Remote Network Monitoring
Management Information Base
Version 2

Status of This Memo

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

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Abstract

This document defines a portion of the Management Information Base (MIB) for use with network management protocols in TCP/IP-based internets. In particular, it defines objects for managing remote network monitoring devices.

This document obsoletes RFC 2021, updates RFC 3273, and contains a new version of the RMON2-MIB module.
1. The Internet-Standard Management Framework

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

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

2. Overview

The RMON2 MIB defines objects that provide RMON analysis up to the application layer.

Remote network monitoring devices, often called monitors or probes, are instruments that exist for the purpose of managing a network. Often, these remote probes are stand-alone devices and devote significant internal resources for the sole purpose of managing a network. An organization may employ many of these devices, one per
network segment, to manage its internet. In addition, these devices may be used for a network management service provider to access a client network, which is often geographically remote.

The objects defined in this document are intended to serve as an interface between an RMON agent and an RMON management application and are not intended for direct manipulation by humans. While some users may tolerate the direct display of some of these objects, few will tolerate the complexity of manually manipulating objects to accomplish row creation. The management application should handle these functions.

2.1. Remote Network Management Goals

  o Offline Operation

  There are times when a management station will not be in constant contact with its remote monitoring devices. This sometimes occurs by design, in an attempt to lower communications costs (especially when communicating over a WAN or dialup link), or by accident, as network failures affect the communications between the management station and the probe.

  For this reason, this MIB allows a probe to be configured to perform diagnostics and to collect statistics continuously, even when communication with the management station may not be possible or efficient. The probe may then attempt to notify the management station when an exceptional condition occurs. Thus, even in circumstances where communication between the management station and probe is not continuous, fault, performance, and configuration information may be continuously accumulated and communicated to the management station conveniently and efficiently.

  o Proactive Monitoring

  Given the resources available on the monitor, it is potentially helpful for it to run diagnostics continuously and to log network performance. The monitor is always available at the onset of any failure. It can notify the management station of the failure and can store historical statistical information about the failure. This historical information can be played back by the management station in an attempt to perform further diagnosis of the cause of the problem.
o Problem Detection and Reporting

The monitor can be configured to recognize conditions, most notably error conditions, and to check for them continuously. When one of these conditions occurs, the event may be logged, and management stations may be notified in a number of ways.

o Value Added Data

Because a remote monitoring device represents a network resource dedicated exclusively to network management functions, and because it is located directly on the monitored portion of the network, the remote network monitoring device has the opportunity to add significant value to the data it collects. For instance, by highlighting those hosts on the network that generate the most traffic or errors, the probe can give the management station precisely the information it needs to solve a class of problems.

o Multiple Managers

An organization may have multiple management stations for different units of the organization, for different functions (e.g., engineering and operations), and in order to provide disaster recovery. Because environments with multiple management stations are common, the remote network monitoring device has to deal with more than one management station, potentially using its resources concurrently.

2.2. Structure of MIB

The objects are arranged into the following groups:

- protocol directory
- protocol distribution
- address mapping
- network layer host
- network layer matrix
- application layer host
- application layer matrix
- user history
- probe configuration

These groups are the basic units of conformance. If a remote monitoring device implements a group, then it must implement all objects in that group. For example, a managed agent that implements the network layer matrix group must implement the nlMatrixSDTable and the nlMatrixDSTable.

Implementations of this MIB must also implement the IF-MIB [RFC2863].

These groups are defined to provide a means of assigning object identifiers, and to provide a method for managed agents to know which objects they must implement.

This document also contains AUGMENTing tables to extend some tables defined in the RMON MIB [RFC2819]. These extensions include the following:

1) Adding the DroppedFrames and LastCreateTime conventions to each table defined in the RMON MIB.

2) Augmenting the RMON filter table with a mechanism that allows filtering based on an offset from the beginning of a particular protocol, even if the protocol headers are of variable length.

3) Augmenting the RMON filter and capture status bits with additional bits for WAN media and generic media. These bits are defined here as follows:

<table>
<thead>
<tr>
<th>Bit</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>For WAN media, this bit is set for packets coming from one direction and cleared for packets coming from the other direction. It is an implementation-specific matter as to which bit is assigned to which direction, but it must be consistent for all packets received by the agent. If the agent knows which end of the link is &quot;local&quot; and which end is &quot;network&quot;, the bit should be set for packets from the &quot;local&quot; side and should be cleared for packets from the &quot;network&quot; side.</td>
</tr>
<tr>
<td>7</td>
<td>For any media, this bit is set for any packet with a physical layer error. This bit may be set in addition to other media-specific bits that denote the same condition.</td>
</tr>
</tbody>
</table>
For any media, this bit is set for any packet that is too short for the media.  This bit may be set in addition to other media-specific bits that denote the same condition.

For any media, this bit is set for any packet that is too long for the media.  This bit may be set in addition to other media-specific bits that denote the same condition.

These enhancements are implemented by RMON-2 probes that also implement RMON and do not add any requirements to probes that are compliant to just RMON.

3. Control of Remote Network Monitoring Devices

Due to the complex nature of the available functions in these devices, the functions often need user configuration.  In many cases, the function requires that parameters be set up for a data collection operation.  The operation can proceed only after these parameters are fully set up.

Many functional groups in this MIB have one or more tables in which to set up control parameters, and one or more data tables in which to place the results of the operation.  The control tables are typically read/write in nature, while the data tables are typically read-only.  Because the parameters in the control table often describe resulting data in the data table, many of the parameters can be modified only when the control entry is not active.  Thus, the method for modifying these parameters is to deactivate the entry, perform the SNMP Set operations to modify the entry, and then reactivate the entry.  Deleting the control entry causes the deletion of any associated data entries, which also gives a convenient method for reclaiming the resources used by the associated data.

Some objects in this MIB provide a mechanism to execute an action on the remote monitoring device.  These objects may execute an action as a result of a change in the state of the object.  For those objects in this MIB, a request to set an object to the same value as it currently holds would thus cause no action to occur.

To facilitate control by multiple managers, resources have to be shared among the managers.  These resources are typically the memory and computation resources that a function requires.
3.1. Resource Sharing among Multiple Management Stations

When multiple management stations wish to use functions that compete for a finite amount of resources on a device, a method to facilitate this sharing of resources is required. Potential conflicts include the following:

- Two management stations wish to use resources simultaneously that together would exceed the capability of the device.
- A management station uses a significant amount of resources for a long period of time.
- A management station uses resources and then crashes, forgetting to free the resources so that others may use them.

The OwnerString mechanism is provided for each management station-initiated function in this MIB to avoid these conflicts and to help resolve them when they occur. Each function has a label identifying the initiator (owner) of the function. This label is set by the initiator to provide for the following possibilities:

- A management station may recognize resources it owns and no longer needs.
- A network operator can find the management station that owns the resource and negotiate for it to be freed.
- A network operator may decide unilaterally to free resources another network operator has reserved.
- Upon initialization, a management station may recognize resources it had reserved in the past. With this information, it may free the resources if it no longer needs them.

Management stations and probes should support any format of the owner string dictated by the local policy of the organization. It is suggested that this name contain one or more of the following: IP address, management station name, network manager’s name, location, or phone number. This information will help users share the resources more effectively.

There is often default functionality that the device or the administrator of the probe (often the network administrator) wishes to set up. The resources associated with this functionality are then owned by the device itself or by the network administrator, and they are intended to be long-lived. In this case, the device or the administrator will set the relevant owner object to a string starting...
with ‘monitor’. Indiscriminate modification of the monitor-owned configuration by network management stations is discouraged. In fact, a network management station should only modify these objects under the direction of the administrator of the probe.

Resources on a probe are scarce and are typically allocated when control rows are created by an application. Since many applications may be using a probe simultaneously, indiscriminate allocation of resources to particular applications is very likely to cause resource shortages in the probe.

When a network management station wishes to utilize a function in a monitor, it is encouraged first to scan the control table of that function to find an instance with similar parameters to share. This is especially true for those instances owned by the monitor, which can be assumed to change infrequently. If a management station decides to share an instance owned by another management station, it should understand that the management station that owns the instance may indiscriminately modify or delete it.

Note that a management application should have the most trust in a monitor-owned row, because it should be changed very infrequently. A row owned by the management application is less long-lived because a network administrator is more likely to reassign resources from a row that is in use by one user than those from a monitor-owned row that is potentially in use by many users. A row owned by another application would be even less long-lived because the other application may delete or modify that row completely at its discretion.

3.2. Row Addition among Multiple Management Stations

The addition of new rows is achieved using the RowStatus Textual Convention [RFC2579]. In this MIB, rows are often added to a table in order to configure a function. This configuration usually involves parameters that control the operation of the function. The agent must check these parameters to make sure they are appropriate given the restrictions defined in this MIB, as well as any implementation-specific restrictions, such as lack of resources. The agent implementor may be confused as to when to check these parameters and when to signal to the management station that the parameters are invalid. There are two opportunities:

- When the management station sets each parameter object.
- When the management station sets the row status object to active.
If the latter option is chosen, it would be unclear to the management station which of the several parameters was invalid and caused the badValue error to be emitted. Thus, wherever possible, the implementor should choose the former option, as it will provide more information to the management station.

A problem can arise when multiple management stations attempt to set configuration information simultaneously using SNMP. When this involves the addition of a new conceptual row in the same control table, the managers may collide, attempting to create the same entry. To guard against these collisions, each such control entry contains a status object with special semantics that help arbitrate among the managers. If an attempt is made with the row addition mechanism to create such a status object and that object already exists, an error is returned. When more than one manager simultaneously attempts to create the same conceptual row, only the first will succeed. The others will receive an error.

In the RMON MIB [RFC2819], the EntryStatus textual convention was introduced to provide this mutual exclusion function. Since then, this function was added to the SNMP framework as the RowStatus textual convention. The RowStatus textual convention is used for the definition of all new tables.

When a manager wishes to create a new control entry, it needs to choose an index for that row. It may choose this index in a variety of ways, hopefully minimizing the chances that the index is in use by another manager. If the index is in use, the mechanism mentioned previously will guard against collisions. Examples of schemes to choose index values include random selection or scanning the control table while looking for the first unused index. Because index values may be any valid value in the range and are chosen by the manager, the agent must allow a row to be created with any unused index value if it has the resources to create a new row.

Some tables in this MIB reference other tables within this MIB. When creating or deleting entries in these tables, it is generally allowable for dangling references to exist. There is no defined order for creating or deleting entries in these tables.

4. Conventions

The following conventions are used throughout the RMON MIB and its companion documents.
Good Packets

Good packets are error-free packets that have a valid frame length. For example, on Ethernet, good packets are error-free packets that are between 64 octets and 1518 octets long. They follow the form defined in IEEE 802.3 section 3.2.all.

Bad Packets

Bad packets are packets that have proper framing and are therefore recognized as packets, but that contain errors within the packet or have an invalid length. For example, on Ethernet, bad packets have a valid preamble and SFD but have a bad CRC, or they are either shorter than 64 octets or longer than 1518 octets.

5. RMON 2 Conventions

The following practices and conventions are introduced in the RMON 2 MIB.

5.1. Usage of the Term "Application Level"

There are many cases in this MIB where the term "Application Level" is used to describe a class of protocols or a capability. This does not typically mean a protocol that is an OSI Layer 7 protocol. Rather, it is used to identify a class of protocols that is not limited to MAC-layer and network-layer protocols, but can also include transport, session, presentation, and application-layer protocols.

5.2. Protocol Directory and Limited Extensibility

Every RMON 2 implementation will have the capability to parse certain types of packets and identify their protocol type at multiple levels. The protocol directory presents an inventory of protocol types the probe is capable of monitoring and allows the addition, deletion, and configuration of protocol types in this list.

One concept deserves special attention: the "limited extensibility" of the protocol directory table. Using the RMON 2 model, protocols are detected by static software that has been written at implementation time. Therefore, as a matter of configuration, an implementation cannot suddenly learn how to parse new packet types. However, an implementation may be written such that the software knows where the demultiplexing field is for a particular protocol, and it can be written in such a way that the decoding of the next layer up is table driven. This works when the code has been written to accommodate it and can be extended no more than one level higher.
This extensibility is called "limited extensibility" to highlight these limitations. However, this can be a very useful tool.

For example, suppose that an implementation has C code that understands how to decode IP packets on any of several Ethernet encapsulations, and also knows how to interpret the IP protocol field to recognize UDP packets and how to decode the UDP port number fields. That implementation may be table driven so that among the many different UDP port numbers possible, it is configured to recognize 161 as SNMP, port 53 as DNS, and port 69 as TFTP. The limited extensibility of the protocol directory table would allow an SNMP operation to create an entry that would create an additional table mapping for UDP that would recognize UDP port 123 as NTP and begin counting such packets.

This limited extensibility is an option that an implementation can choose to allow or disallow for any protocol that has child protocols.

5.3. Errors in Packets

Packets with link-level errors are not counted anywhere in this MIB because most variables in this MIB require the decoding of the contents of the packet, which is meaningless if there is a link-level error.

Packets in which protocol errors are detected are counted for all protocols below the layer in which the error was encountered. The implication of this is that packets in which errors are detected at the network-layer are not counted anywhere in this MIB, while packets with errors detected at the transport layer may have network-layer statistics counted.

6. Definitions

RMON2-MIB DEFINITIONS ::= BEGIN
IMPORTS
   MODULE-IDENTITY, OBJECT-TYPE, Counter32, Integer32,
   Gauge32, IpAddress, TimeTicks, mib-2 FROM SNMPv2-SMI
   TEXTUAL-CONVENTION, RowStatus, DisplayString, TimeStamp
   FROM SNMPv2-TC
   MODULE-COMPLIANCE, OBJECT-GROUP FROM SNMPv2-CONF
   ifIndex FROM IF-MIB
OwnerString, statistics, history, hosts,
matrix, filter, etherStatsEntry, historyControlEntry,
hostControlEntry, matrixControlEntry, filterEntry,
channelEntry FROM RMON-MIB
tokenRing, tokenRingMLStatsEntry, tokenRingFStatsEntry,
ringStationControlEntry, sourceRoutingStatsEntry
-- Remote Network Monitoring MIB
FROM TOKEN-RING-RMON-MIB;

rmon MODULE-IDENTITY
LAST-UPDATED "200605020000Z"    -- May 2, 2006
ORGANIZATION "IETF RMON MIB Working Group"
CONTACT-INFO
"Author:
Steve Waldbusser
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Working Group Chair:
Andy Bierman
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To subscribe send email to: <rmonmib-request@ietf.org>
"

DESCRIPTION
"The MIB module for managing remote monitoring
device implementations. This MIB module
extends the architecture introduced in the original
RMON MIB as specified in RFC 2819.

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this MIB module is part of RFC 4502; see the RFC itself for
full legal notices."

REVISION "200605020000Z"    -- May 2, 2006
DESCRIPTION
"This version updates the proposed-standard version of the
RMON2 MIB (published as RFC 2021) by adding 2 new
enumerations to the nlMatrixTopNControlRateBase object and
4 new enumerations to the alMatrixTopNControlRateBase object.
These new enumerations support the creation of high-capacity
topN reports in the High Capacity RMON MIB [RFC3273].

Additionally, the following objects have been deprecated, as
they have not had enough independent implementations to
demonstrate interoperability to meet the requirements of a
Draft Standard:

probeDownloadFile
probeDownloadTFTPServer
probeDownloadAction
probeDownloadStatus
serialMode
serialProtocol
serialTimeout
serialModemInitString
serialModemHangUpString
serialModemConnectResp
serialModemNoConnectResp
serialDialoutTimeout
serialStatus
serialConnectDestIpAddress
serialConnectType
serialConnectDialString
serialConnectSwitchConnectSeq
serialConnectSwitchDisconnectSeq
serialConnectSwitchResetSeq
serialConnectOwner
serialConnectStatus
netConfigIPAddress
netConfigSubnetMask
netConfigStatus
netDefaultGateway
tokenRingMLStats2DroppedFrames
tokenRingMLStats2CreateTime
tokenRingPStats2DroppedFrames
tokenRingPStats2CreateTime
ringStationControl2DroppedFrames
ingStationControl2CreateTime
sourceRoutingStats2DroppedFrames
sourceRoutingStats2CreateTime
trapDestIndex
trapDestCommunity
trapDestProtocol
trapDestAddress
trapDestOwner
trapDestStatus

In addition, two corrections were made. The LastCreateTime
Textual Convention had been defined with a base type of
another textual convention, which isn’t allowed in SMIv2. The
definition has been modified to use TimeTicks as the base
type.

Further, the SerialConfigEntry SEQUENCE definition included
sub-typing information that is not allowed in SMIv2. This
information has been deleted. Ranges were added to a number of
objects and textual-conventions to constrain their maximum
(and sometimes minimum) sizes. The addition of these ranges
document existing practice for these objects. These objects
are:
  ControlString
  protocolDirID
  protocolDirParameters
  addressMapNetworkAddress
  nlHostAddress
  nlMatrixSDSourceAddress
  nlMatrixSDDestAddress
  nlMatrixDSSourceAddress
  nlMatrixDSDestAddress
  nlMatrixTopNSourceAddress
  nlMatrixTopNDestAddress
  alHostEntry
  alMatrixSDEntry
  alMatrixDSEntry
  alMatrixTopNSourceAddress
  alMatrixTopNDestAddress

Finally, the TimeFilter TC has been updated to encourage agent implementations that allow a MIB walk to behave well even when performed by an application that is not aware of the special TimeFilter semantics."

REVISION "200207080000Z" -- 08 July, 2002
DESCRIPTION
"Added new enumerations to support the High-Capacity RMON MIB as defined in RFC 3273. Also fixed some typos and added clarifications."

REVISION "199605270000Z" -- 27 May, 1996
DESCRIPTION
"Original version. Published as RFC 2021."
::= { mib-2 16 }

-- ( rmon 1 ) through ( rmon 10 ) are defined in RMON and
-- the Token Ring RMON MIB [RFC1513]
-- Textual Conventions

ZeroBasedCounter32 ::= TEXTUAL-CONVENTION
  STATUS current
  DESCRIPTION
    "This TC describes an object that counts events with the following semantics: objects of this type will be set to zero(0) on creation and will thereafter count appropriate events, wrapping back to zero(0) when the value 2^32 is reached.

Provided that an application discovers the new object within the minimum time to wrap, it can use the initial value as a delta since it last polled the table of which this object is part. It is important for a management station to be aware of this minimum time and the actual time between polls, and to discard data if the actual time is too long or there is no defined minimum time.

Typically, this TC is used in tables where the INDEX space is constantly changing and/or the TimeFilter mechanism is in use."

SYNTAX Gauge32

LastCreateTime ::= TEXTUAL-CONVENTION
  STATUS current
  DESCRIPTION
    "This TC describes an object that stores the value of the sysUpTime object at the last time its entry was created.

This can be used for polling applications to determine that an entry has been deleted and re-created between polls, causing an otherwise undetectable discontinuity in the data.

If sysUpTime is reset to zero as a result of a re-initialization of the network management (sub)system, then the values of all LastCreateTime objects are also reset. However, after approximately 497 days without a re-initialization, the sysUpTime object will reach 2^^32-1 and then increment to zero; in this case, existing values of TimeStamp objects do not change. This can lead to ambiguities in the value of TimeStamp objects."

SYNTAX TimeTicks

TimeFilter ::= TEXTUAL-CONVENTION
  STATUS current
  DESCRIPTION
    "To be used for the index to a table. Allows an application to download only those rows changed since a particular time."
Note that this is not a history mechanism. Only current values of underlying objects are returned; saved instance values associated with particular values of sysUpTime are not.

An entry is considered changed if the value of any object in the entry changes, if the row is created, or if any object in the entry is created or deleted. Note that deleted entries cannot be detected or downloaded.

A time-filtered conceptual table is created by inserting a single object of SYNTAX TimeFilter as the first INDEX component in a copy of an existing basic conceptual table (i.e., any SEQUENCE without a TimeFilter INDEX component). Thus, for each conceptual entry ‘I’ in the basic table, there exists N conceptual entries in the time-filtered version, indexed N.I, where ‘N’ is equal to the value of sysUpTime.

When an application retrieves conceptual instances from a time-filtered table, and an INDEX value is provided for the TimeFilter INDEX component ‘N’, the agent will only consider returning basic conceptual entries (e.g., ‘fooColumn.N.I’) if any column within the basic conceptual entry has changed since sysUpTime ‘N’. If not, the basic conceptual entry will be ignored for the particular retrieval operation.

When sysUpTime is equal to zero, this table shall be empty.

One conceptual entry exists for each past value of sysUpTime, except that the whole table is purged should sysUpTime wrap.

As an entry in a time-filtered table is updated (i.e., one of the columns in the basic conceptual table is changed), new conceptual entries are also created in the time-filtered version (which still shares the now updated object values with all other instances). The number of unique time-filtered instances that are created is determined by the value of sysUpTime at which the basic entry was last updated. One unique instance will exist for each value of sysUpTime at the last update time for the row. However, a new TimeFilter index instance is created for each new sysUpTime value. The TimeFilter index values not associated with entry updates are called duplicate time-filtered instances.

After some deployment experience, it has been determined that a time-filtered table is more efficient if the agent stops a MIB walk operation by skipping over rows with a TimeFilter index value higher than the value in the received GetNext/GetBulk request. That is, instead of incrementing a TimeFilter index value, the agent will continue to the next
object or table. As a consequence, GetNext or GetBulk
operations will provide only one pass through a time-filtered
table.

It is suggested that an agent implement a time-filtered table
in this manner to improve performance and avoid a MIB walk
getting stuck in time-filtered tables. It is, however, still
acceptable for an agent to implement a time-filtered table in
the traditional manner (i.e., every conceptual time-filtered
instance is returned in GetNext and GetBulk PDU responses), and
management applications must be able to deal with such
traditional implementations.

See the appendix for further discussion of this textual
convention.

The following example is provided to demonstrate TimeFilter
behavior:

Consider the following basic conceptual table, basicFooTable.
(Note that the basic version of a time-filtered table may not
actually be defined.)

```
basicFooTable:
  INDEX { fooIndex }

BasicFooEntry {     
  fooIndex     Integer32, 
  fooCounts    Counter32 
}
```

For this example, the basicFooTable contains two static
contceptual entries (fooIndex equals ‘1’ and ‘2’), created at
time zero. It also contains one dynamic conceptual entry
(fooIndex equals ‘3’), which is created at time ‘3’ and deleted
at time ‘7’.

The time-filtered version of the basicFooTable could be defined
as follows:

```
FooTable:
  INDEX { fooTimeMark, fooIndex }

FooEntry {     
```
fooTimeMark TimeFilter,
fooIndex Integer32,
fooCounts Counter32
}

Note that entries exist in the time-filtered conceptual table only if they actually exist in the underlying (basic) table.

For this example, the fooTable will have three underlying basic entries (fooIndex == 1, 2, and 3), with the following activity (for sysUpTime equal 0 to 9):

- fooEntry.N.1 is created at time '0' and most recently updated at time '6' to the value '5'.
- fooEntry.N.2 is created at time '0' and most recently updated at time '8' to the value '9'.
- fooEntry.N.3 is created at time '3', updated at time '5' to the value '17', and deleted at time '7'.

The following tables show the values that would be returned for MIB walk operations with various TimeFilter values, done at different times. An application issues a retrieval request at time 'T', with a TimeFilter value, 'N' (typically set to a lower value, such as the value of sysUpTime at the last polling cycle).

The following values would be returned in a MIB walk of fooCounts.N if T equals '0' and N equals '0':

<table>
<thead>
<tr>
<th>fooCounts.N.I</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>fooCounts.0.1</td>
<td>0</td>
</tr>
<tr>
<td>fooCounts.0.2</td>
<td>0</td>
</tr>
</tbody>
</table>

Note that nothing is returned for fooCounts.0.3, since that entry does not exist at sysUpTime equals '0'.

The following values would be returned in a full (traditional) MIB walk of fooCounts.N if T equals '3' and N equals '0':

<table>
<thead>
<tr>
<th>fooCounts.N.I</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>fooCounts.0.1</td>
<td>0</td>
</tr>
<tr>
<td>fooCounts.0.2</td>
<td>0</td>
</tr>
<tr>
<td>fooCounts.0.3</td>
<td>0</td>
</tr>
<tr>
<td>fooCounts.1.3</td>
<td>0</td>
</tr>
<tr>
<td>fooCounts.2.3</td>
<td>0</td>
</tr>
<tr>
<td>fooCounts.3.3</td>
<td>0</td>
</tr>
</tbody>
</table>
Note that there are no instances for T equals 1 or 2 for the first two values of N, as these entries did not change since they were created at time '0'.

Note that the current value for 'fooCounts.N.3' is returned here, even for values of N less than '3' (when the entry was created). The agent only considers the current existence of an entry in the TimeFilter algorithm, not the time when the entry was created.

