

Network Working Group
Request for Comments: 2819
STD: 59
Obsoletes: 1757
Category: Standards Track

S. Waldbusser
Lucent Technologies
May 2000

Remote Network Monitoring Management Information Base

Status of this Memo

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

Copyright Notice

Copyright (C) The Internet Society (2000). All Rights Reserved.

Abstract

This memo 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 memo obsoletes RFC 1757. This memo extends that specification by documenting the RMON MIB in SMIV2 format while remaining semantically identical to the existing SMIV1-based MIB.

Table of Contents

1 The SNMP Management Framework	2
2 Overview	3
2.1 Remote Network Management Goals	4
2.2 Textual Conventions	5
2.3 Structure of MIB	5
2.3.1 The Ethernet Statistics Group	6
2.3.2 The History Control Group	6
2.3.3 The Ethernet History Group	6
2.3.4 The Alarm Group	7
2.3.5 The Host Group	7
2.3.6 The HostTopN Group	7
2.3.7 The Matrix Group	7
2.3.8 The Filter Group	7
2.3.9 The Packet Capture Group	8
2.3.10 The Event Group	8
3 Control of Remote Network Monitoring Devices	8
3.1 Resource Sharing Among Multiple Management Stations ...	9
3.2 Row Addition Among Multiple Management Stations	10
4 Conventions	11
5 Definitions	12
6 Security Considerations	94
7 Acknowledgments	95
8 Author's Address	95
9 References	95
10 Intellectual Property	97
11 Full Copyright Statement	98

1. The SNMP Management Framework

The SNMP Management Framework presently consists of five major components:

- o An overall architecture, described in RFC 2571 [1].
- o Mechanisms for describing and naming objects and events for the purpose of management. The first version of this Structure of Management Information (SMI) is called SMIV1 and described in STD 16, RFC 1155 [2], STD 16, RFC 1212 [3] and RFC 1215 [4]. The second version, called SMIV2, is described in STD 58, RFC 2578 [5], RFC 2579 [6] and RFC 2580 [7].
- o Message protocols for transferring management information. The first version of the SNMP message protocol is called SNMPv1 and described in STD 15, RFC 1157 [8]. A second version of the SNMP message protocol, which is not an Internet standards track protocol, is called SNMPv2c and described in RFC 1901 [9] and RFC

1906 [10]. The third version of the message protocol is called SNMPv3 and described in RFC 1906 [10], RFC 2572 [11] and RFC 2574 [12].

- o Protocol operations for accessing management information. The first set of protocol operations and associated PDU formats is described in STD 15, RFC 1157 [8]. A second set of protocol operations and associated PDU formats is described in RFC 1905 [13].
- o A set of fundamental applications described in RFC 2573 [14] and the view-based access control mechanism described in RFC 2575 [15].

A more detailed introduction to the current SNMP Management Framework can be found in RFC 2570 [22].

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the mechanisms defined in the SMI.

This memo specifies a MIB module that is compliant to the SMIV2. A MIB conforming to the SMIV1 can be produced through the appropriate translations. The resulting translated MIB must be semantically equivalent, except where objects or events are omitted because no translation is possible (use of Counter64). Some machine readable information in SMIV2 will be converted into textual descriptions in SMIV1 during the translation process. However, this loss of machine readable information is not considered to change the semantics of the MIB.

2. Overview

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, often geographically remote.

The objects defined in this document are intended 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. These functions should be handled by the management application.

While most of the objects in this document are suitable for the management of any type of network, there are some which are specific to managing Ethernet networks. These are the objects in the etherStatsTable, the etherHistoryTable, and some attributes of the filterPktStatus and capturBufferPacketStatus objects. The design of this MIB allows similar objects to be defined for other network types. It is intended that future versions of this document and additional documents will define extensions for other network types.

There are a number of companion documents to the RMON MIB. The Token Ring RMON MIB [19] provides objects specific to managing Token Ring networks. The RMON-2 MIB [20] extends RMON by providing RMON analysis up to the application layer. The SMON MIB [21] extends RMON by providing RMON analysis for switched networks.

2.1. Remote Network Management Goals

o Offline Operation

There are sometimes conditions when a management station will not be in constant contact with its remote monitoring devices. This is sometimes 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 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 continuously to run diagnostics 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 into the cause of the problem.

- o Problem Detection and Reporting

The monitor can be configured to recognize conditions, most notably error conditions, and continuously to check for them. 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 an attempt to provide disaster recovery. Because environments with multiple management stations are common, the remote network monitoring device has to deal with more than own management station, potentially using its resources concurrently.

2.2. Textual Conventions

Two new data types are introduced as a textual convention in this MIB document, `OwnerString` and `EntryStatus`.

2.3. Structure of MIB

The objects are arranged into the following groups:

- ethernet statistics
- history control
- ethernet history
- alarm
- host

- hostTopN
- matrix
- filter
- packet capture
- event

These groups are the basic unit 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 host group must implement the hostControlTable, the hostTable and the hostTimeTable. While this section provides an overview of grouping and conformance information for this MIB, the authoritative reference for such information is contained in the MODULE-COMPLIANCE and OBJECT-GROUP macros later in this MIB.

All groups in this MIB are optional. Implementations of this MIB must also implement the system group of MIB-II [16] and the IF-MIB [17]. MIB-II may also mandate the implementation of additional groups.

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

2.3.1. The Ethernet Statistics Group

The ethernet statistics group contains statistics measured by the probe for each monitored Ethernet interface on this device. This group consists of the etherStatsTable.

2.3.2. The History Control Group

The history control group controls the periodic statistical sampling of data from various types of networks. This group consists of the historyControlTable.

2.3.3. The Ethernet History Group

The ethernet history group records periodic statistical samples from an ethernet network and stores them for later retrieval. This group consists of the etherHistoryTable.

2.3.4. The Alarm Group

The alarm group periodically takes statistical samples from variables in the probe and compares them to previously configured thresholds. If the monitored variable crosses a threshold, an event is generated.

A hysteresis mechanism is implemented to limit the generation of alarms. This group consists of the alarmTable and requires the implementation of the event group.

2.3.5. The Host Group

The host group contains statistics associated with each host discovered on the network. This group discovers hosts on the network by keeping a list of source and destination MAC Addresses seen in good packets promiscuously received from the network. This group consists of the hostControlTable, the hostTable, and the hostTimeTable.

2.3.6. The HostTopN Group

The hostTopN group is used to prepare reports that describe the hosts that top a list ordered by one of their statistics. The available statistics are samples of one of their base statistics over an interval specified by the management station. Thus, these statistics are rate based. The management station also selects how many such hosts are reported. This group consists of the hostTopNControlTable and the hostTopNTable, and requires the implementation of the host group.

2.3.7. The Matrix Group

The matrix group stores statistics for conversations between sets of two addresses. As the device detects a new conversation, it creates a new entry in its tables. This group consists of the matrixControlTable, the matrixSDTable and the matrixDSTable.

2.3.8. The Filter Group

The filter group allows packets to be matched by a filter equation. These matched packets form a data stream that may be captured or may generate events. This group consists of the filterTable and the channelTable.

2.3.9. The Packet Capture Group

The Packet Capture group allows packets to be captured after they flow through a channel. This group consists of the `bufferControlTable` and the `captureBufferTable`, and requires the implementation of the filter group.

2.3.10. The Event Group

The event group controls the generation and notification of events from this device. This group consists of the `eventTable` and the `logTable`.

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 parameters to 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 invalid. Thus, the method for modifying these parameters is to invalidate the control entry, causing its deletion and the deletion of any associated data entries, and then create a new control entry with the proper parameters. Deleting the control entry 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:

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

A 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:

- o A management station may recognize resources it owns and no longer needs.
- o A network operator can find the management station that owns the resource and negotiate for it to be freed.
- o A network operator may decide to unilaterally free resources another network operator has reserved.
- o 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 to 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 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 to first 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.

It should be noted 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 re-assign resources from a row that is in use by one user than 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 method described in RFC 1905 [13]. 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 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:

- o When the management station sets each parameter object.
- o When the management station sets the entry status object to valid.

If the latter 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 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 to 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 can succeed. The others will receive an error.

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 looking for the first unused index. Because index values may be any valid value in the range and they 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 long 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 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 are either shorter than 64 octets or longer than 1518 octets.

5. Definitions

```
RMON-MIB DEFINITIONS ::= BEGIN
```

```
IMPORTS
```

```
    MODULE-IDENTITY, OBJECT-TYPE, OBJECT-IDENTITY,
    NOTIFICATION-TYPE, mib-2, Counter32,
    Integer32, TimeTicks                FROM SNMPv2-SMI

    TEXTUAL-CONVENTION, DisplayString    FROM SNMPv2-TC

    MODULE-COMPLIANCE, OBJECT-GROUP,
    NOTIFICATION-GROUP                  FROM SNMPv2-CONF;
```

```
-- Remote Network Monitoring MIB
```

```
rmonMibModule MODULE-IDENTITY
```

```
    LAST-UPDATED "200005110000Z" -- 11 May, 2000
```

```
    ORGANIZATION "IETF RMON MIB Working Group"
```

```
    CONTACT-INFO
```

```
        "Steve Waldbusser
        Phone: +1-650-948-6500
        Fax:   +1-650-745-0671
        Email: waldbusser@nextbeacon.com"
```

```
    DESCRIPTION
```

```
        "Remote network monitoring devices, often called
        monitors or probes, are instruments that exist for
        the purpose of managing a network. This MIB defines
        objects for managing remote network monitoring devices."
```

```
    REVISION "200005110000Z" -- 11 May, 2000
```

```
    DESCRIPTION
```

```
        "Reformatted into SMIV2 format.
```

```
        This version published as RFC 2819."
```

```
    REVISION "199502010000Z" -- 1 Feb, 1995
```

```
    DESCRIPTION
```

```
        "Bug fixes, clarifications and minor changes based on
        implementation experience, published as RFC1757 [18].
```

```
        Two changes were made to object definitions:
```

```
        1) A new status bit has been defined for the
        captureBufferPacketStatus object, indicating that the
        packet order within the capture buffer may not be identical to
        the packet order as received off the wire. This bit may only
```

be used for packets transmitted by the probe. Older NMS applications can safely ignore this status bit, which might be used by newer agents.

2) The packetMatch trap has been removed. This trap was never actually 'approved' and was not added to this document along with the risingAlarm and fallingAlarm traps. The packetMatch trap could not be throttled, which could cause disruption of normal network traffic under some circumstances. An NMS should configure a risingAlarm threshold on the appropriate channelMatches instance if a trap is desired for a packetMatch event. Note that logging of packetMatch events is still supported--only trap generation for such events has been removed.

In addition, several clarifications to individual object definitions have been added to assist agent and NMS implementors:

- global definition of 'good packets' and 'bad packets'
- more detailed text governing conceptual row creation and modification
- instructions for probes relating to interface changes and disruptions
- clarification of some ethernet counter definitions
- recommended formula for calculating network utilization
- clarification of channel and captureBuffer behavior for some unusual conditions
- examples of proper instance naming for each table"

REVISION "1991111010000Z" -- 1 Nov, 1991

DESCRIPTION

"The original version of this MIB, published as RFC1271."

::= { rmonConformance 8 }

rmon OBJECT IDENTIFIER ::= { mib-2 16 }

-- textual conventions

OwnerString ::= TEXTUAL-CONVENTION
STATUS current

DESCRIPTION

"This data type is used to model an administratively assigned name of the owner of a resource. Implementations must accept values composed of well-formed NVT ASCII sequences. In addition, implementations should accept values composed of well-formed UTF-8 sequences.

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. In some cases the agent itself will be the owner of an entry. In these cases, this string shall be set to a string starting with 'monitor'.

SNMP access control is articulated entirely in terms of the contents of MIB views; access to a particular SNMP object instance depends only upon its presence or absence in a particular MIB view and never upon its value or the value of related object instances. Thus, objects of this type afford resolution of resource contention only among cooperating managers; they realize no access control function with respect to uncooperative parties."

SYNTAX OCTET STRING (SIZE (0..127))

EntryStatus ::= TEXTUAL-CONVENTION

STATUS current

DESCRIPTION

"The status of a table entry.

Setting this object to the value invalid(4) has the effect of invalidating the corresponding entry. That is, it effectively disassociates the mapping identified with said entry.

It is an implementation-specific matter as to whether the agent removes an invalidated entry from the table. Accordingly, management stations must be prepared to receive tabular information from agents that corresponds to entries currently not in use. Proper interpretation of such entries requires examination of the relevant EntryStatus object.

An existing instance of this object cannot be set to createRequest(2). This object may only be set to createRequest(2) when this instance is created. When this object is created, the agent may wish to create supplemental object instances with default values to complete a conceptual row in this table. Because the

creation of these default objects is entirely at the option of the agent, the manager must not assume that any will be created, but may make use of any that are created. Immediately after completing the create operation, the agent must set this object to underCreation(3).

When in the underCreation(3) state, an entry is allowed to exist in a possibly incomplete, possibly inconsistent state, usually to allow it to be modified in multiple PDUs. When in this state, an entry is not fully active.

Entries shall exist in the underCreation(3) state until the management station is finished configuring the entry and sets this object to valid(1) or aborts, setting this object to invalid(4). If the agent determines that an entry has been in the underCreation(3) state for an abnormally long time, it may decide that the management station has crashed. If the agent makes this decision, it may set this object to invalid(4) to reclaim the entry. A prudent agent will understand that the management station may need to wait for human input and will allow for that possibility in its determination of this abnormally long period.

An entry in the valid(1) state is fully configured and consistent and fully represents the configuration or operation such a row is intended to represent. For example, it could be a statistical function that is configured and active, or a filter that is available in the list of filters processed by the packet capture process.

A manager is restricted to changing the state of an entry in the following ways:

To:	valid	createRequest	underCreation	invalid
From:				
valid	OK	NO	OK	OK
createRequest	N/A	N/A	N/A	N/A
underCreation	OK	NO	OK	OK
invalid	NO	NO	NO	OK
nonExistent	NO	OK	NO	OK

In the table above, it is not applicable to move the state from the createRequest state to any other state because the manager will never find the variable in that state. The nonExistent state is not a value of the enumeration, rather it means that the entryStatus variable does not exist at all.

