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Traffic Flow Measurement: Meter MIB

Status of this Memo

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, this memo defines managed objects used for obtaining traffic flow information from network traffic meters.

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1 The Network Management Framework

The Internet-standard Network Management Framework consists of three components. They are:

RFC 1155 defines the SMI, the mechanisms used for describing and naming objects for the purpose of management. STD 16, RFC 1212 defines a more concise description mechanism, which is wholly consistent with the SMI.

RFC 1156 defines MIB-I, the core set of managed objects for the Internet suite of protocols. STD 17, RFC 1213 [1] defines MIB-II, an evolution of MIB-I based on implementation experience and new operational requirements.

STD 15, RFC 1157 defines the SNMP, the protocol used for network access to managed objects.

RFC 1442 [2] defines the SMI for version 2 of the Simple Network Management Protocol.

RFCs 1443 and 1444 [3,4] define Textual Conventions and Conformance Statements for version 2 of the Simple Network Management Protocol.

RFC 1452 [5] describes how versions 1 and 2 of the Simple Network Management Protocol should coexist.

The Framework permits new objects to be defined for the purpose of experimentation and evaluation.

2 Objects

Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. Objects in the MIB are defined using the subset of Abstract Syntax Notation One (ASN.1) [6] defined in the SMI. In particular, each object has a name, a syntax, and an encoding. The name is an object identifier, an administratively assigned name, which specifies an object type. The object type together with an object instance serves to uniquely identify a specific instantiation of the object. For human convenience, we often use a textual string, termed the OBJECT DESCRIPTOR, to also refer to the object type.

The syntax of an object type defines the abstract data structure corresponding to that object type. The ASN.1 language is used for this purpose. However, the SMI [2] purposely restricts the ASN.1 constructs which may be used. These restrictions are explicitly made for simplicity.

The encoding of an object type is simply how that object type is represented using the object type’s syntax. Implicitly tied to the notion of an object type’s syntax and encoding is how the object type is represented when being transmitted on the network.

The SMI specifies the use of the basic encoding rules of ASN.1 [7], subject to the additional requirements imposed by the SNMP.

2.1 Format of Definitions

Section 4 contains contains the specification of all object types contained in this MIB module. These object types are defined using the conventions defined in [2] and [3].

3 Overview

Traffic Flow Measurement seeks to provide a well-defined method for gathering traffic flow information from networks and internetworks. The background for this is given in "Traffic Flow Measurement: Background" [8]. The Realtime Traffic Flow Measurement (rtfm) Working Group has produced a measurement architecture to achieve it; this is documented in "Traffic Flow Measurement: Architecture" [9]. The architecture defines three entities:

- METERS, which observe network traffic flows and build up a table of flow data records for them,

- METER REAERS, which collect traffic flow data from meters, and

- MANAGERS, which oversee the operation of meters and meter readers.

This memo defines the SNMP management information for a Traffic Flow Meter (TFM). It documents the earlier work of the Internet Accounting Working Group, and is intended to provide a starting point for the Realtime Traffic Flow Measurement Working Group.

3.1 Scope of Definitions, Textual Conventions

All objects defined in this memo are registered in a single subtree within the mib-2 namespace [1,2], and are for use in network devices which may perform a PDU forwarding or monitoring function. For these devices, the value of the ifSpecific variable in the MIB-II [1] has the OBJECT IDENTIFIER value:

```
flowMIB OBJECT IDENTIFIER ::=  mib-2 40
```

as defined below.

The RTFM Meter MIB was first produced and tested using SNMPv1. It has been converted into SNMPv2 following the guidelines in RFC 1452 [5].

3.2 Usage of the MIB variables

The MIB breaks into four parts - control, flows, rules and conformance statements.

The rules implement the minumum set of packet-matching actions, as set out in the "Traffic Flow Measurment: Architecture" document [9]. In addition they provide for BASIC-style subroutines, allowing a network manager to dramatically reduce the number of rules required to monitor a big network.

Traffic flows are identified by a set of attributes for each of its end-points. Attributes include network addresses for each layer of the network protocol stack, and 'subscriber ids,' which may be used to identify an accountable entity for the flow.

The conformance statements are set out as defined in [4]. They explain what must be implemented in a meter which claims to conform to this MIB.

To retrieve flow data one could simply do a linear scan of the flow table. This would certainly work, but would require a lot of protocol exchanges. To reduce the overhead in retrieving flow data the flow table uses a TimeFilter variable, defined as a Textual Convention in the RMON2 MIB [10]. This, when used together with SNMPv2's GetBulk request, allows a meter reader to scan the flow table and upload a specified set of flow attributes for those rows which have changed since the last reading.

As an alternative method of reading flow data, the MIB provides an index into the flow table called flowColumnActivityTable. This is (logically) a three-dimensional array, subscripted by flow attribute, activity time and starting flow number. This allows a meter reader to retrieve (in an opaque object) data for a column of the flow table with a minimum of SNMP overhead. An attempt has been made to include a full ASN.1 definition of the flowColumnActivityData object.

One aspect of data collection which needs emphasis is that all the MIB variables are set up to allow multiple independent colletors to work properly, i.e. the flow table indexes are stateless. An alternative approach would have been to 'snapshot' the flow table, which would mean that the meter readers would have to be synchronized. The stateless approach does mean that two meter readers will never return exactly the same set of traffic counts, but over long periods (e.g. 15-minute collections over a day) the discrepancies are acceptable. If one really needs a snapshot, this can be achieved by switching to an identical rule set with a different RuleSet number, hence asynchronous collections may be

regarded as a useful generalisation of synchronised ones.

The control variables are the minimum set required for a meter reader. Their number has been whittled down as experience has been gained with the MIB implementation. A few of them are 'general,' i.e. they control the overall behaviour of the meter. These are set by a single 'master' manager, and no other manager should attempt to change their values. The decision as to which manager is the 'master' must be made by the network operations personnel responsible; this MIB does not attempt to provide any support for interaction between managers.

There are three other groups of control groups, arranged into tables in the same way as in the RMON MIB [10]. They are used as follows:

- RULE SET INFO: Before attempting to download a rule table a manager must create a row in the flowRuleSetInfo with flowRuleInfoStatus set to 'createAndWait.' When the rule set is ready the manager must set RuleSetInfo to 'active,' indicating that the rule set is ready for use.

