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Definitions of Managed Objects for IP Flow Information Export
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Abstract

This document defines managed objects for IP Flow Information Export (IPFIX). These objects provide information for monitoring IPFIX Exporters and IPFIX Collectors including the basic configuration information.

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1. Introduction

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This document defines two MIB modules for monitoring IP Flow Information Export (IPFIX) Devices including Exporters and Collectors. Most of the objects defined by the IPFIX MIB module MUST be implemented. Some objects MAY be implemented corresponding to the functionality implemented in the equipment. Since the IPFIX architecture [RFC5470] (Sadasivan, G., Brownlee, N., Claise, B., and J. Quittek, “Architecture for IP Flow Information Export,” March 2009.) foresees the possibility of using Filtering and/or Sampling functions to reduce the data volume this document also provides the IPFIX SELECTOR MIB module which contains the standardized selection methods and is controlled by IANA. The full configuration of the IPFIX Metering Process is out of the scope of these MIB modules.
The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 (Bradner, S., “Key words for use in RFCs to Indicate Requirement Levels,” March 1997.) [RFC2119].

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2. IPFIX Documents Overview

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The IPFIX protocol provides network administrators with access to IP Flow information. The architecture for the export of measured IP Flow information out of an IPFIX Exporting Process to a Collecting Process is defined in [RFC5470] (Sadasivan, G., Brownlee, N., Claise, B., and J. Quittek, “Architecture for IP Flow Information Export,” March 2009.), per the requirements defined in [RFC3917] (Quittek, J., Zseby, T., Claise, B., and S. Zander, “Requirements for IP Flow Information Export (IPFIX),” October 2004.). The protocol document [RFC5101] (Claise, B., “Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information,” January 2008.) specifies how IPFIX Data Records and Templates are carried via a congestion-aware transport protocol from IPFIX Exporting Processes to IPFIX Collecting Processes. IPFIX has a formal description

of IPFIX Information Elements, their name, type and additional semantic information, as specified in [RFC5102] (Quittek, J., Bryant, S., Claise, B., Aitken, P., and J. Meyer, "Information Model for IP Flow Information Export," January 2008.). Finally [RFC5472] (Zseby, T., Boschi, E., Brownlee, N., and B. Claise, "IP Flow Information Export (IPFIX) Applicability," March 2009.) describes what type of applications can use the IPFIX protocol and how they can use the information provided. It furthermore shows how the IPFIX framework relates to other architectures and frameworks.
It is assumed that Flow metering, export and collection is performed according to the IPFIX architecture defined in [RFC5470] (Sadasivan, G., Brownlee, N., Claise, B., and J. Quittek, "Architecture for IP Flow Information Export," March 2009.). The monitored configuration parameters of the export and collection of Flow Templates and Data Records is modeled according to [RFC5101] (Claise, B., "Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information," January 2008.). Packet selection methods that may be optionally used by the IPFIX Metering Process are not considered in this MIB module. They are defined in the Packet Sampling (PSAMP) framework [RFC5474] (Duffield, N., Chiou, D., Claise, B., Greenberg, A., Grossglauser, M., and J. Rexford, "A Framework for Packet Selection and Reporting," March 2009.) and Sampling techniques [RFC5475] (Zseby, T., Molina, M., Duffield, N., Niccolini, S., and F. Raspall, "Sampling and Filtering Techniques for IP Packet Selection," March 2009.) documents. Nevertheless the basis for defining Sampling and Filtering functions is given with the IPFIX SELECTOR MIB module. Since the PSAMP export protocol [RFC5476] (Claise, B., Johnson, A., and J. Quittek, "Packet Sampling (PSAMP) Protocol Specifications," March 2009.) is based on the IPFIX protocol the Sampling and Filtering functions can be added to the IPFIX SELECTOR MIB module as needed.

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3. The Internet-Standard Management Framework

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For a detailed overview of the documents that describe the current Internet-Standard Management Framework, please refer to section 7 of RFC 3410 (Case, J., Mundy, R., Partain, D., and B. Stewart, "Introduction and Applicability Statements for Internet-Standard Management Framework," December 2002.) [RFC3410].
Managed objects are accessed via a virtual information store, termed the Management Information Base or MIB. MIB objects are generally accessed through the Simple Network Management Protocol (SNMP). Objects in the MIB are defined using the mechanisms defined in the Structure of Management Information (SMI). This memo specifies MIB modules that are compliant to the SMIv2, which is described in STD 58, RFC 2578 (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Structure of Management Information Version 2 (SMIv2)," April 1999.)

[RFC2578], STD 58, RFC 2579 (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., "Textual Conventions for SMIv2," April 1999.) [RFC2579] and STD 58, RFC 2580 (McCloghrie, K., Perkins, D., and J. Schoenwaelder, "Conformance Statements for SMIv2," April 1999.) [RFC2580].

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4. Terminology

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The definitions of the basic terms like IP Traffic Flow, Exporting Process, Collecting Process, Observation Points, etc. can be found in the IPFIX protocol document [RFC5101] (Claise, B., "Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information," January 2008.).

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5. Structure of the IPFIX MIB

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The IPFIX MIB module consists of seven main tables, the Transport Session table, the Template table and the corresponding Template Definition table, the Export table, the Metering Process table, the Observation Point table and the Selection Process table. Since the IPFIX architecture [RFC5470] (Sadasivan, G., Brownlee, N., Claise, B., and J. Quittek, "Architecture for IP Flow Information Export," March 2009.) foresees the possibility of using Filtering and/or Sampling functions to reduce the data volume the MIB module provides the basic objects for these functions with the Selection Process table. The IPFIX SELECTOR MIB module defined in the next section provides the standard Filtering and Sampling functions that can be referenced in the ipfixSelectionProcessTable.
All remaining objects contain statistical values for the different tables contained in the MIB module.
The following subsections describe all tables in the IPFIX MIB module.

5.1. The Transport Session Table

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The Transport Session is the basis of the MIB module. The Transport Session table (ipfixTransportSessionTable) contains all Transport Sessions between Exporter and Collector. The table specifies the transport layer protocol of the Transport Session and, depending on that protocol, further parameters for the Transport Session. In case of UDP and TCP these are the source and destination address as well as the source and destination port. For SCTP the table contains the SCTP Assoc

Id which is the index for the SCTP association in the SCTP MIB module [RFC3873] (Pastor, J. and M. Belinchon, “Stream Control Transmission Protocol (SCTP) Management Information Base (MIB),” September 2004.). The mode of operation of the device, i.e. if the Transport Session is used for collecting or exporting is given in the ipfixTransportSessionDeviceMode object. Further on it contains the configured refresh parameters for Templates and Options Templates that are used across unreliable connections as UDP. Finally the IPFIX version which is exported or collected by this Transport Session and a status of the Transport Session is given in the table.

To illustrate the use of the above tables let us assume the following scenario: We have an Exporter on IP address 192.0.2.22 and a Collector on IP address 192.0.2.37. The Exporter uses TCP to export Templates and Data Records. The same Exporter also exports, with UDP, to a Collector with the IP address of 192.0.2.44. This would lead to the following Transport Session table on the Exporter:

```
ipfixTransportSessionTable (1)
|
+- ipfixTransportSessionEntry (1)
   |
   +- index (5) (ipfixTransportSessionIndex)
   |  +- ipfixTransportSessionIndex (1) = 5
   |  +- ipfixTransportSessionProtocol (2) = 6 (TCP)
   |  +- ipfixTransportSessionSourceAddressType (3) = 1 (ipv4)
   |  +- ipfixTransportSessionSourceAddress (4) = 192.0.2.22
   |  +- ipfixTransportSessionDestinationAddressType (5) = 1 (ipv4)
   |  +- ipfixTransportSessionDestinationAddress (6) = 192.0.2.37
   |  +- ipfixTransportSessionSourcePort (7) = 7653
   |  +- ipfixTransportSessionDestinationPort (8) = 4739
   |  +- ipfixTransportSessionSctpAssocId (9) = 0
   |  +- ipfixTransportSessionDeviceMode (10) = exporting(1)
   |  +- ipfixTransportSessionTemplateRefreshTimeout (11) = 0
   |  +- ipfixTransportSessionOptionTemplateRefreshTimeout (12) = 0
   |  +- ipfixTransportSessionTemplateRefreshPacket (13) = 0
   |  +- ipfixTransportSessionOptionTemplateRefreshPacket (14) = 0
   |  +- ipfixTransportSessionIpfixVersion (15) = 10
   |  +- ipfixTransportSessionStatus (16) = 2 (active)
   .
   .
   .
   +- index (11) (ipfixTransportSessionIndex)
      +- ipfixTransportSessionIndex (1) = 11
      +- ipfixTransportSessionProtocol (2) = 17 (UDP)
      +- ipfixTransportSessionSourceAddressType (3) = 1 (ipv4)
      +- ipfixTransportSessionSourceAddress (4) = 192.0.2.22
      +- ipfixTransportSessionDestinationAddressType (5) = 1 (ipv4)
      +- ipfixTransportSessionDestinationAddress (6) = 192.0.2.44
      +- ipfixTransportSessionSourcePort (7) = 14287
      +- ipfixTransportSessionDestinationPort (8) = 4739
      +- ipfixTransportSessionSctpAssocId (9) = 0
      +- ipfixTransportSessionDeviceMode (10) = exporting(1)
      +- ipfixTransportSessionTemplateRefreshTimeout (11) = 100
      +- ipfixTransportSessionOptionTemplateRefreshTimeout (12)
      |                                                    = 100
      +- ipfixTransportSessionTemplateRefreshPacket (13) = 10
      +- ipfixTransportSessionOptionTemplateRefreshPacket (14) = 10
      +- ipfixTransportSessionIpfixVersion (15) = 10
      +- ipfixTransportSessionStatus (16) = 2 (active)
```

The values in brackets are the OID numbers. The Collectors would then have the same entry except that the index would most likely differ and the ipfixTransportSessionDeviceMode would be collecting(2).

5.2. The Template Table

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The Template table lists all Templates (including Options Templates) that are sent (by an Exporter) or received (by a Collector). The (Options) Templates are unique per Transport Session which also gives the device mode (Exporter or Collector) and Observation Domain, thus the table is indexed by

*the Transport Session Index (ipfixTransportSessionIndex)

*and the Observation Domain Id (ipfixTemplateObservationDomainId).

