



EKSAMEN I TTM4128 – NETT OG TJENESTEADMINISTRASJON
EXAM TTM4128 –NETWORK AND SERVICE MANAGEMENT

Contact person / Faglig kontakt:	Professor Finn Arve Aagesen Mob: 99505728
Date / dato:	10.06.2010
Time / tid:	0900-1200
Remedies /	D: No printed or handwritten remedies permitted. Specific, simple calculator permitted
Tillatte hjelpemidler:	D: Ingen trykte eller håndskrevne hjelpemidler tillatt. Bestemt, enkel kalkulator tillatt
Languages/ Språkform:	English/Bokmål
Antall sider spørsmål bokmål:	3
Number of pages of questions in English:	3
Appendix/antall sider vedlegg:	11
Results/Sensurdato:	1 July/1 Juli ¹

¹ Merk at studenten primært må gjøre seg kjent med sensur ved å oppsøke sensuroppslagene. Sensur blir kunngjort på Studweb samt instituttets oppslagstavle. Resultat på Studweb kommer vanligvis noen dager etter at resultatet er kunngjort på instituttets oppslagstavle.

Please note that primarily, the students must get the result of the exam at Studweb or from the notice board at Department of Telematics. The result on Studweb is normally published some days after the result on the department notice board.

TTM 4128 Exam June 10th 2010 (English)

Enclosed : Shortened version of RFC 4022

Task 1. General (15 %)

Please provide short and precise answers.

- 1.1 (5%) Describe shortly the four models that constitute the OSI Network Management Model.
- 1.2. (5%) Explain the overall learning objectives of TTM4128. Which overall learning objectives does the OSI Network Management Model support?
- 1.3 (5%) How do the various models of the SNMP Management Framework comply with the models of the OSI Network Management Model?

Task 2. Web services (15 %)

Please provide short and precise answers.

- 2.1 (7.5 %) What is the vision of the semantic Web? What are the current main components of the Semantic Web? What is the application area of these components?
- 2.2. (7.5 %) Explain how XML can be used to represent semantics. Give an example to illustrate.

Task 3. TCP MIB. (30%)

Please provide short and precise answers.

- 3.1. (5%) In the enclosed RFC 4022 defining the TCP MIB there are object instances of types defined by different Macros. Select 3 of these types. What are the types you have selected used for?
- 3.2. (5%) Describe the structure of valid nodes in the MIB-tree for *managed object types* defined by RFC4022
- 3.3. (10%) Define an instance of tcpConnectionTable defined in RFC4022. The table shall have two rows and is placed in a WEB server with IP-address 129.241.200.19. The MIB Type InetAddressType has Syntax INTEGER unknown (0) ipv4 (1) ipv6 (2) ipv4z (3) ipv6z (4) dns (16). We use IPv4 addressing

Which attributes are index attributes? What are index attributes in general used for?

- 3.4. (10%) A manager shall access the values of tcpConnectionState in the defined instance of tcpConnectionTable. The manager has no knowledge about the content of the table. The manger will access the table by using *getnext-request*.

Describe the principal sequence of commands and responses exchanged between the manager and the agent. Object identifiers used must be defined. (Version and Community are not used in this case).

Which net-snmp commands can be used to traverse tables?

Task 4. CIM and CIM /WBEM. (15 %)

Please provide short and precise answers.

4.1. (5%) What is the CIM Extension Schema?

4.2. (5%) Explain three different ways to express CIM specifications

4.3. (5%) List the most important elements of the CIM meta schema

Task 5. A Network Management Application (25%)

Please provide short and precise answers.

We are considering a network management system as illustrated in Figure 1. A user on a PC X can by using a web browser retrieve a value of an MIB object instance. The user provides as input:

- the IP address of the managed component (agent)
- a community name configured in the agent
- a MIB object name or an 'alias' name, e.g. *hrSystemUptime* or *hostuptime*

The **manager** communicates with the agents by using *net-snmp*. In the agents a *net-snmp* daemon *snmpd* is running with a different community name in each of the agents. Some of the agents are configured to accept snmp version 1 (v1) commands and the others version 2 (v2c) commands.

5.1. (15%) Design an application running in the same component as the manager that provides the service specified above. Explain your design including the technologies and protocols that are used.

5.2. (10%) A user gives the following input on a web browser in PCX.

- *123.12.13.14*
- *abc* (community name)
- *hostuptime*

Explain how your designed application works. Explain what happens from the user activates the web browser until the user receives the result. The types of messages exchanged must be defined.

