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Two-Way Active Measurement Protocol (TWAMP) Light Data Model
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Abstract

This document specifies the data model for implementations of Session-Sender and Session-Reflector for Two-Way Active Measurement Protocol (TWAMP) Light mode using YANG.

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[1.](#) Introduction

The Two-Way Active Measurement Protocol (TWAMP) [[RFC5357](#)] can be used to measure performance parameters of IP networks such as latency, jitter, and packet loss by sending test packets and monitoring their experience in the network. The [[RFC5357](#)] defines two protocols, TWAMP Control and TWAMP Test, and a profile of TWAMP Test, TWAMP Light. The TWAMP Light is known to have many implementations though no common management framework being defined, thus leaving some aspects of test packet processing to interpretation. The goal of this document is to collect analyze these variations; describe common model while allowing for extensions in the future. This document defines such a TWAMP data model and specifies it formally using the YANG data modeling language [[RFC6020](#)].

[1.1.](#) Conventions used in this document

[1.1.1.](#) Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [BCP 14](#) [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

2. Scope, Model, and Applicability

The scope of this document includes model of the TWAMP Light as defined in [Appendix I of \[RFC5357\]](#). This mode of TWAMP Light will be referred in this document as Stateless. Another mode, where the Session-Reflector is aware of the state of the TWAMP test session and thus can independently count reflected test packets, referred as Stateful. This document benefits from earlier attempt to define TWAMP MIB in [\[I-D.elteto-ippm-twamp-mib\]](#) and from TWAMP YANG model defined in [\[I-D.ietf-ippm-twamp-yang\]](#).

Figure 1 updates TWAMP-Light reference model presented in [Appendix I \[RFC5357\]](#) for the scenario when instantiation of a TWAMP-Test session between Session-Sender and Session-Reflector controlled by communication between a Configuration Client as a manager and Configuration Servers as agents of the configuration session.

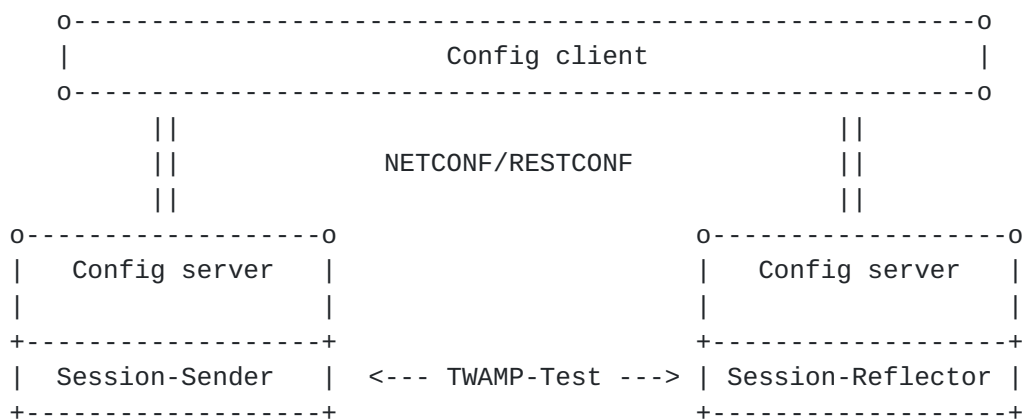


Figure 1: TWAMP Light Reference Model

2.1. Data Model Parameters

This section describes all the parameters of the the TWAMP-Light data model.

2.1.1. Session-Sender

The `twamp-light-session-sender` container holds items that are related to the configuration of the TWAMP-Light Session-Sender logical entity.

The `twamp-light-session-sender-state` container holds information about the state of the particular TWAMP-Light test session.

RPCs `twamp-sender-start` and `twamp-sender-stop` respectively start and stop the referenced by session-id TWAMP-Light test session.

2.1.1.1. Controls for Test Session and Performance Metric Calculation

The data model supports several scenarios for Session-Sender to execute test sessions and calculate performance metrics:

The test mode in which the test packets are sent unbound in time at defined by the parameter `'interval'` in the `twamp-light-session-sender` container frequency is referred as continuous mode. Performance metrics in the continuous mode are calculated at period defined by the parameter `'measurement-interval'`.

