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**YANG Data Model for IEEE 1588v2  
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## Abstract

This document defines a YANG data model for the configuration of IEEE 1588v2 devices and clocks, and also retrieval of the configuration information, data set and running states of IEEE 1588v2 clocks.

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## [1.](#) Introduction

As a synchronization protocol, IEEE 1588v2 [[IEEE1588](#)] is widely supported in the carrier networks. It can provide high precision time synchronization as high as nano-seconds. The protocol depends on a Precision Time Protocol (PTP) engine to automatically decide its state, and a PTP transportation layer to carry the PTP timing and various quality messages. The configuration parameters and state data sets of IEEE 1588v2 are numerous.

Some work on IEEE 1588v2 MIB [[PTP-MIB](#)] is in progress in the IETF TICTOC WG. But the work is only scoped with retrieval of the state data of IEEE 1588v2 by Simple Network Management Protocol (SNMP) and configuration is not considered, thus its use is limited.

Some service providers require the management of the IEEE 1588v2 synchronization network can be more flexible and more Internet-based (typically overlaid on their transport networks). Software Defined Network (SDN) is another driving factor which demands a greater control over synchronization networks.



YANG [[RFC6020](#)] is a data modeling language used to model configuration and state data manipulated by the Network Configuration Protocol (NETCONF) [[RFC6241](#)]. A small set of built-in data types are defined in [[RFC6020](#)], and a collection of common data types are further defined in [[RFC6991](#)]. Advantages of YANG include Internet based configuration capability, validation, roll-back and etc., all these characteristics make it attractive to become a modeling language for IEEE 1588v2.

This document defines a YANG [[RFC6020](#)] data model for the configuration of IEEE 1588v2 devices and clocks, and also retrieval of the state data of IEEE 1588v2 clocks.

In order to fulfill the need of a lightweight implementation, the core module is designed to be generic and minimal, but be extensible with capability negotiation. That is, if a node is verified with a capability of more functions, then more modules can be loaded on demand, otherwise, only a basic module is loaded on the node.

This document defines PTP system information, PTP data sets and running states following the structure and definitions in IEEE 1588v2, and compatible with [[PTP-MIB](#)]. The router specific 1588v2 information is out of scope of this document.

## **2. Conventions used in this document**

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

## **3. Terminology**

Terminologies used in this document are extracted from [[IEEE1588](#)] and [[PTP-MIB](#)].

BC	Boundary Clock
DS	Data Set
E2E	End-to-End
EUI	Extended Unique Identifier.
GPS	Global Positioning System
IANA	Internet Assigned Numbers Authority



IP	Internet Protocol
NIST	National Institute of Standards and Technology
NTP	Network Time Protocol
OC	Ordinary Clock
P2P	Peer-to-Peer
PTP	Precision Time Protocol
TAI	International Atomic Time
TC	Transparent Clock
UTC	Coordinated Universal Time

#### 4. IEEE 1588V2 YANG Model hierarchy

This section describes the hierarchy of IEEE 1588v2 YANG module. Query and retrieval of device wide or port specific configuration information and clock data set is described for this version.

Query and retrieval of clock information include:

- Clock data set attributes in a clock node, including: current-ds, parent-ds, default-ds, time-properties-ds, and transparentClock-default-ds.
- Port specific data set attributes, including: port-ds and transparentClock-port-ds.

```
module: ietf-ptp-dataset
  +--rw ptp-datasets* [domain-number]
    +--rw domain-number                               uint8
    +--rw default-ds
      | +--rw two-step-flag?      boolean
      | +--rw clock-identity?     binary
      | +--rw number-ports?      uint16
      | +--rw clock-quality
      | | +--rw clock-class?      uint8
      | | +--rw clock-accuracy?  uint8
```

```
| | +--rw offset-scaled-log-variance?  uint16
| +--rw priority1?                    uint8
| +--rw priority2?                    uint8
| +--rw slave-only?                   boolean
+--rw current-ds
| +--rw steps-removed?                uint16
| +--rw offset-from-master?          binary
| +--rw mean-path-delay?             binary
+--rw parent-ds
| +--rw parent-port-identity
| | +--rw clock-identity?            binary
| | +--rw port-number?              uint16
| +--rw parent-stats?                boolean
| +--rw observed-parent-offset-scaled-log-variance?  uint16
| +--rw observed-parent-clock-phase-change-rate?    int32
| +--rw grandmaster-identity?          binary
| +--rw grandmaster-clock-quality
| | +--rw grandmaster-clock-class?      uint8
| | +--rw grandmaster-clock-accuracy?   uint8
| | +--rw grandmaster-offset-scaled-log-variance?  uint16
| +--rw grandmaster-priority1?         uint8
| +--rw grandmaster-priority2?         uint8
+--rw time-properties-ds
| +--rw current-utc-offset-valid?      boolean
| +--rw current-utc-offset?            uint16
| +--rw leap59?                        boolean
| +--rw leap61?                        boolean
| +--rw time-traceable?                boolean
| +--rw frequency-traceable?           boolean
| +--rw ptp-timescale?                 boolean
| +--rw time-source?                   uint8
+--rw port-ds-list* [port-number]
| +--rw port-number                    -> ../port-identity/port-number
| +--rw port-identity
| | +--rw clock-identity?              binary
| | +--rw port-number?                uint16
| +--rw port-state?                    uint8
| +--rw log-min-delay-req-interval?    int8
| +--rw peer-mean-path-delay?          int64
| +--rw log-announce-interval?         int8
| +--rw announce-receipt-timeout?      uint8
| +--rw log-sync-interval?             int8
| +--rw delay-mechanism?               enumeration
| +--rw log-min-pdelay-req-interval?   int8
| +--rw version-number?                uint8
+--rw transparent-clock-default-ds
| +--rw clock-identity?                binary
```





```
| +--rw number-ports?      uint16
| +--rw delay-mechanism?   enumeration
| +--rw primary-domain?    uint8
+--rw transparent-clock-port-ds-list* [port-number]
  +--rw port-number        -> ../port-identity/port-number
  +--rw port-identity
    | +--rw clock-identity?  binary
    | +--rw port-number?    uint16
  +--rw log-min-pdelay-req-interval?  int8
  +--rw faulty-flag?        boolean
  +--rw peer-mean-path-delay?  int64
```