Note that the instances 'fooCounts.0.3', 'fooCounts.1.3', and 'fooCounts.2.3' are duplicates and can be suppressed by the agent in a MIB walk.

The following values would be returned in a full (traditional) MIB walk of fooCounts.N if T equals '6' and N equals '3':

```
fooCounts.N.I    Value
=======================
fooCounts.3.1    5
fooCounts.3.3    17
fooCounts.4.1    5
fooCounts.4.3    17
fooCounts.5.1    5
fooCounts.5.3    17
fooCounts.6.1    5
```

Note that no instances for entry 'fooCounts.N.2' are returned, since it has not changed since time '3'.

Note that all instances except 'fooCounts.5.3' and 'fooCounts.6.1' are duplicates and can be suppressed by the agent in a MIB walk.

The following values would be returned in a full (traditional) MIB walk of fooCounts.N if T equals '9' and N equals '6':

```
fooCounts.N.I    Value
=======================
fooCounts.6.1    5
fooCounts.6.2    9
fooCounts.7.2    9
fooCounts.8.2    9
```

Note that no instances for entry 'fooCounts.N.3' are returned, since it was deleted at time '7'.

Note that instances 'fooCounts.6.2' and 'fooCounts.7.2'
are duplicates and can be suppressed by the agent in a MIB walk."

SYNTAX    TimeTicks

DataSource ::= TEXTUAL-CONVENTION
STATUS        current
DESCRIPTION
"Identifies the source of the data that the associated function is configured to analyze. This source can be any interface on this device.

In order to identify a particular interface, this object shall identify the instance of the ifIndex object, defined in [RFC2863], for the desired interface.

For example, if an entry were to receive data from interface #1, this object would be set to ifIndex.1."
SYNTAX      OBJECT IDENTIFIER

-- -- Protocol Directory Group
--
-- Lists the inventory of protocols the probe has the capability of -- monitoring and allows the addition, deletion, and configuration of -- entries in this list.

protocolDirLastChange OBJECT-TYPE
SYNTAX      TimeStamp
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The value of sysUpTime at the time the protocol directory was last modified, either through insertions or deletions, or through modifications of the protocolDirAddressMapConfig, protocolDirHostConfig, or protocolDirMatrixConfig."
 ::= { protocolDir 1 }

protocolDirTable OBJECT-TYPE
SYNTAX      SEQUENCE OF ProtocolDirEntry
MAX-ACCESS not-accessible
STATUS      current
DESCRIPTION
"This table lists the protocols that this agent has the capability to decode and count. There is one entry in this table for each such protocol. These protocols represent different network-layer, transport-layer, and higher-layer
protocols. The agent should boot up with this table
preconfigured with those protocols that it knows about and
wishes to monitor. Implementations are strongly encouraged to
support protocols higher than the network layer (at least for
the protocol distribution group), even for implementations
that don’t support the application-layer groups."

::= { protocolDir 2 }

protocolDirEntry OBJECT-TYPE
SYNTAX     ProtocolDirEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"A conceptual row in the protocolDirTable."

An example of the indexing of this entry is
protocolDirLocalIndex.8.0.0.1.0.0.8.0.2.0.0, which is the
encoding of a length of 8, followed by 8 subids encoding the
protocolDirID of 1.2048, followed by a length of 2 and the
2 subids encoding zero-valued parameters.

Note that some combinations of index values may result in an
index that exceeds 128 sub-identifiers in length, which exceeds
the maximum for the SNMP protocol. Implementations should take
care to avoid such combinations."

INDEX { protocolDirID, protocolDirParameters }
 ::= { protocolDirTable 1 }

ProtocolDirEntry ::= SEQUENCE {
    protocolDirID                  OCTET STRING,
    protocolDirParameters        OCTET STRING,
    protocolDirLocalIndex        INTEGER32,
    protocolDirDescr             DisplayString,
    protocolDirType              BITS,
    protocolDirAddressMapConfig  INTEGER,
    protocolDirHostConfig        INTEGER,
    protocolDirMatrixConfig      INTEGER,
    protocolDirOwner             OwnerString,
    protocolDirStatus            RowStatus
}

protocolDirID OBJECT-TYPE
SYNTAX     OCTET STRING  (SIZE (4..128))
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"A unique identifier for a particular protocol. Standard
identifiers will be defined in such a manner that they
can often be used as specifications for new protocols - i.e., a tree-structured assignment mechanism that matches the protocol encapsulation ‘tree’ and that has algorithmic assignment mechanisms for certain subtrees. See RFC 2074 for more details.

Despite the algorithmic mechanism, the probe will only place entries in here for those protocols it chooses to collect. In other words, it need not populate this table with all possible ethernet protocol types, nor need it create them on the fly when it sees them. Whether it does these things is a matter of product definition (cost/benefit, usability) and is up to the designer of the product.

If an entry is written to this table with a protocolDirID that the agent doesn’t understand, either directly or algorithmically, the SET request will be rejected with an inconsistentName or badValue (for SNMPv1) error."

::= { protocolDirEntry 1 }

protocolDirParameters OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (1..32))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A set of parameters for the associated protocolDirID. See the associated RMON2 Protocol Identifiers document for a description of the possible parameters. There will be one octet in this string for each sub-identifier in the protocolDirID, and the parameters will appear here in the same order as the associated sub-identifiers appear in the protocolDirID.

Every node in the protocolDirID tree has a different, optional set of parameters defined (that is, the definition of parameters for a node is optional). The proper parameter value for each node is included in this string. Note that the inclusion of a parameter value in this string for each node is not optional. What is optional is that a node may have no parameters defined, in which case the parameter field for that node will be zero."

::= { protocolDirEntry 2 }

protocolDirLocalIndex OBJECT-TYPE
SYNTAX Integer32 (1..2147483647)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
The locally arbitrary but unique identifier associated with this protocolDir entry.

The value for each supported protocol must remain constant at least from one re-initialization of the entity’s network management system to the next re-initialization, except that if a protocol is deleted and re-created, it must be re-created with a new value that has not been used since the last re-initialization.

The specific value is meaningful only within a given SNMP entity. A protocolDirLocalIndex must not be re-used until the next agent restart in the event that the protocol directory entry is deleted.

::= { protocolDirEntry 3 }

protocolDirDescr OBJECT-TYPE
SYNTAX DisplayString (SIZE (1..64))
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"A textual description of the protocol encapsulation. A probe may choose to describe only a subset of the entire encapsulation (e.g., only the highest layer).

This object is intended for human consumption only.

This object may not be modified if the associated protocolDirStatus object is equal to active(1)."

::= { protocolDirEntry 4 }

protocolDirType OBJECT-TYPE
SYNTAX BITS {
    extensible(0),
    addressRecognitionCapable(1)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"This object describes 2 attributes of this protocol directory entry.

The presence or absence of the 'extensible' bit describes whether this protocol directory entry can be extended by the user by creating protocol directory entries that are children of this protocol.

An example of an entry that will often allow extensibility is
'ip.udp'. The probe may automatically populate some children of this node, such as 'ip.udp.snmp' and 'ip.udp.dns'.
A probe administrator or user may also populate additional children via remote SNMP requests that create entries in this table. When a child node is added for a protocol for which the probe has no built-in support extending a parent node (for which the probe does have built-in support), that child node is not extendable. This is termed 'limited extensibility'.

When a child node is added through this extensibility mechanism, the values of protocolDirLocalIndex and protocolDirType shall be assigned by the agent.

The other objects in the entry will be assigned by the manager who is creating the new entry.

This object also describes whether this agent can recognize addresses for this protocol, should it be a network-level protocol. That is, while a probe may be able to recognize packets of a particular network-layer protocol and count them, it takes additional logic to be able to recognize the addresses in this protocol and to populate network-layer or application-layer tables with the addresses in this protocol. If this bit is set, the agent will recognize network-layer addresses for this protocol and populate the network- and application-layer host and matrix tables with these protocols.

Note that when an entry is created, the agent will supply values for the bits that match the capabilities of the agent with respect to this protocol. Note that since row creations usually exercise the limited extensibility feature, these bits will usually be set to zero.

::= { protocolDirEntry 5 }

protocolDirAddressMapConfig OBJECT-TYPE
SYNTAX INTEGER {
    notSupported(1),
    supportedOff(2),
    supportedOn(3)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This object describes and configures the probe’s support for address mapping for this protocol. When the probe creates entries in this table for all protocols that it understands,
it will set the entry to notSupported(1) if it doesn’t have the capability to perform address mapping for the protocol or if this protocol is not a network-layer protocol. When an entry is created in this table by a management operation as part of the limited extensibility feature, the probe must set this value to notSupported(1), because limited extensibility of the protocolDirTable does not extend to interpreting addresses of the extended protocols.

If the value of this object is notSupported(1), the probe will not perform address mapping for this protocol and shall not allow this object to be changed to any other value. If the value of this object is supportedOn(3), the probe supports address mapping for this protocol and is configured to perform address mapping for this protocol for all addressMappingControlEntries and all interfaces. If the value of this object is supportedOff(2), the probe supports address mapping for this protocol but is configured to not perform address mapping for this protocol for any addressMappingControlEntries and all interfaces. Whenever this value changes from supportedOn(3) to supportedOff(2), the probe shall delete all related entries in the addressMappingTable.

::= { protocolDirEntry 6 }

protocolDirHostConfig OBJECT-TYPE
SYNTAX INTEGER {
  notSupported(1),
  supportedOff(2),
  supportedOn(3)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION "This object describes and configures the probe’s support for the network-layer and application-layer host tables for this protocol. When the probe creates entries in this table for all protocols that it understands, it will set the entry to notSupported(1) if it doesn’t have the capability to track the nlHostTable for this protocol or if the alHostTable is implemented but doesn’t have the capability to track this protocol. Note that if the alHostTable is implemented, the probe may only support a protocol if it is supported in both the nlHostTable and the alHostTable.

If the associated protocolDirType object has the addressRecognitionCapable bit set, then this is a network-layer protocol for which the probe recognizes addresses, and
thus the probe will populate the nlHostTable and alHostTable with addresses it discovers for this protocol.

If the value of this object is notSupported(1), the probe will not track the nlHostTable or alHostTable for this protocol and shall not allow this object to be changed to any other value. If the value of this object is supportedOn(3), the probe supports tracking of the nlHostTable and alHostTable for this protocol and is configured to track both tables for this protocol for all control entries and all interfaces. If the value of this object is supportedOff(2), the probe supports tracking of the nlHostTable and alHostTable for this protocol but is configured to not track these tables for any control entries or interfaces. Whenever this value changes from supportedOn(3) to supportedOff(2), the probe shall delete all related entries in the nlHostTable and alHostTable.

Note that since each alHostEntry references 2 protocol directory entries, one for the network address and one for the type of the highest protocol recognized, an entry will only be created in that table if this value is supportedOn(3) for both protocols.

::= { protocolDirEntry 7 }

protocolDirMatrixConfig OBJECT-TYPE
SYNTAX      INTEGER {
            notSupported(1),
            supportedOff(2),
            supportedOn(3)
          }
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
"This object describes and configures the probe’s support for the network-layer and application-layer matrix tables for this protocol. When the probe creates entries in this table for all protocols that it understands, it will set the entry to notSupported(1) if it doesn’t have the capability to track the nlMatrixTables for this protocol or if the alMatrixTables are implemented but don’t have the capability to track this protocol. Note that if the alMatrix tables are implemented, the probe may only support a protocol if it is supported in both of the nlMatrixTables and both of the alMatrixTables.

If the associated protocolDirType object has the addressRecognitionCapable bit set, then this is a network-
layer protocol for which the probe recognizes addresses, and thus the probe will populate both of the nlMatrixTables and both of the alMatrixTables with addresses it discovers for this protocol.

If the value of this object is notSupported(1), the probe will not track either of the nlMatrixTables or the alMatrixTables for this protocol and shall not allow this object to be changed to any other value. If the value of this object is supportedOn(3), the probe supports tracking of both of the nlMatrixTables and (if implemented) both of the alMatrixTables for this protocol and is configured to track these tables for this protocol for all control entries and all interfaces. If the value of this object is supportedOff(2), the probe supports tracking of both of the nlMatrixTables and (if implemented) both of the alMatrixTables for this protocol but is configured to not track these tables for this protocol for any control entries or interfaces. Whenever this value changes from supportedOn(3) to supportedOff(2), the probe shall delete all related entries in the nlMatrixTables and the alMatrixTables.

Note that since each alMatrixEntry references 2 protocol directory entries, one for the network address and one for the type of the highest protocol recognized, an entry will only be created in that table if this value is supportedOn(3) for both protocols."

::= { protocolDirEntry 8 }

protocolDirOwner OBJECT-TYPE
SYNTAX          OwnerString
MAX-ACCESS      read-create
STATUS          current
DESCRIPTION
   "The entity that configured this entry and is therefore using the resources assigned to it."
::= { protocolDirEntry 9 }

protocolDirStatus OBJECT-TYPE
SYNTAX          RowStatus
MAX-ACCESS      read-create
STATUS          current
DESCRIPTION
   "The status of this protocol directory entry.

An entry may not exist in the active state unless all objects in the entry have an appropriate value."
If this object is not equal to active(1), all associated entries in the nlHostTable, nlMatrixSDTable, nlMatrixDSTable, alHostTable, alMatrixSDTable, and alMatrixDSTable shall be deleted.

::= { protocolDirEntry 10 }

-- Protocol Distribution Group (protocolDist)
-- Collects the relative amounts of octets and packets for the different protocols detected on a network segment.
-- protocolDistControlTable,
-- protocolDistStatsTable

protocolDistControlTable OBJECT-TYPE
SYNTAX SEQUENCE OF ProtocolDistControlEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Controls the setup of protocol type distribution statistics tables.

Implementations are encouraged to add an entry per monitored interface upon initialization so that a default collection of protocol statistics is available.

Rationale:
This table controls collection of very basic statistics for any or all of the protocols detected on a given interface. An NMS can use this table to quickly determine bandwidth allocation utilized by different protocols.

A media-specific statistics collection could also be configured (e.g., etherStats, trPStats) to easily obtain total frame, octet, and droppedEvents for the same interface."

::= { protocolDist 1 }

protocolDistControlEntry OBJECT-TYPE
SYNTAX ProtocolDistControlEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A conceptual row in the protocolDistControlTable.

An example of the indexing of this entry is protocolDistControlDroppedFrames.7"
INDEX { protocolDistControlIndex }
::= { protocolDistControlTable 1 }

ProtocolDistControlEntry ::= SEQUENCE {
    protocolDistControlIndex                Integer32,
    protocolDistControlDataSource           DataSource,
    protocolDistControlDroppedFrames        Counter32,
    protocolDistControlCreateTime           LastCreateTime,
    protocolDistControlOwner                OwnerString,
    protocolDistControlStatus               RowStatus
}

protocolDistControlIndex OBJECT-TYPE
SYNTAX      Integer32 (1..65535)
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
   "A unique index for this protocolDistControlEntry."
::= { protocolDistControlEntry 1 }

protocolDistControlDataSource OBJECT-TYPE
SYNTAX      DataSource
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
   "The source of data for this protocol distribution.

   The statistics in this group reflect all packets
on the local network segment attached to the
identified interface.

   This object may not be modified if the associated
protocolDistControlStatus object is equal to active(1)."
::= { protocolDistControlEntry 2 }

protocolDistControlDroppedFrames OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
   "The total number of frames that were received by the probe
and therefore not accounted for in the *StatsDropEvents, but
that the probe chose not to count for this entry for
whatever reason. Most often, this event occurs when the probe
is out of some resources and decides to shed load from this
collection.

This count does not include packets that were not counted
because they had MAC-layer errors."
Note that, unlike the dropEvents counter, this number is the exact number of frames dropped.

::= { protocolDistControlEntry 3 }

protocolDistControlCreateTime OBJECT-TYPE
SYNTAX     LastCreateTime
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The value of sysUpTime when this control entry was last activated. This can be used by the management station to ensure that the table has not been deleted and recreated between polls."
::= { protocolDistControlEntry 4 }

protocolDistControlOwner OBJECT-TYPE
SYNTAX      OwnerString
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
"The entity that configured this entry and is therefore using the resources assigned to it."
::= { protocolDistControlEntry 5 }

protocolDistControlStatus OBJECT-TYPE
SYNTAX      RowStatus
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
"The status of this row.

An entry may not exist in the active state unless all objects in the entry have an appropriate value.

If this object is not equal to active(1), all associated entries in the protocolDistStatsTable shall be deleted."
::= { protocolDistControlEntry 6 }

-- per interface protocol distribution statistics table
protocolDistStatsTable OBJECT-TYPE
SYNTAX      SEQUENCE OF ProtocolDistStatsEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"An entry is made in this table for every protocol in the protocolDirTable that has been seen in at least one packet. Counters are updated in this table for every protocol type that is encountered when parsing a packet, but no counters are
updated for packets with MAC-layer errors.

Note that if a protocolDirEntry is deleted, all associated entries in this table are removed.

::= { protocolDist 2 }

protocolDistStatsEntry OBJECT-TYPE
SYNTAX ProtocolDistStatsEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "A conceptual row in the protocolDistStatsTable.

The index is composed of the protocolDistControlIndex of the associated protocolDistControlEntry, followed by the protocolDirLocalIndex of the associated protocol that this entry represents. In other words, the index identifies the protocol distribution an entry is a part of and the particular protocol that it represents.

An example of the indexing of this entry is protocolDistStatsPkts.1.18"
INDEX { protocolDistControlIndex, protocolDirLocalIndex }
::= { protocolDistStatsTable 1 }

ProtocolDistStatsEntry ::= SEQUENCE {
    protocolDistStatsPkts                    ZeroBasedCounter32,
    protocolDistStatsOctets                  ZeroBasedCounter32
}

protocolDistStatsPkts OBJECT-TYPE
SYNTAX ZeroBasedCounter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of packets of this protocol type received without errors. Note that this is the number of link-layer packets, so if a single network-layer packet is fragmented into several link-layer frames, this counter is incremented several times."
 ::= { protocolDistStatsEntry 1 }

protocolDistStatsOctets OBJECT-TYPE
SYNTAX ZeroBasedCounter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The number of octets in packets of this protocol type
received since it was added to the protocolDistStatsTable (excluding framing bits, but including FCS octets), except for those octets in packets that contained errors.

Note that this doesn't count just those octets in the particular protocol frames but includes the entire packet that contained the protocol.

::= { protocolDistStatsEntry 2 }

-- Address Map Group (addressMap)
-- Lists MAC address to network address bindings discovered by the probe and what interface they were last seen on.
-- addressMapControlTable
-- addressMapTable

addressMapInserts OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times an address mapping entry has been inserted into the addressMapTable. If an entry is inserted, then deleted, and then inserted, this counter will be incremented by 2.

Note that the table size can be determined by subtracting addressMapDeletes from addressMapInserts."
::= { addressMap 1 }

addressMapDeletes OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times an address mapping entry has been deleted from the addressMapTable (for any reason). If an entry is deleted, then inserted, and then deleted, this counter will be incremented by 2.

Note that the table size can be determined by subtracting addressMapDeletes from addressMapInserts."
::= { addressMap 2 }

addressMapMaxDesiredEntries OBJECT-TYPE
SYNTAX Integer32 (-1..2147483647)
MAX-ACCESS read-write
DESCRIPTION

"The maximum number of entries that are desired in the addressMapTable. The probe will not create more than this number of entries in the table but may choose to create fewer entries in this table for any reason, including the lack of resources.

If this object is set to a value less than the current number of entries, enough entries are chosen in an implementation-dependent manner and deleted so that the number of entries in the table equals the value of this object.

If this value is set to -1, the probe may create any number of entries in this table.

This object may be used to control how resources are allocated on the probe for the various RMON functions."

::= { addressMap 3 }

addressMapControlTable OBJECT-TYPE
SYNTAX      SEQUENCE OF AddressMapControlEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION

"A table to control the collection of mappings from network layer address to physical address to interface.

Note that this is not like the typical RMON controlTable and dataTable in which each entry creates its own data table. Each entry in this table enables the discovery of addresses on a new interface and the placement of address mappings into the central addressMapTable.

Implementations are encouraged to add an entry per monitored interface upon initialization so that a default collection of address mappings is available."

::= { addressMap 4 }

addressMapControlEntry OBJECT-TYPE
SYNTAX      AddressMapControlEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION

"A conceptual row in the addressMapControlTable.

An example of the indexing of this entry is addressMapControlDroppedFrames.1"
INDEX { addressMapControlIndex }
 ::= { addressMapControlTable 1 }

AddressMapControlEntry ::= SEQUENCE {
    addressMapControlIndex              Integer32,
    addressMapControlDataSource         DataSource,
    addressMapControlDroppedFrames      Counter32,
    addressMapControlOwner              OwnerString,
    addressMapControlStatus             RowStatus
}

addressMapControlIndex OBJECT-TYPE
SYNTAX      Integer32 (1..65535)
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
   "A unique index for this entry in the addressMapControlTable."
 ::= { addressMapControlEntry 1 }

addressMapControlDataSource OBJECT-TYPE
SYNTAX      DataSource
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
   "The source of data for this addressMapControlEntry."
 ::= { addressMapControlEntry 2 }

addressMapControlDroppedFrames OBJECT-TYPE
SYNTAX      Counter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
   "The total number of frames that were received by the probe
and therefore not accounted for in the *StatsDropEvents, but
that the probe chose not to count for this entry for
whatever reason. Most often, this event occurs when the probe
is out of some resources and decides to shed load from this
collection.

This count does not include packets that were not counted
because they had MAC-layer errors.

Note that, unlike the dropEvents counter, this number is the
exact number of frames dropped."
 ::= { addressMapControlEntry 3 }

addressMapControlOwner OBJECT-TYPE
SYNTAX      OwnerString
MAX-ACCESS  read-create
STATUS        current
DESCRIPTION   "The entity that configured this entry and is therefore using the resources assigned to it."
 ::= { addressMapControlEntry 4 }

addressMapControlStatus OBJECT-TYPE
SYNTAX        RowStatus
MAX-ACCESS    read-create
STATUS        current
DESCRIPTION   "The status of this addressMap control entry.

An entry may not exist in the active state unless all objects in the entry have an appropriate value.

If this object is not equal to active(1), all associated entries in the addressMapTable shall be deleted."
 ::= { addressMapControlEntry 5 }

addressMapTable OBJECT-TYPE
SYNTAX        SEQUENCE OF AddressMapEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION   "A table of mappings from network layer address to physical address to interface.

The probe will add entries to this table based on the source MAC and network addresses seen in packets without MAC-level errors. The probe will populate this table for all protocols in the protocol directory table whose value of protocolDirAddressMapConfig is equal to supportedOn(3), and will delete any entries whose protocolDirEntry is deleted or has a protocolDirAddressMapConfig value of supportedOff(2)."
 ::= { addressMap 5 }

addressMapEntry OBJECT-TYPE
SYNTAX        AddressMapEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION   "A conceptual row in the addressMapTable.

The protocolDirLocalIndex in the index identifies the network layer protocol of the addressMapNetworkAddress."
An example of the indexing of this entry is addressMapSource.783495.18.4.128.2.6.6.11.1.3.6.1.2.1.1.1.1.3.6.1.2.1.2.1.2.1.1.

Note that some combinations of index values may result in an index that exceeds 128 sub-identifiers in length, which exceeds the maximum for the SNMP protocol. Implementations should take care to avoid such combinations.

INDEX { addressMapTimeMark, protocolDirLocalIndex, addressMapNetworkAddress, addressMapSource }
::= { addressMapTable 1 }

AddressMapEntry ::= SEQUENCE {
    addressMapTimeMark                 TimeFilter,
    addressMapNetworkAddress           OCTET STRING,
    addressMapSource                   OBJECT IDENTIFIER,
    addressMapPhysicalAddress          OCTET STRING,
    addressMapLastChange               TimeStamp
}

addressMapTimeMark OBJECT-TYPE
SYNTAX      TimeFilter
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
   "A TimeFilter for this entry. See the TimeFilter textual
    convention to see how this works."
::= { addressMapEntry 1 }

addressMapNetworkAddress OBJECT-TYPE
SYNTAX      OCTET STRING (SIZE (1..255))
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
   "The network address for this relation.

This is represented as an octet string with specific semantics and length as identified by the protocolDirLocalIndex component of the index.