The test mode that has specific number of the test packets configured for the test session in the `'number-of-packets'` parameter is referred as periodic mode. The test session may be repeated by the Session-Sender with the same parameters. The `'repeat'` parameter defines number of tests and the `'repeat-interval'` - the interval between the consecutive tests. The performance metrics are calculated after each test session when the interval defined by the `'session-timeout'` expires.

2.1.2. Session-Reflector

The `twamp-light-session-reflector` container holds items that are related to the configuration of the TWAMP-Light Session-Reflector logical entity.

The `twamp-light-session-refl-state` container holds Session-Reflector state data for the particular TWAMP-Light test session.

3. Data Model

Creating TWAMP-Light data model presents number of challenges and among them is identification of a test-session at Session-Reflector. A Session-Reflector MAY require only as little as its IP and UDP port number in received TWAMP-Test packet to spawn new test session. More so, to test processing of Class-of-Service along the same route in Equal Cost Multi-Path environment Session-Sender may run TWAMP test sessions concurrently using the same source IP address, source UDP port number, destination IP address, and destination UDP port number. Thus the only parameter that can be used to differentiate these test sessions would be DSCP value. The DSCP field may get re-marked along the path and without use of [\[RFC7750\]](#) that will go undetected, but by using five-tuple instead of four-tuple as a key we can ensure that TWAMP test packets that are considered as different test sessions follow the same path even in ECMP environments.

3.1. Tree Diagram

```

module: ietf-twamp-light
  +--rw twamp-light
  |   +--rw twamp-light-session-sender {session-sender-light}?
  |   |   +--rw sender-light-enable?    enable
  |   |   +--rw test-session* [session-id]
  |   |       +--rw session-id          uint32
  |   |       +--rw test-session-enable? enable
  |   |       +--rw number-of-packets?   union
  |   |       +--rw packet-padding-size? uint32
  |   |       +--rw interval?            uint32
  |   |       +--rw session-timeout?     uint32
  |   |       +--rw measurement-interval? uint32
  |   |       +--rw repeat?              union
  |   |       +--rw repeat-interval?     uint32
  |   |       +--rw dscp-value?          inet:dscp
  |   |       +--rw test-session-reflector-mode? session-reflector-mode
  |   |       +--rw sender-ip            inet:ip-address
  |   |       +--rw sender-udp-port      inet:port-number
  |   |       +--rw reflector-ip         inet:ip-address
  |   |       +--rw reflector-udp-port   inet:port-number
  |   |       +--rw authentication-params! {twamp-light-authentication}?
  |   |           +--rw key-chain?    kc:key-chain-ref
  |   |       +--rw first-percentile? percentile
  |   |       +--rw second-percentile? percentile
  |   |       +--rw third-percentile? percentile
  |   +--rw twamp-light-session-reflector {session-reflector-light}?
  |   |   +--rw reflector-light-enable?    enable
  |   |   +--rw ref-wait?                  uint32
  |   |   +--rw reflector-light-mode-state? session-reflector-mode
  |   |   +--rw test-session* [session-id]
  |   |       +--rw session-id          uint32
  |   |       +--rw dscp-handling-mode? session-dscp-mode
  |   |       +--rw dscp-value?         inet:dscp
  |   |       +--rw sender-ip           inet:ip-address
  |   |       +--rw sender-udp-port     inet:port-number
  |   |       +--rw reflector-ip        inet:ip-address
  |   |       +--rw reflector-udp-port  inet:port-number
  |   |       +--rw authentication-params! {twamp-light-authentication}?
  |   |           +--rw key-chain?    kc:key-chain-ref
  |   +--ro twamp-light-state
  |   |   +--ro twamp-light-session-sender-state {session-sender-light}?
  |   |   |   +--ro test-session-state* [session-id]
  |   |   |       +--ro session-id          uint32
  |   |   |       +--ro sender-session-state? enumeration
  |   |   |       +--ro current-stats