- METER READER INFO: Any meter reader wishing to collect data reliably for all flows should first create a row in the flowReaderInfoTable with flowReaderStatus set to 'active.' It should write that row's flowReaderLastTime object each time it starts a collection pass through the flow table. The meter will not recover a flow's memory until every meter reader holding a row in this table has collected that flow's data.

- MANAGER INFO: Any manager wishing to download rule sets to the meter must create a row in the flowManagerInfo table with flowManagerStatus set to 'active.'. Once it has a table row, the manager may set the control variables in its row so as to cause the meter to run any valid rule set held by the meter.

4 Definitions

```
FLOW-METER-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, Counter32, Integer32, TimeTicks
        FROM SNMPv2-SMI
    TEXTUAL-CONVENTION, RowStatus, TimeStamp
        FROM SNMPv2-TC
    OBJECT-GROUP, MODULE-COMPLIANCE
        FROM SNMPv2-CONF
    mib-2, ifIndex
        FROM RFC1213-MIB
    OwnerString
        FROM RMON-MIB;

flowMIB MODULE-IDENTITY
    LAST-UPDATED "9603080208Z"
    ORGANIZATION "IETF Realtime Traffic Flow Measurement Working Group"
    CONTACT-INFO
        "Nevil Brownlee, The University of Auckland
        Email: n.brownlee@auckland.ac.nz"
    DESCRIPTION
                "MIB for the RTFM Traffic Flow Meter."
    ::= { mib-2 40 }


flowControl         OBJECT IDENTIFIER ::= { flowMIB 1 }

flowData            OBJECT IDENTIFIER ::= { flowMIB 2 }

flowRules           OBJECT IDENTIFIER ::= { flowMIB 3 }

flowMIBConformance  OBJECT IDENTIFIER ::= { flowMIB 4 }


-- Textual Conventions

TimeFilter ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
        "Used as an index to a table.  A TimeFilter variable allows
        a GetNext or GetBulk request to find rows in a table for
        which the TimeFilter index variable is greater than or equal
        to a specified value.  For example, a meter reader could
        find all rows in the flow table which have been active at or
        since a specified time.
```

```
        More details on TimeFilter variables, their implementation
        and use can be found in the RMON2 MIB [10]."
    SYNTAX  TimeTicks

AddressType ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
        "Indicates the type of an adjacent address or peer address.
        The values used are from the 'Address Family Numbers' section
        of the Assigned Numbers RFC [11]."
    SYNTAX  INTEGER {
        ip(1),
        nsap(3),
        ieee802(6),
        ipx(11),
        appletalk(12),
        decnet(13) }

AdjacentAddress ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
        "Specifies the value of an adjacent address for various
        media.  The values used for IEEE 802 media are from the
        'Network Management Parameters (ifType definitions)'
        section of the Assigned Numbers RFC [11].  Address format
        depends on the actual media, as follows:

        Ethernet:     ethernet(7)
            6-octet 802.3 MAC address in 'canonical' order

        FDDI:         fddi(15)
            FddiMACLongAddress, i.e. a 6-octet MAC address
            in 'canonical' order  (defined in the FDDI MIB [12])

        Token Ring:   tokenring(9)
            6-octet 802.5 MAC address in 'canonical' order

        PeerAddress:  other(1)
            If traffic is being metered inside a tunnel, its
            adjacent addresses will be the peer addresses of hosts
            at the ends of the tunnel
        "
    SYNTAX OCTET STRING (SIZE (6..20))

PeerAddress ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
        "Specifies the value of a peer address for various network
```

```
        protocols.  Address format depends on the actual protocol,
        as follows:

        IP:          ip(1)
            4-octet IpAddress  (defined in the SNMPv2 SMI [2])

        CLNS:        nsap(3)
            NsapAddress  (defined in the SNMPv2 SMI [2])

        Novell:      ipx(11)
            4-octet Network number,
            6-octet Host number (MAC address)

        AppleTalk:   appletalk(12)
            2-octet Network number (sixteen bits),
            1-octet Host number (eight bits)

        DECnet:      decnet(13)
            1-octet Area number (in low-order six bits),
            2-octet Host number (in low-order ten bits)
        "
    SYNTAX OCTET STRING (SIZE (3..20))

TransportAddress ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
        "Specifies the value of a transport address for various
        network protocols.  Format as follows:

        IP:
            2-octet UDP or TCP port number

        Other protocols:
            2-octet port number
        "
    SYNTAX OCTET STRING (SIZE (2))

RuleAddress ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
        "Specifies the value of an address.  Is a superset of
        AdjacentAddress, PeerAddress and TransportAddress."
    SYNTAX OCTET STRING (SIZE (2..20))

FlowAttributeNumber ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
        "Uniquely identifies an attribute within a flow data record."
```

```
    SYNTAX  INTEGER {
        flowIndex(1),
        flowStatus(2),
        flowTimeMark(3),

        sourceInterface(4),
        sourceAdjacentType(5),
        sourceAdjacentAddress(6),
        sourceAdjacentMask(7),
        sourcePeerType(8),
        sourcePeerAddress(9),
        sourcePeerMask(10),
        sourceTransType(11),
        sourceTransAddress(12),
        sourceTransMask(13),

        destInterface(14),
        destAdjacentType(15),
        destAdjacentAddress(16),
        destAdjacentMask(17),
        destPeerType(18),
        destPeerAddress(19),
        destPeerMask(20),
        destTransType(21),
        destTransAddress(22),
        destTransMask(23),

        pduScale(234),
        octetScale(25),

        ruleSet(26),
        toOctets(27),             -- Source-to-Dest
        toPDUs(28),
        fromOctets(29),           -- Dest-to-Source
        fromPDUs(30),
        firstTime(31),            -- Activity times
        lastActiveTime(32),

        sourceSubscriberID(33),   -- Subscriber ID
        destSubscriberID(34),
        sessionID(35),

        sourceClass(36),          -- Computed attributes
        destClass(37),
        flowClass(38),
        sourceKind(39),
        destKind(40),
        flowKind(41) }
```

```
RuleAttributeNumber ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
        "Uniquely identifies an attribute which may be tested in
        a rule.  These include attributes whose values come directly
        from the flow's packets and the five 'meter' variables used to