For example, if the protocolDirLocalIndex indicates an encapsulation of ip, this object is encoded as a length octet of 4, followed by the 4 octets of the IP address, in network byte order."
::= { addressMapEntry 2 }

addressMapSource OBJECT-TYPE
SYNTAX      OBJECT IDENTIFIER
addressMapEntry 3

addressMapPhysicalAddress OBJECT-TYPE
SYNTAX OCTET STRING
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The last source physical address on which the associated
network address was seen. If the protocol of the associated
network address was encapsulated inside of a network-level or
higher protocol, this will be the address of the next-lower
protocol with the addressRecognitionCapable bit enabled and
will be formatted as specified for that protocol."
::= { addressMapEntry 3 }

addressMapLastChange OBJECT-TYPE
SYNTAX TimeStamp
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The value of sysUpTime at the time this entry was last
created or the values of the physical address changed.
This can be used to help detect duplicate address problems, in which case this object will be updated frequently.

::= { addressMapEntry 5 }

--
-- Network Layer Host Group
--
-- Counts the amount of traffic sent from and to each network address discovered by the probe.
-- Note that while the hlHostControlTable also has objects that control an optional alHostTable, implementation of the alHostTable is not required to fully implement this group.

hlHostControlTable OBJECT-TYPE
SYNTAX      SEQUENCE OF HlHostControlEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A list of higher-layer (i.e., non-MAC) host table control entries.

These entries will enable the collection of the network- and application-level host tables indexed by network addresses. Both the network- and application-level host tables are controlled by this table so that they will both be created and deleted at the same time, further increasing the ease with which they can be implemented as a single datastore. (Note that if an implementation stores application-layer host records in memory, it can derive network-layer host records from them.)

Entries in the nlHostTable will be created on behalf of each entry in this table. Additionally, if this probe implements the alHostTable, entries in the alHostTable will be created on behalf of each entry in this table.

Implementations are encouraged to add an entry per monitored interface upon initialization so that a default collection of host statistics is available."

 ::= { nlHost 1 }

hlHostControlEntry OBJECT-TYPE
SYNTAX      HlHostControlEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A conceptual row in the hlHostControlTable.

An example of the indexing of this entry is
hlHostControlNlDroppedFrames.1
INDEX { hlHostControlIndex }
::= { hlHostControlTable 1 }

HlHostControlEntry ::= SEQUENCE {
  hlHostControlIndex               Integer32,
  hlHostControlDataSource          DataSource,
  hlHostControlNlDroppedFrames     Counter32,
  hlHostControlNlInserts           Counter32,
  hlHostControlNlDeletes           Counter32,
  hlHostControlNlMaxDesiredEntries Integer32,
  hlHostControlAlDroppedFrames     Counter32,
  hlHostControlAlInserts           Counter32,
  hlHostControlAlDeletes           Counter32,
  hlHostControlAlMaxDesiredEntries Integer32,
  hlHostControlOwner               OwnerString,
  hlHostControlStatus              RowStatus
}

hlHostControlIndex OBJECT-TYPE
  SYNTAX      Integer32 (1..65535)
  MAX-ACCESS  not-accessible
  STATUS      current
  DESCRIPTION
    "An index that uniquely identifies an entry in the
    hlHostControlTable. Each such entry defines
    a function that discovers hosts on a particular
    interface and places statistics about them in the
    nlHostTable, and optionally in the alHostTable, on
    behalf of this hlHostControlEntry."
  ::= { hlHostControlEntry 1 }

hlHostControlDataSource OBJECT-TYPE
  SYNTAX      DataSource
  MAX-ACCESS  read-create
  STATUS      current
  DESCRIPTION
    "The source of data for the associated host tables.
    The statistics in this group reflect all packets
    on the local network segment attached to the
    identified interface.
    This object may not be modified if the associated
    hlHostControlStatus object is equal to active(1)."
  ::= { hlHostControlEntry 2 }

hlHostControlNlDroppedFrames OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for the associated nlHost entries for whatever reason. Most often, this event occurs when the probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that if the nlHostTable is inactive because no protocols are enabled in the protocol directory, this value should be 0.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped."

 ::=  { hlHostControlEntry 3 }

hlHostControlNlInserts OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of times an nlHost entry has been inserted into the nlHost table. If an entry is inserted, then deleted, and then inserted, this counter will be incremented by 2.

To allow for efficient implementation strategies, agents may delay updating this object for short periods of time. For example, an implementation strategy may allow internal data structures to differ from those visible via SNMP for short periods of time. This counter may reflect the internal data structures for those short periods of time.

Note that the table size can be determined by subtracting hlHostControlNlDeletes from hlHostControlNlInserts."

 ::=  { hlHostControlEntry 4 }

hlHostControlNlDeletes OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of times an nlHost entry has been
deleted from the nlHost table (for any reason). If an entry is deleted, then inserted, and then deleted, this counter will be incremented by 2.

To allow for efficient implementation strategies, agents may delay updating this object for short periods of time. For example, an implementation strategy may allow internal data structures to differ from those visible via SNMP for short periods of time. This counter may reflect the internal data structures for those short periods of time.

Note that the table size can be determined by subtracting hlHostControlNlDeletes from hlHostControlNlInserts."

::= { hlHostControlEntry 5 }

hlHostControlNlMaxDesiredEntries OBJECT-TYPE
SYNTAX Integer32 (-1..2147483647)
MAX-ACCESS read-create
STATUS current
DESCRIPTION "The maximum number of entries that are desired in the nlHostTable on behalf of this control entry. The probe will not create more than this number of associated entries in the table but may choose to create fewer entries in this table for any reason, including the lack of resources.

If this object is set to a value less than the current number of entries, enough entries are chosen in an implementation-dependent manner and deleted so that the number of entries in the table equals the value of this object.

If this value is set to -1, the probe may create any number of entries in this table. If the associated hlHostControlStatus object is equal to ‘active’, this object may not be modified.

This object may be used to control how resources are allocated on the probe for the various RMON functions."
::= { hlHostControlEntry 6 }

hlHostControlAlDroppedFrames OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION "The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for the associated
alHost entries for whatever reason. Most often, this event occurs when the probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that if the alHostTable is not implemented or is inactive because no protocols are enabled in the protocol directory, this value should be 0.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped.

::= { hlHostControlEntry 7 }

hlHostControlAlInserts OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times an alHost entry has been inserted into the alHost table. If an entry is inserted, then deleted, and then inserted, this counter will be incremented by 2.

To allow for efficient implementation strategies, agents may delay updating this object for short periods of time. For example, an implementation strategy may allow internal data structures to differ from those visible via SNMP for short periods of time. This counter may reflect the internal data structures for those short periods of time.

Note that the table size can be determined by subtracting hlHostControlAlDeletes from hlHostControlAlInserts."

::= { hlHostControlEntry 8 }

hlHostControlAlDeletes OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times an alHost entry has been deleted from the alHost table (for any reason). If an entry is deleted, then inserted, and then deleted, this counter will be incremented by 2.

To allow for efficient implementation strategies, agents may delay updating this object for short periods of time. For
example, an implementation strategy may allow internal data structures to differ from those visible via SNMP for short periods of time. This counter may reflect the internal data structures for those short periods of time.

Note that the table size can be determined by subtracting hlHostControlAlDeletes from hlHostControlAlInserts.

\[
::= \{ hlHostControlEntry 9 \}
\]

hlHostControlAlMaxDesiredEntries OBJECT-TYPE
SYNTAX Integer32 (-1..2147483647)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The maximum number of entries that are desired in the alHost table on behalf of this control entry. The probe will not create more than this number of associated entries in the table but may choose to create fewer entries in this table for any reason, including the lack of resources.

If this object is set to a value less than the current number of entries, enough entries are chosen in an implementation-dependent manner and deleted so that the number of entries in the table equals the value of this object.

If this value is set to -1, the probe may create any number of entries in this table. If the associated hlHostControlStatus object is equal to ‘active’, this object may not be modified.

This object may be used to control how resources are allocated on the probe for the various RMON functions."

\[
::= \{ hlHostControlEntry 10 \}
\]

hlHostControlOwner OBJECT-TYPE
SYNTAX OwnerString
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The entity that configured this entry and is therefore using the resources assigned to it."

\[
::= \{ hlHostControlEntry 11 \}
\]

hlHostControlStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The status of this hlHostControlEntry.

An entry may not exist in the active state unless all objects in the entry have an appropriate value.

If this object is not equal to active(1), all associated entries in the nlHostTable and alHostTable shall be deleted."

::= { hlHostControlEntry 12 }

nlHostTable OBJECT-TYPE
SYNTAX      SEQUENCE OF NlHostEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A collection of statistics for a particular network layer address that has been discovered on an interface of this device.

The probe will populate this table for all network layer protocols in the protocol directory table whose value of protocolDirHostConfig is equal to supportedOn(3), and will delete any entries whose protocolDirEntry is deleted or has a protocolDirHostConfig value of supportedOff(2).

The probe will add to this table all addresses seen as the source or destination address in all packets with no MAC errors, and will increment octet and packet counts in the table for all packets with no MAC errors."

::= { nlHost 2 }

nlHostEntry OBJECT-TYPE
SYNTAX      NlHostEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A conceptual row in the nlHostTable.

The hlHostControlIndex value in the index identifies the hlHostControlEntry on whose behalf this entry was created. The protocolDirLocalIndex value in the index identifies the network layer protocol of the nlHostAddress.

An example of the indexing of this entry is nlHostOutPkts.1.783495.18.4.128.2.6.6.

Note that some combinations of index values may result in an index that exceeds 128 sub-identifiers in length, which exceeds the maximum for the SNMP protocol. Implementations should take
INDEX { hlHostControlIndex, nlHostTimeMark,
        protocolDirLocalIndex, nlHostAddress }
::= { nlHostTable 1 }

NlHostEntry ::= SEQUENCE {
    nlHostTimeMark              TimeFilter,
    nlHostAddress               OCTET STRING,
    nlHostInPkts                ZeroBasedCounter32,
    nlHostOutPkts               ZeroBasedCounter32,
    nlHostInOctets              ZeroBasedCounter32,
    nlHostOutOctets             ZeroBasedCounter32,
    nlHostOutMacNonUnicastPkts  ZeroBasedCounter32,
    nlHostCreateTime            LastCreateTime
}

nlHostTimeMark OBJECT-TYPE
SYNTAX      TimeFilter
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION  "A TimeFilter for this entry. See the TimeFilter textual
            convention to see how this works."
::= { nlHostEntry 1 }

nlHostAddress OBJECT-TYPE
SYNTAX      OCTET STRING  (SIZE (1..255))
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION  "The network address for this nlHostEntry.

This is represented as an octet string with
specific semantics and length as identified
by the protocolDirLocalIndex component of the index.

For example, if the protocolDirLocalIndex indicates an
encapsulation of IP, this object is encoded as a length
octet of 4, followed by the 4 octets of the IP address,
in network byte order."
::= { nlHostEntry 2 }

nlHostInPkts OBJECT-TYPE
SYNTAX      ZeroBasedCounter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "The number of packets without errors transmitted to
this address since it was added to the nlHostTable. Note that
this is the number of link-layer packets, so if a single
network-layer packet is fragmented into several link-layer
frames, this counter is incremented several times."
 ::= { nlHostEntry 3 }

nlHostOutPkts OBJECT-TYPE
 SYNTAX ZeroBasedCounter32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The number of packets without errors transmitted by
 this address since it was added to the nlHostTable. Note that
 this is the number of link-layer packets, so if a single
 network-layer packet is fragmented into several link-layer
 frames, this counter is incremented several times."
 ::= { nlHostEntry 4 }

nlHostInOctets OBJECT-TYPE
 SYNTAX ZeroBasedCounter32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The number of octets transmitted to this address
 since it was added to the nlHostTable (excluding
 framing bits, but including FCS octets), excluding
 octets in packets that contained errors.

 Note that this doesn’t count just those octets in the particular
 protocol frames but includes the entire packet that contained
 the protocol."
 ::= { nlHostEntry 5 }

nlHostOutOctets OBJECT-TYPE
 SYNTAX ZeroBasedCounter32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
 "The number of octets transmitted by this address
 since it was added to the nlHostTable (excluding
 framing bits, but including FCS octets), excluding
 octets in packets that contained errors.

 Note that this doesn’t count just those octets in the particular
 protocol frames but includes the entire packet that contained
 the protocol."
 ::= { nlHostEntry 6 }

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nlHostOutMacNonUnicastPkts OBJECT-TYPE
SYNTAX     ZeroBasedCounter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
  "The number of packets without errors transmitted by this
  address that were directed to any MAC broadcast addresses
  or to any MAC multicast addresses since this host was
  added to the nlHostTable. Note that this is the number of
  link-layer packets, so if a single network-layer packet is
  fragmented into several link-layer frames, this counter is
  incremented several times."
 ::= { nlHostEntry 7 }

nlHostCreateTime OBJECT-TYPE
SYNTAX     LastCreateTime
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
  "The value of sysUpTime when this entry was last activated.
  This can be used by the management station to ensure that the
  entry has not been deleted and recreated between polls."
 ::= { nlHostEntry 8 }

--
-- Network Layer Matrix Group
--
-- Counts the amount of traffic sent between each pair of network
-- addresses discovered by the probe.
-- Note that while the hlMatrixControlTable also has objects that
-- control optional alMatrixTables, implementation of the
-- alMatrixTables is not required to fully implement this group.

hlMatrixControlTable OBJECT-TYPE
SYNTAX     SEQUENCE OF HlMatrixControlEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "A list of higher-layer (i.e., non-MAC) matrix control entries.

These entries will enable the collection of the network- and
application-level matrix tables containing conversation statistics indexed by pairs of network addresses.
Both the network- and application-level matrix tables are
controlled by this table so that they will both be created
and deleted at the same time, further increasing the ease with
which they can be implemented as a single datastore. (Note that
if an implementation stores application-layer matrix records
Entries in the nlMatrixSDTable and nlMatrixDSTable will be created on behalf of each entry in this table. Additionally, if this probe implements the alMatrix tables, entries in the alMatrix tables will be created on behalf of each entry in this table."

::= { nlMatrix 1 }

hlMatrixControlEntry OBJECT-TYPE
SYNTAX    HLMatrixControlEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTON
"A conceptual row in the hlMatrixControlTable. An example of indexing of this entry is hlMatrixControlNlDroppedFrames.1"
INDEX { hlMatrixControlIndex }
::= { hlMatrixControlTable 1 }

HlMatrixControlEntry ::= SEQUENCE {
   hlMatrixControlIndex                  Integer32,
   hlMatrixControlDataSource             DataSource,
   hlMatrixControlNlDroppedFrames        Counter32,
   hlMatrixControlNlInserts              Counter32,
   hlMatrixControlNlDeletes              Counter32,
   hlMatrixControlNlMaxDesiredEntries    Integer32,
   hlMatrixControlAlDroppedFrames        Counter32,
   hlMatrixControlAlInserts              Counter32,
   hlMatrixControlAlDeletes              Counter32,
   hlMatrixControlAlMaxDesiredEntries    Integer32,
   hlMatrixControlOwner                  OwnerString,
   hlMatrixControlStatus                 RowStatus  
}

hlMatrixControlIndex OBJECT-TYPE
SYNTAX    Integer32 (1..65535)
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"An index that uniquely identifies an entry in the hlMatrixControlTable. Each such entry defines a function that discovers conversations on a particular interface and places statistics about them in the nlMatrixSDTable and the nlMatrixDSTable, and optionally the alMatrixSDTable and alMatrixDSTable, on behalf of this
hlMatrixControlEntry.
::= { hlMatrixControlEntry 1 }

hlMatrixControlDataSource OBJECT-TYPE
SYNTAX     DataSource
MAX-ACCESS read-create
STATUS      current
DESCRIPTION
"The source of the data for the associated matrix tables.

The statistics in this group reflect all packets on the local network segment attached to the identified interface.

This object may not be modified if the associated hlMatrixControlStatus object is equal to active(1)."
::= { hlMatrixControlEntry 2 }

hlMatrixControlNlDroppedFrames OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS      current
DESCRIPTION
"The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for this entry for whatever reason. Most often, this event occurs when the probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that if the nlMatrixTables are inactive because no protocols are enabled in the protocol directory, this value should be 0.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped."
::= { hlMatrixControlEntry 3 }

hlMatrixControlNlInserts OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS      current
DESCRIPTION
"The number of times an nlMatrix entry has been inserted into the nlMatrix tables. If an entry is inserted,
then deleted, and then inserted, this counter will be incremented by 2. The addition of a conversation into both the nlMatrixSDTable and nlMatrixDSTable shall be counted as two insertions (even though every addition into one table must be accompanied by an insertion into the other).

To allow for efficient implementation strategies, agents may delay updating this object for short periods of time. For example, an implementation strategy may allow internal data structures to differ from those visible via SNMP for short periods of time. This counter may reflect the internal data structures for those short periods of time.

Note that the sum of the nlMatrixSDTable and nlMatrixDSTable sizes can be determined by subtracting hlMatrixControlNlDeletes from hlMatrixControlNlInserts.

::= { hlMatrixControlEntry 4 }

hlMatrixControlNlDeletes OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times an nlMatrix entry has been deleted from the nlMatrix tables (for any reason). If an entry is deleted, then inserted, and then deleted, this counter will be incremented by 2. The deletion of a conversation from both the nlMatrixSDTable and nlMatrixDSTable shall be counted as two deletions (even though every deletion from one table must be accompanied by a deletion from the other).

To allow for efficient implementation strategies, agents may delay updating this object for short periods of time. For example, an implementation strategy may allow internal data structures to differ from those visible via SNMP for short periods of time. This counter may reflect the internal data structures for those short periods of time.

Note that the table size can be determined by subtracting hlMatrixControlNlDeletes from hlMatrixControlNlInserts.

::= { hlMatrixControlEntry 5 }

hlMatrixControlNlMaxDesiredEntries OBJECT-TYPE
SYNTAX Integer32 (-1..2147483647)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The maximum number of entries that are desired in the nlMatrix tables on behalf of this control entry. The probe will not create more than this number of associated entries in the table but may choose to create fewer entries in this table for any reason, including the lack of resources.

If this object is set to a value less than the current number of entries, enough entries are chosen in an implementation-dependent manner and deleted so that the number of entries in the table equals the value of this object.

If this value is set to -1, the probe may create any number of entries in this table. If the associated hlMatrixControlStatus object is equal to 'active', this object may not be modified.

This object may be used to control how resources are allocated on the probe for the various RMON functions."

::= { hlMatrixControlEntry 6 }

hlMatrixControlAlDroppedFrames OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for this entry for whatever reason. Most often, this event occurs when the probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that if the alMatrixTables are not implemented or are inactive because no protocols are enabled in the protocol directory, this value should be 0.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped."

::= { hlMatrixControlEntry 7 }

hlMatrixControlAlInserts OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times an alMatrix entry has been inserted into the alMatrix tables. If an entry is inserted, then deleted, and then inserted, this counter will be incremented by 2. The addition of a conversation into both the alMatrixSDTable and alMatrixDSTable shall be counted as two insertions (even though every addition into one table must be accompanied by an insertion into the other).

To allow for efficient implementation strategies, agents may delay updating this object for short periods of time. For example, an implementation strategy may allow internal data structures to differ from those visible via SNMP for short periods of time. This counter may reflect the internal data structures for those short periods of time.

Note that the table size can be determined by subtracting hlMatrixControlAlDeletes from hlMatrixControlAlInserts."

::= { hlMatrixControlEntry 8 }

hlMatrixControlAlDeletes OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of times an alMatrix entry has been deleted from the alMatrix tables. If an entry is deleted, then inserted, and then deleted, this counter will be incremented by 2. The deletion of a conversation from both the alMatrixSDTable and alMatrixDSTable shall be counted as two deletions (even though every deletion from one table must be accompanied by a deletion from the other).

To allow for efficient implementation strategies, agents may delay updating this object for short periods of time. For example, an implementation strategy may allow internal data structures to differ from those visible via SNMP for short periods of time. This counter may reflect the internal data structures for those short periods of time.

Note that the table size can be determined by subtracting hlMatrixControlAlDeletes from hlMatrixControlAlInserts."

::= { hlMatrixControlEntry 9 }

hlMatrixControlAlMaxDesiredEntries OBJECT-TYPE
SYNTAX Integer32 (-1..2147483647)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The maximum number of entries that are desired in the
alMatrix tables on behalf of this control entry. The probe
will not create more than this number of associated entries in
the table but may choose to create fewer entries in this
table for any reason, including the lack of resources.

If this object is set to a value less than the current number
of entries, enough entries are chosen in an
implementation-dependent manner and deleted so that the number
of entries in the table equals the value of this object.

If this value is set to -1, the probe may create any number
of entries in this table. If the associated
hlMatrixControlStatus object is equal to 'active', this
object may not be modified.

This object may be used to control how resources are allocated
on the probe for the various RMON functions."
 ::= { hlMatrixControlEntry 10 }

hlMatrixControlOwner OBJECT-TYPE
 SYNTAX OwnerString
 MAX-ACCESS read-create
 STATUS current
 DESCRIPTION
 "The entity that configured this entry and is
 therefore using the resources assigned to it."
 ::= { hlMatrixControlEntry 11 }

hlMatrixControlStatus OBJECT-TYPE
 SYNTAX RowStatus
 MAX-ACCESS read-create
 STATUS current
 DESCRIPTION
 "The status of this hlMatrixControlEntry.

An entry may not exist in the active state unless all
objects in the entry have an appropriate value.

If this object is not equal to active(1), all
associated entries in the nlMatrixSDTable,
nlMatrixDSTable, alMatrixSDTable, and alMatrixDSTable
shall be deleted by the agent."
 ::= { hlMatrixControlEntry 12 }

nlMatrixSDTable OBJECT-TYPE
 SYNTAX SEQUENCE OF NlMatrixSDEntry
 MAX-ACCESS not-accessible
A list of traffic matrix entries that collect statistics for conversations between two network-level addresses. This table is indexed first by the source address and then by the destination address to make it convenient to collect all conversations from a particular address.

The probe will populate this table for all network layer protocols in the protocol directory table whose value of protocolDirMatrixConfig is equal to supportedOn(3), and will delete any entries whose protocolDirEntry is deleted or has a protocolDirMatrixConfig value of supportedOff(2).

The probe will add to this table all pairs of addresses seen in all packets with no MAC errors and will increment octet and packet counts in the table for all packets with no MAC errors.

Further, this table will only contain entries that have a corresponding entry in the nlMatrixDSTable with the same source address and destination address.

```
::= { nlMatrix 2 }
```

A conceptual row in the nlMatrixSDTable.

The hlMatrixControlIndex value in the index identifies the hlMatrixControlEntry on whose behalf this entry was created. The protocolDirLocalIndex value in the index identifies the network-layer protocol of the nlMatrixSDSourceAddress and nlMatrixSDDestAddress.

An example of the indexing of this table is nlMatrixSDPkts.1.783495.18.4.128.2.6.6.4.128.2.6.7.

Note that some combinations of index values may result in an index that exceeds 128 sub-identifiers in length, which exceeds the maximum for the SNMP protocol. Implementations should take care to avoid such combinations.

```
::= { hlMatrixControlIndex, nlMatrixSDTimeMark, protocolDirLocalIndex, nlMatrixSDSourceAddress, nlMatrixSDDestAddress }
```

::= { nlMatrixSDTable 1 }
NlMatrixSDEntry ::= SEQUENCE {
    nlMatrixSDTimeMark TimeFilter,
    nlMatrixSDSourceAddress OCTET STRING,
    nlMatrixSDDestAddress OCTET STRING,
    nlMatrixSDPkts ZeroBasedCounter32,
    nlMatrixSDOctets ZeroBasedCounter32,
    nlMatrixSDCreateTime LastCreateTime
}

nlMatrixSDTimeMark OBJECT-TYPE
SYNTAX TimeFilter
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A TimeFilter for this entry. See the TimeFilter textual
convention to see how this works."
::= { nlMatrixSDEntry 1 }

nlMatrixSDSourceAddress OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (1..255))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The network source address for this nlMatrixSDEntry.

This is represented as an octet string with
specific semantics and length as identified
by the protocolDirLocalIndex component of the index.

For example, if the protocolDirLocalIndex indicates an
encapsulation of IP, this object is encoded as a length
octet of 4, followed by the 4 octets of the IP address,
in network byte order."
::= { nlMatrixSDEntry 2 }

nlMatrixSDDestAddress OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (1..255))
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"The network destination address for this
nlMatrixSDEntry.

This is represented as an octet string with
specific semantics and length as identified
by the protocolDirLocalIndex component of the index.

For example, if the protocolDirLocalIndex indicates an
encapsulation of IP, this object is encoded as a length
eoctet of 4, followed by the 4 octets of the IP address,
in network byte order."
 ::= { nlMatrixSDEntry 3 }

nlMatrixSDPkt OBJECT-TYPE
SYNTAX ZeroBasedCounter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of packets without errors transmitted from the
source address to the destination address since this entry was
added to the nlMatrixSDTable. Note that this is the number of
link-layer packets, so if a single network-layer packet is
fragmented into several link-layer frames, this counter is
incremented several times."
 ::= { nlMatrixSDEntry 4 }

nlMatrixSOctets OBJECT-TYPE
SYNTAX ZeroBasedCounter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of octets transmitted from the source address to
the destination address since this entry was added to the
nlMatrixSDTable (excluding framing bits, but
including FCS octets), excluding octets in packets that
contained errors.