```



```

|   | +--ro start-time          yang:date-and-time
|   | +--ro packet-padding-size? uint32
|   | +--ro interval?          uint32
|   | +--ro duplicate-packets?  uint32
|   | +--ro reordered-packets?  uint32
|   | +--ro sender-ip          inet:ip-address
|   | +--ro sender-udp-port     inet:port-number
|   | +--ro reflector-ip       inet:ip-address
|   | +--ro reflector-udp-port  inet:port-number
|   | +--ro dscp?              inet:dscp
|   | +--ro sent-packets?       uint32
|   | +--ro rcv-packets?        uint32
|   | +--ro sent-packets-error? uint32
|   | +--ro rcv-packets-error?  uint32
|   | +--ro last-sent-seq?      uint32
|   | +--ro last-rcv-seq?       uint32
|   | +--ro two-way-delay
|   | | +--ro delay
|   | | | +--ro min?          yang:gauge32
|   | | | +--ro max?          yang:gauge32
|   | | | +--ro avg?          yang:gauge32
|   | | | +--ro delay-variation
|   | | |   +--ro min?        uint32
|   | | |   +--ro max?        uint32
|   | | |   +--ro avg?        uint32
|   | +--ro one-way-delay-far-end
|   | | +--ro delay
|   | | | +--ro min?          yang:gauge32
|   | | | +--ro max?          yang:gauge32
|   | | | +--ro avg?          yang:gauge32
|   | | | +--ro delay-variation
|   | | |   +--ro min?        uint32
|   | | |   +--ro max?        uint32
|   | | |   +--ro avg?        uint32
|   | +--ro one-way-delay-near-end
|   | | +--ro delay
|   | | | +--ro min?          yang:gauge32
|   | | | +--ro max?          yang:gauge32
|   | | | +--ro avg?          yang:gauge32
|   | | | +--ro delay-variation
|   | | |   +--ro min?        uint32
|   | | |   +--ro max?        uint32
|   | | |   +--ro avg?        uint32
|   | +--ro low-percentile
|   | | +--ro delay-percentile
|   | | | +--ro rtt-delay?      percentile
|   | | | +--ro near-end-delay? percentile
|   | | | +--ro far-end-delay? percentile

```



```

|   | |   +--ro jitter-percentile
|   | |   +--ro rtt-jitter?      percentile
|   | |   +--ro near-end-jitter? percentile
|   | |   +--ro far-end-jitter?  percentile
|   | +--ro mid-percentile
|   | |   +--ro delay-percentile
|   | | |   +--ro rtt-delay?      percentile
|   | | |   +--ro near-end-delay? percentile
|   | | |   +--ro far-end-delay?  percentile
|   | |   +--ro jitter-percentile
|   | |   +--ro rtt-jitter?      percentile
|   | |   +--ro near-end-jitter? percentile
|   | |   +--ro far-end-jitter?  percentile
|   | +--ro high-percentile
|   | |   +--ro delay-percentile
|   | | |   +--ro rtt-delay?      percentile
|   | | |   +--ro near-end-delay? percentile
|   | | |   +--ro far-end-delay?  percentile
|   | |   +--ro jitter-percentile
|   | |   +--ro rtt-jitter?      percentile
|   | |   +--ro near-end-jitter? percentile
|   | |   +--ro far-end-jitter?  percentile
|   | +--ro two-way-loss
|   | |   +--ro loss-count?      int32
|   | |   +--ro loss-ratio?      percentage
|   | |   +--ro loss-burst-max?  int32
|   | |   +--ro loss-burst-min?  int32
|   | |   +--ro loss-burst-count? int32
|   | +--ro one-way-loss-far-end
|   | |   +--ro loss-count?      int32
|   | |   +--ro loss-ratio?      percentage
|   | |   +--ro loss-burst-max?  int32
|   | |   +--ro loss-burst-min?  int32
|   | |   +--ro loss-burst-count? int32
|   | +--ro one-way-loss-near-end
|   | |   +--ro loss-count?      int32
|   | |   +--ro loss-ratio?      percentage
|   | |   +--ro loss-burst-max?  int32
|   | |   +--ro loss-burst-min?  int32
|   | |   +--ro loss-burst-count? int32
|   +--ro history-stats* [id]
|       +--ro id                  uint32
|       +--ro end-time            yang:date-and-time
|       +--ro number-of-packets?  uint32
|       +--ro packet-padding-size? uint32
|       +--ro interval?           uint32
|       +--ro duplicate-packets?  uint32
|       +--ro reordered-packets?  uint32

