Network Working Group
Request for Comments: 4560
Obsoletes: 2925
Category: Standards Track

J. Quittek, Ed.
NEC
K. White, Ed.
IBM Corp.

June 2006

Definitions of Managed Objects for Remote Ping, Traceroute, and Lookup Operations

Status of This Memo

Copyright Notice

Abstract

This memo defines Management Information Bases (MIBs) for performing ping, traceroute, and lookup operations at a host. When managing a network, it is useful to be able to initiate and retrieve the results of ping or traceroute operations when they are performed at a remote host. A lookup capability is defined in order to enable resolution of either an IP address to an DNS name or a DNS name to an IP address at a remote host.

Currently, there are several enterprise-specific MIBs for performing remote ping or traceroute operations. The purpose of this memo is to define a standards-based solution to enable interoperability.

Table of Contents

1. Introduction

This document defines standards-based MIB modules for performing specific remote operations. The remote operations defined by this document consist of the ping, traceroute, and lookup functions.

Ping and traceroute are two very useful functions for managing networks. Ping is typically used to determine whether a path exists between two hosts, whereas traceroute shows an actual path.

Both ping and traceroute yield round-trip times measured in milliseconds. These times can be used as a rough approximation for network transit time.

The lookup functions considered in this document are the equivalents of name to address conversion functions such as gethostbyname()/gethostbyaddr() and getaddrinfo()/getnameinfo().

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [RFC2119].

1.1. Ping

Ping is usually implemented using the Internet Control Message Protocol (ICMP) "ECHO" facility. It is also possible to implement a ping capability using alternate methods, including the following:

- Using the UDP echo port (7), if supported.

  This is defined by RFC 862 [RFC862].

- Timing a Simple Network Management Protocol (SNMP) query.

- Timing a TCP connect attempt.

In general, almost any request/response flow can be used to generate a round-trip time. Often, many of the non-ICMP ECHO facility methods stand a better chance of yielding a good response (not timing out, for example) since some routers don’t honor Echo Requests (timeout situation) or are handled at lower priority, thus possibly giving false indications of round trip times.

Note that almost any of the various methods used for generating a round-trip time can be considered a form of system attack when used excessively. Sending a system request too often can negatively effect its performance. Attempting to connect to what is supposed to be an unused port can be very unpredictable. There are tools that attempt to connect to a range of TCP ports to test that any receiving server can handle erroneous connection attempts.

It is also important to a management application using a remote ping capability to know which method is being used. Different methods will yield different response times, since the protocol and resulting processing will be different. It is RECOMMENDED that the ping capability defined within this memo be implemented using the ICMP Echo Facility.

1.2. Traceroute

Traceroute is usually implemented by transmitting a series of probe packets with increasing time-to-live values. A probe packet is a UDP datagram encapsulated into an IP packet. Each hop in a path to the target (destination) host rejects the probe packet (probe's TTL too small) until its time-to-live value becomes large enough for the probe to be forwarded. Each hop in a traceroute path returns an ICMP message that is used to discover the hop and to calculate a round trip time. Some systems use ICMP probes (ICMP Echo request packets) instead of UDP ones to implement traceroute. In both cases traceroute relies on the probes being rejected via an ICMP message to discover the hops taken along a path to the final destination. Both probe types, UDP and ICMP, are encapsulated into an IP packet and thus have a TTL field that can be used to cause a path rejection.

Implementations of the remote traceroute capability as defined within this memo SHOULD be done using UDP packets to a (hopefully) unused port. ICMP probes (ICMP Echo Request packets) SHOULD NOT be used. Many PC implementations of traceroute use the ICMP probe method, which they should not, since this implementation method has been known to have a high probability of failure. Intermediate hops become invisible when a router either refuses to send an ICMP TTL expired message in response to an incoming ICMP packet or simply tosses ICMP echo requests altogether.

The behavior of some routers not to return a TTL expired message in response to an ICMP Echo request is due in part to the following text extracted from RFC 792 [RFC792]:

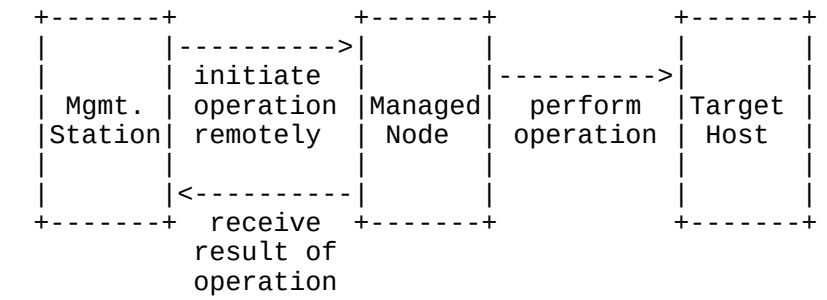
"The ICMP messages typically report errors in the processing of datagrams. To avoid the infinite regress of messages about messages etc., no ICMP messages are sent about ICMP messages."

1.3. Lookup

The Lookup operation enables remote lookup of addresses for a symbolic name as it is, for example, performed by functions getnameinfo() or gethostbyaddr() and lookup of symbolic names for an address as it is, for example, performed by functions getaddrinfo() or gethostbyname(). Note that whatever lookup function is chosen, results are not necessarily consistent with the results of a pure Domain Name Service (DNS) lookup, but may be influenced by local lookup tables or other sources of information. The lookup capability can be used to determine the symbolic name of a hop in a traceroute path. Also, the reverse lookup can be used, for example, for analyzing name lookup problems.

1.4. Remote Operations

The MIB modules defined in this document allow a management station to initiate ping, traceroute, and lookup operations remotely. The basic scenario is illustrated by the following diagram.



A management station is the local host from which the remote ping, traceroute, or Lookup operation is initiated using an SNMP request. The managed node is a remote host where the MIBs defined by this memo are implemented. It receives the remote operation via SNMP and performs the actual ping, traceroute, or lookup function.

2. 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].

3. Structure of the MIBs

This document defines three MIB modules:

- DISMAN-PING-MIB

  Defines a ping MIB.

- DISMAN-TRACEROUTE-MIB

  Defines a traceroute MIB.

- DISMAN-NSLOOKUP-MIB

Provides access to lookup functions for symbolic names and addresses at a remote host provided, for example, by functions getaddrinfo()/getnameinfo() and gethostbyname()/gethostbyaddr().

The ping and traceroute MIBs are structured to allow creation of ping or traceroute tests that can be set up to issue a series of operations periodically and to generate NOTIFICATIONs to report on test results. Many network administrators have in the past written UNIX shell scripts or command batch files to operate in a fashion similar to the functionality provided by the ping and traceroute MIBs defined within this memo. The intent of this document is to acknowledge the importance of these functions and to provide a standards-based solution.

3.1. Ping MIB

The DISMAN-PING-MIB consists of the following components:

- pingMaxConcurrentRequests
- pingCtlTable
- pingResultsTable
- pingProbeHistoryTable

3.1.1. pingMaxConcurrentRequests

The object pingMaxConcurrentRequests enables control of the maximum number of concurrent active requests that an agent implementation supports. It is permissible for an agent either to limit the maximum upper range allowed for this object or to implement this object as read-only with an implementation limit expressed as its value.

3.1.2. pingCtlTable

A remote ping test is started by setting pingCtlAdminStatus to enabled(1). The corresponding pingCtlEntry MUST have been created, and its pingCtlRowStatus set to active(1), prior to starting the test. A single SNMP PDU can be used to create and start a remote ping test. Within the PDU, pingCtlTargetAddress should be set to the target host's address (pingCtlTargetAddressType will default to ipv4(1)), pingCtlAdminStatus to enabled(1), and pingCtlRowStatus to createAndGo(4).

The first index element, pingCtlOwnerIndex, is of type SnmpAdminString, a textual convention that allows for use of the SNMPv3 View-Based Access Control Model (RFC 3415 [RFC3415], VACM) and that allows a management application to identify its entries. The second index, pingCtlTestName (also an SnmpAdminString), enables the same management application to have multiple requests outstanding.

Using the maximum value for the parameters defined within a pingEntry can result in a single remote ping test's taking at most 15 minutes (pingCtlTimeOut times pingCtlProbeCount), plus whatever time it takes to send the ping request and to receive its response over the network from the target host. Use of the defaults for pingCtlTimeOut and pingCtlProbeCount yields a maximum of 3 seconds to perform a "normal" ping test.

A management application can delete an active remote ping request by setting the corresponding pingCtlRowStatus object to destroy(6).

The contents of the pingCtlTable are preserved across reIPLs (Initial Program Loads) of its agent according the values of each of the pingCtlStorageType objects.

3.1.3. pingResultsTable

An entry in the pingResultsTable is created for a corresponding pingCtlEntry once the test defined by this entry is started.

3.1.4. pingProbeHistoryTable

The results of past ping probes are stored in this table on a per-pingCtlEntry basis. This table is initially indexed by pingCtlOwnerIndex and pingCtlTestName so that the results of a probe relate to the pingCtlEntry that caused it. The maximum number of entries stored in this table per pingCtlEntry is determined by the value of pingCtlMaxRows.

An implementation of this MIB will remove the oldest entry in the pingProbeHistoryTable of the corresponding entry in the pingCtlTable to allow the addition of a new entry once the number of rows in the pingProbeHistoryTable reaches the value specified by pingCtlMaxRows for the corresponding entry in the pingCtlTable. An implementation MUST start assigning pingProbeHistoryIndex values at 1 and wrap after exceeding the maximum possible value, as defined by the limit of this object ('ffffffff'h).

3.2. Traceroute MIB

The DISMAN-TRACEROUTE-MIB consists of the following components:

- traceRouteMaxConcurrentRequests
- traceRouteCtlTable
- traceRouteResultsTable
- traceRouteProbeHistoryTable
- traceRouteHopsTable

3.2.1. traceRouteMaxConcurrentRequests

The object traceRouteMaxConcurrentRequests enables control of the maximum number of concurrent active requests that an agent implementation supports. It is permissible for an agent either to limit the maximum upper range allowed for this object or to implement this object as read-only with an implementation limit expressed as its value.

3.2.2. traceRouteCtlTable

A remote traceroute test is started by setting traceRouteCtlAdminStatus to enabled(1). The corresponding traceRouteCtlEntry MUST have been created, and its traceRouteCtlRowStatus set to active(1), prior to starting the test. A single SNMP PDU can be used to create and start a remote traceroute

test. Within the PDU, traceRouteCtlTargetAddress should be set to the target host's address (traceRouteCtlTargetAddressType will default to ipv4(1)), traceRouteCtlAdminStatus to enabled(1), and traceRouteCtlRowStatus to createAndGo(4).

The first index element, traceRouteCtlOwnerIndex, is of type SnmpAdminString, a textual convention that allows for use of the SNMPv3 View-Based Access Control Model (RFC 3415 [RFC3415], VACM) and that allows a management application to identify its entries. The second index, traceRouteCtlTestName (also an SnmpAdminString), enables the same management application to have multiple requests outstanding.

Traceroute has a much longer theoretical maximum time for completion than ping: basically, 42 hours and 30 minutes (the product of traceRouteCtlTimeOut, traceRouteCtlProbesPerHop, and traceRouteCtlMaxTtl) plus some network transit time! Use of the defaults defined within an traceRouteCtlEntry yields a maximum of 4 minutes and 30 seconds for a default traceroute operation. Clearly, 42 plus hours is too long to wait for a traceroute operation to be completed.

The maximum Time to Live (TTL) value in effect for traceroute determines how long the traceroute function will keep increasing the TTL value in the probe it transmits, hoping to reach the target host. The function ends whenever the maximum TTL is exceeded or the target host is reached. The object traceRouteCtlMaxFailures was created in order to impose a throttle for how long traceroute continues to increase the TTL field in a probe without receiving any kind of response (timeouts). It is RECOMMENDED that agent implementations impose a time limit for how long it allows a traceroute operation to take, relative to how the function is implemented. For example, an implementation that can't process multiple traceroute operations at the same time SHOULD impose a shorter maximum allowed time period.

A management application can delete an active remote traceroute request by setting the corresponding traceRouteCtlRowStatus object to destroy(6).

The contents of the traceRouteCtlTable are preserved across reIPLs (Initial Program Loads) of its agent according to the values of each of the traceRouteCtlStorageType objects.

3.2.3. traceRouteResultsTable

An entry in the traceRouteResultsTable is created upon determining the results of a specific traceroute operation. Entries in this table relate back to the traceRouteCtlEntry that caused the

corresponding traceroute operation to occur. The objects traceRouteResultsCurHopCount and traceRouteResultsCurProbeCount can be examined to determine how far the current remote traceroute operation has reached.

3.2.4. traceRouteProbeHistoryTable

The results of past traceroute probes can be stored in this table on a per-traceRouteCtlEntry basis. This table is initially indexed by traceRouteCtlOwnerIndex and traceRouteCtlTestName so that the results of a probe relate to the traceRouteCtlEntry that caused it. The number of entries stored in this table per traceRouteCtlEntry is determined by the value of traceRouteCtlMaxRows.

An implementation of this MIB will remove the oldest entry in the traceRouteProbeHistoryTable of the corresponding entry in the traceRouteCtlTable to allow the addition of an new entry once the number of rows in the traceRouteProbeHistoryTable reaches the value of traceRouteCtlMaxRows for the corresponding entry in the traceRouteCtlTable. An implementation MUST start assigning traceRouteProbeHistoryIndex values at 1 and wrap after exceeding the maximum possible value, as defined by the limit of this object ('ffffffff'h).

3.2.5. traceRouteHopsTable

The current traceroute path can be stored in this table on a per-traceRouteCtlEntry basis. This table is initially indexed by traceRouteCtlOwnerIndex and traceRouteCtlTestName so that a traceroute path relates to the traceRouteCtlEntry that caused it. A third index, traceRouteHopsHopIndex, enables keeping one traceRouteHopsEntry per traceroute hop. Creation of traceRouteHopsTable entries is enabled by setting the corresponding traceRouteCtlCreateHopsEntries object to true(1).

3.3. Lookup MIB

The DISMAN-NSLOOKUP-MIB consists of the following components:

- lookupMaxConcurrentRequests and lookupPurgeTime
- lookupCtlTable
- lookupResultsTable

3.3.1. lookupMaxConcurrentRequests and lookupPurgeTime

The object lookupMaxConcurrentRequests enables control of the maximum number of concurrent active requests that an agent implementation is structured to support. It is permissible for an agent either to limit the maximum upper range allowed for this object or to implement this object as read-only with an implementation limit expressed as its value.

The object lookupPurgeTime provides a method for entries in the lookupCtlTable and lookupResultsTable to be automatically deleted after the corresponding operation is completed.

3.3.2. lookupCtlTable

A remote lookup operation is initiated by performing an SNMP SET request on lookupCtlRowStatus. A single SNMP PDU can be used to create and start a remote lookup operation. Within the PDU, lookupCtlTargetAddress should be set to the entity to be resolved (lookupCtlTargetAddressType will default to ipv4(1)) and lookupCtlRowStatus to createAndGo(4). The object lookupCtlOperStatus can be examined to determine the state of a lookup operation. A management application can delete an active remote lookup request by setting the corresponding lookupCtlRowStatus object to destroy(6).

An lookupCtlEntry is initially indexed by lookupCtlOwnerIndex, which is a type of SnmpAdminString, a textual convention that allows for use of the SNMPv3 View-Based Access Control Model (RFC 3415 [RFC3415],

VACM) and that also allows for a management application to identify its entries. The lookupCtlOwnerIndex portion of the index is then followed by lookupCtlOperationName. The lookupCtlOperationName index enables the same lookupCtlOwnerIndex entity to have multiple outstanding requests.

The value of lookupCtlTargetAddressType determines which lookup function to perform. Specification of dns(16) as the value of this index implies that a function such as getaddrinfo() or gethostbyname() should be performed to determine the numeric addresses associated with a symbolic name via lookupResultsTable entries. Use of a value of either ipv4(1) or ipv6(2) implies that a function such as getnameinfo() or gethostbyaddr() should be performed to determine the symbolic name(s) associated with a numeric address at a remote host.

3.3.3. lookupResultsTable

The lookupResultsTable is used to store the results of lookup operations. Results to be reported here SHOULD be results of a lookup function that is commonly used by applications at the managed node. This implies that results are not necessarily consistent with the results of a pure DNS lookup at the managed node, but may be influenced by local lookup tables or other sources of information, depending on the configuration of the managed node.

The lookupResultsTable is initially indexed by the same index elements that the lookupCtlTable contains (lookupCtlOwnerIndex and lookupCtlOperationName) but has a third index element, lookupResultsIndex (Unsigned32 textual convention), in order to associate multiple results with the same lookupCtlEntry.

A remote host can be multi-homed and can have multiple symbolic (DNS) names. Therefore, a lookup operation can return multiple IP addresses and multiple symbolic names.

If the lookup operation was performed for a certain address by using getnameinfo() or gethostbyaddr(), for example, then entries in the lookupResultsTable MUST be made for each host name returned. If the lookup operation identifies one hostname as the host's 'official host name', then this name MUST be assigned a lookupResultsIndex of 1.

If a lookup operation was performed for a certain symbolic name by using getaddrinfo() or gethostbyname(), for example, then entries in the lookupResultsTable MUST be made for each address returned. The entries MUST be stored in the order that they are retrieved. Values assigned to lookupResultsIndex MUST start at 1 and increase in order.

An implementation SHOULD NOT retain SNMP-created entries in the lookupResultsTable across reIPLs (Initial Program Loads) of its agent, since management applications need to see consistent behavior with respect to the persistence of the table entries that they create.

3.4. Conformance

Each of the three MIB modules defined in this document has two current compliance statements, one for full compliance and one for minimum compliance. The minimum compliance statements are intended to be applied to implementation for devices with very limited resources. The main difference between full and minimum compliance is that for minimum compliance, dynamic creation and deletion of table entries is not required, whereas it is required for full compliance.

In addition, the DISMAN-PING-MIB module and the DISMAN-TRACEROUTE-MIB modules each have a deprecated compliance statement that was current in RFC 2925. Semantically, the new full compliance statements are identical to the deprecated ones. But some of the object groups used in the old compliance statements needed to be split in order to support the new minimal compliance statements.

4. Definitions

The following MIB modules import from [RFC2863], [RFC3411], and [RFC4001]. They also use the REFERENCE clause to reference [RFC1812], [RFC2474], and [RFC3260].