An agent may allow an entryStatus variable to change state in additional ways, so long as the semantics of the states are followed. This allowance is made to ease the implementation of the agent and is made despite the fact that managers should never exercise these additional state transitions."

```
SYNTAX INTEGER {
    valid(1),
    createRequest(2),
    underCreation(3),
    invalid(4)
}
```

```
statistics      OBJECT IDENTIFIER ::= { rmon 1 }
history         OBJECT IDENTIFIER ::= { rmon 2 }
alarm           OBJECT IDENTIFIER ::= { rmon 3 }
hosts           OBJECT IDENTIFIER ::= { rmon 4 }
hostTopN        OBJECT IDENTIFIER ::= { rmon 5 }
matrix          OBJECT IDENTIFIER ::= { rmon 6 }
filter          OBJECT IDENTIFIER ::= { rmon 7 }
capture         OBJECT IDENTIFIER ::= { rmon 8 }
event           OBJECT IDENTIFIER ::= { rmon 9 }
rmonConformance OBJECT IDENTIFIER ::= { rmon 20 }
```

```
-- The Ethernet Statistics Group
```

```
--
```

```
-- Implementation of the Ethernet Statistics group is optional.
```

```
-- Consult the MODULE-COMPLIANCE macro for the authoritative
```

```
-- conformance information for this MIB.
```

```
--
```

```
-- The ethernet statistics group contains statistics measured by the
-- probe for each monitored interface on this device. These
-- statistics take the form of free running counters that start from
-- zero when a valid entry is created.
```

```
--
```

```
-- This group currently has statistics defined only for
-- Ethernet interfaces. Each etherStatsEntry contains statistics
-- for one Ethernet interface. The probe must create one
-- etherStats entry for each monitored Ethernet interface
-- on the device.
```

```
etherStatsTable OBJECT-TYPE
```

```
    SYNTAX      SEQUENCE OF EtherStatsEntry
```

```
    MAX-ACCESS  not-accessible
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "A list of Ethernet statistics entries."
```

```
    ::= { statistics 1 }
```


etherStatsEntry OBJECT-TYPE

SYNTAX EtherStatsEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A collection of statistics kept for a particular Ethernet interface. As an example, an instance of the etherStatsPkts object might be named etherStatsPkts.1"

INDEX { etherStatsIndex }

::= { etherStatsTable 1 }

EtherStatsEntry ::= SEQUENCE {

etherStatsIndex	Integer32,
etherStatsDataSource	OBJECT IDENTIFIER,
etherStatsDropEvents	Counter32,
etherStatsOctets	Counter32,
etherStatsPkts	Counter32,
etherStatsBroadcastPkts	Counter32,
etherStatsMulticastPkts	Counter32,
etherStatsCRCAlignErrors	Counter32,
etherStatsUndersizePkts	Counter32,
etherStatsOversizePkts	Counter32,
etherStatsFragments	Counter32,
etherStatsJabbers	Counter32,
etherStatsCollisions	Counter32,
etherStatsPkts64Octets	Counter32,
etherStatsPkts65to127Octets	Counter32,
etherStatsPkts128to255Octets	Counter32,
etherStatsPkts256to511Octets	Counter32,
etherStatsPkts512to1023Octets	Counter32,
etherStatsPkts1024to1518Octets	Counter32,
etherStatsOwner	OwnerString,
etherStatsStatus	EntryStatus

}

etherStatsIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of this object uniquely identifies this etherStats entry."

::= { etherStatsEntry 1 }

etherStatsDataSource OBJECT-TYPE

SYNTAX OBJECT IDENTIFIER

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object identifies the source of the data that this etherStats entry is configured to analyze. This source can be any ethernet interface on this device. In order to identify a particular interface, this object shall identify the instance of the ifIndex object, defined in RFC 2233 [17], for the desired interface. For example, if an entry were to receive data from interface #1, this object would be set to ifIndex.1.

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

An agent may or may not be able to tell if fundamental changes to the media of the interface have occurred and necessitate an invalidation of this entry. For example, a hot-pluggable ethernet card could be pulled out and replaced by a token-ring card. In such a case, if the agent has such knowledge of the change, it is recommended that it invalidate this entry.

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

::= { etherStatsEntry 2 }

etherStatsDropEvents OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of events in which packets were dropped by the probe due to lack of resources. Note that this number is not necessarily the number of packets dropped; it is just the number of times this condition has been detected."

::= { etherStatsEntry 3 }

etherStatsOctets OBJECT-TYPE

SYNTAX Counter32

UNITS "Octets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of octets of data (including those in bad packets) received on the network (excluding framing bits but including FCS octets).

This object can be used as a reasonable estimate of 10-Megabit ethernet utilization. If greater precision is desired, the etherStatsPkts and etherStatsOctets objects should be sampled before and after a common interval. The differences in the sampled values are Pkts and Octets, respectively, and the number of seconds in the interval is Interval. These values are used to calculate the Utilization as follows:

$$\text{Utilization} = \frac{\text{Pkts} * (9.6 + 6.4) + (\text{Octets} * .8)}{\text{Interval} * 10,000}$$

The result of this equation is the value Utilization which is the percent utilization of the ethernet segment on a scale of 0 to 100 percent."

::= { etherStatsEntry 4 }

etherStatsPkts OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of packets (including bad packets, broadcast packets, and multicast packets) received."

::= { etherStatsEntry 5 }

etherStatsBroadcastPkts OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of good packets received that were directed to the broadcast address. Note that this does not include multicast packets."

::= { etherStatsEntry 6 }

etherStatsMulticastPkts OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of good packets received that were directed to a multicast address. Note that this number does not include packets directed to the broadcast

```
        address."
 ::= { etherStatsEntry 7 }

etherStatsCRCAlignErrors OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of packets received that
        had a length (excluding framing bits, but
        including FCS octets) of between 64 and 1518
        octets, inclusive, but had either a bad
        Frame Check Sequence (FCS) with an integral
        number of octets (FCS Error) or a bad FCS with
        a non-integral number of octets (Alignment Error)."
```

```
 ::= { etherStatsEntry 8 }

etherStatsUndersizePkts OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of packets received that were
        less than 64 octets long (excluding framing bits,
        but including FCS octets) and were otherwise well
        formed."
```

```
 ::= { etherStatsEntry 9 }

etherStatsOversizePkts OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of packets received that were
        longer than 1518 octets (excluding framing bits,
        but including FCS octets) and were otherwise
        well formed."
```

```
 ::= { etherStatsEntry 10 }

etherStatsFragments OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
```

"The total number of packets received that were less than 64 octets in length (excluding framing bits but including FCS octets) and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).

Note that it is entirely normal for etherStatsFragments to increment. This is because it counts both runts (which are normal occurrences due to collisions) and noise hits."

::= { etherStatsEntry 11 }

etherStatsJabbers OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of packets received that were longer than 1518 octets (excluding framing bits, but including FCS octets), and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).

Note that this definition of jabber is different than the definition in IEEE-802.3 section 8.2.1.5 (10BASE5) and section 10.3.1.4 (10BASE2). These documents define jabber as the condition where any packet exceeds 20 ms. The allowed range to detect jabber is between 20 ms and 150 ms."

::= { etherStatsEntry 12 }

etherStatsCollisions OBJECT-TYPE

SYNTAX Counter32

UNITS "Collisions"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The best estimate of the total number of collisions on this Ethernet segment.

The value returned will depend on the location of the RMON probe. Section 8.2.1.3 (10BASE-5) and section 10.3.1.3 (10BASE-2) of IEEE standard 802.3 states that a station must detect a collision, in the receive mode, if three or more stations are transmitting simultaneously. A repeater port must detect a collision when two or more

stations are transmitting simultaneously. Thus a probe placed on a repeater port could record more collisions than a probe connected to a station on the same segment would.

Probe location plays a much smaller role when considering 10BASE-T. 14.2.1.4 (10BASE-T) of IEEE standard 802.3 defines a collision as the simultaneous presence of signals on the DO and RD circuits (transmitting and receiving at the same time). A 10BASE-T station can only detect collisions when it is transmitting. Thus probes placed on a station and a repeater, should report the same number of collisions.

Note also that an RMON probe inside a repeater should ideally report collisions between the repeater and one or more other hosts (transmit collisions as defined by IEEE 802.3k) plus receiver collisions observed on any coax segments to which the repeater is connected."

```
::= { etherStatsEntry 13 }
```

etherStatsPkts64Octets OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of packets (including bad packets) received that were 64 octets in length (excluding framing bits but including FCS octets)."

```
::= { etherStatsEntry 14 }
```

etherStatsPkts65to127Octets OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of packets (including bad packets) received that were between 65 and 127 octets in length inclusive (excluding framing bits but including FCS octets)."

```
::= { etherStatsEntry 15 }
```

etherStatsPkts128to255Octets OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

```
STATUS      current
DESCRIPTION
    "The total number of packets (including bad
    packets) received that were between
    128 and 255 octets in length inclusive
    (excluding framing bits but including FCS octets)."
```

::= { etherStatsEntry 16 }

```
etherStatsPkts256to511Octets OBJECT-TYPE
    SYNTAX      Counter32
    UNITS        "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of packets (including bad
        packets) received that were between
        256 and 511 octets in length inclusive
        (excluding framing bits but including FCS octets)."
```

::= { etherStatsEntry 17 }

```
etherStatsPkts512to1023Octets OBJECT-TYPE
    SYNTAX      Counter32
    UNITS        "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of packets (including bad
        packets) received that were between
        512 and 1023 octets in length inclusive
        (excluding framing bits but including FCS octets)."
```

::= { etherStatsEntry 18 }

```
etherStatsPkts1024to1518Octets OBJECT-TYPE
    SYNTAX      Counter32
    UNITS        "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of packets (including bad
        packets) received that were between
        1024 and 1518 octets in length inclusive
        (excluding framing bits but including FCS octets)."
```

::= { etherStatsEntry 19 }

```
etherStatsOwner 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."

::= { etherStatsEntry 20 }

etherStatsStatus OBJECT-TYPE

SYNTAX EntryStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status of this etherStats entry."

::= { etherStatsEntry 21 }

-- The History Control Group

-- Implementation of the History Control group is optional.

-- Consult the MODULE-COMPLIANCE macro for the authoritative

-- conformance information for this MIB.

--

-- The history control group controls the periodic statistical
-- sampling of data from various types of networks. The
-- historyControlTable stores configuration entries that each
-- define an interface, polling period, and other parameters.
-- Once samples are taken, their data is stored in an entry
-- in a media-specific table. Each such entry defines one
-- sample, and is associated with the historyControlEntry that
-- caused the sample to be taken. Each counter in the
-- etherHistoryEntry counts the same event as its similarly-named
-- counterpart in the etherStatsEntry, except that each value here
-- is a cumulative sum during a sampling period.

--

-- 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. This tends to make more
-- user-friendly reports, and enables comparison of reports
-- from different probes that have relatively accurate time
-- of day.

--

-- The probe is encouraged to add two history control entries
-- per monitored interface upon initialization that describe a short
-- term and a long term polling period. Suggested parameters are 30
-- seconds for the short term polling period and 30 minutes for
-- the long term period.

historyControlTable OBJECT-TYPE

SYNTAX SEQUENCE OF HistoryControlEntry

MAX-ACCESS not-accessible


```

STATUS      current
DESCRIPTION
    "A list of history control entries."
 ::= { history 1 }

```

```

historyControlEntry OBJECT-TYPE
    SYNTAX      HistoryControlEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A list of parameters that set up a periodic sampling of
         statistics.  As an example, an instance of the
         historyControlInterval object might be named
         historyControlInterval.2"
    INDEX { historyControlIndex }
    ::= { historyControlTable 1 }

```

```

HistoryControlEntry ::= SEQUENCE {
    historyControlIndex          Integer32,
    historyControlDataSource     OBJECT IDENTIFIER,
    historyControlBucketsRequested Integer32,
    historyControlBucketsGranted Integer32,
    historyControlInterval      Integer32,
    historyControlOwner         OwnerString,
    historyControlStatus        EntryStatus
}

```

```

historyControlIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "An index that uniquely identifies an entry in the
         historyControl table.  Each such entry defines a
         set of samples at a particular interval for an
         interface on the device."
    ::= { historyControlEntry 1 }

```

```

historyControlDataSource OBJECT-TYPE
    SYNTAX      OBJECT IDENTIFIER
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object identifies the source of the data for
         which historical data was collected and
         placed in a media-specific table on behalf of this
         historyControlEntry.  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 RFC 2233 [17], for the desired interface. For example, if an entry were to receive data from interface #1, this object would be set to ifIndex.1.

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

An agent may or may not be able to tell if fundamental changes to the media of the interface have occurred and necessitate an invalidation of this entry. For example, a hot-pluggable ethernet card could be pulled out and replaced by a token-ring card. In such a case, if the agent has such knowledge of the change, it is recommended that it invalidate this entry.

This object may not be modified if the associated historyControlStatus object is equal to valid(1)."
 ::= { historyControlEntry 2 }

historyControlBucketsRequested 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 media-specific table associated with this historyControlEntry.

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

DEFVAL { 50 }

::= { historyControlEntry 3 }

historyControlBucketsGranted 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 media-specific table associated with this historyControlEntry.

When the associated historyControlBucketsRequested object is created or modified, the probe should set this object as closely to the requested value as is 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 historyControlBucketsRequested object.

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 media-specific table.

When the number of buckets reaches the value of this object and a new bucket is to be added to the media-specific table, the oldest bucket associated with this historyControlEntry 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 media-specific table associated with this historyControlEntry. 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 media-specific entries may be allowed to grow."

```
::= { historyControlEntry 4 }
```

historyControlInterval OBJECT-TYPE

SYNTAX Integer32 (1..3600)

UNITS "Seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The interval in seconds over which the data is sampled for each bucket in the part of the media-specific table associated with this historyControlEntry. This interval can be set to any number of seconds between 1 and 3600 (1 hour).

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 set the historyControlInterval object to a value less than this interval. This is typically most important for the 'octets' counter in any media-specific table. For example, on an Ethernet network, the etherHistoryOctets counter could overflow in about one hour at the Ethernet's maximum utilization.

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

```
DEFVAL { 1800 }
::= { historyControlEntry 5 }
```

historyControlOwner 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."

```
::= { historyControlEntry 6 }
```

historyControlStatus OBJECT-TYPE

SYNTAX EntryStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status of this historyControl entry.

Each instance of the media-specific table associated with this historyControlEntry will be deleted by the agent if this historyControlEntry is not equal to valid(1)."

```
::= { historyControlEntry 7 }
```

-- The Ethernet History Group

-- Implementation of the Ethernet History group is optional.

-- Consult the MODULE-COMPLIANCE macro for the authoritative

-- conformance information for this MIB.

--

-- The Ethernet History group records periodic statistical samples

-- from a network and stores them for later retrieval.