```



```

|      +--ro loss-packets?          uint32
|      +--ro sender-ip              inet:ip-address
|      +--ro sender-udp-port        inet:port-number
|      +--ro reflector-ip           inet:ip-address
|      +--ro reflector-udp-port      inet:port-number
|      +--ro dscp?                  inet:dscp
|      +--ro sent-packets?          uint32
|      +--ro rcv-packets?           uint32
|      +--ro sent-packets-error?    uint32
|      +--ro rcv-packets-error?     uint32
|      +--ro last-sent-seq?         uint32
|      +--ro last-rcv-seq?         uint32
|      +--ro two-way-delay
|      |   +--ro delay
|      |   |   +--ro min?          yang:gauge32
|      |   |   +--ro max?          yang:gauge32
|      |   |   +--ro avg?          yang:gauge32
|      |   +--ro delay-variation
|      |   |   +--ro min?          uint32
|      |   |   +--ro max?          uint32
|      |   |   +--ro avg?          uint32
|      +--ro one-way-delay-far-end
|      |   +--ro delay
|      |   |   +--ro min?          yang:gauge32
|      |   |   +--ro max?          yang:gauge32
|      |   |   +--ro avg?          yang:gauge32
|      |   +--ro delay-variation
|      |   |   +--ro min?          uint32
|      |   |   +--ro max?          uint32
|      |   |   +--ro avg?          uint32
|      +--ro one-way-delay-near-end
|      |   +--ro delay
|      |   |   +--ro min?          yang:gauge32
|      |   |   +--ro max?          yang:gauge32
|      |   |   +--ro avg?          yang:gauge32
|      |   +--ro delay-variation
|      |   |   +--ro min?          uint32
|      |   |   +--ro max?          uint32
|      |   |   +--ro avg?          uint32
+--ro twamp-light-session-refl-state {session-reflector-light}?
    +--ro reflector-light-admin-status  boolean
    +--ro test-session-state* [session-id]
        +--ro session-id                uint32
        +--ro sent-packets?             uint32
        +--ro rcv-packets?              uint32
        +--ro sent-packets-error?       uint32
        +--ro rcv-packets-error?        uint32
        +--ro last-sent-seq?            uint32

```



```
    +---ro last-rcv-seq?      uint32
    +---ro sender-ip          inet:ip-address
    +---ro sender-udp-port    inet:port-number
    +---ro reflector-ip       inet:ip-address
    +---ro reflector-udp-port inet:port-number
```

rpcs:

```
    +---x twamp-sender-start
    |   +---w input
    |   +---w session-id      uint32
    +---x twamp-sender-stop
    |   +---w input
    |   +---w session-id      uint32
```

3.2. YANG Module

<CODE BEGINS> file "ietf-twamp-light@2017-06-13.yang"

```
module ietf-twamp-light {
  namespace "urn:ietf:params:xml:ns:yang:ietf-twamp-light";
  //namespace need to be assigned by IANA
  prefix "ietf-twamp-light";

  import ietf-inet-types {
    prefix inet;
  }
  import ietf-yang-types {
    prefix yang;
  }
  import ietf-key-chain {
    prefix kc;
  }

  organization
    "IETF IPPM (IP Performance Metrics) Working Group";

  contact
    "draft-mirsky-ippm-twamp-light-yang@tools.ietf.org";

  description "TWAMP Light Data Model";

  revision "2017-06-13" {
    description
      "08 version. Appendix I RFC 5357 is covered.";
    reference "RFC 5357";
  }
}
```



```
feature session-sender-light {
  description
    "This feature relates to the device functions as the
    TWAMP Light Session-Sender";
}

feature session-reflector-light {
  description
    "This feature relates to the device functions as the
    TWAMP Light Session-Reflector";
}

feature twamp-light-authentication {
  description
    "TWAMP Light authentication supported";
}

typedef enable {
  type boolean;
  description "enable";
}

typedef session-reflector-mode {
  type enumeration {
    enum stateful {
      description
        "When the Session-Reflector is stateful,
        i.e. is aware of TWAMP-Test session state.";
    }
    enum stateless {
      description
        "When the Session-Reflector is stateless,
        i.e. is not aware of the state of
        TWAMP-Test session.";
    }
  }
  description "State of the Session-Reflector";
}

typedef session-dscp-mode {
  type enumeration {
    enum copy-received-value {
      description
        "Use DSCP value copied from received
        TWAMP test packet of the test session.";
    }
    enum use-configured-value {
      description
```



```
        "Use DSCP value configured for this
        test session on the Session-Reflector.";
    }
}
description
"DSCP handling mode by Session-Reflector.";
}

typedef percentage {
    type decimal64 {
        fraction-digits 5;
    }
    description "Percentage";
}

typedef percentile {
    type decimal64 {
        fraction-digits 2;
    }
    description
    "Percentile is a measure used in statistics
    indicating the value below which a given
    percentage of observations in a group of
    observations fall.";
}

grouping maintenance-statistics {
    description "Maintenance statistics grouping";
    leaf sent-packets {
        type uint32;
        description "Packets sent";
    }
    leaf rcv-packets {
        type uint32;
        description "Packets received";
    }
    leaf sent-packets-error {
        type uint32;
        description "Packets sent error";
    }
    leaf rcv-packets-error {
        type uint32;
        description "Packets received error";
    }
    leaf last-sent-seq {
        type uint32;
        description "Last sent sequence number";
    }
}
```



```
    leaf last-rcv-seq {
      type uint32;
      description "Last received sequence number";
    }
  }

grouping twamp-session-percentile {
  description "Percentile grouping";
  leaf first-percentile {
    type percentile;
    default 95.00;
    description
      "First percentile to report";
  }
  leaf second-percentile {
    type percentile;
    default 99.00;
    description
      "Second percentile to report";
  }
  leaf third-percentile {
    type percentile;
    default 99.90;
    description
      "Third percentile to report";
  }
}

grouping delay-statistics {
  description "Delay statistics grouping";
  container delay {
    description "Packets transmitted delay";
    leaf min {
      type yang:gauge32;
      units microseconds;
      description
        "Min of Packets transmitted delay";
    }
    leaf max {
      type yang:gauge32;
      units microseconds;
      description
        "Max of Packets transmitted delay";
    }
    leaf avg {
      type yang:gauge32;
      units microseconds;
      description