Note that this doesn't count just those octets in the particular
protocol frames but includes the entire packet that contained
the protocol."
 ::= { nlMatrixSDEntry 5 }

nlMatrixSDCreateTime OBJECT-TYPE
SYNTAX LastCreateTime
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The value of sysUpTime when this entry was last activated.
This can be used by the management station to ensure that the
entry has not been deleted and recreated between polls."
 ::= { nlMatrixSDEntry 6 }

-- Traffic matrix tables from destination to source

nlMatrixDSTable OBJECT-TYPE
SYNTAX      SEQUENCE OF NlMatrixDSEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A list of traffic matrix entries that collect statistics for conversations between two network-level addresses. This table is indexed first by the destination address and then by the source address to make it convenient to collect all conversations to a particular address.

The probe will populate this table for all network layer protocols in the protocol directory table whose value of protocolDirMatrixConfig is equal to supportedOn(3), and will delete any entries whose protocolDirEntry is deleted or has a protocolDirMatrixConfig value of supportedOff(2).

The probe will add to this table all pairs of addresses seen in all packets with no MAC errors and will increment octet and packet counts in the table for all packets with no MAC errors.

Further, this table will only contain entries that have a corresponding entry in the nlMatrixSDTable with the same source address and destination address."

::= { nlMatrix 3 }

nlMatrixDSEntry OBJECT-TYPE
SYNTAX      NlMatrixDSEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A conceptual row in the nlMatrixDSSTable.

The hlMatrixControlIndex value in the index identifies the hlMatrixControlEntry on whose behalf this entry was created. The protocolDirLocalIndex value in the index identifies the network-layer protocol of the nlMatrixDSSourceAddress and nlMatrixDSDestAddress.

An example of the indexing of this table is nlMatrixDSPkts.1.783495.18.4.128.2.6.7.4.128.2.6.6.

Note that some combinations of index values may result in an index that exceeds 128 sub-identifiers in length, which exceeds the maximum for the SNMP protocol. Implementations should take care to avoid such combinations."

INDEX { hlMatrixControlIndex, nlMatrixDSSTimeMark, protocolDirLocalIndex,}
nlMatrixDSTimeMark, nlMatrixDSSourceAddress, nlMatrixDSDestAddress )
::= { nlMatrixDSTable 1 }

nlMatrixDSEntry ::= SEQUENCE {
    nlMatrixDSTimeMark               TimeFilter,
    nlMatrixDSSourceAddress          OCTET STRING,
    nlMatrixDSDestAddress            OCTET STRING,
    nlMatrixDSPkts                   ZeroBasedCounter32,
    nlMatrixDSOctets                  ZeroBasedCounter32,
    nlMatrixDSCreateTime              LastCreateTime
}

nlMatrixDSTimeMark OBJECT-TYPE
SYNTAX      TimeFilter
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A TimeFilter for this entry.  See the TimeFilter textual
convention to see how this works."
::= { nlMatrixDSEntry 1 }

nlMatrixDSSourceAddress OBJECT-TYPE
SYNTAX      OCTET STRING  (SIZE (1..255))
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"The network source address for this nlMatrixDSEntry.

This is represented as an octet string with
specific semantics and length as identified
by the protocolDirLocalIndex component of the index.

For example, if the protocolDirLocalIndex indicates an
encapsulation of IP, this object is encoded as a length
octet of 4, followed by the 4 octets of the IP address,
in network byte order."
::= { nlMatrixDSEntry 2 }

nlMatrixDSDestAddress OBJECT-TYPE
SYNTAX      OCTET STRING  (SIZE (1..255))
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"The network destination address for this
nlMatrixDSEntry.

This is represented as an octet string with
specific semantics and length as identified
by the protocolDirLocalIndex component of the index.

For example, if the protocolDirLocalIndex indicates an encapsulation of IP, this object is encoded as a length octet of 4, followed by the 4 octets of the IP address, in network byte order.

\[
::= \{ \text{nlMatrixDSEntry 3} \}
\]

nlMatrixDSPkts OBJECT-TYPE
SYNTAX ZeroBasedCounter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of packets without errors transmitted from the source address to the destination address since this entry was added to the nlMatrixDSTable. Note that this is the number of link-layer packets, so if a single network-layer packet is fragmented into several link-layer frames, this counter is incremented several times."

\[
::= \{ \text{nlMatrixDSEntry 4} \}
\]

nlMatrixDSOctets OBJECT-TYPE
SYNTAX ZeroBasedCounter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of octets transmitted from the source address to the destination address since this entry was added to the nlMatrixDSTable (excluding framing bits, but including FCS octets), excluding octets in packets that contained errors.

Note that this doesn’t count just those octets in the particular protocol frames but includes the entire packet that contained the protocol."

\[
::= \{ \text{nlMatrixDSEntry 5} \}
\]

nlMatrixDSCreateTime OBJECT-TYPE
SYNTAX LastCreateTime
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The value of sysUpTime when this entry was last activated. This can be used by the management station to ensure that the entry has not been deleted and recreated between polls."

\[
::= \{ \text{nlMatrixDSEntry 6} \}
\]
SYNTAX  SEQUENCE OF NlMatrixTopNControlEntry
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
 "A set of parameters that control the creation of a
report of the top N matrix entries according to
a selected metric."
 ::= { nlMatrix 4 } 

NlMatrixTopNControlEntry OBJECT-TYPE
SYNTAX  NlMatrixTopNControlEntry
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
 "A conceptual row in the nlMatrixTopNControlTable.

An example of the indexing of this table is
nlMatrixTopNControlDuration.3"
INDEX { nlMatrixTopNControlIndex }
 ::= { nlMatrixTopNControlTable 1 }

NlMatrixTopNControlEntry ::= SEQUENCE {
 nlMatrixTopNControlIndex            Integer32,
nlMatrixTopNControlMatrixIndex      Integer32,
nlMatrixTopNControlRateBase         INTEGER,
nlMatrixTopNControlTimeRemaining    Integer32,
nlMatrixTopNControlGeneratedReports Counter32,
nlMatrixTopNControlDuration         Integer32,
nlMatrixTopNControlRequestedSize    Integer32,
nlMatrixTopNControlGrantedSize      Integer32,
nlMatrixTopNControlStartTime        TimeStamp,
nlMatrixTopNControlOwner            OwnerString,
nlMatrixTopNControlStatus           RowStatus
}

nlMatrixTopNControlIndex OBJECT-TYPE
SYNTAX  Integer32 (1..65535)
MAX-ACCESS  not-accessible
STATUS  current
DESCRIPTION
 "An index that uniquely identifies an entry
in the nlMatrixTopNControlTable. Each such
entry defines one topN report prepared for
one interface."
 ::= { nlMatrixTopNControlEntry 1 }

nlMatrixTopNControlMatrixIndex OBJECT-TYPE
SYNTAX  Integer32 (1..65535)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The nlMatrix[SD/DS] table for which a topN report will be
prepared on behalf of this entry. The nlMatrix[SD/DS] table
is identified by the value of the hlMatrixControlIndex
for that table - that value is used here to identify the
particular table.

This object may not be modified if the associated
nlMatrixTopNControlStatus object is equal to active(1)."
 ::= { nlMatrixTopNControlEntry 2 }

nlMatrixTopNControlRateBase OBJECT-TYPE
SYNTAX INTEGER {
    nlMatrixTopNPkts(1),
    nlMatrixTopNOctets(2),
    nlMatrixTopNHighCapacityPkts(3),
    nlMatrixTopNHighCapacityOctets(4)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The variable for each nlMatrix[SD/DS] entry that the
nlMatrixTopNEntries are sorted by, as well as a control
for the table that the results will be reported in.

This object may not be modified if the associated
nlMatrixTopNControlStatus object is equal to active(1).

If this value is less than or equal to 2, when the report
is prepared, entries are created in the nlMatrixTopNTable
associated with this object.
If this value is greater than or equal to 3, when the report
is prepared, entries are created in the
nlMatrixTopNHighCapacityTable associated with this object."
 ::= { nlMatrixTopNControlEntry 3 }

nlMatrixTopNControlTimeRemaining OBJECT-TYPE
SYNTAX Integer32 (0..2147483647)
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The number of seconds left in the report currently
being collected. When this object is modified by
the management station, a new collection is started,
possibly aborting a currently running report. The
new value is used as the requested duration of this
report and is immediately loaded into the associated
nlMatrixTopNControlDuration object.

When the report finishes, the probe will automatically
start another collection with the same initial value
of nlMatrixTopNControlTimeRemaining. Thus, the management
station may simply read the resulting reports repeatedly,
checking the startTime and duration each time to ensure that a
report was not missed or that the report parameters were not
changed.

While the value of this object is non-zero, it decrements
by one per second until it reaches zero. At the time
that this object decrements to zero, the report is made
accessible in the nlMatrixTopNTable, overwriting any report
that may be there.

When this object is modified by the management station, any
associated entries in the nlMatrixTopNTable shall be deleted.

(Note that this is a different algorithm than the one used
in the hostTopNTable)."

DEFVAL { 1800 }
::= { nlMatrixTopNControlEntry 4 }

nlMatrixTopNControlGeneratedReports OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of reports that have been generated by this entry."
::= { nlMatrixTopNControlEntry 5 }

nlMatrixTopNControlDuration OBJECT-TYPE
SYNTAX     Integer32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of seconds that this report has collected
during the last sampling interval.

When the associated nlMatrixTopNControlTimeRemaining object is
set, this object shall be set by the probe to the
same value and shall not be modified until the next
time the nlMatrixTopNControlTimeRemaining is set.

This value shall be zero if no reports have been
requested for this nlMatrixTopNControlEntry."
::= { nlMatrixTopNControlEntry 6 }

nlMatrixTopNControlRequestedSize OBJECT-TYPE
SYNTAX     Integer32 (0..2147483647)
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The maximum number of matrix entries requested for this report.

When this object is created or modified, the probe
should set nlMatrixTopNControlGrantedSize as closely to this
object as possible for the particular probe
implementation and available resources."
DEFVAL { 150 }
::= { nlMatrixTopNControlEntry 7 }

nlMatrixTopNControlGrantedSize OBJECT-TYPE
SYNTAX     Integer32 (0..2147483647)
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The maximum number of matrix entries in this report.

When the associated nlMatrixTopNControlRequestedSize object is
created or modified, the probe should set this
object as closely to the requested value as
possible for the particular implementation and
available resources. The probe must not lower this
value except as a side-effect of a set to the associated
nlMatrixTopNControlRequestedSize object.

If the value of nlMatrixTopNControlRateBase is equal to
nlMatrixTopNPkts, when the next topN report is generated,
matrix entries with the highest value of nlMatrixTopNPktRate
shall be placed in this table in decreasing order of this rate
until there is no more room or until there are no more
matrix entries.

If the value of nlMatrixTopNControlRateBase is equal to
nlMatrixTopNOctets, when the next topN report is generated,
matrix entries with the highest value of nlMatrixTopNOctetRate
shall be placed in this table in decreasing order of this rate
until there is no more room or until there are no more
matrix entries.

It is an implementation-specific matter how entries with the
same value of nlMatrixTopNPktRate or nlMatrixTopNOctetRate are
sorted. It is also an implementation-specific matter as to
whether zero-valued entries are available."
 ::= { nlMatrixTopNControlEntry 8 }

nlMatrixTopNControlStartTime OBJECT-TYPE
 SYNTAX     TimeStamp
 MAX-ACCESS read-only
 STATUS     current
 DESCRIPTION
 "The value of sysUpTime when this topN report was
 last started. In other words, this is the time that
 the associated nlMatrixTopNControlTimeRemaining object was
 modified to start the requested report or the time
 the report was last automatically (re)started.

 This object may be used by the management station to
determine whether a report was missed."
 ::= { nlMatrixTopNControlEntry 9 }

nlMatrixTopNControlOwner OBJECT-TYPE
 SYNTAX     OwnerString
 MAX-ACCESS read-create
 STATUS     current
 DESCRIPTION
 "The entity that configured this entry and is
 therefore using the resources assigned to it."
 ::= { nlMatrixTopNControlEntry 10 }

nlMatrixTopNControlStatus OBJECT-TYPE
 SYNTAX     RowStatus
 MAX-ACCESS read-create
 STATUS     current
 DESCRIPTION
 "The status of this nlMatrixTopNControlEntry.

 An entry may not exist in the active state unless all
 objects in the entry have an appropriate value.

 If this object is not equal to active(1), all
 associated entries in the nlMatrixTopNTable shall be deleted
 by the agent."
 ::= { nlMatrixTopNControlEntry 11 }

nlMatrixTopNTable OBJECT-TYPE
 SYNTAX     SEQUENCE OF NlMatrixTopNEntry
 MAX-ACCESS not-accessible
 STATUS     current
 DESCRIPTION
 "A set of statistics for those network-layer matrix entries
that have counted the highest number of octets or packets.
::= { nlMatrix 5 }

nlMatrixTopNEntry OBJECT-TYPE
SYNTAX     NlMatrixTopNEntry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"A conceptual row in the nlMatrixTopNTable.

The nlMatrixTopNControlIndex value in the index identifies the
nlMatrixTopNControlEntry on whose behalf this entry was
created.

An example of the indexing of this table is
nlMatrixTopNPktRate.3.10"
INDEX { nlMatrixTopNControlIndex, nlMatrixTopNIndex }
::= { nlMatrixTopNTable 1 }

NlMatrixTopNEntry ::= SEQUENCE {
    nlMatrixTopNIndex                 Integer32,
    nlMatrixTopNProtocolDirLocalIndex Integer32,
    nlMatrixTopNSourceAddress         OCTET STRING,
    nlMatrixTopNDestAddress           OCTET STRING,
    nlMatrixTopNPktRate               Gauge32,
    nlMatrixTopNReversePktRate        Gauge32,
    nlMatrixTopNOctetRate             Gauge32,
    nlMatrixTopNReverseOctetRate      Gauge32
}

nlMatrixTopNIndex OBJECT-TYPE
SYNTAX     Integer32 (1..65535)
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"An index that uniquely identifies an entry in
the nlMatrixTopNTable among those in the same report.
This index is between 1 and N, where N is the
number of entries in this report.

If the value of nlMatrixTopNControlRateBase is equal to
nlMatrixTopNPkts, increasing values of nlMatrixTopNIndex shall
be assigned to entries with decreasing values of
nlMatrixTopNPktRate until index N is assigned or there are no
more nlMatrixTopNEntries.

If the value of nlMatrixTopNControlRateBase is equal to
nlMatrixTopNOctets, increasing values of nlMatrixTopNIndex

shall be assigned to entries with decreasing values of nlMatrixTopNOctetRate until index N is assigned or there are no more nlMatrixTopNEntries.

::= { nlMatrixTopNEntry 1 }

nlMatrixTopNProtocolDirLocalIndex OBJECT-TYPE
SYNTAX     Integer32 (1..2147483647)
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "The protocolDirLocalIndex of the network-layer protocol of this entry's network address."
::= { nlMatrixTopNEntry 2 }

nlMatrixTopNSourceAddress OBJECT-TYPE
SYNTAX     OCTET STRING  (SIZE (1..255))
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "The network-layer address of the source host in this conversation.

This is represented as an octet string with specific semantics and length as identified by the associated nlMatrixTopNProtocolDirLocalIndex.

For example, if the protocolDirLocalIndex indicates an encapsulation of IP, this object is encoded as a length octet of 4, followed by the 4 octets of the IP address, in network byte order."
::= { nlMatrixTopNEntry 3 }

nlMatrixTopNDestAddress OBJECT-TYPE
SYNTAX     OCTET STRING  (SIZE (1..255))
MAX-ACCESS read-only
STATUS     current
DESCRIPTION "The network-layer address of the destination host in this conversation.

This is represented as an octet string with specific semantics and length as identified by the associated nlMatrixTopNProtocolDirLocalIndex.

For example, if the nlMatrixTopNProtocolDirLocalIndex indicates an encapsulation of IP, this object is encoded as a length octet of 4, followed by the 4 octets of the IP address, in network byte order."
::= { nlMatrixTopNEntry 4 }

nlMatrixTopNPktRate OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of packets seen from the source host
to the destination host during this sampling interval, counted
using the rules for counting the nlMatrixSDPkts object.
If the value of nlMatrixTopNControlRateBase is
nlMatrixTopNPkts, this variable will be used to sort this
report."
::= { nlMatrixTopNEntry 5 }

nlMatrixTopNReversePktRate OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of packets seen from the destination host to the
source host during this sampling interval, counted
using the rules for counting the nlMatrixSDPkts object. (Note
that the corresponding nlMatrixSDPkts object selected is the
one whose source address is equal to nlMatrixTopNDestAddress
and whose destination address is equal to
nlMatrixTopNSourceAddress.)

Note that if the value of nlMatrixTopNControlRateBase is equal
to nlMatrixTopNPkts, the sort of topN entries is based
entirely on nlMatrixTopNPktRate, and not on the value of this
object."
::= { nlMatrixTopNEntry 6 }

nlMatrixTopNOctetRate OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of octets seen from the source host
to the destination host during this sampling interval, counted
using the rules for counting the nlMatrixSDOctets object. If
the value of nlMatrixTopNControlRateBase is
nlMatrixTopNOctets, this variable will be used to sort this
report."
::= { nlMatrixTopNEntry 7 }

nlMatrixTopNReverseOctetRate OBJECT-TYPE
SYNTAX Gauge32  
MAX-ACCESS read-only  
STATUS current  
DESCRIPTION "The number of octets seen from the destination host to the source host during this sampling interval, counted using the rules for counting the nlMatrixDSOctets object. (Note that the corresponding nlMatrixSDOctets object selected is the one whose source address is equal to nlMatrixTopNDestAddress and whose destination address is equal to nlMatrixTopNSourceAddress.)

Note that if the value of nlMatrixTopNControlRateBase is equal to nlMatrixTopNOctets, the sort of topN entries is based entirely on nlMatrixTopNOctetRate, and not on the value of this object."

::= { nlMatrixTopNEntry 8 }

-- Application Layer Functions
--
-- The application layer host, matrix, and matrixTopN functions report on protocol usage at the network layer or higher. Note that the use of the term application layer does not imply that only application-layer protocols are counted, rather it means that protocols up to and including the application layer are supported.
--
-- Application Layer Host Group
--
-- Counts the amount of traffic, by protocol, sent from and to each network address discovered by the probe.
-- Implementation of this group requires implementation of the Network Layer Host Group.

alHostTable OBJECT-TYPE
SYNTAX SEQUENCE OF AlHostEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "A collection of statistics for a particular protocol from a particular network address that has been discovered on an interface of this device.

The probe will populate this table for all protocols in the protocol directory table whose value of protocolDirHostConfig is equal to supportedOn(3), and will delete any entries whose protocolDirEntry is deleted or has a protocolDirHostConfig value of supportedOff(2)."
The probe will add to this table all addresses seen as the source or destination address in all packets with no MAC errors and will increment octet and packet counts in the table for all packets with no MAC errors. Further, entries will only be added to this table if their address exists in the nlHostTable and will be deleted from this table if their address is deleted from the nlHostTable.

::= { alHost 1 }

alHostEntry OBJECT-TYPE
SYNTAX     AlHostEntry
MAX-ACCESS not-accessible
STATUS      current
DESCRIPTION
"A conceptual row in the alHostTable.

The hlHostControlIndex value in the index identifies the hlHostControlEntry on whose behalf this entry was created.
The first protocolDirLocalIndex value in the index identifies the network-layer protocol of the address.
The nlHostAddress value in the index identifies the network-layer address of this entry.
The second protocolDirLocalIndex value in the index identifies the protocol that is counted by this entry.

An example of the indexing in this entry is alHostOutPkts.1.783495.18.4.128.2.6.6.34.

Note that some combinations of index values may result in an index that exceeds 128 sub-identifiers in length, which exceeds the maximum for the SNMP protocol. Implementations should take care to avoid such combinations."

INDEX { hlHostControlIndex, alHostTimeMark,
    protocolDirLocalIndex, nlHostAddress,
    protocolDirLocalIndex }
::= { alHostTable 1 }

AlHostEntry ::= SEQUENCE {
    alHostTimeMark                 TimeFilter,
    alHostInPkts                   ZeroBasedCounter32,
    alHostOutPkts                  ZeroBasedCounter32,
    alHostInOctets                 ZeroBasedCounter32,
    alHostOutOctets                ZeroBasedCounter32,
    alHostCreateTime               LastCreateTime
}

alHostTimeMark OBJECT-TYPE
SYNTAX     TimeFilter
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION  "A TimeFilter for this entry.  See the TimeFilter textual
     convention to see how this works."
 ::= { alHostEntry 1 }

alHostInPkts OBJECT-TYPE
SYNTAX      ZeroBasedCounter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "The number of packets of this protocol type without errors
    transmitted to this address since it was added to the
    alHostTable.  Note that this is the number of link-layer
    packets, so if a single network-layer packet is fragmented
    into several link-layer frames, this counter is incremented
    several times."
 ::= { alHostEntry 2 }

alHostOutPkts OBJECT-TYPE
SYNTAX      ZeroBasedCounter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "The number of packets of this protocol type without errors
    transmitted by this address since it was added to the
    alHostTable.  Note that this is the number of link-layer
    packets, so if a single network-layer packet is fragmented
    into several link-layer frames, this counter is incremented
    several times."
 ::= { alHostEntry 3 }

alHostInOctets OBJECT-TYPE
SYNTAX      ZeroBasedCounter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION  "The number of octets transmitted to this address
    of this protocol type since it was added to the
    alHostTable (excluding framing bits, but including
    FCS octets), excluding octets in packets that
    contained errors.

    Note that this doesn't count just those octets in the particular
    protocol frames but includes the entire packet that contained
    the protocol."
 ::= { alHostEntry 4 }

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alHostOutOctets OBJECT-TYPE
SYNTAX ZeroBasedCounter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of octets transmitted by this address
of this protocol type since it was added to the
alHostTable (excluding framing bits, but including
FCS octets), excluding octets in packets that
contained errors.

Note that this doesn’t count just those octets in the particular
protocol frames but includes the entire packet that contained
the protocol."
 ::= { alHostEntry 5 }

alHostCreateTime OBJECT-TYPE
SYNTAX LastCreateTime
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The value of sysUpTime when this entry was last activated.
This can be used by the management station to ensure that the
entry has not been deleted and recreated between polls."
 ::= { alHostEntry 6 }

--
-- Application Layer Matrix Group
--
-- Counts the amount of traffic, by protocol, sent between each pair
-- of network addresses discovered by the probe.
-- Implementation of this group requires implementation of the Network
-- Layer Matrix Group.

alMatrixSDTable OBJECT-TYPE
SYNTAX SEQUENCE OF AlMatrixSDEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A list of application traffic matrix entries that collect
statistics for conversations of a particular protocol between
two network-level addresses. This table is indexed first by
the source address and then by the destination address to make
it convenient to collect all statistics from a particular
address.

The probe will populate this table for all protocols in the
protocol directory table whose value of
protocolDirMatrixConfig is equal to supportedOn(3), and will delete any entries whose protocolDirEntry is deleted or has a protocolDirMatrixConfig value of supportedOff(2).

The probe will add to this table all pairs of addresses for all protocols seen in all packets with no MAC errors and will increment octet and packet counts in the table for all packets with no MAC errors. Further, entries will only be added to this table if their address pair exists in the nlMatrixSDTable and will be deleted from this table if the address pair is deleted from the nlMatrixSDTable.

::= { alMatrix 1 }

alMatrixSDEntry OBJECT-TYPE
SYNTAX        AlMatrixSDEntry
MAX-ACCESS    not-accessible
STATUS        current
DESCRIPTION
"A conceptual row in the alMatrixSDTable.

The hlMatrixControlIndex value in the index identifies the hlMatrixControlEntry on whose behalf this entry was created.
The first protocolDirLocalIndex value in the index identifies the network-layer protocol of the nlMatrixSDSourceAddress and nlMatrixSDDestAddress.
The nlMatrixSDSourceAddress value in the index identifies the network-layer address of the source host in this conversation.
The nlMatrixSDDestAddress value in the index identifies the network-layer address of the destination host in this conversation.
The second protocolDirLocalIndex value in the index identifies the protocol that is counted by this entry.

An example of the indexing of this entry is
alMatrixSDPkts.1.783495.18.4.128.2.6.6.4.128.2.6.7.34.