4.1. DISMAN-PING-MIB

```
DISMAN-PING-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, Integer32,
    Unsigned32, Gauge32, mib-2,
    NOTIFICATION-TYPE, OBJECT-IDENTITY
        FROM SNMPv2-SMI                   -- RFC2578
    TEXTUAL-CONVENTION, RowStatus,
    StorageType, DateAndTime, TruthValue
        FROM SNMPv2-TC                    -- RFC2579
    MODULE-COMPLIANCE, OBJECT-GROUP,
    NOTIFICATION-GROUP
        FROM SNMPv2-CONF                  -- RFC2580
    InterfaceIndexOrZero                  -- RFC2863
        FROM IF-MIB
    SnmpAdminString
        FROM SNMP-FRAMEWORK-MIB           -- RFC3411
    InetAddressType, InetAddress
        FROM INET-ADDRESS-MIB;            -- RFC4001

 pingMIB MODULE-IDENTITY
    LAST-UPDATED "200606130000Z"          -- 13 June 2006
    ORGANIZATION "IETF Distributed Management Working Group"
    CONTACT-INFO
        "Juergen Quittek

        NEC Europe Ltd.
        Network Laboratories
        Kurfuersten-Anlage 36
        69115 Heidelberg
        Germany

        Phone: +49 6221 4342-115
```

```
           Email: quittek@netlab.nec.de"
       DESCRIPTION
           "The Ping MIB (DISMAN-PING-MIB) provides the capability of
           controlling the use of the ping function at a remote
           host.

           Copyright (C) The Internet Society (2006).  This version of
           this MIB module is part of RFC 4560; see the RFC itself for
           full legal notices."

        --  Revision history

        REVISION     "200606130000Z"         -- 13 June 2006
        DESCRIPTION
            "Updated version, published as RFC 4560.
                - Correctly considered IPv6 in DESCRIPTION
                  clause of pingCtlDataSize
                - Replaced references to RFC 2575 by RFC 3415
                - Replaced references to RFC 2571 by RFC 3411
                - Replaced references to RFC 2851 by RFC 4001
                - Added DEFVAL { {} } to definition of
                  pingCtlTrapGeneration
                - Changed DEFVAL of object pingCtlDescr from
                  DEFVAL { '00'H } to DEFVAL { ''H }
                - Changed DEFVAL of object pingCtlSourceAddressType
                  from DEFVAL { ipv4 } to DEFVAL { unknown }
                - Extended DESCRIPTION clause of pingResultsTable
                  describing re-initialization of entries
                - Changed SYNTAX of pingResultsProbeResponses and
                  pingResultsSentProbes from Unsigned32 to Gauge32
                - Changed status of pingCompliance to deprecated
                - Added pingFullCompliance and pingMinimumCompliance
                - Changed status of pingGroup and pingTimeStampGroup
                  to deprecated
                - Added pingMinimumGroup, pingCtlRowStatusGroup,
                  and pingHistoryGroup"

        REVISION     "200009210000Z"         -- 21 September 2000
        DESCRIPTION
            "Initial version, published as RFC 2925."

       ::= { mib-2 80 }

    -- Textual Conventions

     OperationResponseStatus ::= TEXTUAL-CONVENTION
       STATUS  current
       DESCRIPTION
```

```
          "Used to report the result of an operation:

           responseReceived(1) - Operation is completed successfully.
           unknown(2) - Operation failed due to unknown error.
           internalError(3) - An implementation detected an error
                in its own processing that caused an operation
                to fail.
           requestTimedOut(4) - Operation failed to receive a
                valid reply within the time limit imposed on it.
           unknownDestinationAddress(5) - Invalid destination
                address.
           noRouteToTarget(6) - Could not find a route to target.
           interfaceInactiveToTarget(7) - The interface to be
                used in sending a probe is inactive, and an
                alternate route does not exist.
           arpFailure(8) - Unable to resolve a target address to a
                media-specific address.
           maxConcurrentLimitReached(9) - The maximum number of
                concurrent active operations would have been exceeded
                if the corresponding operation was allowed.
           unableToResolveDnsName(10) - The DNS name specified was
                unable to be mapped to an IP address.
           invalidHostAddress(11) - The IP address for a host
                has been determined to be invalid.  Examples of this
                are broadcast or multicast addresses."
      SYNTAX INTEGER {
                  responseReceived(1),
                  unknown(2),
                  internalError(3),
                  requestTimedOut(4),
                  unknownDestinationAddress(5),
                  noRouteToTarget(6),
                  interfaceInactiveToTarget(7),
                  arpFailure(8),
                  maxConcurrentLimitReached(9),
                  unableToResolveDnsName(10),
                  invalidHostAddress(11)
                }

    -- Top level structure of the MIB

    pingNotifications             OBJECT IDENTIFIER ::= { pingMIB 0 }
    pingObjects                   OBJECT IDENTIFIER ::= { pingMIB 1 }
    pingConformance               OBJECT IDENTIFIER ::= { pingMIB 2 }


    -- The registration node (point) for ping implementation types
```

```
    pingImplementationTypeDomains  OBJECT IDENTIFIER ::= { pingMIB 3 }

    pingIcmpEcho OBJECT-IDENTITY
       STATUS      current
       DESCRIPTION
           "Indicates that an implementation is using the Internet
           Control Message Protocol (ICMP) 'ECHO' facility."
       ::= { pingImplementationTypeDomains 1 }

    pingUdpEcho OBJECT-IDENTITY
       STATUS      current
       DESCRIPTION
           "Indicates that an implementation is using the UDP echo
           port (7)."

       REFERENCE
           "RFC 862, 'Echo Protocol'."
       ::= { pingImplementationTypeDomains 2 }

    pingSnmpQuery OBJECT-IDENTITY
       STATUS      current
       DESCRIPTION
           "Indicates that an implementation is using an SNMP query
            to calculate a round trip time."
       ::= { pingImplementationTypeDomains 3 }

    pingTcpConnectionAttempt OBJECT-IDENTITY
       STATUS      current
       DESCRIPTION
           "Indicates that an implementation is attempting to
           connect to a TCP port in order to calculate a round
           trip time."
       ::= { pingImplementationTypeDomains 4 }


    -- Simple Object Definitions

    pingMaxConcurrentRequests OBJECT-TYPE
       SYNTAX      Unsigned32
       UNITS       "requests"
       MAX-ACCESS  read-write
       STATUS      current
       DESCRIPTION
          "The maximum number of concurrent active ping requests
          that are allowed within an agent implementation.  A value
          of 0 for this object implies that there is no limit for
          the number of concurrent active requests in effect.
```

```
          The limit applies only to new requests being activated.
          When a new value is set, the agent will continue processing
          all the requests already active, even if their number
          exceeds the limit just imposed."
       DEFVAL { 10 }
       ::= { pingObjects 1 }

    -- Ping Control Table

    pingCtlTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF PingCtlEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines the ping Control Table for providing, via SNMP,
           the capability of performing ping operations at
           a remote host.  The results of these operations are
           stored in the pingResultsTable and the
           pingProbeHistoryTable."
      ::= { pingObjects 2 }

    pingCtlEntry OBJECT-TYPE
       SYNTAX      PingCtlEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines an entry in the pingCtlTable.  The first index
           element, pingCtlOwnerIndex, is of type SnmpAdminString,
           a textual convention that allows for use of the SNMPv3
           View-Based Access Control Model (RFC 3415, VACM)
           and that allows a management application to identify its
           entries.  The second index, pingCtlTestName (also an
           SnmpAdminString), enables the same management
           application to have multiple outstanding requests."
       INDEX {
                pingCtlOwnerIndex,
                pingCtlTestName
             }
       ::= { pingCtlTable 1 }

    PingCtlEntry ::=
       SEQUENCE {
           pingCtlOwnerIndex             SnmpAdminString,
           pingCtlTestName               SnmpAdminString,
           pingCtlTargetAddressType      InetAddressType,
           pingCtlTargetAddress          InetAddress,
           pingCtlDataSize               Unsigned32,
           pingCtlTimeOut                Unsigned32,
```

```
            pingCtlProbeCount             Unsigned32,
            pingCtlAdminStatus            INTEGER,
            pingCtlDataFill               OCTET STRING,
            pingCtlFrequency              Unsigned32,
            pingCtlMaxRows                Unsigned32,
            pingCtlStorageType            StorageType,
            pingCtlTrapGeneration         BITS,
            pingCtlTrapProbeFailureFilter Unsigned32,
            pingCtlTrapTestFailureFilter  Unsigned32,
            pingCtlType                   OBJECT IDENTIFIER,
            pingCtlDescr                  SnmpAdminString,
            pingCtlSourceAddressType      InetAddressType,
            pingCtlSourceAddress          InetAddress,
            pingCtlIfIndex                InterfaceIndexOrZero,
            pingCtlByPassRouteTable       TruthValue,
            pingCtlDSField                Unsigned32,
            pingCtlRowStatus              RowStatus
         }

      pingCtlOwnerIndex OBJECT-TYPE
         SYNTAX      SnmpAdminString (SIZE(0..32))
         MAX-ACCESS  not-accessible
         STATUS      current
         DESCRIPTION
            "To facilitate the provisioning of access control by a
            security administrator using the View-Based Access
            Control Model (RFC 2575, VACM) for tables in which
            multiple users may need to create or
            modify entries independently, the initial index is used
            as an 'owner index'.  Such an initial index has a syntax
            of SnmpAdminString and can thus be trivially mapped to a
            securityName or groupName defined in VACM, in
            accordance with a security policy.

            When used in conjunction with such a security policy, all
            entries in the table belonging to a particular user (or
            group) will have the same value for this initial index.
            For a given user's entries in a particular table, the
            object identifiers for the information in these entries
            will have the same subidentifiers (except for the 'column'
            subidentifier) up to the end of the encoded owner index.
            To configure VACM to permit access to this portion of the
            table, one would create vacmViewTreeFamilyTable entries
            with the value of vacmViewTreeFamilySubtree including
            the owner index portion, and vacmViewTreeFamilyMask
            'wildcarding' the column subidentifier.  More elaborate
            configurations are possible."
         ::= { pingCtlEntry 1 }
```

```
    pingCtlTestName OBJECT-TYPE
       SYNTAX      SnmpAdminString (SIZE(0..32))
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "The name of the ping test.  This is locally unique, within
           the scope of a pingCtlOwnerIndex."
       ::= { pingCtlEntry 2 }

    pingCtlTargetAddressType OBJECT-TYPE
       SYNTAX      InetAddressType
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Specifies the type of host address to be used at a remote
           host for performing a ping operation."
       DEFVAL { unknown }
       ::= { pingCtlEntry 3 }

    pingCtlTargetAddress OBJECT-TYPE

       SYNTAX      InetAddress
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Specifies the host address to be used at a remote host for
           performing a ping operation.  The host address type is
           determined by the value of the corresponding
           pingCtlTargetAddressType.

           A value for this object MUST be set prior to transitioning
           its corresponding pingCtlEntry to active(1) via
           pingCtlRowStatus."
       DEFVAL { ''H }
       ::= { pingCtlEntry 4 }

    pingCtlDataSize OBJECT-TYPE
       SYNTAX      Unsigned32 (0..65507)
       UNITS       "octets"
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Specifies the size of the data portion to be
           transmitted in a ping operation, in octets.  Whether this
           value can be applied depends on the selected
           implementation method for performing a ping operation,
           indicated by pingCtlType in the same conceptual row.
           If the method used allows applying the value contained
```

```
            in this object, then it MUST be applied.  If the specified
            size is not appropriate for the chosen ping method, the
            implementation SHOULD use whatever size (appropriate to
            the method) is closest to the specified size.

            The maximum value for this object was computed by
            subtracting the smallest possible IP header size of
            20 octets (IPv4 header with no options) and the UDP
            header size of 8 octets from the maximum IP packet size.
            An IP packet has a maximum size of 65535 octets
            (excluding IPv6 Jumbograms)."
        DEFVAL { 0 }
        ::= { pingCtlEntry 5 }

    pingCtlTimeOut OBJECT-TYPE
        SYNTAX      Unsigned32 (1..60)
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the time-out value, in seconds, for a
            remote ping operation."
        DEFVAL { 3 }

        ::= { pingCtlEntry 6 }

    pingCtlProbeCount OBJECT-TYPE
        SYNTAX      Unsigned32 (1..15)
        UNITS       "probes"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the number of times to perform a ping
            operation at a remote host as part of a single ping test."
        DEFVAL { 1 }
        ::= { pingCtlEntry 7 }

    pingCtlAdminStatus OBJECT-TYPE
        SYNTAX      INTEGER {
                              enabled(1), -- test should be started
                              disabled(2) -- test should be stopped
                            }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Reflects the desired state that a pingCtlEntry should be
            in:
```

```
                enabled(1)  - Attempt to activate the test as defined by
                              this pingCtlEntry.
                disabled(2) - Deactivate the test as defined by this
                              pingCtlEntry.

            Refer to the corresponding pingResultsOperStatus to
            determine the operational state of the test defined by
            this entry."
         DEFVAL { disabled }
        ::= { pingCtlEntry 8 }

    pingCtlDataFill  OBJECT-TYPE
        SYNTAX      OCTET STRING (SIZE(0..1024))
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The content of this object is used together with the
            corresponding pingCtlDataSize value to determine how to
            fill the data portion of a probe packet.  The option of
            selecting a data fill pattern can be useful when links
            are compressed or have data pattern sensitivities.  The
            contents of pingCtlDataFill should be repeated in a ping
            packet when the size of the data portion of the ping
            packet is greater than the size of pingCtlDataFill."
        DEFVAL { '00'H }
        ::= { pingCtlEntry 9 }

    pingCtlFrequency  OBJECT-TYPE
        SYNTAX      Unsigned32
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The number of seconds to wait before repeating a ping test
            as defined by the value of the various objects in the
            corresponding row.

            A single ping test consists of a series of ping probes.
            The number of probes is determined by the value of the
            corresponding pingCtlProbeCount object.  After a single
            test is completed the number of seconds as defined by the
            value of pingCtlFrequency MUST elapse before the
            next ping test is started.

            A value of 0 for this object implies that the test
            as defined by the corresponding entry will not be
            repeated."
        DEFVAL { 0 }
```

```
       ::= { pingCtlEntry 10 }

    pingCtlMaxRows OBJECT-TYPE
       SYNTAX      Unsigned32
       UNITS       "rows"
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "The maximum number of corresponding entries allowed
           in the pingProbeHistoryTable.  An implementation of this
           MIB will remove the oldest corresponding entry in the
           pingProbeHistoryTable to allow the addition of an
           new entry once the number of corresponding rows in the
           pingProbeHistoryTable reaches this value.

           Old entries are not removed when a new test is
           started.  Entries are added to the pingProbeHistoryTable
           until pingCtlMaxRows is reached before entries begin to
           be removed.

           A value of 0 for this object disables creation of
           pingProbeHistoryTable entries."
       DEFVAL      { 50 }
       ::= { pingCtlEntry 11 }

    pingCtlStorageType OBJECT-TYPE
       SYNTAX      StorageType
       MAX-ACCESS  read-create
       STATUS      current

       DESCRIPTION
           "The storage type for this conceptual row.
           Conceptual rows having the value 'permanent' need not
           allow write-access to any columnar objects in the row."
       DEFVAL { nonVolatile }
       ::= { pingCtlEntry 12 }

    pingCtlTrapGeneration OBJECT-TYPE
       SYNTAX      BITS {
                      probeFailure(0),
                      testFailure(1),
                      testCompletion(2)
                    }
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "The value of this object determines when and whether
           to generate a notification for this entry:
```

```
            probeFailure(0)   - Generate a pingProbeFailed
                notification subject to the value of
                pingCtlTrapProbeFailureFilter.  The object
                pingCtlTrapProbeFailureFilter can be used
                to specify the number of consecutive probe
                failures that are required before a
                pingProbeFailed notification can be generated.
            testFailure(1)    - Generate a pingTestFailed
                notification.  In this instance the object
                pingCtlTrapTestFailureFilter can be used to
                determine the number of probe failures that
                signal when a test fails.
            testCompletion(2) - Generate a pingTestCompleted
                notification.

            By default, no bits are set, indicating that
            none of the above options is selected."
        DEFVAL { {} }  -- no bits set.
        ::= { pingCtlEntry 13 }

    pingCtlTrapProbeFailureFilter OBJECT-TYPE
        SYNTAX      Unsigned32 (0..15)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The value of this object is used to determine when
            to generate a pingProbeFailed NOTIFICATION.

            Setting BIT probeFailure(0) of object
            pingCtlTrapGeneration to '1' implies that a
            pingProbeFailed NOTIFICATION is generated only when

            a number of consecutive ping probes equal to the
            value of pingCtlTrapProbeFailureFilter fail within
            a given ping test.  After triggering the notification,
            the probe failure counter is reset to zero."
        DEFVAL { 1 }
        ::= { pingCtlEntry 14 }

    pingCtlTrapTestFailureFilter OBJECT-TYPE
        SYNTAX      Unsigned32 (0..15)
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The value of this object is used to determine when
            to generate a pingTestFailed NOTIFICATION.

            Setting BIT testFailure(1) of object
```

```
            pingCtlTrapGeneration to '1' implies that a
            pingTestFailed NOTIFICATION is generated only when
            a number of consecutive ping tests equal to the
            value of pingCtlTrapProbeFailureFilter fail.
            After triggering the notification, the test failure
            counter is reset to zero."
        DEFVAL { 1 }
        ::= { pingCtlEntry 15 }

    pingCtlType OBJECT-TYPE
        SYNTAX      OBJECT IDENTIFIER
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The value of this object is used either to report or
            to select the implementation method to be used for
            calculating a ping response time.  The value of this
            object MAY be selected from pingImplementationTypeDomains.

            Additional implementation types SHOULD be allocated as
            required by implementers of the DISMAN-PING-MIB under
            their enterprise-specific registration point and not
            beneath pingImplementationTypeDomains."
        DEFVAL { pingIcmpEcho }
        ::= { pingCtlEntry 16 }

    pingCtlDescr OBJECT-TYPE
        SYNTAX      SnmpAdminString
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The purpose of this object is to provide a
            descriptive name of the remote ping test."
        DEFVAL { ''H }

        ::= { pingCtlEntry 17 }

    pingCtlSourceAddressType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the type of the source address,
            pingCtlSourceAddress, to be used at a remote host
            when a ping operation is performed."
        DEFVAL { unknown }
        ::= { pingCtlEntry 18 }
```

```
     pingCtlSourceAddress OBJECT-TYPE
       SYNTAX      InetAddress
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Use the specified IP address (which must be given in
           numeric form, not as a hostname) as the source address
           in outgoing probe packets.  On hosts with more than one
           IP address, this option can be used to select the address
           to be used.  If the IP address is not one of this
           machine's interface addresses, an error is returned and
           nothing is sent.  A zero-length octet string value for
           this object disables source address specification.

           The address type (InetAddressType) that relates to
           this object is specified by the corresponding value
           of pingCtlSourceAddressType."
       DEFVAL { ''H }
       ::= { pingCtlEntry 19 }

    pingCtlIfIndex OBJECT-TYPE
       SYNTAX      InterfaceIndexOrZero
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Setting this object to an interface's ifIndex prior
           to starting a remote ping operation directs
           the ping probes to be transmitted over the
           specified interface.  A value of zero for this object
           means that this option is not enabled."
       DEFVAL { 0 }
       ::= { pingCtlEntry 20 }

    pingCtlByPassRouteTable OBJECT-TYPE
       SYNTAX      TruthValue
       MAX-ACCESS  read-create
       STATUS      current

       DESCRIPTION
          "The purpose of this object is to enable optional
          bypassing the route table.  If enabled, the remote
          host will bypass the normal routing tables and send
          directly to a host on an attached network.  If the
          host is not on a directly attached network, an
          error is returned.  This option can be used to perform
          the ping operation to a local host through an
          interface that has no route defined (e.g., after the
          interface was dropped by the routing daemon at the host)."
```

```
       DEFVAL { false }
       ::= { pingCtlEntry 21 }

    pingCtlDSField OBJECT-TYPE
       SYNTAX      Unsigned32 (0..255)
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Specifies the value to store in the Type of Service
           (TOS) octet in the IPv4 header or in the Traffic
           Class octet in the IPv6 header, respectively, of the
           IP packet used to encapsulate the ping probe.

           The octet to be set in the IP header contains the
           Differentiated Services (DS) Field in the six most
           significant bits.

           This option can be used to determine what effect an
           explicit DS Field setting has on a ping response.
           Not all values are legal or meaningful.  A value of 0
           means that the function represented by this option is
           not supported.  DS Field usage is often not supported
           by IP implementations, and not all values are supported.
           Refer to RFC 2474 and RFC 3260 for guidance on usage of
           this field."
       REFERENCE
           "Refer to RFC 1812 for the definition of the IPv4 TOS
           octet and to RFC 2460 for the definition of the IPv6
           Traffic Class octet.  Refer to RFC 2474 and RFC 3260
           for the definition of the Differentiated Services Field."
       DEFVAL { 0 }
       ::= { pingCtlEntry 22 }

    pingCtlRowStatus OBJECT-TYPE
       SYNTAX      RowStatus
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "This object allows entries to be created and deleted
           in the pingCtlTable.  Deletion of an entry in this
           table results in the deletion of all corresponding (same
           pingCtlOwnerIndex and pingCtlTestName index values)
           pingResultsTable and pingProbeHistoryTable entries.

           A value MUST be specified for pingCtlTargetAddress
           prior to acceptance of a transition to active(1) state.

           When a value for pingCtlTargetAddress is set,
```

```
            the value of object pingCtlRowStatus changes
            from notReady(3) to notInService(2).

            Activation of a remote ping operation is controlled
            via pingCtlAdminStatus, not by changing
            this object's value to active(1).

            Transitions in and out of active(1) state are not
            allowed while an entry's pingResultsOperStatus is
            active(1), with the exception that deletion of
            an entry in this table by setting its RowStatus
            object to destroy(6) will stop an active
            ping operation.

            The operational state of a ping operation
            can be determined by examination of its
            pingResultsOperStatus object."
        REFERENCE
            "See definition of RowStatus in RFC 2579, 'Textual
            Conventions for SMIv2.'"
        ::= { pingCtlEntry 23 }

    -- Ping Results Table

     pingResultsTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF PingResultsEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Defines the Ping Results Table for providing
            the capability of performing ping operations at
            a remote host.  The results of these operations are
            stored in the pingResultsTable and the pingProbeHistoryTable.

            An entry is added to the pingResultsTable when an
            pingCtlEntry is started by successful transition
            of its pingCtlAdminStatus object to enabled(1).

            If the object pingCtlAdminStatus already has the value
            enabled(1), and if the corresponding pingResultsOperStatus
            object has the value completed(3), then successfully writing
            enabled(1) to object pingCtlAdminStatus re-initializes the
            already existing entry in the pingResultsTable.  The values
            of objects in the re-initialized entry are the same as the
            values of objects in a new entry would be.

            An entry is removed from the pingResultsTable when
            its corresponding pingCtlEntry is deleted."
```

```
      ::= { pingObjects 3 }

    pingResultsEntry OBJECT-TYPE
       SYNTAX      PingResultsEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines an entry in the pingResultsTable.  The
           pingResultsTable has the same indexing as the
           pingCtlTable so that a pingResultsEntry
           corresponds to the pingCtlEntry that caused it to
           be created."
       INDEX {
                pingCtlOwnerIndex,
                pingCtlTestName
             }
       ::= { pingResultsTable 1 }

    PingResultsEntry ::=
       SEQUENCE {
           pingResultsOperStatus          INTEGER,
           pingResultsIpTargetAddressType InetAddressType,
           pingResultsIpTargetAddress     InetAddress,
           pingResultsMinRtt              Unsigned32,
           pingResultsMaxRtt              Unsigned32,
           pingResultsAverageRtt          Unsigned32,
           pingResultsProbeResponses      Gauge32,
           pingResultsSentProbes          Gauge32,
           pingResultsRttSumOfSquares     Unsigned32,
           pingResultsLastGoodProbe       DateAndTime
        }

    pingResultsOperStatus OBJECT-TYPE
       SYNTAX      INTEGER {
                             enabled(1),   -- test is in progress
                             disabled(2),  -- test has stopped
                             completed(3)  -- test is completed
                           }
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "Reflects the operational state of a pingCtlEntry:

              enabled(1)    - Test is active.
