

Network Working Group
Request for Comments: 4022
Obsoletes: 2452, 2012
Category: Standards Track

R. Raghunarayan, Ed.
Cisco Systems
March 2005

Management Information Base
for the Transmission Control Protocol (TCP)

Status of This Memo

This document specifies an Internet standards track protocol for the Internet community, and requests discussion and suggestions for improvements. Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the standardization state and status of this protocol. Distribution of this memo is unlimited.

Copyright Notice

Copyright (C) The Internet Society (2005).

Abstract

This memo defines a portion of the Management Information Base (MIB) for use with network management protocols in the Internet community. In particular, it describes managed objects used for implementations of the Transmission Control Protocol (TCP) in an IP version independent manner. This memo obsoletes RFCs 2452 and 2012.

Table of Contents

1. The Internet-Standard Management Framework	2
2. Overview.	2
2.1. Relationship to Other MIBs.	2
3. Definitions	4
4. Acknowledgements.	20
5. References.	20
5.1. Normative References.	20
5.2. Informative References.	21
6. Security Considerations	21
7. Contributors.	23
Editor's Address.	23
Full Copyright Statement.	24

1. 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].

2. Overview

The current TCP-MIB defined in this memo consists of two tables and a group of scalars:

- The tcp group of scalars includes two sets of objects:
 - o Parameters of a TCP protocol engine. These include parameters such as the retransmission algorithm in use (e.g., vanj [VANJ]) and the retransmission timeout values.
 - o Statistics of a TCP protocol engine. These include counters for the number of active/passive opens, input/output segments, and errors. Discontinuities in the stats are identified identified via the sysUpTime object, defined in [RFC3418].
- The tcpConnectionTable provides access to status information for all TCP connections handled by a TCP protocol engine. In addition, the table reports identification of the operating system level processes that handle the TCP connections.
- The tcpListenerTable provides access to information about all TCP listening endpoints known by a TCP protocol engine. And as with the connection table, the tcpListenerTable also reports the identification of the operating system level processes that handle this listening TCP endpoint.

2.1. Relationship to Other MIBs

This section discusses the relationship of this TCP-MIB module to other MIB modules.

2.1.1. Relationship to RFC1213-MIB

TCP related MIB objects were originally defined as part of the RFC1213-MIB defined in RFC 1213 [RFC1213]. The TCP related objects of the RFC1213-MIB were later copied into a separate MIB module and published in RFC 2012 [RFC2012] in SMIV2 format.

The previous versions of the TCP-MIB both defined the `tcpConnTable`, which has been deprecated basically for two reasons:

- (1) The `tcpConnTable` only supports IPv4.

The current approach in the IETF is to write IP version neutral MIBs, based on the `InetAddressType` and `InetAddress` constructs defined in [RFC4001], rather than to have different definitions for various version of IP. This reduces the amount of overhead when new objects are introduced, as there is only one place to add them. Hence, the approach taken in [RFC2452], of having separate tables, is not continued.

- (2) The `tcpConnTable` mixes listening endpoints with connections.

It turns out that connections tend to have a different behaviour and management access pattern than listening endpoints. Therefore, splitting the original `tcpConnTable` into two tables allows for the addition of specific status and statistics objects for listening endpoints and connections.

2.1.2. Relationship to IPV6-TCP-MIB

The IPV6-TCP-MIB defined in RFC 2452 has been moved to Historic status because the approach of having separate IP version specific tables is not followed anymore. Implementation of RFC 2452 is no longer suggested.

2.1.3. Relationship to HOST-RESOURCES-MIB and SYSAPPL-MIB

The `tcpConnectionTable` and the `tcpListenerTable` report the identification of the operating system level process that handles a connection or a listening endpoint. The value is reported as an `Unsigned32`, which is expected to be the same as the `hrSWRunIndex` of the HOST-RESOURCES-MIB [RFC2790] (if the value is smaller than 2147483647) or the `sysAppElmtRunIndex` of the SYSAPPL-MIB [RFC2287]. This allows management applications to identify the TCP connections that belong to an operating system level process, which has proven to be valuable in operational environments.