## 5. IEEE 1588v2 YANG Module

```
<CODE BEGINS> file "ietf-ptp-dataset@2015-11-10.yang"

module ietf-ptp-dataset{
  namespace "urn:ietf:params:xml:ns:yang:ietf-ptp-dataset";
  prefix "ptp-dataset";
  organization "IETF TICTOC WG";
  contact "jiangyuanlong@huawei.com";
  description
    "This YANG module defines a data model for the configuration
    of IEEE 1588v2 clocks, and also retrieval of the state data
    of IEEE 1588v2 clocks.";
  revision "2015-11-10" {
    description "Latest revision.";
    reference "draft-jxl-tictoc-1588v2-yang";
  }

  grouping default-ds-entry {
    description
      "Collection of members of the default data set.";

    leaf two-step-flag {
      type boolean;
      description
        "The flag indicates whether the Two Step process is
        used.";
    }
    leaf clock-identity {
      type binary {
        length "8";
      }
      description
        "The clockIdentity of the local clock";
    }
  }

  leaf number-ports {
    type uint16;
    description
      "The number of PTP ports on the device.";
  }

  container clock-quality {
    description
      "The clockQuality of the local clock. It contains
      clockClass, clockAccuracy and offsetScaledLogVariance.";
  }
}
```



```
    leaf clock-class {
        type uint8;
        default 248;
        description
            "The clockClass denotes the traceability of the time
            or frequency distributed by the grandmaster clock.";
    }
    leaf clock-accuracy {
        type uint8;
        description
            "The clockAccuracy indicates the expected accuracy
            of a clock when it is the grandmaster.";
    }
    leaf offset-scaled-log-variance {
        type uint16;
        description
            "An estimate of the variations of the local clock
            from a linear timescale when it is not synchronized
            to another clock using the protocol.";
    }
}

leaf priority1 {
    type uint8;
    description
        " The priority1 attribute of the local clock.";
}
leaf priority2{
    type uint8;
    description
        "The priority2 attribute of the local clock. ";
}

leaf slave-only {
    type boolean;
    description
        "Indicates whether the clock is a slave-only clock.";
}
}

grouping current-ds-entry {
    description
        "Collection of members of current data set.";

    leaf steps-removed {
```



```
    type uint16;
    default 0;
    description
        "The number of communication paths traversed
        between the local clock and the grandmaster clock.";
}
leaf offset-from-master {
    type binary {
        length "1..255";
    }
    description
        "An implementation-specific representation of the
        current value of the time difference between a master
        and a slave clock as computed by the slave.";
}
leaf mean-path-delay {
    type binary {
        length "1..255";
    }
    description
        "An implementation-specific representation of the
        current value of the mean propagation time between a
        master and slave clock as computed by the slave.";
}
}

grouping parent-ds-entry {
    description
        "Collection of members of the parent data set.";

    container parent-port-identity {
        description
            "The portIdentity of the port on the master.
            It contains two members: clockIdentity and portNumer.";

        leaf clock-identity {
            type binary {
                length "8";
            }
            description
                "The clockIdentity of the master clock.";
        }

        leaf port-number {
            type uint16;
```





```
        description
            "The portNumber for the port on the specific
            master.";
    }
}
leaf parent-stats {
    type boolean;
    default false;
    description
        "Indicates whether the values of
        observedParentOffsetScaledLogVariance and
        observedParentClockPhaseChangeRate of parentDS
        have been measured and are valid.";
}
leaf observed-parent-offset-scaled-log-variance {
    type uint16;
    default 0xFFFF;
    description
        "An estimate of the parent clock's PTP variance
        as observed by the slave clock.";
}
leaf observed-parent-clock-phase-change-rate {
    type int32;
    description
        "An estimate of the parent clock's phase change rate
        as observed by the slave clock.";
}
leaf grandmaster-identity {
    type binary{
        length "8";
    }
    description
        "The clockIdentity attribute of the grandmaster clock.";
}
container grandmaster-clock-quality {
    description
        "The clockQuality of the grandmaster clock. It contains
        clockClass, clockAccuracy and offsetScaledLogVariance.";

    leaf grandmaster-clock-class {
        type uint8;
        default 248;
        description
            "The clockClass attribute of the grandmaster clock.";
    }
}
```



```
    leaf grandmaster-clock-accuracy {
      type uint8;
      description
        "The clockAccuracy attribute of the grandmaster
        clock.";
    }
    leaf grandmaster-offset-scaled-log-variance {
      type uint16;
      description
        "The offsetScaledLogVariance of the grandmaster
        clock.";
    }
  }
  leaf grandmaster-priority1 {
    type uint8;
    description
      "The priority1 attribute of the grandmaster clock.";
  }
  leaf grandmaster-priority2 {
    type uint8;
    description
      "The priority2 attribute of the grandmaster clock.";
  }
}

grouping time-properties-ds-entry {
  description
    "Collection of members of the timeProperties data set.";

  leaf current-utc-offset-valid {
    type boolean;
    description
      "Indicates whether current UTC offset is valid.";
  }
  leaf current-utc-offset {
    type uint16;
    description
      "The offset between TAI and UTC when the epoch of the
      PTP system is the PTP epoch, otherwise the value has
      no meaning.";
  }
  leaf leap59 {
    type boolean;
    description
```



```
        "Indicates whether the last minute of the current UTC
        day contains 59 seconds.";
    }
    leaf leap61 {
        type boolean;
        description
            "Indicates whether the last minute of the current UTC
            day contains 61 seconds.";
    }
    leaf time-traceable {
        type boolean;
        description
            "Indicates whether the timescale and the
            currentUtcOffset are traceable to a primary
            reference.";
    }
    leaf frequency-traceable {
        type boolean;
        description
            "Indicates whether the frequency determining the
            timescale is traceable to a primary reference.";
    }
    leaf PTP-timescale {
        type boolean;
        description
            "Indicates whether the clock timescale
            of the grandmaster clock is PTP.";
    }
    leaf time-source {
        type uint8;
        description
            "The source of time used by the grandmaster clock.";
    }
}

grouping port-ds-entry {
