Management Information Base for the User Datagram Protocol (UDP)

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.

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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 User Datagram Protocol (UDP) in an IP version independent manner. This memo obsoletes RFCs 2013 and 2454.

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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

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 User Datagram Protocol (UDP), as defined in RFC 768 [RFC0768], in an IP version independent manner.

The current UDP-MIB defined in this memo consists of one table and a group of scalars:

- The udp group of scalars reports parameters and statistics of a UDP protocol engine. Two scalars, udpHCInDatagrams and udpHCOutDatagrams, have been added to this group since the publication of RFC 2013 [RFC2013] in order to provide high-capacity counters for fast networks. Discontinuities in the values of the counters in this group are indicated by discontinuities in the value of the sysUpTime object, which is defined in RFC 3418 [RFC3418].

- The udpEndpointTable provides access to status information for all UDP endpoints handled by a UDP protocol engine. The table provides for strictly listening endpoints, as with the historical udpTable, and also for "connected" UDP endpoints, which only accept packets from a given remote system. It also reports identification of the operating system level processes that handle UDP connections. Addresses and ports of UDP endpoints in this table are represented using the InetAddressType, InetAddress, and InetPortNumber textual conventions defined in RFC 4001 [RFC4001].
2.1. Relationship to Other MIBs

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

2.1.1. Relationship to RFC1213-MIB

UDP related MIB objects were originally defined as part of the RFC1213-MIB, defined in RFC 1213 [RFC1213]. The UDP related objects of the RFC1213-MIB were later copied into a separate MIB module and published in RFC 2013 [RFC2013] in SMIv2 format.

The previous versions of the UDP-MIB both defined the udpTable, which has been deprecated for basically two reasons:

1. The udpTable only supports IPv4.

   The current approach in the IETF is to write IP version neutral MIBs rather than have different definitions for various version of IP. This reduces the amount of overhead when new objects are introduced, since there is only one place to add them. Hence, the approach taken in RFC 2454 [RFC2454] of having separate tables is not continued.

2. The udpTable does not permit describing "connected" UDP endpoints.

   It turns out that "connected" endpoints tend to have a different behaviour and management access pattern from those of listening endpoints. Adding remote endpoint information to the udpEndpointTable thus allows for the addition of specific status and statistic objects for "connected" endpoints and connections.

2.1.2. Relationship to the IPV6-UDP-MIB

The IPV6-UDP-MIB, defined in RFC 2454 [RFC2454], has been moved to Historic because the approach of having separate IP version specific tables is not followed anymore. Implementation of RFC 2454 is thus not suggested anymore.

Note that because scoped addresses are now represented using the IPv4z and IPv6z address types, there is no longer a need to explicitly include the ifIndex in the index clause of the udpEndpointTable. This is a change from the use of ipv6UdpIfIndex in RFC 2454.
2.1.3. Relationship to HOST-RESOURCES-MIB and SYSAPPL-MIB

The udpEndpointTable reports 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 sysApplElmtRunIndex of the SYSAPPL-MIB [RFC2287]. This allows management applications to identify the UDP connections that belong to an operating system level process, which has proven valuable in operational environments.

3. Definitions

UDP-MIB DEFINITIONS ::= BEGIN

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

udpMIB MODULE-IDENTITY
LAST-UPDATED "200505200000Z"  -- May 20, 2005
ORGANIZATION
"IETF IPv6 Working Group
http://www.ietf.org/html.charters/ipv6-charter.html"
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DESCRIPTION
"The MIB module for managing UDP implementations.
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version of this MIB module is part of RFC 4113;
see the RFC itself for full legal notices."
REVISION "200505200000Z" -- May 20, 2005
DESCRIPTION
"IP version neutral revision, incorporating the
following revisions:

- Added udpHCInDatagrams and udpHCOutDatagrams in order
to provide high-capacity counters for fast networks.
- Added text to the descriptions of all counter objects
to indicate how discontinuities are detected.
- Deprecated the IPv4-specific udpTable and replaced it
with the version neutral udpEndpointTable. This
table includes support for connected UDP endpoints
and support for identification of the operating
system process associated with a UDP endpoint.
- Deprecated the udpGroup and replaced it with object
groups representing the current set of objects.
- Deprecated udpMIBCompliance and replaced it with
udpMIBCompliance2, which includes the compliance
information for the new object groups.

This version published as RFC 4113."
REVISION "199411010000Z" -- November 1, 1994
DESCRIPTION
"Initial SMIv2 version, published as RFC 2013."
REVISION "199103310000Z" -- March 31, 1991
DESCRIPTION
"The initial revision of this MIB module was part of
MIB-II, published as RFC 1213."