Note that some combinations of index values may result in an index that exceeds 128 sub-identifiers in length, which exceeds the maximum for the SNMP protocol. Implementations should take care to avoid such combinations."

INDEX { hlMatrixControlIndex, alMatrixSDTimeMark, protocolDirLocalIndex, nlMatrixSDSourceAddress, nlMatrixSDDestAddress, protocolDirLocalIndex }

::= { alMatrixSDTable 1 }

AlMatrixSDEntry ::= SEQUENCE {
    alMatrixSDTimeMark                 TimeFilter,
alMatrixSDPkts     ZeroBasedCounter32,
alMatrixSDOctets   ZeroBasedCounter32,
alMatrixSDCreateTime LastCreateTime
}

alMatrixSDTimeMark OBJECT-TYPE
SYNTAX     TimeFilter
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"A TimeFilter for this entry. See the TimeFilter textual
convention to see how this works."
::= { alMatrixSDEntry 1 }

alMatrixSDPkts OBJECT-TYPE
SYNTAX     ZeroBasedCounter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of packets of this protocol type without errors
transmitted from the source address to the destination address
since this entry was added to the alMatrixSDTable. Note that
this is the number of link-layer packets, so if a single
network-layer packet is fragmented into several link-layer
frames, this counter is incremented several times."
::= { alMatrixSDEntry 2 }

alMatrixSDOctets OBJECT-TYPE
SYNTAX     ZeroBasedCounter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The number of octets in packets of this protocol type
transmitted from the source address to the destination address
since this entry was added to the alMatrixSDTable (excluding
framing bits, but including FCS octets), excluding octets
in packets that contained errors.

Note that this doesn’t count just those octets in the particular
protocol frames but includes the entire packet that contained the protocol."
::= { alMatrixSDEntry 3 }

alMatrixSDCreateTime OBJECT-TYPE
SYNTAX     LastCreateTime
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The value of sysUpTime when this entry was last activated. This can be used by the management station to ensure that the entry has not been deleted and recreated between polls."

::= { alMatrixSDEntry 4 }

-- Traffic matrix tables from destination to source

alMatrixDSTable OBJECT-TYPE
SYNTAX      SEQUENCE OF AlMatrixDSEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A list of application traffic matrix entries that collect statistics for conversations of a particular protocol between two network-level addresses. This table is indexed first by the destination address and then by the source address to make it convenient to collect all statistics to a particular address.

The probe will populate this table for all protocols in the protocol directory table whose value of protocolDirMatrixConfig is equal to supportedOn(3), and will delete any entries whose protocolDirEntry is deleted or has a protocolDirMatrixConfig value of supportedOff(2).

The probe will add to this table all pairs of addresses for all protocols seen in all packets with no MAC errors and will increment octet and packet counts in the table for all packets with no MAC errors. Further, entries will only be added to this table if their address pair exists in the nlMatrixDSTable and will be deleted from this table if the address pair is deleted from the nlMatrixDSTable."

::= { alMatrix 2 }

alMatrixDSEntry OBJECT-TYPE
SYNTAX      AlMatrixDSEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A conceptual row in the alMatrixDSTable.

The hlMatrixControlIndex value in the index identifies the hlMatrixControlEntry on whose behalf this entry was created. The first protocolDirLocalIndex value in the index identifies the network-layer protocol of the alMatrixDSSourceAddress and alMatrixDSDestAddress.

The nlMatrixDSDestAddress value in the index identifies the network-layer address of the destination host in this
conversation.

The nlMatrixDSSourceAddress value in the index identifies the
network-layer address of the source host in this conversation.
The second protocolDirLocalIndex value in the index identifies
the protocol that is counted by this entry.

An example of the indexing of this entry is
alMatrixDSPkts.1.783495.18.4.128.2.6.7.4.128.2.6.6.34.

Note that some combinations of index values may result in an
index that exceeds 128 sub-identifiers in length, which exceeds
the maximum for the SNMP protocol. Implementations should take
care to avoid such combinations.

INDEX { hlMatrixControlIndex, alMatrixDSTimeMark,
protocolDirLocalIndex,
nlMatrixDSDestAddress, nlMatrixDSSourceAddress,
protocolDirLocalIndex }
::= { alMatrixDSTable 1 }

AlMatrixDSEntry ::= SEQUENCE {
  alMatrixDSTimeMark                 TimeFilter,
  alMatrixDSPkts                     ZeroBasedCounter32,
  alMatrixDSOctets                   ZeroBasedCounter32,
  alMatrixDSCreateTime               LastCreateTime
}

alMatrixDSTimeMark OBJECT-TYPE
SYNTAX      TimeFilter
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
  "A TimeFilter for this entry.  See the TimeFilter textual
  convention to see how this works."
::= { alMatrixDSEntry 1 }

alMatrixDSPkts OBJECT-TYPE
SYNTAX      ZeroBasedCounter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
  "The number of packets of this protocol type without errors
  transmitted from the source address to the destination address
  since this entry was added to the alMatrixDSTable.  Note that
  this is the number of link-layer packets, so if a single
  network-layer packet is fragmented into several link-layer
  frames, this counter is incremented several times."
::= { alMatrixDSEntry 2 }
alMatrixDSOctets OBJECT-TYPE
SYNTAX      ZeroBasedCounter32
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
"The number of octets in packets of this protocol type
transmitted from the source address to the destination address
since this entry was added to the alMatrixDSTable (excluding
framing bits, but including FCS octets), excluding octets
in packets that contained errors.

Note that this doesn’t count just those octets in the particular
protocol frames but includes the entire packet that contained
the protocol."
 ::= { alMatrixDSEntry 3 }

alMatrixDSCreateTime OBJECT-TYPE
SYNTAX     LastCreateTime
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The value of sysUpTime when this entry was last activated.
This can be used by the management station to ensure that the
entry has not been deleted and recreated between polls."
 ::= { alMatrixDSEntry 4 }

alMatrixTopNControlTable OBJECT-TYPE
SYNTAX      SEQUENCE OF AlMatrixTopNControlEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A set of parameters that control the creation of a
report of the top N matrix entries according to
a selected metric."
 ::= { alMatrix 3 }

alMatrixTopNControlEntry OBJECT-TYPE
SYNTAX      AlMatrixTopNControlEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
"A conceptual row in the alMatrixTopNControlTable.

An example of the indexing of this table is
alMatrixTopNControlDuration.3"
INDEX { alMatrixTopNControlIndex }
 ::= { alMatrixTopNControlTable 1 }
AlMatrixTopNControlEntry ::= SEQUENCE {
    alMatrixTopNControlIndex            Integer32,
    alMatrixTopNControlMatrixIndex      Integer32,
    alMatrixTopNControlRateBase         INTEGER,
    alMatrixTopNControlTimeRemaining    Integer32,
    alMatrixTopNControlGeneratedReports Counter32,
    alMatrixTopNControlDuration         Integer32,
    alMatrixTopNControlRequestedSize    Integer32,
    alMatrixTopNControlGrantedSize      Integer32,
    alMatrixTopNControlStartTime        TimeStamp,
    alMatrixTopNControlOwner            OwnerString,
    alMatrixTopNControlStatus           RowStatus
}

alMatrixTopNControlIndex OBJECT-TYPE
SYNTAX     Integer32 (1..65535)
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"An index that uniquely identifies an entry in the alMatrixTopNControlTable. Each such entry defines one topN report prepared for one interface."
 ::= { alMatrixTopNControlEntry 1 }

alMatrixTopNControlMatrixIndex OBJECT-TYPE
SYNTAX     Integer32 (1..65535)
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The alMatrix[SD/DS] table for which a topN report will be prepared on behalf of this entry. The alMatrix[SD/DS] table is identified by the value of the hlMatrixControlIndex for that table - that value is used here to identify the particular table.

This object may not be modified if the associated alMatrixTopNControlStatus object is equal to active(1)."
 ::= { alMatrixTopNControlEntry 2 }

alMatrixTopNControlRateBase OBJECT-TYPE
SYNTAX     INTEGER {
    alMatrixTopNTerminalsPkts(1),
    alMatrixTopNTerminalsOctets(2),
    alMatrixTopNAllPkts(3),
    alMatrixTopNAllOctets(4),
    alMatrixTopNTerminalsHighCapacityPkts(5),
    alMatrixTopNTerminalsHighCapacityOctets(6),
...}
alMatrixTopNAllHighCapacityPkts(7),
alMatrixTopNAllHighCapacityOctets(8)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"This object controls which alMatrix[SD/DS] entry that the
alMatrixTopNEntries are sorted by, which view of the matrix
table that will be used, as well as which table the results
will be reported in.

The values alMatrixTopNTerminalsPkts,
alMatrixTopNTerminalsOctets,
alMatrixTopNTerminalsHighCapacityPkts, and
alMatrixTopNTerminalsHighCapacityOctets cause collection
only from protocols that have no child protocols that are
counted. The values alMatrixTopNAllPkts,
alMatrixTopNAllOctets, alMatrixTopNAllHighCapacityPkts, and
alMatrixTopNAllHighCapacityOctets cause collection from all
alMatrix entries.

This object may not be modified if the associated
alMatrixTopNControlStatus object is equal to active(1)."
::= { alMatrixTopNControlEntry 3 }

alMatrixTopNControlTimeRemaining OBJECT-TYPE
SYNTAX     Integer32 (0..2147483647)
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
"The number of seconds left in the report currently
being collected. When this object is modified by
the management station, a new collection is started,
possibly aborting a currently running report. The
new value is used as the requested duration of this
report and is immediately loaded into the associated
alMatrixTopNControlDuration object.

When the report finishes, the probe will automatically
start another collection with the same initial value
of alMatrixTopNControlTimeRemaining. Thus, the management
station may simply read the resulting reports repeatedly,
checking the startTime and duration each time to ensure that a
report was not missed or that the report parameters were not
changed.

While the value of this object is non-zero, it decrements
by one per second until it reaches zero. At the time
that this object decrements to zero, the report is made accessible in the alMatrixTopNTable, overwriting any report that may be there.

When this object is modified by the management station, any associated entries in the alMatrixTopNTable shall be deleted.

(Note that this is a different algorithm than the one used in the hostTopNTable).

DEFVAL { 1800 }
 ::= { alMatrixTopNControlEntry 4 }

alMatrixTopNControlGeneratedReports OBJECT-TYPE
 SYNTAX Counter32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
   "The number of reports that have been generated by this entry."
 ::= { alMatrixTopNControlEntry 5 }

alMatrixTopNControlDuration OBJECT-TYPE
 SYNTAX Integer32
 MAX-ACCESS read-only
 STATUS current
 DESCRIPTION
   "The number of seconds that this report has collected during the last sampling interval.

When the associated alMatrixTopNControlTimeRemaining object is set, this object shall be set by the probe to the same value and shall not be modified until the next time the alMatrixTopNControlTimeRemaining is set.

This value shall be zero if no reports have been requested for this alMatrixTopNControlEntry."
 ::= { alMatrixTopNControlEntry 6 }

alMatrixTopNControlRequestedSize OBJECT-TYPE
 SYNTAX Integer32 (0..2147483647)
 MAX-ACCESS read-create
 STATUS current
 DESCRIPTION
   "The maximum number of matrix entries requested for this report.

When this object is created or modified, the probe should set alMatrixTopNControlGrantedSize as closely to this object as possible for the particular probe implementation and available resources."
DEFVAL { 150 }
::= { alMatrixTopNControlEntry 7 }

alMatrixTopNControlGrantedSize OBJECT-TYPE
SYNTAX     Integer32 (0..2147483647)
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The maximum number of matrix entries in this report.
When the associated alMatrixTopNControlRequestedSize object
is created or modified, the probe should set this
object as closely to the requested value as
possible for the particular implementation and
available resources. The probe must not lower this
value except as a side-effect of a set to the associated
alMatrixTopNControlRequestedSize object.

If the value of alMatrixTopNControlRateBase is equal to
alMatrixTopNTerminalsPkts or alMatrixTopNAIIPkts, when the
next topN report is generated, matrix entries with the highest
value of alMatrixTopNPktRate shall be placed in this table in
decreasing order of this rate until there is no more room or
until there are no more matrix entries.

If the value of alMatrixTopNControlRateBase is equal to
alMatrixTopNTerminalsOctets or alMatrixTopNAIIOctets, when the
next topN report is generated, matrix entries with the highest
value of alMatrixTopNOctetRate shall be placed in this table
in decreasing order of this rate until there is no more room or
until there are no more matrix entries.

It is an implementation-specific matter how entries with the
same value of alMatrixTopNPktRate or alMatrixTopNOctetRate are
sorted. It is also an implementation-specific matter as to
whether zero-valued entries are available."
::= { alMatrixTopNControlEntry 8 }

alMatrixTopNControlStartTime OBJECT-TYPE
SYNTAX     TimeStamp
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The value of sysUpTime when this topN report was
last started. In other words, this is the time that
the associated alMatrixTopNControlTimeRemaining object
was modified to start the requested report or the time
the report was last automatically (re)started.
This object may be used by the management station to
determine whether a report was missed.

```plaintext
::= { alMatrixTopNControlEntry 9 }
```

**alMatrixTopNControlOwner** OBJECT-TYPE

SYNTAX OwnerString

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The entity that configured this entry and is
therefore using the resources assigned to it."

```plaintext
::= { alMatrixTopNControlEntry 10 }
```

**alMatrixTopNControlStatus** OBJECT-TYPE

SYNTAX RowStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status of this alMatrixTopNControlEntry.

An entry may not exist in the active state unless all
objects in the entry have an appropriate value.

If this object is not equal to active(1), all
associated entries in the alMatrixTopNTable shall be
deleted by the agent."

```plaintext
::= { alMatrixTopNControlEntry 11 }
```

**alMatrixTopNTable** OBJECT-TYPE

SYNTAX SEQUENCE OF AlMatrixTopNEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A set of statistics for those application-layer matrix
entries that have counted the highest number of octets or
packets."

```plaintext
::= { alMatrix 4 }
```

**alMatrixTopNEntry** OBJECT-TYPE

SYNTAX AlMatrixTopNEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A conceptual row in the alMatrixTopNTable.

The alMatrixTopNControlIndex value in the index identifies
the alMatrixTopNControlEntry on whose behalf this entry was
created."
An example of the indexing of this table is

\[ \text{alMatrixTopNPktRate.3.10} \]

INDEX { alMatrixTopNControlIndex, alMatrixTopNIndex }

::= { alMatrixTopNTable 1 }

AlMatrixTopNEntry ::= SEQUENCE {
    alMatrixTopNIndex                      Integer32,
    alMatrixTopNProtocolDirLocalIndex      Integer32,
    alMatrixTopNSourceAddress              OCTET STRING,
    alMatrixTopNDestAddress                OCTET STRING,
    alMatrixTopNAppProtocolDirLocalIndex   Integer32,
    alMatrixTopNPktRate                    Gauge32,
    alMatrixTopNReversePktRate             Gauge32,
    alMatrixTopNOctetRate                  Gauge32,
    alMatrixTopNReverseOctetRate           Gauge32
}

alMatrixTopNIndex OBJECT-TYPE
SYNTAX     Integer32 (1..65535)
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"An index that uniquely identifies an entry in
the AlMatrixTopNTable among those in the same report.

This index is between 1 and N, where N is the
number of entries in this report.

If the value of alMatrixTopNControlRateBase is equal to
alMatrixTopNTerminalsPkts or alMatrixTopNAllPkts, increasing
values of alMatrixTopNIndex shall be assigned to entries with
decreasing values of alMatrixTopNPktRate until index N is
assigned or there are no more alMatrixTopNEntries.

If the value of alMatrixTopNControlRateBase is equal to
alMatrixTopNTerminalsOctets or alMatrixTopNAllOctets,
increasing values of alMatrixTopNIndex shall be assigned to
entries with decreasing values of alMatrixTopNOctetRate until
index N is assigned or there are no more alMatrixTopNEntries."

::= { alMatrixTopNEntry 1 }

alMatrixTopNProtocolDirLocalIndex OBJECT-TYPE
SYNTAX     Integer32 (1..2147483647)
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The protocolDirLocalIndex of the network-layer protocol of
this entry's network address."
::= { alMatrixTopNEntry 2 }

alMatrixTopNSourceAddress OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (1..255))
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The network-layer address of the source host in this conversation.

This is represented as an octet string with specific semantics and length as identified by the associated alMatrixTopNProtocolDirLocalIndex.

For example, if the alMatrixTopNProtocolDirLocalIndex indicates an encapsulation of IP, this object is encoded as a length octet of 4, followed by the 4 octets of the IP address, in network byte order."
::= { alMatrixTopNEntry 3 }

alMatrixTopNDestAddress OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (1..255))
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The network-layer address of the destination host in this conversation.

This is represented as an octet string with specific semantics and length as identified by the associated alMatrixTopNProtocolDirLocalIndex.

For example, if the alMatrixTopNProtocolDirLocalIndex indicates an encapsulation of IP, this object is encoded as a length octet of 4, followed by the 4 octets of the IP address, in network byte order."
::= { alMatrixTopNEntry 4 }

alMatrixTopNAppProtocolDirLocalIndex OBJECT-TYPE
SYNTAX Integer32 (1..2147483647)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The type of the protocol counted by this matrix entry."
::= { alMatrixTopNEntry 5 }

alMatrixTopNPktRate OBJECT-TYPE
SYNTAX Gauge32
MAX-ACCESS read-only
STATUS         current
DESCRIPTION    "The number of packets seen of this protocol from the source
host to the destination host during this sampling interval,
counted using the rules for counting the alMatrixSDPkts
object.

If the value of alMatrixTopNControlRateBase is
alMatrixTopNTerminalsPkts or alMatrixTopNAllPkts, this
variable will be used to sort this report."
::= { alMatrixTopNEntry 6 }

alMatrixTopNReversePktRate OBJECT-TYPE
SYNTAX         Gauge32
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION    "The number of packets seen of this protocol from the
destination host to the source host during this sampling
interval, counted using the rules for counting the
alMatrixDSPkts object. (Note that the corresponding
alMatrixSDPkts object selected is the one whose source address
is equal to alMatrixTopNDestAddress and whose destination
address is equal to alMatrixTopNSourceAddress.)

Note that if the value of alMatrixTopNControlRateBase is equal
to alMatrixTopNTerminalsPkts or alMatrixTopNAllPkts, the sort
of topN entries is based entirely on alMatrixTopNPktRate, and
not on the value of this object."
::= { alMatrixTopNEntry 7 }

alMatrixTopNOctetRate OBJECT-TYPE
SYNTAX         Gauge32
MAX-ACCESS     read-only
STATUS         current
DESCRIPTION    "The number of octets seen of this protocol from the source
host to the destination host during this sampling interval,
counted using the rules for counting the alMatrixSDOctets
object.

If the value of alMatrixTopNControlRateBase is
alMatrixTopNTerminalsOctets or alMatrixTopNAllOctets, this
variable will be used to sort this report."
::= { alMatrixTopNEntry 8 }

alMatrixTopNReverseOctetRate OBJECT-TYPE
SYNTAX     Gauge32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION  
"The number of octets seen of this protocol from the
destination host to the source host during this sampling
interval, counted using the rules for counting the
alMatrixDSTOctets object. (Note that the corresponding
alMatrixSDOctets object selected is the one whose source
address is equal to alMatrixTopNDestAddress and whose
destination address is equal to alMatrixTopNSourceAddress.)

Note that if the value of alMatrixTopNControlRateBase is equal
to alMatrixTopNTerminalsOctets or alMatrixTopNAllOctets, the
sort of topN entries is based entirely on
alMatrixTopNOctetRate, and not on the value of this object."  
::= { alMatrixTopNEntry 9 }

--
-- User History Collection Group (usrHistory)
--
-- The usrHistory group combines mechanisms seen in the alarm and
-- history groups to provide user-specified history collection,
-- utilizing two additional control tables and one additional data
-- table. This function has traditionally been done by NMS
-- applications, via periodic polling. The usrHistory group allows
-- this task to be offloaded to an RMON probe.
--
-- Data (an ASN.1 INTEGER based object) is collected in the same
-- manner as any history data table (e.g., etherHistoryTable) except
-- that the user specifies the MIB instances to be collected. Objects
-- are collected in bucket-groups, with the intent that all MIB
-- instances in the same bucket-group are collected as atomically as
-- possible by the RMON probe.
--
-- The usrHistoryControlTable is a one-dimensional read-create table.
-- Each row configures a collection of user history buckets, much
-- the same as a historyControlEntry, except that the creation of a
-- row in this table will cause one or more associated instances in
-- the usrHistoryObjectTable to be created. The user specifies the
-- number of bucket elements (rows in the usrHistoryObjectTable)
-- requested, as well as the number of buckets requested.
--
-- The usrHistoryObjectTable is a 2-d read-write table.
-- Each row configures a single MIB instance to be collected.
-- All rows with the same major index constitute a bucket-group.
--
-- The usrHistoryTable is a 3-d read-only table containing
-- the data of associated usrHistoryControlEntries. Each
-- entry represents the value of a single MIB instance
-- during a specific sampling interval (or the rate of
-- change during the interval).
--
-- A sample value is stored in two objects - an absolute value and
-- a status object. This allows numbers from -(2G-1) to +4G to be
-- stored. The status object also indicates whether a sample is
-- valid. This allows data collection to continue if periodic
-- retrieval of a particular instance fails for any reason.
--
-- Row Creation Order Relationships
--
-- The static nature of the usrHistoryObjectTable creates
-- some row creation/modification issues. The rows in this
-- table need to be set before the associated
-- usrHistoryControlEntry can be activated.
--
-- Note that the usrHistoryObject entries associated with a
-- particular usrHistoryControlEntry are not required to
-- be active before the control entry is activated. However,
-- the usrHistory data entries associated with an inactive
-- usrHistoryObject entry will be inactive (i.e.,
-- usrHistoryValStatus == valueNotAvailable).
--
usrHistoryControlTable OBJECT-TYPE
SYNTAX SEQUENCE OF UsrHistoryControlEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A list of data-collection configuration entries."
::= { usrHistory 1 }

usrHistoryControlEntry OBJECT-TYPE
SYNTAX UsrHistoryControlEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A list of parameters that set up a group of user-defined
MIB objects to be sampled periodically (called a
bucket-group).

For example, an instance of usrHistoryControlInterval
might be named usrHistoryControlInterval.1"
INDEX { usrHistoryControlIndex }
::= { usrHistoryControlTable 1 }
UsrHistoryControlEntry ::= SEQUENCE {
    usrHistoryControlIndex             Integer32,
    usrHistoryControlObjects           Integer32,
    usrHistoryControlBucketsRequested  Integer32,
    usrHistoryControlBucketsGranted    Integer32,
    usrHistoryControlInterval          Integer32,
    usrHistoryControlOwner             OwnerString,
    usrHistoryControlStatus            RowStatus
}

usrHistoryControlIndex OBJECT-TYPE
SYNTAX     Integer32 (1..65535)
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
  "An index that uniquely identifies an entry in the
   usrHistoryControlTable. Each such entry defines a
   set of samples at a particular interval for a specified
   set of MIB instances available from the managed system."
::= { usrHistoryControlEntry 1 }

usrHistoryControlObjects OBJECT-TYPE
SYNTAX     Integer32 (1..65535)
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
  "The number of MIB objects to be collected
   in the portion of usrHistoryTable associated with this
   usrHistoryControlEntry.

   This object may not be modified if the associated instance
   of usrHistoryControlStatus is equal to active(1)."
::= { usrHistoryControlEntry 2 }

usrHistoryControlBucketsRequested OBJECT-TYPE
SYNTAX     Integer32 (1..65535)
MAX-ACCESS read-create
STATUS     current
DESCRIPTION
  "The requested number of discrete time intervals
   over which data is to be saved in the part of the
   usrHistoryTable associated with this usrHistoryControlEntry.

   When this object is created or modified, the probe
   should set usrHistoryControlBucketsGranted as closely to
   this object as possible for the particular probe
   implementation and available resources."
DEFVAL { 50 }

::= { usrHistoryControlEntry 3 }

usrHistoryControlBucketsGranted OBJECT-TYPE
SYNTAX Integer32 (1..65535)
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The number of discrete sampling intervals
over which data shall be saved in the part of
the usrHistoryTable associated with this
usrHistoryControlEntry.

When the associated usrHistoryControlBucketsRequested
object is created or modified, the probe should set
this object as closely to the requested value as
possible for the particular probe implementation and
available resources. The probe must not lower this
value except as a result of a modification to the associated
usrHistoryControlBucketsRequested object.

The associated usrHistoryControlBucketsRequested object
should be set before or at the same time as this object
to allow the probe to accurately estimate the resources
required for this usrHistoryControlEntry.

There will be times when the actual number of buckets
associated with this entry is less than the value of
this object. In this case, at the end of each sampling
interval, a new bucket will be added to the usrHistoryTable.