-- Once samples are taken, their data is stored in an entry

-- in a media-specific table. Each such entry defines one

```
-- sample, and is associated with the historyControlEntry that
-- caused the sample to be taken.  This group defines the
-- etherHistoryTable, for Ethernet networks.
--
```

etherHistoryTable OBJECT-TYPE

SYNTAX SEQUENCE OF EtherHistoryEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A list of Ethernet history entries."

::= { history 2 }

etherHistoryEntry OBJECT-TYPE

SYNTAX EtherHistoryEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"An historical sample of Ethernet statistics on a particular Ethernet interface. This sample is associated with the historyControlEntry which set up the parameters for a regular collection of these samples. As an example, an instance of the etherHistoryPkts object might be named etherHistoryPkts.2.89"

INDEX { etherHistoryIndex , etherHistorySampleIndex }

::= { etherHistoryTable 1 }

EtherHistoryEntry ::= SEQUENCE {

etherHistoryIndex Integer32,

etherHistorySampleIndex Integer32,

etherHistoryIntervalStart TimeTicks,

etherHistoryDropEvents Counter32,

etherHistoryOctets Counter32,

etherHistoryPkts Counter32,

etherHistoryBroadcastPkts Counter32,

etherHistoryMulticastPkts Counter32,

etherHistoryCRCAlignErrors Counter32,

etherHistoryUndersizePkts Counter32,

etherHistoryOversizePkts Counter32,

etherHistoryFragments Counter32,

etherHistoryJabbers Counter32,

etherHistoryCollisions Counter32,

etherHistoryUtilization Integer32

}

etherHistoryIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The history of which this entry is a part. The history identified by a particular value of this index is the same history as identified by the same value of historyControlIndex."

::= { etherHistoryEntry 1 }

etherHistorySampleIndex OBJECT-TYPE

SYNTAX Integer32 (1..2147483647)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An index that uniquely identifies the particular sample this entry represents among all samples associated with the same historyControlEntry. This index starts at 1 and increases by one as each new sample is taken."

::= { etherHistoryEntry 2 }

etherHistoryIntervalStart OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

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 the probe to delay collecting the first sample of the history, as each sample must be of the same interval. Also note that the sample which is currently being collected is not accessible in this table until the end of its interval."

::= { etherHistoryEntry 3 }

etherHistoryDropEvents OBJECT-TYPE

SYNTAX Counter32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of events in which packets were dropped by the probe due to lack of resources during this sampling interval. Note that this number is not necessarily the number of packets dropped, it is just the number of times this condition has been

```
        detected."
 ::= { etherHistoryEntry 4 }

etherHistoryOctets OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Octets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The total number of octets of data (including
         those in bad packets) received on the
         network (excluding framing bits but including
         FCS octets)."
```

```
 ::= { etherHistoryEntry 5 }

etherHistoryPkts OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of packets (including bad packets)
         received during this sampling interval."
```

```
 ::= { etherHistoryEntry 6 }

etherHistoryBroadcastPkts OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of good packets received during this
         sampling interval that were directed to the
         broadcast address."
```

```
 ::= { etherHistoryEntry 7 }

etherHistoryMulticastPkts OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of good packets received during this
         sampling interval that were directed to a
         multicast address. Note that this number does not
         include packets addressed to the broadcast address."
```

```
 ::= { etherHistoryEntry 8 }
```

etherHistoryCRCAlignErrors OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of packets received during this sampling interval that had a length (excluding framing bits but including FCS octets) between 64 and 1518 octets, inclusive, but had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error)."

::= { etherHistoryEntry 9 }

etherHistoryUndersizePkts OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of packets received during this sampling interval that were less than 64 octets long (excluding framing bits but including FCS octets) and were otherwise well formed."

::= { etherHistoryEntry 10 }

etherHistoryOversizePkts OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of packets received during this sampling interval that were longer than 1518 octets (excluding framing bits but including FCS octets) but were otherwise well formed."

::= { etherHistoryEntry 11 }

etherHistoryFragments OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The total number of packets received during this sampling interval that were less than 64 octets in length (excluding framing bits but including FCS

octets) had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).

Note that it is entirely normal for etherHistoryFragments to increment. This is because it counts both runts (which are normal occurrences due to collisions) and noise hits."

::= { etherHistoryEntry 12 }

etherHistoryJabbers OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of packets received during this sampling interval that were longer than 1518 octets (excluding framing bits but including FCS octets), and had either a bad Frame Check Sequence (FCS) with an integral number of octets (FCS Error) or a bad FCS with a non-integral number of octets (Alignment Error).

Note that this definition of jabber is different than the definition in IEEE-802.3 section 8.2.1.5 (10BASE5) and section 10.3.1.4 (10BASE2). These documents define jabber as the condition where any packet exceeds 20 ms. The allowed range to detect jabber is between 20 ms and 150 ms."

::= { etherHistoryEntry 13 }

etherHistoryCollisions OBJECT-TYPE

SYNTAX Counter32

UNITS "Collisions"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The best estimate of the total number of collisions on this Ethernet segment during this sampling interval.

The value returned will depend on the location of the RMON probe. Section 8.2.1.3 (10BASE-5) and section 10.3.1.3 (10BASE-2) of IEEE standard 802.3 states that a station must detect a collision, in the receive mode, if three or more stations are transmitting simultaneously. A repeater port must detect a collision when two or more

stations are transmitting simultaneously. Thus a probe placed on a repeater port could record more collisions than a probe connected to a station on the same segment would.

Probe location plays a much smaller role when considering 10BASE-T. 14.2.1.4 (10BASE-T) of IEEE standard 802.3 defines a collision as the simultaneous presence of signals on the DO and RD circuits (transmitting and receiving at the same time). A 10BASE-T station can only detect collisions when it is transmitting. Thus probes placed on a station and a repeater, should report the same number of collisions.

Note also that an RMON probe inside a repeater should ideally report collisions between the repeater and one or more other hosts (transmit collisions as defined by IEEE 802.3k) plus receiver collisions observed on any coax segments to which the repeater is connected."

```
::= { etherHistoryEntry 14 }
```

etherHistoryUtilization OBJECT-TYPE

SYNTAX Integer32 (0..10000)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The best estimate of the mean physical layer network utilization on this interface during this sampling interval, in hundredths of a percent."

```
::= { etherHistoryEntry 15 }
```

-- The Alarm Group

-- Implementation of the Alarm group is optional. The Alarm Group requires the implementation of the Event group.

-- Consult the MODULE-COMPLIANCE macro for the authoritative conformance information for this MIB.

--

-- The Alarm group periodically takes statistical samples from variables in the probe and compares them to thresholds that have been configured. The alarm table stores configuration entries that each define a variable, polling period, and threshold parameters. If a sample is found to cross the threshold values, an event is generated. Only variables that resolve to an ASN.1 primitive type of INTEGER (INTEGER, Integer32, Counter32, Counter64, Gauge32, or TimeTicks) may be monitored in this way.

--

```
-- This function has a hysteresis mechanism to limit the generation
-- of events.  This mechanism generates one event as a threshold
-- is crossed in the appropriate direction.  No more events are
-- generated for that threshold until the opposite threshold is
-- crossed.
--
-- In the case of a sampling a deltaValue, a probe may implement
-- this mechanism with more precision if it takes a delta sample
-- twice per period, each time comparing the sum of the latest two
-- samples to the threshold.  This allows the detection of threshold
-- crossings that span the sampling boundary.  Note that this does
-- not require any special configuration of the threshold value.
-- It is suggested that probes implement this more precise algorithm.
```

alarmTable OBJECT-TYPE

```
SYNTAX      SEQUENCE OF AlarmEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "A list of alarm entries."
 ::= { alarm 1 }
```

alarmEntry OBJECT-TYPE

```
SYNTAX      AlarmEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "A list of parameters that set up a periodic checking
    for alarm conditions.  For example, an instance of the
    alarmValue object might be named alarmValue.8"
INDEX { alarmIndex }
 ::= { alarmTable 1 }
```

AlarmEntry ::= SEQUENCE {

alarmIndex	Integer32,
alarmInterval	Integer32,
alarmVariable	OBJECT IDENTIFIER,
alarmSampleType	INTEGER,
alarmValue	Integer32,
alarmStartupAlarm	INTEGER,
alarmRisingThreshold	Integer32,
alarmFallingThreshold	Integer32,
alarmRisingEventIndex	Integer32,
alarmFallingEventIndex	Integer32,
alarmOwner	OwnerString,
alarmStatus	EntryStatus

```
}
```

alarmIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An index that uniquely identifies an entry in the alarm table. Each such entry defines a diagnostic sample at a particular interval for an object on the device."

::= { alarmEntry 1 }

alarmInterval OBJECT-TYPE

SYNTAX Integer32

UNITS "Seconds"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The interval in seconds over which the data is sampled and compared with the rising and falling thresholds. When setting this variable, care should be taken in the case of deltaValue sampling - the interval should be set short enough that the sampled variable is very unlikely to increase or decrease by more than $2^{31} - 1$ during a single sampling interval.

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

::= { alarmEntry 2 }

alarmVariable 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 INTEGER (INTEGER, Integer32, Counter32, Counter64, 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 alarm mechanism, the probe must only grant write access to this object in

those views that have read access to all objects on the probe.

During a set operation, if the supplied variable name is not available in the selected MIB view, a badValue error must be returned. If at any time the variable name of an established alarmEntry is no longer available in the selected MIB view, the probe must change the status of this alarmEntry to invalid(4).

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

::= { alarmEntry 3 }

alarmSampleType OBJECT-TYPE

SYNTAX INTEGER {
 absoluteValue(1),
 deltaValue(2)
}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The method of sampling the selected variable and calculating the value to be compared against the thresholds. If the value of this object is absoluteValue(1), the value of the selected variable will be compared directly with the thresholds at the end of the sampling interval. 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 compared with the thresholds.

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

::= { alarmEntry 4 }

alarmValue OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of the statistic during the last sampling period. For example, if the sample type is deltaValue, this value will be the difference between the samples at the beginning and end of the period. If the sample type is absoluteValue, this value will be the sampled value at the end of the period.

This is the value that is compared with the rising and falling thresholds.

The value during the current sampling period is not made available until the period is completed and will remain available until the next period completes."

::= { alarmEntry 5 }

alarmStartupAlarm OBJECT-TYPE

```
SYNTAX      INTEGER {
                risingAlarm(1),
                fallingAlarm(2),
                risingOrFallingAlarm(3)
            }
```

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The alarm that may be sent when this entry is first set to valid. If the first sample after this entry becomes valid is greater than or equal to the risingThreshold and alarmStartupAlarm is equal to risingAlarm(1) or risingOrFallingAlarm(3), then a single rising alarm will be generated. If the first sample after this entry becomes valid is less than or equal to the fallingThreshold and alarmStartupAlarm is equal to fallingAlarm(2) or risingOrFallingAlarm(3), then a single falling alarm will be generated.

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

::= { alarmEntry 6 }

alarmRisingThreshold OBJECT-TYPE

```
SYNTAX      Integer32
```

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A threshold for the sampled statistic. When the current sampled value is greater than or equal to this threshold, and the value at the last sampling interval was less than this threshold, a single event will be generated.

A single event will also be generated if the first sample after this entry becomes valid is greater than or equal to this threshold and the associated alarmStartupAlarm is equal to risingAlarm(1) or risingOrFallingAlarm(3).

After a rising event is generated, another such event

will not be generated until the sampled value falls below this threshold and reaches the alarmFallingThreshold.

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

::= { alarmEntry 7 }

alarmFallingThreshold OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A threshold for the sampled statistic. When the current sampled value is less than or equal to this threshold, and the value at the last sampling interval was greater than this threshold, a single event will be generated. A single event will also be generated if the first sample after this entry becomes valid is less than or equal to this threshold and the associated alarmStartupAlarm is equal to fallingAlarm(2) or risingOrFallingAlarm(3).

After a falling event is generated, another such event will not be generated until the sampled value rises above this threshold and reaches the alarmRisingThreshold.

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

::= { alarmEntry 8 }

alarmRisingEventIndex OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The index of the eventEntry that is used when a rising threshold is crossed. The eventEntry identified by a particular value of this index is the same as identified by the same value of the eventIndex object. If there is no corresponding entry in the eventTable, then no association exists. In particular, if this value is zero, no associated event will be generated, as zero is not a valid event index.

This object may not be modified if the associated

```
    alarmStatus object is equal to valid(1)."  
 ::= { alarmEntry 9 }
```

alarmFallingEventIndex OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The index of the eventEntry that is used when a falling threshold is crossed. The eventEntry identified by a particular value of this index is the same as identified by the same value of the eventIndex object. If there is no corresponding entry in the eventTable, then no association exists. In particular, if this value is zero, no associated event will be generated, as zero is not a valid event index."

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

```
 ::= { alarmEntry 10 }
```

alarmOwner 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."

```
 ::= { alarmEntry 11 }
```

alarmStatus OBJECT-TYPE

SYNTAX EntryStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status of this alarm entry."

```
 ::= { alarmEntry 12 }
```

-- The Host Group

-- Implementation of the Host group is optional.

-- Consult the MODULE-COMPLIANCE macro for the authoritative
-- conformance information for this MIB.

--

-- The host group discovers new hosts on the network by
-- keeping a list of source and destination MAC Addresses seen
-- in good packets. For each of these addresses, the host group

-- keeps a set of statistics. The hostControlTable controls
-- which interfaces this function is performed on, and contains
-- some information about the process. On behalf of each
-- hostControlEntry, data is collected on an interface and placed
-- in both the hostTable and the hostTimeTable. If the
-- monitoring device finds itself short of resources, it may
-- delete entries as needed. It is suggested that the device
-- delete the least recently used entries first.

-- The hostTable contains entries for each address discovered on
-- a particular interface. Each entry contains statistical
-- data about that host. This table is indexed by the
-- MAC address of the host, through which a random access
-- may be achieved.

-- The hostTimeTable contains data in the same format as the
-- hostTable, and must contain the same set of hosts, but is
-- indexed using hostTimeCreationOrder rather than hostAddress.
-- The hostTimeCreationOrder is an integer which reflects
-- the relative order in which a particular entry was discovered
-- and thus inserted into the table. As this order, and thus
-- the index, is among those entries currently in the table,
-- the index for a particular entry may change if an
-- (earlier) entry is deleted. Thus the association between
-- hostTimeCreationOrder and hostTimeEntry may be broken at
-- any time.

-- The hostTimeTable has two important uses. The first is the
-- fast download of this potentially large table. Because the
-- index of this table runs from 1 to the size of the table,
-- inclusive, its values are predictable. This allows very
-- efficient packing of variables into SNMP PDU's and allows
-- a table transfer to have multiple packets outstanding.
-- These benefits increase transfer rates tremendously.