It contains the Set Id and an access time denoting the time when the (Options) Template was last sent or received.
To resume the above example the Exporter may want to export a Template and an Options Template for each Transport Session defined above. This leads to the following Template table defining Template and Options Template:

```
ipfixTemplateTable (3)
|
+- ipfixTemplateEntry (1)
   |
   +- index (5) (ipfixTransportSessionIndex)
   |  +- index (3) (ipfixTemplateObservationDomainId)
   |     + index (257) (ipfixTemplateId)
   |     | +- ipfixTemplateObservationDomainId (1) = 3
   |     | +- ipfixTemplateId (2) = 257
   |     | +- ipfixTemplateSetId (3) = 2
   |     | +- ipfixTemplateAccessTime (4)
   |     |                              = 2008-7-1,12:49:11.2,+2:0
   |     |
   |     + index (264) (ipfixTemplateId)
   |       +- ipfixTemplateObservationDomainId (1) = 3
   |       +- ipfixTemplateId (2) = 264
   |       +- ipfixTemplateSetId (3) = 3
   |       +- ipfixTemplateAccessTime (4)
   .                                  = 2008-7-1,12:47:04.8,+2:0
   .
   .
   .
   +- index (11) (ipfixTransportSessionIndex)
      +- index (3) (ipfixTemplateObservationDomainId)
         + index (273) (ipfixTemplateId)
         | +- ipfixTemplateObservationDomainId (1) = 3
         | +- ipfixTemplateId (2) = 273
         | +- ipfixTemplateSetId (3) = 2
         | +- ipfixTemplateAccessTime (4)
         |                            = 2008-7-1,12:49:11.2,+2:0
         |
         + index (289) (ipfixTemplateId)
           +- ipfixTemplateObservationDomainId (1) = 3
           +- ipfixTemplateId (2) = 289
           +- ipfixTemplateSetId (3) = 3
           +- ipfixTemplateAccessTime (4)
                                      = 2008-7-1,12:47:04.8,+2:0
```

We assume that the Transport Session that is stored with index 5 in the Transport Session table of the Exporter is stored with index 17 in the Transport Session table of the (corresponding) Collector. Then, the Template table would look as follows:

```
ipfixTemplateTable (3)
|
+- ipfixTemplateEntry (1)
   |
   +- index (17) (ipfixTransportSessionIndex)
      +- index (3) (ipfixTemplateObservationDomainId)
         + index (257) (ipfixTemplateId)
         | +- ipfixTemplateObservationDomainId (1) = 3
         | +- ipfixTemplateId (2) = 257
         | +- ipfixTemplateSetId (3) = 2
         | +- ipfixTemplateAccessTime (4)
         |                              = 2008-7-1,12:49:11.8,+2:0
         |
         + index (264) (ipfixTemplateId)
           +- ipfixTemplateObservationDomainId (1) = 3
           +- ipfixTemplateId (2) = 264
           +- ipfixTemplateSetId (3) = 3
           +- ipfixTemplateAccessTime (4)
                                        = 2008-7-1,12:47:05.3,+2:0
```

The table on the second Collector would be analog to the one shown above.

5.3. The Template Definition Table

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The Template Definition table lists all the Information Elements contained in a Template or Options Template. Therefore it has the same indexes as the corresponding Template table plus the Template Id. Its own index denotes the order of the Information Element inside the Template. Besides the Information Element Id and the length of the encoded value the table contains the enterprise number for enterprise specific Information Elements and flags for each Information Element. The flags indicate if the Information Element is used for scoping or as a Flow Key.
To resume the above example again the Exporter is configured to export the octets received and dropped at the Observation Point since the last export of these values. In addition it exports the start and end time of the flow relative to the timestamp contained in the IPFIX header. This leads to the following Template Definition table on the Exporter:

```
ipfixTemplateDefinitionTable (4)
|
+- ipfixTemplateDefinitionEntry (1)
   |
   +- index (5) (ipfixTransportSessionIndex)
      +- index (3) (ipfixTemplateObservationDomainId)
         + index (257) (ipfixTemplateId)
           +- index (1) (ipfixTemplateDefinitionIndex)
           |  +- ipfixTemplateDefinitionIndex (1) = 1
           |  +- ipfixTemplateDefinitionIeId (2) = 158
           |  |                      (flowStartDeltaMicroseconds)
           |  +- ipfixTemplateDefinitionIeLength (3) = 4
           |  +- ipfixTemplateDefinitionEnterprise (4) = 0
           |  +- ipfixTemplateDefinitionFlags (5) = 0
           |
           +- index (2) (ipfixTemplateDefinitionIndex)
           |  +- ipfixTemplateDefinitionIndex (1) = 2
           |  +- ipfixTemplateDefinitionIeId (2) = 159
           |  |                      (flowEndDeltaMicroseconds)
           |  +- ipfixTemplateDefinitionIeLength (3) = 4
           |  +- ipfixTemplateDefinitionEnterprise (4) = 0
           |  +- ipfixTemplateDefinitionFlags (5) = 0
           |
           +- index (3) (ipfixTemplateDefinitionIndex)
           |  +- ipfixTemplateDefinitionIndex (1) = 3
           |  +- ipfixTemplateDefinitionIeId (2) = 1
           |  |                                  (octetDeltaCount)
           |  +- ipfixTemplateDefinitionIeLength (3) = 8
           |  +- ipfixTemplateDefinitionEnterprise (4) = 0
           |  +- ipfixTemplateDefinitionFlags (5) = 0
           |
           +- index (4) (ipfixTemplateDefinitionIndex)
              +- ipfixTemplateDefinitionIndex (1) = 4
              +- ipfixTemplateDefinitionIeId (2) = 132
              |                          (droppedOctetDeltaCount)
              +- ipfixTemplateDefinitionIeLength (3) = 8
              +- ipfixTemplateDefinitionEnterprise (4) = 0
              +- ipfixTemplateDefinitionFlags (5) = 0
```

The corresponding table entry on the collector is the same except that it would have another ipfixTransportSessionIndex, e.g. 17 as in the previous example.

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5.4. The Export Table

On Exporters, the Export table (ipfixExportTable) can be used to support features like failover, load-balancing, duplicate export to several Collectors etc. The table has three indexes that link an entry with

- the Metering Process table (ipfixMeteringProcessCacheId, see below),
- and the Transport Session table (ipfixTransportSessionIndex).

Those entries with the same ipfixExportIndex and the same ipfixMeteringProcessCacheId define a Transport Session group. The member type for each group member describes its functionality. All Transport Sessions referenced in this table MUST have the ipfixTransportSessionDeviceMode exporting(1).
If the Exporter does not use Transport Session grouping then each ipfixExportIndex contains a single ipfixMeteringProcessCacheId and thus a singe Transport Session (ipfixTransportSessionIndex) and this session MUST have the member type primary(1).
For failover a Transport Session group can contain one Transport Session with member type "primary" and several Transport Sessions with type secondary(2). Entries with other member types are not allowed for that type of group. For load-balancing or parallel export all Transport Sessions in the group MUST have the same member type either loadBalancing(4) or parallel(3).
The algorithms used for failover or load-balancing are out of the scope of this document.
To continue the example we assume that the Exporter uses the two connections shown in the examples above as one primary Transport Session protected by a secondary Transport Session. The Exporter then has the following entries in the ipfixExportTable:

```
ipfixExportTable (5)
|
+- ipfixExportEntry (1)
   |
   +- index (7) (ipfixExportIndex)
   |  +- index (9) (ipfixMeteringProcessCacheId)
   |     |  +- index (5) (ipfixTransportSessionIndex)
   |        |  +- ipfixExportIndex (1) = 7
   |        |  +- ipfixExportMemberType (2) = 1 (primary)
   |        |
   |        +- index (11) (ipfixTransportSessionIndex)
   |           +- ipfixExportIndex (1) = 7
   |           +- ipfixExportMemberType (2) = 2 (secondary)
   |
   +- index (8) (ipfixExportIndex)
      +- index (9) (ipfixMeteringProcessCacheId)
         +- index (5) (ipfixTransportSessionIndex)
         |  +- ipfixExportIndex (1) = 8
         |  +- ipfixExportMemberType (2) = 2 (secondary)
         +- index (11) (ipfixTransportSessionIndex)
            +- ipfixExportIndex (1) = 8
            +- ipfixExportMemberType (2) = 1 (primary)
```

The example shows that the Exporter uses the Metering Process Cache 9 explained below to export IPFIX Data Records for the Transport Sessions 5 and 11. The Templates 257 and 264 defined above are exported within Transport Session 5 and the Templates 273 and 289 are exported within Transport Session 11. If we assume that Templates 257 and 264 are identical then the Collector that receives Transport Session 11 is a backup for the Collector of Transport Session 5.

5.5. The Metering Process Table

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The Metering Process as defined in [RFC5101] (Claise, B., "Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information," January 2008.) consists of a set of functions. Maintaining the Flow Records is one of them. This function is responsible for passing the Flow Records to the Exporting Process and also for detecting Flow expiration. The Flow Records that are maintained by the Metering Process can be grouped by the Observation Points they are observed at. The instance that maintains such a group of Flow Records is a kind of cache. For this reason the Metering Process table (ipfixMeteringProcessTable) is indexed by cache IDs (ipfixMeteringProcessCacheId). Each cache can be maintained by a separate instance of the Metering Process. To specify

the Observation Point(s) where the Flow Records are gathered the ipfixMeteringProcessObservationPointGroupRef may contain an ipfixObservationPointGroupId from the Observation Point table (ipfixObservationPointTable) described in the next section. If an Observation Point is not specified for the Flow Records the ipfixMeteringProcessObservationPointGroupRef MUST be zero(0). The timeouts (ipfixMeteringProcessCacheActiveTimeout and ipfixMeteringProcessCacheInactiveTimeout) specify when Flow Records are expired.

```
ipfixMeteringProcessTable (6)
|
+- ipfixMeteringProcessEntry (1)
   |
   +- index (9) (ipfixMeteringProcessCacheId)
      +- ipfixMeteringProcessCacheId (1) = 9
      +- ipfixMeteringProcessObservationPointGroupRef (2) = 17
      +- ipfixMeteringProcessCacheActiveTimeout (3) = 100
      +- ipfixMeteringProcessCacheInactiveTimeout (4) = 100
```

5.6. The Observation Point Table

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The Observation Point table (ipfixObservationPointTable) groups Observation Points with the ipfixObservationPointGroupId. Each entry contains the Observation Domain ID in which the Observation Point is located and a reference to the ENTITY MIB module [RFC4133] (Bierman, A. and K. McCloghrie, “Entity MIB (Version 3),” August 2005.) or the IF MIB module [RFC2863] (McCloghrie, K. and F. Kastenholz, “The Interfaces Group MIB,” June 2000.). The objects in the ENTITY MIB module referenced by ipfixObservationPointPhysicalEntity or IF MIB module referenced by ipfixObservationPointPhysicalInterface denote the Observation Point. If no such index can be given in those modules the references MUST be 0. If a reference is given in both object ipfixObservationPointPhysicalEntity and ipfixObservationPointPhysicalInterface then both MUST point to the same physical interface. In addition a direction can be given to render more specific which Flow to monitor.

```
ipfixObservationPointTable (7)
|
+- ipfixObservationPointEntry (1)
   |
   +- index (17) (ipfixObservationPointGroupId)
      +- index (1) (ipfixObservationPointIndex)
      |  +- ipfixObservationPointGroupId (1) = 17
      |  +- ipfixObservationPointIndex (2) = 1
      |  +- ipfixObservationPointObservationDomainId (3) = 3
      |  +- ipfixObservationPointPhysicalEntity (4) = 6
      |  +- ipfixObservationPointPhysicalInterface(5) = 0
      |  +- ipfixObservationPointPhysicalEntityDirection (6)
                                                    = 3 (both)
      |
      +- index (2) (ipfixObservationPointIndex)
         +- ipfixObservationPointGroupId (1) = 17
         +- ipfixObservationPointIndex (2) = 2
         +- ipfixObservationPointObservationDomainId (3) = 3
         +- ipfixObservationPointPhysicalEntity (4) = 0
         +- ipfixObservationPointPhysicalInterface (5) = 0
         +- ipfixObservationPointPhysicalEntityDirection (6)
                                                  = 1 (ingress)
```