        hold an AttributeValue.  Attributes derived from the rules -
        e.g. address masks - may not be tested."
    SYNTAX  INTEGER {
        null(0),
        sourceInterface(4),       -- Source Address
        sourceAdjacentType(5),
        sourceAdjacentAddress(6),
        sourcePeerType(8),
        sourcePeerAddress(9),
        sourceTransType(11),
        sourceTransAddress(12),
        destInterface(14),        -- Dest Address
        destAdjacentType(15),
        destAdjacentAddress(16),
        destPeerType(18),
        destPeerAddress(19),
        destTransType(21),
        destTransAddress(22),
        sourceSubscriberID(33),   -- Subscriber ID
        destSubscriberID(34),
        sessionID(35),
        v1(51),                   -- Meter variables
        v2(52),
        v3(53),
        v4(54),
        v5(55) }

ActionNumber ::= TEXTUAL-CONVENTION
    STATUS  current
    DESCRIPTION
        "Uniquely identifies the action of a rule, i.e. the Pattern
        Matching Engine's opcode number.  Details of the opcodes
        are given in the 'Traffic Flow Measurement: Architecture'
        document [9]."
    SYNTAX  INTEGER {
        ignore(1),
        fail(2),
        count(3),
        countPkt(4),
        return(5),
        gosub(6),
        gosubAct(7),
```

```
        assign(8),
        assignAct(9),
        goto(10),
        gotoAct(11),
        pushRuleTo(12),
        pushRuleToAct(13),
        pushPktTo(14),
        pushPktToAct(15) }


--
-- Control Group:  Rule Set Info Table
--

flowRuleSetInfoTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF FlowRuleSetInfoEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "An array of information about the rule sets held in the
        meter.   Rule set 1 is the meter default, used when the meter
        starts up.  It is built in to the meter; it may not be
        changed."
    ::= { flowControl 1 }

flowRuleSetInfoEntry OBJECT-TYPE
    SYNTAX  FlowRuleSetInfoEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "Information about a particular rule set."
    INDEX  { flowRuleInfoIndex }
    ::= { flowRuleSetInfoTable 1 }

FlowRuleSetInfoEntry ::= SEQUENCE {
    flowRuleInfoIndex         Integer32,
    flowRuleInfoSize          Integer32,
    flowRuleInfoOwner         OwnerString,
    flowRuleInfoTimeStamp     TimeStamp,
    flowRuleInfoStatus        RowStatus
    }

flowRuleInfoIndex OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "An index which selects an entry in the flowRuleSetInfoTable.
```

```
        Each such entry contains control information for a particular
        rule set which the meter may run."
    ::= { flowRuleSetInfoEntry 1 }

flowRuleInfoSize OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "Number of rules in this rule set.  Setting this variable will
        cause the meter to allocate space for these rules."
    ::= { flowRuleSetInfoEntry 2 }

flowRuleInfoOwner OBJECT-TYPE
    SYNTAX  OwnerString
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "Identifies the manager which configured this rule set."
    ::= { flowRuleSetInfoEntry 3 }

flowRuleInfoTimeStamp OBJECT-TYPE
    SYNTAX  TimeStamp
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "Time this rule set was last changed."
    ::= { flowRuleSetInfoEntry 4 }

flowRuleInfoStatus OBJECT-TYPE
    SYNTAX  RowStatus
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "The status of this rule set.  If this object's value is
        not active(1), the meter must not attempt to use this
        rule set."
    ::= { flowRuleSetInfoEntry 5 }

--
-- Control Group:  Interface Info Table
--

flowInterfaceTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF FlowInterfaceEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
```

```
        "An array of information specific to each meter interface."
    ::= { flowControl 2 }

flowInterfaceEntry OBJECT-TYPE
    SYNTAX  FlowInterfaceEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "Information about a particular interface."
    INDEX   { ifIndex }
    ::= { flowInterfaceTable 1 }

FlowInterfaceEntry ::= SEQUENCE {
    flowInterfaceRate         Integer32,
    flowInterfaceLostPackets  Counter32
    }

flowInterfaceRate OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-write
    STATUS  current
    DESCRIPTION
        "The parameter N for statistical counting on this interface.
        Set to N to count 1/Nth of the packets appearing at this
        interface.  A meter should choose its own algorithm to
        introduce variance into the sampling so that exactly every Nth
        packet is not counted.  A sampling rate of 1 counts all
        packets.  A sampling rate of 0 results in the interface
        being ignored by the meter."
    ::= { flowInterfaceEntry 1 }

flowInterfaceLostPackets OBJECT-TYPE
    SYNTAX  Counter32
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The number of packets the meter has lost for this interface.
        Such losses may occur because the meter has been unable to
        keep up with the traffic volume."
    ::= { flowInterfaceEntry 2 }

--
-- Control Group:  Meter Reader Info Table
--

-- Any meter reader wishing to collect data reliably for all flows
-- should first create a row in this table.  It should write that
-- row's flowReaderLastTime object each time it starts a collection
```

```
-- pass through the flow table.

-- The meter will not recover a flow's memory until every meter reader
-- holding a row in this table has collected that flow's data.

-- If a meter reader does not create a row in this table, e.g. because
-- it failed authentication in the meter's SNMP write community,
-- collection can still proceed but the meter may not be able to
-- recover inactive flows.

flowReaderInfoTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF FlowReaderInfoEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "An array of information about meter readers which have
        registered their intent to collect flow data from this meter."
    ::= { flowControl 3 }

flowReaderInfoEntry OBJECT-TYPE
    SYNTAX  FlowReaderInfoEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "Information about a particular meter reader."
    INDEX  { flowReaderIndex }
    ::= { flowReaderInfoTable 1 }

FlowReaderInfoEntry ::= SEQUENCE {
    flowReaderIndex            Integer32,
    flowReaderTimeout          Integer32,
    flowReaderOwner            OwnerString,
    flowReaderLastTime         TimeStamp,
    flowReaderPreviousTime     TimeStamp,
    flowReaderStatus           RowStatus
    }

flowReaderIndex OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "Selects an entry from the array of meter reader info entries."
    ::= { flowReaderInfoEntry 1 }