-- The second use of the hostTimeTable is the efficient discovery
-- by the management station of new entries added to the table.
-- After the management station has downloaded the entire table,
-- it knows that new entries will be added immediately after the
-- end of the current table. It can thus detect new entries there
-- and retrieve them easily.

-- Because the association between hostTimeCreationOrder and
-- hostTimeEntry may be broken at any time, the management
-- station must monitor the related hostControlLastDeleteTime
-- object. When the management station thus detects a deletion,
-- it must assume that any such associations have been broken,
-- and invalidate any it has stored locally. This includes

```
-- restarting any download of the hostTimeTable that may have been
-- in progress, as well as rediscovering the end of the
-- hostTimeTable so that it may detect new entries.  If the
-- management station does not detect the broken association,
-- it may continue to refer to a particular host by its
-- creationOrder while unwittingly retrieving the data associated
-- with another host entirely.  If this happens while downloading
-- the host table, the management station may fail to download
-- all of the entries in the table.
```

```
hostControlTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF HostControlEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A list of host table control entries."
    ::= { hosts 1 }
```

```
hostControlEntry OBJECT-TYPE
    SYNTAX      HostControlEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A list of parameters that set up the discovery of hosts
        on a particular interface and the collection of statistics
        about these hosts.  For example, an instance of the
        hostControlTableSize object might be named
        hostControlTableSize.1"
    INDEX { hostControlIndex }
    ::= { hostControlTable 1 }
```

```
HostControlEntry ::= SEQUENCE {

    hostControlIndex      Integer32,
    hostControlDataSource OBJECT IDENTIFIER,
    hostControlTableSize  Integer32,
    hostControlLastDeleteTime TimeTicks,
    hostControlOwner      OwnerString,
    hostControlStatus     EntryStatus
}
```

```
hostControlIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "An index that uniquely identifies an entry in the
```

hostControl table. Each such entry defines a function that discovers hosts on a particular interface and places statistics about them in the hostTable and the hostTimeTable on behalf of this hostControlEntry."
 ::= { hostControlEntry 1 }

hostControlDataSource OBJECT-TYPE

SYNTAX OBJECT IDENTIFIER

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object identifies the source of the data for this instance of the host function. 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 RFC 2233 [17], for the desired interface. For example, if an entry were to receive data from interface #1, this object would be set to ifIndex.1.

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

An agent may or may not be able to tell if fundamental changes to the media of the interface have occurred and necessitate an invalidation of this entry. For example, a hot-pluggable ethernet card could be pulled out and replaced by a token-ring card. In such a case, if the agent has such knowledge of the change, it is recommended that it invalidate this entry.

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

::= { hostControlEntry 2 }

hostControlTableSize OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of hostEntries in the hostTable and the hostTimeTable associated with this hostControlEntry."

::= { hostControlEntry 3 }

hostControlLastDeleteTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

```
STATUS      current
DESCRIPTION
    "The value of sysUpTime when the last entry
    was deleted from the portion of the hostTable
    associated with this hostControlEntry.  If no
    deletions have occurred, this value shall be zero."
 ::= { hostControlEntry 4 }

hostControlOwner 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."
    ::= { hostControlEntry 5 }

hostControlStatus OBJECT-TYPE
    SYNTAX      EntryStatus
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The status of this hostControl entry.

        If this object is not equal to valid(1), all associated
        entries in the hostTable, hostTimeTable, and the
        hostTopNTable shall be deleted by the agent."
    ::= { hostControlEntry 6 }

hostTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF HostEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A list of host entries."
    ::= { hosts 2 }

hostEntry OBJECT-TYPE
    SYNTAX      HostEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A collection of statistics for a particular host that has
        been discovered on an interface of this device.  For example,
        an instance of the hostOutBroadcastPkts object might be
        named hostOutBroadcastPkts.1.6.8.0.32.27.3.176"
    INDEX { hostIndex, hostAddress }
    ::= { hostTable 1 }
```

```

HostEntry ::= SEQUENCE {
    hostAddress      OCTET STRING,
    hostCreationOrder Integer32,
    hostIndex        Integer32,
    hostInPkts       Counter32,
    hostOutPkts       Counter32,
    hostInOctets      Counter32,
    hostOutOctets     Counter32,
    hostOutErrors     Counter32,
    hostOutBroadcastPkts Counter32,
    hostOutMulticastPkts Counter32
}

```

```

hostAddress OBJECT-TYPE
    SYNTAX      OCTET STRING
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The physical address of this host."
    ::= { hostEntry 1 }

```

```

hostCreationOrder OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "An index that defines the relative ordering of
        the creation time of hosts captured for a
        particular hostControlEntry. This index shall
        be between 1 and N, where N is the value of
        the associated hostControlTableSize. The ordering
        of the indexes is based on the order of each entry's
        insertion into the table, in which entries added earlier
        have a lower index value than entries added later."

```

It is important to note that the order for a particular entry may change as an (earlier) entry is deleted from the table. Because this order may change, management stations should make use of the hostControlLastDeleteTime variable in the hostControlEntry associated with the relevant portion of the hostTable. By observing this variable, the management station may detect the circumstances where a previous association between a value of hostCreationOrder and a hostEntry may no longer hold."

```

::= { hostEntry 2 }

```

hostIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The set of collected host statistics of which this entry is a part. The set of hosts identified by a particular value of this index is associated with the hostControlEntry as identified by the same value of hostControlIndex."

::= { hostEntry 3 }

hostInPkts OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of good packets transmitted to this address since it was added to the hostTable."

::= { hostEntry 4 }

hostOutPkts OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of packets, including bad packets, transmitted by this address since it was added to the hostTable."

::= { hostEntry 5 }

hostInOctets OBJECT-TYPE

SYNTAX Counter32

UNITS "Octets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of octets transmitted to this address since it was added to the hostTable (excluding framing bits but including FCS octets), except for those octets in bad packets."

::= { hostEntry 6 }

hostOutOctets OBJECT-TYPE

SYNTAX Counter32

UNITS "Octets"

MAX-ACCESS read-only

```
STATUS      current
DESCRIPTION
    "The number of octets transmitted by this address since
    it was added to the hostTable (excluding framing
    bits but including FCS octets), including those
    octets in bad packets."
::= { hostEntry 7 }

hostOutErrors OBJECT-TYPE
SYNTAX      Counter32
UNITS       "Packets"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The number of bad packets transmitted by this address
    since this host was added to the hostTable."
::= { hostEntry 8 }

hostOutBroadcastPkts OBJECT-TYPE
SYNTAX      Counter32
UNITS       "Packets"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The number of good packets transmitted by this
    address that were directed to the broadcast address
    since this host was added to the hostTable."
::= { hostEntry 9 }

hostOutMulticastPkts OBJECT-TYPE
SYNTAX      Counter32
UNITS       "Packets"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The number of good packets transmitted by this
    address that were directed to a multicast address
    since this host was added to the hostTable.
    Note that this number does not include packets
    directed to the broadcast address."
::= { hostEntry 10 }

-- host Time Table

hostTimeTable OBJECT-TYPE
SYNTAX      SEQUENCE OF HostTimeEntry
MAX-ACCESS  not-accessible
STATUS      current
```

DESCRIPTION

"A list of time-ordered host table entries."

::= { hosts 3 }

hostTimeEntry OBJECT-TYPE

SYNTAX HostTimeEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A collection of statistics for a particular host that has been discovered on an interface of this device. This collection includes the relative ordering of the creation time of this object. For example, an instance of the hostTimeOutBroadcastPkts object might be named hostTimeOutBroadcastPkts.1.687"

INDEX { hostTimeIndex, hostTimeCreationOrder }

::= { hostTimeTable 1 }

HostTimeEntry ::= SEQUENCE {

hostTimeAddress OCTET STRING,

hostTimeCreationOrder Integer32,

hostTimeIndex Integer32,

hostTimeInPkts Counter32,

hostTimeOutPkts Counter32,

hostTimeInOctets Counter32,

hostTimeOutOctets Counter32,

hostTimeOutErrors Counter32,

hostTimeOutBroadcastPkts Counter32,

hostTimeOutMulticastPkts Counter32

}

hostTimeAddress OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The physical address of this host."

::= { hostTimeEntry 1 }

hostTimeCreationOrder OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An index that uniquely identifies an entry in the hostTime table among those entries associated with the same hostControlEntry. This index shall be between 1 and N, where N is the value of

the associated hostControlTableSize. The ordering of the indexes is based on the order of each entry's insertion into the table, in which entries added earlier have a lower index value than entries added later. Thus the management station has the ability to learn of new entries added to this table without downloading the entire table.

It is important to note that the index for a particular entry may change as an (earlier) entry is deleted from the table. Because this order may change, management stations should make use of the hostControlLastDeleteTime variable in the hostControlEntry associated with the relevant portion of the hostTimeTable. By observing this variable, the management station may detect the circumstances where a download of the table may have missed entries, and where a previous association between a value of hostTimeCreationOrder and a hostTimeEntry may no longer hold."

::= { hostTimeEntry 2 }

hostTimeIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The set of collected host statistics of which this entry is a part. The set of hosts identified by a particular value of this index is associated with the hostControlEntry as identified by the same value of hostControlIndex."

::= { hostTimeEntry 3 }

hostTimeInPkts OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of good packets transmitted to this address since it was added to the hostTimeTable."

::= { hostTimeEntry 4 }

hostTimeOutPkts OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

```
STATUS      current
DESCRIPTION
    "The number of packets, including bad packets, transmitted
    by this address since it was added to the hostTimeTable."
 ::= { hostTimeEntry 5 }

hostTimeInOctets OBJECT-TYPE
SYNTAX      Counter32
UNITS       "Octets"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The number of octets transmitted to this address since
    it was added to the hostTimeTable (excluding framing
    bits but including FCS octets), except for those
    octets in bad packets."
 ::= { hostTimeEntry 6 }

hostTimeOutOctets OBJECT-TYPE
SYNTAX      Counter32
UNITS       "Octets"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The number of octets transmitted by this address since
    it was added to the hostTimeTable (excluding framing
    bits but including FCS octets), including those
    octets in bad packets."
 ::= { hostTimeEntry 7 }

hostTimeOutErrors OBJECT-TYPE
SYNTAX      Counter32
UNITS       "Packets"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The number of bad packets transmitted by this address
    since this host was added to the hostTimeTable."
 ::= { hostTimeEntry 8 }

hostTimeOutBroadcastPkts OBJECT-TYPE
SYNTAX      Counter32
UNITS       "Packets"
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "The number of good packets transmitted by this
    address that were directed to the broadcast address
```

```
        since this host was added to the hostTimeTable."  
 ::= { hostTimeEntry 9 }
```

hostTimeOutMulticastPkts OBJECT-TYPE

```
SYNTAX      Counter32  
UNITS       "Packets"  
MAX-ACCESS  read-only  
STATUS      current  
DESCRIPTION  
    "The number of good packets transmitted by this  
    address that were directed to a multicast address  
    since this host was added to the hostTimeTable.  
    Note that this number does not include packets directed  
    to the broadcast address."  
 ::= { hostTimeEntry 10 }
```

-- The Host Top "N" Group

-- Implementation of the Host Top N group is optional. The Host Top N
-- group requires the implementation of the host group.
-- Consult the MODULE-COMPLIANCE macro for the authoritative
-- conformance information for this MIB.

--
-- The Host Top N group is used to prepare reports that describe
-- the hosts that top a list ordered by one of their statistics.
-- The available statistics are samples of one of their
-- base statistics, over an interval specified by the management
-- station. Thus, these statistics are rate based. The management
-- station also selects how many such hosts are reported.

-- The hostTopNControlTable is used to initiate the generation of
-- such a report. The management station may select the parameters
-- of such a report, such as which interface, which statistic,
-- how many hosts, and the start and stop times of the sampling.
-- When the report is prepared, entries are created in the
-- hostTopNTable associated with the relevant hostTopNControlEntry.
-- These entries are static for each report after it has been
-- prepared.

hostTopNControlTable OBJECT-TYPE

```
SYNTAX      SEQUENCE OF HostTopNControlEntry  
MAX-ACCESS  not-accessible  
STATUS      current  
DESCRIPTION  
    "A list of top N host control entries."  
 ::= { hostTopN 1 }
```

hostTopNControlEntry OBJECT-TYPE

```

SYNTAX      HostTopNControlEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "A set of parameters that control the creation of a report
    of the top N hosts according to several metrics.  For
    example, an instance of the hostTopNDuration object might
    be named hostTopNDuration.3"
INDEX { hostTopNControlIndex }
 ::= { hostTopNControlTable 1 }

```

```

HostTopNControlEntry ::= SEQUENCE {
    hostTopNControlIndex      Integer32,
    hostTopNHostIndex         Integer32,
    hostTopNRateBase          INTEGER,
    hostTopNTimeRemaining     Integer32,
    hostTopNDuration          Integer32,
    hostTopNRequestedSize     Integer32,
    hostTopNGrantedSize       Integer32,
    hostTopNStartTime         TimeTicks,
    hostTopNOwner              OwnerString,
    hostTopNStatus             EntryStatus
}

```

```

hostTopNControlIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "An index that uniquely identifies an entry
        in the hostTopNControl table.  Each such
        entry defines one top N report prepared for
        one interface."
    ::= { hostTopNControlEntry 1 }

```

```

hostTopNHostIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The host table for which a top N report will be prepared
        on behalf of this entry.  The host table identified by a
        particular value of this index is associated with the same
        host table as identified by the same value of
        hostIndex.

        This object may not be modified if the associated
        hostTopNStatus object is equal to valid(1)."
```

```
::= { hostTopNControlEntry 2 }
```

```
hostTopNRateBase OBJECT-TYPE
```

```
SYNTAX      INTEGER {
                hostTopNInPkts(1),
                hostTopNOutPkts(2),
                hostTopNInOctets(3),
                hostTopNOutOctets(4),
                hostTopNOutErrors(5),
                hostTopNOutBroadcastPkts(6),
                hostTopNOutMulticastPkts(7)
            }
```

```
MAX-ACCESS read-create
```

```
STATUS      current
```

```
DESCRIPTION
```

"The variable for each host that the hostTopNRate variable is based upon.