    description
        "Collection of members of the port data set.";

    container port-identity {
        description
            "The PortIdentity attribute of the local port.
            It contains two members: clockIdentity and
            portNumber.";

        leaf clock-identity {
```



```
    type binary {
      length "8";
    }
    description
      "The clockIdentity of the local clock.";
  }

  leaf port-number {
    type uint16;
    description
      "The portNumber for a port on the local clock.";
  }
}

leaf port-state {
  type uint8;
  default 1;
  description
    "Current state associated with the port.";
}

leaf log-min-delay-req-interval {
  type int8;
  description
    "The logarithm to the base 2 of the minDelayReqInterval
    (the minimum permitted mean time interval between
    successive Delay_Req messages).";
}

leaf peer-mean-path-delay {
  type int64;
  default 0;
  description
    "An estimate of the current one-way propagation delay
    on the link when the delayMechanism is P2P, otherwise
    it is zero.";
}

leaf log-announce-interval {
  type int8;
  description
    "The logarithm to the base 2 of the of the mean
    announceInterval (mean time interval between
    successive Announce messages).";
}
```





```
leaf announce-receipt-timeout {
  type uint8;
  description
    "The number of announceInterval that have to pass
    without receipt of an announce message before the
    occurrence of the event ANNOUNCE_RECEIPT_TIMEOUT_
    EXPIRES.";
}

leaf log-sync-interval {
  type int8;
  description
    "The logarithm to the base 2 of the mean SyncInterval
    for multicast messages. The rates for unicast
    transmissions are negotiated separately on a per port
    basis.";
}

leaf delay-mechanism {
  type enumeration {
    enum E2E {
      value 01;
      description
        "The port uses the delay request-response
        mechanism.";
    }
    enum P2P {
      value 02;
      description
        "The port uses the peer delay mechanism.";
    }
    enum DISABLED {
      value 254;
      description
        "The port does not implement the delay
        mechanism.";
    }
  }
  description
    "The propagation delay measuring option used by the
    port in computing meanPathDelay.";
}

leaf log-min-Pdelay-req-interval {
  type int8;
  description
    "The logarithm to the base 2 of the
```



```
        minPdelayReqInterval (minimum permitted mean time
        interval between successive Pdelay_Req messages).";
    }

    leaf version-number {
        type uint8;
        description
            "The PTP version in use on the port.";
    }
}

grouping transparent-clock-default-ds-entry {
    description
        "Collection of members of the transparentClockDefault data
        set (default data set for a transparent clock).";

    leaf clock-identity {
        type binary {
            length "8";
        }
        description
            "The clockIdentity of the transparent clock.";
    }
    leaf number-ports {
        type uint16;
        description
            "The number of PTP ports on the device.";
    }
    leaf delay-mechanism {
        type enumeration {
            enum E2E {
                value 1;
                description
                    "The port uses the delay request-response
                    mechanism.";
            }
            enum P2P {
                value 2;
                description
                    "The port uses the peer delay mechanism.";
            }
            enum DISABLED {
                value 254;
                description
                    "The port does not implement the delay
                    mechanism.";
            }
        }
    }
}
```



```
    }
  }
  description
    "The propagation delay measuring option
    used by the transparent clock.";
}
leaf primary-domain {
  type uint8;
  default 0;
  description
    "The domainNumber of the primary syntonization domain.";
}
}

grouping transparent-clock-port-ds-entry {
  description
    "Collection of members of the transparentClockPort data
    set (port data set for a transparent clock).";

  container port-identity {
    description
      "This object specifies the portIdentity of the local
      port.";

    leaf clock-identity {
      type binary {
        length "8";
      }
      description
        "The clockIdentity of the transparent clock.";
    }

    leaf port-number {
      type uint16;
      description
        "The portNumber for a port on the transparent
        clock.";
    }
  }
}

leaf log-min-pdelay-req-interval {
  type int8;
  description
    "The logarithm to the base 2 of the
    minPdelayReqInterval (minimum permitted mean time
    interval between successive Pdelay_Req messages).";
}
```



```
leaf faulty-flag {
    type boolean;
    default false;
    description
        "Indicates whether the port is faulty.";
}
leaf peer-mean-path-delay {
    type int64;
    default 0;
    description
        "An estimate of the current one-way propagation delay
        on the link when the delayMechanism is P2P, otherwise
        it is zero.";
}
}

list ptp-datasets {

    key "domain-number";
    min-elements "1";

    description
        "List of one or more PTP datasets in the device,
        one for each domain-number (see IEEE 1588-2008 subclause
        6.3)";

    leaf domain-number {
        type uint8;
        description
            "The domainNumber of the current syntonization domain.";
    }

    container default-ds {
        description
            "The default data set of the clock.";
        uses default-ds-entry;
    }

    container current-ds {
        description
            "The current data set of the clock.";
        uses current-ds-entry;
    }

    container parent-ds {
        description
            "The parent data set of the clock.";
```





```
    uses parent-ds-entry;
}

container time-properties-ds {
    description
        "The timeProperties data set of the clock.";
    uses time-properties-ds-entry;
}

list port-ds-list {
    key "port-number";
    description
        "List of port data sets of the clock.";
    leaf port-number{
        type leafref{
            path "../port-identity/port-number";
        }
        description
            "Refers to the portNumber member of
            portDS.portIdentity.";
    }
    uses port-ds-entry;
}

container transparent-clock-default-ds {
    description
        "The members of the transparentClockDefault Data Set";
    uses transparent-clock-default-ds-entry;
}

list transparent-clock-port-ds-list {
    key "port-number";
    description
        "List of transparentClockPort data sets
        of the transparent clock.";
    leaf port-number{
        type leafref{
            path "../port-identity/port-number";
        }
        description
            "Refers to the portNumber member
            of transparentClockPortDS.portIdentity.";
    }
    uses transparent-clock-port-ds-entry;
}
}
```