flowReaderTimeout OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-create
```

```
    STATUS  current
    DESCRIPTION
        "Specifies the maximum time (in seconds) between flow data
        collections for this meter reader.  If this time elapses
        without a collection, the meter should assume that this meter
        reader has stopped collecting, and delete this row from the
        table."
    ::= { flowReaderInfoEntry 2 }

flowReaderOwner OBJECT-TYPE
    SYNTAX  OwnerString
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "Identifies the meter reader which created this row."
    ::= { flowReaderInfoEntry 3 }

flowReaderLastTime OBJECT-TYPE
    SYNTAX  TimeStamp
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "Time this meter reader began its most recent data collection.

        This variable should be written by a meter reader as the first
        step in reading flow data.  The meter will set this LastTime
        value to sysUptime and set its PreviousTime value (below) to
        the old  LastTime.  This allows the meter to recover flows
        which have been inactive since PreviousTime, for these have
        been collected at least once.

        If the meter fails to write flowLastReadTime, e.g. by
        failing authentication in the meter's SNMP write community,
        collection may still proceed but the meter may not be able to
        recover inactive flows."
    ::= { flowReaderInfoEntry 4 }

flowReaderPreviousTime OBJECT-TYPE
    SYNTAX  TimeStamp
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Time this meter reader began the collection before last."
    ::= { flowReaderInfoEntry 5 }

flowReaderStatus OBJECT-TYPE
    SYNTAX  RowStatus
    MAX-ACCESS  read-create
```

```
    STATUS  current
    DESCRIPTION
        "The status of this meter reader."
    ::= { flowReaderInfoEntry 6 }

--
-- Control Group:  Manager Info Table
--

-- Any manager wishing to download rule sets to the meter must create
-- a row in this table.  Once it has a table row, the manager may set
-- the control variables in its row so as to cause the meter to run
-- any valid rule set held by the meter.

flowManagerInfoTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF FlowManagerInfoEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "An array of information about managers which have
        registered their intent to run rule sets on this meter."
    ::= { flowControl 4 }

flowManagerInfoEntry OBJECT-TYPE
    SYNTAX  FlowManagerInfoEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "Information about a particular meter reader."
    INDEX  { flowManagerIndex }
    ::= { flowManagerInfoTable 1 }

FlowManagerInfoEntry ::= SEQUENCE {
    flowManagerIndex           Integer32,
    flowManagerCurrentRuleSet  Integer32,
    flowManagerStandbyRuleSet  Integer32,
    flowManagerHighWaterMark   INTEGER,
    flowManagerCounterWrap     INTEGER,
    flowManagerOwner           OwnerString,
    flowManagerTimeStamp       TimeStamp,
    flowManagerStatus          RowStatus
    }

flowManagerIndex OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
```

```
        "Selects an entry from the array of manager info entries."
    ::= { flowManagerInfoEntry 1 }

flowManagerCurrentRuleSet OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "Index to the array of rule sets.  Specifies which set of
        rules is currently being used for accounting by this manager.
        When the manager sets this variable the meter will close its
        current rule set and start using the new one.  Flows created
        by the old rule set remain in memory, orphaned until their
        data has been read.  Specifying rule set 0 (the empty set)
        stops flow measurement by this manager."
    ::= { flowManagerInfoEntry 2 }

flowManagerStandbyRuleSet OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "Index to the array of rule sets.  After reaching
        HighWaterMark (see below) the manager may switch to using its
        standby rule set.  For this to be effective the manager should
        have downloaded a standby rule set which uses a coarser
        reporting granularity.  The manager may also need to
        decrease the meter reading interval so that the meter can
        recover flows measured by its normal rule set."
    DEFVAL { 0 }  -- No standby
    ::= { flowManagerInfoEntry 3 }

flowManagerHighWaterMark OBJECT-TYPE
    SYNTAX  INTEGER (0..100)
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "A value expressed as a percentage, interpreted by the meter
        as an indication of how full the flow table should be before
        it should switch to the standby rule set (if one has been
        specified) forthis manager.  Values of 0% or 100% disable
        the checking represented by this variable."
    ::= { flowManagerInfoEntry 4 }

flowManagerCounterWrap OBJECT-TYPE
    SYNTAX  INTEGER { wrap(1), scale(2) }
    MAX-ACCESS  read-create
    STATUS  current
```

```
    DESCRIPTION
        "Specifies whether PDU and octet counters should wrap when
        they reach the top of their range (normal behaviour for
        Counter32 objects), or whether their scale factors should
        be used instead.  The combination of counter and scale
        factor allows counts to be returned as binary floating
        point numbers, with 32-bit mantissas and 8-bit exponents."
    DEFVAL { wrap }
    ::= { flowManagerInfoEntry 5 }

flowManagerOwner OBJECT-TYPE
    SYNTAX  OwnerString
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "Identifies the manager which created this row."
    ::= { flowManagerInfoEntry 6 }

flowManagerTimeStamp OBJECT-TYPE
    SYNTAX  TimeStamp
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "Time this row was last changed by its manager."
    ::= { flowManagerInfoEntry 7 }

flowManagerStatus OBJECT-TYPE
    SYNTAX  RowStatus
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "The status of this manager."
    ::= { flowManagerInfoEntry 8 }

--
-- Control Group:  General Meter Control Variables
--

-- At present the meter only runs a single rule set  - the 'current'
-- one and has a single 'standby' rule set.  In future it may be
-- developed so as to run multiple rule sets simultaneously; that would
-- require a more elaborate set of control variables to allow reliable
-- operation.

flowFloodMark OBJECT-TYPE
    SYNTAX  INTEGER (0..100)
    MAX-ACCESS  read-write
    STATUS  current
```

```
    DESCRIPTION
        "A value expressed as a percentage, interpreted by the meter
        as an indication of how full the flow table should be before
        it should take some action to avoid running out of resources
        to handle new flows.  Values of 0% or 100% disable the