3. Definitions

TCP-MIB DEFINITIONS ::= BEGIN

IMPORTS

```
MODULE-IDENTITY, OBJECT-TYPE, Integer32, Unsigned32,
Gauge32, Counter32, Counter64, IpAddress, mib-2
                                FROM SNMPv2-SMI
MODULE-COMPLIANCE, OBJECT-GROUP  FROM SNMPv2-CONF
InetAddress, InetAddressType,
InetPortNumber                  FROM INET-ADDRESS-MIB;
```

tcpMIB MODULE-IDENTITY

```
LAST-UPDATED "200502180000Z" -- 18 February 2005
ORGANIZATION
```

```
    "IETF IPv6 MIB Revision Team
    http://www.ietf.org/html.charters/ipv6-charter.html"
```

CONTACT-INFO

```
    "Rajiv Raghunarayan (editor)
```

```

    Cisco Systems Inc.
    170 West Tasman Drive
    San Jose, CA 95134
```

```

    Phone: +1 408 853 9612
    Email: <raraghun@cisco.com>
```

```

    Send comments to <ipv6@ietf.org>"
```

DESCRIPTION

```
    "The MIB module for managing TCP implementations.
```

```

    Copyright (C) The Internet Society (2005). This version
    of this MIB module is a part of RFC 4022; see the RFC
    itself for full legal notices."
```

```
REVISION      "200502180000Z" -- 18 February 2005
```

DESCRIPTION

```
    "IP version neutral revision, published as RFC 4022."
```

```
REVISION      "9411010000Z"
```

DESCRIPTION

```
    "Initial SMIV2 version, published as RFC 2012."
```

```
REVISION      "9103310000Z"
```

DESCRIPTION

```
    "The initial revision of this MIB module was part of
    MIB-II."
```

```
::= { mib-2 49 }
```

-- the TCP base variables group

```
tcp      OBJECT IDENTIFIER ::= { mib-2 6 }

-- Scalars

tcpRtoAlgorithm OBJECT-TYPE
    SYNTAX      INTEGER {
        other(1),      -- none of the following
        constant(2),   -- a constant rto
        rsre(3),        -- MIL-STD-1778, Appendix B
        vanj(4),        -- Van Jacobson's algorithm
        rfc2988(5)      -- RFC 2988
    }
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION   "The algorithm used to determine the timeout value used for
        retransmitting unacknowledged octets."
    ::= { tcp 1 }

tcpRtoMin OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    UNITS        "milliseconds"
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION   "The minimum value permitted by a TCP implementation for
        the retransmission timeout, measured in milliseconds.
        More refined semantics for objects of this type depend
        on the algorithm used to determine the retransmission
        timeout; in particular, the IETF standard algorithm
        rfc2988(5) provides a minimum value."
    ::= { tcp 2 }

tcpRtoMax OBJECT-TYPE
    SYNTAX      Integer32 (0..2147483647)
    UNITS        "milliseconds"
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION   "The maximum value permitted by a TCP implementation for
        the retransmission timeout, measured in milliseconds.
        More refined semantics for objects of this type depend
        on the algorithm used to determine the retransmission
        timeout; in particular, the IETF standard algorithm
        rfc2988(5) provides an upper bound (as part of an
        adaptive backoff algorithm)."
    ::= { tcp 3 }
```

```
tcpMaxConn OBJECT-TYPE
    SYNTAX      Integer32 (-1 | 0..2147483647)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The limit on the total number of TCP connections the entity
        can support.  In entities where the maximum number of
        connections is dynamic, this object should contain the
        value -1."
    ::= { tcp 4 }

tcpActiveOpens OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of times that TCP connections have made a direct
        transition to the SYN-SENT state from the CLOSED state.

        Discontinuities in the value of this counter are
        indicated via discontinuities in the value of sysUpTime."
    ::= { tcp 5 }

tcpPassiveOpens OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of times TCP connections have made a direct
        transition to the SYN-RCVD state from the LISTEN state.

        Discontinuities in the value of this counter are
        indicated via discontinuities in the value of sysUpTime."
    ::= { tcp 6 }

tcpAttemptFails OBJECT-TYPE
    SYNTAX      Counter32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of times that TCP connections have made a direct
        transition to the CLOSED state from either the SYN-SENT
        state or the SYN-RCVD state, plus the number of times that
        TCP connections have made a direct transition to the
        LISTEN state from the SYN-RCVD state.

        Discontinuities in the value of this counter are
        indicated via discontinuities in the value of sysUpTime."
```

```
::= { tcp 7 }
```

tcpEstabResets OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of times that TCP connections have made a direct transition to the CLOSED state from either the ESTABLISHED state or the CLOSE-WAIT state.

