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H. Gerstung
Meinberg
C. Elliott

B. Haberman, Ed.
JHU APL

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Definitions of Managed Objects for Network Time Protocol Version 4 (NTPv4)

Abstract

The Network Time Protocol (NTP) is used in networks of all types and sizes for time synchronization of servers, workstations, and other networked equipment. As time synchronization is more and more a mission-critical service, standardized means for monitoring and management of this subsystem of a networked host are required to allow operators of such a service to set up a monitoring system that is platform- and vendor-independent. This document provides a standardized collection of data objects for monitoring the NTP entity of such a network participant and it is part of the NTP version 4 standardization effort.

5Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc5907.

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1. Introduction

The NTPv4 MIB module is designed to allow Simple Network Management Protocol (SNMP) to be used to monitor and manage local NTP [RFC5905] entities. It provides a collection of data objects that can be queried using the SNMP protocol and represent the current status of the NTP entity. This includes general information about the NTP entity itself (vendor, product, version) as well as connectivity to upstream NTP servers used as sources of reference time and to hardware reference clocks like radio clocks. The most important values are included in order to be able to detect failures before they can have an impact on the overall time synchronization status of the network. There are also a collection of notification objects to inform about state changes in the NTP entity. There are objects to control these notifications as well.

2. Conventions Used in This Document

The capitalized 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. The Internet-Standard Management Framework

For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 [RFC3410].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies a MIB module that is compliant to the SMIv2, which is described in STD 58, RFC 2578 [RFC2578], STD 58, RFC 2579 [RFC2579] and STD 58, RFC 2580 [RFC2580].

4. Technical Description

The NTPv4 MIB module is divided into sections for general server information, current NTP entity status, status information of all mobilized associations (e.g., unicast upstream time servers, multicast or broadcast, time references, and hardware clocks), NTP entity control objects, NTP objects used only for notifications, as well as SNMP notification definitions for core events.

The general server information section contains static information and can be queried to identify which NTP implementation is running on a host. This includes the vendor and product name of the running NTP software as well as version information, hardware/os platform identity, and the time resolution of the underlying OS.

Section 2 (current NTP status) includes data objects that represent the current operational status of the NTP entity.

The third section contains data objects that represent the set of time references ("associations") with which the NTP entity is currently working.

The fourth section contains objects that can be used to control the NTP entity. The currently defined objects control how often the heartbeat interval notification is sent out and which notifications are enabled.

The fifth section contains objects that are only used as varbinds in notifications. There is currently only one object in this section -- a message that adds a cleartext event message to notifications.

Certain important events can occur while the NTP entity is running. The notification section defines SNMP notifications for a collection of the most important ones ("core events") and additionally provides a heartbeat notification as well as a test notification to allow management systems to test the reception of NTP-related notifications as well as enable heartbeat-based monitoring systems to assure that the NTP entity is still up and running.

Some values are included both in numeric and in human-readable (string) format. This has been done to simplify the representation of a status information. If the two representations of a certain value differ, the numeric representation takes precedence.