::= { mib-2 50 }

-- the UDP group

udp OBJECT IDENTIFIER ::= { mib-2 7 }

udpInDatagrams OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of UDP datagrams delivered to UDP
users."
Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by discontinuities in the value of sysUpTime.

::= { udp 1 }

udpNoPorts OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of received UDP datagrams for which there was no application at the destination port.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by discontinuities in the value of sysUpTime."

::= { udp 2 }

udpInErrors OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of received UDP datagrams that could not be delivered for reasons other than the lack of an application at the destination port.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by discontinuities in the value of sysUpTime."

::= { udp 3 }

udpOutDatagrams OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of UDP datagrams sent from this entity.

Discontinuities in the value of this counter can occur at re-initialization of the management system, and at other times as indicated by discontinuities in the value of sysUpTime."

::= { udp 4 }
udpHCInDatagrams OBJECT-TYPE
SYNTAX     Counter64
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The total number of UDP datagrams delivered to UDP
users, for devices that can receive more than 1
million UDP datagrams per second.

Discontinuities in the value of this counter can occur
at re-initialization of the management system, and at
other times as indicated by discontinuities in the
value of sysUpTime."
::= { udp 8 }

udpHCOutDatagrams OBJECT-TYPE
SYNTAX     Counter64
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The total number of UDP datagrams sent from this
entity, for devices that can transmit more than 1
million UDP datagrams per second.

Discontinuities in the value of this counter can occur
at re-initialization of the management system, and at
other times as indicated by discontinuities in the
value of sysUpTime."
::= { udp 9 }

--
-- { udp 6 } was defined as the ipv6UdpTable in RFC2454’s
-- IPV6-UDP-MIB. This RFC obsoletes RFC 2454, so { udp 6 } is
-- obsoleted.
--

-- The UDP "Endpoint" table.

udpEndpointTable OBJECT-TYPE
SYNTAX     SEQUENCE OF UdpEndpointEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
 "A table containing information about this entity’s UDP
endpoints on which a local application is currently
accepting or sending datagrams."
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 \texttt{::ffff:10.0.0.1} and \texttt{::ffff:10.0.0.2} would use InetAddressType ipv4(1).

Unlike the udpTable in RFC 2013, this table also allows the representation of an application that completely specifies both local and remote addresses and ports. A listening application is represented in three possible ways:

1) An application that is willing to accept both IPv4 and IPv6 datagrams is represented by a udpEndpointLocalAddressType of unknown(0) and a udpEndpointLocalAddress of ''h (a zero-length octet-string).

2) An application that is willing to accept only IPv4 or only IPv6 datagrams is represented by a udpEndpointLocalAddressType of the appropriate address type and a udpEndpointLocalAddress of '0.0.0.0' or '::' respectively.

3) An application that is listening for datagrams only for a specific IP address but from any remote system is represented by a udpEndpointLocalAddressType of the appropriate address type, with udpEndpointLocalAddress specifying the local address.

In all cases where the remote is a wildcard, the udpEndpointRemoteAddressType is unknown(0), the udpEndpointRemoteAddress is ''h (a zero-length octet-string), and the udpEndpointRemotePort is 0.

If the operating system is demultiplexing UDP packets by remote address and port, or if the application has 'connected' the socket specifying a default remote address and port, the udpEndpointRemote* values should be used to reflect this.

::= { udp 7 }

udpEndpointEntry OBJECT-TYPE
SYNTAX    UdpEndpointEntry
MAX-ACCESS not-accessible
STATUS     current
Description

"Information about a particular current UDP endpoint.

Implementers need to be aware that if the total number of elements (octets or sub-identifiers) in udpEndpointLocalAddress and udpEndpointRemoteAddress exceeds 111, then OIDs of column instances in this table will have more than 128 sub-identifiers and cannot be accessed using SNMPv1, SNMPv2c, or SNMPv3."

INDEX { udpEndpointLocalAddressType,
    udpEndpointLocalAddress,
    udpEndpointLocalPort,
    udpEndpointRemoteAddressType,
    udpEndpointRemoteAddress,
    udpEndpointRemotePort,
    udpEndpointInstance }
::= { udpEndpointTable 1 }

UdpEndpointEntry ::= SEQUENCE {
    udpEndpointLocalAddressType   InetAddressType,
    udpEndpointLocalAddress       InetAddress,
    udpEndpointLocalPort          InetPortNumber,
    udpEndpointRemoteAddressType  InetAddressType,
    udpEndpointRemoteAddress      InetAddress,
    udpEndpointRemotePort         InetPortNumber,
    udpEndpointInstance           Unsigned32,
    udpEndpointProcess            Unsigned32
}

udpEndpointLocalAddressType OBJECT-TYPE
SYNTAX     InetAddressType
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The address type of udpEndpointLocalAddress. Only IPv4, IPv4z, IPv6, and IPv6z addresses are expected, or unknown(0) if datagrams for all local IP addresses are accepted."
::= { udpEndpointEntry 1 }

udpEndpointLocalAddress OBJECT-TYPE
SYNTAX     InetAddress
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The local IP address for this UDP endpoint.