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

```
::= { hostTopNControlEntry 3 }
```

```
hostTopNTimeRemaining OBJECT-TYPE
```

```
SYNTAX      Integer32
```

```
UNITS       "Seconds"
```

```
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, which is loaded into the associated hostTopNDuration object.

When this object is set to a non-zero value, any associated hostTopNEntries shall be made inaccessible by the monitor. While the value of this object is non-zero, it decrements by one per second until it reaches zero. During this time, all associated hostTopNEntries shall remain inaccessible. At the time that this object decrements to zero, the report is made accessible in the hostTopNTable. Thus, the hostTopN table needs to be created only at the end of the collection interval."

```
DEFVAL { 0 }
```

```
::= { hostTopNControlEntry 4 }
```

`hostTopNDuration OBJECT-TYPE``SYNTAX Integer32``UNITS "Seconds"``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The number of seconds that this report has collected during the last sampling interval, or if this report is currently being collected, the number of seconds that this report is being collected during this sampling interval.

When the associated `hostTopNTimeRemaining` 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 `hostTopNTimeRemaining` is set.

This value shall be zero if no reports have been requested for this `hostTopNControlEntry`."

`DEFVAL { 0 }``::= { hostTopNControlEntry 5 }``hostTopNRequestedSize OBJECT-TYPE``SYNTAX Integer32``MAX-ACCESS read-create``STATUS current``DESCRIPTION`

"The maximum number of hosts requested for the top N table.

When this object is created or modified, the probe should set `hostTopNGrantedSize` as closely to this object as is possible for the particular probe implementation and available resources."

`DEFVAL { 10 }``::= { hostTopNControlEntry 6 }``hostTopNGrantedSize OBJECT-TYPE``SYNTAX Integer32``MAX-ACCESS read-only``STATUS current``DESCRIPTION`

"The maximum number of hosts in the top N table.

When the associated `hostTopNRequestedSize` object is created or modified, the probe should set this object as closely to the requested value as is possible for the particular implementation and available

resources. The probe must not lower this value except as a result of a set to the associated hostTopNRequestedSize object.

Hosts with the highest value of hostTopNRate shall be placed in this table in decreasing order of this rate until there is no more room or until there are no more hosts."

::= { hostTopNControlEntry 7 }

hostTopNStartTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime when this top N report was last started. In other words, this is the time that the associated hostTopNTimeRemaining object was modified to start the requested report."

::= { hostTopNControlEntry 8 }

hostTopNOwner 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."

::= { hostTopNControlEntry 9 }

hostTopNStatus OBJECT-TYPE

SYNTAX EntryStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status of this hostTopNControl entry.

If this object is not equal to valid(1), all associated hostTopNEntries shall be deleted by the agent."

::= { hostTopNControlEntry 10 }

hostTopNTable OBJECT-TYPE

SYNTAX SEQUENCE OF HostTopNEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A list of top N host entries."

::= { hostTopN 2 }

```
hostTopNEntry OBJECT-TYPE
    SYNTAX      HostTopNEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A set of statistics for a host that is part of a top N
        report.  For example, an instance of the hostTopNRate
        object might be named hostTopNRate.3.10"
    INDEX { hostTopNReport, hostTopNIndex }
    ::= { hostTopNTable 1 }

HostTopNEntry ::= SEQUENCE {
    hostTopNReport      Integer32,
    hostTopNIndex       Integer32,
    hostTopNAddress     OCTET STRING,
    hostTopNRate        Integer32
}

hostTopNReport OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object identifies the top N report of which
        this entry is a part.  The set of hosts
        identified by a particular value of this
        object is part of the same report as identified
        by the same value of the hostTopNControlIndex object."
    ::= { hostTopNEntry 1 }

hostTopNIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "An index that uniquely identifies an entry in
        the hostTopN table among those in the same report.
        This index is between 1 and N, where N is the
        number of entries in this table.  Increasing values
        of hostTopNIndex shall be assigned to entries with
        decreasing values of hostTopNRate until index N
        is assigned to the entry with the lowest value of
        hostTopNRate or there are no more hostTopNEntries."
    ::= { hostTopNEntry 2 }

hostTopNAddress OBJECT-TYPE
    SYNTAX      OCTET STRING
    MAX-ACCESS  read-only
```



```
STATUS      current
DESCRIPTION
    "The physical address of this host."
 ::= { hostTopNEntry 3 }

hostTopNRate OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The amount of change in the selected variable
         during this sampling interval.  The selected
         variable is this host's instance of the object
         selected by hostTopNRateBase."
    ::= { hostTopNEntry 4 }

-- The Matrix Group

-- Implementation of the Matrix group is optional.
-- Consult the MODULE-COMPLIANCE macro for the authoritative
-- conformance information for this MIB.
--
-- The Matrix group consists of the matrixControlTable, matrixSDTable
-- and the matrixDSTable.  These tables store statistics for a
-- particular conversation between two addresses.  As the device
-- detects a new conversation, including those to a non-unicast
-- address, it creates a new entry in both of the matrix tables.
-- It must only create new entries based on information
-- received in good packets.  If the monitoring device finds
-- itself short of resources, it may delete entries as needed.
-- It is suggested that the device delete the least recently used
-- entries first.

matrixControlTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF MatrixControlEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A list of information entries for the
         traffic matrix on each interface."
    ::= { matrix 1 }

matrixControlEntry OBJECT-TYPE
    SYNTAX      MatrixControlEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Information about a traffic matrix on a particular
```

interface. For example, an instance of the
matrixControlLastDeleteTime object might be named
matrixControlLastDeleteTime.1"

```
INDEX { matrixControlIndex }
 ::= { matrixControlTable 1 }
```

```
MatrixControlEntry ::= SEQUENCE {
    matrixControlIndex          Integer32,
    matrixControlDataSource     OBJECT IDENTIFIER,
    matrixControlTableSize     Integer32,
    matrixControlLastDeleteTime TimeTicks,
    matrixControlOwner         OwnerString,
    matrixControlStatus        EntryStatus
}
```

matrixControlIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An index that uniquely identifies an entry in the
matrixControl table. Each such entry defines
a function that discovers conversations on a particular
interface and places statistics about them in the
matrixSDTable and the matrixDSTable on behalf of this
matrixControlEntry."

```
::= { matrixControlEntry 1 }
```

matrixControlDataSource OBJECT-TYPE

SYNTAX OBJECT IDENTIFIER

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object identifies the source of
the data from which this entry creates a traffic matrix.
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 RFC 2233 [17], for the desired
interface. For example, if an entry were to receive data
from interface #1, this object would be set to ifIndex.1.

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

An agent may or may not be able to tell if fundamental
changes to the media of the interface have occurred and

necessitate an invalidation of this entry. For example, a hot-pluggable ethernet card could be pulled out and replaced by a token-ring card. In such a case, if the agent has such knowledge of the change, it is recommended that it invalidate this entry.

This object may not be modified if the associated matrixControlStatus object is equal to valid(1)."
::= { matrixControlEntry 2 }

matrixControlTableSize OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of matrixSDEntries in the matrixSDTable for this interface. This must also be the value of the number of entries in the matrixDSTable for this interface."

::= { matrixControlEntry 3 }

matrixControlLastDeleteTime OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of sysUpTime when the last entry was deleted from the portion of the matrixSDTable or matrixDSTable associated with this matrixControlEntry. If no deletions have occurred, this value shall be zero."

::= { matrixControlEntry 4 }

matrixControlOwner 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."

::= { matrixControlEntry 5 }

matrixControlStatus OBJECT-TYPE

SYNTAX EntryStatus

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status of this matrixControl entry."

If this object is not equal to valid(1), all associated entries in the matrixSDTable and the matrixDSTable shall be deleted by the agent."

::= { matrixControlEntry 6 }

matrixSDTable OBJECT-TYPE

SYNTAX SEQUENCE OF MatrixSDEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A list of traffic matrix entries indexed by source and destination MAC address."

::= { matrix 2 }

matrixSDEntry OBJECT-TYPE

SYNTAX MatrixSDEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A collection of statistics for communications between two addresses on a particular interface. For example, an instance of the matrixSDPkts object might be named matrixSDPkts.1.6.8.0.32.27.3.176.6.8.0.32.10.8.113"

INDEX { matrixSDIndex,
matrixSDSourceAddress, matrixSDDestAddress }

::= { matrixSDTable 1 }

MatrixSDEntry ::= SEQUENCE {

matrixSDSourceAddress OCTET STRING,

matrixSDDestAddress OCTET STRING,

matrixSDIndex Integer32,

matrixSDPkts Counter32,

matrixSDOctets Counter32,

matrixSDErrors Counter32

}

matrixSDSourceAddress OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The source physical address."

::= { matrixSDEntry 1 }

matrixSDDestAddress OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The destination physical address."

::= { matrixSDEntry 2 }

matrixSDIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The set of collected matrix statistics of which this entry is a part. The set of matrix statistics identified by a particular value of this index is associated with the same matrixControlEntry as identified by the same value of matrixControlIndex."

::= { matrixSDEntry 3 }

matrixSDPkts OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of packets transmitted from the source address to the destination address (this number includes bad packets)."

::= { matrixSDEntry 4 }

matrixSDOctets OBJECT-TYPE

SYNTAX Counter32

UNITS "Octets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of octets (excluding framing bits but including FCS octets) contained in all packets transmitted from the source address to the destination address."

::= { matrixSDEntry 5 }

matrixSDErrors OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of bad packets transmitted from the source address to the destination address."

::= { matrixSDEntry 6 }

-- Traffic matrix tables from destination to source

matrixDSTable OBJECT-TYPE

SYNTAX SEQUENCE OF MatrixDSEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A list of traffic matrix entries indexed by destination and source MAC address."

::= { matrix 3 }

matrixDSEntry OBJECT-TYPE

SYNTAX MatrixDSEntry

MAX-ACCESS not-accessible

STATUS current

DESCRIPTION

"A collection of statistics for communications between two addresses on a particular interface. For example, an instance of the matrixSDPkts object might be named matrixSDPkts.1.6.8.0.32.10.8.113.6.8.0.32.27.3.176"

INDEX { matrixDSIndex,
matrixDSDestAddress, matrixDSSourceAddress }

::= { matrixDSTable 1 }

MatrixDSEntry ::= SEQUENCE {

matrixDSSourceAddress OCTET STRING,

matrixDSDestAddress OCTET STRING,

matrixDSIndex Integer32,

matrixDSPkts Counter32,

matrixDSOctets Counter32,

matrixDSErrors Counter32

}

matrixDSSourceAddress OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The source physical address."

::= { matrixDSEntry 1 }

matrixDSDestAddress OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The destination physical address."

::= { matrixDSEntry 2 }

```
matrixDSIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The set of collected matrix statistics of which
        this entry is a part. The set of matrix statistics
        identified by a particular value of this index
        is associated with the same matrixControlEntry
        as identified by the same value of matrixControlIndex."
    ::= { matrixDSEntry 3 }

matrixDSPkts OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of packets transmitted from the source
        address to the destination address (this number includes
        bad packets)."
    ::= { matrixDSEntry 4 }

matrixDSOctets OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Octets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of octets (excluding framing bits
        but including FCS octets) contained in all packets
        transmitted from the source address to the
        destination address."
    ::= { matrixDSEntry 5 }

matrixDSErrors OBJECT-TYPE
    SYNTAX      Counter32
    UNITS       "Packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of bad packets transmitted from
        the source address to the destination address."
    ::= { matrixDSEntry 6 }

-- The Filter Group

-- Implementation of the Filter group is optional.
```

```
-- Consult the MODULE-COMPLIANCE macro for the authoritative
-- conformance information for this MIB.
--
-- The Filter group allows packets to be captured with an
-- arbitrary filter expression.  A logical data and
-- event stream or "channel" is formed by the packets
-- that match the filter expression.
--
-- This filter mechanism allows the creation of an arbitrary
-- logical expression with which to filter packets.  Each
-- filter associated with a channel is OR'ed with the others.
-- Within a filter, any bits checked in the data and status are
-- AND'ed with respect to other bits in the same filter.  The
-- NotMask also allows for checking for inequality.  Finally,
-- the channelAcceptType object allows for inversion of the
-- whole equation.
--
-- If a management station wishes to receive a trap to alert it
-- that new packets have been captured and are available for
-- download, it is recommended that it set up an alarm entry that
-- monitors the value of the relevant channelMatches instance.
--
-- The channel can be turned on or off, and can also
-- generate events when packets pass through it.
```

```
filterTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF FilterEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A list of packet filter entries."
    ::= { filter 1 }
```

```
filterEntry OBJECT-TYPE
    SYNTAX      FilterEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A set of parameters for a packet filter applied on a
        particular interface.  As an example, an instance of the
        filterPktData object might be named filterPktData.12"
    INDEX { filterIndex }
    ::= { filterTable 1 }
```

```
FilterEntry ::= SEQUENCE {
    filterIndex          Integer32,
    filterChannelIndex   Integer32,
    filterPktDataOffset  Integer32,
```



```

    filterPktData          OCTET STRING,
    filterPktDataMask      OCTET STRING,
    filterPktDataNotMask   OCTET STRING,
    filterPktStatus        Integer32,
    filterPktStatusMask    Integer32,
    filterPktStatusNotMask Integer32,
    filterOwner            OwnerString,
    filterStatus           EntryStatus
}

filterIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "An index that uniquely identifies an entry
         in the filter table.  Each such entry defines
         one filter that is to be applied to every packet
         received on an interface."
    ::= { filterEntry 1 }

filterChannelIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "This object identifies the channel of which this filter
         is a part.  The filters identified by a particular value
         of this object are associated with the same channel as
         identified by the same value of the channelIndex object."
    ::= { filterEntry 2 }

filterPktDataOffset OBJECT-TYPE
    SYNTAX      Integer32
    UNITS       "Octets"
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The offset from the beginning of each packet where
         a match of packet data will be attempted.  This offset
         is measured from the point in the physical layer
         packet after the framing bits, if any.  For example,
         in an Ethernet frame, this point is at the beginning of
         the destination MAC address.