5. MIB Definition

```
-- ****************************************************************
--
--    The Network Time Protocol Version 4
--    Management Information Base (MIB)
--
--    Authors: Heiko Gerstung (heiko.gerstung@meinberg.de)
--             Chris Elliott (chelliot@pobox.com)
--
--    for the Internet Engineering Task Force (IETF)
--    NTP Working Group (ntpwg)
--
--
-- ****************************************************************
--   Rev 1.00
--         Published as RFC 5907
--
-- ****************************************************************

NTPv4-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE , mib-2, Integer32, NOTIFICATION-TYPE,
    Unsigned32, Counter32, TimeTicks
        FROM SNMPv2-SMI -- RFC 2578
    MODULE-COMPLIANCE, OBJECT-GROUP, NOTIFICATION-GROUP
        FROM SNMPv2-CONF -- RFC 2580
    DisplayString, TEXTUAL-CONVENTION
        FROM SNMPv2-TC -- RFC 2579
```

```
    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB -- RFC 4001
    Utf8String
        FROM SYSAPPL-MIB; -- RFC 2287

ntpSnmpMIB MODULE-IDENTITY
    LAST-UPDATED "201005170000Z" -- May 17, 2010
    ORGANIZATION "The IETF NTP Working Group (ntpwg)"
    CONTACT-INFO
            "     WG Email: ntpwg@lists.ntp.isc.org
                  Subscribe:
                   https://lists.ntp.isc.org/mailman/listinfo/ntpwg

                  Heiko Gerstung
                  Meinberg Funkuhren Gmbh & Co. KG
                  Lange Wand 9
                  Bad Pyrmont  31812
                  Germany

                  Phone: +49 5281 9309 25
                  Email: heiko.gerstung@meinberg.de

                  Chris Elliott
                  1516 Kent St.
                  Durham, NC 27707
                  USA

                  Phone: +1-919-308-1216
                  Email: chelliot@pobox.com

                  Brian Haberman
                  11100 Johns Hopkins Road
                  Laurel, MD 20723
                  USA

                  Phone: +1-443-778-1319
                  Email: brian@innovationslab.net"
     DESCRIPTION
        "The Management Information Base for NTP time entities.

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         Relating to IETF Documents
```

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          (http://trustee.ietf.org/license-info)."

    REVISION     "201005170000Z"
    DESCRIPTION
        "This revision of the MIB module is published as RFC 5907."

    ::= { mib-2 197 }

ntpSnmpMIBObjects  OBJECT IDENTIFIER ::= { ntpSnmpMIB 1 }

-- MIB contains 6 groups

ntpEntInfo         OBJECT IDENTIFIER ::= { ntpSnmpMIBObjects 1 }
ntpEntStatus       OBJECT IDENTIFIER ::= { ntpSnmpMIBObjects 2 }
ntpAssociation     OBJECT IDENTIFIER ::= { ntpSnmpMIBObjects 3 }
ntpEntControl      OBJECT IDENTIFIER ::= { ntpSnmpMIBObjects 4 }
ntpEntNotifObjects OBJECT IDENTIFIER ::= { ntpSnmpMIBObjects 5 }

--
-- Textual Conventions
--

NtpStratum ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "d"
    STATUS      current
    DESCRIPTION
        "The NTP stratum, with 16 representing no stratum."
    SYNTAX      Unsigned32 (1..16)

NtpDateTime ::= TEXTUAL-CONVENTION
    DISPLAY-HINT "4d:4d:4d.4d"
    STATUS      current
    DESCRIPTION
        "NTP date/time on the device, in 128-bit
         NTP date format.  If time is not syncronized, this
         field shall be a zero-length string.

         This trusted certificate (TC) is not to be used for objects
         that are used to set the time of the node querying this
         object.  NTP should be used for this -- or at least SNTP."
    REFERENCE "RFC 5905, section 6"
    SYNTAX      OCTET STRING (SIZE (0 | 16))

--
-- Section 1: General NTP Entity information objects
--            (relatively static information)
--
```

```
ntpEntSoftwareName OBJECT-TYPE
    SYNTAX      Utf8String
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The product name of the running NTP version, e.g., 'ntpd'."
    ::= { ntpEntInfo  1 }

ntpEntSoftwareVersion OBJECT-TYPE
    SYNTAX      Utf8String
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The software version of the installed NTP implementation
         as a full version string, e.g., 'ntpd-4.2.0b@1.1433 ...'"
    ::= { ntpEntInfo  2 }

ntpEntSoftwareVendor OBJECT-TYPE
    SYNTAX      Utf8String
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The vendor/author of the installed NTP version."
    ::= { ntpEntInfo  3 }

ntpEntSystemType OBJECT-TYPE
    SYNTAX      Utf8String
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "General hardware/os platform information,
         e.g., 'Linux 2.6.12 / x86'."
    -- freely configurable, default is OS Version / Hardware platform
    ::= { ntpEntInfo  4 }

ntpEntTimeResolution OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The time resolution in integer format, where the resolution
        is represented as divisions of a second, e.g., a value of 1000
        translates to 1.0 ms."
    ::= { ntpEntInfo  5 }
```

