In constrained devices there will be only one domain, but probably multiple seeds.

The parameter *k* determines how many copies of a message can be forwarded. The counters *c-too-high*, *nr-forwarded*, and *nr-not-forwarded* give insight in the consequences of the current value of *k*.

The other counters give insight in the loss of messages caused by the medium or forwarding delays. The inconsistent/consistent counters indicate when consistent or inconsistent messages were received according to the definition of consistent in [RFC7731].

```
<CODE BEGINS>file "ietf-yang-mpl-statistics@2018-03-29.yang"
```

```
module ietf-yang-mpl-statistics {  
  
  yang-version 1.1;  
  
  namespace  
    "urn:ietf:params:xml:ns:yang:ietf-yang-mpl-statistics";  
  
  prefix mpl;  
  
  organization  
    "IETF ROLL (Routing over Low power and lossy networks)  
    Working Group";  
  
  contact  
    "WG Web:  http://tools.ietf.org/wg/roll/  
    WG List:  mailto:roll@ietf.org  
  
    WG Chair: Peter van der Stok  
              mailto:consultancy@vanderstok.org  
  
    WG Chair: Ines Robles  
              mailto:maria.ines.robles@ericsson.com  
  
    Editor:   Peter van der Stok  
              mailto:consultancy@vanderstok.org";
```

```
description
  "This module contains information about the operation
  of the MPL protocol.

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  Relating to IETF Documents
  (http://trustee.ietf.org/license-info).

  This version of this YANG module is part of RFC XXXX; see
  the RFC itself for full legal notices."

revision "2018-03-29" {
  description "Initial revision.";
  reference
    "I-D:draft-ietf-roll-mpl-yang: A YANG model for Multicast
    Protocol for Low power and lossy Networks (MPL)";
}

list mpl-statistics{
  key "seedID domainID";

  config false;

  description
    "List describes performance statistics integrated over
    the messages identified by seed and domain identifiers. A
    forwarder can receive and forward multiple copies of a message
    uniquely identified by seqno, domain, and seed.";

  leaf seedID{
    type uint64;
    description
      "value uniquely identifies the MPL Seed within a MPL
      domain.";
  }

  leaf domainID{
    type uint16;
    description
```

```
    "together with seed-ID uniquely identifies buffer set.";
  }

  leaf c-too-high {
    type uint64;
    description
      "Number of times that a copy was not forwarded
       because c > k.";
  }

  leaf nr-forwarded {
    type uint64;
    description
      "number of times copies are forwarded, while c <= k.";
  }

  leaf nr-of-messages-received{
    type uint64;
    description
      "number of messages received,
       must be smaller than or equal to seqno.";
  }

  leaf nr-of-copies-received{
    type uint64;
    description
      "total number of message copies received.";
  }

  leaf nr-of-messages-forwarded{
    type uint64;
    description
      "number of forwarded messages, must be smaller than or
equal to nr-of-messages-received.";
  }

  leaf nr-of-copies-forwarded{
    type uint64;
    description
      "number of forwarded copies, can be larger than
number-of-copies-received.";
  }

  leaf nr-of-refused{
    type uint64;
    description
      "number of refused copies because seqno too small.";
  }
```

```
leaf nr-of-missed{
  type uint64;
  description
    "number of messages that were not received
     is equal to the number of empty message buffers
     seqno < min-seqno.";
}

leaf nr-of-notreceived{
  type uint64;
  description
    "number of messages that were not received
     according to control message.";
}

leaf nr-of-inconsistent-data{
  type uint64;
  description
    "number of inconsistent data messages.";
}

leaf nr-of-consistent-data{
  type uint64;
  description
    "number of consistent data messages.";
}

leaf nr-of-consistent-control{
  type uint64;
  description
    "number of consistent control messages.";
}

leaf nr-of-inconsistent-control{
  type uint64;
  description
    "number of inconsistent control messages.";
}

leaf statistics-interval{
  type uint64;
  description
    "Interval, expressed in seconds, during which
     the statistics are collected.";
}

action reset-statistics{
  description
```

```
        "set all statistics counters and
        statistics-interval to zero.";
    }

    } // list mpl statistics
} // module ietf-yang-mpl-statistics

<CODE ENDS>
```

5. IANA Considerations

This specification has no consequences for IANA.

6. Acknowledgements

Andy Bierman has commented on the use of YANG for mpl. YANG doctors pointed out a wrong use of config.

7. Changelog

Changes from version 00 to version 01

- o config false in "statistics" and "seeds" modules
- o separated into 4 modules
- o inserted choice in domain modules
- o more explanatory text
- o renamed some parameters
- o Introduced section per module
- o reset of statistics is added

8. References

8.1. Normative References

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- [RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011, <<https://www.rfc-editor.org/info/rfc6241>>.
- [RFC7223] Bjorklund, M., "A YANG Data Model for Interface Management", RFC 7223, DOI 10.17487/RFC7223, May 2014, <<https://www.rfc-editor.org/info/rfc7223>>.
- [RFC7731] Hui, J. and R. Kelsey, "Multicast Protocol for Low-Power and Lossy Networks (MPL)", RFC 7731, DOI 10.17487/RFC7731, February 2016, <<https://www.rfc-editor.org/info/rfc7731>>.

8.2. Informative References

- [RFC6206] Levis, P., Clausen, T., Hui, J., Gnawali, O., and J. Ko, "The Trickle Algorithm", RFC 6206, DOI 10.17487/RFC6206, March 2011, <<https://www.rfc-editor.org/info/rfc6206>>.
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