<CODE ENDS>

## 6. Security Considerations

YANG modules are designed to be accessed via the NETCONF protocol [[RFC6241](#)], thus security considerations in [[RFC6241](#)] apply here. Security measures such as using the NETCONF over SSH [[RFC6242](#)] and restricting its use with access control [[RFC6536](#)] can further improve its security, avoid injection attacks and misuse of the protocol.

Some data nodes defined in this YANG module are writable, and any changes to them may adversely impact a synchronization network.

## 7. IANA Considerations

This document registers a URI in the IETF XML registry, and the following registration is requested to be made:

URI: urn:ietf:params:xml:ns:yang:ietf-ptp-dataset

This document registers a YANG module in the YANG Module Names:

name: ietf-ptp-dataset

namespace: urn:ietf:params:xml:ns:yang:ietf-ptp-dataset

## 8. References

### 8.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997
- [RFC6020] Bjorklund, M., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF) ", [RFC 6020](#), October 2010
- [RFC6991] Schoenwaelder, J., "Common YANG Data Types", [RFC 6991](#), July 2013
- [IEEE1588] IEEE, "IEEE Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems", IEEE Std 1588-2008, July 2008

## **8.2. Informative References**

- [RFC6241] Enns, R., Bjorklund, M., Schoenwaelder, J., and A. Bierman, "Network Configuration Protocol (NETCONF)", [RFC 6241](#), June 2011
- [RFC6242] Wasserman, M., "Using the NETCONF Protocol over Secure Shell (SSH)", [RFC 6242](#), June 2011
- [RFC6536] Bierman, A. and M. Bjorklund, "Network Configuration Protocol (NETCONF) Access Control Model", [RFC 6536](#), March 2012
- [PTP-MIB] Shankarkumar, V., Montini, L., Frost, T., and Dowd, G., "Precision Time Protocol Version 2 (PTPv2) Management Information Base", [draft-ietf-tictoc-ntp-mib-07](#), Work in progress

## **9. Acknowledgments**

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