5.7. The Selection Process Table

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This table supports the usage of Filtering and Sampling functions as described in [RFC5470] (Sadasivan, G., Brownlee, N., Claise, B., and J. Quittek, “Architecture for IP Flow Information Export,” March 2009.). It contains lists of functions per Metering Process cache (ipfixMeteringProcessCacheId). The selection process index ipfixSelectionProcessIndex forms groups of selection methods that are applied to an observed packet stream. The selection process selector index (ipfixSelectionProcessSelectorIndex) indicates the order in which the functions are applied to the packets observed at the Observation Points associated with the Metering Process cache. The selection methods are applied in increasing order i.e., selection methods with a lower ipfixSelectionProcessSelectorIndex are applied first. The functions are referred by object identifiers pointing to the function with its parameters. If the selection method does not use parameters then it MUST point to the root of the function subtree (see also Section Section 6 (Structure of the IPFIX SELECTOR MIB)). If the function uses parameters then it MUST point to an entry in the parameter table of the selection method. If no Filtering or Sampling function is used for a Metering Process then an entry for the Metering

Process SHOULD be created pointing to the Select All function (ipfixFuncSelectAll).

5.8. The Statistical Tables

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For the ipfixTransportSessionTable, the ipfixTemplateTable, the ipfixMeteringProcessTable and the ipfixSelectionProcessTable statistical tables are defined that augment those tables. All the statistical tables contain a discontinuity object that holds a timestamp that denotes the time when a discontinuity event occurred to notify the management system that the counters contained in those tables might not be continuous anymore.

5.8.1. The Transport Session Statistical Table

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The Transport Session Statistical table (ipfixTransportSessionStatsTable) augments the ipfixTransportSessionTable with statistical values. It contains the rate (in bytes per second) with which it receives or sends out IPFIX Messages, the number of bytes, packets, messages, Records, Templates and Options Templates received or sent and the number of messages that were discarded.

5.8.2. The Template Statistical Table

TOC

This table contains a statistical value for each Template. It augments the Template table (ipfixTemplateTable) and specifies the number of Data Records exported or collected for the Template.

5.8.3. The Metering Process Statistical Table

TOC

This table augments the Metering Process table (ipfixMeteringProcessTable). It contains the statistical values for the exported Data Records and the number of active and inactive flows that are currently observed.

TOC

5.8.4. The Selection Process Statistical Table

This table augments the Selection Process table (ipfixSelectionProcessTable) and introduces two generic statistical values, the number of packets observed and the number of packets dropped by the selection method.

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6. Structure of the IPFIX SELECTOR MIB

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The IPFIX SELECTOR MIB module defined in this section provides the standard Filtering and Sampling functions that can be referenced in the ipfixSelectionProcessTable. The subtree ipfixSelectorFunctions is a placeholder where all standard Filtering and Sampling functions should be located. It currently contains the Select All function (ipfixFuncSelectAll). The IPFIX SELECTOR MIB module is maintained by IANA and can be extended through Expert Review [RFC5226] (Narten, T. and H. Alvestrand, “Guidelines for Writing an IANA Considerations Section in RFCs,” May 2008.), i.e., review by one of a group of experts designated by an IETF Area Director. The group of experts MUST check the requested MIB objects for completeness and accuracy of the description. Requests for MIB objects that duplicate the functionality of existing objects SHOULD be declined. The smallest available OID SHOULD be assigned to a new MIB objects. The specification of new MIB objects SHOULD follow the structure specified in the next Section and MUST be published using a well-established and persistent publication medium. The experts will initially be drawn from the Working Group Chairs and document editors of the IPFIX and PSAMP Working Groups.

6.1. The Selector Functions

TOC

The following figure shows how the MIB tree usually should look like. It already contains the ipfixFuncSelectAll. The subtree in ipfixFuncF2 gives the basic structure which all selection methods SHOULD follow.

```
ipfixSelectorFunctions
|
+- ipfixFuncSelectAll
|  |
|  +- ipfixFuncSelectAllAvail (is the function available?)
|
+- ipfixFuncF2
|  |
|  +- ipfixFuncF2Avail (is the function F2 available)
|  |
|  +- ipfixFuncF2Parameters (a table with parameters)
...
|
+- ipfixFunFn...
```

The selection method SHOULD be designed as a MIB subtree introduced by an object with the name ipfixFunc appended by a function name. The objects in this subtree SHOULD be prefixed by this name. If the function is named Fx then we would start a subtree with an OID named ipfixFuncFx. This subtree should contain an object ipfixFuncFxAvail which has the type TruthValue. If a selection method takes parameters the MIB should contain a table named ipfixFuncFxParameters which should contain all the parameters that the selection method specifies. An entry in this table will be referenced by the IPFIX MIB module if the selection method with the parameters is used.
To illustrate the structure defined above the following contains an example of a function MyFunc that holds three integer parameters Param1, Param2 and Param3. In the example there are currently two instances of the parameters set defined with indexes 1 and 4.

```
ipfixSelectorFunctions (1)
|
+- ipfixFuncMyFunc (?)
   |
   +- ipfixFuncMyFuncAvail (1) = true
   +- ipfixFuncMyFuncParameters (2)
      |
      +- ipfixFuncMyFuncParametersEntry (1)
         |
         +- index (1) (ipfixFuncMyFuncParametersIndex)
         |  +- ipfixFuncMyFuncParam1 (1) = 47
         |  +- ipfixFuncMyFuncParam2 (2) = -128
         |  +- ipficFuncMyFuncParam3 (3) = 19
         |
         +- index(4) (ipfixFuncMyFuncParametersIndex)
            +- ipfixFuncMyFuncParam1 (1) = 19
            +- ipfixFuncMyFuncParam2 (2) = -1
            +- ipficFuncMyFuncParam3 (3) = 728
```

If the function defined above is referenced in the IPFIX MIB module the ipfixSelectionProcessTable would look as follows:

```
ipfixSelectionProcessTable (8)
|
+- ipfixSelectionProcessEntry (1)
   |
   +- index (9) (ipfixMeteringProcessCacheId)
      +- index (1) (ipfixSelectionProcessIndex)
         +- index (1) (ipfixSelectionProcessSelectorIndex)
         |  +- ipfixSelectionProcessSelectorFunction (3)
         |                          = ipfixSelectorFunctions.?.2.1.4
         +- index (2) (ipfixSelectionProcessSelectorIndex)
            +- ipfixSelectionProcessSelectorFunction (3)
                                    = ipfixSelectorFunctions.?.2.1.1
```

This means that for the ipfixMeteringProcessCacheId(9) a Selection Process with index 1 is created that applies two times the same function but with different parameter sets. First the function MyFunc is applied with the parameters of the set with index 4 and the with the parameters of the set with index 1.

---

7. Relationship to Other MIB Modules

TOC

Besides the usual imports from the SNMP Standards [RFC2578] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., “Structure of Management Information Version 2 (SMIv2),” April 1999.),

[RFC2579] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., “Textual Conventions for SMIv2,” April 1999.) and [RFC2580] (McCloghrie, K., Perkins, D., and J. Schoenwaelder, “Conformance Statements for SMIv2,” April 1999.) the IPFIX MIB module references the ENTITY MIB module [RFC4133] (Bierman, A. and K. McCloghrie, “Entity MIB (Version 3),” August 2005.) and the IF MIB module [RFC2863] (McCloghrie, K. and F. Kastenholz, “The Interfaces Group MIB,” June 2000.).

7.1. Relationship to the ENTITY MIB and IF MIB

TOC

The Observation Point table (ipfixObservationPointTable) contains a reference to the ENTITY MIB module[RFC4133] (Bierman, A. and K. McCloghrie, “Entity MIB (Version 3),” August 2005.) (ipfixObservationPointPhysicalEntity) or the IF MIB module [RFC2863] (McCloghrie, K. and F. Kastenholz, “The Interfaces Group MIB,” June 2000.) (ipfixObservationPointPhysicalInterface). If the implementors of the IPFIX MIB module want to specify the physical entity where Flows are observed then they SHOULD also implement the ENTITY MIB and/or the IF MIB module. The implementation of the ENTITY MIB and/or IF MIB module is OPTIONAL. If one of them is not implemented then all values of the respective column ipfixObservationPointPhysicalEntity or ipfixObservationPointPhysicalInterface in the Observation Point table are zero and the values of the ipfixObservationPointPhysicalEntityDirection columns are unknown(0) if none of them is defined.

7.2. MIB modules required for IMPORTS

TOC

The IPFIX MIB module requires the modules SNMPv2-SMI[RFC2578] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., “Structure of Management Information Version 2 (SMIv2),” April 1999.), SNMPv2-TC[RFC2579] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., “Textual Conventions for SMIv2,” April 1999.) and SNMPv2-CONF[RFC2580] (McCloghrie, K., Perkins, D., and J. Schoenwaelder, “Conformance Statements for SMIv2,” April 1999.). Further on it imports the textual conventions InetAddressType and InetAddress from the INET ADDRESS MIB module[RFC4001] (Daniele, M., Haberman, B., Routhier, S., and J. Schoenwaelder, “Textual Conventions for Internet Network Addresses,” February 2005.).
The IPFIX SELECTOR MIB module also requires the modules SNMPv2-SMI[RFC2578] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., “Structure of Management Information Version 2

(SMIv2),” April 1999.), SNMPv2-TC[RFC2579] (McCloghrie, K., Ed., Perkins, D., Ed., and J. Schoenwaelder, Ed., “Textual Conventions for SMIv2,” April 1999.) and SNMPv2-CONF[RFC2580] (McCloghrie, K., Perkins, D., and J. Schoenwaelder, “Conformance Statements for SMIv2,” April 1999.).

---

8. MIB Definitions

TOC

This section contains the definitions of the IPFIX-MIB module and the IPFIX-SELECTOR-MIB module. There are different mandatory groups defined for Collector and Exporter implementations. The statistical objects are made OPTIONAL.