              disabled(2)   - Test has stopped.
              completed(3)  - Test is completed."
       ::= { pingResultsEntry 1 }
```

```
    pingResultsIpTargetAddressType OBJECT-TYPE
       SYNTAX      InetAddressType
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "This object indicates the type of address stored
           in the corresponding pingResultsIpTargetAddress
           object."
       DEFVAL { unknown }
       ::= { pingResultsEntry 2 }

    pingResultsIpTargetAddress OBJECT-TYPE
       SYNTAX      InetAddress
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "This object reports the IP address associated
           with a pingCtlTargetAddress value when the destination
           address is specified as a DNS name.  The value of
           this object should be a zero-length octet string
           when a DNS name is not specified or when a
           specified DNS name fails to resolve.

           The address type (InetAddressType) that relates to
           this object is specified by the corresponding value
           of pingResultsIpTargetAddressType."
       DEFVAL { ''H }
       ::= { pingResultsEntry 3 }

    pingResultsMinRtt OBJECT-TYPE
       SYNTAX      Unsigned32
       UNITS       "milliseconds"
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "The minimum ping round-trip-time (RTT) received.  A value
           of 0 for this object implies that no RTT has been received."
       ::= { pingResultsEntry 4 }

    pingResultsMaxRtt OBJECT-TYPE
       SYNTAX      Unsigned32
       UNITS       "milliseconds"
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION

           "The maximum ping round-trip-time (RTT) received.  A value
           of 0 for this object implies that no RTT has been received."
```

```
      ::= { pingResultsEntry 5 }

    pingResultsAverageRtt OBJECT-TYPE
      SYNTAX      Unsigned32
      UNITS       "milliseconds"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
          "The current average ping round-trip-time (RTT)."
      ::= { pingResultsEntry 6 }

    pingResultsProbeResponses OBJECT-TYPE
      SYNTAX      Gauge32
      UNITS       "responses"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
          "Number of responses received for the corresponding
          pingCtlEntry and pingResultsEntry.  The value of this object
          MUST be reported as 0 when no probe responses have been
          received."
      ::= { pingResultsEntry 7 }

    pingResultsSentProbes OBJECT-TYPE
      SYNTAX      Gauge32
      UNITS       "probes"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
          "The value of this object reflects the number of probes sent
          for the corresponding pingCtlEntry and pingResultsEntry.
          The value of this object MUST be reported as 0 when no probes
          have been sent."
      ::= { pingResultsEntry 8 }

    pingResultsRttSumOfSquares OBJECT-TYPE
      SYNTAX      Unsigned32
      UNITS       "milliseconds"
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
          "This object contains the sum of the squares for all ping
          responses received.  Its purpose is to enable standard
          deviation calculation.  The value of this object MUST
          be reported as 0 when no ping responses have been
          received."
      ::= { pingResultsEntry 9 }
```

```
    pingResultsLastGoodProbe OBJECT-TYPE
       SYNTAX      DateAndTime
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "Date and time when the last response was received for
           a probe."
       ::= { pingResultsEntry 10 }

    -- Ping Probe History Table

    pingProbeHistoryTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF PingProbeHistoryEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines a table for storing the results of ping
           operations.  The number of entries in this table is
           limited per entry in the pingCtlTable by the value
           of the corresponding pingCtlMaxRows object.

           An entry in this table is created when the result of
           a ping probe is determined.  The initial 2 instance
           identifier index values identify the pingCtlEntry
           that a probe result (pingProbeHistoryEntry) belongs
           to.  An entry is removed from this table when
           its corresponding pingCtlEntry is deleted.

           An implementation of this MIB will remove the oldest
           entry in the pingProbeHistoryTable of the
           corresponding entry in the pingCtlTable to allow
           the addition of an new entry once the number of rows
           in the pingProbeHistoryTable reaches the value
           specified by pingCtlMaxRows for the corresponding
           entry in the pingCtlTable."
      ::= { pingObjects 4 }

    pingProbeHistoryEntry OBJECT-TYPE
       SYNTAX      PingProbeHistoryEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines an entry in the pingProbeHistoryTable.
           The first two index elements identify the
           pingCtlEntry that a pingProbeHistoryEntry belongs
           to.  The third index element selects a single
           probe result."
       INDEX {
```

```
                pingCtlOwnerIndex,
                pingCtlTestName,
                pingProbeHistoryIndex
              }
       ::= { pingProbeHistoryTable 1 }

    PingProbeHistoryEntry ::=
       SEQUENCE {
           pingProbeHistoryIndex         Unsigned32,
           pingProbeHistoryResponse      Unsigned32,
           pingProbeHistoryStatus        OperationResponseStatus,
           pingProbeHistoryLastRC        Integer32,
           pingProbeHistoryTime          DateAndTime
       }

    pingProbeHistoryIndex OBJECT-TYPE
       SYNTAX      Unsigned32 (1..'ffffffff'h)
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "An entry in this table is created when the result of
           a ping probe is determined.  The initial 2 instance
           identifier index values identify the pingCtlEntry
           that a probe result (pingProbeHistoryEntry) belongs
           to.

           An implementation MUST start assigning
           pingProbeHistoryIndex values at 1 and wrap after
           exceeding the maximum possible value as defined by
           the limit of this object ('ffffffff'h)."
       ::= { pingProbeHistoryEntry 1 }

    pingProbeHistoryResponse OBJECT-TYPE
       SYNTAX      Unsigned32
       UNITS       "milliseconds"
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "The amount of time measured in milliseconds from when
           a probe was sent to when its response was received or
           when it timed out.  The value of this object is reported
           as 0 when it is not possible to transmit a probe."
       ::= { pingProbeHistoryEntry 2 }

    pingProbeHistoryStatus OBJECT-TYPE
       SYNTAX      OperationResponseStatus
       MAX-ACCESS  read-only
       STATUS      current
```

```
       DESCRIPTION
           "The result of a particular probe done by a remote host."
       ::= { pingProbeHistoryEntry 3 }

    pingProbeHistoryLastRC        OBJECT-TYPE
       SYNTAX      Integer32
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "The last implementation-method-specific reply code received.
           If the ICMP Echo capability is being used, then a successful
           probe ends when an ICMP response is received that contains
           the code ICMP_ECHOREPLY(0).  The ICMP codes are maintained
           by IANA.  Standardized ICMP codes are listed at
           http://www.iana.org/assignments/icmp-parameters.
           The ICMPv6 codes are listed at
           http://www.iana.org/assignments/icmpv6-parameters."
       ::= { pingProbeHistoryEntry 4 }

    pingProbeHistoryTime OBJECT-TYPE
       SYNTAX      DateAndTime
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "Timestamp for when this probe result was determined."
       ::= { pingProbeHistoryEntry 5 }


    -- Notification Definition section

    pingProbeFailed NOTIFICATION-TYPE
         OBJECTS {
           pingCtlTargetAddressType,
           pingCtlTargetAddress,
           pingResultsOperStatus,
           pingResultsIpTargetAddressType,
           pingResultsIpTargetAddress,
           pingResultsMinRtt,
           pingResultsMaxRtt,
           pingResultsAverageRtt,
           pingResultsProbeResponses,
           pingResultsSentProbes,
           pingResultsRttSumOfSquares,
           pingResultsLastGoodProbe
         }
         STATUS  current
         DESCRIPTION
             "Generated when a probe failure is detected, when the
```

```
            corresponding pingCtlTrapGeneration object is set to
            probeFailure(0), subject to the value of
            pingCtlTrapProbeFailureFilter.  The object
            pingCtlTrapProbeFailureFilter can be used to specify the
            number of consecutive probe failures that are required
            before this notification can be generated."

        ::= { pingNotifications 1 }

    pingTestFailed NOTIFICATION-TYPE
        OBJECTS {
          pingCtlTargetAddressType,
          pingCtlTargetAddress,
          pingResultsOperStatus,
          pingResultsIpTargetAddressType,
          pingResultsIpTargetAddress,
          pingResultsMinRtt,
          pingResultsMaxRtt,
          pingResultsAverageRtt,
          pingResultsProbeResponses,
          pingResultsSentProbes,
          pingResultsRttSumOfSquares,
          pingResultsLastGoodProbe
        }
        STATUS  current
        DESCRIPTION
            "Generated when a ping test is determined to have failed,
            when the corresponding pingCtlTrapGeneration object is
            set to testFailure(1).  In this instance,
            pingCtlTrapTestFailureFilter should specify the number of
            probes in a test required to have failed in order to
            consider the test failed."
        ::= { pingNotifications 2 }

    pingTestCompleted NOTIFICATION-TYPE
        OBJECTS {
          pingCtlTargetAddressType,
          pingCtlTargetAddress,
          pingResultsOperStatus,
          pingResultsIpTargetAddressType,
          pingResultsIpTargetAddress,
          pingResultsMinRtt,
          pingResultsMaxRtt,
          pingResultsAverageRtt,
          pingResultsProbeResponses,
          pingResultsSentProbes,
          pingResultsRttSumOfSquares,
          pingResultsLastGoodProbe
```

```
        }
        STATUS  current
        DESCRIPTION
            "Generated at the completion of a ping test when the
            corresponding pingCtlTrapGeneration object has the
            testCompletion(2) bit set."
        ::= { pingNotifications 3 }

    -- Conformance information

    -- Compliance statements

    pingCompliances OBJECT IDENTIFIER ::= { pingConformance 1 }
    pingGroups      OBJECT IDENTIFIER ::= { pingConformance 2 }

    -- Compliance statements

    pingFullCompliance MODULE-COMPLIANCE
       STATUS  current
       DESCRIPTION
               "The compliance statement for SNMP entities that
               fully implement the DISMAN-PING-MIB."
       MODULE  -- this module
           MANDATORY-GROUPS {
                               pingMinimumGroup,
                               pingCtlRowStatusGroup,
                               pingHistoryGroup,
                               pingNotificationsGroup
                             }

           OBJECT pingMaxConcurrentRequests
           MIN-ACCESS  read-only
           DESCRIPTION
               "The agent is not required to support set
               operations to this object."

           OBJECT pingCtlStorageType
           MIN-ACCESS  read-only
           DESCRIPTION
               "Write access is not required."

           OBJECT pingCtlType
           MIN-ACCESS  read-only
           DESCRIPTION
               "Write access is not required.  In addition, the only
               value that MUST be supported by an implementation is
               pingIcmpEcho."
```

```
            OBJECT pingCtlSourceAddressType
            SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access to this object is not required by
                implementations that are not capable of binding the
                send socket with a source address.  An implementation
                is only required to support IPv4 and IPv6 addresses."

            OBJECT pingCtlSourceAddress
            SYNTAX  InetAddress (SIZE(0|4|16))
            MIN-ACCESS  read-only

            DESCRIPTION
                "Write access to this object is not required by
                implementations that are not capable of binding the
                send socket with a source address.  An implementation
                is only required to support IPv4 and IPv6 addresses."

            OBJECT pingCtlIfIndex
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  If write access is
                not supported, return a 0 as the value of this object.
                A value of 0 means that the function represented by
                this option is not supported."

            OBJECT pingCtlByPassRouteTable
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access to this object is not required by
                implementations that are not capable of its
                implementation.  The function represented by this
                object is implementable if the setsockopt
                SOL_SOCKET SO_DONTROUTE option is supported."

            OBJECT pingCtlDSField
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  If write access is
                not supported, return a 0 as the value of this object.
                A value of 0 means that the function represented by
                this option is not supported."

            OBJECT pingResultsIpTargetAddressType
            SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
            DESCRIPTION
                "An implementation is only required to
```

```
                support IPv4 and IPv6 addresses."

            OBJECT pingResultsIpTargetAddress
            SYNTAX  InetAddress (SIZE(0|4|16))
            DESCRIPTION
                "An implementation is only required to
                support IPv4 and globally unique IPv6 addresses."

            OBJECT pingResultsLastGoodProbe
            DESCRIPTION
                "This object is mandatory for implementations that have
                access to a system clock and that are capable of setting
                the values for DateAndTime objects.  It is RECOMMENDED
                that when this object is not supported its values
                be reported as '0000000000000000'H."

            OBJECT pingProbeHistoryTime
            DESCRIPTION
                "This object is mandatory for implementations that have
                access to a system clock and that are capable of setting
                the values for DateAndTime objects.  It is RECOMMENDED
                that when this object is not supported its values
                be reported as '0000000000000000'H."
        ::= { pingCompliances 2 }

    pingMinimumCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
                "The minimum compliance statement for SNMP entities
                that implement the minimal subset of the
                DISMAN-PING-MIB.  Implementors might choose this
                subset for small devices with limited resources."
        MODULE  -- this module
            MANDATORY-GROUPS { pingMinimumGroup }

            GROUP pingCtlRowStatusGroup
            DESCRIPTION
                "A compliant implementation does not have to implement
                the pingCtlRowStatusGroup."

            GROUP pingHistoryGroup
            DESCRIPTION
                "A compliant implementation does not have to implement
                the pingHistoryGroup."

            GROUP pingNotificationsGroup
            DESCRIPTION
                "A compliant implementation does not have to implement
```

```
            the pingNotificationsGroup."

        OBJECT pingMaxConcurrentRequests
        MIN-ACCESS  read-only
        DESCRIPTION
            "The agent is not required to support set
            operations to this object."

        OBJECT pingCtlDataFill
        MIN-ACCESS  read-only
        DESCRIPTION
            "The agent is not required to support set
            operations to this object."

        OBJECT pingCtlFrequency
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If write access is
            not supported, return a 0 as the value of this object.
            A value of 0 means that the function represented by
            this option is not supported."

        OBJECT pingCtlMaxRows
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If the
            pingHistoryGroup is not implemented, then write
            access to this object MUST be disabled, and the object
            MUST return a value of 0 when retrieved."

        OBJECT pingCtlStorageType
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required."

        OBJECT pingCtlTrapGeneration
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If the
            pingNotificationsGroup is not implemented, then write
            access to this object MUST be disabled, and the object
            MUST return a value with no bit set when retrieved.
            No bit set indicates that not notification is
            generated."

        OBJECT pingCtlTrapProbeFailureFilter
        MIN-ACCESS  read-only
        DESCRIPTION
```

```
            "If write access to pingCtlTrapGeneration is not
            supported, then write access to this object must also
            not be supported.  In this case, return 0 as the value
            of this object."

        OBJECT pingCtlTrapTestFailureFilter
        MIN-ACCESS  read-only
        DESCRIPTION
            "If write access to pingCtlTrapGeneration is not
            supported, then write access to this object must also
            not be supported.  In this case, return 0 as the value
            of this object."

        OBJECT pingCtlType
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  In addition, the only
            value that MUST be supported by an implementation is
            pingIcmpEcho."

        OBJECT pingCtlDescr
        MIN-ACCESS  read-only
        DESCRIPTION
            "The agent is not required to support set
            operations to this object."

        OBJECT pingCtlSourceAddressType
        SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access to this object is not required by
            implementations that are not capable of binding the
            send socket with a source address.  An implementation
            is only required to support IPv4 and IPv6 addresses."

        OBJECT pingCtlSourceAddress
        SYNTAX  InetAddress (SIZE(0|4|16))
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access to this object is not required by
            implementations that are not capable of binding the
            send socket with a source address.  An implementation
            is only required to support IPv4 and IPv6 addresses."

        OBJECT pingCtlIfIndex
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If write access is
```

```
            not supported, return a 0 as the value of this object.
            A value of 0 means that the function represented by
            this option is not supported."

        OBJECT pingCtlByPassRouteTable
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If write access is
            not supported, return false(2) as the value of this
            object.  A value of false(2) means that the function
            represented by this option is not supported."

        OBJECT pingCtlDSField
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If write access is
            not supported, return a 0 as the value of this object.
            A value of 0 means that the function represented by
            this option is not supported."

        OBJECT pingResultsIpTargetAddressType
        SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }

        DESCRIPTION
            "An implementation is only required to
            support IPv4 and IPv6 addresses."

        OBJECT pingResultsIpTargetAddress
        SYNTAX  InetAddress (SIZE(0|4|16))
        DESCRIPTION
            "An implementation is only required to
            support IPv4 and globally unique IPv6 addresses."

        OBJECT pingResultsLastGoodProbe
        DESCRIPTION
            "This object is mandatory for implementations that have
            access to a system clock and that are capable of setting
            the values for DateAndTime objects.  It is RECOMMENDED
            that when this object is not supported its values
            be reported as '0000000000000000'H."

        OBJECT pingProbeHistoryTime
        DESCRIPTION
            "If the pingHistoryGroup is implemented, then this
            object is mandatory for implementations that have
            access to a system clock and that are capable of setting
            the values for DateAndTime objects.  It is RECOMMENDED
            that when this object is not supported its values
```

```
                be reported as '0000000000000000'H."

        ::= { pingCompliances 3 }

    pingCompliance MODULE-COMPLIANCE
        STATUS  deprecated
        DESCRIPTION
                "The compliance statement for the DISMAN-PING-MIB.  This
                compliance statement has been deprecated because the
                group pingGroup and the pingTimeStampGroup have been
                split and deprecated.  The pingFullCompliance statement
                is semantically identical to the deprecated
                pingCompliance statement."

        MODULE  -- this module
            MANDATORY-GROUPS {
                               pingGroup,
                               pingNotificationsGroup
                             }
            GROUP pingTimeStampGroup
            DESCRIPTION
                "This group is mandatory for implementations that have
                access to a system clock and that are capable of setting
                the values for DateAndTime objects.  It is RECOMMENDED
                that when this group is not supported the values
                for the objects in this group be reported as
                '0000000000000000'H."

            OBJECT pingMaxConcurrentRequests
            MIN-ACCESS  read-only
            DESCRIPTION
                "The agent is not required to support set
                operations to this object."

            OBJECT pingCtlStorageType
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  It is also allowed
                that implementations support only the volatile
                StorageType enumeration."

            OBJECT pingCtlType
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  In addition, the only
                value that MUST be supported by an implementation is
                pingIcmpEcho."
```

```
            OBJECT pingCtlByPassRouteTable
            MIN-ACCESS  read-only
            DESCRIPTION
                "This object is not required by implementations that
                are not capable of its implementation.  The function
                represented by this object is implementable if the
                setsockopt SOL_SOCKET SO_DONTROUTE option is
                supported."

            OBJECT pingCtlSourceAddressType
            SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
            MIN-ACCESS  read-only
            DESCRIPTION
                "This object is not required by implementations that
                are not capable of binding the send socket with a
                source address.  An implementation is only required to
                support IPv4 and IPv6 addresses."

            OBJECT pingCtlSourceAddress
            SYNTAX  InetAddress (SIZE(0|4|16))
            MIN-ACCESS  read-only
            DESCRIPTION
                "This object is not required by implementations that
                are not capable of binding the send socket with a
                source address.  An implementation is only required to
                support IPv4 and globally unique IPv6 addresses."

            OBJECT pingCtlIfIndex
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  When write access is
                not supported, return a 0 as the value of this object.
                A value of 0 means that the function represented by
                this option is not supported."

            OBJECT pingCtlDSField
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  When write access is
                not supported, return a 0 as the value of this object.
                A value of 0 means that the function represented by
                this option is not supported."

            OBJECT pingResultsIpTargetAddressType
            SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
            DESCRIPTION
                "An implementation is only required to
                support IPv4 and IPv6 addresses."
```

```
            OBJECT pingResultsIpTargetAddress
            SYNTAX  InetAddress (SIZE(0|4|16))
            DESCRIPTION
                "An implementation is only required to
                support IPv4 and globally unique IPv6 addresses."
        ::= { pingCompliances 1 }

    -- MIB groupings

    pingMinimumGroup OBJECT-GROUP
      OBJECTS {
                pingMaxConcurrentRequests,
                pingCtlTargetAddressType,
                pingCtlTargetAddress,
                pingCtlDataSize,
                pingCtlTimeOut,
                pingCtlProbeCount,
                pingCtlAdminStatus,
                pingCtlDataFill,
                pingCtlFrequency,
                pingCtlMaxRows,
                pingCtlStorageType,
                pingCtlTrapGeneration,
                pingCtlTrapProbeFailureFilter,
                pingCtlTrapTestFailureFilter,
                pingCtlType,
                pingCtlDescr,

                pingCtlByPassRouteTable,
                pingCtlSourceAddressType,
                pingCtlSourceAddress,
                pingCtlIfIndex,
                pingCtlDSField,
                pingResultsOperStatus,
                pingResultsIpTargetAddressType,
                pingResultsIpTargetAddress,
                pingResultsMinRtt,
                pingResultsMaxRtt,
                pingResultsAverageRtt,
                pingResultsProbeResponses,
                pingResultsSentProbes,
                pingResultsRttSumOfSquares,
                pingResultsLastGoodProbe
              }
      STATUS  current
      DESCRIPTION
          "The group of objects that constitute the remote ping
          capability."
```

```
       ::= { pingGroups 4 }

    pingCtlRowStatusGroup OBJECT-GROUP
      OBJECTS {
                pingCtlRowStatus
              }
      STATUS  current
      DESCRIPTION
          "The RowStatus object of the pingCtlTable."
       ::= { pingGroups 5 }

    pingHistoryGroup OBJECT-GROUP
      OBJECTS {
                pingProbeHistoryResponse,
                pingProbeHistoryStatus,
                pingProbeHistoryLastRC,
                pingProbeHistoryTime
              }
      STATUS  current
      DESCRIPTION
          "The group of objects that constitute the history
          capability."
       ::= { pingGroups 6 }

    pingNotificationsGroup NOTIFICATION-GROUP
      NOTIFICATIONS {
                pingProbeFailed,
                pingTestFailed,
                pingTestCompleted
             }

      STATUS        current
      DESCRIPTION
          "The notification that are required to be supported by
          implementations of this MIB."
      ::= { pingGroups 3 }

    pingGroup OBJECT-GROUP
      OBJECTS {
                pingMaxConcurrentRequests,
                pingCtlTargetAddressType,
                pingCtlTargetAddress,
                pingCtlDataSize,
                pingCtlTimeOut,
                pingCtlProbeCount,
                pingCtlAdminStatus,
                pingCtlDataFill,
                pingCtlFrequency,
```

```
                pingCtlMaxRows,
                pingCtlStorageType,
                pingCtlTrapGeneration,
                pingCtlTrapProbeFailureFilter,
                pingCtlTrapTestFailureFilter,
                pingCtlType,
                pingCtlDescr,
                pingCtlByPassRouteTable,
                pingCtlSourceAddressType,
                pingCtlSourceAddress,
                pingCtlIfIndex,
                pingCtlDSField,
                pingCtlRowStatus,
                pingResultsOperStatus,
                pingResultsIpTargetAddressType,
                pingResultsIpTargetAddress,
                pingResultsMinRtt,
                pingResultsMaxRtt,
                pingResultsAverageRtt,
                pingResultsProbeResponses,
                pingResultsSentProbes,
                pingResultsRttSumOfSquares,
                pingProbeHistoryResponse,
                pingProbeHistoryStatus,
                pingProbeHistoryLastRC
              }
    STATUS  deprecated
    DESCRIPTION
        "The group of objects that constitute the remote ping
        capability."
     ::= { pingGroups 1 }

  pingTimeStampGroup OBJECT-GROUP

    OBJECTS {
              pingResultsLastGoodProbe,
              pingProbeHistoryTime
            }
    STATUS  deprecated
    DESCRIPTION
        "The group of DateAndTime objects."
     ::= { pingGroups 2 }

END
```