        checking represented by this variable."
    ::= { flowControl 5 }

flowInactivityTimeout OBJECT-TYPE
    SYNTAX  Integer32 (1..3600)
    MAX-ACCESS  read-write
    STATUS  current
    DESCRIPTION
        "The time in seconds since the last packet seen, after
        which the flow may be terminated.  Note that although a
        flow may have been terminated, its data must be collected
        before its memory can be recovered."
    DEFVAL { 600 } -- 10 minutes
    ::= { flowControl 6 }

flowActiveFlows OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The numbers of flows which are currently in use, i.e. have
        been active since the last collection."
    ::= { flowControl 7 }

flowMaxFlows OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The maximum number of flows allowed in the meter's
        flow table.  At present this is determined when the meter
        is first started up."
    ::= { flowControl 8 }


--
-- The Flow Table
--

-- This is a table kept by a meter, with one flow data entry for every
-- flow being measured.  Each flow data entry stores the attribute
-- values for a traffic flow.  Details of flows and their attributes
-- are given in the 'Traffic Flow Measurement: Architecture'
```

```
-- document [9].

-- From time to time a meter reader may sweep the flow table so as
-- to read counts.  This is most effectively achieved by using the
-- TimeMark variable together with successive GetBulk requests to
-- retrieve the values of the desired flow attribute variables.

-- This scheme allows multiple meter readers to independently use the
-- same meter; the meter readers do not have to be synchronised and
-- they may use different collection intervals.

flowDataTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF FlowDataEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "The list of all flows being measured."
    ::= { flowData 1 }

flowDataEntry OBJECT-TYPE
    SYNTAX  FlowDataEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "The flow data record for a particular flow."
    INDEX { flowDataTimeMark, flowDataIndex }
    ::= { flowDataTable 1 }

FlowDataEntry ::= SEQUENCE {
    flowDataIndex                   Integer32,
    flowDataTimeMark                TimeFilter,
    flowDataStatus                  INTEGER,

    flowDataSourceInterface         Integer32,
    flowDataSourceAdjacentType      AddressType,
    flowDataSourceAdjacentAddress   AdjacentAddress,
    flowDataSourceAdjacentMask      AdjacentAddress,
    flowDataSourcePeerType          AddressType,
    flowDataSourcePeerAddress       PeerAddress,
    flowDataSourcePeerMask          PeerAddress,
    flowDataSourceTransType         INTEGER,
    flowDataSourceTransAddress      TransportAddress,
    flowDataSourceTransMask         TransportAddress,

    flowDataDestInterface           Integer32,
    flowDataDestAdjacentType        AddressType,
    flowDataDestAdjacentAddress     AdjacentAddress,
    flowDataDestAdjacentMask        AdjacentAddress,
```

```
    flowDataDestPeerType            AddressType,
    flowDataDestPeerAddress         PeerAddress,
    flowDataDestPeerMask            PeerAddress,
    flowDataDestTransType           INTEGER,
    flowDataDestTransAddress        TransportAddress,
    flowDataDestTransMask           TransportAddress,

    flowDataPDUScale                INTEGER,
    flowDataOctetScale              INTEGER,

    flowDataRuleSet                 INTEGER,

    flowDataToOctets                Counter32,    -- Source->Dest
    flowDataToPDUs                  Counter32,
    flowDataFromOctets              Counter32,    -- Dest->Source
    flowDataFromPDUs                Counter32,
    flowDataFirstTime               TimeTicks,    -- Activity times
    flowDataLastActiveTime          TimeTicks,

    flowDataSourceSubscriberID      OCTET STRING,
    flowDataDestSubscriberID        OCTET STRING,
    flowDataSessionID               OCTET STRING,

    flowDataSourceClass             INTEGER,
    flowDataDestClass               INTEGER,
    flowDataClass                   INTEGER,
    flowDataSourceKind              INTEGER,
    flowDataDestKind                INTEGER,
    flowDataKind                    INTEGER
    }

flowDataIndex OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Value of this flow data record's index within the meter's
        flow table."
    ::= { flowDataEntry 1 }

flowDataTimeMark OBJECT-TYPE
    SYNTAX  TimeFilter
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "A TimeFilter for this entry.  Allows GetNext and GetBulk
        to find flow table rows which have changed since a specified
        value of sysUptime."
```

```
    ::= { flowDataEntry 2 }

flowDataStatus OBJECT-TYPE
    SYNTAX  INTEGER { inactive(1), current(2), idle(3) }
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Status of this flow data record."
    ::= { flowDataEntry 3 }

flowDataSourceInterface OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Index of the interface associated with the source address
        for this flow.  It's value is one of those contained in the
        ifIndex field of the meter's interfaces table."
    ::= { flowDataEntry 4 }

flowDataSourceAdjacentType OBJECT-TYPE
    SYNTAX  AddressType
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Adjacent address type of the source for this flow.  If
        accounting is being performed at the network level the
        adjacent address will probably be an 802 MAC address, and
        the adjacent address type will indicate the medium type."
    ::= { flowDataEntry 5 }

flowDataSourceAdjacentAddress OBJECT-TYPE
    SYNTAX  AdjacentAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Address of the adjacent device on the path for the source
        for this flow."
    ::= { flowDataEntry 6 }

flowDataSourceAdjacentMask OBJECT-TYPE
    SYNTAX  AdjacentAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "1-bits in this mask indicate which bits must match when
        comparing the adjacent source address for this flow."
    ::= { flowDataEntry 7 }
```

```
flowDataSourcePeerType OBJECT-TYPE
    SYNTAX  AddressType
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Peer address type of the source for this flow."
    ::= { flowDataEntry 8 }

flowDataSourcePeerAddress OBJECT-TYPE
    SYNTAX  PeerAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Address of the peer device for the source of this flow."
    ::= { flowDataEntry 9 }

flowDataSourcePeerMask OBJECT-TYPE
    SYNTAX  PeerAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "1-bits in this mask indicate which bits must match when
        comparing the source peer address for this flow."
    ::= { flowDataEntry 10 }