Discontinuities in the value of this counter are indicated via discontinuities in the value of sysUpTime."

```
::= { tcp 8 }
```

tcpCurrEstab OBJECT-TYPE

SYNTAX Gauge32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of TCP connections for which the current state is either ESTABLISHED or CLOSE-WAIT."

```
::= { tcp 9 }
```

tcpInSegs OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of segments received, including those received in error. This count includes segments received on currently established connections.

Discontinuities in the value of this counter are indicated via discontinuities in the value of sysUpTime."

```
::= { tcp 10 }
```

tcpOutSegs OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of segments sent, including those on current connections but excluding those containing only retransmitted octets.

Discontinuities in the value of this counter are indicated via discontinuities in the value of sysUpTime."

```
::= { tcp 11 }
```

```
tcpRetransSegs OBJECT-TYPE
```

```
    SYNTAX      Counter32
```

```
    MAX-ACCESS  read-only
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "The total number of segments retransmitted; that is, the
        number of TCP segments transmitted containing one or more
        previously transmitted octets.
```

```
        Discontinuities in the value of this counter are
        indicated via discontinuities in the value of sysUpTime."
```

```
::= { tcp 12 }
```

```
tcpInErrs OBJECT-TYPE
```

```
    SYNTAX      Counter32
```

```
    MAX-ACCESS  read-only
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "The total number of segments received in error (e.g., bad
        TCP checksums).
```

```
        Discontinuities in the value of this counter are
        indicated via discontinuities in the value of sysUpTime."
```

```
::= { tcp 14 }
```

```
tcpOutRsts OBJECT-TYPE
```

```
    SYNTAX      Counter32
```

```
    MAX-ACCESS  read-only
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "The number of TCP segments sent containing the RST flag.
```

```
        Discontinuities in the value of this counter are
        indicated via discontinuities in the value of sysUpTime."
```

```
::= { tcp 15 }
```

```
-- { tcp 16 } was used to represent the ipv6TcpConnTable in RFC 2452,
-- which has since been obsoleted.  It MUST not be used.
```

```
tcpHCInSegs OBJECT-TYPE
```

```
    SYNTAX      Counter64
```

```
    MAX-ACCESS  read-only
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "The total number of segments received, including those
        received in error.  This count includes segments received
```

on currently established connections. This object is the 64-bit equivalent of tcpInSegs.

Discontinuities in the value of this counter are indicated via discontinuities in the value of sysUpTime."
::= { tcp 17 }

tcpHCOutSegs OBJECT-TYPE

SYNTAX Counter64

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of segments sent, including those on current connections but excluding those containing only retransmitted octets. This object is the 64-bit equivalent of tcpOutSegs.

Discontinuities in the value of this counter are indicated via discontinuities in the value of sysUpTime."
::= { tcp 18 }

-- The TCP Connection table

tcpConnectionTable OBJECT-TYPE

SYNTAX SEQUENCE OF TcpConnectionEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table containing information about existing TCP connections. Note that unlike earlier TCP MIBs, there is a separate table for connections in the LISTEN state."

::= { tcp 19 }

tcpConnectionEntry OBJECT-TYPE

SYNTAX TcpConnectionEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A conceptual row of the tcpConnectionTable containing information about a particular current TCP connection. Each row of this table is transient in that it ceases to exist when (or soon after) the connection makes the transition to the CLOSED state."