4.2. DISMAN-TRACEROUTE-MIB

```
   DISMAN-TRACEROUTE-MIB DEFINITIONS ::= BEGIN

   IMPORTS
       MODULE-IDENTITY, OBJECT-TYPE, Integer32,
       Gauge32, Unsigned32, mib-2,
       NOTIFICATION-TYPE,
       OBJECT-IDENTITY
           FROM SNMPv2-SMI                   -- RFC2578
       RowStatus, StorageType,
       TruthValue, DateAndTime
           FROM SNMPv2-TC                    -- RFC2579
       MODULE-COMPLIANCE, OBJECT-GROUP,
       NOTIFICATION-GROUP
           FROM SNMPv2-CONF                  -- RFC2580
       SnmpAdminString
           FROM SNMP-FRAMEWORK-MIB           -- RFC3411
       InterfaceIndexOrZero                  -- RFC2863
           FROM IF-MIB
       InetAddressType, InetAddress
           FROM INET-ADDRESS-MIB             -- RFC4001
       OperationResponseStatus
           FROM DISMAN-PING-MIB;             -- RFC4560

    traceRouteMIB MODULE-IDENTITY
       LAST-UPDATED "200606130000Z"          -- 13 June 2006
       ORGANIZATION "IETF Distributed Management Working Group"
       CONTACT-INFO
           "Juergen Quittek

           NEC Europe Ltd.
           Network Laboratories
           Kurfuersten-Anlage 36
           69115 Heidelberg
           Germany

           Phone: +49 6221 4342-115
           Email: quittek@netlab.nec.de"
       DESCRIPTION
           "The Traceroute MIB (DISMAN-TRACEROUTE-MIB) provides
           access to the traceroute capability at a remote host.

           Copyright (C) The Internet Society (2006). This version of
           this MIB module is part of RFC 4560; see the RFC itself for
           full legal notices."

        --  Revision history
```

```
        REVISION     "200606130000Z"         -- 13 June 2006
        DESCRIPTION
            "Updated version, published as RFC 4560.
                - Correctly considered IPv6 in DESCRIPTION clause of
                  object traceRouteCtlDataSize
                - Replaced references to RFC 2575 by RFC 3415
                - Replaced references to RFC 2571 by RFC 3411
                - Replaced references to RFC 2851 by RFC 4001
                - Clarified DESCRIPTION clause of object
                  traceRouteResultsLastGoodPath
                - Changed range of object traceRouteCtlInitialTtl
                  from (0..255) to (1..255)
                - Extended DESCRIPTION clause of traceRouteResultsTable
                  describing re-initialization of entries
                - Changed SYNTAX of traceRouteResultsTestAttempts and
                  traceRouteResultsTestSuccesses from Unsigned32 to
                  Gauge32
                - Changed status of traceRouteCompliance to deprecated
                - Added traceRouteFullCompliance and
                  traceRouteMinimumCompliance
                - Changed status of traceRouteGroup and
                  traceRouteTimeStampGroup to deprecated
                - Added traceRouteMinimumGroup,
                  traceRouteCtlRowStatusGroup, and
                  traceRouteHistoryGroup
                - Changed DEFVAL of object
                  traceRouteCtlTargetAddressType from { ipv4 }
                  to { unknown }
                - Changed DEFVAL of object traceRouteCtlDescr
                  from { '00'H } to { ''H }
                - Added DEFVAL for object traceRouteCtlTrapGeneration
                  of DEFVAL { { } }"
        REVISION     "200009210000Z"         -- 21 September 2000
        DESCRIPTION
            "Initial version, published as RFC 2925."

       ::= { mib-2 81 }

    -- Top level structure of the MIB

    traceRouteNotifications  OBJECT IDENTIFIER ::= { traceRouteMIB 0 }
    traceRouteObjects        OBJECT IDENTIFIER ::= { traceRouteMIB 1 }
    traceRouteConformance    OBJECT IDENTIFIER ::= { traceRouteMIB 2 }

    -- The registration node (point) for traceroute implementation types

    traceRouteImplementationTypeDomains OBJECT IDENTIFIER
    ::= { traceRouteMIB 3 }
```

```
    traceRouteUsingUdpProbes OBJECT-IDENTITY
       STATUS      current
       DESCRIPTION
           "Indicates that an implementation is using UDP probes to
           perform the traceroute operation."
       ::= { traceRouteImplementationTypeDomains 1 }


    -- Simple Object Definitions

    traceRouteMaxConcurrentRequests OBJECT-TYPE
       SYNTAX      Unsigned32
       UNITS       "requests"
       MAX-ACCESS  read-write
       STATUS      current
       DESCRIPTION
          "The maximum number of concurrent active traceroute requests
          that are allowed within an agent implementation.  A value
          of 0 for this object implies that there is no limit for
          the number of concurrent active requests in effect.

          The limit applies only to new requests being activated.
          When a new value is set, the agent will continue processing
          all the requests already active, even if their number
          exceeds the limit just imposed."
       DEFVAL { 10 }
       ::= { traceRouteObjects 1 }


     -- Traceroute Control Table

    traceRouteCtlTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF TraceRouteCtlEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines the Remote Operations Traceroute Control Table for
           providing the capability of invoking traceroute from a remote
           host.  The results of traceroute operations can be stored in
           the traceRouteResultsTable, traceRouteProbeHistoryTable, and
           the traceRouteHopsTable."
      ::= { traceRouteObjects 2 }

    traceRouteCtlEntry OBJECT-TYPE
       SYNTAX      TraceRouteCtlEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
```

```
            "Defines an entry in the traceRouteCtlTable.  The first
            index element, traceRouteCtlOwnerIndex, is of type
            SnmpAdminString, a textual convention that allows for
            use of the SNMPv3 View-Based Access Control Model
            (RFC 3415, VACM) and that allows a management
            application to identify its entries.  The second index,
            traceRouteCtlTestName (also an SnmpAdminString),
            enables the same management application to have
            multiple requests outstanding."
        INDEX {
                traceRouteCtlOwnerIndex,
                traceRouteCtlTestName
              }
        ::= { traceRouteCtlTable 1 }

    TraceRouteCtlEntry ::=
        SEQUENCE {
          traceRouteCtlOwnerIndex         SnmpAdminString,
          traceRouteCtlTestName           SnmpAdminString,
          traceRouteCtlTargetAddressType  InetAddressType,
          traceRouteCtlTargetAddress      InetAddress,
          traceRouteCtlByPassRouteTable   TruthValue,
          traceRouteCtlDataSize           Unsigned32,
          traceRouteCtlTimeOut            Unsigned32,
          traceRouteCtlProbesPerHop       Unsigned32,
          traceRouteCtlPort               Unsigned32,
          traceRouteCtlMaxTtl             Unsigned32,
          traceRouteCtlDSField            Unsigned32,
          traceRouteCtlSourceAddressType  InetAddressType,
          traceRouteCtlSourceAddress      InetAddress,
          traceRouteCtlIfIndex            InterfaceIndexOrZero,
          traceRouteCtlMiscOptions        SnmpAdminString,
          traceRouteCtlMaxFailures        Unsigned32,
          traceRouteCtlDontFragment       TruthValue,
          traceRouteCtlInitialTtl         Unsigned32,
          traceRouteCtlFrequency          Unsigned32,
          traceRouteCtlStorageType        StorageType,
          traceRouteCtlAdminStatus        INTEGER,
          traceRouteCtlDescr              SnmpAdminString,
          traceRouteCtlMaxRows            Unsigned32,
          traceRouteCtlTrapGeneration     BITS,
          traceRouteCtlCreateHopsEntries  TruthValue,
          traceRouteCtlType               OBJECT IDENTIFIER,
          traceRouteCtlRowStatus          RowStatus
        }

    traceRouteCtlOwnerIndex OBJECT-TYPE
        SYNTAX      SnmpAdminString (SIZE(0..32))
```

```
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
         "To facilitate the provisioning of access control by a
         security administrator using the View-Based Access
         Control Model (RFC 3415, VACM) for tables in which
         multiple users may need to create or
         modify entries independently, the initial index is used as
         an 'owner index'.  Such an initial index has a syntax of
         SnmpAdminString and can thus be trivially mapped to a
         securityName or groupName defined in VACM, in
         accordance with a security policy.

         When used in conjunction with such a security policy,
         all entries in the table belonging to a particular user
         (or group) will have the same value for this initial
         index.  For a given user's entries in a particular
         table, the object identifiers for the information in
         these entries will have the same subidentifiers (except
         for the 'column' subidentifier) up to the end of the
         encoded owner index. To configure VACM to permit access
         to this portion of the table, one would create
         vacmViewTreeFamilyTable entries with the value of
         vacmViewTreeFamilySubtree including the owner index
         portion, and vacmViewTreeFamilyMask 'wildcarding' the
         column subidentifier.  More elaborate configurations
         are possible."
      ::= { traceRouteCtlEntry 1 }

    traceRouteCtlTestName OBJECT-TYPE
      SYNTAX      SnmpAdminString (SIZE(0..32))
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
          "The name of a traceroute test.  This is locally unique,
          within the scope of a traceRouteCtlOwnerIndex."
      ::= { traceRouteCtlEntry 2 }

   traceRouteCtlTargetAddressType OBJECT-TYPE
      SYNTAX      InetAddressType
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
          "Specifies the type of host address to be used on the
          traceroute request at the remote host."
      DEFVAL { unknown }
      ::= { traceRouteCtlEntry 3 }
```

```
    traceRouteCtlTargetAddress OBJECT-TYPE
       SYNTAX      InetAddress
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Specifies the host address used on the
           traceroute request at the remote host.  The
           host address type can be determined by
           examining the value of the corresponding
           traceRouteCtlTargetAddressType.

           A value for this object MUST be set prior to
           transitioning its corresponding traceRouteCtlEntry to
           active(1) via traceRouteCtlRowStatus."
       ::= { traceRouteCtlEntry 4 }

    traceRouteCtlByPassRouteTable OBJECT-TYPE
       SYNTAX TruthValue
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
          "The purpose of this object is to enable optional
          bypassing the route table.  If enabled, the remote
          host will bypass the normal routing tables and send
          directly to a host on an attached network.  If the
          host is not on a directly attached network, an
          error is returned.  This option can be used to perform
          the traceroute operation to a local host through an
          interface that has no route defined (e.g., after the
          interface was dropped by the routing daemon at the host)."
       DEFVAL { false }
       ::= { traceRouteCtlEntry 5 }

    traceRouteCtlDataSize OBJECT-TYPE
       SYNTAX      Unsigned32 (0..65507)
       UNITS       "octets"
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Specifies the size of the data portion of a traceroute
           request, in octets.  If the RECOMMENDED traceroute method
           (UDP datagrams as probes) is used, then the value
           contained in this object MUST be applied.  If another
           traceroute method is used for which the specified size
           is not appropriate, then the implementation SHOULD use
           whatever size (appropriate to the method) is closest to
           the specified size.
```

```
            The maximum value for this object was computed by
            subtracting the smallest possible IP header size of
            20 octets (IPv4 header with no options) and the UDP
            header size of 8 octets from the maximum IP packet size.
            An IP packet has a maximum size of 65535 octets
            (excluding IPv6 Jumbograms)."
        DEFVAL { 0 }
        ::= { traceRouteCtlEntry 6 }

    traceRouteCtlTimeOut OBJECT-TYPE
        SYNTAX      Unsigned32 (1..60)
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the time-out value, in seconds, for
            a traceroute request."
        DEFVAL { 3 }
        ::= { traceRouteCtlEntry 7 }

    traceRouteCtlProbesPerHop OBJECT-TYPE
        SYNTAX      Unsigned32 (1..10)
        UNITS       "probes"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the number of times to reissue a traceroute
            request with the same time-to-live (TTL) value."
        DEFVAL { 3 }
        ::= { traceRouteCtlEntry 8 }

    traceRouteCtlPort OBJECT-TYPE
        SYNTAX      Unsigned32 (1..65535)
        UNITS       "UDP Port"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the (initial) UDP port to send the traceroute
            request to.  A port needs to be specified that is not in
            use at the destination (target) host.  The default
            value for this object is the IANA assigned port,
            33434, for the traceroute function."
        DEFVAL { 33434 }
        ::= { traceRouteCtlEntry 9 }

    traceRouteCtlMaxTtl OBJECT-TYPE
        SYNTAX      Unsigned32 (1..255)
        UNITS       "time-to-live value"
```

```
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the maximum time-to-live value."
        DEFVAL { 30 }
        ::= { traceRouteCtlEntry 10 }

    traceRouteCtlDSField OBJECT-TYPE
        SYNTAX      Unsigned32 (0..255)
        MAX-ACCESS  read-create
        STATUS      current

        DESCRIPTION
            "Specifies the value to store in the Type of Service
            (TOS) octet in the IPv4 header or in the Traffic
            Class octet in the IPv6 header, respectively, of the
            IP packet used to encapsulate the traceroute probe.

            The octet to be set in the IP header contains the
            Differentiated Services (DS) Field in the six most
            significant bits.

            This option can be used to determine what effect an
            explicit DS Field setting has on a traceroute response.
            Not all values are legal or meaningful.  A value of 0
            means that the function represented by this option is
            not supported.  DS Field usage is often not supported
            by IP implementations, and not all values are supported.
            Refer to RFC 2474 and RFC 3260 for guidance on usage of
            this field."
        REFERENCE
            "Refer to RFC 1812 for the definition of the IPv4 TOS
            octet and to RFC 2460 for the definition of the IPv6
            Traffic Class octet.  Refer to RFC 2474 and RFC 3260
            for the definition of the Differentiated Services Field."
        DEFVAL { 0 }
        ::= { traceRouteCtlEntry 11 }

    traceRouteCtlSourceAddressType OBJECT-TYPE
        SYNTAX      InetAddressType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Specifies the type of the source address,
            traceRouteCtlSourceAddress, to be used at a remote host
            when a traceroute operation is performed."
        DEFVAL { unknown }
        ::= { traceRouteCtlEntry 12 }
```

```
    traceRouteCtlSourceAddress OBJECT-TYPE
       SYNTAX      InetAddress
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Use the specified IP address (which must be given as an
           IP number, not a hostname) as the source address in
           outgoing probe packets.  On hosts with more than one IP
           address, this option can be used to select the address
           to be used.  If the IP address is not one of this
           machine's interface addresses, an error is returned, and
           nothing is sent.  A zero-length octet string value for
           this object disables source address specification.
           The address type (InetAddressType) that relates to
           this object is specified by the corresponding value
           of traceRouteCtlSourceAddressType."
       DEFVAL { ''H }
       ::= { traceRouteCtlEntry 13 }

    traceRouteCtlIfIndex OBJECT-TYPE
       SYNTAX      InterfaceIndexOrZero
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Setting this object to an interface's ifIndex prior
           to starting a remote traceroute operation directs
           the traceroute probes to be transmitted over the
           specified interface.  A value of zero for this object
           implies that this option is not enabled."
       DEFVAL { 0 }
       ::= { traceRouteCtlEntry 14 }

    traceRouteCtlMiscOptions OBJECT-TYPE
       SYNTAX      SnmpAdminString
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Enables an application to specify implementation-dependent
           options."
       DEFVAL { ''H }
       ::= { traceRouteCtlEntry 15 }

    traceRouteCtlMaxFailures OBJECT-TYPE
       SYNTAX      Unsigned32 (0..255)
       UNITS       "timeouts"
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
```

```
            "The value of this object indicates the maximum number
            of consecutive timeouts allowed before a remote traceroute
            request is terminated.  A value of either 255 (maximum
            hop count/possible TTL value) or 0 indicates that the
            function of terminating a remote traceroute request when a
            specific number of consecutive timeouts are detected is
            disabled."
        DEFVAL { 5 }
        ::= { traceRouteCtlEntry 16 }

    traceRouteCtlDontFragment OBJECT-TYPE
        SYNTAX         TruthValue
        MAX-ACCESS     read-create
        STATUS         current
        DESCRIPTION
            "This object enables setting of the don't fragment flag (DF)
            in the IP header for a probe.  Use of this object enables
            a manual PATH MTU test is performed."
        DEFVAL  { false }
        ::= { traceRouteCtlEntry 17 }

    traceRouteCtlInitialTtl OBJECT-TYPE
        SYNTAX         Unsigned32 (1..255)
        MAX-ACCESS     read-create
        STATUS         current
        DESCRIPTION
            "The value of this object specifies the initial TTL value to
            use.  This enables bypassing the initial (often well known)
            portion of a path."
        DEFVAL { 1 }
        ::= { traceRouteCtlEntry 18 }

    traceRouteCtlFrequency  OBJECT-TYPE
        SYNTAX      Unsigned32
        UNITS       "seconds"
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The number of seconds to wait before repeating a
            traceroute test, as defined by the value of the
            various objects in the corresponding row.

            After a single test is completed the number of seconds
            as defined by the value of traceRouteCtlFrequency MUST
            elapse before the next traceroute test is started.

            A value of 0 for this object implies that the test
            as defined by the corresponding entry will not be
```

```
            repeated."
        DEFVAL { 0 }
        ::= { traceRouteCtlEntry 19 }

    traceRouteCtlStorageType OBJECT-TYPE
        SYNTAX      StorageType
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The storage type for this conceptual row.
            Conceptual rows having the value 'permanent' need not
            allow write-access to any columnar objects in the row."
        DEFVAL { nonVolatile }
        ::= { traceRouteCtlEntry 20 }

    traceRouteCtlAdminStatus OBJECT-TYPE
        SYNTAX      INTEGER {

                              enabled(1), -- operation should be started
                              disabled(2) -- operation should be stopped
                            }
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "Reflects the desired state that an traceRouteCtlEntry
            should be in:

               enabled(1)  - Attempt to activate the test as defined by
                             this traceRouteCtlEntry.
               disabled(2) - Deactivate the test as defined by this
                             traceRouteCtlEntry.

            Refer to the corresponding traceRouteResultsOperStatus to
            determine the operational state of the test defined by
            this entry."
         DEFVAL { disabled }
        ::= { traceRouteCtlEntry 21 }

    traceRouteCtlDescr OBJECT-TYPE
        SYNTAX      SnmpAdminString
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "The purpose of this object is to provide a
            descriptive name of the remote traceroute
            test."
        DEFVAL { ''H }
        ::= { traceRouteCtlEntry 22 }
```

```
    traceRouteCtlMaxRows OBJECT-TYPE
       SYNTAX      Unsigned32
       UNITS       "rows"
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "The maximum number of corresponding entries allowed
           in the traceRouteProbeHistoryTable.  An implementation
           of this MIB will remove the oldest corresponding entry
           in the traceRouteProbeHistoryTable to allow the
           addition of an new entry once the number of
           corresponding rows in the traceRouteProbeHistoryTable
           reaches this value.

           Old entries are not removed when a new test is
           started.  Entries are added to the
           traceRouteProbeHistoryTable until traceRouteCtlMaxRows
           is reached before entries begin to be removed.
           A value of 0 for this object disables creation of
           traceRouteProbeHistoryTable entries."
       DEFVAL      { 50 }
       ::= { traceRouteCtlEntry 23 }

    traceRouteCtlTrapGeneration OBJECT-TYPE
       SYNTAX      BITS {
                     pathChange(0),
                     testFailure(1),
                     testCompletion(2)
                   }
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "The value of this object determines when and whether to
           generate a notification for this entry:

           pathChange(0)     - Generate a traceRoutePathChange
               notification when the current path varies from a
               previously determined path.
           testFailure(1)    - Generate a traceRouteTestFailed
               notification when the full path to a target
               can't be determined.
           testCompletion(2) - Generate a traceRouteTestCompleted
               notification when the path to a target has been
               determined.

           The value of this object defaults to an empty set,
           indicating that none of the above options has been
           selected."
```

```
      DEFVAL { { } }
      ::= { traceRouteCtlEntry 24 }

   traceRouteCtlCreateHopsEntries OBJECT-TYPE
      SYNTAX      TruthValue
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
          "The current path for a traceroute test is kept in the
          traceRouteHopsTable on a per-hop basis when the value of
          this object is true(1)."
      DEFVAL { false }
      ::= { traceRouteCtlEntry 25 }

   traceRouteCtlType OBJECT-TYPE
      SYNTAX      OBJECT IDENTIFIER
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
          "The value of this object is used either to report or to
          select the implementation method to be used for
          performing a traceroute operation.  The value of this
          object may be selected from
          traceRouteImplementationTypeDomains.

          Additional implementation types should be allocated as
          required by implementers of the DISMAN-TRACEROUTE-MIB