When the number of buckets reaches the value of this object
and a new bucket is to be added to the usrHistoryTable,
the oldest bucket associated with this usrHistoryControlEntry
shall be deleted by the agent so that the new bucket can be
added.

When the value of this object changes to a value less than
the current value, entries are deleted from the
usrHistoryTable associated with this usrHistoryControlEntry.
Enough of the oldest of these entries shall be deleted by the
agent so that their number remains less than or equal to the
new value of this object.

When the value of this object changes to a value greater
than the current value, the number of associated usrHistory
entries may be allowed to grow."

::= { usrHistoryControlEntry 4 }
The interval in seconds over which the data is sampled for each bucket in the part of the usrHistory table associated with this usrHistoryControlEntry.

Because the counters in a bucket may overflow at their maximum value with no indication, a prudent manager will take into account the possibility of overflow in any of the associated counters. It is important to consider the minimum time in which any counter could overflow on a particular media type and to set the usrHistoryControlInterval object to a value less than this interval.

This object may not be modified if the associated usrHistoryControlStatus object is equal to active(1).

DEFVAL { 1800 }
::= { usrHistoryControlEntry 5 }

The entity that configured this entry and is therefore using the resources assigned to it.

::= { usrHistoryControlEntry 6 }

The status of this variable history control entry.

An entry may not exist in the active state unless all objects in the entry have an appropriate value.

If this object is not equal to active(1), all associated entries in the usrHistoryTable shall be deleted.

::= { usrHistoryControlEntry 7 }

-- Object table

usrHistoryObjectTable OBJECT-TYPE
SYNTAX SEQUENCE OF UsrHistoryObjectEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A list of data-collection configuration entries."
::= { usrHistory 2 }

usrHistoryObjectEntry OBJECT-TYPE
SYNTAX UsrHistoryObjectEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A list of MIB instances to be sampled periodically.
Entries in this table are created when an associated
usrHistoryControlObjects object is created.
The usrHistoryControlIndex value in the index is
that of the associated usrHistoryControlEntry.
For example, an instance of usrHistoryObjectVariable might be
usrHistoryObjectVariable.1.3"
INDEX { usrHistoryControlIndex, usrHistoryObjectIndex }
::= { usrHistoryObjectTable 1 }

UsrHistoryObjectEntry ::= SEQUENCE {
    usrHistoryObjectIndex             Integer32,
    usrHistoryObjectVariable          OBJECT IDENTIFIER,
    usrHistoryObjectSampleType        INTEGER
}

usrHistoryObjectIndex OBJECT-TYPE
SYNTAX Integer32 (1..65535)
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"An index used to uniquely identify an entry in the
usrHistoryObject table. Each such entry defines a
MIB instance to be collected periodically."
::= { usrHistoryObjectEntry 1 }

usrHistoryObjectVariable OBJECT-TYPE
SYNTAX OBJECT IDENTIFIER
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The object identifier of the particular variable to be
sampled.

Only variables that resolve to an ASN.1 primitive type of Integer32 (Integer32, Counter, Gauge, or TimeTicks) may be sampled.

Because SNMP access control is articulated entirely in terms of the contents of MIB views, no access control mechanism exists that can restrict the value of this object to identify only those objects that exist in a particular MIB view. Because there is thus no acceptable means of restricting the read access that could be obtained through the user history mechanism, the probe must only grant write access to this object in those views that have read access to all objects on the probe. See USM [RFC3414] and VACM [RFC3415] for more information.

During a set operation, if the supplied variable name is not available in the selected MIB view, a badValue error must be returned.

This object may not be modified if the associated usrHistoryControlStatus object is equal to active(1)."

::= { usrHistoryObjectEntry 2 }

usrHistoryObjectSampleType OBJECT-TYPE
SYNTAX INTEGER {
  absoluteValue(1),
  deltaValue(2)
}
MAX-ACCESS read-create
STATUS current
DESCRIPTION
"The method of sampling the selected variable for storage in the usrHistoryTable.

If the value of this object is absoluteValue(1), the value of the selected variable will be copied directly into the history bucket.

If the value of this object is deltaValue(2), the value of the selected variable at the last sample will be subtracted from the current value, and the difference will be stored in the history bucket. If the associated usrHistoryObjectVariable instance could not be obtained at the previous sample interval, then a delta sample is not possible, and the value of the associated usrHistoryValStatus object for this interval will be valueNotAvailable(1)."
This object may not be modified if the associated
usrHistoryControlStatus object is equal to active(1).
::= { usrHistoryObjectEntry 3 }

-- data table

usrHistoryTable OBJECT-TYPE
SYNTAX SEQUENCE OF UsrHistoryEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A list of user-defined history entries."
::= { usrHistory 3 }

usrHistoryEntry OBJECT-TYPE
SYNTAX UsrHistoryEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"A historical sample of user-defined variables. This sample
is associated with the usrHistoryControlEntry that set up the
parameters for a regular collection of these samples.

The usrHistoryControlIndex value in the index identifies the
usrHistoryControlEntry on whose behalf this entry was created.
The usrHistoryObjectIndex value in the index identifies the
usrHistoryObjectEntry on whose behalf this entry was created.

For example, an instance of usrHistoryAbsValue, which represents
the 14th sample of a variable collected as specified by
usrHistoryControlEntry.1 and usrHistoryObjectEntry.1.5,
would be named usrHistoryAbsValue.1.14.5"
INDEX { usrHistoryControlIndex, usrHistorySampleIndex,
usrHistoryObjectIndex }
::= { usrHistoryTable 1 }

UsrHistoryEntry ::= SEQUENCE {
    usrHistorySampleIndex    Integer32,
    usrHistoryIntervalStart   TimeStamp,
    usrHistoryIntervalEnd     TimeStamp,
    usrHistoryAbsValue        Gauge32,
    usrHistoryValStatus       INTEGER
}

usrHistorySampleIndex OBJECT-TYPE
SYNTAX     Integer32 (1..2147483647)
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"An index that uniquely identifies the particular sample this entry represents among all samples associated with the same usrHistoryControlEntry. This index starts at 1 and increases by one as each new sample is taken."
::= { usrHistoryEntry 1 }

usrHistoryIntervalStart OBJECT-TYPE
SYNTAX TimeStamp
STATUS current
DESCRIPTION
"The value of sysUpTime at the start of the interval over which this sample was measured. If the probe keeps track of the time of day, it should start the first sample of the history at a time such that when the next hour of the day begins, a sample is started at that instant.

Note that following this rule may require that the probe delay collecting the first sample of the history, as each sample must be of the same interval. Also note that the sample that is currently being collected is not accessible in this table until the end of its interval."
::= { usrHistoryEntry 2 }

usrHistoryIntervalEnd OBJECT-TYPE
SYNTAX TimeStamp
STATUS current
DESCRIPTION
"The value of sysUpTime at the end of the interval over which this sample was measured."
::= { usrHistoryEntry 3 }

usrHistoryAbsValue OBJECT-TYPE
SYNTAX Gauge32
STATUS current
DESCRIPTION
"The absolute value (i.e., unsigned value) of the user-specified statistic during the last sampling period. The value during the current sampling period is not made available until the period is completed.

To obtain the true value for this sampling interval, the associated instance of usrHistoryValStatus must be checked, and usrHistoryAbsValue adjusted as necessary."
If the MIB instance could not be accessed during the sampling interval, then this object will have a value of zero, and the associated instance of usrHistoryValStatus will be set to ‘valueNotAvailable(1)’.

The access control check prescribed in the definition of usrHistoryObjectVariable SHOULD be checked for each sampling interval. If this check determines that access should not be allowed, then this object will have a value of zero, and the associated instance of usrHistoryValStatus will be set to ‘valueNotAvailable(1)’.

::= { usrHistoryEntry 4 }

usrHistoryValStatus OBJECT-TYPE
SYNTAX INTEGER {
    valueNotAvailable(1),
    valuePositive(2),
    valueNegative(3)
}
MAX-ACCESS read-only
STATUS current
DESCRIPTION
    "This object indicates the validity and sign of the data in the associated instance of usrHistoryAbsValue.

If the MIB instance could not be accessed during the sampling interval, then ‘valueNotAvailable(1)’ will be returned.

If the sample is valid and the actual value of the sample is greater than or equal to zero, then ‘valuePositive(2)’ is returned.

If the sample is valid and the actual value of the sample is less than zero, ‘valueNegative(3)’ will be returned. The associated instance of usrHistoryAbsValue should be multiplied by -1 to obtain the true sample value."

::= { usrHistoryEntry 5 }

-- The Probe Configuration Group
--
-- This group controls the configuration of various operating
-- parameters of the probe.

ControlString ::= TEXTUAL-CONVENTION
STATUS current
DESCRIPTION
    "This data type is used to communicate with a modem or a
serial data switch. A ControlString contains embedded commands to control how the device will interact with the remote device through the serial interface. Commands are represented as two-character sequences beginning with the ‘^’ character.

The following commands are recognized by the device (note that command characters are case sensitive):

- **^s** Send string that follows, which is terminated by the next command or the end of string.
- **^c** Delay for the number of seconds that follows. Toss out any data received rather than store it in a buffer for parsing.
- **^t** Set timeout to the value represented by the decimal digits that follow. The default timeout is 20 seconds. Note that this timeout may be overridden by a smaller serialTimeout configured for the associated serial interface (see serialConfigTable).
- **^w** Wait for the reply string that follows, which is terminated by the next command or the end of string. Partial and case-insensitive matching is applied, i.e., if the reply string (any case combination) is found anywhere in the received string, then the a match is found. If the current timeout elapses without a match, then the remaining control string is ignored.
- **^!** The ‘^’ character.
- **^d** Delay the number of seconds specified by the decimal digits that follow.
- **^b** Send break for the number of milliseconds specified by the decimal digits that follow. If no digits follow, break will be enforced for 250 milliseconds by default.

The following ASCII control characters may be inserted into the ‘^s’ send string or the ‘^w’ reply string:

- **^@** 0x00
- **^A** 0x01
- ..
- **^M** 0x0D
- ..
- **^Z** 0x1A
- **^[** 0x1B
- **^** 0x1C
- **^]** 0x1D
- **^^** 0x1E
- **^_** 0x1F
Binary data may also be inserted into the data stream. The control sequence for each byte of binary data is ^0x##, where ## is the hexadecimal representation of the data byte. Two ASCII characters (0-9, a-f, A-F) must follow the '^^0x' control prefix. For example, '^^0xD^^0xA' is interpreted as a carriage return followed by a line feed.

SYNTAX OCTET STRING (SIZE (0..255))

probeCapabilities OBJECT-TYPE
SYNTAX BITS {
  etherStats(0),
  historyControl(1),
  etherHistory(2),
  alarm(3),
  hosts(4),
  hostTopN(5),
  matrix(6),
  filter(7),
  capture(8),
  event(9),
  tokenRingMLStats(10),
  tokenRingPStats(11),
  tokenRingMLHistory(12),
  tokenRingPHistory(13),
  ringStation(14),
  ringStationOrder(15),
  ringStationConfig(16),
  sourceRouting(17),
  protocolDirectory(18),
  protocolDistribution(19),
  addressMapping(20),
  nlHost(21),
  nlMatrix(22),
  alHost(23),
  alMatrix(24),
  usrHistory(25),
  probeConfig(26)
}  
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"An indication of the RMON MIB groups supported on at least one interface by this probe."
::= { probeConfig 1 }

probeSoftwareRev OBJECT-TYPE
SYNTAX DisplayString (SIZE(0..15))
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The software revision of this device. This string will have a zero length if the revision is unknown."
::= { probeConfig 2 }

probeHardwareRev OBJECT-TYPE
SYNTAX DisplayString (SIZE(0..31))
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The hardware revision of this device. This string will have a zero length if the revision is unknown."
::= { probeConfig 3 }

probeDateTime OBJECT-TYPE
SYNTAX OCTET STRING (SIZE (0 | 8 | 11))
MAX-ACCESS read-write
STATUS current
DESCRIPTION
"Probe’s current date and time.

<table>
<thead>
<tr>
<th>field</th>
<th>octets</th>
<th>contents</th>
<th>range</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1-2</td>
<td>year</td>
<td>0..65536</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>month</td>
<td>1..12</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>day</td>
<td>1..31</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>hour</td>
<td>0..23</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>minutes</td>
<td>0..59</td>
</tr>
<tr>
<td>6</td>
<td>7</td>
<td>seconds</td>
<td>0..60</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>deci-seconds</td>
<td>0..9</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>direction from UTC</td>
<td>'+' / '-'</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>hours from UTC</td>
<td>0..11</td>
</tr>
<tr>
<td></td>
<td>11</td>
<td>minutes from UTC</td>
<td>0..59</td>
</tr>
</tbody>
</table>

For example, Tuesday May 26, 1992 at 1:30:15 PM EDT would be displayed as:

1992-5-26,13:30:15.0,-4:0

Note that if only local time is known, then time zone information (fields 8-10) is not present, and that if no time information is known, the null string is returned."
::= { probeConfig 4 }

probeResetControl OBJECT-TYPE
SYNTAX INTEGER {
   running(1),
   warmBoot(2),
   coldBoot(3)
}

MAX-ACCESS read-write
STATUS current
DESCRIPTION
"Setting this object to warmBoot(2) causes the device to restart the application software with current configuration parameters saved in non-volatile memory. Setting this object to coldBoot(3) causes the device to reinitialize configuration parameters in non-volatile memory to default values and to restart the application software. When the device is running normally, this variable has a value of running(1)."

::= { probeConfig 5 }

-- The following download objects do not restrict an implementation
-- from implementing additional download mechanisms (controlled in an
-- implementation-specific manner). Further, in the case where the RMON
-- agent shares a processor with other types of systems, the
-- implementation is not required to download those non-RMON functions
-- with this mechanism.

probeDownloadFile OBJECT-TYPE
   SYNTAX DisplayString (SIZE(0..127))
   MAX-ACCESS read-write
   STATUS deprecated
   DESCRIPTION
   "The file name to be downloaded from the TFTP server when a
download is next requested via this MIB. This value is set to
the zero-length string when no file name has been specified.

This object has been deprecated, as it has not had enough
independent implementations to demonstrate interoperability to meet the requirements of a Draft Standard."

::= { probeConfig 6 }

probeDownloadTFTPServer OBJECT-TYPE
   SYNTAX IpAddress
   MAX-ACCESS read-write
   STATUS deprecated
   DESCRIPTION
   "The IP address of the TFTP server that contains the boot
image to load when a download is next requested via this MIB.
This value is set to '0.0.0.0' when no IP address has been
This object has been deprecated, as it has not had enough independent implementations to demonstrate interoperability to meet the requirements of a Draft Standard.

::= { probeConfig 7 }

probeDownloadAction OBJECT-TYPE
SYNTAX INTEGER {
    notDownloading(1),
    downloadToPROM(2),
    downloadToRAM(3)
}
MAX-ACCESS read-write
STATUS    deprecated
DESCRIPTION
"When this object is set to downloadToRAM(3) or downloadToPROM(2), the device will discontinue its normal operation and begin download of the image specified by probeDownloadFile from the server specified by probeDownloadTFTPServer using the TFTP protocol. If downloadToRAM(3) is specified, the new image is copied to RAM only (the old image remains unaltered in the flash EPROM). If downloadToPROM(2) is specified, the new image is written to the flash EPROM memory after its checksum has been verified to be correct. When the download process is completed, the device will warm boot to restart the newly loaded application. When the device is not downloading, this object will have a value of notDownloading(1).

This object has been deprecated, as it has not had enough independent implementations to demonstrate interoperability to meet the requirements of a Draft Standard."

::= { probeConfig 8 }

probeDownloadStatus OBJECT-TYPE
SYNTAX INTEGER {
    downloadSuccess(1),
    downloadStatusUnknown(2),
    downloadGeneralError(3),
    downloadNoResponseFromServer(4),
    downloadChecksumError(5),
    downloadIncompatibleImage(6),
    downloadTftpFileNotFound(7),
    downloadTftpAccessViolation(8)
}
MAX-ACCESS read-only
STATUS          deprecated
DESCRIPTION     "The status of the last download procedure, if any.  This
object will have a value of downloadStatusUnknown(2) if no
download process has been performed.

This object has been deprecated, as it has not had enough
independent implementations to demonstrate interoperability to
meet the requirements of a Draft Standard."
 ::= { probeConfig 9 }

serialConfigTable  OBJECT-TYPE
SYNTAX     SEQUENCE OF SerialConfigEntry
MAX-ACCESS not-accessible
STATUS     deprecated
DESCRIPTION     "A table of serial interface configuration entries.  This data
will be stored in non-volatile memory and preserved across
probe resets or power loss.

This table has been deprecated, as it has not had enough
independent implementations to demonstrate interoperability to
meet the requirements of a Draft Standard."
 ::= { probeConfig 10 }

serialConfigEntry  OBJECT-TYPE
SYNTAX     SerialConfigEntry
MAX-ACCESS not-accessible
STATUS     deprecated
DESCRIPTION     "A set of configuration parameters for a particular
serial interface on this device.  If the device has no serial
interfaces, this table is empty.

The index is composed of the ifIndex assigned to this serial
line interface."
INDEX  { ifIndex }
 ::= { serialConfigTable 1 }

SerialConfigEntry ::= SEQUENCE {
  serialMode                   INTEGER,
  serialProtocol               INTEGER,
  serialTimeout                Integer32,
  serialModemInitString        ControlString,
  serialModemHangUpString      ControlString,
  serialModemConnectResp       DisplayString,
  serialModemNoConnectResp     DisplayString,
  serialDialoutTimeout         Integer32,
serialStatus  RowStatus

serialMode  OBJECT-TYPE
SYNTAX     INTEGER {
            direct(1),
            modem(2)
        }
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
            "The type of incoming connection to be expected on this
            serial interface."
DEFVAL { direct }
::= { serialConfigEntry 1 }

serialProtocol  OBJECT-TYPE
SYNTAX     INTEGER {
            other(1),
            slip(2),
            ppp(3)
        }
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
            "The type of data link encapsulation to be used on this
            serial interface."
DEFVAL { slip }
::= { serialConfigEntry 2 }

serialTimeout  OBJECT-TYPE
SYNTAX     Integer32 (1..65535)
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
            "This timeout value is used when the Management Station has
            initiated the conversation over the serial link. This variable
            represents the number of seconds of inactivity allowed before
            terminating the connection on this serial interface. Use the
            serialDialoutTimeout in the case where the probe has initiated
            the connection for the purpose of sending a trap."
DEFVAL { 300 }
::= { serialConfigEntry 3 }

serialModemInitString  OBJECT-TYPE
SYNTAX     ControlString (SIZE (0..255))
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION

"A control string that controls how a modem attached to this serial interface should be initialized. The initialization is performed once during startup and again after each connection is terminated if the associated serialMode has the value of modem(2).

A control string that is appropriate for a wide variety of modems is: ‘^s^MATE0Q0V1X4 S0=1 S2=43^M’.

::= { serialConfigEntry 4 }

serialModemHangUpString OBJECT-TYPE
SYNTAX     ControlString (SIZE (0..255))
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION

"A control string that specifies how to disconnect a modem connection on this serial interface. This object is only meaningful if the associated serialMode has the value of modem(2).

A control string that is appropriate for a wide variety of modems is: ‘^d2^s+++^d2^sATH0^M^d2’.

::= { serialConfigEntry 5 }

serialModemConnectResp OBJECT-TYPE
SYNTAX     DisplayString (SIZE (0..255))
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION

"An ASCII string containing substrings that describe the expected modem connection response code and associated bps rate. The substrings are delimited by the first character in the string, for example:

/CONNECT/300/CONNECT 1200/1200/CONNECT 2400/2400/
CONNECT 4800/4800/CONNECT 9600/9600

will be interpreted as:

response code   bps rate
CONNECT         300
CONNECT 1200    1200
CONNECT 2400    2400
CONNECT 4800    4800
CONNECT 9600    9600

The agent will use the information in this string to adjust the bps rate of this serial interface once a modem connection is established.

A value that is appropriate for a wide variety of modems is:
serialModemNoConnectResp OBJECT-TYPE
SYNTAX       DisplayString (SIZE (0..255))
MAX-ACCESS   read-create
STATUS       deprecated
DESCRIPTION
   "An ASCII string containing response codes that may be
generated by a modem to report the reason why a connection
attempt has failed. The response codes are delimited by
the first character in the string, for example:
/NO CARRIER/BUSY/NO DIALTONE/NO ANSWER/ERROR/

If one of these response codes is received via this serial
interface while attempting to make a modem connection,
the agent will issue the hang up command as specified by
serialModemHangUpString.

A value that is appropriate for a wide variety of modems is:
'/NO CARRIER/BUSY/NO DIALTONE/NO ANSWER/ERROR/'."
::= { serialConfigEntry 6 }

serialDialoutTimeout OBJECT-TYPE
SYNTAX       Integer32 (1..65535)
MAX-ACCESS   read-create
STATUS       deprecated
DESCRIPTION
   "This timeout value is used when the probe initiates the
serial connection with the intention of contacting a
management station. This variable represents the number
of seconds of inactivity allowed before terminating the
connection on this serial interface."
DEFVAL { 20 }
::= { serialConfigEntry 7 }

serialStatus OBJECT-TYPE
SYNTAX       RowStatus
MAX-ACCESS   read-create
STATUS       deprecated
DESCRIPTION
   "The status of this serialConfigEntry.

   An entry may not exist in the active state unless all
   objects in the entry have an appropriate value."
::= { serialConfigEntry 8 }
netConfigTable OBJECT-TYPE
SYNTAX SEQUENCE OF NetConfigEntry
MAX-ACCESS not-accessible
STATUS deprecated
DESCRIPTION
"A table of netConfigEntries.

This table has been deprecated, as it has not had enough
independent implementations to demonstrate interoperability to
meet the requirements of a Draft Standard."
 ::= { probeConfig 11 }

netConfigEntry OBJECT-TYPE
SYNTAX NetConfigEntry
MAX-ACCESS not-accessible
STATUS deprecated
DESCRIPTION
"A set of configuration parameters for a particular
network interface on this device. If the device has no network
interface, this table is empty.

The index is composed of the ifIndex assigned to the
corresponding interface."
INDEX { ifIndex }
 ::= { netConfigTable 1 }

NetConfigEntry ::= SEQUENCE {
  netConfigIPAddress         IpAddress,
  netConfigSubnetMask        IpAddress,
  netConfigStatus            RowStatus
}

netConfigIPAddress OBJECT-TYPE
SYNTAX IpAddress
MAX-ACCESS read-create
STATUS deprecated
DESCRIPTION
"The IP address of this Net interface. The default value
for this object is 0.0.0.0. If either the netConfigIPAddress
or netConfigSubnetMask is 0.0.0.0, then when the device
boots, it may use BOOTP to try to figure out what these
values should be. If BOOTP fails before the device
can talk on the network, this value must be configured
(e.g., through a terminal attached to the device). If BOOTP is
used, care should be taken to not send BOOTP broadcasts too
frequently and to eventually send them very infrequently if no
replies are received."
 ::= { netConfigEntry 1 }
netConfigSubnetMask  OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
"The subnet mask of this Net interface.  The default value
for this object is 0.0.0.0.  If either the netConfigIPAddress
or netConfigSubnetMask is 0.0.0.0, then when the device
boots, it may use BOOTP to try to figure out what these
values should be.  If BOOTP fails before the device
can talk on the network, this value must be configured
(e.g., through a terminal attached to the device).  If BOOTP is
used, care should be taken to not send BOOTP broadcasts too
frequently and to eventually send them very infrequently if no
replies are received."
 ::= { netConfigEntry 2 }

netConfigStatus  OBJECT-TYPE
SYNTAX     RowStatus
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
"The status of this netConfigEntry.
An entry may not exist in the active state unless all
objects in the entry have an appropriate value."
 ::= { netConfigEntry 3 }

netDefaultGateway  OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS read-write
STATUS     deprecated
DESCRIPTION
"The IP Address of the default gateway.  If this value is
undefined or unknown, it shall have the value 0.0.0.0."
 ::= { probeConfig 12 }

-- Trap Destination Table
--
-- This table defines the destination addresses for traps generated
-- from the device.  This table maps a community to one or more trap
-- destination entries.
--
-- The same trap will be sent to all destinations specified in the
-- entries that have the same trapDestCommunity as the eventCommunity
-- (as defined by RMON MIB), as long as no access control mechanism
-- (e.g., VACM) prohibits sending to one or more of the destinations.
-- Information in this table will be stored in non-volatile memory.
-- If the device has gone through a hard restart, this information
-- will be reset to its default state.

trapDestTable OBJECT-TYPE
SYNTAX SEQUENCE OF TrapDestEntry
MAX-ACCESS not-accessible
STATUS deprecated
DESCRIPTION
"A list of trap destination entries."
::= { probeConfig 13 }

trapDestEntry OBJECT-TYPE
SYNTAX TrapDestEntry
MAX-ACCESS not-accessible
STATUS deprecated
DESCRIPTION
"This entry includes a destination IP address to which
traps are sent for this community."
INDEX { trapDestIndex }
::= { trapDestTable 1 }

TrapDestEntry ::= SEQUENCE {
  trapDestIndex               Integer32,
  trapDestCommunity           OCTET STRING,
  trapDestProtocol            INTEGER,
  trapDestAddress             OCTET STRING,
  trapDestOwner               OwnerString,
  trapDestStatus              RowStatus
}

trapDestIndex OBJECT-TYPE
SYNTAX Integer32 (1..65535)
MAX-ACCESS not-accessible
STATUS deprecated
DESCRIPTION
"A value that uniquely identifies this trapDestEntry."
::= { trapDestEntry 1 }

trapDestCommunity OBJECT-TYPE
SYNTAX OCTET STRING (SIZE(0..127))
MAX-ACCESS read-create
STATUS deprecated
DESCRIPTION
"A community to which this destination address belongs.
This entry is associated with any eventEntries in the RMON
MIB whose value of eventCommunity is equal to the value of
this object. Every time an associated event entry sends a
trap due to an event, that trap will be sent to each
address in the trapDestTable with a trapDestCommunity equal to eventCommunity, as long as no access control mechanism precludes it (e.g., VACM).