INDEX { tcpConnectionLocalAddressType,
tcpConnectionLocalAddress,
tcpConnectionLocalPort,
tcpConnectionRemAddressType,

```

        tcpConnectionRemAddress,
        tcpConnectionRemPort }
 ::= { tcpConnectionTable 1 }

```

```

TcpConnectionEntry ::= SEQUENCE {
    tcpConnectionLocalAddressType  InetAddressType,
    tcpConnectionLocalAddress      InetAddress,
    tcpConnectionLocalPort         InetPortNumber,
    tcpConnectionRemAddressType    InetAddressType,
    tcpConnectionRemAddress        InetAddress,
    tcpConnectionRemPort           InetPortNumber,
    tcpConnectionState             INTEGER,
    tcpConnectionProcess           Unsigned32
}

```

```

tcpConnectionLocalAddressType OBJECT-TYPE
    SYNTAX      InetAddressType
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The address type of tcpConnectionLocalAddress."
    ::= { tcpConnectionEntry 1 }

```

```

tcpConnectionLocalAddress OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The local IP address for this TCP connection.  The type
         of this address is determined by the value of
         tcpConnectionLocalAddressType.

         As this object is used in the index for the
         tcpConnectionTable, implementors should be
         careful not to create entries that would result in OIDs
         with more than 128 subidentifiers; otherwise the information
         cannot be accessed by using SNMPv1, SNMPv2c, or SNMPv3."
    ::= { tcpConnectionEntry 2 }

```

```

tcpConnectionLocalPort OBJECT-TYPE
    SYNTAX      InetPortNumber
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The local port number for this TCP connection."
    ::= { tcpConnectionEntry 3 }

```

```

tcpConnectionRemAddressType OBJECT-TYPE

```

```
SYNTAX      InetAddressType
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "The address type of tcpConnectionRemAddress."
 ::= { tcpConnectionEntry 4 }
```

tcpConnectionRemAddress OBJECT-TYPE

```
SYNTAX      InetAddress
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "The remote IP address for this TCP connection.  The type
    of this address is determined by the value of
    tcpConnectionRemAddressType.

    As this object is used in the index for the
    tcpConnectionTable, implementors should be
    careful not to create entries that would result in OIDs
    with more than 128 subidentifiers; otherwise the information
    cannot be accessed by using SNMPv1, SNMPv2c, or SNMPv3."
 ::= { tcpConnectionEntry 5 }
```

tcpConnectionRemPort OBJECT-TYPE

```
SYNTAX      InetPortNumber
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "The remote port number for this TCP connection."
 ::= { tcpConnectionEntry 6 }
```

tcpConnectionState OBJECT-TYPE

```
SYNTAX      INTEGER {
                closed(1),
                listen(2),
                synSent(3),
                synReceived(4),
                established(5),
                finWait1(6),
                finWait2(7),
                closeWait(8),
                lastAck(9),
                closing(10),
                timeWait(11),
                deleteTCB(12)
            }
MAX-ACCESS  read-write
STATUS      current
```

DESCRIPTION

"The state of this TCP connection.

The value listen(2) is included only for parallelism to the old tcpConnTable and should not be used. A connection in LISTEN state should be present in the tcpListenerTable.

The only value that may be set by a management station is deleteTCB(12). Accordingly, it is appropriate for an agent to return a 'badValue' response if a management station attempts to set this object to any other value.

If a management station sets this object to the value deleteTCB(12), then the TCB (as defined in [RFC793]) of the corresponding connection on the managed node is deleted, resulting in immediate termination of the connection.

As an implementation-specific option, a RST segment may be sent from the managed node to the other TCP endpoint (note, however, that RST segments are not sent reliably)."

::= { tcpConnectionEntry 7 }

tcpConnectionProcess OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The system's process ID for the process associated with this connection, or zero if there is no such process. This value is expected to be the same as HOST-RESOURCES-MIB::hrSWRunIndex or SYSAPPL-MIB::sysAppElmtRunIndex for some row in the appropriate tables."