         This object may not be modified if the associated
         filterStatus object is equal to valid(1)."
    DEFVAL { 0 }

```

```
::= { filterEntry 3 }
```

filterPktData OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The data that is to be matched with the input packet. For each packet received, this filter and the accompanying filterPktDataMask and filterPktDataNotMask will be adjusted for the offset. The only bits relevant to this match algorithm are those that have the corresponding filterPktDataMask bit equal to one. The following three rules are then applied to every packet:

- (1) If the packet is too short and does not have data corresponding to part of the filterPktData, the packet will fail this data match.
- (2) For each relevant bit from the packet with the corresponding filterPktDataNotMask bit set to zero, if the bit from the packet is not equal to the corresponding bit from the filterPktData, then the packet will fail this data match.
- (3) If for every relevant bit from the packet with the corresponding filterPktDataNotMask bit set to one, the bit from the packet is equal to the corresponding bit from the filterPktData, then the packet will fail this data match.

Any packets that have not failed any of the three matches above have passed this data match. In particular, a zero length filter will match any packet.

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

```
::= { filterEntry 4 }
```

filterPktDataMask OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The mask that is applied to the match process. After adjusting this mask for the offset, only those bits in the received packet that correspond to bits set in this mask are relevant for further processing by the

match algorithm. The offset is applied to filterPktDataMask in the same way it is applied to the filter. For the purposes of the matching algorithm, if the associated filterPktData object is longer than this mask, this mask is conceptually extended with '1' bits until it reaches the length of the filterPktData object.

This object may not be modified if the associated filterStatus object is equal to valid(1)."
 ::= { filterEntry 5 }

filterPktDataNotMask OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The inversion mask that is applied to the match process. After adjusting this mask for the offset, those relevant bits in the received packet that correspond to bits cleared in this mask must all be equal to their corresponding bits in the filterPktData object for the packet to be accepted. In addition, at least one of those relevant bits in the received packet that correspond to bits set in this mask must be different to its corresponding bit in the filterPktData object.

For the purposes of the matching algorithm, if the associated filterPktData object is longer than this mask, this mask is conceptually extended with '0' bits until it reaches the length of the filterPktData object.

This object may not be modified if the associated filterStatus object is equal to valid(1)."
 ::= { filterEntry 6 }

filterPktStatus OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The status that is to be matched with the input packet. The only bits relevant to this match algorithm are those that have the corresponding filterPktStatusMask bit equal to one. The following two rules are then applied to every packet:

- (1) For each relevant bit from the packet status with the corresponding filterPktStatusNotMask bit set to zero, if the bit from the packet status is not equal to the

corresponding bit from the filterPktStatus, then the packet will fail this status match.

- (2) If for every relevant bit from the packet status with the corresponding filterPktStatusNotMask bit set to one, the bit from the packet status is equal to the corresponding bit from the filterPktStatus, then the packet will fail this status match.

Any packets that have not failed either of the two matches above have passed this status match. In particular, a zero length status filter will match any packet's status.

The value of the packet status is a sum. This sum initially takes the value zero. Then, for each error, E, that has been discovered in this packet, 2^E raised to a value representing E is added to the sum. The errors and the bits that represent them are dependent on the media type of the interface that this channel is receiving packets from.

The errors defined for a packet captured off of an Ethernet interface are as follows:

bit #	Error
0	Packet is longer than 1518 octets
1	Packet is shorter than 64 octets
2	Packet experienced a CRC or Alignment error

For example, an Ethernet fragment would have a value of 6 ($2^1 + 2^2$).

As this MIB is expanded to new media types, this object will have other media-specific errors defined.

For the purposes of this status matching algorithm, if the packet status is longer than this filterPktStatus object, this object is conceptually extended with '0' bits until it reaches the size of the packet status.

This object may not be modified if the associated filterStatus object is equal to valid(1)."
 ::= { filterEntry 7 }

```
filterPktStatusMask OBJECT-TYPE
    SYNTAX      Integer32
    MAX-ACCESS  read-create
    STATUS      current
```

DESCRIPTION

"The mask that is applied to the status match process. Only those bits in the received packet that correspond to bits set in this mask are relevant for further processing by the status match algorithm. For the purposes of the matching algorithm, if the associated filterPktStatus object is longer than this mask, this mask is conceptually extended with '1' bits until it reaches the size of the filterPktStatus. In addition, if a packet status is longer than this mask, this mask is conceptually extended with '0' bits until it reaches the size of the packet status.

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

::= { filterEntry 8 }

filterPktStatusNotMask OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The inversion mask that is applied to the status match process. Those relevant bits in the received packet status that correspond to bits cleared in this mask must all be equal to their corresponding bits in the filterPktStatus object for the packet to be accepted. In addition, at least one of those relevant bits in the received packet status that correspond to bits set in this mask must be different to its corresponding bit in the filterPktStatus object for the packet to be accepted.

For the purposes of the matching algorithm, if the associated filterPktStatus object or a packet status is longer than this mask, this mask is conceptually extended with '0' bits until it reaches the longer of the lengths of the filterPktStatus object and the packet status.

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

::= { filterEntry 9 }

filterOwner 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."

```
::= { filterEntry 10 }
```

```
filterStatus OBJECT-TYPE
```

```
SYNTAX      EntryStatus
```

```
MAX-ACCESS read-create
```

```
STATUS      current
```

```
DESCRIPTION
```

```
"The status of this filter entry."
```

```
::= { filterEntry 11 }
```

```
channelTable OBJECT-TYPE
```

```
SYNTAX      SEQUENCE OF ChannelEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS      current
```

```
DESCRIPTION
```

```
"A list of packet channel entries."
```

```
::= { filter 2 }
```

```
channelEntry OBJECT-TYPE
```

```
SYNTAX      ChannelEntry
```

```
MAX-ACCESS not-accessible
```

```
STATUS      current
```

```
DESCRIPTION
```

```
"A set of parameters for a packet channel applied on a
particular interface.  As an example, an instance of the
channelMatches object might be named channelMatches.3"
```

```
INDEX { channelIndex }
```

```
::= { channelTable 1 }
```

```
ChannelEntry ::= SEQUENCE {
```

```
channelIndex          Integer32,
```

```
channelIfIndex        Integer32,
```

```
channelAcceptType     INTEGER,
```

```
channelDataControl    INTEGER,
```

```
channelTurnOnEventIndex Integer32,
```

```
channelTurnOffEventIndex Integer32,
```

```
channelEventIndex     Integer32,
```

```
channelEventStatus    INTEGER,
```

```
channelMatches        Counter32,
```

```
channelDescription    DisplayString,
```

```
channelOwner          OwnerString,
```

```
channelStatus         EntryStatus
```

```
}
```

```
channelIndex OBJECT-TYPE
```

```
SYNTAX      Integer32 (1..65535)
```

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

```
STATUS      current
```

DESCRIPTION

"An index that uniquely identifies an entry in the channel table. Each such entry defines one channel, a logical data and event stream.

It is suggested that before creating a channel, an application should scan all instances of the filterChannelIndex object to make sure that there are no pre-existing filters that would be inadvertently be linked to the channel."

```
::= { channelEntry 1 }
```

channelIfIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object uniquely identifies the interface on this remote network monitoring device to which the associated filters are applied to allow data into this channel. The interface identified by a particular value of this object is the same interface as identified by the same value of the ifIndex object, defined in RFC 2233 [17].

The filters in this group are applied to all packets on the local network segment attached to the identified interface.

An agent may or may not be able to tell if fundamental changes to the media of the interface have occurred and necessitate an invalidation of this entry. For example, a hot-pluggable ethernet card could be pulled out and replaced by a token-ring card. In such a case, if the agent has such knowledge of the change, it is recommended that it invalidate this entry.

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

```
::= { channelEntry 2 }
```

channelAcceptType OBJECT-TYPE

SYNTAX INTEGER {
 acceptMatched(1),
 acceptFailed(2)
}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object controls the action of the filters associated with this channel. If this object is equal to `acceptMatched(1)`, packets will be accepted to this channel if they are accepted by both the packet data and packet status matches of an associated filter. If this object is equal to `acceptFailed(2)`, packets will be accepted to this channel only if they fail either the packet data match or the packet status match of each of the associated filters.

In particular, a channel with no associated filters will match no packets if set to `acceptMatched(1)` case and will match all packets in the `acceptFailed(2)` case.

This object may not be modified if the associated `channelStatus` object is equal to `valid(1)`."

::= { `channelEntry 3` }

`channelDataControl` OBJECT-TYPE

SYNTAX INTEGER {
 `on(1)`,
 `off(2)`
}

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"This object controls the flow of data through this channel. If this object is `on(1)`, data, status and events flow through this channel. If this object is `off(2)`, data, status and events will not flow through this channel."

DEFVAL { `off` }

::= { `channelEntry 4` }

`channelTurnOnEventIndex` OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object identifies the event that is configured to turn the associated `channelDataControl` from off to on when the event is generated. The event identified by a particular value of this object is the same event as identified by the same value of the `eventIndex` object. If there is no corresponding entry in the `eventTable`, then no association exists. In fact, if no event is intended for this channel, `channelTurnOnEventIndex` must be set to zero, a non-existent event index.

This object may not be modified if the associated
channelStatus object is equal to valid(1)."
::= { channelEntry 5 }

channelTurnOffEventIndex OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object identifies the event that is configured to turn the associated channelDataControl from on to off when the event is generated. The event identified by a particular value of this object is the same event as identified by the same value of the eventIndex object. If there is no corresponding entry in the eventTable, then no association exists. In fact, if no event is intended for this channel, channelTurnOffEventIndex must be set to zero, a non-existent event index.

This object may not be modified if the associated
channelStatus object is equal to valid(1)."
::= { channelEntry 6 }

channelEventIndex OBJECT-TYPE

SYNTAX Integer32 (0..65535)

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The value of this object identifies the event that is configured to be generated when the associated channelDataControl is on and a packet is matched. The event identified by a particular value of this object is the same event as identified by the same value of the eventIndex object. If there is no corresponding entry in the eventTable, then no association exists. In fact, if no event is intended for this channel, channelEventIndex must be set to zero, a non-existent event index.

This object may not be modified if the associated
channelStatus object is equal to valid(1)."
::= { channelEntry 7 }

channelEventStatus OBJECT-TYPE

SYNTAX INTEGER {
 eventReady(1),
 eventFired(2),

```

        eventAlwaysReady(3)
    }

```

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The event status of this channel.

If this channel is configured to generate events when packets are matched, a means of controlling the flow of those events is often needed. When this object is equal to eventReady(1), a single event may be generated, after which this object will be set by the probe to eventFired(2). While in the eventFired(2) state, no events will be generated until the object is modified to eventReady(1) (or eventAlwaysReady(3)). The management station can thus easily respond to a notification of an event by re-enabling this object.

If the management station wishes to disable this flow control and allow events to be generated at will, this object may be set to eventAlwaysReady(3). Disabling the flow control is discouraged as it can result in high network traffic or other performance problems."

DEFVAL { eventReady }

::= { channelEntry 8 }

channelMatches OBJECT-TYPE

SYNTAX Counter32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of times this channel has matched a packet. Note that this object is updated even when channelDataControl is set to off."

::= { channelEntry 9 }

channelDescription OBJECT-TYPE

SYNTAX DisplayString (SIZE (0..127))

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"A comment describing this channel."

::= { channelEntry 10 }

channelOwner 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."
 ::= { channelEntry 11 }

channelStatus OBJECT-TYPE
    SYNTAX      EntryStatus
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The status of this channel entry."
    ::= { channelEntry 12 }

-- The Packet Capture Group

-- Implementation of the Packet Capture group is optional. The Packet
-- Capture Group requires implementation of the Filter Group.
-- Consult the MODULE-COMPLIANCE macro for the authoritative
-- conformance information for this MIB.
--
-- The Packet Capture group allows packets to be captured
-- upon a filter match. The bufferControlTable controls
-- the captured packets output from a channel that is
-- associated with it. The captured packets are placed
-- in entries in the captureBufferTable. These entries are
-- associated with the bufferControlEntry on whose behalf they
-- were stored.

bufferControlTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF BufferControlEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A list of buffers control entries."
    ::= { capture 1 }

bufferControlEntry OBJECT-TYPE
    SYNTAX      BufferControlEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A set of parameters that control the collection of a stream
        of packets that have matched filters. As an example, an
        instance of the bufferControlCaptureSliceSize object might
        be named bufferControlCaptureSliceSize.3"
```

```

INDEX { bufferControlIndex }
 ::= { bufferControlTable 1 }

```

```

BufferControlEntry ::= SEQUENCE {
    bufferControlIndex          Integer32,
    bufferControlChannelIndex   Integer32,
    bufferControlFullStatus     INTEGER,
    bufferControlFullAction     INTEGER,
    bufferControlCaptureSliceSize Integer32,
    bufferControlDownloadSliceSize Integer32,
    bufferControlDownloadOffset Integer32,
    bufferControlMaxOctetsRequested Integer32,
    bufferControlMaxOctetsGranted Integer32,
    bufferControlCapturedPackets Integer32,
    bufferControlTurnOnTime     TimeTicks,
    bufferControlOwner          OwnerString,
    bufferControlStatus         EntryStatus
}

```

```

bufferControlIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "An index that uniquely identifies an entry
         in the bufferControl table. The value of this
         index shall never be zero. Each such
         entry defines one set of packets that is
         captured and controlled by one or more filters."
    ::= { bufferControlEntry 1 }

```

```

bufferControlChannelIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "An index that identifies the channel that is the
         source of packets for this bufferControl table.
         The channel identified by a particular value of this
         index is the same as identified by the same value of
         the channelIndex object.

         This object may not be modified if the associated
         bufferControlStatus object is equal to valid(1)."
```

```

    ::= { bufferControlEntry 2 }

```

```

bufferControlFullStatus OBJECT-TYPE
    SYNTAX      INTEGER {

```

```

        spaceAvailable(1),
        full(2)
    }
MAX-ACCESS read-only
STATUS current
DESCRIPTION
    "This object shows whether the buffer has room to
    accept new packets or if it is full.

    If the status is spaceAvailable(1), the buffer is
    accepting new packets normally. If the status is
    full(2) and the associated bufferControlFullAction
    object is wrapWhenFull, the buffer is accepting new
    packets by deleting enough of the oldest packets
    to make room for new ones as they arrive. Otherwise,
    if the status is full(2) and the
    bufferControlFullAction object is lockWhenFull,
    then the buffer has stopped collecting packets.

    When this object is set to full(2) the probe must
    not later set it to spaceAvailable(1) except in the
    case of a significant gain in resources such as
    an increase of bufferControlOctetsGranted. In
    particular, the wrap-mode action of deleting old
    packets to make room for newly arrived packets
    must not affect the value of this object."
 ::= { bufferControlEntry 3 }

```

bufferControlFullAction OBJECT-TYPE

```

SYNTAX      INTEGER {
                lockWhenFull(1),
                wrapWhenFull(2)      -- FIFO
            }
MAX-ACCESS read-create
STATUS current
DESCRIPTION
    "Controls the action of the buffer when it
    reaches the full status. When in the lockWhenFull(1)
    state and a packet is added to the buffer that
    fills the buffer, the bufferControlFullStatus will
    be set to full(2) and this buffer will stop capturing
    packets."
 ::= { bufferControlEntry 4 }

```

bufferControlCaptureSliceSize OBJECT-TYPE

```

SYNTAX      Integer32
UNITS       "Octets"
MAX-ACCESS read-create

```

STATUS current

DESCRIPTION

"The maximum number of octets of each packet that will be saved in this capture buffer. For example, if a 1500 octet packet is received by the probe and this object is set to 500, then only 500 octets of the packet will be stored in the associated capture buffer. If this variable is set to 0, the capture buffer will save as many octets as is possible.