This object may not be modified if the associated trapDestStatus object is equal to active(1).

::= { trapDestEntry 2 }

trapDestProtocol OBJECT-TYPE
SYNTAX INTEGER {
    ip(1),
    ipx(2)
}
MAX-ACCESS read-create
STATUS   deprecated
DESCRIPTION
"The protocol with which this trap is to be sent."
::= { trapDestEntry 3 }

trapDestAddress OBJECT-TYPE
SYNTAX OCTET STRING
MAX-ACCESS read-create
STATUS    deprecated
DESCRIPTION
"The destination address for traps on behalf of this entry.

If the associated trapDestProtocol object is equal to ip(1),
the encoding of this object is the same as the snmpUDPAddress textual convention in RFC 3417, 'Transport Mappings for the Simple Network Management Protocol (SNMP)' [RFC3417]:

-- for a SnmpUDPAddress of length 6:

-- octets contents encoding
--  1-4    IP-address    network-byte order
--  5-6    UDP-port      network-byte order

If the associated trapDestProtocol object is equal to ipx(2),
the encoding of this object is the same as the snmpIPXAddress textual convention in RFC 3417, 'Transport Mappings for the Simple Network Management Protocol (SNMP)' [RFC3417]:

-- for a SnmpIPXAddress of length 12:

-- octets contents encoding
--  1-4    network-number network-byte order
--  5-10   physical-address network-byte order
-- 11-12   socket-number   network-byte order

This object may not be modified if the associated
trapDestStatus object is equal to active(1)."
::= { trapDestEntry 4 }

trapDestOwner OBJECT-TYPE
SYNTAX OwnerString
MAX-ACCESS read-create
STATUS deprecated
DESCRIPTION
"The entity that configured this entry and is therefore using the resources assigned to it."
::= { trapDestEntry 5 }

trapDestStatus OBJECT-TYPE
SYNTAX RowStatus
MAX-ACCESS read-create
STATUS deprecated
DESCRIPTION
"The status of this trap destination entry.

An entry may not exist in the active state unless all objects in the entry have an appropriate value."
::= { trapDestEntry 6 }

-- Serial Connection Table

-- The device may communicate with a management station using SLIP. In order for the device to send traps via SLIP, it must be able to initiate a connection over the serial interface. The serialConnectionTable stores the parameters for such connection initiation.

serialConnectionTable OBJECT-TYPE
SYNTAX SEQUENCE OF SerialConnectionEntry
MAX-ACCESS not-accessible
STATUS deprecated
DESCRIPTION
"A list of serialConnectionEntries.

This table has been deprecated, as it has not had enough independent implementations to demonstrate interoperability to meet the requirements of a Draft Standard."
::= { probeConfig 14 }

serialConnectionEntry OBJECT-TYPE
SYNTAX SerialConnectionEntry
MAX-ACCESS not-accessible
STATUS deprecated
DESCRIPTION
"Configuration for a SLIP link over a serial line."
INDEX { serialConnectIndex } ::= { serialConnectionTable 1 }

SerialConnectionEntry ::= SEQUENCE {
  serialConnectIndex                   Integer32,
  serialConnectDestIpAddress           IpAddress,
  serialConnectType                    INTEGER,
  serialConnectDialString              ControlString,
  serialConnectSwitchConnectSeq        ControlString,
  serialConnectSwitchDisconnectSeq     ControlString,
  serialConnectSwitchResetSeq          ControlString,
  serialConnectOwner                   OwnerString,
  serialConnectStatus                  RowStatus
}

serialConnectIndex  OBJECT-TYPE
SYNTAX     Integer32 (1..65535)
MAX-ACCESS not-accessible
STATUS     deprecated
DESCRIPTION
  "A value that uniquely identifies this serialConnection entry."
 ::= { serialConnectionEntry 1 }

serialConnectDestIpAddress  OBJECT-TYPE
SYNTAX     IpAddress
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
  "The IP Address that can be reached at the other end of this serial connection.
   This object may not be modified if the associated
   serialConnectStatus object is equal to active(1)."
 ::= { serialConnectionEntry 2 }

serialConnectType  OBJECT-TYPE
SYNTAX     INTEGER {
  direct(1),
  modem(2),
  switch(3),
  modemSwitch(4)
}
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
"The type of outgoing connection to be made. If this object has the value direct(1), then a direct serial connection is assumed. If this object has the value modem(2), then serialConnectDialString will be used to make a modem connection. If this object has the value switch(3), then serialConnectSwitchConnectSeq will be used to establish the connection over a serial data switch, and serialConnectSwitchDisconnectSeq will be used to terminate the connection. If this object has the value modem-switch(4), then a modem connection will be made first, followed by the switch connection.

This object may not be modified if the associated serialConnectStatus object is equal to active(1)."

DEFVAL { direct }
::= { serialConnectionEntry 3 }

serialConnectDialString OBJECT-TYPE
SYNTAX ControlString (SIZE(0..255))
MAX-ACCESS read-create
STATUS deprecated
DESCRIPTION "A control string that specifies how to dial the phone number in order to establish a modem connection. The string should include the dialing prefix and suffix. For example: '^s^MATD9,888-1234^M' will instruct the Probe to send a carriage return, followed by the dialing prefix 'ATD', the phone number '9,888-1234', and a carriage return as the dialing suffix.

This object may not be modified if the associated serialConnectStatus object is equal to active(1)."
::= { serialConnectionEntry 4 }

serialConnectSwitchConnectSeq OBJECT-TYPE
SYNTAX ControlString (SIZE(0..255))
MAX-ACCESS read-create
STATUS deprecated
DESCRIPTION "A control string that specifies how to establish a data switch connection.

This object may not be modified if the associated serialConnectStatus object is equal to active(1)."
::= { serialConnectionEntry 5 }

serialConnectSwitchDisconnectSeq OBJECT-TYPE
SYNTAX ControlString (SIZE(0..255))
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
  "A control string that specifies how to terminate a
  data switch connection.

  This object may not be modified if the associated
  serialConnectStatus object is equal to active(1)."
::= { serialConnectionEntry 6 } serialConnectSwitchResetSeq OBJECT-TYPE
SYNTAX     ControlString (SIZE(0..255))
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
  "A control string that specifies how to reset a data
  switch in the event of a timeout.

  This object may not be modified if the associated
  serialConnectStatus object is equal to active(1)."
::= { serialConnectionEntry 7 } serialConnectOwner OBJECT-TYPE
SYNTAX     OwnerString
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
  "The entity that configured this entry and is
  therefore using the resources assigned to it."
::= { serialConnectionEntry 8 } serialConnectStatus OBJECT-TYPE
SYNTAX     RowStatus
MAX-ACCESS read-create
STATUS     deprecated
DESCRIPTION
  "The status of this serialConnectionEntry.

  If the manager attempts to set this object to active(1) when
  the serialConnectType is set to modem(2) or modem-switch(4)
  and the serialConnectDialString is a zero-length string or
  cannot be correctly parsed as a ConnectString, the set
  request will be rejected with badValue(3).

  If the manager attempts to set this object to active(1) when
  the serialConnectType is set to switch(3) or modem-switch(4)
  and the serialConnectSwitchConnectSeq,
  the serialConnectSwitchDisconnectSeq, or
the serialConnectSwitchResetSeq is a zero-length string or cannot be correctly parsed as a ConnectString, the set request will be rejected with badValue(3).

An entry may not exist in the active state unless all objects in the entry have an appropriate value.

```c
::= { serialConnectionEntry 9 }
```

--

-- Extensions to the RMON 1 MIB for RMON 2 devices
--
-- These extensions include the standard LastCreateTime Textual
-- Convention for all control tables, as well as an augmentation of
-- the filter entry that provides variable-length offsets into
-- packets.

-- Each of the following, except for filterDroppedFrames, is a
-- read-only object which, if implemented, automatically appears when
-- the RMON1 row it is associated with is created.

**etherStats2Table** OBJECT-TYPE
SYNTAX SEQUENCE OF EtherStats2Entry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Contains the RMON-2 augmentations to RMON-1."
::= { statistics 4 }

**etherStats2Entry** OBJECT-TYPE
SYNTAX EtherStats2Entry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION "Contains the RMON-2 augmentations to RMON-1."
AUGMENTS { etherStatsEntry }
::= { etherStats2Table 1 }

EtherStats2Entry ::= SEQUENCE {
    etherStatsDroppedFrames Counter32,
    etherStatsCreateTime LastCreateTime
}

**etherStatsDroppedFrames** OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for this entry for whatever reason. Most often, this event occurs when the probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped."

::= { etherStats2Entry 1 }

etherStatsCreateTime OBJECT-TYPE
SYNTAX LastCreateTime
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The value of sysUpTime when this control entry was last activated. This can be used by the management station to ensure that the table has not been deleted and recreated between polls."

::= { etherStats2Entry 2 }

historyControl2Table OBJECT-TYPE
SYNTAX SEQUENCE OF HistoryControl2Entry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1."

::= { history 5 }

HistoryControl2Entry OBJECT-TYPE
SYNTAX HistoryControl2Entry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1."
AUGMENTS { historyControlEntry }

::= { historyControl2Table 1 }

HistoryControl2Entry ::= SEQUENCE {
    historyControlDroppedFrames Counter32
}

historyControlDroppedFrames OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for this entry for whatever reason. Most often, this event occurs when the probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped."

::= { historyControl2Entry 1 }

hostControl2Table OBJECT-TYPE
SYNTAX SEQUENCE OF HostControl2Entry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1."
::= { hosts 4 }

hostControl2Entry OBJECT-TYPE
SYNTAX HostControl2Entry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1."
AUGMENTS { hostControlEntry }
::= { hostControl2Table 1 }

HostControl2Entry ::= SEQUENCE {
  hostControlDroppedFrames Counter32,
  hostControlCreateTime LastCreateTime
}

hostControlDroppedFrames OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS current
DESCRIPTION
"The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for this entry for whatever reason. Most often, this event occurs when the
probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped.

 ::= { hostControl2Entry 1 }

hostControlCreateTime OBJECT-TYPE
SYNTAX     LastCreateTime
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The value of sysUpTime when this control entry was last activated. This can be used by the management station to ensure that the table has not been deleted and recreated between polls."
 ::= { hostControl2Entry 2 }

matrixControl2Table OBJECT-TYPE
SYNTAX     SEQUENCE OF MatrixControl2Entry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1."
 ::= { matrix 4 }

matrixControl2Entry OBJECT-TYPE
SYNTAX     MatrixControl2Entry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1."
AUGMENTS { matrixControlEntry }
 ::= { matrixControl2Table 1 }

MatrixControl2Entry ::= SEQUENCE {
   matrixControlDroppedFrames  Counter32,
   matrixControlCreateTime     LastCreateTime
}

matrixControlDroppedFrames OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for this entry for whatever reason. Most often, this event occurs when the probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped."

::= { matrixControl2Entry 1 }

matrixControlCreateTime OBJECT-TYPE
SYNTAX     LastCreateTime
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
"The value of sysUpTime when this control entry was last activated. This can be used by the management station to ensure that the table has not been deleted and recreated between polls."

::= { matrixControl2Entry 2 }

channel2Table  OBJECT-TYPE
SYNTAX     SEQUENCE OF Channel2Entry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1."

::= { filter 3 }

channel2Entry  OBJECT-TYPE
SYNTAX     Channel2Entry
MAX-ACCESS not-accessible
STATUS     current
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1."

AUGMENTS { channelEntry }

::= { channel2Table 1 }

Channel2Entry ::= SEQUENCE {
  channelDroppedFrames    Counter32,
  channelCreateTime       LastCreateTime
}

channelDroppedFrames OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for this entry for whatever reason. Most often, this event occurs when the probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped."
::= { channel2Entry 1 }

cchannelCreateTime OBJECT-TYPE
SYNTAX     LastCreateTime
MAX-ACCESS read-only
STATUS     current
DESCRIPTION
 "The value of sysUpTime when this control entry was last activated. This can be used by the management station to ensure that the table has not been deleted and recreated between polls."
::= { channel2Entry 2 }

tokenRingMLStats2Table   OBJECT-TYPE
SYNTAX     SEQUENCE OF TokenRingMLStats2Entry
MAX-ACCESS not-accessible
STATUS     deprecated
DESCRIPTION
 "Contains the RMON-2 augmentations to RMON-1.

This table has been deprecated, as it has not had enough independent implementations to demonstrate interoperability to meet the requirements of a Draft Standard."
::= { statistics 5 }

tokenRingMLStats2Entry   OBJECT-TYPE
SYNTAX     TokenRingMLStats2Entry
MAX-ACCESS not-accessible
STATUS     deprecated
DESCRIPTION
 "Contains the RMON-2 augmentations to RMON-1."
AUGMENTS { tokenRingMLStatsEntry }
::= { tokenRingMLStats2Table 1 }

TokenRingMLStats2Entry ::= SEQUENCE {
  tokenRingMLStatsDroppedFrames Counter32,
  tokenRingMLStatsCreateTime LastCreateTime
}

tokenRingMLStatsDroppedFrames OBJECT-TYPE
  SYNTAX     Counter32
  MAX-ACCESS read-only
  STATUS     deprecated
  DESCRIPTION
    "The total number of frames that were received by the probe
    and therefore not accounted for in the *StatsDropEvents, but
    that the probe chose not to count for this entry for
    whatever reason. Most often, this event occurs when the
    probe is out of some resources and decides to shed load from
    this collection.

    This count does not include packets that were not counted
    because they had MAC-layer errors.

    Note that, unlike the dropEvents counter, this number is the
    exact number of frames dropped."
::= { tokenRingMLStats2Entry 1 }

tokenRingMLStatsCreateTime OBJECT-TYPE
  SYNTAX     LastCreateTime
  MAX-ACCESS read-only
  STATUS     deprecated
  DESCRIPTION
    "The value of sysUpTime when this control entry was last
    activated. This can be used by the management station to
    ensure that the table has not been deleted and recreated
    between polls."
::= { tokenRingMLStats2Entry 2 }

tokenRingPStats2Table OBJECT-TYPE
  SYNTAX     SEQUENCE OF TokenRingPStats2Entry
  MAX-ACCESS not-accessible
  STATUS     deprecated
  DESCRIPTION
    "Contains the RMON-2 augmentations to RMON-1.

    This table has been deprecated, as it has not had enough
    independent implementations to demonstrate interoperability
    to meet the requirements of a Draft Standard."
::= { statistics 6 }
tokenRingPStats2Entry OBJECT-TYPE
SYNTAX TokenRingPStats2Entry
MAX-ACCESS not-accessible
STATUS deprecated
DESCRIPTION "Contains the RMON-2 augmentations to RMON-1."
AUGMENTS { tokenRingPStatsEntry }
::= { tokenRingPStats2Table 1 }

TokenRingPStats2Entry ::= SEQUENCE {
  tokenRingPStatsDroppedFrames Counter32,
  tokenRingPStatsCreateTime   LastCreateTime
}

tokenRingPStatsDroppedFrames OBJECT-TYPE
SYNTAX Counter32
MAX-ACCESS read-only
STATUS deprecated
DESCRIPTION "The total number of frames that were received by the probe
and therefore not accounted for in the *StatsDropEvents, but
that the probe chose not to count for this entry for
whatever reason. Most often, this event occurs when the
probe is out of some resources and decides to shed load from
this collection.

This count does not include packets that were not counted
because they had MAC-layer errors.

Note that, unlike the dropEvents counter, this number is the
exact number of frames dropped."
::= { tokenRingPStats2Entry 1 }

tokenRingPStatsCreateTime OBJECT-TYPE
SYNTAX LastCreateTime
MAX-ACCESS read-only
STATUS deprecated
DESCRIPTION "The value of sysUpTime when this control entry was last
activated. This can be used by the management station to
ensure that the table has not been deleted and recreated
between polls."
::= { tokenRingPStats2Entry 2 }

ringStationControl2Table OBJECT-TYPE
SYNTAX SEQUENCE OF RingStationControl2Entry
MAX-ACCESS not-accessible
STATUS deprecated
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1.

This table has been deprecated, as it has not had enough independent implementations to demonstrate interoperability to meet the requirements of a Draft Standard."

::= { tokenRing 7 }

ringStationControl2Entry  OBJECT-TYPE
SYNTAX  RingStationControl2Entry
MAX-ACCESS not-accessible
STATUS     deprecated
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1."
AUGMENTS { ringStationControlEntry }
 ::= { ringStationControl2Table 1 }

RingStationControl2Entry ::= SEQUENCE {
    ringStationControlDroppedFrames  Counter32,
    ringStationControlCreateTime    LastCreateTime
}

ringStationControlDroppedFrames OBJECT-TYPE
SYNTAX     Counter32
MAX-ACCESS read-only
STATUS     deprecated
DESCRIPTION
"The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for this entry for whatever reason. Most often, this event occurs when the probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped."
 ::= { ringStationControl2Entry 1 }

ringStationControlCreateTime OBJECT-TYPE
SYNTAX     LastCreateTime
MAX-ACCESS read-only
STATUS     deprecated
DESCRIPTION
"The value of sysUpTime when this control entry was last activated. This can be used by the management station to
ensure that the table has not been deleted and recreated between polls.
::= { ringStationControl2Entry 2 }

sourceRoutingStats2Table OBJECT-TYPE
SYNTAX    SEQUENCE OF SourceRoutingStats2Entry
MAX-ACCESS not-accessible
STATUS     deprecated
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1.
This table has been deprecated, as it has not had enough independent implementations to demonstrate interoperability to meet the requirements of a Draft Standard."
::= { tokenRing 8 }

sourceRoutingStats2Entry OBJECT-TYPE
SYNTAX    SourceRoutingStats2Entry
MAX-ACCESS not-accessible
STATUS     deprecated
DESCRIPTION
"Contains the RMON-2 augmentations to RMON-1."
AUGMENTS { sourceRoutingStatsEntry }
::= { sourceRoutingStats2Table 1 }

SourceRoutingStats2Entry ::= SEQUENCE {
   sourceRoutingStatsDroppedFrames Counter32,
   sourceRoutingStatsCreateTime LastCreateTime
}

sourceRoutingStatsDroppedFrames OBJECT-TYPE
SYNTAX    Counter32
MAX-ACCESS read-only
STATUS     deprecated
DESCRIPTION
"The total number of frames that were received by the probe and therefore not accounted for in the *StatsDropEvents, but that the probe chose not to count for this entry for whatever reason. Most often, this event occurs when the probe is out of some resources and decides to shed load from this collection.

This count does not include packets that were not counted because they had MAC-layer errors.

Note that, unlike the dropEvents counter, this number is the exact number of frames dropped."
::= { sourceRoutingStats2Entry 1 }
sourceRoutingStatsCreateTime OBJECT-TYPE
   SYNTAX     LastCreateTime
   MAX-ACCESS read-only
   STATUS     deprecated
   DESCRIPTION
               "The value of sysUpTime when this control entry was last
               activated. This can be used by the management station to
               ensure that the table has not been deleted and recreated
               between polls."
   ::= { sourceRoutingStats2Entry 2 }

filter2Table OBJECT-TYPE
   SYNTAX     SEQUENCE OF Filter2Entry
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION
               "Provides a variable-length packet filter feature to the
               RMON-1 filter table."
   ::= { filter 4 }

filter2Entry OBJECT-TYPE
   SYNTAX     Filter2Entry
   MAX-ACCESS not-accessible
   STATUS     current
   DESCRIPTION
               "Provides a variable-length packet filter feature to the
               RMON-1 filter table."
   AUGMENTS { filterEntry }
   ::= { filter2Table 1 }

Filter2Entry ::= SEQUENCE {
    filterProtocolDirDataLocalIndex     Integer32,
    filterProtocolDirLocalIndex         Integer32
}

filterProtocolDirDataLocalIndex OBJECT-TYPE
   SYNTAX     Integer32 (0..2147483647)
   MAX-ACCESS read-create
   STATUS     current
   DESCRIPTION
               "When this object is set to a non-zero value, the filter that
               it is associated with performs the following operations on
               every packet:

1) If the packet doesn’t match the protocol directory entry
   identified by this object, discard the packet and exit
   (i.e., discard the packet if it is not of the identified
   protocol)."
2) If the associated filterProtocolDirLocalIndex is non-zero and the packet doesn’t match the protocol directory entry identified by that object, discard the packet and exit.

3) If the packet matches, perform the regular filter algorithm as if the beginning of this named protocol is the beginning of the packet, potentially applying the filterOffset value to move further into the packet.

DEFVAL { 0 } ::= { filter2Entry 1 }

filterProtocolDirLocalIndex OBJECT-TYPE
   SYNTAX Integer32 (0..2147483647)
   MAX-ACCESS read-create
   STATUS current
   DESCRIPTION
      "When this object is set to a non-zero value, the filter that it is associated with will discard the packet if the packet doesn’t match this protocol directory entry."

DEFVAL { 0 } ::= { filter2Entry 2 }

-- Conformance Macros

rmon2MIBCompliances OBJECT IDENTIFIER ::= { rmonConformance 1 }
rmon2MIBGroups OBJECT IDENTIFIER ::= { rmonConformance 2 }

rmon2MIBCompliance MODULE-COMPLIANCE
   STATUS current
   DESCRIPTION
      "Describes the requirements for conformance to the RMON2 MIB"
   MODULE -- this module
      MANDATORY-GROUPS { protocolDirectoryGroup, protocolDistributionGroup, addressMapGroup, nlHostGroup, nlMatrixGroup, usrHistoryGroup, probeInformationGroup }

OBJECT nlMatrixTopNControlRateBase
   SYNTAX INTEGER {
      nlMatrixTopNPkts(1),
      nlMatrixTopNOctets(2)
   }
   DESCRIPTION
"Conformance to RMON2 requires only support for these values of nlMatrixTopNControlRateBase."

GROUP rmon1EnhancementGroup
DESCRIPTION
"The rmon1EnhancementGroup is mandatory for systems that implement RMON [RFC2819]."

GROUP rmon1EthernetEnhancementGroup
DESCRIPTION
"The rmon1EthernetEnhancementGroup is optional and is appropriate for systems that implement the Ethernet group of RMON [RFC2819]."

::= { rmon2MIBCompliances 1 }

rmon2MIBApplicationLayerCompliance MODULE-COMPLIANCE
STATUS current
DESCRIPTION
"Describes the requirements for conformance to the RMON2 MIB with Application-Layer Enhancements."
MODULE -- this module
MANDATORY-GROUPS { protocolDirectoryGroup,
protocolDistributionGroup,
addressMapGroup,
nlHostGroup,
nlMatrixGroup,
alHostGroup,
alMatrixGroup,
usrHistoryGroup,
probeInformationGroup }

OBJECT nlMatrixTopNControlRateBase
SYNTAX INTEGER {
   nlMatrixTopNPkts(1),
   nlMatrixTopNOctets(2)
}
DESCRIPTION
"Conformance to RMON2 requires only support for these values of nlMatrixTopNControlRateBase."

OBJECT alMatrixTopNControlRateBase
SYNTAX INTEGER {
   alMatrixTopNTerminalsPkts(1),
   alMatrixTopNTerminalsOctets(2),
   alMatrixTopNAllPkts(3),
   alMatrixTopNAllOctets(4)
}
DESCRIPTION
"Conformance to RMON2 requires only support for these
values of alMatrixTopNControlRateBase."