          under their enterprise specific registration point,
          not beneath traceRouteImplementationTypeDomains."
      DEFVAL { traceRouteUsingUdpProbes }
      ::= { traceRouteCtlEntry 26 }

   traceRouteCtlRowStatus OBJECT-TYPE
      SYNTAX      RowStatus
      MAX-ACCESS  read-create
      STATUS      current
      DESCRIPTION
          "This object allows entries to be created and deleted
          in the traceRouteCtlTable.  Deletion of an entry in
          this table results in a deletion of all corresponding (same
          traceRouteCtlOwnerIndex and traceRouteCtlTestName
          index values) traceRouteResultsTable,
          traceRouteProbeHistoryTable, and traceRouteHopsTable
          entries.

          A value MUST be specified for traceRouteCtlTargetAddress
          prior to acceptance of a transition to active(1) state.
```

```
            When a value for pingCtlTargetAddress is set,
            the value of object pingCtlRowStatus changes
            from notReady(3) to notInService(2).

            Activation of a remote traceroute operation is
            controlled via traceRouteCtlAdminStatus, and not
            by transitioning of this object's value to active(1).

            Transitions in and out of active(1) state are not
            allowed while an entry's traceRouteResultsOperStatus
            is active(1), with the exception that deletion of
            an entry in this table by setting its RowStatus
            object to destroy(6) will stop an active
            traceroute operation.

            The operational state of an traceroute operation
            can be determined by examination of the corresponding
            traceRouteResultsOperStatus object."
        REFERENCE
            "See definition of RowStatus in RFC 2579, 'Textual
            Conventions for SMIv2.'"
        ::= { traceRouteCtlEntry 27 }


    -- Traceroute Results Table

    traceRouteResultsTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF TraceRouteResultsEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Defines the Remote Operations Traceroute Results Table for
            keeping track of the status of a traceRouteCtlEntry.

            An entry is added to the traceRouteResultsTable when an
            traceRouteCtlEntry is started by successful transition
            of its traceRouteCtlAdminStatus object to enabled(1).

            If the object traceRouteCtlAdminStatus already has the value
            enabled(1), and if the corresponding
            traceRouteResultsOperStatus object has the value
            completed(3), then successfully writing enabled(1) to the
            object traceRouteCtlAdminStatus re-initializes the already
            existing entry in the traceRouteResultsTable.  The values of
            objects in the re-initialized entry are the same as
            the values of objects in a new entry would be.

            An entry is removed from the traceRouteResultsTable when
```

```
            its corresponding traceRouteCtlEntry is deleted."
        ::= { traceRouteObjects 3 }

    traceRouteResultsEntry OBJECT-TYPE
       SYNTAX      TraceRouteResultsEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines an entry in the traceRouteResultsTable.  The
           traceRouteResultsTable has the same indexing as the
           traceRouteCtlTable so that a traceRouteResultsEntry
           corresponds to the traceRouteCtlEntry that caused it to
           be created."
       INDEX {
               traceRouteCtlOwnerIndex,
               traceRouteCtlTestName
             }
       ::= { traceRouteResultsTable 1 }

    TraceRouteResultsEntry ::=
       SEQUENCE {
         traceRouteResultsOperStatus       INTEGER,
         traceRouteResultsCurHopCount      Gauge32,
         traceRouteResultsCurProbeCount    Gauge32,
         traceRouteResultsIpTgtAddrType    InetAddressType,
         traceRouteResultsIpTgtAddr        InetAddress,
         traceRouteResultsTestAttempts     Gauge32,
         traceRouteResultsTestSuccesses    Gauge32,
         traceRouteResultsLastGoodPath     DateAndTime
       }

    traceRouteResultsOperStatus OBJECT-TYPE
       SYNTAX      INTEGER {
                             enabled(1),  -- test is in progress
                             disabled(2), -- test has stopped
                             completed(3) -- test is completed
                           }
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "Reflects the operational state of an traceRouteCtlEntry:

              enabled(1)   - Test is active.
              disabled(2)  - Test has stopped.
              completed(3) - Test is completed."
       ::= { traceRouteResultsEntry 1 }

    traceRouteResultsCurHopCount OBJECT-TYPE
```

```
        SYNTAX      Gauge32
        UNITS       "hops"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Reflects the current TTL value (from 1 to
            255) for a remote traceroute operation.
            Maximum TTL value is determined by
            traceRouteCtlMaxTtl."
        ::= { traceRouteResultsEntry 2 }

    traceRouteResultsCurProbeCount OBJECT-TYPE
        SYNTAX      Gauge32
        UNITS       "probes"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Reflects the current probe count (1..10) for
            a remote traceroute operation.  The maximum
            probe count is determined by
            traceRouteCtlProbesPerHop."
        ::= { traceRouteResultsEntry 3 }

    traceRouteResultsIpTgtAddrType OBJECT-TYPE
        SYNTAX      InetAddressType

        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object indicates the type of address stored
            in the corresponding traceRouteResultsIpTgtAddr
            object."
        ::= { traceRouteResultsEntry 4 }

    traceRouteResultsIpTgtAddr OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object reports the IP address associated
            with a traceRouteCtlTargetAddress value when the
            destination address is specified as a DNS name.
            The value of this object should be a zero-length
            octet string when a DNS name is not specified or
            when a specified DNS name fails to resolve."
        ::= { traceRouteResultsEntry 5 }

    traceRouteResultsTestAttempts OBJECT-TYPE
```

```
        SYNTAX      Gauge32
        UNITS       "tests"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The current number of attempts to determine a path
            to a target.  The value of this object MUST be started
            at 0."
        ::= { traceRouteResultsEntry 6 }

    traceRouteResultsTestSuccesses OBJECT-TYPE
        SYNTAX      Gauge32
        UNITS       "tests"
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The current number of attempts to determine a path
            to a target that have succeeded.  The value of this
            object MUST be reported as 0 when no attempts have
            succeeded."
        ::= { traceRouteResultsEntry 7 }

    traceRouteResultsLastGoodPath OBJECT-TYPE
        SYNTAX      DateAndTime
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The date and time when the last complete path
            was determined.  A path is complete if responses
            were received or timeout occurred for each hop on
            the path; i.e., for each TTL value from the value
            of the corresponding traceRouteCtlInitialTtl object
            up to the end of the path or (if no reply from the
            target IP address was received) up to the value of
            the corresponding traceRouteCtlMaxTtl object."
        ::= { traceRouteResultsEntry 8 }

    -- Trace Route Probe History Table

    traceRouteProbeHistoryTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF TraceRouteProbeHistoryEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Defines the Remote Operations Traceroute Results Table
            for storing the results of a traceroute operation.

            An implementation of this MIB will remove the oldest
```

```
            entry in the traceRouteProbeHistoryTable of the
            corresponding entry in the traceRouteCtlTable to allow
            the addition of a new entry once the number of rows in
            the traceRouteProbeHistoryTable reaches the value specified
            by traceRouteCtlMaxRows for the corresponding entry in the
            traceRouteCtlTable."
        ::= { traceRouteObjects 4 }

    traceRouteProbeHistoryEntry OBJECT-TYPE
       SYNTAX      TraceRouteProbeHistoryEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines a table for storing the results of a traceroute
           operation.  Entries in this table are limited by
           the value of the corresponding traceRouteCtlMaxRows
           object.

           The first two index elements identify the
           traceRouteCtlEntry that a traceRouteProbeHistoryEntry
           belongs to.  The third index element selects a single
           traceroute operation result.  The fourth and fifth indexes
           select the hop and the probe for a particular
           traceroute operation."
       INDEX {
                traceRouteCtlOwnerIndex,
                traceRouteCtlTestName,
                traceRouteProbeHistoryIndex,
                traceRouteProbeHistoryHopIndex,
                traceRouteProbeHistoryProbeIndex

             }
       ::= { traceRouteProbeHistoryTable 1 }

    TraceRouteProbeHistoryEntry ::=
       SEQUENCE {
         traceRouteProbeHistoryIndex         Unsigned32,
         traceRouteProbeHistoryHopIndex      Unsigned32,
         traceRouteProbeHistoryProbeIndex    Unsigned32,
         traceRouteProbeHistoryHAddrType     InetAddressType,
         traceRouteProbeHistoryHAddr         InetAddress,
         traceRouteProbeHistoryResponse      Unsigned32,
         traceRouteProbeHistoryStatus        OperationResponseStatus,
         traceRouteProbeHistoryLastRC        Integer32,
         traceRouteProbeHistoryTime          DateAndTime
       }

    traceRouteProbeHistoryIndex OBJECT-TYPE
```

```
      SYNTAX      Unsigned32 (1..'ffffffff'h)
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
          "An entry in this table is created when the result of
          a traceroute probe is determined.  The initial 2 instance
          identifier index values identify the traceRouteCtlEntry
          that a probe result (traceRouteProbeHistoryEntry) belongs
          to.  An entry is removed from this table when
          its corresponding traceRouteCtlEntry is deleted.

          An implementation MUST start assigning
          traceRouteProbeHistoryIndex values at 1 and wrap after
          exceeding the maximum possible value, as defined by the
          limit of this object ('ffffffff'h)."
      ::= { traceRouteProbeHistoryEntry 1 }

   traceRouteProbeHistoryHopIndex OBJECT-TYPE
      SYNTAX      Unsigned32 (1..255)
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
         "Indicates which hop in a traceroute path the probe's
         results are for.  The value of this object is initially
         determined by the value of traceRouteCtlInitialTtl."
      ::= { traceRouteProbeHistoryEntry 2 }

   traceRouteProbeHistoryProbeIndex OBJECT-TYPE
      SYNTAX      Unsigned32 (1..10)
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
         "Indicates the index of a probe for a particular
         hop in a traceroute path.  The number of probes per
         hop is determined by the value of the corresponding
         traceRouteCtlProbesPerHop object."
      ::= { traceRouteProbeHistoryEntry 3 }

   traceRouteProbeHistoryHAddrType OBJECT-TYPE
      SYNTAX      InetAddressType
      MAX-ACCESS  read-only
      STATUS      current
      DESCRIPTION
          "This objects indicates the type of address stored
          in the corresponding traceRouteProbeHistoryHAddr
          object."
      ::= { traceRouteProbeHistoryEntry 4 }
```

```
    traceRouteProbeHistoryHAddr OBJECT-TYPE
       SYNTAX      InetAddress
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
          "The address of a hop in a traceroute path.  This object
          is not allowed to be a DNS name.  The value of the
          corresponding object, traceRouteProbeHistoryHAddrType,
          indicates this object's IP address type."
       ::= { traceRouteProbeHistoryEntry 5 }

    traceRouteProbeHistoryResponse OBJECT-TYPE
       SYNTAX      Unsigned32
       UNITS       "milliseconds"
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "The amount of time measured in milliseconds from when
           a probe was sent to when its response was received or
           when it timed out.  The value of this object is reported
           as 0 when it is not possible to transmit a probe."
       ::= { traceRouteProbeHistoryEntry 6 }

    traceRouteProbeHistoryStatus OBJECT-TYPE
       SYNTAX      OperationResponseStatus
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "The result of a traceroute operation made by a remote
           host for a particular probe."
       ::= { traceRouteProbeHistoryEntry 7 }

    traceRouteProbeHistoryLastRC OBJECT-TYPE
       SYNTAX      Integer32
       MAX-ACCESS  read-only

       STATUS      current
       DESCRIPTION
           "The last implementation-method-specific reply code received.

           Traceroute is usually implemented by transmitting a series of
           probe packets with increasing time-to-live values.  A probe
           packet is a UDP datagram encapsulated into an IP packet.
           Each hop in a path to the target (destination) host rejects
           the probe packets (probe's TTL too small, ICMP reply) until
           either the maximum TTL is exceeded or the target host is
           received."
       ::= { traceRouteProbeHistoryEntry 8 }
```

```
    traceRouteProbeHistoryTime OBJECT-TYPE
       SYNTAX      DateAndTime
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "Timestamp for when this probe's results were determined."
       ::= { traceRouteProbeHistoryEntry 9 }

    -- Traceroute Hop Results Table

    traceRouteHopsTable OBJECT-TYPE
       SYNTAX      SEQUENCE OF TraceRouteHopsEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines the Remote Operations Traceroute Hop Table for
           keeping track of the results of traceroute tests on a
           per-hop basis."
       ::= { traceRouteObjects 5 }

    traceRouteHopsEntry OBJECT-TYPE
       SYNTAX      TraceRouteHopsEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines an entry in the traceRouteHopsTable.
           The first two index elements identify the
           traceRouteCtlEntry that a traceRouteHopsEntry
           belongs to.  The third index element,
           traceRouteHopsHopIndex, selects a
           hop in a traceroute path."
       INDEX {
               traceRouteCtlOwnerIndex,
               traceRouteCtlTestName,
               traceRouteHopsHopIndex
             }

       ::= { traceRouteHopsTable 1 }

    TraceRouteHopsEntry ::=
       SEQUENCE {
           traceRouteHopsHopIndex         Unsigned32,
           traceRouteHopsIpTgtAddressType InetAddressType,
           traceRouteHopsIpTgtAddress     InetAddress,
           traceRouteHopsMinRtt           Unsigned32,
           traceRouteHopsMaxRtt           Unsigned32,
           traceRouteHopsAverageRtt       Unsigned32,
           traceRouteHopsRttSumOfSquares  Unsigned32,
```

```
            traceRouteHopsSentProbes       Unsigned32,
            traceRouteHopsProbeResponses   Unsigned32,
            traceRouteHopsLastGoodProbe    DateAndTime
          }

    traceRouteHopsHopIndex OBJECT-TYPE
       SYNTAX      Unsigned32 (1..'ffffffff'h)
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Specifies the hop index for a traceroute hop.  Values
           for this object with respect to the same
           traceRouteCtlOwnerIndex and traceRouteCtlTestName
           MUST start at 1 and be given increasing values for
           subsequent hops.  The value of traceRouteHopsHopIndex is not
           necessarily the number of the hop on the traced path.

           The traceRouteHopsTable keeps the current traceroute
           path per traceRouteCtlEntry if enabled by
           setting the corresponding traceRouteCtlCreateHopsEntries
           to true(1).

           All hops (traceRouteHopsTable entries) in a traceroute
           path MUST be updated at the same time when a traceroute
           operation is completed.  Care needs to be applied when a path
           either changes or can't be determined.  The initial portion
           of the path, up to the first hop change, MUST retain the
           same traceRouteHopsHopIndex values.  The remaining portion
           of the path SHOULD be assigned new traceRouteHopsHopIndex
           values."
       ::= { traceRouteHopsEntry 1 }

    traceRouteHopsIpTgtAddressType OBJECT-TYPE
       SYNTAX      InetAddressType
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "This object indicates the type of address stored
           in the corresponding traceRouteHopsIpTgtAddress
           object."
       ::= { traceRouteHopsEntry 2 }

    traceRouteHopsIpTgtAddress OBJECT-TYPE
       SYNTAX      InetAddress
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "This object reports the IP address associated with
```

```
            the hop.  A value for this object should be reported
            as a numeric IP address, not as a DNS name.

            The address type (InetAddressType) that relates to
            this object is specified by the corresponding value
            of pingCtlSourceAddressType."
        ::= { traceRouteHopsEntry 3 }

    traceRouteHopsMinRtt OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The minimum traceroute round-trip-time (RTT) received for
            this hop.  A value of 0 for this object implies that no
            RTT has been received."
        ::= { traceRouteHopsEntry 4 }

    traceRouteHopsMaxRtt OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The maximum traceroute round-trip-time (RTT) received for
            this hop.  A value of 0 for this object implies that no
            RTT has been received."
        ::= { traceRouteHopsEntry 5 }

    traceRouteHopsAverageRtt OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The current average traceroute round-trip-time (RTT) for
            this hop."
        ::= { traceRouteHopsEntry 6 }

    traceRouteHopsRttSumOfSquares OBJECT-TYPE
        SYNTAX      Unsigned32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "This object contains the sum of the squares of all
            round-trip-times received for this hop.  Its purpose is
            to enable standard deviation calculation."
        ::= { traceRouteHopsEntry 7 }

    traceRouteHopsSentProbes OBJECT-TYPE
```

```
       SYNTAX      Unsigned32
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "The value of this object reflects the number of probes sent
           for this hop during this traceroute test.  The value of this
           object should start at 0."
       ::= { traceRouteHopsEntry 8 }

   traceRouteHopsProbeResponses OBJECT-TYPE
       SYNTAX      Unsigned32
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "Number of responses received for this hop during this
           traceroute test.  This value of this object should start
           at 0."
       ::= { traceRouteHopsEntry 9 }

   traceRouteHopsLastGoodProbe OBJECT-TYPE
       SYNTAX      DateAndTime
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "Date and time at which the last response was received for a
            probe for this hop during this traceroute test."
       ::= { traceRouteHopsEntry 10 }

   -- Notification Definition section

   traceRoutePathChange NOTIFICATION-TYPE
        OBJECTS {
          traceRouteCtlTargetAddressType,
          traceRouteCtlTargetAddress,
          traceRouteResultsIpTgtAddrType,
          traceRouteResultsIpTgtAddr
        }
        STATUS  current
        DESCRIPTION
            "The path to a target has changed."
        ::= { traceRouteNotifications 1 }

   traceRouteTestFailed NOTIFICATION-TYPE
        OBJECTS {
          traceRouteCtlTargetAddressType,
          traceRouteCtlTargetAddress,
          traceRouteResultsIpTgtAddrType,
          traceRouteResultsIpTgtAddr
```

```
        }
        STATUS  current
        DESCRIPTION
            "Could not determine the path to a target."
        ::= { traceRouteNotifications 2 }

    traceRouteTestCompleted NOTIFICATION-TYPE
        OBJECTS {
          traceRouteCtlTargetAddressType,
          traceRouteCtlTargetAddress,
          traceRouteResultsIpTgtAddrType,
          traceRouteResultsIpTgtAddr
        }
        STATUS  current
        DESCRIPTION
            "The path to a target has just been determined."
        ::= { traceRouteNotifications 3 }

    -- Conformance information
    -- Compliance statements

    traceRouteCompliances OBJECT IDENTIFIER
        ::= { traceRouteConformance 1 }
    traceRouteGroups      OBJECT IDENTIFIER
        ::= { traceRouteConformance 2 }

    -- Compliance statements

    traceRouteFullCompliance MODULE-COMPLIANCE
       STATUS  current
       DESCRIPTION
               "The compliance statement for SNMP entities that
               fully implement the DISMAN-TRACEROUTE-MIB."
       MODULE  -- this module
           MANDATORY-GROUPS {
                               traceRouteMinimumGroup,
                               traceRouteCtlRowStatusGroup,
                               traceRouteHistoryGroup
                             }

           GROUP traceRouteHopsTableGroup
           DESCRIPTION
               "This group lists the objects that make up a
               traceRouteHopsEntry.  Support of the traceRouteHopsTable
               is optional."

           GROUP traceRouteNotificationsGroup
           DESCRIPTION
```

```
            "This group defines a collection of optional
            notifications."

        OBJECT traceRouteMaxConcurrentRequests
        MIN-ACCESS  read-only
        DESCRIPTION
            "The agent is not required to support SET
            operations to this object."

        OBJECT traceRouteCtlByPassRouteTable
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access to this object is not required by
            implementations that are not capable of its
            implementation.  The function represented by this
            object is implementable if the setsockopt
            SOL_SOCKET SO_DONTROUTE option is supported."

        OBJECT traceRouteCtlDSField
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If write access is
            not supported, return a 0 as the value of this object.
            A value of 0 implies that the function represented by
            this option is not supported."

        OBJECT traceRouteCtlSourceAddressType
        SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access to this object is not required by
            implementations that are not capable of binding the
            send socket with a source address.  An implementation
            is only required to support IPv4 and IPv6 addresses."

        OBJECT traceRouteCtlSourceAddress
        SYNTAX  InetAddress (SIZE(0|4|16))
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access to this object is not required by
            implementations that are not capable of binding the
            send socket with a source address.  An implementation
            is only required to support IPv4 and IPv6 addresses."

        OBJECT traceRouteCtlIfIndex
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If write access is
```

```
            not supported, return a 0 as the value of this object.