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

1. For an application that is 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 instance of the udpEndpointLocalAddressType object being unknown(0).

2. For an application that is willing to accept only IPv4 or only IPv6 datagrams, the value of this object must be '0.0.0.0' or '::', respectively, while the corresponding instance of the udpEndpointLocalAddressType object represents the appropriate address type.

3. For an application that is listening for data destined only to a specific IP address, the value of this object is the specific IP address for which this node is receiving packets, with the corresponding instance of the udpEndpointLocalAddressType object representing the appropriate address type.

As this object is used in the index for the udpEndpointTable, implementors of this table should be careful not to create entries that would result in OIDs with more than 128 subidentifiers; else the information cannot be accessed using SNMPv1, SNMPv2c, or SNMPv3.
udpEndpointLocalAdressType and 
udpEndpointRemoteAddressType are not supported. In 
particular, if the value of this object is not 
unknown(0), it is expected to always refer to the 
same IP version as udpEndpointLocalAdressType.

::= { udpEndpointEntry 4 }

udpEndpointRemoteAddress OBJECT-TYPE
SYNTAX     InetAddress
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The remote IP address for this UDP endpoint. If 
datagrams from any remote system are to be accepted, 
this value is ''h (a zero-length octet-string). 
Otherwise, it has the type described by 
udpEndpointRemoteAddressType and is the address of the 
remote system from which datagrams are to be accepted 
(or to which all datagrams will be sent).

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

::= { udpEndpointEntry 5 }

udpEndpointRemotePort OBJECT-TYPE
SYNTAX     InetPortNumber
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The remote port number for this UDP endpoint. If 
datagrams from any remote system are to be accepted, 
this value is zero."

::= { udpEndpointEntry 6 }

udpEndpointInstance OBJECT-TYPE
SYNTAX     Unsigned32 (1..'ffffffff'h)
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"The instance of this tuple. This object is used to 
distinguish among multiple processes ‘connected’ to 
the same UDP endpoint. For example, on a system 
implementing the BSD sockets interface, this would be 
used to support the SO_REUSEADDR and SO_REUSEPORT 
socket options."
::= { udpEndpointEntry 7 }

udpEndpointProcess OBJECT-TYPE
SYNTAX     Unsigned32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The system’s process ID for the process associated with
this endpoint, 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."
::= { udpEndpointEntry 8 }

-- The deprecated UDP Listener table

-- The deprecated UDP listener table only contains information
-- about this entity’s IPv4 UDP end-points on which a local
-- application is currently accepting datagrams. It does not
-- provide more detailed connection information, or information
-- about IPv6 endpoints.

udpTable OBJECT-TYPE
SYNTAX     SEQUENCE OF UdpEntry
MAX-ACCESS not-accessible
STATUS     deprecated
DESCRIPTION
"A table containing IPv4-specific UDP listener
information. It contains information about all local
IPv4 UDP end-points on which an application is
currently accepting datagrams. This table has been
deprecated in favor of the version neutral
udpEndpointTable."
::= { udp 5 }

udpEntry OBJECT-TYPE
SYNTAX     UdpEntry
MAX-ACCESS not-accessible
STATUS     deprecated
DESCRIPTION
"Information about a particular current UDP listener."
INDEX   { udpLocalAddress, udpLocalPort }
::= { udpTable 1 }

UdpEntry ::= SEQUENCE {
  udpLocalAddress   IpAddress,
  udpLocalPort      Integer32
udpLocalAddress OBJECT-TYPE
SYNTAX IpAddress
MAX-ACCESS read-only
STATUS deprecated
DESCRIPTION
"The local IP address for this UDP listener. In the
case of a UDP listener that is willing to accept
datagrams for any IP interface associated with the
node, the value 0.0.0.0 is used."
 ::= { udpEntry 1 }

udpLocalPort OBJECT-TYPE
SYNTAX Integer32 (0..65535)
MAX-ACCESS read-only
STATUS deprecated
DESCRIPTION
"The local port number for this UDP listener."
 ::= { udpEntry 2 }

-- conformance information

udpMIBConformance OBJECT IDENTIFIER ::= { udpMIB 2 }
udpMIBCompliances OBJECT IDENTIFIER ::= { udpMIBConformance 1 }
udpMIBGroups OBJECT IDENTIFIER ::= { udpMIBConformance 2 }

-- compliance statements

udpMIBCompliance2 MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"The compliance statement for systems that implement
UDP.