```
ntpEntTimePrecision OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The entity's precision in integer format, shows the precision.
         A value of -5 would mean 2^-5 = 31.25 ms."
    ::= { ntpEntInfo  6 }

ntpEntTimeDistance OBJECT-TYPE
    SYNTAX      DisplayString
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The distance from this NTP entity to the root time reference
        (stratum 0) source including the unit, e.g., '13.243 ms'."
    ::= { ntpEntInfo  7 }

--
-- Section 2: Current NTP status (dynamic information)
--

ntpEntStatusCurrentMode OBJECT-TYPE
    SYNTAX      INTEGER {
                            notRunning(1),
                            notSynchronized(2),
                            noneConfigured(3),
                            syncToLocal(4),
                            syncToRefclock(5),
                            syncToRemoteServer(6),
                            unknown(99)
                        }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The current mode of the NTP.  The definition of each possible
         value is:
            notRunning(1) - NTP is not running.
            notSynchronized(2) - NTP is not synchronized to any time
                                 source (stratum = 16).
            noneConfigured(3) - NTP is not synchronized and does not
                                have a reference configured
                                (stratum = 16).
            syncToLocal(4) - NTP is distributing time based on its
                             local clock (degraded accuracy and/or
                             reliability).
            syncToRefclock(5) - NTP is synchronized to a local
                                hardware refclock (e.g., GPS).
```

```
            syncToRemoteServer(6) - NTP is synchronized to a remote
                                    NTP server ('upstream' server).
            unknown(99) - The state of NTP is unknown."
    ::= { ntpEntStatus 1 }

ntpEntStatusStratum OBJECT-TYPE
    SYNTAX      NtpStratum
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The NTP entity's own stratum value.  Should be a stratum of
         syspeer + 1 (or 16 if no syspeer)."
    ::= { ntpEntStatus 2 }

ntpEntStatusActiveRefSourceId OBJECT-TYPE
    SYNTAX      Unsigned32 ( 0..99999 )
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The association ID of the current syspeer."
    ::= { ntpEntStatus 3 }

ntpEntStatusActiveRefSourceName OBJECT-TYPE
    SYNTAX      Utf8String
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The hostname/descriptive name of the current reference source
         selected as syspeer, e.g., 'ntp1.ptb.de' or 'GPS' or
         'DCFi', ..."
    ::= { ntpEntStatus 4 }

ntpEntStatusActiveOffset OBJECT-TYPE
    SYNTAX      DisplayString
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The time offset to the current selected reference time source
         as a string including unit, e.g., '0.032 ms' or '1.232 s'."
    ::= { ntpEntStatus 5 }

ntpEntStatusNumberOfRefSources OBJECT-TYPE
    SYNTAX      Unsigned32 (0..99)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of reference sources configured for NTP."
    ::= { ntpEntStatus 6 }
```

```
ntpEntStatusDispersion OBJECT-TYPE
    SYNTAX      DisplayString
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The root dispersion of the running NTP entity, e.g., '6.927'."
    ::= { ntpEntStatus 7 }

ntpEntStatusEntityUptime OBJECT-TYPE
    SYNTAX      TimeTicks
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The uptime of the NTP entity, (i.e., the time since ntpd was
         (re-)initialized not sysUptime!).  The time is represented in
         hundreds of seconds since Jan 1, 1970 (00:00:00.000) UTC."
    ::= { ntpEntStatus 8 }

ntpEntStatusDateTime OBJECT-TYPE
    SYNTAX      NtpDateTime
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The current NTP date/time on the device, in 128-bit
         NTP date format.  If time is not syncronized, this
         field shall be a zero-length string.

         This object can be used to timestamp events on this
         node and allow a management station to correlate
         different time objects.  For example, a management
         station could query this object and sysUpTime in
         the same operation to be able to relate sysUpTime
         to NTP time.