flowDataSourceTransType OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Transport address type of the source for this flow.  The
        value of this attribute will depend on the peer address type."
    ::= { flowDataEntry 11 }

flowDataSourceTransAddress OBJECT-TYPE
    SYNTAX  TransportAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Transport address for the source of this flow."
    ::= { flowDataEntry 12 }

flowDataSourceTransMask OBJECT-TYPE
    SYNTAX  TransportAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "1-bits in this mask indicate which bits must match when
```

```
        comparing the transport source address for this flow."
    ::= { flowDataEntry 13 }

flowDataDestInterface OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Index of the interface associated with the dest address for
        this flow.  This value is one of the values contained in the
        ifIndex field of the interfaces table."
    ::= { flowDataEntry 14 }

flowDataDestAdjacentType OBJECT-TYPE
    SYNTAX  AddressType
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Adjacent address type of the destination for this flow."
    ::= { flowDataEntry 15 }

flowDataDestAdjacentAddress OBJECT-TYPE
    SYNTAX  AdjacentAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Address of the adjacent device on the path for the
        destination for this flow."
    ::= { flowDataEntry 16 }

flowDataDestAdjacentMask OBJECT-TYPE
    SYNTAX  AdjacentAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "1-bits in this mask indicate which bits must match when
        comparing the adjacent dest address for this flow."
    ::= { flowDataEntry 17 }

flowDataDestPeerType OBJECT-TYPE
    SYNTAX  AddressType
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Peer address type of the destination for this flow."
    ::= { flowDataEntry 18 }

flowDataDestPeerAddress OBJECT-TYPE
```

```
    SYNTAX  PeerAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Address of the peer device for the destination of this flow."
    ::= { flowDataEntry 19 }

flowDataDestPeerMask OBJECT-TYPE
    SYNTAX  PeerAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "1-bits in this mask indicate which bits must match when
        comparing the dest peer type for this flow."
    ::= { flowDataEntry 20 }

flowDataDestTransType OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Transport address type of the destination for this flow.  The
        value of this attribute will depend on the peer address type."
    ::= { flowDataEntry 21 }

flowDataDestTransAddress OBJECT-TYPE
    SYNTAX  TransportAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Transport address for the destination of this flow."
    ::= { flowDataEntry 22 }

flowDataDestTransMask OBJECT-TYPE
    SYNTAX  TransportAddress
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "1-bits in this mask indicate which bits must match when
        comparing the transport destination address for this flow."
    ::= { flowDataEntry 23 }

flowDataPDUScale OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The scale factor applied to this particular flow.  Indicates
```

```
        the number of bits the PDU counter values should be moved left
        to obtain the actual values."
    ::= { flowDataEntry 24 }

flowDataOctetScale OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The scale factor applied to this particular flow.  Indicates
        the number of bits the octet counter values should be moved
        left to obtain the actual values."
    ::= { flowDataEntry 25 }

flowDataRuleSet OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The RuleSet number of the rule set which created this flow."
    ::= { flowDataEntry 26 }

flowDataToOctets OBJECT-TYPE
    SYNTAX  Counter32
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The count of octets flowing from source to dest address and
        being delivered to the protocol level being metered.  In the
        case of IP this would count the number of octets delivered to
        the IP level."
    ::= { flowDataEntry 27 }

flowDataToPDUs OBJECT-TYPE
    SYNTAX  Counter32
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The count of protocol packets flowing from source to dest
        address and being delivered to the protocol level being
        metered.  In the case of IP, for example, this would count the
        IP packets delivered to the IP protocol level."
    ::= { flowDataEntry 28 }

flowDataFromOctets OBJECT-TYPE
    SYNTAX  Counter32
    MAX-ACCESS  read-only
    STATUS  current
```

```
    DESCRIPTION
        "The count of octets flowing from dest to source address and
        being delivered to the protocol level being metered."
    ::= { flowDataEntry 29 }

flowDataFromPDUs OBJECT-TYPE
    SYNTAX  Counter32
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The count of protocol packets flowing from dest to source
        address and being delivered to the protocol level being
        metered.  In the case of IP, for example, this would count
        the IP packets delivered to the IP protocol level."
    ::= { flowDataEntry 30 }

flowDataFirstTime OBJECT-TYPE
    SYNTAX  TimeTicks
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The time at which this flow was first entered in the table"
    ::= { flowDataEntry 31 }

flowDataLastActiveTime OBJECT-TYPE
    SYNTAX  TimeTicks
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "The last time this flow had activity, i.e. the time of
        arrival of the most recent PDU belonging to this flow."
    ::= { flowDataEntry 32 }

flowDataSourceSubscriberID OBJECT-TYPE
    SYNTAX  OCTET STRING (SIZE (4..20))
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Subscriber ID associated with the source address for this
        flow."
    ::= { flowDataEntry 33 }

flowDataDestSubscriberID OBJECT-TYPE
    SYNTAX  OCTET STRING (SIZE (4..20))
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Subscriber ID associated with the dest address for this
```

```
        flow."
    ::= { flowDataEntry 34 }

flowDataSessionID OBJECT-TYPE
    SYNTAX  OCTET STRING (SIZE (4..10))
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Session ID for this flow.  Such an ID might be allocated
        by a network access server to distinguish a series of sessions
        between the same pair of addresses, which would otherwise
        appear to be parts of the same accounting flow."
    ::= { flowDataEntry 35 }

flowDataSourceClass OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Source class for this flow.  Determined by the rules, set by
        a PushRule action when this flow was entered in the table."
    ::= { flowDataEntry 36 }

flowDataDestClass OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Destination class for this flow.  Determined by the rules, set