8.1. IPFIX MIB Definition

TOC

```
IPFIX-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, mib-2, Unsigned32, Counter64,
    Gauge32
        FROM SNMPv2-SMI                                 -- RFC2578
    TimeStamp, DateAndTime
        FROM SNMPv2-TC                                  -- RFC2579
    MODULE-COMPLIANCE, OBJECT-GROUP
        FROM SNMPv2-CONF                                -- RFC2580
    InterfaceIndexOrZero
        FROM IF-MIB                                     -- RFC2863
    InetAddressType, InetAddress, InetPortNumber
        FROM INET-ADDRESS-MIB                           -- RFC4001
    PhysicalIndexOrZero
        FROM ENTITY-MIB;                                -- RFC4133

ipfixMIB MODULE-IDENTITY
    LAST-UPDATED "201001120900Z"         -- 12 January 2010
    ORGANIZATION "IETF IPFIX Working Group"
    CONTACT-INFO
        "WG charter:
          http://www.ietf.org/html.charters/ipfix-charter.html

        Mailing Lists:
          General Discussion: ipfix@ietf.org
          To Subscribe: http://www1.ietf.org/mailman/listinfo/ipfix
          Archive:
      http://www1.ietf.org/mail-archive/web/ipfix/current/index.html

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           85748 Garching
           Germany
           Phone: +49 89 289-18008
           Email: muenz@net.in.tum.de
           URI:   http://www.net.in.tum.de/~muenz"
    DESCRIPTION
        "The IPFIX MIB defines managed objects for IP Flow
        Information eXport. These objects provide information about
        managed nodes supporting the IP Flow Information Export
        protocol, for Exporters as well as for Collectors.

        Copyright (c) 2009 IETF Trust and the persons identified as
        the document authors.  All rights reserved. This version
        of this MIB module is part of RFC yyyy; see the RFC itself
        for full legal notices."
-- replace yyyy with actual RFC number & remove this notice

--  Revision history

    REVISION     "201001120900Z"         -- 12 January 2010
    DESCRIPTION
        "Initial version, published as RFC yyyy."
-- replace yyyy with actual RFC number & remove this notice

    ::= { mib-2 xxx }
-- xxx to be assigned by IANA.

--*****************************************************************
-- Top Level Structure of the MIB
--*****************************************************************

ipfixObjects     OBJECT IDENTIFIER ::= { ipfixMIB 1 }
ipfixConformance OBJECT IDENTIFIER ::= { ipfixMIB 2 }

ipfixMainObjects OBJECT IDENTIFIER ::= { ipfixObjects 1 }
```

```
ipfixStatistics  OBJECT IDENTIFIER ::= { ipfixObjects 2 }

--====================================================================
-- 1.1: Objects used by all IPFIX implementations
--====================================================================
--------------------------------------------------------------------
-- 1.1.1: Transport Session Table
--------------------------------------------------------------------
ipfixTransportSessionTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixTransportSessionEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists the currently established Transport
        Sessions between an Exporting Process and a Collecting
        Process."
    ::= { ipfixMainObjects 1 }

ipfixTransportSessionEntry OBJECT-TYPE
    SYNTAX      IpfixTransportSessionEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixTransportSessionTable"
    INDEX       { ipfixTransportSessionIndex }
    ::= { ipfixTransportSessionTable 1 }

IpfixTransportSessionEntry ::=
    SEQUENCE {
       ipfixTransportSessionIndex                  Unsigned32,
       ipfixTransportSessionProtocol               Unsigned32,
       ipfixTransportSessionSourceAddressType      InetAddressType,
       ipfixTransportSessionSourceAddress          InetAddress,
       ipfixTransportSessionDestinationAddressType InetAddressType,
       ipfixTransportSessionDestinationAddress     InetAddress,
       ipfixTransportSessionSourcePort             InetPortNumber,
       ipfixTransportSessionDestinationPort        InetPortNumber,
       ipfixTransportSessionSctpAssocId            Unsigned32,
       ipfixTransportSessionDeviceMode             INTEGER,
       ipfixTransportSessionTemplateRefreshTimeout Unsigned32,
       ipfixTransportSessionOptionsTemplateRefreshTimeout Unsigned32,
       ipfixTransportSessionTemplateRefreshPacket  Unsigned32,
       ipfixTransportSessionOptionsTemplateRefreshPacket Unsigned32,
       ipfixTransportSessionIpfixVersion           Unsigned32,
       ipfixTransportSessionStatus                 INTEGER
    }

ipfixTransportSessionIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
```

```
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Locally arbitrary, but unique identifier of an entry in
        the ipfixTransportSessionTable. The value is expected to
        remain constant from a re-initialization of the entity's
        network management agent to the next re-initialization."
    ::= { ipfixTransportSessionEntry 1 }

ipfixTransportSessionProtocol OBJECT-TYPE
    SYNTAX      Unsigned32 (1..255)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The transport protocol used for receiving or transmitting
        IPFIX Messages. Protocol numbers are assigned by IANA.  A
        current list of all assignments is available from
        <http://www.iana.org/>."
    REFERENCE
        "RFC5101 Section 10 - Specification of the IP Flow
        Information Export(IPFIX) Protocol for the Exchange of IP
        Traffic Flow Information"
    ::= { ipfixTransportSessionEntry 2 }

ipfixTransportSessionSourceAddressType OBJECT-TYPE
    SYNTAX      InetAddressType
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The type of address used for the source address
        as specified in RFC4001. This object is used with protocols
        (specified in ipfixTransportSessionProtocol) like TCP(6)
        and UDP(17) that have the notion of addresses. SCTP(132)
        should use the ipfixTransportSessionSctpAssocId instead.
        If SCTP(132) or any other protocol without the notion of
        addresses is used the object MUST  be set to unknown(0)."
    ::= { ipfixTransportSessionEntry 3 }

ipfixTransportSessionSourceAddress OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The source address of the Exporter of the IPFIX Transport
        Session. This value is interpreted according to the value of
        ipfixTransportSessionAddressType as specified in RFC4001.
        This object is used with protocols (specified in
        ipfixTransportSessionProtocol) like TCP(6) and UDP(17) that
        have the notion of addresses. SCTP(132) should use the
```

```
        ipfixTransportSessionSctpAssocId instead. If SCTP(132) or
        any other protocol without the notion of addresses is used
        the object MUST  be set to a zero-length string."
    ::= { ipfixTransportSessionEntry 4 }

ipfixTransportSessionDestinationAddressType OBJECT-TYPE
    SYNTAX      InetAddressType
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The type of address used for the destination address
        as specified in RFC4001. This object is used with protocols
        (specified in ipfixTransportSessionProtocol) like TCP(6)
        and UDP(17) that have the notion of addresses. SCTP(132)
        should use the ipfixTransportSessionSctpAssocId instead.
        If SCTP(132) or any other protocol without the notion of
        addresses is used the object MUST  be set to unknown(0)."
    ::= { ipfixTransportSessionEntry 5 }

ipfixTransportSessionDestinationAddress OBJECT-TYPE
    SYNTAX      InetAddress
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The destination address of the Collector of the IPFIX
        Transport Session. This value is interpreted according to
        the value of ipfixTransportSessionAddressType as specified
        in RFC4001. This object is used with protocols
        (specified in ipfixTransportSessionProtocol) like TCP(6)
        and UDP(17) that have the notion of addresses. SCTP(132)
        should use the ipfixTransportSessionSctpAssocId instead.
        If SCTP(132) or any other protocol without the notion of
        addresses is used the object MUST  be set to a zero-length
        string"
    ::= { ipfixTransportSessionEntry 6 }

ipfixTransportSessionSourcePort OBJECT-TYPE
    SYNTAX      InetPortNumber
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The transport protocol port number of the Exporter.
        This object is used with protocols (specified in
        ipfixTransportSessionProtocol) like TCP(6)
        and UDP(17) that have the notion of ports.  SCTP(132)
        should copy the value of sctpAssocLocalPort if the
        Transport Session is in collecting mode or
        sctpAssocRemPort if the Transport Session is in
        exporting mode. The association is referenced with
```

```
        by the ipfixTransportSessionSctpAssocId.
        If any other protocol without the notion of
        ports is used the object MUST  be set to zero."
    ::= { ipfixTransportSessionEntry 7 }

ipfixTransportSessionDestinationPort OBJECT-TYPE
    SYNTAX      InetPortNumber
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The transport protocol port number of the Collector. The
        default value is 4739 for all currently defined transport
        protocol types. This object is used with protocols
        (specified in ipfixTransportSessionProtocol) like TCP(6)
        and UDP(17) that have the notion of ports. SCTP(132)
        should copy the value of  sctpAssocRemPort if the
        Transport Session is in collecting mode or
        sctpAssocLocalPort if the Transport Session is in
        exporting mode. The association is referenced with
        by the ipfixTransportSessionSctpAssocId.
        If any other protocol without the notion of
        ports is used the object MUST  be set to zero."
    ::= { ipfixTransportSessionEntry 8 }

ipfixTransportSessionSctpAssocId OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The association id used for the SCTP session between the
        Exporter and the Collector of the IPFIX Transport Session.
        It is equal to the sctpAssocId entry in the sctpAssocTable
        defined in the SCTP MIB. This object is only valid if
        ipfixTransportSessionProtocol has the value 132 (SCTP). In
        all other cases the value MUST be zero."
    REFERENCE
        "RFC3873 - Stream Control Transmission Protocol (SCTP)
        Management Information Base (MIB)"
    ::= { ipfixTransportSessionEntry 9 }

ipfixTransportSessionDeviceMode OBJECT-TYPE
    SYNTAX      INTEGER {
                    exporting(1),
                    collecting(2)
                }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The mode of operation of the device for the given Transport
```

```
        Session. This object can have the following values:

        exporting(1)
            This value MUST be used if the Transport Session is
            used for exporting Records to other IPFIX Devices,
            i.e. this device acts as Exporter.

        collecting(2)
            This value MUST be used if the Transport Session is
            used for collecting Records from other IPFIX Devices,
            i.e. this device acts as Collector."
    ::= { ipfixTransportSessionEntry 10 }

ipfixTransportSessionTemplateRefreshTimeout OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "On Exporters this object contains the time in seconds
        after which IPFIX Templates MUST be resent by the
        Exporter.

        On Collectors this object contains the lifetime in seconds
        after which a Template becomes invalid when it is not
        received again within this lifetime.

        This object is only valid if ipfixTransportSessionProtocol
        has the value 17 (UDP). In all other cases the value MUST
        be zero."
    REFERENCE
        "RFC5101 Sections 10.3.6 and 10.3.7 - Specification of
        the IP Flow Information Export(IPFIX) Protocol for the
        Exchange of IP Traffic Flow Information"
    ::= { ipfixTransportSessionEntry 11 }

ipfixTransportSessionOptionsTemplateRefreshTimeout OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "On Exporters this object contains the time in seconds
        after which IPFIX Options Templates MUST be resent by the
        Exporter.

        On Collectors this object contains the lifetime in seconds
        after which an Options Template becomes invalid when it is
        not received again within this lifetime.
```

```
        This object is only valid if ipfixTransportSessionProtocol
        has the value 17 (UDP). In all other cases the value MUST
        be zero."
    REFERENCE
        "RFC5101 Sections 10.3.6 and 10.3.7 - Specification of
        the IP Flow Information Export(IPFIX) Protocol for the
        Exchange of IP Traffic Flow Information"
    ::= { ipfixTransportSessionEntry 12 }

ipfixTransportSessionTemplateRefreshPacket OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "On Exporters this object contains the number of exported
        IPFIX Messages after which IPFIX Templates MUST be resent
        by the Exporter.

        On Collectors this object contains the lifetime in number
        of exported IPFIX Messages after which a Template becomes
        invalid when it is not received again within this lifetime.

        This object is only valid if ipfixTransportSessionProtocol
        has the value 17 (UDP). In all other cases the value MUST
        be zero."
    REFERENCE
        "RFC5101 Sections 10.3.6 and 10.3.7 - Specification of
        the IP Flow Information Export(IPFIX) Protocol for the
        Exchange of IP Traffic Flow Information"
    ::= { ipfixTransportSessionEntry 13 }

ipfixTransportSessionOptionsTemplateRefreshPacket OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "On Exporters this object contains the number of exported
        IPFIX Messages after which IPFIX Options Templates MUST be
        resent by the Exporter.

        On Collectors this object contains the lifetime in number
        of exported IPFIX Messages after which an Options Template
        becomes invalid when it is not received again within this
        lifetime.

        This object is only valid if ipfixTransportSessionProtocol
        has the value 17 (UDP). In all other cases the value MUST
```

```
        be zero."
    REFERENCE
        "RFC5101 Sections 10.3.6 and 10.3.7 - Specification of
        the IP Flow Information Export(IPFIX) Protocol for the
        Exchange of IP Traffic Flow Information"
    ::= { ipfixTransportSessionEntry 14 }

ipfixTransportSessionIpfixVersion OBJECT-TYPE
    SYNTAX      Unsigned32 (0..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "On Exporters the object contains the version number of the
        IPFIX protocol that the Exporter uses to export its data in
        this Transport Session.

        On Collectors the object contains the version number of the
        IPFIX protocol it receives for this Transport Session.

        If IPFIX Messages of different IPFIX protocol versions are
        transmitted or received in this Transport Session, this