            A value of 0 implies that the function represented by
            this option is not supported."

        OBJECT traceRouteCtlMiscOptions
        MIN-ACCESS  read-only
        DESCRIPTION
            "Support of this object is optional.  If not
            supporting, do not allow write access and return a
            zero-length octet string as the value of the object."

        OBJECT traceRouteCtlStorageType
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  It is also allowed
            that implementations support only the volatile(2)
            StorageType enumeration."

        OBJECT traceRouteCtlType
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  In addition, the only
            value that is RECOMMENDED to be supported by an
            implementation is traceRouteUsingUdpProbes."

        OBJECT traceRouteResultsIpTgtAddrType
        SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
        DESCRIPTION
            "An implementation should only support IPv4 and
            globally unique IPv6 address values for this object."

        OBJECT traceRouteResultsIpTgtAddr
        SYNTAX  InetAddress (SIZE(0|4|16))
        DESCRIPTION
            "An implementation should only support IPv4 and
            globally unique IPv6 address values for this object."

        OBJECT traceRouteResultsLastGoodPath
        DESCRIPTION
            "If the traceRouteHopsTableGroup is implemented, then
            this object is mandatory for implementations that have
            access to a system clock and that are capable of setting
            the values for DateAndTime objects.  It is RECOMMENDED
            that when this object is not supported its values
            be reported as '0000000000000000'H."

        OBJECT traceRouteProbeHistoryHAddrType
        SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
```

```
            DESCRIPTION
                "An implementation should only support IPv4 and
                globally unique IPv6 address values for this object."

            OBJECT traceRouteProbeHistoryHAddr
            SYNTAX  InetAddress (SIZE(0|4|16))
            DESCRIPTION
                "An implementation should only support IPv4 and
                globally unique IPv6 address values for this object."

            OBJECT traceRouteProbeHistoryTime
            DESCRIPTION
                "This object is mandatory for implementations that have
                access to a system clock and that are capable of setting
                the values for DateAndTime objects.  It is RECOMMENDED
                that when this object is not supported its values
                be reported as '0000000000000000'H."

            OBJECT traceRouteHopsIpTgtAddressType
            SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
            DESCRIPTION
                "An implementation should only support IPv4 and
                globally unique IPv6 address values for this object."

            OBJECT traceRouteHopsIpTgtAddress
            SYNTAX  InetAddress (SIZE(0|4|16))
            DESCRIPTION
                "An implementation should only support IPv4 and
                globally unique IPv6 address values for this object."

            OBJECT traceRouteHopsLastGoodProbe
            DESCRIPTION
                "This object is mandatory for implementations that have
                access to a system clock and that are capable of setting
                the values for DateAndTime objects.  It is RECOMMENDED
                that when this object is not supported its values
                be reported as '0000000000000000'H."

        ::= { traceRouteCompliances 2 }

    traceRouteMinimumCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
                "The minimum compliance statement for SNMP entities
                which implement the minimal subset of the
                DISMAN-TRACEROUTE-MIB.  Implementors might choose this
                subset for small devices with limited resources."
        MODULE  -- this module
```

```
            MANDATORY-GROUPS { traceRouteMinimumGroup }

            GROUP traceRouteCtlRowStatusGroup
            DESCRIPTION
                "A compliant implementation does not have to implement
                the traceRouteCtlRowStatusGroup."

            GROUP traceRouteHistoryGroup
            DESCRIPTION
                "A compliant implementation does not have to implement
                the traceRouteHistoryGroup."

            GROUP traceRouteHopsTableGroup
            DESCRIPTION
                "This group lists the objects that make up a
                traceRouteHopsEntry.  Support of the traceRouteHopsTable
                is optional."

            GROUP traceRouteNotificationsGroup
            DESCRIPTION
                "This group defines a collection of optional
                notifications."

            OBJECT traceRouteMaxConcurrentRequests
            MIN-ACCESS  read-only
            DESCRIPTION
                "The agent is not required to support SET
                operations to this object."

            OBJECT traceRouteCtlByPassRouteTable
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  If write access is
                not supported, return a false(2) as the value of this
                object.  A value of false(2) means that the function
                represented by this option is not supported."

            OBJECT traceRouteCtlDSField
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  If write access is
                not supported, return a 0 as the value of this object.
                A value of 0 implies that the function represented by
                this option is not supported."

            OBJECT traceRouteCtlSourceAddressType
            SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
            MIN-ACCESS  read-only
```

```
            DESCRIPTION
                "Write access to this object is not required by
                implementations that are not capable of binding the
                send socket with a source address.  An implementation
                is only required to support IPv4 and IPv6 addresses."

            OBJECT traceRouteCtlSourceAddress
            SYNTAX  InetAddress (SIZE(0|4|16))
            MIN-ACCESS  read-only

            DESCRIPTION
                "Write access to this object is not required by
                implementations that are not capable of binding the
                send socket with a source address.  An implementation
                is only required to support IPv4 and IPv6 addresses."

            OBJECT traceRouteCtlIfIndex
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  If write access is
                not supported, return a 0 as the value of this object.
                A value of 0 implies that the function represented by
                this option is not supported."

            OBJECT traceRouteCtlMiscOptions
            MIN-ACCESS  read-only
            DESCRIPTION
                "Support of this object is optional.  If not
                supporting, do not allow write access, and return a
                zero-length octet string as the value of the object."

            OBJECT traceRouteCtlDontFragment
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  If write access is
                not supported, return a false(2) as the value of this
                object.  A value of false(2) means that the function
                represented by this option is not supported."

            OBJECT traceRouteCtlInitialTtl
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  If write access is
                not supported, return a 1 as the value of this object."

            OBJECT traceRouteCtlFrequency
            MIN-ACCESS  read-only
            DESCRIPTION
```

```
            "Write access is not required.  If write access is
            not supported, return a 0 as the value of this object.
            A value of 0 implies that the function represented by
            this option is not supported."

        OBJECT traceRouteCtlStorageType
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  It is also allowed
            that implementations support only the volatile(2)
            StorageType enumeration."

        OBJECT traceRouteCtlDescr
        MIN-ACCESS  read-only
        DESCRIPTION
            "The agent is not required to support set
            operations to this object."

        OBJECT traceRouteCtlMaxRows
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If the
            traceRouteHistoryGroup is not implemented, then write
            access to this object MUST be disabled, and the object
            MUST return a value of 0 when retrieved."

        OBJECT traceRouteCtlTrapGeneration
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If the
            traceRouteNotificationsGroup is not implemented, then
            write access to this object MUST be disabled, and the
            object MUST return a value with no bit set when
            retrieved.  No bit set indicates that no notification
            is generated."

        OBJECT traceRouteCtlCreateHopsEntries
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  If the
            traceRouteHopsTableGroup is not implemented, then
            write access to this object MUST be disabled, and the
            object MUST return a value of false(2) when retrieved."

        OBJECT traceRouteCtlType
        MIN-ACCESS  read-only
        DESCRIPTION
            "Write access is not required.  In addition, the only
```

```
            value that is RECOMMENDED to be supported by an
            implementation is traceRouteUsingUdpProbes."

        OBJECT traceRouteResultsIpTgtAddrType
        SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
        DESCRIPTION
            "An implementation should only support IPv4 and
            globally unique IPv6 address values for this object."

        OBJECT traceRouteResultsIpTgtAddr
        SYNTAX  InetAddress (SIZE(0|4|16))
        DESCRIPTION
            "An implementation should only support IPv4 and
            globally unique IPv6 address values for this object."

        OBJECT traceRouteResultsLastGoodPath
        DESCRIPTION
            "This object is mandatory for implementations that have
            access to a system clock and that are capable of setting
            the values for DateAndTime objects.  It is RECOMMENDED
            that when this object is not supported its values
            be reported as '0000000000000000'H."

        OBJECT traceRouteProbeHistoryHAddrType
        SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
        DESCRIPTION
            "An implementation should only support IPv4 and
            globally unique IPv6 address values for this object."

        OBJECT traceRouteProbeHistoryHAddr
        SYNTAX  InetAddress (SIZE(0|4|16))
        DESCRIPTION
            "An implementation should only support IPv4 and
            globally unique IPv6 address values for this object."

        OBJECT traceRouteProbeHistoryTime
        DESCRIPTION
            "If the traceRouteHistoryGroup is implemented, then
            this object is mandatory for implementations that have
            access to a system clock and that are capable of setting
            the values for DateAndTime objects.  It is RECOMMENDED
            that when this object is not supported its values
            be reported as '0000000000000000'H."

        OBJECT traceRouteHopsIpTgtAddressType
        SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
        DESCRIPTION
            "An implementation should only support IPv4 and
```

```
            globally unique IPv6 address values for this object."

        OBJECT traceRouteHopsIpTgtAddress
        SYNTAX  InetAddress (SIZE(0|4|16))
        DESCRIPTION
            "An implementation should only support IPv4 and
            globally unique IPv6 address values for this object."

        OBJECT traceRouteHopsLastGoodProbe
        DESCRIPTION
            "If the traceRouteHopsTableGroup is implemented, then
            this object is mandatory for implementations that have
            access to a system clock and that are capable of setting
            the values for DateAndTime objects.  It is RECOMMENDED
            that when this object is not supported its values
            be reported as '0000000000000000'H."

    ::= { traceRouteCompliances 3 }

traceRouteCompliance MODULE-COMPLIANCE
    STATUS  deprecated
    DESCRIPTION
            "The compliance statement for the DISMAN-TRACEROUTE-MIB.
            This compliance statement has been deprecated because
            the traceRouteGroup and the traceRouteTimeStampGroup
            have been split and deprecated. The
            traceRouteFullCompliance is semantically identical to the
            deprecated traceRouteCompliance statement."
    MODULE  -- this module
        MANDATORY-GROUPS {
                            traceRouteGroup
                          }
        GROUP traceRouteTimeStampGroup
        DESCRIPTION
            "This group is mandatory for implementations that have
            access to a system clock and that are capable of setting
            the values for DateAndTime objects."

        GROUP traceRouteNotificationsGroup
        DESCRIPTION
            "This group defines a collection of optional
            notifications."

        GROUP traceRouteHopsTableGroup
        DESCRIPTION
            "This group lists the objects that make up a
            traceRouteHopsEntry.  Support of the traceRouteHopsTable
            is optional."
```

```
            OBJECT traceRouteMaxConcurrentRequests
            MIN-ACCESS  read-only
            DESCRIPTION
                "The agent is not required to support SET
                operations to this object."

            OBJECT traceRouteCtlByPassRouteTable
            MIN-ACCESS  read-only
            DESCRIPTION
                "This object is not required by implementations that
                are not capable of its implementation.  The function
                represented by this object is implementable if the
                setsockopt SOL_SOCKET SO_DONTROUTE option is
                supported."

            OBJECT traceRouteCtlSourceAddressType
            SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
            MIN-ACCESS  read-only

            DESCRIPTION
                "This object is not required by implementations that
                are not capable of binding the send socket with a
                source address.  An implementation is only required to
                support IPv4 and IPv6 addresses."

            OBJECT traceRouteCtlSourceAddress
            SYNTAX  InetAddress (SIZE(0|4|16))
            MIN-ACCESS  read-only
            DESCRIPTION
                "This object is not required by implementations that
                are not capable of binding the send socket with a
                source address.  An implementation is only required to
                support IPv4 and globally unique IPv6 addresses."

            OBJECT traceRouteCtlIfIndex
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  When write access is
                not supported, return a 0 as the value of this object.
                A value of 0 implies that the function represented by
                this option is not supported."

            OBJECT traceRouteCtlMiscOptions
            MIN-ACCESS  read-only
            DESCRIPTION
                "Support of this object is optional.  When not
                supporting, do not allow write access, and return a
                zero-length octet string as the value of the object."
```

```
            OBJECT traceRouteCtlStorageType
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  It is also allowed
               that implementations support only the volatile
                StorageType enumeration."

            OBJECT traceRouteCtlDSField
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  When write access is
                not supported, return a 0 as the value of this object.
                A value of 0 implies that the function represented by
                this option is not supported."

            OBJECT traceRouteCtlType
            MIN-ACCESS  read-only
            DESCRIPTION
                "Write access is not required.  In addition, the only
                value that is RECOMMENDED to be supported by an
                implementation is traceRouteUsingUdpProbes."

            OBJECT traceRouteResultsIpTgtAddrType
            SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
            DESCRIPTION
                "An implementation should only support IPv4 and
                globally unique IPv6 address values for this object."

            OBJECT traceRouteResultsIpTgtAddr
            SYNTAX  InetAddress (SIZE(0|4|16))
            DESCRIPTION
                "An implementation should only support IPv4 and
                globally unique IPv6 address values for this object."

            OBJECT traceRouteProbeHistoryHAddrType
            SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
            DESCRIPTION
                "An implementation should only support IPv4 and
                globally unique IPv6 address values for this object."

            OBJECT traceRouteProbeHistoryHAddr
            SYNTAX  InetAddress (SIZE(0|4|16))
            DESCRIPTION
                "An implementation should only support IPv4 and
                globally unique IPv6 address values for this object."

            OBJECT traceRouteHopsIpTgtAddressType
            SYNTAX  InetAddressType { unknown(0), ipv4(1), ipv6(2) }
```

```
            DESCRIPTION
                "An implementation should only support IPv4 and
                globally unique IPv6 address values for this object."

            OBJECT traceRouteHopsIpTgtAddress
            SYNTAX  InetAddress (SIZE(0|4|16))
            DESCRIPTION
                "An implementation should only support IPv4 and
                globally unique IPv6 address values for this object."
        ::= { traceRouteCompliances 1 }

    -- MIB groupings

    traceRouteMinimumGroup OBJECT-GROUP
      OBJECTS {
                traceRouteMaxConcurrentRequests,
                traceRouteCtlTargetAddressType,
                traceRouteCtlTargetAddress,
                traceRouteCtlByPassRouteTable,
                traceRouteCtlDataSize,
                traceRouteCtlTimeOut,
                traceRouteCtlProbesPerHop,
                traceRouteCtlPort,
                traceRouteCtlMaxTtl,
                traceRouteCtlDSField,
                traceRouteCtlSourceAddressType,
                traceRouteCtlSourceAddress,
                traceRouteCtlIfIndex,
                traceRouteCtlMiscOptions,
                traceRouteCtlMaxFailures,
                traceRouteCtlDontFragment,
                traceRouteCtlInitialTtl,
                traceRouteCtlFrequency,
                traceRouteCtlStorageType,
                traceRouteCtlAdminStatus,
                traceRouteCtlMaxRows,
                traceRouteCtlTrapGeneration,
                traceRouteCtlDescr,
                traceRouteCtlCreateHopsEntries,
                traceRouteCtlType,
                traceRouteResultsOperStatus,
                traceRouteResultsCurHopCount,
                traceRouteResultsCurProbeCount,
                traceRouteResultsIpTgtAddrType,
                traceRouteResultsIpTgtAddr,
                traceRouteResultsTestAttempts,
                traceRouteResultsTestSuccesses,
                traceRouteResultsLastGoodPath
```

```
            }
      STATUS  current
      DESCRIPTION
          "The group of objects that constitute the remote traceroute
          operation."
      ::= { traceRouteGroups 5 }

    traceRouteCtlRowStatusGroup OBJECT-GROUP
      OBJECTS {
                traceRouteCtlRowStatus
            }
      STATUS  current
      DESCRIPTION
          "The RowStatus object of the traceRouteCtlTable."
      ::= { traceRouteGroups 6 }

    traceRouteHistoryGroup OBJECT-GROUP
      OBJECTS {
                traceRouteProbeHistoryHAddrType,
                traceRouteProbeHistoryHAddr,
                traceRouteProbeHistoryResponse,
                traceRouteProbeHistoryStatus,
                traceRouteProbeHistoryLastRC,
                traceRouteProbeHistoryTime
             }

      STATUS  current
      DESCRIPTION
          "The group of objects that constitute the history
          capability."
       ::= { traceRouteGroups 7 }

    traceRouteNotificationsGroup NOTIFICATION-GROUP
      NOTIFICATIONS {
                traceRoutePathChange,
                traceRouteTestFailed,
                traceRouteTestCompleted
            }
      STATUS   current
      DESCRIPTION
          "The notifications that are required to be supported by
          implementations of this MIB."
      ::= { traceRouteGroups 3 }

    traceRouteHopsTableGroup OBJECT-GROUP
      OBJECTS {
                traceRouteHopsIpTgtAddressType,
                traceRouteHopsIpTgtAddress,
```

```
                traceRouteHopsMinRtt,
                traceRouteHopsMaxRtt,
                traceRouteHopsAverageRtt,
                traceRouteHopsRttSumOfSquares,
                traceRouteHopsSentProbes,
                traceRouteHopsProbeResponses,
                traceRouteHopsLastGoodProbe
              }
      STATUS   current
      DESCRIPTION
          "The group of objects that constitute the
          traceRouteHopsTable."
     ::= { traceRouteGroups 4 }

    traceRouteGroup OBJECT-GROUP
      OBJECTS {
                traceRouteMaxConcurrentRequests,
                traceRouteCtlTargetAddressType,
                traceRouteCtlTargetAddress,
                traceRouteCtlByPassRouteTable,
                traceRouteCtlDataSize,
                traceRouteCtlTimeOut,
                traceRouteCtlProbesPerHop,
                traceRouteCtlPort,
                traceRouteCtlMaxTtl,
                traceRouteCtlDSField,
                traceRouteCtlSourceAddressType,
                traceRouteCtlSourceAddress,
                traceRouteCtlIfIndex,
                traceRouteCtlMiscOptions,
                traceRouteCtlMaxFailures,
                traceRouteCtlDontFragment,
                traceRouteCtlInitialTtl,
                traceRouteCtlFrequency,
                traceRouteCtlStorageType,
                traceRouteCtlAdminStatus,
                traceRouteCtlMaxRows,
                traceRouteCtlTrapGeneration,
                traceRouteCtlDescr,
                traceRouteCtlCreateHopsEntries,
                traceRouteCtlType,
                traceRouteCtlRowStatus,
                traceRouteResultsOperStatus,
                traceRouteResultsCurHopCount,
                traceRouteResultsCurProbeCount,
                traceRouteResultsIpTgtAddrType,
                traceRouteResultsIpTgtAddr,
                traceRouteResultsTestAttempts,
```

```
                traceRouteResultsTestSuccesses,
                traceRouteProbeHistoryHAddrType,
                traceRouteProbeHistoryHAddr,
                traceRouteProbeHistoryResponse,
                traceRouteProbeHistoryStatus,
                traceRouteProbeHistoryLastRC
              }
      STATUS  deprecated
      DESCRIPTION
          "The group of objects that constitute the remote traceroute
          operation."
      ::= { traceRouteGroups 1 }

    traceRouteTimeStampGroup OBJECT-GROUP
      OBJECTS {
                traceRouteResultsLastGoodPath,
                traceRouteProbeHistoryTime
               }
      STATUS  deprecated
      DESCRIPTION
          "The group of DateAndTime objects."
       ::= { traceRouteGroups 2 }

   END
```