There are a number of INDEX objects that cannot be
represented in the form of OBJECT clauses in SMIv2, but
for which we have the following compliance
requirements, expressed in OBJECT clause form in this
description clause:

-- OBJECT udpEndpointLocalAddressType
-- SYNTAX InetAddressType { unknown(0), ipv4(1),
-- ipv6(2), ipv4z(3),
-- ipv6z(4) }
-- DESCRIPTION
-- Support for dns(5) is not required.
-- OBJECT udpEndpointLocalAddress
RFC 4113  UDP MIB  June 2005

-- SYNTAX      InetAddress (SIZE(0|4|8|16|20))
-- DESCRIPTION
--     Support is only required for zero-length
--     octet-strings, and for scoped and unscoped
--     IPv4 and IPv6 addresses.
-- OBJECT      udpEndpointRemoteAddressType
-- SYNTAX      InetAddressType { unknown(0), ipv4(1),
--                               ipv6(2), ipv4z(3),
--                               ipv6z(4) }
-- DESCRIPTION
--     Support for dns(5) is not required.
-- OBJECT      udpEndpointRemoteAddress
-- SYNTAX      InetAddress (SIZE(0|4|8|16|20))
-- DESCRIPTION
--     Support is only required for zero-length
--     octet-strings, and for scoped and unscoped
--     IPv4 and IPv6 addresses.

"MODULE  -- this module
MANDATORY-GROUPS { udpBaseGroup, udpEndpointGroup } GROUP       udpHCGroup
DESCRIPTION
"This group is mandatory for systems that
are capable of receiving or transmitting more than
1 million UDP datagrams per second. 1 million
datagrams per second will cause a Counter32 to
wrap in just over an hour."
::= { udpMIBCompliances 2 }

udpMIBCompliance MODULE-COMPLIANCE
STATUS     deprecated
DESCRIPTION
"The compliance statement for IPv4-only systems that
implement UDP. For IP version independence, this
compliance statement is deprecated in favor of
udpMIBCompliance2. However, agents are still
e encouraged to implement these objects in order to
interoperate with the deployed base of managers."
MODULE  -- this module
MANDATORY-GROUPS { udpGroup }
::= { udpMIBCompliances 1 }

-- units of conformance

udpGroup OBJECT-GROUP
OBJECTS   { udpInDatagrams, udpNoPorts,
             udpInErrors, udpOutDatagrams,
             udpLocalAddress, udpLocalPort }
STATUS deprecated
DESCRIPTION
"The deprecated group of objects providing for
management of UDP over IPv4."
::= { udpMIBGroups 1 }

udpBaseGroup OBJECT-GROUP
OBJECTS   { udpInDatagrams, udpNoPorts, udpInErrors,
             udpOutDatagrams }
STATUS     current
DESCRIPTION
"The group of objects providing for counters of UDP
statistics."
::= { udpMIBGroups 2 }

udpHCGroup OBJECT-GROUP
OBJECTS   { udpHCInDatagrams, udpHCOutDatagrams }
STATUS     current
DESCRIPTION
"The group of objects providing for counters of high
speed UDP implementations."
::= { udpMIBGroups 3 }

udpEndpointGroup OBJECT-GROUP
OBJECTS    { udpEndpointProcess }
STATUS     current
DESCRIPTION
"The group of objects providing for the IP version
independent management of UDP 'endpoints'."
::= { udpMIBGroups 4 }

END

4. Acknowledgements

This document contains a modified subset of RFC 1213 and replaces
RFCs 2013 and 2454. Acknowledgments are therefore due to the authors
and editors of these documents for their excellent work.

5. Contributors

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

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Email: fenner@research.at.com
6. Security Considerations

There are no management objects defined in this MIB that have a MAX-ACCESS clause of read-write and/or read-create. So, if this MIB is implemented correctly, then there is no risk that an intruder can alter or create any management objects of this MIB module via direct SNMP SET operations.

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:

The indices of the udpEndpointTable and udpTable contain information on the listeners on an entity. In particular, the udpEndpointLocalPort and udpLocalPort objects in the indices 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 the implementors 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).

Furthermore, 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. IANA Considerations

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

<table>
<thead>
<tr>
<th>Descriptor</th>
<th>OBJECT IDENTIFIER value</th>
</tr>
</thead>
<tbody>
<tr>
<td>udp</td>
<td>{ mib-2 7}</td>
</tr>
<tr>
<td>udpMIB</td>
<td>{ mib-2 50 }</td>
</tr>
</tbody>
</table>

8. References

8.1. Normative References


8.2. Informative References


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