```



```
        "Avg of Packets transmitted delay";
    }
}

container delay-variation {
    description
    "Packets transmitted delay variation";
    leaf min {
        type uint32;
        units microseconds;
        description
        "Min of Packets transmitted
        delay variation";
    }
    leaf max {
        type uint32;
        units microseconds;
        description
        "Max of Packets transmitted
        delay variation";
    }
    leaf avg {
        type uint32;
        units microseconds;
        description
        "Avg of Packets transmitted
        delay variation";
    }
}

}

grouping time-percentile-report {
    description "Delay percentile report grouping";
    container delay-percentile {
        description
        "Report round-trip, near- and far-end delay";
        leaf rtt-delay {
            type percentile;
            description
            "Percentile of round-trip delay";
        }
        leaf near-end-delay {
            type percentile;
            description
            "Percentile of near-end delay";
        }
        leaf far-end-delay {
            type percentile;
            description
```



```
        "Percentile of far-end delay";
    }
}
container jitter-percentile {
    description
    "Report round-trip, near- and far-end jitter";
    leaf rtt-jitter {
        type percentile;
        description
        "Percentile of round-trip jitter";
    }
    leaf near-end-jitter {
        type percentile;
        description
        "Percentile of near-end jitter";
    }
    leaf far-end-jitter {
        type percentile;
        description
        "Percentile of far-end jitter";
    }
}
}

grouping packet-loss-statistics {
    description
    "Grouping for Packet Loss statistics";
    leaf loss-count {
        type int32;
        description
        "Number of lost packets
        during the test interval.";
    }
    leaf loss-ratio {
        type percentage;
        description
        "Ratio of packets lost to packets
        sent during the test interval.";
    }
    leaf loss-burst-max {
        type int32;
        description
        "Maximum number of consecutively
        lost packets during the test interval.";
    }
    leaf loss-burst-min {
        type int32;
        description
```



```
        "Minimum number of consecutively
        lost packets during the test interval.";
    }

    leaf loss-burst-count {
        type int32;
        description
        "Number of occasions with packet
        loss during the test interval.";
    }
}

grouping session-light-parameters {
    description
    "Parameters common among
    Session-Sender and Session-Reflector";
    leaf sender-ip {
        type inet:ip-address;
        mandatory true;
        description "Sender IP address";
    }
    leaf sender-udp-port {
        type inet:port-number {
            range "49152..65535";
        }
        mandatory true;
        description "Sender UDP port number";
    }
    leaf reflector-ip {
        type inet:ip-address;
        mandatory true;
        description "Reflector IP address";
    }
    leaf reflector-udp-port {
        type inet:port-number {
            range "49152..65535";
        }
        mandatory true;
        description "Reflector UDP port number";
    }
}

grouping session-light-auth-params {
    description
    "Grouping for TWAMP Light authentication parameters";
    container authentication-params {
        if-feature twamp-light-authentication;
        presence "Enables TWAMP Light authentication";
        description
```



```
    "Parameters for TWAMP Light authentication";
    leaf key-chain {
        type kc:key-chain-ref;
        description "Name of key-chain";
    }
}

/*Configuration Data*/
container twamp-light {
    description
        "Top level container for TWAMP-Light configuration";

    container twamp-light-session-sender {
        if-feature session-sender-light;
        description "TWAMP-Light Session-Sender container";

        leaf sender-light-enable {
            type enable;
            default "true";
            description
                "Whether this network element is enabled to
                act as TWAMP-Light Sender";
        }

        list test-session {
            key "session-id";
            unique "sender-ip sender-udp-port reflector-ip"
                +" reflector-udp-port dscp-value";
            description
                "This structure is a container of test session
                managed objects";

            leaf session-id {
                type uint32;
                description "Session ID";
            }

            leaf test-session-enable {
                type enable;
                default "true";