         This object is not to be used to set the time of
         the node querying this object.  NTP should be used
         for this -- or at least SNTP."
    REFERENCE "RFC 5905, section 6"
    ::= { ntpEntStatus 9 }

ntpEntStatusLeapSecond OBJECT-TYPE
    SYNTAX      NtpDateTime
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Date the next known leap second will occur.  If there is
         no leap second announced, then this object should be 0."
    ::= { ntpEntStatus 10 }
```

```
ntpEntStatusLeapSecDirection OBJECT-TYPE
    SYNTAX      Integer32 (-1..1)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "Direction of next known leap second.  If there is no
         leap second announced, then this object should be 0."
    ::= { ntpEntStatus 11 }

ntpEntStatusInPkts OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of NTP messages delivered to the
         NTP entity from the transport service.
         Discountinuities in the value of this counter can occur
         upon cold start or reinitialization of the NTP entity, the
         management system and at other times as indicated by
         discontinuities in the value of sysUpTime."

    ::= { ntpEntStatus 12 }

ntpEntStatusOutPkts OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of NTP messages delivered to the
         transport service by this NTP entity.
         Discountinuities in the value of this counter can occur
         upon cold start or reinitialization of the NTP entity, the
         management system and at other times as indicated by
         discontinuities in the value of sysUpTime."
    ::= { ntpEntStatus 13 }

ntpEntStatusBadVersion OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of NTP messages that were delivered
         to this NTP entity and were for an unsupported NTP
         version.
```

```
         Discountinuities in the value of this counter can occur
         upon cold start or reinitialization of the NTP entity, the
         management system and at other times as indicated by
         discontinuities in the value of sysUpTime."
    ::= { ntpEntStatus 14 }

ntpEntStatusProtocolError OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of NTP messages that were delivered
         to this NTP entity and this entity was not able to
         process due to an NTP protocol error.
         Discountinuities in the value of this counter can occur
         upon cold start or reinitialization of the NTP entity, the
         management system and at other times as indicated by
         discontinuities in the value of sysUpTime."
    ::= { ntpEntStatus 15 }

ntpEntStatusNotifications OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "notifications"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of SNMP notifications that this NTP
         entity has generated.
         Discountinuities in the value of this counter can occur
         upon cold start or reinitialization of the NTP entity, the
         management system and at other times as indicated by
         discontinuities in the value of sysUpTime."
    ::= { ntpEntStatus 16 }

ntpEntStatPktModeTable OBJECT-TYPE
    SYNTAX           SEQUENCE OF NtpEntStatPktModeEntry
    MAX-ACCESS       not-accessible
    STATUS           current
    DESCRIPTION
        "The number of packets sent and received by packet mode.
         One entry per packet mode."
    ::= { ntpEntStatus 17 }

ntpEntStatPktModeEntry OBJECT-TYPE
    SYNTAX      NtpEntStatPktModeEntry
    MAX-ACCESS  not-accessible
    STATUS      current
```

```
    DESCRIPTION
        "A statistical record of the number of packets sent and
         received for each packet mode."
    INDEX       { ntpEntStatPktMode }
    ::= { ntpEntStatPktModeTable 1 }

NtpEntStatPktModeEntry   ::= SEQUENCE {
        ntpEntStatPktMode              INTEGER,
        ntpEntStatPktSent              Counter32,
        ntpEntStatPktReceived          Counter32
}

ntpEntStatPktMode OBJECT-TYPE
    SYNTAX      INTEGER {
                    symetricactive(1),
                    symetricpassive(2),
                    client(3),
                    server(4),
                    broadcastserver(5),
                    broadcastclient(6)
                }
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The NTP packet mode."
    ::= { ntpEntStatPktModeEntry 1 }

ntpEntStatPktSent OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of NTP packets sent with this packet mode.
         Discountinuities in the value of this counter can occur
         upon cold start or reinitialization of the NTP entity, the
         management system and at other times as indicated by
         discontinuities in the value of sysUpTime."

    ::= { ntpEntStatPktModeEntry 2 }

ntpEntStatPktReceived OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of NTP packets received with this packet mode.
```

```
         Discountinuities in the value of this counter can occur
         upon cold start or reinitialization of the NTP entity, the
         management system and at other times as indicated by
         discontinuities in the value of sysUpTime."