GROUP  rmon1EnhancementGroup
DESCRIPTION
"The rmon1EnhancementGroup is mandatory for systems that implement RMON [RFC2819]."

GROUP  rmon1EthernetEnhancementGroup
DESCRIPTION
"The rmon1EthernetEnhancementGroup is optional and is appropriate for systems that implement the Ethernet group of RMON [RFC2819]."

::= { rmon2MIBCompliances 2 }

protocolDirectoryGroup OBJECT-GROUP
OBJECTS { protocolDirLastChange, protocolDirLocalIndex, protocolDirDescr, protocolDirType, protocolDirAddressMapConfig, protocolDirHostConfig, protocolDirMatrixConfig, protocolDirOwner, protocolDirStatus }
STATUS  current
DESCRIPTION
"Lists the inventory of protocols the probe has the capability of monitoring and allows the addition, deletion, and configuration of entries in this list."

::= { rmon2MIBGroups 1 }

protocolDistributionGroup OBJECT-GROUP
OBJECTS { protocolDistControlDataSource, protocolDistControlDroppedFrames, protocolDistControlCreateTime, protocolDistControlOwner, protocolDistControlStatus, protocolDistStatsPkts, protocolDistStatsOctets }
STATUS  current
DESCRIPTION
"Collects the relative amounts of octets and packets for the different protocols detected on a network segment."

::= { rmon2MIBGroups 2 }

addressMapGroup OBJECT-GROUP
OBJECTS { addressMapInserts, addressMapDeletes, addressMapMaxDesiredEntries, addressMapControlDataSource, addressMapControlDroppedFrames, addressMapControlOwner, addressMapControlStatus, addressMapPhysicalAddress, addressMapLastChange }
STATUS  current
DESCRIPTION
"Lists MAC address to network address bindings discovered by the probe and what interface they were last seen on."
 ::= { rmon2MIBGroups 3 }

nlHostGroup OBJECT-GROUP
OBJECTS { hlHostControlDataSource,
            hlHostControlNLDroppedFrames, hlHostControlNlInserts,
            hlHostControlNLDeletes, hlHostControlNLMaxDesiredEntries,
            hlHostControlALDroppedFrames, hlHostControlALInserts,
            hlHostControlALDeletes, hlHostControlALMaxDesiredEntries,
            hlHostControlStatus, nlHostInPkts, nlHostOutPkts,
            nlHostInOctets, nlHostOutOctets,
            nlHostOutMacNonUnicastPkts, nlHostCreateTime }
STATUS  current
DESCRIPTION
"Counts the amount of traffic sent from and to each network address discovered by the probe. Note that while the hlHostControlTable also has objects that control an optional alHostTable, implementation of the alHostTable is not required to fully implement this group."
 ::= { rmon2MIBGroups 4 }

nlMatrixGroup OBJECT-GROUP
OBJECTS { hlMatrixControlDataSource, nlMatrixControlNPkts, nlMatrixControlNPEtherDeviceClass,
            nlMatrixControlNPSupportMask, nlMatrixControlNPKnockdown,
            nlMatrixControlNPKnockDownValue, nlMatrixControlNPKnockDownAction,
            nlMatrixControlNPKnockDownAverage, nlMatrixControlNPKnockDownMax,
            nlMatrixControlNPKnockDownAverageSecond, nlMatrixControlNPKnockDownMaxSecond,
            nlMatrixControlNPKnockDownAverageFourth, nlMatrixControlNPKnockDownMaxFourth,
            nlMatrixControlNPKnockDownAverageSixth, nlMatrixControlNPKnockDownMaxSixth,
            nlMatrixControlNPKnockDownAverageEighth, nlMatrixControlNPKnockDownMaxEighth,
            nlMatrixControlNPKnockDownTotal, nlMatrixControlNPKnockDownTotalSecond,
            nlMatrixControlNPKnockDownTotalSixth, nlMatrixControlNPKnockDownTotalEighth,
            nlMatrixControlNPKnockDownTotalAverage, nlMatrixControlNPKnockDownTotalMax,
            nlMatrixControlNPKnockDownTotalAverageSecond, nlMatrixControlNPKnockDownTotalMaxSecond,
            nlMatrixControlNPKnockDownTotalAverageSixth, nlMatrixControlNPKnockDownTotalMaxSixth,
            nlMatrixControlNPKnockDownTotalAverageEighth, nlMatrixControlNPKnockDownTotalMaxEighth,
            nlMatrixControlNPKnockDownReportedPkts, nlMatrixControlNPKnockDownReportedOctets,
            nlMatrixControlNPKnockDownRequestedPkts, nlMatrixControlNPKnockDownRequestedOctets,
            nlMatrixControlNPKnockDownGrantedPkts, nlMatrixControlNPKnockDownGrantedOctets,
            nlMatrixControlNPKnockDownGeneratedReports, nlMatrixControlNPKnockDownDuration,
            nlMatrixControlNPKnockDownRequestedSize, nlMatrixControlNPKnockDownGrantedSize,
            nlMatrixControlNPKnockDownStartTime, nlMatrixControlNPKnockDownEndTime,
            nlMatrixControlNPKnockDownTimeout, nlMatrixControlNPKnockDownOwner,
            nlMatrixControlNPKnockDownStatus, nlMatrixControlNPKnockDownGeneratedReports,
            nlMatrixControlNPKnockDownDuration, nlMatrixControlNPKnockDownRequestedSize,
            nlMatrixControlNPKnockDownGrantedSize, nlMatrixControlNPKnockDownStartTime,
            nlMatrixControlNPKnockDownEndTime, nlMatrixControlNPKnockDownTimeout,
            nlMatrixControlNPKnockDownOwner, nlMatrixControlNPKnockDownStatus,
            nlMatrixControlNPKnockDownGeneratedReports, nlMatrixControlNPKnockDownDuration,
            nlMatrixControlNPKnockDownRequestedSize, nlMatrixControlNPKnockDownGrantedSize,
            nlMatrixControlNPKnockDownStartTime, nlMatrixControlNPKnockDownEndTime,
            nlMatrixControlNPKnockDownTimeout, nlMatrixControlNPKnockDownOwner,
nlMatrixTopNOctetRate, nlMatrixTopNReverseOctetRate }

STATUS  current
DESCRIPTION
"Counts the amount of traffic sent between each pair of network addresses discovered by the probe. Note that while the hlMatrixControlTable also has objects that control optional alMatrixTables, implementation of the alMatrixTables is not required to fully implement this group."
::= { rmon2MIBGroups 5 }

alHostGroup OBJECT-GROUP
OBJECTS { alHostInPkts, alHostOutPkts,
           alHostInOctets, alHostOutOctets, alHostCreateTime }
STATUS  current
DESCRIPTION
"Counts the amount of traffic, by protocol, sent from and to each network address discovered by the probe. Implementation of this group requires implementation of the Network-Layer Host Group."
::= { rmon2MIBGroups 6 }

alMatrixGroup OBJECT-GROUP
OBJECTS { alMatrixSDPkts, alMatrixSDOctets, alMatrixSDCreateTime,
           alMatrixDSPkts, alMatrixDSOctets, alMatrixDSCreateTime,
           alMatrixTopNControlMatrixIndex,
           alMatrixTopNControlRateBase,
           alMatrixTopNControlTimeRemaining,
           alMatrixTopNControlGeneratedReports,
           alMatrixTopNControlDuration,
           alMatrixTopNControlRequestedSize,
           alMatrixTopNControlGrantedSize,
           alMatrixTopNControlStartTime,
           alMatrixTopNControlOwner, alMatrixTopNControlStatus,
           alMatrixTopNProtocolDirLocalIndex,
           alMatrixTopNSourceAddress, alMatrixTopNDestAddress,
           alMatrixTopNPktRate, alMatrixTopNReversePktRate,
           alMatrixTopNOctetRate, alMatrixTopNReverseOctetRate }
STATUS  current
DESCRIPTION
"Counts the amount of traffic, by protocol, sent between each pair of network addresses discovered by the probe. Implementation of this group requires implementation of the Network-Layer Matrix Group."
::= { rmon2MIBGroups 7 }

usrHistoryGroup OBJECT-GROUP
OBJECTS { usrHistoryControlObjects,
usrHistoryControlBucketsRequested,
usrHistoryControlBucketsGranted,
usrHistoryControlInterval,
usrHistoryControlOwner, usrHistoryControlStatus,
usrHistoryObjectVariable, usrHistoryObjectSampleType,
usrHistoryIntervalStart, usrHistoryIntervalEnd,
usrHistoryAbsValue, usrHistoryValStatus }

STATUS  current
DESCRIPTION
"The usrHistoryGroup provides user-defined collection of
historical information from MIB objects on the probe."
::= { rmon2MIBGroups 8 }

probeInformationGroup OBJECT-GROUP
OBJECTS { probeCapabilities,
probeSoftwareRev, probeHardwareRev, probeDateTime }
STATUS  current
DESCRIPTION
"This group describes various operating parameters of the
probe and controls the local time of the probe."
::= { rmon2MIBGroups 9 }

probeConfigurationGroup OBJECT-GROUP
OBJECTS { probeResetControl, probeDownloadFile,
probeDownloadTFTPServer, probeDownloadAction,
probeDownloadStatus, serialMode, serialProtocol, serialTimeout,
serialModemInitString, serialModemHangUpString,
serialModemConnectResp, serialModemNoConnectResp,
serialDialoutTimeout, serialStatus,
netConfigIPAddress, netConfigSubnetMask,
netConfigStatus, netDefaultGateway,
trapDestCommunity, trapDestProtocol, trapDestAddress,
trapDestOwner, trapDestStatus,
serialConnectDestIpAddress, serialConnectType,
serialConnectDialString, serialConnectSwitchConnectSeq,
serialConnectSwitchDisconnectSeq,
serialConnectSwitchResetSeq,
serialConnectOwner, serialConnectStatus }
STATUS  deprecated
DESCRIPTION
"This group controls the configuration of various operating
parameters of the probe. This group is not referenced by any
MODULE-COMPLIANCE macro because it is ‘grandfathered’ from
more recent MIB review rules that would require it."
::= { rmon2MIBGroups 10 }
rmon1EnhancementGroup OBJECT-GROUP
  OBJECTS { historyControlDroppedFrames, hostControlDroppedFrames, hostControlCreateTime, matrixControlDroppedFrames, matrixControlCreateTime, channelDroppedFrames, channelCreateTime, filterProtocolDirDataLocalIndex, filterProtocolDirLocalIndex }
  STATUS current
  DESCRIPTION "This group adds some enhancements to RMON-1 that help management stations."
  ::= { rmon2MIBGroups 11 }

rmon1EthernetEnhancementGroup OBJECT-GROUP
  OBJECTS { etherStatsDroppedFrames, etherStatsCreateTime }
  STATUS current
  DESCRIPTION "This group adds some enhancements to RMON-1 that help management stations."
  ::= { rmon2MIBGroups 12 }

rmon1TokenRingEnhancementGroup OBJECT-GROUP
  OBJECTS { tokenRingMLStatsDroppedFrames, tokenRingMLStatsCreateTime, tokenRingPStatsDroppedFrames, tokenRingPStatsCreateTime, ringStationControlDroppedFrames, ringStationControlCreateTime, sourceRoutingStatsDroppedFrames, sourceRoutingStatsCreateTime }
  STATUS deprecated
  DESCRIPTION "This group adds some enhancements to RMON-1 that help management stations. This group is not referenced by any MODULE-COMPLIANCE macro because it is ‘grandfathered’ from more recent MIB review rules that would require it."
  ::= { rmon2MIBGroups 13 }
END
7. Security Considerations

In order to implement this MIB, a probe must capture all packets on the locally-attached network, including packets between third parties. These packets are analyzed to collect network addresses, protocol usage information, and conversation statistics. Data of this nature may be considered sensitive in some environments. In such environments, the administrator may wish to restrict SNMP access to the probe.

The usrHistoryGroup periodically samples the values of user-specified variables on the probe and stores them in another table. Since the access-control specified for a stored snapshot may be different from the access-control for the sampled variable, the agent MUST ensure that usrHistoryObjectVariable is not writable in MIB views that don’t already have read access to the entire agent. Because the access control configuration can change over time, information could later be deemed sensitive that would still be accessible to this function. For this reason, an agent SHOULD check the access control on every sample. If an agent doesn’t implement the latter check, there is potential for sensitive information to be revealed.

A probe implementing this MIB is likely to also implement RMON [RFC2819], which includes functions for returning the contents of captured packets, potentially including sensitive user data or passwords. It is recommended that SNMP access to these functions be restricted.

There are a number of management objects defined in this MIB that have 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.

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.

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.
8. Appendix - TimeFilter Implementation Notes

1) Theory of Operation

The TimeFilter mechanism allows an NMS to reduce the number of SNMP transactions required for a ‘table-update’ operation, by retrieving only the rows that have changed since a specified time (usually the last poll time). Polling of tables that incorporate a ‘TimeFilter’ INDEX can be reduced to a theoretical minimum (if used correctly). It can be easily implemented by an agent in a way independent of the number of NMS applications using the same time-filtered table.

Although the name ‘TimeFilter’ may imply that a history of change events is maintained by the agent, this is not the case. A time-filtered-value represents the current value of the object instance, not the ‘saved’ value at the time indicated by the TimeFilter INDEX value. Note that TimeFilter objects only appear in INDEX clauses (always not-accessible), so their value is never retrieved. By design, the actual value of a TimeFilter instance is not in itself meaningful (it’s not a ‘last-change-timestamp’).

The TimeFilter is a boolean filtering function applied in internal Get* PDU processing. If the ‘last-change-time’ of the specified instance is less than the particular TimeFilter INDEX value, then the instance is considered ‘not-present’, and either it is skipped for GetNext and GetBulk PDUs, or a ‘noSuchInstance’ exception is returned for Get PDUs.

For TimeFilter purposes:

- a row is created when an accessible column is created within the row.
- a column that is created or deleted causes the TimeFilter to update the time-stamp, only because the value of the column is changing (non-existent <-> some value).
- a row is deleted when all accessible columns are deleted. This event is not detectable with TimeFilter, and deleted rows are not retrievable with SNMP.

1.1) Agent Implementation of a Time-Filtered Table

In implementation, the time-filtered rows (one for each tick of sysUpTime) are only conceptual. The agent simply filters a real table based on:

* the current value of sysUpTime,
the TimeFilter value passed in the varbind, and

* the last-update timestamp of each requested row (agent implementation requirement).

For example, to implement a time-filtered table row (e.g., set of counters), an agent maintains a timestamp in a 32-bit storage location, initialized to zero. This is in addition to whatever instrumentation is needed for the set of counters.

Each time one of the counters is updated, the current value of sysUpTime is recorded in the associated timestamp. If this is not possible or practical, then a background polling process must ‘refresh’ the timestamp by sampling counter values and comparing them to recorded samples. The timestamp update must occur within 5 seconds of the actual change event.

When an agent receives a Get, GetNext, or GetBulk PDU requesting a time-filtered instance, after the agent has determined that the instance is within the specified MIB view, the following conceptual test is applied to determine if the object is returned or filtered:

```c
/* return TRUE if the object is present */
boolean time_filter_test (TimeFilter last_modified_timestamp,
                          TimeFilter index_value_in_pdu )
{
    if (last_modified_timestamp < index_value_in_pdu)
        return FALSE;
    else
        return TRUE;
}
```

The agent applies this function regardless of the lastActivationTime of the conceptual row in question. In other words, counter discontinuities are ignored (i.e., a conceptual row is deleted and then re-created later). An agent should consider an object instance ‘changed’ when it is created (either at restart time for scalars and static objects, or row-creation-time for dynamic tables).

Note that using a timeFilter INDEX value of zero removes the filtering functionality, as the instance will always be ‘present’ according to the test above.

After some deployment experience, it has been determined that a time-filtered table is more efficient to use if the agent stops a MIB walk operation after one time-filtered entry. That is, a GetNext or GetBulk operation will provide one pass through a given table (i.e.,
the agent will continue to the next object or table) instead of incrementing a TimeMark INDEX value, even if there exist higher TimeMark values that are valid for the same conceptual row.

It is acceptable for an agent to implement a time-filtered table in this manner or in the traditional manner (i.e., every conceptual time-filtered instance is returned in GetNext and GetBulk PDU responses).

1.2) NMS Implementation of a Time-Filtered Table

The particular TimeFilter INDEX values used by an NMS reflect the polling interval of the NMS, relative to the particular agent’s notion of sysUpTime.

An NMS needs to maintain one timestamp variable per agent (initialized to zero) for an arbitrary group of time-filtered MIB objects that are gathered together in the same PDU. Each time the Get* PDU is sent, a request for sysUpTime is included. The retrieved sysUpTime value is used as the timeFilter value in the next polling cycle. If a polling sweep of a time-filtered group of objects requires more than one SNMP transaction, then the sysUpTime value retrieved in the first GetResponse PDU of the polling sweep is saved as the next timeFilter value.

The actual last-update time of a given object is not indicated in the returned GetResponse instance identifier, but rather the timeFilter value passed in the Get*Request PDU is returned.

A "time-filtered get-next/bulk-sweep", done once per polling cycle, is a series of GetNext or GetBulk transactions and is over when one of the following events occurs:

1) the TimeFilter index value returned in the GetResponse is different from the TimeFilter index value passed in the GetNext or GetBulk request. Counter values will still be returned beyond this point (until the last-change-time is reached), but most likely the same values will be returned.

2) the return PDU includes instances lexicographically greater than the objects expected (i.e., same GetNext semantics as if the TimeFilter weren’t there).

3) a noSuchName or other exception/error is returned.

Note that the use of a time-filtered table in combination with a GetRequest PDU neutralizes any optimization that otherwise might be achieved with the TimeFilter. Either the current time-filtered
object-value is returned, or, if there is no time-filtered object-
value instance, then a ‘noSuchInstance’ exception (SNMPv2c or SNMPv3)
or ‘noSuchName’ error (SNMPv1) is returned.

2) TimeFilter Example

The following example demonstrates how an NMS and Agent might use a
table with a TimeFilter object in the INDEX. A static table is
assumed to keep the example simple, but dynamic tables can also be
supported.

2.1) General Assumptions

fooEntry INDEX { fooTimeMark, fooIfIndex }

FooEntry = SEQUENCE {
    fooTimeMark TimeFilter,
    fooIfIndex  Integer32,
    fooCounts  Counter32
}

The NMS polls the fooTable every 15 seconds, and the baseline poll
occurs when the agent has been up for 6 seconds, and when the NMS has
been up for 10 seconds.

There are 2 static rows in this table at system initialization
(fooCounts.0.1 and fooCounts.0.2).

Row 1 was updated as follows:

    SysUpTime   fooCounts.*.1 value
      500        1
      900        2
     2300        3

Row 2 was updated as follows:

    SysUpTime   fooCounts.*.2 value
      1100       1
      1400       2

2.2) SNMP Transactions from NMS Perspective

Time nms-1000:
  # NMS baseline poll -- get everything since last agent
  # restart - TimeFilter == 0

  get-bulk(nonRptrs=1, maxReps=2, sysUpTime.0,
           fooCounts.0);
returns:
    sysUpTime.0 == 600
    fooCounts.0.1 == 1  # incremented at time 500
    fooCounts.0.2 == 0  # visible; created at time 0

Time nms-2500:
# NMS 1st poll
# TimeFilter index == 600

get-bulk(nonRptrs=1, maxReps=2, sysUpTime.0,
         fooCounts.600);
returns:
    sysUpTime.0 == 2100
    fooCounts.600.1 == 2   # incremented at time 900
    fooCounts.601.1 == 2   # indicates end of sweep

Time nms-4000:
# NMS 2nd poll
# TimeFilter == 2100

get-bulk(nonRptrs=1, maxReps=2, sysUpTime.0,
         fooCounts.2100);
returns:
    sysUpTime.0 == 3600
    fooCounts.2100.1 == 3  # incremented at time 2300
    fooCounts.2102.1 == 3  # indicates end-of-sweep

# the counter value for row 2 is not returned because
# it hasn’t changed since sysUpTime == 2100.
# The next timetick value for row 1 is returned instead

Time nms-5500:
# NMS 3rd poll
# TimeFilter == 3600

get-bulk(nonRptrs=1, maxReps=2, sysUpTime.0,
         fooCounts.3600);
returns:
    sysUpTime.0 == 5100
    some-instance-outside-the-fooTable == <don’t care>
    some-instance-outside-the-fooTable == <don’t care>

# no ‘fooTable’ counter values at all are returned
# because neither counter has been updated since
# sysUpTime == 3600
2.3) Transactions and TimeFilter Maintenance: Agent Perspective

Time agt-0:
   # initialize fooTable
   fooCounts.1 = 0; changed.1 = 0;
   fooCounts.2 = 0; changed.2 = 0;

Time agt-500:
   # increment fooCounts.1
   ++fooCounts.1; changed.1 = 500;

Time agt-600
   # answer get-bulk
   #   get-bulk(nonRptrs=1, maxReps=2, sysUpTime.0,
   #       fooCounts.0);
   # (changed >= 0)
   # return both counters

Time agt-900:
   # increment fooCounts.1
   ++fooCounts.1; changed.1 = 900;

Time agt-1100:
   # increment fooCounts.2
   ++fooCounts.2; changed.2 = 1100;

Time agt-1400:
   # increment fooCounts.2
   ++fooCounts.2; changed.2 = 1400;

Time agt-2100
   # answer get-bulk
   #   get-bulk(nonRptrs=1, maxReps=2, sysUpTime.0,
   #       fooCounts.600);
   # (changed >= 600)
   # return both counters

Time agt-2300:
   # increment fooCounts.1
   ++fooCounts.1; changed.1 = 2300;

Time agt-3600:
   # answer get-bulk
   #   get-bulk(nonRptrs=1, maxReps=2, sysUpTime.0,
   #       fooCounts.2100);
   # (changed >= 2100)
   # return only fooCounts.1 from the fooTable--twice
9. Changes since RFC 2021

This version obsoletes the proposed-standard version of the RMON2 MIB (published as RFC 2021) by adding 2 new enumerations to the nlMatrixTopNControlRateBase object and 4 new enumerations to the alMatrixTopNControlRateBase object. These new enumerations support the creation of high capacity top N reports in the High Capacity RMON MIB [RFC3273].

Additionally, the following objects have been deprecated, as they have not had enough independent implementations to demonstrate interoperability to meet the requirements of a Draft Standard:

- probeDownloadFile
- probeDownloadTFTPServer
- probeDownloadAction
- probeDownloadStatus
- serialMode
- serialProtocol
- serialTimeout
- serialModemInitString
- serialModemHangUpString
- serialModemConnectResp
- serialModemNoConnectResp
- serialDialoutTimeout
- serialStatus
- serialConnectDestIpAddress
- serialConnectType
- serialConnectDialString
- serialConnectSwitchConnectSeq
- serialConnectSwitchDisconnectSeq
- serialConnectSwitchResetSeq
- serialConnectOwner
- serialConnectStatus
- netConfigIPAddress
- netConfigSubnetMask
- netConfigStatus
- netDefaultGateway
- tokenRingMLStats2DroppedFrames
- tokenRingMLStats2CreateTime
- tokenRingPStats2DroppedFrames
tokenRingPStats2CreateTime
ringStationControl2DroppedFrames
ringStationControl2CreateTime
sourceRoutingStats2DroppedFrames
sourceRoutingStats2CreateTime
trapDestIndex
trapDestCommunity
trapDestProtocol
trapDestAddress
trapDestOwner
trapDestStatus

In addition, two corrections were made. The LastCreateTime Textual Convention had been defined with a base type of another textual convention, which isn’t allowed in SMIV2. The definition has been modified to use TimeTicks as the base type.

Further, the SerialConfigEntry SEQUENCE definition included sub-typing information that is not allowed in SMIV2. This information has been deleted. Ranges were added to a number of objects and textual-conventions to constrain their maximum (and sometimes minimum) sizes. The addition of these ranges documents existing practice for these objects. These objects are:

ControlString
protocolDirID
protocolDirParameters
addressMapNetworkAddress
nlHostAddress
nlMatrixSDDSourceAddress
nlMatrixSDDestAddress
nlMatrixDSSourceAddress
nlMatrixDSDestAddress
nlMatrixTopNSourceAddress
nlMatrixTopNDestAddress
alHostEntry
alMatrixSDEntry
alMatrixDSEntry
alMatrixTopNSourceAddress
alMatrixTopNDestAddress

Finally, the TimeFilter TC has been updated to encourage agent implementations that allow a MIB walk to behave well even when performed by an application that is not aware of the special TimeFilter semantics.
10. Acknowledgements

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The TimeFilter mechanism was invented and documented by Jeanne Haney and further documented by Andy Bierman.

The User History group was created by Andy Bierman.

11. References

11.1. Normative References


11.2. Informative References


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