        object contains the maximum version number."
    REFERENCE
        "RFC5101 Section 3.1 - Specification of the IP Flow
        Information Export (IPFIX) Protocol for the Exchange of IP
        Traffic Flow Information"
    ::= { ipfixTransportSessionEntry 15 }

ipfixTransportSessionStatus OBJECT-TYPE
    SYNTAX      INTEGER {
                    unknown(0),
                    inactive(1),
                    active(2)
                }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The status of a Transport Session. This object can have the
        following values:

        unknown(0)
            This value MUST be used if the status of the
            Transport Session cannot be detected by the equipment.
            This value should be avoided as far as possible.

        inactive(1)
            This value MUST be used for Transport Sessions that
            are specified in the system but not currently active.
            The value can be used e.g. for Transport Sessions that
```

```
            are backup (secondary) sessions in a Transport Session
            group.

        active(2)
            This value MUST be used for Transport Sessions that are
            currently active and transmitting or receiving data."
    ::= { ipfixTransportSessionEntry 16 }

-------------------------------------------------------------------
-- 1.1.2: Template Table
-------------------------------------------------------------------
ipfixTemplateTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixTemplateEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists the Templates and Options Templates that
        are transmitted by the Exporting Process or received by the
        Collecting Process.

        The table contains the Templates and Options Templates that
        are received or used for exporting data for a given
        Transport Session group and Observation Domain.

        Withdrawn or invalidated (Options) Template MUST be removed
        from this table."
    ::= { ipfixMainObjects 2 }

ipfixTemplateEntry OBJECT-TYPE
    SYNTAX      IpfixTemplateEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixTemplateTable"
    INDEX       {
        ipfixTransportSessionIndex,
        ipfixTemplateObservationDomainId,
        ipfixTemplateId
    }
    ::= { ipfixTemplateTable 1 }

IpfixTemplateEntry ::=
    SEQUENCE {
        ipfixTemplateObservationDomainId Unsigned32,
        ipfixTemplateId                  Unsigned32,
        ipfixTemplateSetId               Unsigned32,
        ipfixTemplateAccessTime          DateAndTime
    }
```

```
ipfixTemplateObservationDomainId OBJECT-TYPE
    SYNTAX      Unsigned32 (0..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The ID of the Observation Domain for which this Template
        is defined. This value is used when sending IPFIX Messages.

        The special value of 0 indicates that the Data Records
        exported with this (Option Template) cannot be applied to a
        single Observation Domain."
    REFERENCE
        "RFC5101 Section 3.1 - Specification of the IP Flow
        Information Export (IPFIX) Protocol for the Exchange of IP
        Traffic Flow Information"
    ::= { ipfixTemplateEntry 1 }

ipfixTemplateId OBJECT-TYPE
    SYNTAX      Unsigned32 (256..65535)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This number indicates the Template Id in the IPFIX
        message. Values from 0 to 255 are not allowed for Template
        Ids."
    REFERENCE
        "RFC5101 Section 3.4.1 - Specification of the IP Flow
        Information Export (IPFIX) Protocol for the Exchange of IP
        Traffic Flow Information"
    ::= { ipfixTemplateEntry 2 }

ipfixTemplateSetId OBJECT-TYPE
    SYNTAX      Unsigned32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This number indicates the Set ID of the Template. This
        object allows to easily retrieve the Template type.

        Currently there are two values defined. The value 2 is
        used for Sets containing Template definitions. The value 3
        is used for Sets containing Options Template definitions."
    REFERENCE
        "RFC5101 Section 3.3.2 - Specification of the IP Flow
        Information Export (IPFIX) Protocol for the Exchange of IP
        Traffic Flow Information"
    ::= { ipfixTemplateEntry 3 }

ipfixTemplateAccessTime OBJECT-TYPE
```

```
    SYNTAX      DateAndTime
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "If the Transport Session is in exporting mode
        (ipfixTransportSessionDeviceMode) the time when this
        (Options) Template was last sent to the Collector(s).

        In the specific case of UDP as transport protocol, this
        time is used to know when a retransmission of the
        (Options) Template is needed.

        If it is in collecting mode it this object contains the
        time when this (Options) Template was last received from
        the Exporter. In the specific case of UDP as transport
        protocol, this time is used to know when this (Options)
        Template times out and thus is no longer valid."
    ::= { ipfixTemplateEntry 4 }

-------------------------------------------------------------------
-- 1.1.3: Exported Template Definition Table
-------------------------------------------------------------------
ipfixTemplateDefinitionTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixTemplateDefinitionEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "On Exporters this table lists the (Options) Template fields
        of which a (Options) Template is defined. It defines the
        (Options) Template given in the ipfixTemplateId specified in
        the ipfixTemplateTable.

        On Collectors this table lists the (Options) Template fields
        of which a (Options) Template is defined. It defines the
        (Options) Template given in the ipfixTemplateId specified in
        the ipfixTemplateTable."
    ::= { ipfixMainObjects 3 }

ipfixTemplateDefinitionEntry OBJECT-TYPE
    SYNTAX      IpfixTemplateDefinitionEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixTemplateDefinitionTable"
    INDEX       {
        ipfixTransportSessionIndex,
        ipfixTemplateObservationDomainId,
        ipfixTemplateId,
        ipfixTemplateDefinitionIndex
```

```
    }
    ::= { ipfixTemplateDefinitionTable 1 }

IpfixTemplateDefinitionEntry ::=
    SEQUENCE {
        ipfixTemplateDefinitionIndex           Unsigned32,
        ipfixTemplateDefinitionIeId            Unsigned32,
        ipfixTemplateDefinitionIeLength        Unsigned32,
        ipfixTemplateDefinitionEnterpriseNumber Unsigned32,
        ipfixTemplateDefinitionFlags           BITS
    }

ipfixTemplateDefinitionIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..65535)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "The ipfixTemplateDefinitionIndex specifies the order in
        which the Information Elements are used in the (Options)
        Template Record.

        Since a Template Record can contain a maximum of 65535
        Information Elements the index is limited to this value."
    REFERENCE
        "RFC5101 Section 3.4.1 and 3.4.2 - Specification of the
        IP Flow Information Export (IPFIX) Protocol for the
        Exchange of IP Traffic Flow Information"
    ::= { ipfixTemplateDefinitionEntry 1 }

ipfixTemplateDefinitionIeId OBJECT-TYPE
    SYNTAX      Unsigned32 (1..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This indicates the Information Element Id at position
        ipfixTemplateDefinitionIndex in the (Options) Template
        ipfixTemplateId. This implicitly specifies the data type
        of the Information Element. The elements are registered
        at IANA. A current list of assignments can be found at
        <http://www.iana.org/assignments/ipfix>"
    REFERENCE
        "RFC5101 Section 3.2 - Specification of the IP Flow
        Information Export (IPFIX) Protocol for the Exchange of IP
        Traffic Flow Information

        RFC5102 - Information Model for IP Flow Information Export"
    ::= { ipfixTemplateDefinitionEntry 2 }

ipfixTemplateDefinitionIeLength OBJECT-TYPE
```

```
    SYNTAX      Unsigned32 (0..65535)
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This indicates the length of the Information Element Id at
        position ipfixTemplateDefinitionIndex in the (Options)
        Template ipfixTemplateId."
    REFERENCE
        "RFC5101 Section 3.2 - Specification of the IP Flow
        Information Export (IPFIX) Protocol for the Exchange of IP
        Traffic Flow Information

        RFC5102 - Information Model for IP Flow Information Export"
    ::= { ipfixTemplateDefinitionEntry 3 }

ipfixTemplateDefinitionEnterpriseNumber OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "IANA enterprise number of the authority defining the
        Information Element identifier in this Template Record.
        Enterprise numbers are assigned by IANA.  A current list of
        all assignments is available from
        <http://www.iana.org/assignments/enterprise-numbers/>.

        This object must be zero(0) for all standard Information
        Elements registered with IANA. A current list of these
        elements is available from
        <http://www.iana.org/assignments/ipfix/ipfix.xhtml>."
    REFERENCE
        "RFC5101 Section 3.2 - Specification of the IP Flow
        Information Export (IPFIX) Protocol for the Exchange of IP
        Traffic Flow Information

        RFC5102 - Information Model for IP Flow Information Export"
    ::= { ipfixTemplateDefinitionEntry 4 }

ipfixTemplateDefinitionFlags OBJECT-TYPE
    SYNTAX      BITS {
                    scope(0),
                    flowKey(1)
                }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This bitmask indicates special attributes for the
        Information Element:
```

```
        scope(0)
            This Information Element is used for scope.

        flowKey(1)
            This Information Element is a Flow key.

        Thus we get the following values for an Information Element:

        If neither bit scope(0) nor bit flowKey(1) are set
            The Information Element is neither used for scoping nor
            as Flow Key.
        If only bit scope(0) is set
            The Information Element is used for scoping.
        If only bit flowKey(1) is set
            The Information Element is used as Flow Key.

        Both bit scope(0) and flowKey(1) MUST NOT be set at the same
        time. This combination is not allowed."
    REFERENCE
        "RFC5101 Section 2 and 3.4.2.1 - Specification of the IP
        Flow Information Export (IPFIX) Protocol for the Exchange
        of IP Traffic Flow Information

        RFC5102 - Information Model for IP Flow Information Export"
    ::= { ipfixTemplateDefinitionEntry 5 }

-------------------------------------------------------------------
-- 1.1.4: Export Table
-------------------------------------------------------------------
ipfixExportTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixExportEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists all exports of an IPFIX device.

        On Exporters this table contains all exports grouped by
        Transport Session, Observation Domain Id, Template Id and
        Metering Process represented by the
        ipfixMeteringProcessCacheId. Thanks to the ipfixExportIndex
        the exports can group one or more Transport Sessions to
        achieve a special functionality like failover management,
        load-balancing etc. The entries with the same
        ipfixExportIndex, the same ipfixObservationDomainId
        and the same ipfixMeteringProcessCacheId define a Transport
        Session group. If the Exporter does not use Transport
        Session grouping then each ipfixExportIndex contains a
        single ipfixMeteringProcessCacheId and thus a singe
        Transport Session and this session MUST have the member
```

```
        type primary(1). Transport Sessions referenced in this
        table MUST have the ipfixTransportSessionDeviceMode
        exporting(1).

        On Collectors this table is not needed."
    ::= { ipfixMainObjects 4 }

ipfixExportEntry OBJECT-TYPE
    SYNTAX      IpfixExportEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixExportTable"
    INDEX       {
        ipfixExportIndex,
        ipfixMeteringProcessCacheId,
        ipfixTransportSessionIndex
    }
    ::= { ipfixExportTable 1 }

IpfixExportEntry ::=
    SEQUENCE {
       ipfixExportIndex      Unsigned32,
       ipfixExportMemberType INTEGER
    }

ipfixExportIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Locally arbitrary, but unique identifier of an entry in
        the ipfixExportTable. The value is expected
        to remain constant from a re-initialization of the entity's
        network management agent to the next re-initialization.

        A common ipfixExportIndex between two entries from this
        table expresses that there is a relationship between the
        Transport Sessions in ipfixTransportSessionIndex. The type
        of relationship is expressed by the value of
        ipfixExportMemberType."
    ::= { ipfixExportEntry 1 }

ipfixExportMemberType OBJECT-TYPE
    SYNTAX      INTEGER {
                    unknown(0),
                    primary(1),
                    secondary(2),
                    parallel(3),
```

```
                loadBalancing(4)
            }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The type of a member Transport Session in a Transport
        Session group (identified by the value of ipfixExportIndex,
        ipfixObservationDomainId and ipfixMeteringProcessCacheId).
        The following values are valid:

        unknown(0)
            This value MUST be used if the status of the group
            membership cannot be detected by the equipment. This
            value should be avoided as far as possible.

        primary(1)
            This value is used for a group member that is used as
            the primary target of an Exporter. Other group members
            (with the same ipfixExportIndex and
            ipfixMeteringProcessCacheId) MUST NOT have the value
            primary(1) but MUST have the value secondary(2).
            This value MUST also be specified if the Exporter does
            not support Transport Session grouping. In this case
            the group contains only one Transport Session.

        secondary(2)
            This value is used for a group member that is used as a
            secondary target of an Exporter. The Exporter will use
            one of the targets specified as secondary(2) within the
            same Transport Session group when the primary target is
            not reachable.

        parallel(3)
            This value is used for a group member that is used for
            duplicate exporting i.e., all group members identified
            by the ipfixExportIndex are exporting the same Records
            in parallel. This implies that all group members MUST
            have the same membertype parallel(3).

        loadBalancing(4)