4.3. DISMAN-NSLOOKUP-MIB

```
   DISMAN-NSLOOKUP-MIB DEFINITIONS ::= BEGIN

   IMPORTS
       MODULE-IDENTITY, OBJECT-TYPE,
       Unsigned32, mib-2, Integer32
           FROM SNMPv2-SMI                  -- RFC2578
       RowStatus
           FROM SNMPv2-TC                   -- RFC2579
       MODULE-COMPLIANCE, OBJECT-GROUP
           FROM SNMPv2-CONF                 -- RFC2580
       SnmpAdminString
           FROM SNMP-FRAMEWORK-MIB          -- RFC3411
       InetAddressType, InetAddress
           FROM INET-ADDRESS-MIB;           -- RFC4001

    lookupMIB MODULE-IDENTITY
       LAST-UPDATED "200606130000Z"         -- 13 June 2006
       ORGANIZATION "IETF Distributed Management Working Group"
       CONTACT-INFO
           "Juergen Quittek
```

```
            NEC Europe Ltd.
            Network Laboratories
            Kurfuersten-Anlage 36
            69115 Heidelberg
            Germany

            Phone: +49 6221 4342-115
            Email: quittek@netlab.nec.de"
        DESCRIPTION
            "The Lookup MIB (DISMAN-NSLOOKUP-MIB) enables determination
            of either the name(s) corresponding to a host address or of
            the address(es) associated with a host name at a remote
            host.

            Copyright (C) The Internet Society (2006).  This version of
            this MIB module is part of RFC 4560; see the RFC itself for
            full legal notices."

         --  Revision history

         REVISION     "200606130000Z"         -- 13 June 2006
         DESCRIPTION
             "Updated version, published as RFC 4560.
                 - Replaced references to RFC 2575 by RFC 3415
                 - Replaced references to RFC 2571 by RFC 3411
                 - Replaced references to RFC 2851 by RFC 4001
                 - Added value enabled(1) to SYNTAX clause of
                   lookupCtlOperStatus
                 - Added lookupMinimumCompliance
                 - Defined semantics of value 0 for object
                   lookupPurgeTime
                 - Added DEFVAL { unknown } to object
                   lookupCtlTargetAddressType OBJECT-TYPE"

         REVISION     "200009210000Z"         -- 21 September 2000
         DESCRIPTION
             "Initial version, published as RFC 2925."

        ::= { mib-2 82 }

    -- Top level structure of the MIB

    lookupObjects        OBJECT IDENTIFIER ::= { lookupMIB 1 }
    lookupConformance    OBJECT IDENTIFIER ::= { lookupMIB 2 }

    -- Simple Object Definitions

    lookupMaxConcurrentRequests OBJECT-TYPE
```

```
      SYNTAX      Unsigned32
      UNITS       "requests"
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
         "The maximum number of concurrent active lookup requests
         that are allowed within an agent implementation.  A value
         of 0 for this object implies that there is no limit for
         the number of concurrent active requests in effect.

         The limit applies only to new requests being activated.
         When a new value is set, the agent will continue processing
         all the requests already active, even if their number
         exceed the limit just imposed."
      DEFVAL { 10 }
      ::= { lookupObjects 1 }

   lookupPurgeTime OBJECT-TYPE
      SYNTAX      Unsigned32 (0..86400)
      UNITS       "seconds"
      MAX-ACCESS  read-write
      STATUS      current
      DESCRIPTION
         "The amount of time to wait before automatically
         deleting an entry in the lookupCtlTable and any
         dependent lookupResultsTable entries
         after the lookup operation represented by a
         lookupCtlEntry has been completed.
         A lookupCtEntry is considered complete
         when its lookupCtlOperStatus object has a
         value of completed(3).

         A value of 0 indicates that automatic deletion
         of entries is disabled."
      DEFVAL { 900 }  -- 15 minutes as default
      ::= { lookupObjects 2 }

   -- Lookup Control Table

   lookupCtlTable OBJECT-TYPE
      SYNTAX      SEQUENCE OF LookupCtlEntry
      MAX-ACCESS  not-accessible
      STATUS      current
      DESCRIPTION
          "Defines the Lookup Control Table for providing
          the capability of performing a lookup operation
          for a symbolic host name or for a host address
          from a remote host."
```

```
      ::= { lookupObjects 3 }

    lookupCtlEntry OBJECT-TYPE
       SYNTAX      LookupCtlEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines an entry in the lookupCtlTable.  A
           lookupCtlEntry is initially indexed by
           lookupCtlOwnerIndex, which is a type of SnmpAdminString,
           a textual convention that allows for the use of the SNMPv3
           View-Based Access Control Model (RFC 3415, VACM)
           and that also allows a management application to identify
           its entries.  The second index element,
           lookupCtlOperationName, enables the same
           lookupCtlOwnerIndex entity to have multiple outstanding
           requests.  The value of lookupCtlTargetAddressType
           determines which lookup function to perform."
       INDEX {
                lookupCtlOwnerIndex,
                lookupCtlOperationName
             }
       ::= { lookupCtlTable 1 }

    LookupCtlEntry ::=
       SEQUENCE {
           lookupCtlOwnerIndex         SnmpAdminString,
           lookupCtlOperationName      SnmpAdminString,
           lookupCtlTargetAddressType  InetAddressType,
           lookupCtlTargetAddress      InetAddress,
           lookupCtlOperStatus         INTEGER,
           lookupCtlTime               Unsigned32,
           lookupCtlRc                 Integer32,
           lookupCtlRowStatus          RowStatus
       }

    lookupCtlOwnerIndex OBJECT-TYPE
       SYNTAX      SnmpAdminString (SIZE(0..32))
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
          "To facilitate the provisioning of access control by a
          security administrator using the View-Based Access
          Control Model (RFC 2575, VACM) for tables in which
          multiple users may need to create or
          modify entries independently, the initial index is used as
          an 'owner index'.  Such an initial index has a syntax of
          SnmpAdminString and can thus be trivially mapped to a
```

```
          securityName or groupName defined in VACM, in
          accordance with a security policy.

          When used in conjunction with such a security policy all
          entries in the table belonging to a particular user (or
          group) will have the same value for this initial index.
          For a given user's entries in a particular table, the
          object identifiers for the information in these entries
          will have the same subidentifiers (except for the
          'column' subidentifier) up to the end of the encoded
          owner index.  To configure VACM to permit access to this
          portion of the table, one would create
          vacmViewTreeFamilyTable entries with the value of
          vacmViewTreeFamilySubtree including the owner index
          portion, and vacmViewTreeFamilyMask 'wildcarding' the
          column subidentifier.  More elaborate configurations
          are possible."
       ::= { lookupCtlEntry 1 }

    lookupCtlOperationName OBJECT-TYPE
       SYNTAX      SnmpAdminString (SIZE(0..32))
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "The name of a lookup operation.  This is locally unique,
           within the scope of an lookupCtlOwnerIndex."
       ::= { lookupCtlEntry 2 }

    lookupCtlTargetAddressType OBJECT-TYPE
       SYNTAX      InetAddressType
       MAX-ACCESS  read-create
       STATUS      current

       DESCRIPTION
           "Specifies the type of address for performing a
           lookup operation for a symbolic host name or for a host
           address from a remote host.

           Specification of dns(16) as the value for this object
           means that a function such as, for example, getaddrinfo()
           or gethostbyname() should be performed to return one or
           more numeric addresses.  Use of a value of either ipv4(1)
           or ipv6(2) means that a functions such as, for example,
           getnameinfo() or gethostbyaddr() should be used to return
           the symbolic names associated with a host."
       DEFVAL { unknown }
       ::= { lookupCtlEntry 3 }
```

```
    lookupCtlTargetAddress OBJECT-TYPE
       SYNTAX      InetAddress
       MAX-ACCESS  read-create
       STATUS      current
       DESCRIPTION
           "Specifies the address used for a resolver lookup at a
           remote host.  The corresponding lookupCtlTargetAddressType
           objects determines its type, as well as the function
           that can be requested.

           A value for this object MUST be set prior to
           transitioning its corresponding lookupCtlEntry to
           active(1) via lookupCtlRowStatus."
       ::= { lookupCtlEntry 4 }

    lookupCtlOperStatus OBJECT-TYPE
       SYNTAX      INTEGER {
                      enabled(1),    -- operation is active
                      notStarted(2), -- operation has not started
                      completed(3)   -- operation is done
                   }
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "Reflects the operational state of an lookupCtlEntry:

              enabled(1)    - Operation is active.
              notStarted(2) - Operation has not been enabled.
              completed(3)  - Operation has been completed.

            An operation is automatically enabled(1) when its
            lookupCtlRowStatus object is transitioned to active(1)
            status.  Until this occurs, lookupCtlOperStatus MUST
            report a value of notStarted(2).  After the lookup
            operation is completed (success or failure), the value
            for lookupCtlOperStatus MUST be transitioned to
            completed(3)."
       ::= { lookupCtlEntry 5 }

    lookupCtlTime OBJECT-TYPE
       SYNTAX      Unsigned32
       UNITS       "milliseconds"
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
           "Reports the number of milliseconds that a lookup
           operation required to be completed at a remote host.
           Completed means operation failure as well as
```

```
            success."
        ::= { lookupCtlEntry 6 }

    lookupCtlRc OBJECT-TYPE
        SYNTAX      Integer32
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "The system-specific return code from a lookup
            operation.  All implementations MUST return a value
            of 0 for this object when the remote lookup
            operation succeeds.  A non-zero value for this
            objects indicates failure.  It is recommended that
            implementations return the error codes that are
            generated by the lookup function used."
        ::= { lookupCtlEntry 7 }

    lookupCtlRowStatus OBJECT-TYPE
        SYNTAX      RowStatus
        MAX-ACCESS  read-create
        STATUS      current
        DESCRIPTION
            "This object allows entries to be created and deleted
            in the lookupCtlTable.

            A remote lookup operation is started when an
            entry in this table is created via an SNMP set
            request and the entry is activated.  This
            occurs by setting the value of this object
            to CreateAndGo(4) during row creation or
            by setting this object to active(1) after
            the row is created.

            A value MUST be specified for lookupCtlTargetAddress
            prior to the acceptance of a transition to active(1) state.
            A remote lookup operation starts when its entry
            first becomes active(1).  Transitions in and
            out of active(1) state have no effect on the
            operational behavior of a remote lookup
            operation, with the exception that deletion of
            an entry in this table by setting its RowStatus
            object to destroy(6) will stop an active
            remote lookup operation.

            The operational state of a remote lookup operation
            can be determined by examination of its
            lookupCtlOperStatus object."
        REFERENCE
```

```
            "See definition of RowStatus in RFC 2579,
            'Textual Conventions for SMIv2.'"
        ::= { lookupCtlEntry 8 }


    -- Lookup Results Table

     lookupResultsTable OBJECT-TYPE
        SYNTAX      SEQUENCE OF LookupResultsEntry
        MAX-ACCESS  not-accessible
        STATUS      current
        DESCRIPTION
            "Defines the Lookup Results Table for providing
            the capability of determining the results of a
            operation at a remote host.

            One or more entries are added to the
            lookupResultsTable when a lookup operation,
            as reflected by an lookupCtlEntry, is completed
            successfully.  All entries related to a
            successful lookup operation MUST be added
            to the lookupResultsTable at the same time
            that the associating lookupCtlOperStatus
            object is transitioned to completed(2).

            The number of entries added depends on the
            results determined for a particular lookup
            operation.  All entries associated with an
            lookupCtlEntry are removed when the
            lookupCtlEntry is deleted.

            A remote host can be multi-homed and have more than one IP
            address associated with it (returned by lookup function),
            or it can have more than one symbolic name (returned
            by lookup function).

            A function such as, for example, getnameinfo() or
            gethostbyaddr() is called with a host address as its
            parameter and is used primarily to determine a symbolic
            name to associate with the host address.  Entries in the
            lookupResultsTable MUST be made for each host name
            returned.  If the function identifies an 'official host
            name,' then this symbolic name MUST be assigned a
            lookupResultsIndex of 1.

            A function such as, for example, getaddrinfo() or
            gethostbyname() is called with a symbolic host name and is
            used primarily to retrieve a host address.  The entries
```

```
            MUST be stored in the order that they are retrieved from
            the lookup function.  lookupResultsIndex 1 MUST be
            assigned to the first entry."
        ::= { lookupObjects 4 }

    lookupResultsEntry OBJECT-TYPE
       SYNTAX      LookupResultsEntry
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Defines an entry in the lookupResultsTable.  The
           first two index elements identify the
           lookupCtlEntry that a lookupResultsEntry belongs
           to.  The third index element selects a single
           lookup operation result."
       INDEX {
                lookupCtlOwnerIndex,
                lookupCtlOperationName,
                lookupResultsIndex
             }
       ::= { lookupResultsTable 1 }

    LookupResultsEntry ::=
       SEQUENCE {
           lookupResultsIndex        Unsigned32,
           lookupResultsAddressType  InetAddressType,
           lookupResultsAddress      InetAddress
        }

    lookupResultsIndex OBJECT-TYPE
       SYNTAX      Unsigned32 (1..'ffffffff'h)
       MAX-ACCESS  not-accessible
       STATUS      current
       DESCRIPTION
           "Entries in the lookupResultsTable are created when
           the result of a lookup operation is determined.

           Entries MUST be stored in the lookupResultsTable in
           the order that they are retrieved.  Values assigned
           to lookupResultsIndex MUST start at 1 and increase
           consecutively."
       ::= { lookupResultsEntry 1 }

    lookupResultsAddressType OBJECT-TYPE
       SYNTAX      InetAddressType
       MAX-ACCESS  read-only
       STATUS      current
       DESCRIPTION
```

```
            "Indicates the type of result of a remote lookup
            operation.  A value of unknown(0) implies either that
            the operation hasn't been started or that
            it has failed."
        ::= { lookupResultsEntry 2 }

    lookupResultsAddress OBJECT-TYPE
        SYNTAX      InetAddress
        MAX-ACCESS  read-only
        STATUS      current
        DESCRIPTION
            "Reflects a result for a remote lookup operation
            as per the value of lookupResultsAddressType.

            The address type (InetAddressType) that relates to
            this object is specified by the corresponding value
            of lookupResultsAddress."

        ::= { lookupResultsEntry 3 }


    -- Conformance information
    -- Compliance statements

    lookupCompliances OBJECT IDENTIFIER ::= { lookupConformance 1 }
    lookupGroups      OBJECT IDENTIFIER ::= { lookupConformance 2 }

    -- Compliance statements

    lookupCompliance MODULE-COMPLIANCE
        STATUS  current
        DESCRIPTION
                "The compliance statement for SNMP entities that
                fully implement the DISMAN-NSLOOKUP-MIB."
        MODULE  -- this module
            MANDATORY-GROUPS { lookupGroup }

            OBJECT lookupMaxConcurrentRequests
            MIN-ACCESS  read-only
            DESCRIPTION
                "The agent is not required to support set
                operations to this object."

            OBJECT lookupPurgeTime
            MIN-ACCESS  read-only
            DESCRIPTION
                "The agent is not required to support a set
                operation to this object."
```

```
       ::= { lookupCompliances 1 }

    lookupMinimumCompliance MODULE-COMPLIANCE
       STATUS  current
       DESCRIPTION
               "The minimum compliance statement for SNMP entities
               that implement the minimal subset of the
               DISMAN-NSLOOKUP-MIB.  Implementors might choose this
               subset for small devices with limited resources."
       MODULE  -- this module
           MANDATORY-GROUPS { lookupGroup }

           OBJECT lookupMaxConcurrentRequests
           MIN-ACCESS  read-only
           DESCRIPTION
               "The agent is not required to support set
               operations to this object."

           OBJECT lookupPurgeTime
           MIN-ACCESS  read-only
           DESCRIPTION
               "The agent is not required to support a set
               operation to this object."

           OBJECT lookupCtlRowStatus
           MIN-ACCESS  read-only
           DESCRIPTION
               "Write access is not required.  If write access is
               not supported, then at least one entry in the
               lookupCtlTable MUST be established already when the SNMP
               agent starts offering access to the NSLOOKUP-MIB module.
               If, in such a case, only a single entry is offered, then
               it is RECOMMENDED that this entry use strings with a
               length of 0 for both of its two index objects."
       ::= { lookupCompliances 2 }

    -- MIB groupings

    lookupGroup OBJECT-GROUP
      OBJECTS {
                 lookupMaxConcurrentRequests,
                 lookupPurgeTime,
                 lookupCtlOperStatus,
                 lookupCtlTargetAddressType,
                 lookupCtlTargetAddress,
                 lookupCtlTime,
                 lookupCtlRc,
                 lookupCtlRowStatus,
```

```
                lookupResultsAddressType,
                lookupResultsAddress
              }
      STATUS  current
      DESCRIPTION
          "The group of objects that constitute the remote
          Lookup operation."
       ::= { lookupGroups 1 }

   END
```