::= { tcpConnectionEntry 8 }

-- The TCP Listener table

tcpListenerTable OBJECT-TYPE

SYNTAX SEQUENCE OF TcpListenerEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A table containing information about TCP listeners. A listening application can be represented in three possible ways:

1. An application that is willing to accept both IPv4 and IPv6 datagrams is represented by

a tcpListenerLocalAddressType of unknown (0) and a tcpListenerLocalAddress of ''h (a zero-length octet-string).

2. An application that is willing to accept only IPv4 or IPv6 datagrams is represented by a tcpListenerLocalAddressType of the appropriate address type and a tcpListenerLocalAddress of '0.0.0.0' or ':::' respectively.
3. An application that is listening for data destined only to a specific IP address, but from any remote system, is represented by a tcpListenerLocalAddressType of an appropriate address type, with tcpListenerLocalAddress as the specific local address.

NOTE: The address type in this table represents the address type used for the communication, irrespective of the higher-layer abstraction. For example, an application using IPv6 'sockets' to communicate via IPv4 between ::ffff:10.0.0.1 and ::ffff:10.0.0.2 would use InetAddressType ipv4(1))."

::= { tcp 20 }

tcpListenerEntry OBJECT-TYPE

SYNTAX TcpListenerEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A conceptual row of the tcpListenerTable containing information about a particular TCP listener."

INDEX { tcpListenerLocalAddressType,
tcpListenerLocalAddress,
tcpListenerLocalPort }

::= { tcpListenerTable 1 }

TcpListenerEntry ::= SEQUENCE {

tcpListenerLocalAddressType InetAddressType,

tcpListenerLocalAddress InetAddress,

tcpListenerLocalPort InetPortNumber,

tcpListenerProcess Unsigned32

}

tcpListenerLocalAddressType OBJECT-TYPE

SYNTAX InetAddressType

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"The address type of tcpListenerLocalAddress. The value should be unknown (0) if connection initiations to all local IP addresses are accepted."

::= { tcpListenerEntry 1 }

tcpListenerLocalAddress OBJECT-TYPE

SYNTAX InetAddress
MAX-ACCESS not-accessible
STATUS current

DESCRIPTION

"The local IP address for this TCP connection.

The value of this object can be represented in three possible ways, depending on the characteristics of the listening application:

1. For an application willing to accept both IPv4 and IPv6 datagrams, the value of this object must be ''h (a zero-length octet-string), with the value of the corresponding tcpListenerLocalAddressType object being unknown (0).
2. For an application willing to accept only IPv4 or IPv6 datagrams, the value of this object must be '0.0.0.0' or ':::' respectively, with tcpListenerLocalAddressType representing the appropriate address type.
3. For an application which is listening for data destined only to a specific IP address, the value of this object is the specific local address, with tcpListenerLocalAddressType representing the appropriate address type.

As this object is used in the index for the tcpListenerTable, implementors should be careful not to create entries that would result in OIDs with more than 128 subidentifiers; otherwise the information cannot be accessed, using SNMPv1, SNMPv2c, or SNMPv3."

::= { tcpListenerEntry 2 }

tcpListenerLocalPort OBJECT-TYPE

SYNTAX InetPortNumber
MAX-ACCESS not-accessible
STATUS current

DESCRIPTION

"The local port number for this TCP connection."

::= { tcpListenerEntry 3 }

tcpListenerProcess OBJECT-TYPE

SYNTAX Unsigned32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The system's process ID for the process associated with this listener, or zero if there is no such process. This value is expected to be the same as HOST-RESOURCES-MIB::hrSWRunIndex or SYSAPPL-MIB::sysAppElmtRunIndex for some row in the appropriate tables."

::= { tcpListenerEntry 4 }

-- The deprecated TCP Connection table

tcpConnTable OBJECT-TYPE

SYNTAX SEQUENCE OF TcpConnEntry

MAX-ACCESS not-accessible

STATUS deprecated

DESCRIPTION

"A table containing information about existing IPv4-specific TCP connections or listeners. This table has been deprecated in favor of the version neutral tcpConnectionTable."

::= { tcp 13 }

tcpConnEntry OBJECT-TYPE

SYNTAX TcpConnEntry

MAX-ACCESS not-accessible

STATUS deprecated

DESCRIPTION

"A conceptual row of the tcpConnTable containing information about a particular current IPv4 TCP connection. Each row of this table is transient in that it ceases to exist when (or soon after) the connection makes the transition to the CLOSED state."