    ::= { ntpEntStatPktModeEntry 3 }

--
-- Section 3: The status of all currently mobilized associations
--

ntpAssociationTable OBJECT-TYPE
    SYNTAX           SEQUENCE OF NtpAssociationEntry
    MAX-ACCESS       not-accessible
    STATUS           current
    DESCRIPTION
        "The table of currently mobilized associations."
    ::= { ntpAssociation 1 }

ntpAssociationEntry OBJECT-TYPE
    SYNTAX      NtpAssociationEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The table entry of currently mobilized associations."
    INDEX       { ntpAssocId }
    ::= { ntpAssociationTable 1 }

NtpAssociationEntry   ::= SEQUENCE {
        ntpAssocId                  Unsigned32,
        ntpAssocName                Utf8String,
        ntpAssocRefId               DisplayString,
        ntpAssocAddressType         InetAddressType,
        ntpAssocAddress             InetAddress,
        ntpAssocOffset              DisplayString,
        ntpAssocStratum             NtpStratum,
        ntpAssocStatusJitter        DisplayString,
        ntpAssocStatusDelay         DisplayString,
        ntpAssocStatusDispersion    DisplayString
}

ntpAssocId      OBJECT-TYPE
    SYNTAX      Unsigned32 ( 1..99999 )
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The association ID.  This is an internal, unique ID."
    ::= { ntpAssociationEntry 1 }
```

```
ntpAssocName    OBJECT-TYPE
    SYNTAX      Utf8String
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The hostname or other descriptive name for the association."
    ::= { ntpAssociationEntry 2 }

ntpAssocRefId   OBJECT-TYPE
    SYNTAX      DisplayString
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The refclock driver ID, if available."
    -- a refclock driver ID like "127.127.1.0" for non
    -- uni/multi/broadcast associations
    ::= { ntpAssociationEntry 3 }

ntpAssocAddressType OBJECT-TYPE
    SYNTAX      InetAddressType { ipv4(1), ipv6(2), ipv4z(3), ipv6z(4) }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The type of address of the association.  Can be either IPv4 or
         IPv6 (both with or without zone index) and contains the type of
         address for unicast, multicast, and broadcast associations."
    ::= { ntpAssociationEntry 4 }

ntpAssocAddress OBJECT-TYPE
    SYNTAX      InetAddress (SIZE (4|8|16|20))
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The IP address (IPv4 or IPv6, with or without zone index) of
         the association.  The type and size depends on the
         ntpAssocAddressType object.  Represents the IP address of a
         uni/multi/broadcast association."
    ::= { ntpAssociationEntry 5 }

ntpAssocOffset  OBJECT-TYPE
    SYNTAX      DisplayString
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The time offset to the association as a string."
    -- including unit, e.g., "0.032 ms" or "1.232 s"
    ::= { ntpAssociationEntry 6 }
```

```
ntpAssocStratum OBJECT-TYPE
    SYNTAX      NtpStratum
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The association stratum value."
    ::= { ntpAssociationEntry 7 }

ntpAssocStatusJitter OBJECT-TYPE
    SYNTAX      DisplayString
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The jitter in milliseconds as a string."
    ::= { ntpAssociationEntry 8 }

ntpAssocStatusDelay OBJECT-TYPE
    SYNTAX      DisplayString
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The network delay in milliseconds as a string."
    ::= { ntpAssociationEntry 9 }

ntpAssocStatusDispersion OBJECT-TYPE
    SYNTAX      DisplayString
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The root dispersion of the association."
    -- e.g., "6.927"
    ::= { ntpAssociationEntry 10 }

ntpAssociationStatisticsTable OBJECT-TYPE
    SYNTAX           SEQUENCE OF NtpAssociationStatisticsEntry
    MAX-ACCESS       not-accessible
    STATUS           current
    DESCRIPTION
        "The table of statistics for current associations."
    ::= { ntpAssociation 2 }

ntpAssociationStatisticsEntry OBJECT-TYPE
    SYNTAX      NtpAssociationStatisticsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The table entry of statistics for current associations."
    INDEX       { ntpAssocId }
```

```
    ::= { ntpAssociationStatisticsTable 1 }

NtpAssociationStatisticsEntry   ::= SEQUENCE {
        ntpAssocStatInPkts          Counter32,
        ntpAssocStatOutPkts         Counter32,
        ntpAssocStatProtocolError   Counter32
}

ntpAssocStatInPkts OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of NTP messages delivered to the
         NTP entity from this association.
         Discountinuities in the value of this counter can occur
         upon cold start or reinitialization of the NTP entity, the
         management system and at other times as indicated by
         discontinuities in the value of sysUpTime."