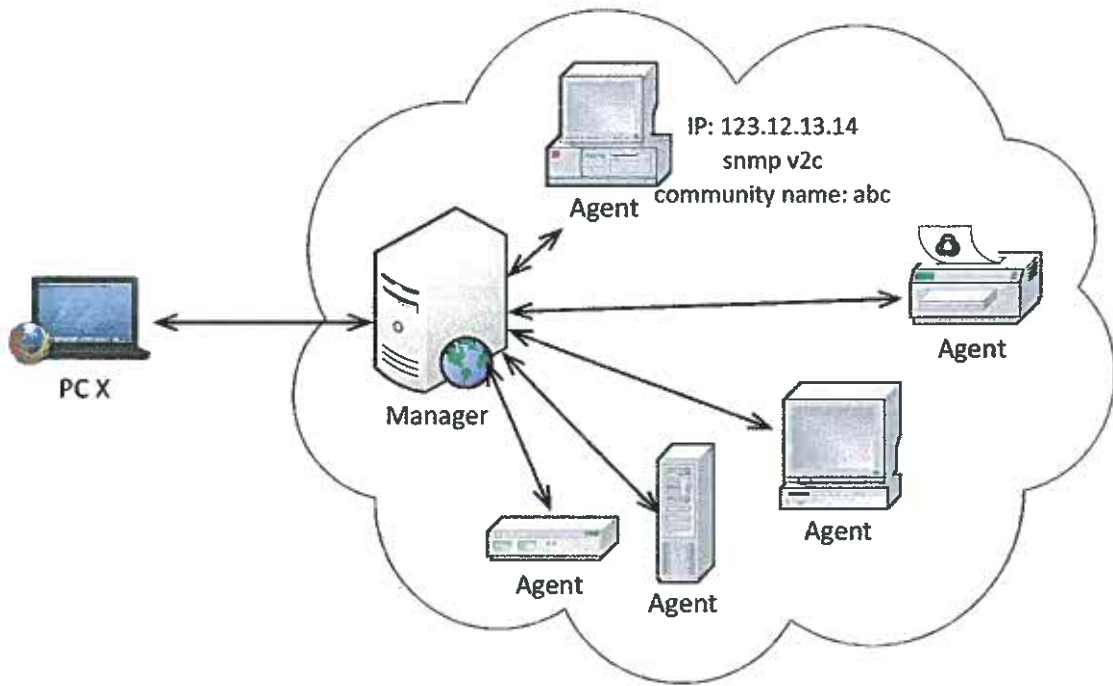


Figure 1.

TTM 4128 Eksamen 10de Juni 2010 (Norsk Bokmål)

Vedlagt: Forkortet versjon av RFC 4022

Oppgave 1. Generelt (15 %)

Vennligst gi korte og presise svar.

- 1.1 (5%) Beskriv kort de fire modeller som "OSI Network Management Model" består av.
- 1.2. (5%) Hva er "overall" læringsmål for TTM4128? Hvilke læringsmål støtter "OSI Network Management Modell" opp om?
- 1.3 (5%) Hvordan harmonerer de ulike modeller i "SNMP Management Framework" med modellene i "OSI Network Management Modell"?

Oppgave 2. Web services (15 %)

Vennligst gi korte og presise svar.

- 2.1 (7.5 %) Hva er visjonen til semantisk web? Hva er de eksisterende komponenter i semantisk web? Hva er anvendelsesområdet for disse komponenter?
- 2.2. (7.5 %) Forklar hvordan XML kan brukes for å representere semantikk. Illustrer med et eksempel.

Oppgave 3. TCP MIB. (30%)

Vennligst gi korte og presise svar.

- 3.1. (5%) I vedlagte RFC 4022 som definerer TCP MIB er det objektinstanser av typer definert ved forskjellige makroer. Velg ut 3 av disse typer. Hva er anvendelsen til de typer du har valgt ut?
- 3.2. (5%) Beskriv strukturen av gyldige noder i MIB-treet for "*managed object types*" definert ved RFC4022.
- 3.3. (10%) Definer en instans av `tcpConnectionTable` definert i RFC4022. Tabellen skal ha 2 rader og skal befinne seg i en web-server med IP-adresse 129.241.200.19. Den anvendte typen `InetAddressType` har Syntax INTEGER unknown (0) ipv4 (1) ipv6 (2) ipv4z (3) ipv6z (4) dns (16). Vi bruker IPv4 adressering.
- Hvilke attributter er indeksattributter? Hva brukes indeksattributter til generelt?
- 3.4. (10%) En "manager" skal hente ut verdiene av `tcpConnectionState` i den definerte instans av `tcpConnectionTable`. Manager har ingen kjennskap til innholdet i tabellen. Manager vil aksessere tabellen ved bruk av *getnext-request*.

Beskriv den prinsipielle sekvens av kommandoer og responser som utveksles mellom manager og agent. Objekt-identifikatorer må defineres. (Version og Community skal ikke brukes i dette tilfelle).

Hvilke kommander i net-snmp kan brukes for å traversere tabeller?

Oppgave 4. CIM. (15 %)

Vennligst gi korte og presise svar.

4.1. (5%) Hva er "CIM Extension Schema"?

4.2. (5%) Beskriv 3 ulike måter for å representere CIM spesifikasjoner

4.3. (5%) List de viktigste elementer i "CIM meta schema"

Oppgave 5. "Network Management"-anvendelse (25%)

Vennligst gi korte og presise svar.