INDEX { tcpConnLocalAddress,
tcpConnLocalPort,
tcpConnRemAddress,
tcpConnRemPort }

::= { tcpConnTable 1 }

TcpConnEntry ::= SEQUENCE {

tcpConnState	INTEGER,
tcpConnLocalAddress	IpAddress,
tcpConnLocalPort	Integer32,
tcpConnRemAddress	IpAddress,
tcpConnRemPort	Integer32

}

tcpConnState OBJECT-TYPE

```
SYNTAX      INTEGER {
                closed(1),
                listen(2),
                synSent(3),
                synReceived(4),
                established(5),
                finWait1(6),
                finWait2(7),
                closeWait(8),
                lastAck(9),
                closing(10),
                timeWait(11),
                deleteTCB(12)
            }
```

MAX-ACCESS read-write

STATUS deprecated

DESCRIPTION

"The state of this TCP connection.

The only value that may be set by a management station is deleteTCB(12). Accordingly, it is appropriate for an agent to return a 'badValue' response if a management station attempts to set this object to any other value.

If a management station sets this object to the value deleteTCB(12), then the TCB (as defined in [RFC793]) of the corresponding connection on the managed node is deleted, resulting in immediate termination of the connection.

As an implementation-specific option, a RST segment may be sent from the managed node to the other TCP endpoint (note, however, that RST segments are not sent reliably)."

::= { tcpConnEntry 1 }

tcpConnLocalAddress OBJECT-TYPE

```
SYNTAX      IpAddress
```

MAX-ACCESS read-only

STATUS deprecated

DESCRIPTION

"The local IP address for this TCP connection. In the case of a connection in the listen state willing to accept connections for any IP interface associated with the node, the value 0.0.0.0 is used."

::= { tcpConnEntry 2 }

```
tcpConnLocalPort OBJECT-TYPE
    SYNTAX      Integer32 (0..65535)
    MAX-ACCESS  read-only
    STATUS      deprecated
    DESCRIPTION
        "The local port number for this TCP connection."
    ::= { tcpConnEntry 3 }

tcpConnRemAddress OBJECT-TYPE
    SYNTAX      IpAddress
    MAX-ACCESS  read-only
    STATUS      deprecated
    DESCRIPTION
        "The remote IP address for this TCP connection."
    ::= { tcpConnEntry 4 }

tcpConnRemPort OBJECT-TYPE
    SYNTAX      Integer32 (0..65535)
    MAX-ACCESS  read-only
    STATUS      deprecated
    DESCRIPTION
        "The remote port number for this TCP connection."
    ::= { tcpConnEntry 5 }

-- conformance information

tcpMIBConformance OBJECT IDENTIFIER ::= { tcpMIB 2 }

tcpMIBCompliances OBJECT IDENTIFIER ::= { tcpMIBConformance 1 }
tcpMIBGroups      OBJECT IDENTIFIER ::= { tcpMIBConformance 2 }

-- compliance statements

tcpMIBCompliance2 MODULE-COMPLIANCE
    STATUS      current
    DESCRIPTION
        "The compliance statement for systems that implement TCP.

        A number of INDEX objects cannot be
        represented in the form of OBJECT clauses in SMIV2 but
        have the following compliance requirements,
        expressed in OBJECT clause form in this description
        clause:

        -- OBJECT      tcpConnectionLocalAddressType
        -- SYNTAX      InetAddressType { ipv4(1), ipv6(2) }
        -- DESCRIPTION
        --      This MIB requires support for only global IPv4
```

```

--      and IPv6 address types.
--
-- OBJECT      tcpConnectionRemAddressType
-- SYNTAX      InetAddressType { ipv4(1), ipv6(2) }
-- DESCRIPTION
--      This MIB requires support for only global IPv4
--      and IPv6 address types.
--
-- OBJECT      tcpListenerLocalAddressType
-- SYNTAX      InetAddressType { unknown(0), ipv4(1),
--                               ipv6(2) }
-- DESCRIPTION
--      This MIB requires support for only global IPv4
--      and IPv6 address types. The type unknown also
--      needs to be supported to identify a special
--      case in the listener table: a listen using
--      both IPv4 and IPv6 addresses on the device.
--
"
MODULE -- this module
    MANDATORY-GROUPS { tcpBaseGroup, tcpConnectionGroup,
                        tcpListenerGroup }
    GROUP      tcpHCGroup
    DESCRIPTION
        "This group is mandatory for systems that are capable
        of receiving or transmitting more than 1 million TCP
        segments per second. 1 million segments per second will
        cause a Counter32 to wrap in just over an hour."
    OBJECT      tcpConnectionState
    SYNTAX      INTEGER { closed(1), listen(2), synSent(3),
                        synReceived(4), established(5),
                        finWait1(6), finWait2(7), closeWait(8),
                        lastAck(9), closing(10), timeWait(11) }

    MIN-ACCESS  read-only
    DESCRIPTION
        "Write access is not required, nor is support for the value
        deleteTCB (12)."
```