    ::= { ntpAssociationStatisticsEntry 1 }

ntpAssocStatOutPkts OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of NTP messages delivered to the
         transport service by this NTP entity for this
         association.
         Discountinuities in the value of this counter can occur
         upon cold start or reinitialization of the NTP entity, the
         management system and at other times as indicated by
         discontinuities in the value of sysUpTime."

    ::= { ntpAssociationStatisticsEntry 2 }

ntpAssocStatProtocolError OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of NTP messages that were delivered
         to this NTP entity from this association and this entity
         was not able to process due to an NTP protocol error.
```

```
         Discountinuities in the value of this counter can occur
         upon cold start or reinitialization of the NTP entity, the
         management system and at other times as indicated by
         discontinuities in the value of sysUpTime."

    ::= { ntpAssociationStatisticsEntry 3 }

--
-- Section 4: Control objects
--

ntpEntHeartbeatInterval OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS       "seconds"
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "The interval at which the ntpEntNotifHeartbeat notification
         should be sent, in seconds.  If set to 0 and the
         entNotifHeartbeat bit in ntpEntNotifBits is 1, then
         ntpEntNotifHeartbeat is sent once.
         This value is stored persistently and will be restored to its
         last set value upon cold start or restart."
    DEFVAL { 60 }
    ::= { ntpEntControl 1 }

ntpEntNotifBits OBJECT-TYPE
    SYNTAX       BITS {
                     notUsed(0), -- Used to sync up bit and notification
                                 -- indices
                     entNotifModeChange(1),
                     entNotifStratumChange(2),
                     entNotifSyspeerChanged(3),
                     entNotifAddAssociation(4),
                     entNotifRemoveAssociation(5),
                     entNotifConfigChanged(6),
                     entNotifLeapSecondAnnounced(7),
                     entNotifHeartbeat(8)
    }
    MAX-ACCESS  read-write
    STATUS      current
    DESCRIPTION
        "A bit for each notification.  A 1 for a particular bit enables
         that particular notification, a 0 disables it.
         This value is stored persistently and will be restored to its
         last set value upon cold start or restart."
    ::= { ntpEntControl 2 }
```

```
--
-- Section 5: Notification objects
--

ntpEntNotifMessage OBJECT-TYPE
    SYNTAX      Utf8String
    MAX-ACCESS  accessible-for-notify
    STATUS      current
    DESCRIPTION
        "Used as a payload object for all notifications.  Holds a
         cleartext event message."
    DEFVAL { "no event" }
    ::= { ntpEntNotifObjects 1 }

--
-- SNMP notification definitions
--

ntpEntNotifications OBJECT IDENTIFIER ::= { ntpSnmpMIB 0 }

ntpEntNotifModeChange NOTIFICATION-TYPE
    OBJECTS     { ntpEntStatusCurrentMode }
    STATUS      current
    DESCRIPTION
        "The notification to be sent when the NTP entity changes mode,
         including starting and stopping (if possible)."
    ::= { ntpEntNotifications 1 }

ntpEntNotifStratumChange NOTIFICATION-TYPE
    OBJECTS     { ntpEntStatusDateTime, ntpEntStatusStratum,
                  ntpEntNotifMessage }
    STATUS      current
    DESCRIPTION
        "The notification to be sent when stratum level of NTP changes."
    ::= { ntpEntNotifications 2 }

ntpEntNotifSyspeerChanged NOTIFICATION-TYPE
    OBJECTS     { ntpEntStatusDateTime, ntpEntStatusActiveRefSourceId,
                  ntpEntNotifMessage }
    STATUS      current
    DESCRIPTION
        "The notification to be sent when a (new) syspeer has been
         selected."
    ::= { ntpEntNotifications 3 }

ntpEntNotifAddAssociation NOTIFICATION-TYPE
    OBJECTS  { ntpEntStatusDateTime, ntpAssocName, ntpEntNotifMessage }
    STATUS      current
```