                description
                    "Whether this TWAMP Test session is enabled";
            }

            leaf number-of-packets {
                type union {
                    type uint32 {
```



```
        range 1..4294967294 {
            description
            "The overall number of UDP test packet
            to be transmitted by the sender for this
            test session";
        }
    }
    type enumeration {
        enum forever {
            description
            "Indicates that the test session SHALL
            be run *forever*.";
        }
    }
}
default 10;
description
"This value determines if the TWAMP-Test session is
bound by number of test packets or not.";
}

leaf packet-padding-size {
    type uint32;
    default 27;
    description
    "Size of the Packet Padding. Suggested to run
    Path MTU Discovery to avoid packet fragmentation in
    IPv4 and packet blackholing in IPv6";
}

leaf interval {
    type uint32;
    units microseconds;
    description
    "Time interval between transmission of two
    consecutive packets in the test session in
    microseconds";
}

leaf session-timeout {
    when "../number-of-packets != 'forever'" {
        description
        "Test session timeout only valid if the
        test mode is periodic.";
    }
    type uint32;
    units "seconds";
    default 900;
}
```



```
    description
    "The timeout value for the Session-Sender to
    collect outstanding reflected packets.";
}

leaf measurement-interval {
    when "../number-of-packets = 'forever'" {
        description
        "Valid only when the test to run forever,
        i.e. continuously.";
    }
    type uint32;
    units "seconds";
    default 60;
    description
    "Interval to calculate performance metric when
    the test mode is 'continuous'.";
}

leaf repeat {
    type union {
        type uint32 {
            range 0..4294967294;
        }
        type enumeration {
            enum forever {
                description
                "Indicates that the test session SHALL
                be repeated *forever* using the
                information in repeat-interval
                parameter, and SHALL NOT decrement
                the value.";
            }
        }
    }
    default 0;
    description
    "This value determines if the TWAMP-Test session must
    be repeated. When a test session has completed, the
    repeat parameter is checked. The default value
    of 0 indicates that the session MUST NOT be repeated.
    If the repeat value is 1 through 4,294,967,294
    then the test session SHALL be repeated using the
    information in repeat-interval parameter.
    The implementation MUST decrement the value of repeat
    after determining a repeated session is expected.";
}
```



```
    leaf repeat-interval {
      when "../repeat != '0'";
      type uint32;
      units seconds;
      default 0;
      description
        "This parameter determines the timing of repeated
        TWAMP-Test sessions when repeat is more than 0.";
    }

    leaf dscp-value {
      type inet:dscp;
      default 0;
      description
        "DSCP value to be set in the test packet.";
    }

    leaf test-session-reflector-mode {
      type session-reflector-mode;
      default "stateless";
      description
        "The mode of TWAMP-Reflector for the test session.";
    }

    uses session-light-parameters;
    uses session-light-auth-params;
    uses twamp-session-percentile;
  }
}

container twamp-light-session-reflector {
  if-feature session-reflector-light;
  description
    "TWAMP-Light Session-Reflector container";
  leaf reflector-light-enable {
    type enable;
    default "true";
    description
      "Whether this network element is enabled to
      act as TWAMP-Light Reflector";
  }

  leaf ref-wait {
    type uint32 {
      range 1..604800;
    }
    units seconds;
    default 900;
  }
}
```



```
    description
    "REFWAIT(TWAMP test session timeout in seconds),
    the default value is 900";
}

leaf reflector-light-mode-state {
    type session-reflector-mode;
    default stateless;
    description
    "The state of the mode of the TWAMP-Light
    Session-Reflector";
}

list test-session {
    key "session-id";
    unique "sender-ip sender-udp-port reflector-ip"
    +" reflector-udp-port";
    description
    "This structure is a container of test session
    managed objects";

    leaf session-id {
        type uint32;
        description "Session ID";
    }

    leaf dscp-handling-mode {
        type session-dscp-mode;
        default copy-received-value;
        description
        "Session-Reflector handling of DSCP:
        - use value copied from received TWAMP-Test packet;