::= { tcpMIBCompliances 2 }

```

tcpMIBCompliance MODULE-COMPLIANCE
    STATUS      deprecated
    DESCRIPTION
        "The compliance statement for IPv4-only systems that
        implement TCP. In order to be IP version independent, this
        compliance statement is deprecated in favor of
        tcpMIBCompliance2. However, agents are still encouraged
        to implement these objects in order to interoperate with
        the deployed base of managers."
```

```
MODULE -- this module
    MANDATORY-GROUPS { tcpGroup }
    OBJECT      tcpConnState
    MIN-ACCESS  read-only
    DESCRIPTION
        "Write access is not required."
    ::= { tcpMIBCompliances 1 }

-- units of conformance

tcpGroup OBJECT-GROUP
    OBJECTS { tcpRtoAlgorithm, tcpRtoMin, tcpRtoMax,
              tcpMaxConn, tcpActiveOpens,
              tcpPassiveOpens, tcpAttemptFails,
              tcpEstabResets, tcpCurrEstab, tcpInSegs,
              tcpOutSegs, tcpRetransSegs, tcpConnState,
              tcpConnLocalAddress, tcpConnLocalPort,
              tcpConnRemAddress, tcpConnRemPort,
              tcpInErrs, tcpOutRsts }
    STATUS      deprecated
    DESCRIPTION
        "The tcp group of objects providing for management of TCP
        entities."
    ::= { tcpMIBGroups 1 }

tcpBaseGroup OBJECT-GROUP
    OBJECTS { tcpRtoAlgorithm, tcpRtoMin, tcpRtoMax,
              tcpMaxConn, tcpActiveOpens,
              tcpPassiveOpens, tcpAttemptFails,
              tcpEstabResets, tcpCurrEstab, tcpInSegs,
              tcpOutSegs, tcpRetransSegs,
              tcpInErrs, tcpOutRsts }
    STATUS      current
    DESCRIPTION
        "The group of counters common to TCP entities."
    ::= { tcpMIBGroups 2 }

tcpConnectionGroup OBJECT-GROUP
    OBJECTS { tcpConnectionState, tcpConnectionProcess }
    STATUS      current
    DESCRIPTION
        "The group provides general information about TCP
        connections."
    ::= { tcpMIBGroups 3 }

tcpListenerGroup OBJECT-GROUP
    OBJECTS { tcpListenerProcess }
```

```
STATUS      current
DESCRIPTION
    "This group has objects providing general information about
    TCP listeners."
 ::= { tcpMIBGroups 4 }
```

```
tcpHCGroup OBJECT-GROUP
OBJECTS      { tcpHCInSegs, tcpHCOutSegs }
STATUS      current
DESCRIPTION
    "The group of objects providing for counters of high speed
    TCP implementations."
 ::= { tcpMIBGroups 5 }
```

END

4. Acknowledgements

This document contains a modified subset of RFC 1213 and updates RFC 2012 and RFC 2452. Acknowledgements are therefore due to the authors and editors of these documents for their excellent work. Several useful comments regarding usability and design were also received from Kristine Adamson. The authors would like to thank all these people for their contribution to this effort.