        by a PushRule action when this flow was entered in the table."
    ::= { flowDataEntry 37 }

flowDataClass OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Class for this flow.  Determined by the rules, set by a
        PushRule action when this flow was entered in the table."
    ::= { flowDataEntry 38 }

flowDataSourceKind OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Source kind for this flow.  Determined by the rules, set by
        a PushRule action when this flow was entered in the table."
```

```
    ::= { flowDataEntry 39 }

flowDataDestKind OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Destination kind for this flow.  Determined by the rules, set
        by a PushRule action when this flow was entered in the table."
    ::= { flowDataEntry 40 }

flowDataKind OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Class for this flow.  Determined by the rules, set by a
        PushRule action when this flow was entered in the table."
    ::= { flowDataEntry 41 }


--
-- The Activity Column Table
--

flowColumnActivityTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF FlowColumnActivityEntry
    MAX-ACCESS  not-accessible
    STATUS   current
    DESCRIPTION
        "Index into the Flow Table.  Allows a meter reader to retrieve
        a list containing the flow table indeces of flows which were
        last active at or after a given time, together with the values
        of a specified attribute for each such flow."
    ::= { flowData 2 }

flowColumnActivityEntry OBJECT-TYPE
    SYNTAX  FlowColumnActivityEntry
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "The Column Activity Entry for a particular attribute,
        activity time and flow."
    INDEX { flowColumnActivityAttribute, flowColumnActivityTime,
            flowColumnActivityIndex }
    ::= { flowColumnActivityTable 1 }

FlowColumnActivityEntry ::= SEQUENCE {
```

```
    flowColumnActivityAttribute   FlowAttributeNumber,
    flowColumnActivityTime        TimeFilter,
    flowColumnActivityIndex       Integer32,
    flowColumnActivityData        OCTET STRING
    }

flowColumnActivityAttribute OBJECT-TYPE
    SYNTAX  FlowAttributeNumber
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Specifies the attribute for which values are required from
        active flows."
    ::= { flowColumnActivityEntry 1 }

flowColumnActivityTime OBJECT-TYPE
    SYNTAX  TimeFilter
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "This variable is a copy of flowDataLastActiveTime in the
        flow data record identified by the flowColumnActivityIndex
        value of this flowColumnActivityTable entry."
    ::= { flowColumnActivityEntry 2 }

flowColumnActivityIndex OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Index of a flow table entry which was active at or after
        a specified flowColumnActivityTime."
    ::= { flowColumnActivityEntry 3 }

flowColumnActivityData OBJECT-TYPE
    SYNTAX  OCTET STRING (SIZE (3..1000))
    MAX-ACCESS  read-only
    STATUS  current
    DESCRIPTION
        "Collection of attribute data for flows active after
        flowColumnActivityTime.  Within the OCTET STRING is a
        sequence of { flow index, attribute value } pairs, one for
        each active flow.  The end of the sequence is marked by a
        flow index value of 0, indicating that there are no more
        rows in this column.

        The format of objects inside flowColumnFlowData is as follows.
        All numbers are unsigned.  Numbers and strings appear with
```

```
        their high-order bytes leading.  Numbers are fixed size, as
        specified by their SYNTAX in the flow table (above), i.e. one
        octet for flowAddressType and small constants, and four octets
        for Counter and Timeticks.  Strings are variable-length, with
        the length given in a single leading octet.

        The following is an attempt at an ASN.1 definition of
        flowColumnActivityData:

        flowColumnActivityData ::= SEQUENCE flowRowItemEntry
        flowRowItemEntry ::= SEQUENCE {
           flowRowNumber    INTEGER (1..65535),
                                -- 0 indicates the end of this column
           flowDataValue   flowDataType -- Choice depends on attribute
           }
        flowDataType ::= CHOICE {
            flowByteValue   INTEGER (1..255),
            flowShortValue  INTEGER (1..65535),
            flowLongValue   Integer32,
            flowStringValue OCTET STRING  -- Length (n) in first byte,
                  -- n+1 bytes total length, trailing zeroes truncated
            }"
    ::= { flowColumnActivityEntry 4 }


--
-- The Rule Table
--

-- This is an array of rule tables; the one in use is selected by
-- CurrentRuleSet.  To change the rule set the manager chooses a set
-- number which is not in use, downloads the new rule set there, then
-- writes the new set number into CurrentRuleSet.  Rule set 1 is the
-- default rule set, used by the meter on start-up.  Several rule sets
-- can be held in a meter so that the manager can change the rules
-- easily, for example with time of day.  Note that a manager may
-- not change the default rule set, nor the rules in its current rule
-- set!  See the 'Traffic Flow Measurement: Architecture' document [9]
-- for details of rules and how they are used.

flowRuleTable OBJECT-TYPE
    SYNTAX  SEQUENCE OF FlowRuleEntry
    MAX-ACCESS  not-accessible
    STATUS   current
    DESCRIPTION
        "Contains all the rule sets which may be used by the meter."
    ::= { flowRules 1 }
```

```
flowRuleEntry OBJECT-TYPE
    SYNTAX  FlowRuleEntry
    MAX-ACCESS  not-accessible
    STATUS   current
    DESCRIPTION
        "The rule record itself."
    INDEX { flowRuleSet, flowRuleIndex }
    ::= { flowRuleTable 1 }

FlowRuleEntry ::= SEQUENCE {
    flowRuleSet                 INTEGER,
    flowRuleIndex               INTEGER,
    flowRuleSelector            RuleAttributeNumber,
    flowRuleMask                RuleAddress,
    flowRuleMatchedValue        RuleAddress,
    flowRuleAction              ActionNumber,
    flowRuleParameter           Integer32
    }

flowRuleSet OBJECT-TYPE
    SYNTAX  INTEGER (1..255)
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "Selects a rule set from the array of rule sets."
    ::= { flowRuleEntry 1 }

flowRuleIndex OBJECT-TYPE
    SYNTAX  INTEGER (1..65535)
    MAX-ACCESS  not-accessible
    STATUS  current
    DESCRIPTION
        "The index into the Rule table.  N.B: These values will
        often be consecutive, given the fall-through semantics of
        processing the table."
    ::= { flowRuleEntry 2 }

flowRuleSelector OBJECT-TYPE
    SYNTAX  RuleAttributeNumber