        - use value explicitly configured";
    }

    leaf dscp-value {
        when "../dscp-handling-mode = 'use-configured-value'";
        type inet:dscp;
        default 0;
        description
        "DSCP value to be set in the reflected packet
        if dscp-handling-mode is set to use-configured-value.";
    }

    uses session-light-parameters;
    uses session-light-auth-params;
}
}
```



```
    }

/*Operational state data nodes*/
container twamp-light-state{
    config "false";
    description
    "Top level container for TWAMP-Light state data";

    container twamp-light-session-sender-state {
        if-feature session-sender-light;
        description
        "Session-Sender container for state data";
        list test-session-state{
            key "session-id";
            description
            "This structure is a container of test session
            managed objects";

            leaf session-id {
                type uint32;
                description "Session ID";
            }

            leaf sender-session-state {
                type enumeration {
                    enum active {
                        description "Test session is active";
                    }
                    enum ready {
                        description "Test session is idle";
                    }
                }
                description
                "State of the particular TWAMP-Light test
                session at the sender";
            }
        }

        container current-stats {
            description
            "This container contains the results for the current
            Measurement Interval in a Measurement session ";
            leaf start-time {
                type yang:date-and-time;
                mandatory true;
                description
                "The time that the current Measurement Interval started";
            }
        }
    }
}
```



```
leaf packet-padding-size {
    type uint32;
    default 27;
    description
        "Size of the Packet Padding. Suggested to run
        Path MTU Discovery to avoid packet fragmentation
        in IPv4 and packet backholing in IPv6";
}

leaf interval {
    type uint32;
    units microseconds;
    description
        "Time interval between transmission of two
        consecutive packets in the test session";
}

leaf duplicate-packets {
    type uint32;
    description "Duplicate packets";
}

leaf reordered-packets {
    type uint32;
    description "Reordered packets";
}

uses session-light-parameters;
leaf dscp {
    type inet:dscp;
    description
        "The DSCP value that was placed in the header of
        TWAMP UDP test packets by the Session-Sender.";
}

uses maintenance-statistics;

container two-way-delay {
    description
        "two way delay result of the test session";
    uses delay-statistics;
}

container one-way-delay-far-end {
    description
        "one way delay far-end of the test session";
    uses delay-statistics;
}

container one-way-delay-near-end {
```



```
    description
    "one way delay near-end of the test session";
    uses delay-statistics;
}

container low-percentile {
    when "/twamp-light/twamp-light-session-sender/"
    +"test-session[session-id]/"
    +"first-percentile != '0.00'" {
        description
        "Only valid if the
        the first-percentile is not NULL";
    }
    description
    "Low percentile report";
    uses time-percentile-report;
}

container mid-percentile {
    when "/twamp-light/twamp-light-session-sender/"
    +"test-session[session-id]/"
    +"second-percentile != '0.00'" {
        description
        "Only valid if the
        the first-percentile is not NULL";
    }
    description
    "Mid percentile report";
    uses time-percentile-report;
}

container high-percentile {
    when "/twamp-light/twamp-light-session-sender/"
    +"test-session[session-id]/"
    +"third-percentile != '0.00'" {
        description
        "Only valid if the
        the first-percentile is not NULL";
    }
    description
    "High percentile report";
    uses time-percentile-report;
}

container two-way-loss {
    description
    "two way loss count and ratio result of
    the test session";
```



```
    uses packet-loss-statistics;
  }
  container one-way-loss-far-end {
    when "/twamp-light/twamp-light-session-sender/"
    +"test-session[session-id]/"
    +"test-session-reflector-mode = 'stateful'" {
      description
        "One-way statistic is only valid if the
        session-reflector is in stateful mode.";
    }
    description
      "one way loss count and ratio far-end of
      the test session";
    uses packet-loss-statistics;
  }
  container one-way-loss-near-end {