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

DEFVAL { 100 }

::= { bufferControlEntry 5 }

bufferControlDownloadSliceSize OBJECT-TYPE

SYNTAX Integer32

UNITS "Octets"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The maximum number of octets of each packet in this capture buffer that will be returned in an SNMP retrieval of that packet. For example, if 500 octets of a packet have been stored in the associated capture buffer, the associated bufferControlDownloadOffset is 0, and this object is set to 100, then the captureBufferPacket object that contains the packet will contain only the first 100 octets of the packet.

A prudent manager will take into account possible interoperability or fragmentation problems that may occur if the download slice size is set too large. In particular, conformant SNMP implementations are not required to accept messages whose length exceeds 484 octets, although they are encouraged to support larger datagrams whenever feasible."

DEFVAL { 100 }

::= { bufferControlEntry 6 }

bufferControlDownloadOffset OBJECT-TYPE

SYNTAX Integer32

UNITS "Octets"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The offset of the first octet of each packet in this capture buffer that will be returned in an SNMP retrieval of that packet. For example, if 500 octets of a packet have been stored in the associated capture buffer and this object is set to 100, then the captureBufferPacket object that contains the packet will contain bytes starting 100 octets into the packet."

DEFVAL { 0 }
::= { bufferControlEntry 7 }

bufferControlMaxOctetsRequested OBJECT-TYPE

SYNTAX Integer32

UNITS "Octets"

MAX-ACCESS read-create

STATUS current

DESCRIPTION

"The requested maximum number of octets to be saved in this captureBuffer, including any implementation-specific overhead. If this variable is set to -1, the capture buffer will save as many octets as is possible.

When this object is created or modified, the probe should set bufferControlMaxOctetsGranted as closely to this object as is possible for the particular probe implementation and available resources. However, if the object has the special value of -1, the probe must set bufferControlMaxOctetsGranted to -1."

DEFVAL { -1 }
::= { bufferControlEntry 8 }

bufferControlMaxOctetsGranted OBJECT-TYPE

SYNTAX Integer32

UNITS "Octets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The maximum number of octets that can be saved in this captureBuffer, including overhead. If this variable is -1, the capture buffer will save as many octets as possible.

When the bufferControlMaxOctetsRequested object is created or modified, the probe should set this object as closely to the requested value as is possible for the particular probe implementation and available resources. However, if the request object has the special value

of -1, the probe must set this object to -1.

The probe must not lower this value except as a result of a modification to the associated `bufferControlMaxOctetsRequested` object.

When this maximum number of octets is reached and a new packet is to be added to this capture buffer and the corresponding `bufferControlFullAction` is set to `wrapWhenFull(2)`, enough of the oldest packets associated with this capture buffer shall be deleted by the agent so that the new packet can be added. If the corresponding `bufferControlFullAction` is set to `lockWhenFull(1)`, the new packet shall be discarded. In either case, the probe must set `bufferControlFullStatus` to `full(2)`.

When the value of this object changes to a value less than the current value, entries are deleted from the `captureBufferTable` associated with this `bufferControlEntry`. Enough of the oldest of these `captureBufferEntries` shall be deleted by the agent so that the number of octets used 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 `captureBufferEntries` may be allowed to grow."

::= { `bufferControlEntry` 9 }

`bufferControlCapturedPackets` OBJECT-TYPE

SYNTAX Integer32

UNITS "Packets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of packets currently in this captureBuffer."

::= { `bufferControlEntry` 10 }

`bufferControlTurnOnTime` OBJECT-TYPE

SYNTAX TimeTicks

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The value of `sysUpTime` when this capture buffer was first turned on."


```
 ::= { bufferControlEntry 11 }
```

```
bufferControlOwner 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."
```

```
 ::= { bufferControlEntry 12 }
```

```
bufferControlStatus OBJECT-TYPE
```

```
    SYNTAX      EntryStatus
```

```
    MAX-ACCESS  read-create
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "The status of this buffer Control Entry."
```

```
 ::= { bufferControlEntry 13 }
```

```
captureBufferTable OBJECT-TYPE
```

```
    SYNTAX      SEQUENCE OF CaptureBufferEntry
```

```
    MAX-ACCESS  not-accessible
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "A list of packets captured off of a channel."
```

```
 ::= { capture 2 }
```

```
captureBufferEntry OBJECT-TYPE
```

```
    SYNTAX      CaptureBufferEntry
```

```
    MAX-ACCESS  not-accessible
```

```
    STATUS      current
```

```
    DESCRIPTION
```

```
        "A packet captured off of an attached network.  As an
        example, an instance of the captureBufferPacketData
        object might be named captureBufferPacketData.3.1783"
```

```
    INDEX { captureBufferControlIndex, captureBufferIndex }
```

```
 ::= { captureBufferTable 1 }
```

```
CaptureBufferEntry ::= SEQUENCE {
```

```
    captureBufferControlIndex  Integer32,
```

```
    captureBufferIndex         Integer32,
```

```
    captureBufferPacketID      Integer32,
```

```
    captureBufferPacketData    OCTET STRING,
```

```
    captureBufferPacketLength  Integer32,
```

```
    captureBufferPacketTime    Integer32,
```

```
    captureBufferPacketStatus  Integer32
```

```
}
```

captureBufferControlIndex OBJECT-TYPE

SYNTAX Integer32 (1..65535)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The index of the bufferControlEntry with which this packet is associated."

::= { captureBufferEntry 1 }

captureBufferIndex OBJECT-TYPE

SYNTAX Integer32 (1..2147483647)

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An index that uniquely identifies an entry in the captureBuffer table associated with a particular bufferControlEntry. This index will start at 1 and increase by one for each new packet added with the same captureBufferControlIndex."

Should this value reach 2147483647, the next packet added with the same captureBufferControlIndex shall cause this value to wrap around to 1."

::= { captureBufferEntry 2 }

captureBufferPacketID OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"An index that describes the order of packets that are received on a particular interface. The packetID of a packet captured on an interface is defined to be greater than the packetID's of all packets captured previously on the same interface. As the captureBufferPacketID object has a maximum positive value of $2^{31} - 1$, any captureBufferPacketID object shall have the value of the associated packet's packetID mod 2^{31} ."

::= { captureBufferEntry 3 }

captureBufferPacketData OBJECT-TYPE

SYNTAX OCTET STRING

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The data inside the packet, starting at the beginning of the packet plus any offset specified in the

associated bufferControlDownloadOffset, including any link level headers. The length of the data in this object is the minimum of the length of the captured packet minus the offset, the length of the associated bufferControlCaptureSliceSize minus the offset, and the associated bufferControlDownloadSliceSize. If this minimum is less than zero, this object shall have a length of zero."

::= { captureBufferEntry 4 }

captureBufferPacketLength OBJECT-TYPE

SYNTAX Integer32

UNITS "Octets"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The actual length (off the wire) of the packet stored in this entry, including FCS octets."

::= { captureBufferEntry 5 }

captureBufferPacketTime OBJECT-TYPE

SYNTAX Integer32

UNITS "Milliseconds"

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"The number of milliseconds that had passed since this capture buffer was first turned on when this packet was captured."

::= { captureBufferEntry 6 }

captureBufferPacketStatus OBJECT-TYPE

SYNTAX Integer32

MAX-ACCESS read-only

STATUS current

DESCRIPTION

"A value which indicates the error status of this packet."

The value of this object is defined in the same way as filterPktStatus. The value is a sum. This sum initially takes the value zero. Then, for each error, E, that has been discovered in this packet, 2 raised to a value representing E is added to the sum.

The errors defined for a packet captured off of an Ethernet interface are as follows:

bit #	Error
0	Packet is longer than 1518 octets

- 1 Packet is shorter than 64 octets
- 2 Packet experienced a CRC or Alignment error
- 3 First packet in this capture buffer after it was detected that some packets were not processed correctly.
- 4 Packet's order in buffer is only approximate (May only be set for packets sent from the probe)

For example, an Ethernet fragment would have a value of 6 ($2^1 + 2^2$).

As this MIB is expanded to new media types, this object will have other media-specific errors defined."
 ::= { captureBufferEntry 7 }

-- The Event Group

-- Implementation of the Event group is optional.
-- Consult the MODULE-COMPLIANCE macro for the authoritative
-- conformance information for this MIB.

--
-- The Event group controls the generation and notification
-- of events from this device. Each entry in the eventTable
-- describes the parameters of the event that can be triggered.
-- Each event entry is fired by an associated condition located
-- elsewhere in the MIB. An event entry may also be associated
-- with a function elsewhere in the MIB that will be executed
-- when the event is generated. For example, a channel may
-- be turned on or off by the firing of an event.

--
-- Each eventEntry may optionally specify that a log entry
-- be created on its behalf whenever the event occurs.
-- Each entry may also specify that notification should
-- occur by way of SNMP trap messages. In this case, the
-- community for the trap message is given in the associated
-- eventCommunity object. The enterprise and specific trap
-- fields of the trap are determined by the condition that
-- triggered the event. Two traps are defined: risingAlarm and
-- fallingAlarm. If the eventTable is triggered by a condition
-- specified elsewhere, the enterprise and specific trap fields
-- must be specified for traps generated for that condition.

eventTable OBJECT-TYPE

SYNTAX SEQUENCE OF EventEntry
MAX-ACCESS not-accessible
STATUS current
DESCRIPTION

```

    "A list of events to be generated."
    ::= { event 1 }

```

eventEntry OBJECT-TYPE

```

SYNTAX      EventEntry
MAX-ACCESS  not-accessible
STATUS      current
DESCRIPTION
    "A set of parameters that describe an event to be generated
    when certain conditions are met.  As an example, an instance
    of the eventLastTimeSent object might be named
    eventLastTimeSent.6"
INDEX { eventIndex }
::= { eventTable 1 }

```

```

EventEntry ::= SEQUENCE {
    eventIndex      Integer32,
    eventDescription DisplayString,
    eventType       INTEGER,
    eventCommunity  OCTET STRING,
    eventLastTimeSent TimeTicks,
    eventOwner      OwnerString,
    eventStatus     EntryStatus
}

```

eventIndex OBJECT-TYPE

```

SYNTAX      Integer32 (1..65535)
MAX-ACCESS  read-only
STATUS      current
DESCRIPTION
    "An index that uniquely identifies an entry in the
    event table.  Each such entry defines one event that
    is to be generated when the appropriate conditions
    occur."
::= { eventEntry 1 }

```

eventDescription OBJECT-TYPE

```

SYNTAX      DisplayString (SIZE (0..127))
MAX-ACCESS  read-create
STATUS      current
DESCRIPTION
    "A comment describing this event entry."
::= { eventEntry 2 }

```

eventType OBJECT-TYPE

```

SYNTAX      INTEGER {
        none(1),
        log(2),

```

```
        snmptrap(3),    -- send an SNMP trap
        logandtrap(4)
    }
MAX-ACCESS read-create
STATUS      current
DESCRIPTION
    "The type of notification that the probe will make
    about this event.  In the case of log, an entry is
    made in the log table for each event.  In the case of
    snmp-trap, an SNMP trap is sent to one or more
    management stations."
::= { eventEntry 3 }

eventCommunity OBJECT-TYPE
    SYNTAX      OCTET STRING (SIZE (0..127))
    MAX-ACCESS read-create
    STATUS      current
    DESCRIPTION
        "If an SNMP trap is to be sent, it will be sent to
        the SNMP community specified by this octet string."
    ::= { eventEntry 4 }

eventLastTimeSent OBJECT-TYPE
    SYNTAX      TimeTicks
    MAX-ACCESS read-only
    STATUS      current
    DESCRIPTION
        "The value of sysUpTime at the time this event
        entry last generated an event.  If this entry has
        not generated any events, this value will be
        zero."
    ::= { eventEntry 5 }

eventOwner 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.

        If this object contains a string starting with 'monitor'
        and has associated entries in the log table, all connected
        management stations should retrieve those log entries,
        as they may have significance to all management stations
        connected to this device"
    ::= { eventEntry 6 }
```

```

eventStatus OBJECT-TYPE
    SYNTAX      EntryStatus
    MAX-ACCESS  read-create
    STATUS      current
    DESCRIPTION
        "The status of this event entry.

        If this object is not equal to valid(1), all associated
        log entries shall be deleted by the agent."
    ::= { eventEntry 7 }

--
logTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF LogEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A list of events that have been logged."
    ::= { event 2 }

logEntry OBJECT-TYPE
    SYNTAX      LogEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "A set of data describing an event that has been
        logged.  For example, an instance of the logDescription
        object might be named logDescription.6.47"
    INDEX { logEventIndex, logIndex }
    ::= { logTable 1 }

LogEntry ::= SEQUENCE {
    logEventIndex      Integer32,
    logIndex           Integer32,
    logTime            TimeTicks,
    logDescription     DisplayString
}

logEventIndex OBJECT-TYPE
    SYNTAX      Integer32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The event entry that generated this log
        entry.  The log identified by a particular
        value of this index is associated with the same
        eventEntry as identified by the same value
        of eventIndex."