            This value is used for a group member that is used
            as one target for load-balancing. This means that a
            Record is sent to one of the group members in this
            group identified by ipfixExportIndex.
            This implies that all group members MUST have the same
            membertype loadBalancing(4)."
    ::= { ipfixExportEntry 2 }

-----------------------------------------------------------------
```

```
-- 1.1.5: Metering Process Table
--------------------------------------------------------------------
ipfixMeteringProcessTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixMeteringProcessEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists so called caches used at the Metering
        Process to store the metering data of Flows observed at
        the Observation Points given in the
        ipfixObservationPointGroupReference. The table lists the
        timeouts that specify when the cached metering data is
        expired.

        On Collectors the table is not needed."
    ::= { ipfixMainObjects 5 }

ipfixMeteringProcessEntry OBJECT-TYPE
    SYNTAX      IpfixMeteringProcessEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixMeteringProcessTable."
    INDEX       { ipfixMeteringProcessCacheId }
    ::= { ipfixMeteringProcessTable 1 }

IpfixMeteringProcessEntry ::=
    SEQUENCE {
        ipfixMeteringProcessCacheId             Unsigned32,
        ipfixMeteringProcessObservationPointGroupRef Unsigned32,
        ipfixMeteringProcessCacheActiveTimeout   Unsigned32,
        ipfixMeteringProcessCacheInactiveTimeout Unsigned32
    }

ipfixMeteringProcessCacheId OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Locally arbitrary, but unique identifier of an entry in the
        ipfixMeterinProcessTable. The value is expected to remain
        constant from a re-initialization of the entity's network
        management agent to the next re-initialization."
    ::= { ipfixMeteringProcessEntry 1 }

ipfixMeteringProcessObservationPointGroupRef OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-only
    STATUS      current
```

```
    DESCRIPTION
        "The Observation Point Group Id that links this table entry
        to the ipfixObservationPointTable. The matching
        ipfixObservationPointGroupId in that table gives the
        Observation Points used in that cache. If the Observation
        Points are unknown the
        ipfixMeteringProcessObservationPointGroupRef MUST be zero."
    ::= { ipfixMeteringProcessEntry 2 }

ipfixMeteringProcessCacheActiveTimeout OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The time in seconds after which an active Flow is expired.

        On the Exporter this object contains the time after which a
        Flow is expired (and a Data Record for the template is sent)
        even though packets matching this Flow are still received by
        the Metering Process. If this value is 0 the Flow is not
        prematurely expired."
    REFERENCE
        "RFC5470 Section 5.1.1, item 3 -
        Architecture for IP Flow Information Export"
    ::= { ipfixMeteringProcessEntry 3 }

ipfixMeteringProcessCacheInactiveTimeout OBJECT-TYPE
    SYNTAX      Unsigned32
    UNITS       "seconds"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The time in seconds after which an inactive Flow is
        expired.

        On the Exporter this object contains the time after which a
        Flow is expired (and a Data Record for the template is sent)
        when no packets matching this Flow are received by the
        Metering Process for the given number of seconds. If this
        value is zero the Flow is timed out immediately i.e., a Data
        Record is sent for every packet received by the Metering
        Process."
    REFERENCE
        "RFC5470 Section 5.1.1, item 1 -
        Architecture for IP Flow Information Export"
    ::= { ipfixMeteringProcessEntry 4 }

-----------------------------------------------------------------
```

```
-- 1.1.6: Observation Point Table
-------------------------------------------------------------------
ipfixObservationPointTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixObservationPointEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists the Observation Points used within an
        Exporter by the Metering Process. The index
        ipfixObservationPointGroupId groups Observation Points
        and is referenced in the Metering Process table.

        On Collectors this table is not needed."
    ::= { ipfixMainObjects 6 }

ipfixObservationPointEntry OBJECT-TYPE
    SYNTAX      IpfixObservationPointEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixObservationPointTable."
    INDEX       {
        ipfixObservationPointGroupId,
        ipfixObservationPointIndex
    }
    ::= { ipfixObservationPointTable 1 }

IpfixObservationPointEntry ::=
    SEQUENCE {
        ipfixObservationPointGroupId           Unsigned32,
        ipfixObservationPointIndex             Unsigned32,
        ipfixObservationPointObservationDomainId Unsigned32,
        ipfixObservationPointPhysicalEntity    PhysicalIndexOrZero,
        ipfixObservationPointPhysicalInterface InterfaceIndexOrZero,
        ipfixObservationPointPhysicalEntityDirection INTEGER
    }

ipfixObservationPointGroupId OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Locally arbitrary, but unique identifier of an entry in the
        ipfixObservationPointTable. The value is expected to remain
        constant from a re-initialization of the entity's network
        management agent to the next re-initialization.

        This index represents a group of Observation Points.
```

```
        The special value of 0 MUST NOT be used within this table
        but is reserved for the usage in the
        ipfixMeteringProcessTable. An index of 0 for the
        ipfixObservationPointGroupReference index in that table
        indicates that an Observation Point is unknown or
        unspecified for a Metering Process cache."
    ::= { ipfixObservationPointEntry 1 }

ipfixObservationPointIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Locally arbitrary, but unique identifier of an entry in the
        ipfixObservationPointTable. The value is expected to remain
        constant from a re-initialization of the entity's network
        management agent to the next re-initialization.

        This index represents a single Observation Point in an
        Observation Point group."
    ::= { ipfixObservationPointEntry 2 }

ipfixObservationPointObservationDomainId OBJECT-TYPE
    SYNTAX      Unsigned32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The ID of the Observation Domain in which this
        Observation Point is included.

        The special value of 0 indicates that the Observation
        Points within this group cannot be applied to a single
        Observation Domain."
    REFERENCE
        "RFC5101 Section 3.1 - Specification of the IP Flow
        Information Export (IPFIX) Protocol for the Exchange of IP
        Traffic Flow Information"
    ::= { ipfixObservationPointEntry 3 }

ipfixObservationPointPhysicalEntity OBJECT-TYPE
    SYNTAX      PhysicalIndexOrZero
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object contains the index of a physical entity in
        the ENTITY MIB. This physical entity is the given
        Observation Point. If such a physical entity cannot be
        specified or is not known then the object is zero."
    ::= { ipfixObservationPointEntry 4 }
```

```
ipfixObservationPointPhysicalInterface OBJECT-TYPE
    SYNTAX      InterfaceIndexOrZero
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object contains the index of a physical interface in
        the IF MIB. This physical interface is the given
        Observation Point. If such a physical interface cannot be
        specified or is not known then the object is zero.

        This object MAY be used stand alone or in addition to
        ipfixObservationPointPhysicalEntity. If
        ipfixObservationPointPhysicalEntity is not zero this object
        MUST point to the same physical interface that is
        referenced in ipfixObservationPointPhysicalEntity.
        Otherwise it may reference any interface in the IF MIB."
    ::= { ipfixObservationPointEntry 5 }

ipfixObservationPointPhysicalEntityDirection OBJECT-TYPE
    SYNTAX      INTEGER {
                    unknown(0),
                    ingress(1),
                    egress(2),
                    both(3)
                }
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The direction of the flow that is monitored on the given
        physical entity. The following values are valid:

        unknown(0)
            This value MUST be used if a direction is not
            known for the given physical entity.

        ingress(1)
            This value is used for monitoring incoming flows on the
            given physical entity.

        egress(2)
            This value is used for monitoring outgoing flows on the
            given physical entity.

        both(3)
            This value is used for monitoring incoming and outgoing
            flows on the given physical entity."
    ::= { ipfixObservationPointEntry 6 }

-----------------------------------------------------------------
```

```
-- 1.1.7: Selection Process Table
--------------------------------------------------------------------
ipfixSelectionProcessTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixSelectionProcessEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table contains Selector Functions connected to a
        Metering Process by the index ipfixMeteringProcessCacheId.
        The Selector Functions are grouped into Selection Processes
        by the ipfixSelectionProcessIndex. The Selector Functions
        are applied within the Selection Process to the packets
        observed for the given Metering Process cache in increasing
        order implied by the ipfixSelectionProcessSelectorIndex.
        This means Selector Functions with lower
        ipfixSelectionProcessSelectorIndex are applied first. The
        remaining packets are accounted in Flow Records.

        Since IPFIX does not define any Selector Function (except
        selecting every packet) this is a placeholder for future
        use and a guideline for implementing enterprise specific
        Selector Function objects.

        The following object tree should visualizes how the
        Selector Function objects should be implemented:

        ipfixSelectorFunctions
        |
        +- ipfixFuncSelectAll
        |  |
        |  +- ipfixFuncSelectAllAvail (is the function available?)
        |
        +- ipfixFuncF2
        |  |
        |  +- ipfixFuncF2Avail (is the function F2 available)
        |  |
        |  +- ipfixFuncF2Parameters (a table with parameters)
        ...
        |
        +- ipfixFunFn...

        If a Selector Function takes parameters the MIB should
        contain a table with an entry for each set of parameters
        used at the Exporter."
    ::= { ipfixMainObjects 7 }

ipfixSelectionProcessEntry OBJECT-TYPE
    SYNTAX      IpfixSelectionProcessEntry
    MAX-ACCESS  not-accessible
```

```
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixSelectionProcessTable."
    INDEX       {
        ipfixMeteringProcessCacheId,
        ipfixSelectionProcessIndex,
        ipfixSelectionProcessSelectorIndex
    }
    ::= { ipfixSelectionProcessTable 1 }

IpfixSelectionProcessEntry ::= SEQUENCE {
        ipfixSelectionProcessIndex            Unsigned32,
        ipfixSelectionProcessSelectorIndex    Unsigned32,
        ipfixSelectionProcessSelectorFunction OBJECT IDENTIFIER
    }

ipfixSelectionProcessIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Locally arbitrary, but unique identifier of an entry in the
        ipfixSelectionProcessTable. The value is expected to remain
        constant from a re-initialization of the entity's network
        management agent to the next re-initialization."
    ::= { ipfixSelectionProcessEntry 1 }

ipfixSelectionProcessSelectorIndex OBJECT-TYPE
    SYNTAX      Unsigned32 (1..4294967295)
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Index specifying the order in which the referenced
        ipfixSelctionProcessSelectorFunction's are applied to the
        observed packet stream within the given Selection Process
        (identified by the ipfixSelectionProcessIndex). The
        Selector Functions are applied in increasing order i.e.,
        Selector Functions with lower index are applied first."
    ::= { ipfixSelectionProcessEntry 2 }

ipfixSelectionProcessSelectorFunction OBJECT-TYPE
    SYNTAX      OBJECT IDENTIFIER
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The pointer to the Selector Function used at position
        ipfixSelectionProcessSelectorIndex in the list of Selector
        Functions for the Metering Process cache specified by the
        index ipfixMeteringProcessCacheId and the for the given
```

```
        Selection Process (identified by the
        ipfixSelectionProcessIndex).

        This usually points to an object in the IPFIX SELECTOR MIB.
        If the Selector Function does take no parameters then it
        MUST point to the root of the function subtree. If the
        function takes parameters then it MUST point to an entry
        in the parameter table of the Selector Function."
    ::= { ipfixSelectionProcessEntry 3 }

-----------------------------------------------------------------------
-- 1.2.1: Transport Session Statistics Table
-----------------------------------------------------------------------
ipfixTransportSessionStatsTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixTransportSessionStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists Transport Sessions statistics between
        Exporting Process and Collecting Process."
    ::= { ipfixStatistics 1 }

ipfixTransportSessionStatsEntry OBJECT-TYPE
    SYNTAX      IpfixTransportSessionStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixTransportSessionStatsTable"
    AUGMENTS    { ipfixTransportSessionEntry }
    ::= { ipfixTransportSessionStatsTable 1 }

IpfixTransportSessionStatsEntry ::=
    SEQUENCE {
        ipfixTransportSessionRate              Gauge32,
        ipfixTransportSessionPackets           Counter64,
        ipfixTransportSessionBytes             Counter64,
        ipfixTransportSessionMessages          Counter64,
        ipfixTransportSessionDiscardedMessages Counter64,
        ipfixTransportSessionRecords           Counter64,
        ipfixTransportSessionTemplates         Counter64,
        ipfixTransportSessionOptionsTemplates  Counter64,
        ipfixTransportSessionDiscontinuityTime TimeStamp
    }

ipfixTransportSessionRate OBJECT-TYPE
    SYNTAX      Gauge32
    UNITS       "bytes/second"
    MAX-ACCESS  read-only
    STATUS      current
```

```
    DESCRIPTION
        "The number of bytes per second received by the
        Collector or transmitted by the Exporter. A
        value of zero (0) means that no packets were sent or
        received yet. This object is updated every second."
    ::= { ipfixTransportSessionStatsEntry 1 }