5. References

5.1. Normative References

- [RFC793] Postel, J., "Transmission Control Protocol", STD 7, RFC 793, DARPA, September 1981.
- [RFC2287] Krupczak, C. and J. Saperia, "Definitions of System-Level Managed Objects for Applications", RFC 2287, February 1998.
- [RFC2578] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.
- [RFC2579] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.
- [RFC2580] McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.
- [RFC2790] Waldbusser, S. and P. Grillo, "Host Resources MIB", RFC 2790, March 2000.

- [RFC4001] Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, "Textual Conventions for Internet Network Addresses", RFC 4001, February 2005.

5.2. Informative References

- [RFC1213] McCloghrie, K. and M. Rose, "Management Information Base for Network Management of TCP/IP-based internets", RFC 1213, March 1991.
- [RFC2012] McCloghrie, K., Ed., "SNMPv2 Management Information Base for the Transmission Control Protocol using SMIV2", RFC 2012, November 1996.
- [RFC2452] Daniele, M., "IP Version 6 Management Information Base for the Transmission Control Protocol", RFC 2452, December 1998.
- [RFC2988] Paxson, V. and M. Allman, "Computing TCP's Retransmission Timer", RFC 2988, November 2000.
- [RFC3410] Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.
- [RFC3418] Presuhn, R., Ed., "Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)", RFC 3418, December 2002.
- [VANJ] Jacobson, V., "Congestion Avoidance and Control", SIGCOMM 1988, Stanford, California.

6. Security Considerations

There are a number of management objects defined in this MIB module with a MAX-ACCESS clause of read-write. 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 tables and objects and their sensitivity/vulnerability:

- o The tcpConnectionState and tcpConnState objects have a MAX-ACCESS clause of read-write, which allows termination of an arbitrary connection. Unauthorized access could cause a denial of service.

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:

- o The tcpConnectionTable and the tcpConnTable contain objects providing information about the active connections on the device, the status of these connections, and the associated processes. This information may be used by an attacker to launch attacks against known/unknown weakness in certain protocols/applications. In addition, access to the connection table could also have privacy implications, as it provides detailed information on active connections.
- o The tcpListenerTable and the tcpConnTable contain objects providing information about listeners on an entity. For example, the tcpListenerLocalPort and tcpConnLocalPort objects can be used to identify what ports are open on the machine and what attacks are likely to succeed, without the attacker having to run a port scanner.

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 [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.

7. Contributors

This document is an output of the IPv6 MIB revision team, and contributors to earlier versions of this document include:

Bill Fenner, AT&T Labs -- Research
EMail: fenner@research.att.com

Brian Haberman
EMail: brian@innovationslab.net

Shawn A. Routhier, Wind River
EMail: shawn.routhier@windriver.com

Juergen Schoenwalder, TU Braunschweig
EMail: schoenw@ibr.cs.tu-bs.de

Dave Thaler, Microsoft
EMail: dthaler@windows.microsoft.com

This document updates parts of the MIBs from several documents. RFC 2012 has been the base document for these updates, and RFC 2452 was the first document to define the managed objects for implementations of TCP over IPv6.

RFC 2012:

Keith McCloghrie, Cisco Systems (Editor)
EMail: kzm@cisco.com

RFC 2452:

Mike Daniele, Compaq Computer Corporation
EMail: daniele@zk3.dec.com

Editor's Address

Rajiv Raghunarayan
Cisco Systems Inc.
170 West Tasman Drive
San Jose, CA 95134
USA

EMail: raraghun@cisco.com

Full Copyright Statement

Copyright (C) The Internet Society (2005).

This document is subject to the rights, licenses and restrictions contained in BCP 78, and except as set forth therein, the authors retain all their rights.

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Intellectual Property

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the procedures with respect to rights in RFC documents can be found in BCP 78 and BCP 79.

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at <http://www.ietf.org/ipr>.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at ietf-ipr@ietf.org.

Acknowledgement

Funding for the RFC Editor function is currently provided by the Internet Society.