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "Indicates the attribute to be matched.

        null(0) is a special case; null rules always succeed.

        v1(51), v2(52), v3(53), v4(54) and v5(55) select meter
        variables, each of which can hold the name (i.e. selector
```

```
        value) of an address attribute.  When one of these is used
        as a selector, its value specifies the attribute to be
        tested.  Variable values are set by an Assign action."
    ::= { flowRuleEntry 3 }

flowRuleMask OBJECT-TYPE
    SYNTAX  RuleAddress
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "The initial mask used to compute the desired value.  If the
        mask is zero the rule's test will always succeed."
    ::= { flowRuleEntry 4 }

flowRuleMatchedValue OBJECT-TYPE
    SYNTAX  RuleAddress
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "The resulting value to be matched for equality.
        Specifically, if the attribute chosen by the flowRuleSelector
        logically ANDed with the mask specified by the flowRuleMask
        equals the value specified in the flowRuleMatchedValue, then
        continue processing the table entry based on the action
        specified by the flowRuleAction entry.  Otherwise, proceed to
        the next entry in the rule table."
    ::= { flowRuleEntry 5 }

flowRuleAction OBJECT-TYPE
    SYNTAX  ActionNumber
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "The action to be taken if this rule's test succeeds, or if
        the meter's 'test' flag is off.  Actions are opcodes for the
        meter's Packet Matching Engine; details are given in the
        'Traffic Flow Measurement: Architecture' document [9]."
    ::= { flowRuleEntry 6 }

flowRuleParameter OBJECT-TYPE
    SYNTAX  Integer32
    MAX-ACCESS  read-create
    STATUS  current
    DESCRIPTION
        "A parameter value providing extra information for the
        rule's action."
    ::= { flowRuleEntry 7 }
```

```
--
-- Traffic Flow Meter conformance statement
--

flowMIBCompliances
    OBJECT IDENTIFIER ::= { flowMIBConformance 1 }

flowMIBGroups
    OBJECT IDENTIFIER ::= { flowMIBConformance 2 }

flowControlGroup OBJECT-GROUP
    OBJECTS  {
        flowRuleInfoSize, flowRuleInfoOwner,
            flowRuleInfoTimeStamp, flowRuleInfoStatus,
        flowInterfaceRate,
            flowInterfaceLostPackets,
        flowReaderTimeout, flowReaderOwner,
            flowReaderLastTime, flowReaderPreviousTime,
            flowReaderStatus,
        flowManagerCurrentRuleSet, flowManagerStandbyRuleSet,
            flowManagerHighWaterMark,
            flowManagerOwner, flowManagerTimeStamp,
            flowManagerStatus,
        flowFloodMark,
            flowInactivityTimeout,
            flowActiveFlows,
            flowMaxFlows }
    STATUS  current
    DESCRIPTION
        "The control group defines objects which are used to control
        an accounting meter."
    ::= {flowMIBGroups 1 }

flowDataTableGroup OBJECT-GROUP
    OBJECTS  {
        flowDataIndex,
        flowDataStatus,
        flowDataSourceInterface,
        flowDataSourceAdjacentType,
        flowDataSourceAdjacentAddress, flowDataSourceAdjacentMask,
        flowDataSourcePeerType,
        flowDataSourcePeerAddress, flowDataSourcePeerMask,
        flowDataSourceTransType,
        flowDataSourceTransAddress, flowDataSourceTransMask,
        flowDataDestInterface,
        flowDataDestAdjacentType,
        flowDataDestAdjacentAddress, flowDataDestAdjacentMask,
        flowDataDestPeerType,
```

```
        flowDataDestPeerAddress, flowDataDestPeerMask,
        flowDataDestTransType,
        flowDataDestTransAddress, flowDataDestTransMask,
        flowDataRuleSet,
        flowDataToOctets, flowDataToPDUs,
        flowDataFromOctets, flowDataFromPDUs,
        flowDataFirstTime, flowDataLastActiveTime,
        flowDataSourceClass, flowDataDestClass, flowDataClass,
        flowDataSourceKind, flowDataDestKind, flowDataKind
        }
    STATUS  current
    DESCRIPTION
        "The flow table group defines objects which provide the
        structure for the rule table, including the creation time
        and activity time indexes into it.  In addition it defines
        objects which provide a base set of flow attributes for the
        adjacent, peer and transport layers, together with a flow's
        counters and times.  Finally it defines a flow's class and
        kind attributes, which are set by rule actions."
    ::= {flowMIBGroups 2 }

flowDataScaleGroup OBJECT-GROUP
    OBJECTS  {
        flowManagerCounterWrap,
        flowDataPDUScale, flowDataOctetScale
        }
    STATUS  current
    DESCRIPTION
        "The flow scale group defines objects which specify scale
        factors for counters."
    ::= {flowMIBGroups 3 }

flowDataSubscriberGroup OBJECT-GROUP
    OBJECTS  {
        flowDataSourceSubscriberID, flowDataDestSubscriberID,
        flowDataSessionID
        }
    STATUS  current
    DESCRIPTION
        "The flow subscriber group defines objects which may be used
        to identify the end point(s) of a flow."
    ::= {flowMIBGroups 4 }

flowDataColumnTableGroup OBJECT-GROUP
    OBJECTS  {
        flowColumnActivityAttribute,
        flowColumnActivityTime,
        flowColumnActivityIndex,
```

```
        flowColumnActivityData
        }
    STATUS  current
    DESCRIPTION
        "The flow column table group defines objects which can be used
        to collect part of a column of attribute values from the flow
        table."
    ::= {flowMIBGroups 5 }

flowRuleTableGroup OBJECT-GROUP
    OBJECTS  {
        flowRuleSelector,
        flowRuleMask, flowRuleMatchedValue,
        flowRuleAction, flowRuleParameter
        }
    STATUS  current
    DESCRIPTION
        "The rule table group defines objects which hold the set(s)
        of rules specifying which traffic flows are to be accounted
        for."
    ::= {flowMIBGroups 6 }

flowMIBCompliance MODULE-COMPLIANCE
    STATUS  current
    DESCRIPTION
        "The compliance statement for a Traffic Flow Meter."
    MODULE
        MANDATORY-GROUPS  {
            flowControlGroup,
            flowDataTableGroup,
            flowRuleTableGroup
            }
    ::= { flowMIBCompliances 1 }

END
```

5 Acknowledgements

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6 References

[1] McCloghrie, K., and M. Rose, Editors, "Management Information Base for Network Management of TCP/IP-based internets," STD 17, RFC 1213, Performance Systems International, March 1991.

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7 Security Considerations

Security issues are not discussed in this document.

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