ipfixTransportSessionPackets OBJECT-TYPE
    SYNTAX      Counter64
    UNITS       "packets"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of packets received by the Collector
        or transmitted by the Exporter.
        Discontinuities in the value of this counter can occur at
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixTransportSessionDiscontinuityTime."
    ::= { ipfixTransportSessionStatsEntry 2 }

ipfixTransportSessionBytes OBJECT-TYPE
    SYNTAX      Counter64
    UNITS       "bytes"
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of bytes received by the Collector
        or transmitted by the Exporter.
        Discontinuities in the value of this counter can occur at
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixTransportSessionDiscontinuityTime."
    ::= { ipfixTransportSessionStatsEntry 3 }

ipfixTransportSessionMessages OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of IPFIX messages received by the
        Collector or transmitted by the Exporter.
        Discontinuities in the value of this counter can occur at
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixTransportSessionDiscontinuityTime."
    ::= { ipfixTransportSessionStatsEntry 4 }

ipfixTransportSessionDiscardedMessages OBJECT-TYPE
```

```
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of received IPFIX Message that are malformed,
        cannot be decoded, are received in the wrong order or are
        missing according to the sequence number.

        If used at the Exporter the number of messages that could
        not be sent due to e.g. internal buffer overflows, network
        congestion, or routing issues.
        Discontinuities in the value of this counter can occur at
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixTransportSessionDiscontinuityTime."
    ::= { ipfixTransportSessionStatsEntry 5 }

ipfixTransportSessionRecords OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of Data Records received by the Collector or
        transmitted by the Exporter.
        Discontinuities in the value of this counter can occur at
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixTransportSessionDiscontinuityTime."
    ::= { ipfixTransportSessionStatsEntry 6 }

ipfixTransportSessionTemplates OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of Templates received or transmitted.
        Discontinuities in the value of this counter can occur at
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixTransportSessionDiscontinuityTime."
    ::= { ipfixTransportSessionStatsEntry 7 }

ipfixTransportSessionOptionsTemplates OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of Options Templates received or transmitted.
        Discontinuities in the value of this counter can occur at
```

```
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixTransportSessionDiscontinuityTime."
    ::= { ipfixTransportSessionStatsEntry 8 }

ipfixTransportSessionDiscontinuityTime OBJECT-TYPE
    SYNTAX       TimeStamp
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The value of sysUpTime at the most recent occasion at which
        one or more of the Transport Session counters suffered a
        discontinuity.
        A value of zero indicates no such discontinuity has
        occurred since the last re-initialisation of the local
        management subsystem."
    ::= { ipfixTransportSessionStatsEntry 9 }

-- ------------------------------------------------------------------
-- 1.2.2: Template Statistics Table
-- ------------------------------------------------------------------
ipfixTemplateStatsTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixTemplateStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists statistics objects per Template."
    ::= { ipfixStatistics 2 }

ipfixTemplateStatsEntry OBJECT-TYPE
    SYNTAX      IpfixTemplateStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixTemplateStatsTable"
    AUGMENTS    { ipfixTemplateEntry }
    ::= { ipfixTemplateStatsTable 1 }

IpfixTemplateStatsEntry ::=
    SEQUENCE {
        ipfixTemplateDataRecords       Counter64,
        ipfixTemplateDiscontinuityTime TimeStamp
    }

ipfixTemplateDataRecords OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
```

```
        "The number of Data Records that are transmitted or received
        per Template.
        Discontinuities in the value of this counter can occur at
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixTemplateDiscontinuityTime."
    ::= { ipfixTemplateStatsEntry 1 }

ipfixTemplateDiscontinuityTime OBJECT-TYPE
    SYNTAX       TimeStamp
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The value of sysUpTime at the most recent occasion at which
        the Template counter suffered a discontinuity.
        A value of zero indicates no such discontinuity has
        occurred since the last re-initialisation of the local
        management subsystem."
    ::= { ipfixTemplateStatsEntry 2 }

-------------------------------------------------------------------
-- 1.2.3: Metering Process Statistics Table
-------------------------------------------------------------------
ipfixMeteringProcessStatsTable  OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixMeteringProcessStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "This table lists statistic objects that have data per
        Metering Process cache.

        On Collectors this table is not needed."
    ::= { ipfixStatistics 3 }

ipfixMeteringProcessStatsEntry OBJECT-TYPE
    SYNTAX      IpfixMeteringProcessStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixMeteringProcessStatsTable."
    AUGMENTS    { ipfixMeteringProcessEntry }
    ::= { ipfixMeteringProcessStatsTable 1 }

IpfixMeteringProcessStatsEntry ::=
    SEQUENCE {
        ipfixMeteringProcessCacheActiveFlows       Gauge32,
        ipfixMeteringProcessCacheInactiveFlows     Gauge32,
        ipfixMeteringProcessCacheDataRecords       Counter64,
        ipfixMeteringProcessCacheDiscontinuityTime TimeStamp
```

```
    }

ipfixMeteringProcessCacheActiveFlows OBJECT-TYPE
    SYNTAX      Gauge32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of Flows currently active at this cache."
    ::= { ipfixMeteringProcessStatsEntry 1 }

ipfixMeteringProcessCacheInactiveFlows OBJECT-TYPE
    SYNTAX      Gauge32
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of Flows currently inactive at this cache."
    ::= { ipfixMeteringProcessStatsEntry 2 }

ipfixMeteringProcessCacheDataRecords OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of Data Records generated.
        Discontinuities in the value of this counter can occur at
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixTemplateDiscontinuityTime."
    ::= { ipfixMeteringProcessStatsEntry 3 }

ipfixMeteringProcessCacheDiscontinuityTime OBJECT-TYPE
    SYNTAX       TimeStamp
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The value of sysUpTime at the most recent occasion at which
        the Metering Process counter suffered a discontinuity.
        A value of zero indicates no such discontinuity has
        occurred since the last re-initialisation of the local
        management subsystem."
    ::= { ipfixMeteringProcessStatsEntry 4 }

-- ------------------------------------------------------------------
-- 1.2.4: Selection Process Statistics Table
-- ------------------------------------------------------------------
ipfixSelectionProcessStatsTable OBJECT-TYPE
    SYNTAX      SEQUENCE OF IpfixSelectionProcessStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
```

```
    DESCRIPTION
        "This table contains statistics for the Selector Functions
        connected to Metering Process by the index
        ipfixMeteringProcessCacheId.

        The indexes MUST match an entry in the
        ipfixSelectionProcessTable."
    ::= { ipfixStatistics 4 }

ipfixSelectionProcessStatsEntry OBJECT-TYPE
    SYNTAX      IpfixSelectionProcessStatsEntry
    MAX-ACCESS  not-accessible
    STATUS      current
    DESCRIPTION
        "Defines an entry in the ipfixSelectionProcessStatsTable."
    AUGMENTS    { ipfixSelectionProcessEntry }
    ::= { ipfixSelectionProcessStatsTable 1 }

IpfixSelectionProcessStatsEntry ::= SEQUENCE {
        ipfixSelectionProcessStatsPacketsObserved   Counter64,
        ipfixSelectionProcessStatsPacketsDropped    Counter64,
        ipfixSelectionProcessStatsDiscontinuityTime TimeStamp
    }

ipfixSelectionProcessStatsPacketsObserved OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of packets observed at the entry point of the
        function. The entry point may be the Observation Point or
        the exit point of another Selector Function.
        Discontinuities in the value of this counter can occur at
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixSelectionProcessStatsDiscontinuityTime."
    ::= { ipfixSelectionProcessStatsEntry 1 }

ipfixSelectionProcessStatsPacketsDropped OBJECT-TYPE
    SYNTAX      Counter64
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "The number of packets dropped while selecting packets.
        Discontinuities in the value of this counter can occur at
        re-initialisation of the management system, and at other
        times as indicated by the value of
        ipfixSelectionProcessStatsDiscontinuityTime."
    ::= { ipfixSelectionProcessStatsEntry 2 }
```

```
ipfixSelectionProcessStatsDiscontinuityTime OBJECT-TYPE
    SYNTAX       TimeStamp
    MAX-ACCESS   read-only
    STATUS       current
    DESCRIPTION
        "The value of sysUpTime at the most recent occasion at which
        one or more of the Selector counters suffered a
        discontinuity.
        A value of zero indicates no such discontinuity has
        occurred since the last re-initialisation of the local
        management subsystem."
    ::= { ipfixSelectionProcessStatsEntry 3 }

--====================================================================
-- 2: Conformance Information
--====================================================================
ipfixCompliances OBJECT IDENTIFIER ::= { ipfixConformance 1 }
ipfixGroups      OBJECT IDENTIFIER ::= { ipfixConformance 2 }

--------------------------------------------------------------------
-- 2.1: Compliance Statements
--------------------------------------------------------------------
ipfixCollectorCompliance MODULE-COMPLIANCE
    STATUS      current
    DESCRIPTION
        "An implementation that builds an IPFIX Collector
        that complies to this module MUST implement the objects
        defined in the mandatory group ipfixCommonGroup.

        The implementation of all objects in the other groups is
        optional and depends on the corresponding functionality
        implemented in the equipment.

        An implementation that is compliant to this MIB module
        is limited to use only the values TCP (6), UDP (17) and
        SCTP (132) in the ipfixTransportSessionProtocol object
        because these are the only protocol currently specified
        for usage within IPFIX (see RFC5101)."
    MODULE  -- this module
    MANDATORY-GROUPS {
        ipfixCommonGroup
    }

    GROUP ipfixCommonStatsGroup
    DESCRIPTION
        "These objects should be implemented if the statistics
        function is implemented in the equipment."
    ::= { ipfixCompliances 1 }
```

```
ipfixExporterCompliance MODULE-COMPLIANCE
    STATUS  current
    DESCRIPTION
        "An implementation that builds an IPFIX Exporter that
        complies to this module MUST implement the objects defined
        in the mandatory group ipfixCommonGroup. The implementation
        of all other objects depends on the implementation of the
        corresponding functionality in the equipment."
    MODULE  -- this module
    MANDATORY-GROUPS {
            ipfixCommonGroup,
            ipfixExporterGroup
    }

    GROUP ipfixCommonStatsGroup
    DESCRIPTION
        "These objects should be implemented if the statistics
        function is implemented in the equipment."

    GROUP ipfixExporterStatsGroup
    DESCRIPTION
        "These objects MUST be implemented if statistical functions
        are implemented on the equipment."
    ::= { ipfixCompliances 2 }

-------------------------------------------------------------------
-- 2.2: MIB Grouping
-------------------------------------------------------------------
ipfixCommonGroup OBJECT-GROUP
    OBJECTS {
        ipfixTransportSessionProtocol,
        ipfixTransportSessionSourceAddressType,
        ipfixTransportSessionSourceAddress,
        ipfixTransportSessionDestinationAddressType,
        ipfixTransportSessionDestinationAddress,
        ipfixTransportSessionSourcePort,
        ipfixTransportSessionDestinationPort,
        ipfixTransportSessionSctpAssocId,
        ipfixTransportSessionDeviceMode,
        ipfixTransportSessionTemplateRefreshTimeout,
        ipfixTransportSessionOptionsTemplateRefreshTimeout,
        ipfixTransportSessionTemplateRefreshPacket,
        ipfixTransportSessionOptionsTemplateRefreshPacket,
        ipfixTransportSessionIpfixVersion,
        ipfixTransportSessionStatus,

        ipfixTemplateSetId,
        ipfixTemplateAccessTime,
```

```
        ipfixTemplateDefinitionIeId,
        ipfixTemplateDefinitionIeLength,
        ipfixTemplateDefinitionEnterpriseNumber,
        ipfixTemplateDefinitionFlags
    }
    STATUS      current
    DESCRIPTION
        "The main IPFIX objects."
    ::= { ipfixGroups 1 }

ipfixCommonStatsGroup OBJECT-GROUP
    OBJECTS {
        ipfixTransportSessionRate,
        ipfixTransportSessionPackets,
        ipfixTransportSessionBytes,
        ipfixTransportSessionMessages,
        ipfixTransportSessionDiscardedMessages,
        ipfixTransportSessionRecords,
        ipfixTransportSessionTemplates,
        ipfixTransportSessionOptionsTemplates,
        ipfixTransportSessionDiscontinuityTime,

        ipfixTemplateDataRecords,
        ipfixTemplateDiscontinuityTime
    }
    STATUS      current
    DESCRIPTION
        "Common statistical objects."
    ::= { ipfixGroups 2 }

ipfixExporterGroup OBJECT-GROUP
    OBJECTS {
        ipfixExportMemberType,

        ipfixMeteringProcessObservationPointGroupRef,
        ipfixMeteringProcessCacheActiveTimeout,
        ipfixMeteringProcessCacheInactiveTimeout,

        ipfixObservationPointObservationDomainId,
        ipfixObservationPointPhysicalEntity,
        ipfixObservationPointPhysicalInterface,
        ipfixObservationPointPhysicalEntityDirection,

        ipfixSelectionProcessSelectorFunction
    }
    STATUS      current
    DESCRIPTION
        "The main objects for Exporters."
```

```
    ::= { ipfixGroups 3 }

ipfixExporterStatsGroup OBJECT-GROUP
    OBJECTS {
        ipfixMeteringProcessCacheActiveFlows,
        ipfixMeteringProcessCacheInactiveFlows,
        ipfixMeteringProcessCacheDataRecords,
        ipfixMeteringProcessCacheDiscontinuityTime,

        ipfixSelectionProcessStatsPacketsObserved,
        ipfixSelectionProcessStatsPacketsDropped,
        ipfixSelectionProcessStatsDiscontinuityTime
    }
    STATUS      current
    DESCRIPTION
        "The statistical objects for Exporters."
    ::= { ipfixGroups 4 }

END
```