```
    DESCRIPTION
        "The notification to be sent when a new association is
         mobilized."
    ::= { ntpEntNotifications 4 }

ntpEntNotifRemoveAssociation NOTIFICATION-TYPE
    OBJECTS  { ntpEntStatusDateTime, ntpAssocName,  ntpEntNotifMessage }
    STATUS      current
    DESCRIPTION
        "The notification to be sent when an association is
         demobilized."
    ::= { ntpEntNotifications 5 }

ntpEntNotifConfigChanged NOTIFICATION-TYPE
    OBJECTS     { ntpEntStatusDateTime, ntpEntNotifMessage }
    STATUS      current
    DESCRIPTION
        "The notification to be sent when the NTP configuration has
         changed, e.g., when the system connected to the Internet and
         was assigned a new IP address by the ISPs DHCP server."
    ::= { ntpEntNotifications 6 }

ntpEntNotifLeapSecondAnnounced NOTIFICATION-TYPE
    OBJECTS     { ntpEntStatusDateTime, ntpEntNotifMessage }
    STATUS      current
    DESCRIPTION
        "The notification to be sent when a leap second has been
         announced."
    ::= { ntpEntNotifications 7 }

ntpEntNotifHeartbeat NOTIFICATION-TYPE
    OBJECTS     { ntpEntStatusDateTime, ntpEntStatusCurrentMode,
                  ntpEntHeartbeatInterval, ntpEntNotifMessage }
    STATUS      current
    DESCRIPTION
        "The notification to be sent periodically (as defined by
         ntpEntHeartbeatInterval) to indicate that the NTP entity is
         still alive."
    ::= { ntpEntNotifications 8 }

--
-- Conformance/Compliance statements
--

ntpEntConformance OBJECT IDENTIFIER ::= { ntpSnmpMIB 2 }

ntpEntCompliances OBJECT IDENTIFIER ::= { ntpEntConformance 1 }
ntpEntGroups      OBJECT IDENTIFIER ::= { ntpEntConformance 2 }
```

```
ntpEntNTPCompliance MODULE-COMPLIANCE
    STATUS      current
    DESCRIPTION
        "The compliance statement for SNMP entities that use NTP and
         implement the NTP MIB."
    MODULE  -- this module
        MANDATORY-GROUPS {
                            ntpEntObjectsGroup1
        }
        ::= { ntpEntCompliances 1 }

ntpEntSNTPCompliance MODULE-COMPLIANCE
    STATUS      current
    DESCRIPTION
        "The compliance statement for SNMP entities that use SNTP and
         implement the NTP MIB."
    MODULE  -- this module
        MANDATORY-GROUPS {
                            ntpEntObjectsGroup1
        }
        GROUP ntpEntObjectsGroup2
        DESCRIPTION
                "Optional object group."
        GROUP ntpEntNotifGroup
        DESCRIPTION
                "Optional notifications for this MIB."
        ::= { ntpEntCompliances 2 }

ntpEntObjectsGroup1 OBJECT-GROUP
    OBJECTS {
              ntpEntSoftwareName,
              ntpEntSoftwareVersion,
              ntpEntSoftwareVendor,
              ntpEntSystemType,
              ntpEntStatusEntityUptime,
              ntpEntStatusDateTime,
              ntpAssocName,
              ntpAssocRefId,
              ntpAssocAddressType,
              ntpAssocAddress
    }
    STATUS      current
    DESCRIPTION
        "A collection of objects for the NTP MIB."
    ::= { ntpEntGroups 1 }