```

```
::= { logEntry 1 }
```

```
logIndex OBJECT-TYPE
```

```
SYNTAX      Integer32 (1..2147483647)
```

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

```
STATUS      current
```

```
DESCRIPTION
```

"An index that uniquely identifies an entry in the log table amongst those generated by the same eventEntries. These indexes are assigned beginning with 1 and increase by one with each new log entry. The association between values of logIndex and logEntries is fixed for the lifetime of each logEntry. The agent may choose to delete the oldest instances of logEntry as required because of lack of memory. It is an implementation-specific matter as to when this deletion may occur."

```
::= { logEntry 2 }
```

```
logTime OBJECT-TYPE
```

```
SYNTAX      TimeTicks
```

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

```
STATUS      current
```

```
DESCRIPTION
```

"The value of sysUpTime when this log entry was created."

```
::= { logEntry 3 }
```

```
logDescription OBJECT-TYPE
```

```
SYNTAX      DisplayString (SIZE (0..255))
```

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

```
STATUS      current
```

```
DESCRIPTION
```

"An implementation dependent description of the event that activated this log entry."

```
::= { logEntry 4 }
```

```
-- Remote Network Monitoring Traps
```

```
rmonEventsV2 OBJECT-IDENTITY
```

```
STATUS      current
```

```
DESCRIPTION "Definition point for RMON notifications."
```

```
::= { rmon 0 }
```

```
risingAlarm NOTIFICATION-TYPE
```

```
OBJECTS { alarmIndex, alarmVariable, alarmSampleType,  
          alarmValue, alarmRisingThreshold }
```

```
STATUS      current
```



```

DESCRIPTION
    "The SNMP trap that is generated when an alarm
    entry crosses its rising threshold and generates
    an event that is configured for sending SNMP
    traps."
 ::= { rmonEventsV2 1 }

fallingAlarm NOTIFICATION-TYPE
    OBJECTS { alarmIndex, alarmVariable, alarmSampleType,
              alarmValue, alarmFallingThreshold }
    STATUS current
    DESCRIPTION
        "The SNMP trap that is generated when an alarm
        entry crosses its falling threshold and generates
        an event that is configured for sending SNMP
        traps."
 ::= { rmonEventsV2 2 }

-- Conformance information

rmonCompliances OBJECT IDENTIFIER ::= { rmonConformance 9 }
rmonGroups      OBJECT IDENTIFIER ::= { rmonConformance 10 }

-- Compliance Statements
rmonCompliance MODULE-COMPLIANCE
    STATUS current
    DESCRIPTION
        "The requirements for conformance to the RMON MIB. At least
        one of the groups in this module must be implemented to
        conform to the RMON MIB. Implementations of this MIB
        must also implement the system group of MIB-II [16] and the
        IF-MIB [17]."
```

MODULE -- this module

```

    GROUP rmonEtherStatsGroup
        DESCRIPTION
            "The RMON Ethernet Statistics Group is optional."

    GROUP rmonHistoryControlGroup
        DESCRIPTION
            "The RMON History Control Group is optional."

    GROUP rmonEthernetHistoryGroup
        DESCRIPTION
            "The RMON Ethernet History Group is optional."

    GROUP rmonAlarmGroup
        DESCRIPTION
```

"The RMON Alarm Group is optional."

GROUP rmonHostGroup

DESCRIPTION

"The RMON Host Group is mandatory when the
rmonHostTopNGroup is implemented."

GROUP rmonHostTopNGroup

DESCRIPTION

"The RMON Host Top N Group is optional."

GROUP rmonMatrixGroup

DESCRIPTION

"The RMON Matrix Group is optional."

GROUP rmonFilterGroup

DESCRIPTION

"The RMON Filter Group is mandatory when the
rmonPacketCaptureGroup is implemented."

GROUP rmonPacketCaptureGroup

DESCRIPTION

"The RMON Packet Capture Group is optional."

GROUP rmonEventGroup

DESCRIPTION

"The RMON Event Group is mandatory when the
rmonAlarmGroup is implemented."

::= { rmonCompliances 1 }

rmonEtherStatsGroup OBJECT-GROUP

OBJECTS {

etherStatsIndex, etherStatsDataSource,
etherStatsDropEvents, etherStatsOctets, etherStatsPkts,
etherStatsBroadcastPkts, etherStatsMulticastPkts,
etherStatsCRCAlignErrors, etherStatsUndersizePkts,
etherStatsOversizePkts, etherStatsFragments,
etherStatsJabbers, etherStatsCollisions,
etherStatsPkts64Octets, etherStatsPkts65to127Octets,
etherStatsPkts128to255Octets,
etherStatsPkts256to511Octets,
etherStatsPkts512to1023Octets,
etherStatsPkts1024to1518Octets,
etherStatsOwner, etherStatsStatus

}

STATUS current

DESCRIPTION

"The RMON Ethernet Statistics Group."

```
 ::= { rmonGroups 1 }

rmonHistoryControlGroup OBJECT-GROUP
  OBJECTS {
    historyControlIndex, historyControlDataSource,
    historyControlBucketsRequested,
    historyControlBucketsGranted, historyControlInterval,
    historyControlOwner, historyControlStatus
  }
  STATUS current
  DESCRIPTION
    "The RMON History Control Group."
  ::= { rmonGroups 2 }

rmonEthernetHistoryGroup OBJECT-GROUP
  OBJECTS {
    etherHistoryIndex, etherHistorySampleIndex,
    etherHistoryIntervalStart, etherHistoryDropEvents,
    etherHistoryOctets, etherHistoryPkts,
    etherHistoryBroadcastPkts, etherHistoryMulticastPkts,
    etherHistoryCRCAlignErrors, etherHistoryUndersizePkts,
    etherHistoryOversizePkts, etherHistoryFragments,
    etherHistoryJabbers, etherHistoryCollisions,
    etherHistoryUtilization
  }
  STATUS current
  DESCRIPTION
    "The RMON Ethernet History Group."
  ::= { rmonGroups 3 }

rmonAlarmGroup OBJECT-GROUP
  OBJECTS {
    alarmIndex, alarmInterval, alarmVariable,
    alarmSampleType, alarmValue, alarmStartupAlarm,
    alarmRisingThreshold, alarmFallingThreshold,
    alarmRisingEventIndex, alarmFallingEventIndex,
    alarmOwner, alarmStatus
  }
  STATUS current
  DESCRIPTION
    "The RMON Alarm Group."
  ::= { rmonGroups 4 }

rmonHostGroup OBJECT-GROUP
  OBJECTS {
    hostControlIndex, hostControlDataSource,
    hostControlTableSize, hostControlLastDeleteTime,
    hostControlOwner, hostControlStatus,
```

```
    hostAddress, hostCreationOrder, hostIndex,
    hostInPkts, hostOutPkts, hostInOctets,
    hostOutOctets, hostOutErrors, hostOutBroadcastPkts,
    hostOutMulticastPkts, hostTimeAddress,
    hostTimeCreationOrder, hostTimeIndex,
    hostTimeInPkts, hostTimeOutPkts, hostTimeInOctets,
    hostTimeOutOctets, hostTimeOutErrors,
    hostTimeOutBroadcastPkts, hostTimeOutMulticastPkts
}
STATUS current
DESCRIPTION
    "The RMON Host Group."
 ::= { rmonGroups 5 }

rmonHostTopNGroup OBJECT-GROUP
OBJECTS {
    hostTopNControlIndex, hostTopNHostIndex,
    hostTopNRateBase, hostTopNTimeRemaining,
    hostTopNDuration, hostTopNRequestedSize,
    hostTopNGrantedSize, hostTopNStartTime,
    hostTopNOwner, hostTopNStatus,
    hostTopNReport, hostTopNIndex,
    hostTopNAddress, hostTopNRate
}
STATUS current
DESCRIPTION
    "The RMON Host Top 'N' Group."
 ::= { rmonGroups 6 }

rmonMatrixGroup OBJECT-GROUP
OBJECTS {
    matrixControlIndex, matrixControlDataSource,
    matrixControlTableSize, matrixControlLastDeleteTime,
    matrixControlOwner, matrixControlStatus,
    matrixSDSourceAddress, matrixSDDestAddress,
    matrixSDIndex, matrixSDPkts,
    matrixSDOctets, matrixSDErrors,
    matrixDSSourceAddress, matrixDSDestAddress,
    matrixDSIndex, matrixDSPkts,
    matrixDSOctets, matrixDSErrors
}
STATUS current
DESCRIPTION
    "The RMON Matrix Group."
 ::= { rmonGroups 7 }

rmonFilterGroup OBJECT-GROUP
OBJECTS {
```

```
    filterIndex, filterChannelIndex, filterPktDataOffset,
    filterPktData, filterPktDataMask,
    filterPktDataNotMask, filterPktStatus,
    filterPktStatusMask, filterPktStatusNotMask,
    filterOwner, filterStatus,
    channelIndex, channelIfIndex, channelAcceptType,
    channelDataControl, channelTurnOnEventIndex,
    channelTurnOffEventIndex, channelEventIndex,
    channelEventStatus, channelMatches,
    channelDescription, channelOwner, channelStatus
}
STATUS current
DESCRIPTION
    "The RMON Filter Group."
 ::= { rmonGroups 8 }

rmonPacketCaptureGroup OBJECT-GROUP
OBJECTS {
    bufferControlIndex, bufferControlChannelIndex,
    bufferControlFullStatus, bufferControlFullAction,
    bufferControlCaptureSliceSize,
    bufferControlDownloadSliceSize,
    bufferControlDownloadOffset,
    bufferControlMaxOctetsRequested,
    bufferControlMaxOctetsGranted,
    bufferControlCapturedPackets,
    bufferControlTurnOnTime,
    bufferControlOwner, bufferControlStatus,
    captureBufferControlIndex, captureBufferIndex,
    captureBufferPacketID, captureBufferPacketData,
    captureBufferPacketLength, captureBufferPacketTime,
    captureBufferPacketStatus
}
STATUS current
DESCRIPTION
    "The RMON Packet Capture Group."
 ::= { rmonGroups 9 }

rmonEventGroup OBJECT-GROUP
OBJECTS {
    eventIndex, eventDescription, eventType,
    eventCommunity, eventLastTimeSent,
    eventOwner, eventStatus,
    logEventIndex, logIndex, logTime,
    logDescription
}
STATUS current
DESCRIPTION
```

```
        "The RMON Event Group."
 ::= { rmonGroups 10 }

rmonNotificationGroup NOTIFICATION-GROUP
  NOTIFICATIONS { risingAlarm, fallingAlarm }
  STATUS        current
  DESCRIPTION
    "The RMON Notification Group."
 ::= { rmonGroups 11 }

END
```

6. 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.

This MIB also 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.

SNMPv1 by itself is not a secure environment. 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.

It is recommended that the implementors consider the security features as provided by the SNMPv3 framework. Specifically, the use of the User-based Security Model RFC 2574 [12] and the View-based Access Control Model RFC 2575 [15] is recommended.

It is then a customer/user responsibility to ensure that the SNMP entity giving access to an instance of this MIB, is properly configured to give access to the objects only to those principals (users) that have legitimate rights to indeed GET or SET (change/create/delete) them.

7. Acknowledgments

This document was produced by the IETF Remote Network Monitoring Working Group.

8. Author's Address

Steve Waldbusser

Phone: +1-650-948-6500

Fax: +1-650-745-0671

Email: waldbusser@nextbeacon.com

9. References

- [1] Harrington, D., Presuhn, R., and B. Wijnen, "An Architecture for Describing SNMP Management Frameworks", RFC 2571, April 1999.
- [2] Rose, M. and K. McCloghrie, "Structure and Identification of Management Information for TCP/IP-based Internets", STD 16, RFC 1155, May 1990.
- [3] Rose, M. and K. McCloghrie, "Concise MIB Definitions", STD 16, RFC 1212, March 1991.
- [4] Rose, M., "A Convention for Defining Traps for use with the SNMP", RFC 1215, March 1991.
- [5] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Structure of Management Information Version 2 (SMIv2)", STD 58, RFC 2578, April 1999.
- [6] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Textual Conventions for SMIv2", STD 58, RFC 2579, April 1999.
- [7] McCloghrie, K., Perkins, D., Schoenwaelder, J., Case, J., Rose, M. and S. Waldbusser, "Conformance Statements for SMIv2", STD 58, RFC 2580, April 1999.
- [8] Case, J., Fedor, M., Schoffstall, M. and J. Davin, "Simple Network Management Protocol", STD 15, RFC 1157, May 1990.
- [9] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Introduction to Community-based SNMPv2", RFC 1901, January 1996.

- [10] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Transport Mappings for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1906, January 1996.
- [11] Case, J., Harrington D., Presuhn R. and B. Wijnen, "Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)", RFC 2572, April 1999.
- [12] Blumenthal, U. and B. Wijnen, "User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)", RFC 2574, April 1999.
- [13] Case, J., McCloghrie, K., Rose, M. and S. Waldbusser, "Protocol Operations for Version 2 of the Simple Network Management Protocol (SNMPv2)", RFC 1905, January 1996.
- [14] Levi, D., Meyer, P. and B. Stewart, "SNMPv3 Applications", RFC 2573, April 1999.
- [15] Wijnen, B., Presuhn, R. and K. McCloghrie, "View-based Access Control Model (VACM) for the Simple Network Management Protocol (SNMP)", RFC 2575, April 1999.
- [16] McCloghrie, K. and M. Rose, Editors, "Management Information Base for Network Management of TCP/IP-based internets: MIB-II", STD 17, RFC 1213, March 1991.
- [17] McCloghrie, K. and F. Kastenholz, "The Interfaces Group MIB using SMIV2", RFC 2233, November 1997.
- [18] Waldbusser, S., "Remote Network Monitoring MIB", RFC 1757, February 1995.
- [19] Waldbusser, S., "Token Ring Extensions to the Remote Network Monitoring MIB", RFC 1513, September 1993.
- [20] Waldbusser, S., "Remote Network Monitoring Management Information Base Version 2 using SMIV2", RFC 2021, January 1997.
- [21] Waterman, R., Lahaye, B., Romascanu, D. and S. Waldbusser, "Remote Network Monitoring MIB Extensions for Switched Networks Version 1.0", RFC 2613, June 1999.
- [22] Case, J., Mundy, R., Partain, D. and B. Stewart, "Introduction to Version 3 of the Internet-standard Network Management Framework", RFC 2570, April 1999.

10. Intellectual Property

The IETF takes no position regarding the validity or scope of any intellectual property or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; neither does it represent that it has made any effort to identify any such rights. Information on the IETF's procedures with respect to rights in standards-track and standards-related documentation can be found in BCP-11. Copies of claims of rights made available for publication and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementors or users of this specification can be obtained from the IETF Secretariat.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights which may cover technology that may be required to practice this standard. Please address the information to the IETF Executive Director.

11. Full Copyright Statement

Copyright (C) The Internet Society (2000). All Rights Reserved.

This document and translations of it may be copied and furnished to others, and derivative works that comment on or otherwise explain it or assist in its implementation may be prepared, copied, published and distributed, in whole or in part, without restriction of any kind, provided that the above copyright notice and this paragraph are included on all such copies and derivative works. However, this document itself may not be modified in any way, such as by removing the copyright notice or references to the Internet Society or other Internet organizations, except as needed for the purpose of developing Internet standards in which case the procedures for copyrights defined in the Internet Standards process must be followed, or as required to translate it into languages other than English.

The limited permissions granted above are perpetual and will not be revoked by the Internet Society or its successors or assigns.

This document and the information contained herein is provided on an "AS IS" basis and THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIMS ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Acknowledgement

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