    when "/twamp-light/twamp-light-session-sender/"
    +"test-session[session-id]/"
    +"test-session-reflector-mode = 'stateful'" {
      description
        "One-way statistic is only valid if the
        session-reflector is in stateful mode.";
    }
    description
      "one way loss count and ratio near-end of
      the test session";
    uses packet-loss-statistics;
  }
}

list history-stats {
  key id;
  description
    "This container contains the results for the history
    Measurement Interval in a Measurement session ";
  leaf id {
    type uint32;
    description
      "The identifier for the Measurement Interval
      within this session";
  }
  leaf end-time {
    type yang:date-and-time;
    mandatory true;
    description
      "The time that the Measurement Interval ended";
  }
  leaf number-of-packets {
```



```
    type uint32;
    description
    "The overall number of UDP test packets to be
    transmitted by the sender for this test session";
}

leaf packet-padding-size {
    type uint32;
    default 27;
    description
    "Size of the Packet Padding. Suggested to run
    Path MTU Discovery to avoid packet fragmentation
    in IPv4 and packet blackholing in IPv6";
}

leaf interval {
    type uint32;
    units microseconds;
    description
    "Time interval between transmission of two
    consecutive packets in the test session";
}

leaf duplicate-packets {
    type uint32;
    description "Duplicate packets";
}

leaf reordered-packets {
    type uint32;
    description "Reordered packets";
}

leaf loss-packets {
    type uint32;
    description "Loss packets";
}

uses session-light-parameters;
leaf dscp {
    type inet:dscp;
    description
    "The DSCP value that was placed in the header of
    TWAMP UDP test packets by the Session-Sender.";
}

uses maintenance-statistics;

container two-way-delay{
    description
    "two way delay result of the test session";
    uses delay-statistics;
```



```
    }
    container one-way-delay-far-end{
      description
        "one way delay far end of the test session";
      uses delay-statistics;
    }
    container one-way-delay-near-end{
      description
        "one way delay near end of the test session";
      uses delay-statistics;
    }
  }
}

container twamp-light-session-refl-state {
  if-feature session-reflector-light;
  description
    "TWAMP-Light Session-Reflector container for
    state data";
  leaf reflector-light-admin-status {
    type boolean;
    mandatory "true";
    description
      "Whether this network element is enabled to
      act as TWAMP-Light Reflector";
  }

  list test-session-state {
    key "session-id";
    description
      "This structure is a container of test session
      managed objects";

    leaf session-id {
      type uint32;
      description "Session ID";
    }

    uses maintenance-statistics;
    uses session-light-parameters;
  }
}

rpc twamp-sender-start {
  description
    "start the configured sender session";
```



```
input {  
  leaf session-id {  
    type uint32;  
    mandatory true;  
    description  
      "The session to be started";  
  }  
}  
}  
  
rpc twamp-sender-stop {  
  description  
    "stop the configured sender session";  
  input {  
    leaf session-id {  
      type uint32;  
      mandatory true;  
      description  
        "The session to be stopped";  
    }  
  }  
}  
}
```

<CODE ENDS>

4. IANA Considerations

This document registers a URI in the IETF XML registry [[RFC3688](#)]. Following the format in [[RFC3688](#)], the following registration is requested to be made.

URI: urn:ietf:params:xml:ns:yang:ietf-twamp-light

Registrant Contact: The IPPM WG of the IETF.

XML: N/A, the requested URI is an XML namespace.

This document registers a YANG module in the YANG Module Names registry [[RFC6020](#)].

name: ietf-twamp-light

namespace: urn:ietf:params:xml:ns:yang:ietf-twamp-light

prefix: twamp

reference: RFC XXXX

5. Security Considerations

The configuration, state, action data defined in this document may be accessed via the NETCONF protocol [RFC6241]. SSH [RFC6242] is mandatory secure transport that is the lowest NETCONF layer. The NETCONF access control model [RFC6536] provides means to restrict access for particular NETCONF users to a pre-configured subset of all available NETCONF protocol operations and content.

But, in general, this TWAMP Light YANG module does not change any underlying security issues that already may exist in [I-D.elteto-ippm-twamp-mib].

6. References

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[6.2. Informative References](#)

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[Appendix A. Acknowledgements](#)

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