ntpEntObjectsGroup2 OBJECT-GROUP
    OBJECTS {
```

```
                ntpEntTimeResolution,
                ntpEntTimePrecision,
                ntpEntTimeDistance,
                ntpEntStatusCurrentMode,
                ntpEntStatusStratum,
                ntpEntStatusActiveRefSourceId,
                ntpEntStatusActiveRefSourceName,
                ntpEntStatusActiveOffset,
                ntpEntStatusNumberOfRefSources,
                ntpEntStatusDispersion,
                ntpEntStatusLeapSecond,
                ntpEntStatusLeapSecDirection,
                ntpEntStatusInPkts,
                ntpEntStatusOutPkts,
                ntpEntStatusBadVersion,
                ntpEntStatusProtocolError,
                ntpEntStatusNotifications,
                ntpEntStatPktSent,
                ntpEntStatPktReceived,
                ntpAssocOffset,
                ntpAssocStratum,
                ntpAssocStatusJitter,
                ntpAssocStatusDelay,
                ntpAssocStatusDispersion,
                ntpAssocStatInPkts,
                ntpAssocStatOutPkts,
                ntpAssocStatProtocolError,
                ntpEntHeartbeatInterval,
                ntpEntNotifBits,
                ntpEntNotifMessage
    }
    STATUS      current
    DESCRIPTION
        "A collection of objects for the NTP MIB."
    ::= { ntpEntGroups 2 }

ntpEntNotifGroup NOTIFICATION-GROUP
    NOTIFICATIONS {
                    ntpEntNotifModeChange,
                    ntpEntNotifStratumChange,
                    ntpEntNotifSyspeerChanged,
                    ntpEntNotifAddAssociation,
                    ntpEntNotifRemoveAssociation,
                    ntpEntNotifConfigChanged,
                    ntpEntNotifLeapSecondAnnounced,
                    ntpEntNotifHeartbeat
    }
    STATUS      current
```

```
    DESCRIPTION
        "A collection of notifications for the NTP MIB"
    ::= { ntpEntGroups 3 }

END
```

6. IANA Considerations

The MIB module in this document uses the following IANA-assigned OBJECT IDENTIFIER values recorded in the SMI Numbers registry:

Descriptor	OBJECT IDENTIFIER value
ntpSnmp	{ mib-2 197 }

7. Security Considerations

There are currently two management objects defined in this MIB module with a MAX-ACCESS clause of read-write and/or read-create. Such objects may be considered sensitive or vulnerable in some network environments. The support for SET operations in a non-secure environment without proper protection can have a negative effect on network operations. These are the objects and their sensitivity/ vulnerability:

ntpEntHeartbeatInterval controls the interval of heartbeat notifications. If set to 1, this will cause the NTP entity to send one notification each second. This is the maximum rate (1/s) that can be generated automatically. If it is set to 0, then one single hearbeat notification will be created and no further automatically generated notification is sent. This functionality can be used to create notifications at a higher rate (as high as the object can be written).

ntpEntNotifBits enables/disables notifications. Could be used to switch off notifications in order to delay or eliminate the notification for critical and important events.

Some of the readable objects in this MIB module (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

ntpEntSoftwareName, ntpEntSoftwareVersion, ntpEntSoftwareVendor, and ntpEntSystemType all can be used to identify software and its version as well as the operating system and hardware platform. This might help a potential attacker to find security problems and therefore can be used in the preparation of an attack.

SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in this MIB module. It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see RFC 3410 [RFC3410], section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy). Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of this MIB module is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

8. Acknowledgments

Bert Wijnen provided valuable feedback as the MIB Doctor for this document.

9. References

9.1. Normative References

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9.2. Informative References

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Authors' Addresses

Heiko Gerstung
Meinberg Funkuhren Gmbh & Co. KG
Lange Wand 9
Bad Pyrmont 31812
Germany

Phone: +49 5281 9309 25
EMail: heiko.gerstung@meinberg.de

Chris Elliott
1516 Kent St.
Durham, NC 27707
USA

Phone: +1-919-308-1216
EMail: chelliot@pobox.com

Brian Haberman (editor)
Johns Hopkins University Applied Physics Lab
11100 Johns Hopkins Road
Laurel, MD 20723-6099
US

Phone: +1 443 778 1319
EMail: brian@innovationslab.net