Vi betrakter et system for nettadministrasjon som illustrert i Figur 1. En bruker på PCX kan ved å bruke en web-browser hente ut verdien av en instans av et MIB-objekt. Brukeren gir følgende input:

- IP-adressen til nettkomponenten (agenten)
- Et "community name" konfigurert i agenten
- Et MIB-objekt navn eller 'alias' navn, for eksempel *hrSystemUptime* eller *hostuptime*.

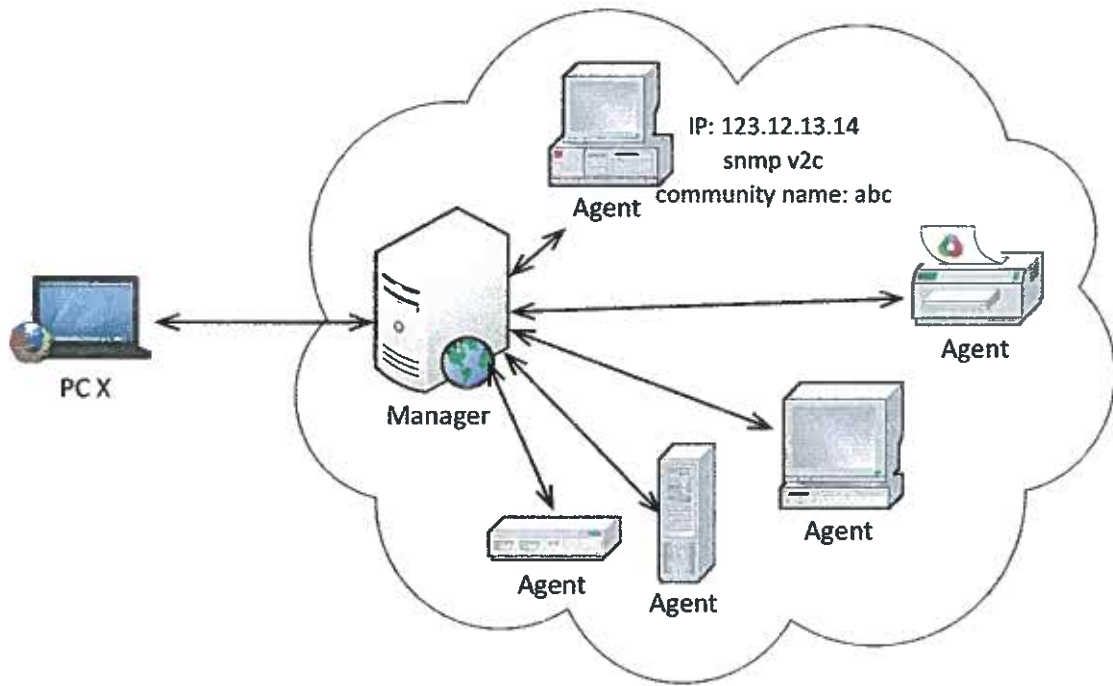
Manager kommuniserer med agentene ved bruk av *net-snmp*. En *net-snmp* "daemon" *snmpd* kjører i agentene med forskjellig "community name" i hver av agentene. Noen agenter er konfigurert for å akseptere snmp version 1 (v1) kommandoer. De øvrige er konfigurert for version 2 (v2c) kommandoer

5.1. (15%) Du skal designe en anvendelse som kjører i samme komponent som manager og som gir den tjeneste som er spesifisert. Forklar din design inklusive de teknologier og protokoller som anvendes.

5.2. (10%) En bruker gir følgende input via sin web-browser

- *123.12.13.14*
- *abc* (community name)
- *hostuptime*

Forklar hvordan din applikasjon virker. Forklar hva som hender fra brukeren aktiverer sin web-browser til brukeren mottar resultatet. Meldingstyper som utveksles skal defineres.



Figur 1.

Exam TTM4128 June 10th 2010,
Eksamen TTM 4128, 10de juni 2010

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

R. Raghunathan, Ed.
Cisco Systems
March 2005

Management Information Base for the Transmission Control Protocol (TCP)

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: *Parameters* of a TCP protocol engine and *statistics* of a TCP protocol engine.

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.

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,
InetAddressType 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 Raghunathan (editor)

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."

::= { 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."

::= { 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."

::= { 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."

::= { 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."

::= { 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."

::= { 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."

::= { 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."

::= { 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."

::= { 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."

::= { 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)."

::= { tcp 14 }

tcpOutRsts OBJECT-TYPE

SYNTAX Counter32
MAX-ACCESS read-only

STATUS current
DESCRIPTION
"The number of TCP segments sent containing the RST flag."
::= { tcp 15 }

tcpHCInSegs OBJECT-TYPE
SYNTAX Counter64
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of segments received, including those received in error."
::= { 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."
::= { 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."  
 ::= { 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."

::= { 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."

::= { 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::sysApplElmtRunIndex 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."
 ::= { 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."
 ::= { 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 }

-- 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

```