5. Security Considerations

There are a number of management objects defined in the three MIB modules 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 tables and objects and their sensitivity/vulnerability:

- pingMaxConcurrentRequests
- traceRouteMaxConcurrentRequests
- lookupMaxConcurrentRequests

  The MIB modules limit their maximum numbers of concurrent requests by the values of these objects. Unauthorized access to them may lead to an overload of the managed node and to a disruption of other functions of the managed node.

- pingCtlTable
- traceRouteCtlTable
- lookupCtlTable

  All objects in entries of these tables (except index objects) have a MAX-ACCESS clause of read-create. Unauthorized access to these objects can disturb the measurements controlled by the tables. Also, the functions offered by the MIB modules can be misused for illegal data retrieval and for attacking other systems by floods of ping probes, traceroute probes or lookup requests, respectively.

In general, all three, the ping, traceroute, and lookup functions, when used excessively are considered a form of system attack. In the case of ping, sending a system request too often can negatively effect its performance and attempting to connect to what is supposed to be an unused port can be very unpredictable. Excessive use of the traceroute capability can, like ping, negatively affect system performance. The same applies to excessive use of the lookup service, particularly if the lookup cannot be resolved locally. In

insecure environments, it is RECOMMENDED that the MIBs defined within this memo not be supported.

- lookupPurgeTime
  Unauthorized access to this object can lead to the deletion of results of lookup operations before they are read by a management system, if the object is set to 0 or small values close to 0. If the object is set to very high values, unauthorized access can lead to a high consumption of resources for storing lookup results.

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. However, the only information that can be disclosed without encryption is the configuration and results of measurements that are performed by implementations of the MIB modules.

To facilitate the provisioning of access control by a security administrator using the View-Based Access Control Model (VACM), defined in RFC 3415 [RFC3415], for tables in which multiple users may need to create or modify entries independently, the initial index is used as an "owner index." Such an initial index has a syntax of SnmpAdminString and can thus be trivially mapped to a securityName or groupName defined in VACM, in accordance with a security policy.

All entries in related tables belonging to a particular user will have the same value for this initial index. For a given user's entries in a particular table, the object identifiers for the information in these entries will have the same subidentifiers (except for the "column" subidentifier) up to the end of the encoded owner index. To configure VACM to permit access to this portion of the table, one would create vacmViewTreeFamilyTable entries with the value of vacmViewTreeFamilySubtree including the owner index portion, and vacmViewTreeFamilyMask 'wildcarding' the column subidentifier. More elaborate configurations are possible. The VACM access control mechanism described above provides control.

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.

6. Acknowledgements

This document is a product of the DISMAN Working Group. Thanks to Eduardo Cardona for suggesting the minimum compliance statements and to Juergen Schoenwaelder for the very detailed and constructive MIB review.

7. References

7.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[RFC2578] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.

[RFC2579] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.

[RFC2580] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M., and S. Waldbusser, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.

[RFC2863] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB", RFC 2863, June 2000.

[RFC3411] Harrington, D., Presuhn, R., and B. Wijnen, "An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks", STD 62, RFC 3411, December 2002.

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

7.2. Informative References

[RFC792] Postel, J., "Internet Control Message Protocol", STD 5, RFC 792, September 1981.

[RFC862] Postel, J., "Echo Protocol", STD 20, RFC 862, May 1983.

[RFC1812] Baker, F., "Requirements for IP Version 4 Routers", RFC 1812, June 1995.

[RFC2474] Nichols, K., Blake, S., Baker, F., and D. Black, "Definition of the Differentiated Services Field (DS Field) in the IPv4 and IPv6 Headers", RFC 2474, December 1998.

[RFC3260] Grossman, D., "New Terminology and Clarifications for Diffserv", RFC 3260, April 2002.

[RFC3410] Case, J., Mundy, R., Partain, D. and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework", RFC 3410, December 2002.

[RFC3415] Wijnen, B., Presuhn, R., and K. McCloghrie, "View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)", STD 62, RFC 3415, December 2002.

Authors' Addresses

Juergen Quittek
NEC Europe Ltd.
Network Laboratories
Kurfuersten-Anlage 36
69115 Heidelberg
Germany

Phone: +49 6221 4342-115
EMail: quittek@netlab.nec.de

Kenneth D. White
Dept. BRQA/Bldg. 501/G114
IBM Corporation
P.O.Box 12195
3039 Cornwallis
Research Triangle Park, NC 27709, USA

EMail: wkenneth@us.ibm.com

Full Copyright Statement

Intellectual Property

Acknowledgement

Funding for the RFC Editor function is provided by the IETF Administrative Support Activity (IASA).