8.2. IPFIX SELECTOR MIB Definition

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```
IPFIX-SELECTOR-MIB DEFINITIONS ::= BEGIN

IMPORTS
    MODULE-IDENTITY, OBJECT-TYPE, mib-2
        FROM SNMPv2-SMI                                 -- RFC2578
    TruthValue
        FROM SNMPv2-TC                                  -- RFC2579
    MODULE-COMPLIANCE, OBJECT-GROUP
        FROM SNMPv2-CONF;                               -- RFC2580

ipfixSelectorMIB MODULE-IDENTITY
    LAST-UPDATED "200906020900Z"         -- 02 June 2009
    ORGANIZATION "IETF IPFIX Working Group"
    CONTACT-INFO
        "WG charter:
          http://www.ietf.org/html.charters/ipfix-charter.html

        Mailing Lists:
          General Discussion: ipfix@ietf.org
          To Subscribe: http://www1.ietf.org/mailman/listinfo/ipfix
          Archive:
      http://www1.ietf.org/mail-archive/web/ipfix/current/index.html

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    DESCRIPTION
        "The IPFIX SELECTOR MIB module defines the standard
        filtering and sampling functions that can be referenced in
        the ipfixSelectorTable of the IPFIX MIB. The subtree
        ipfixSelectorFunctions is a placeholder where all standard
        filtering and sampling functions should be located.

        The IPFIX SELECTOR MIB module is maintained by IANA and can
        be extended through Expert Review [RFC5226], i.e. review by
        one of a group of experts designated by an IETF Area
        Director. The group of experts MUST check the requested MIB
        objects for completeness and accuracy of the description.
        Requests for MIB objects that duplicate the functionality of
        existing objects SHOULD be declined. The smallest available
        OID SHOULD be assigned to a new MIB objects. The
        specification of new MIB objects SHOULD follow the structure
        specified in RFC yyyy and MUST be published using a
        well-established and persistent publication medium. The
        experts will initially be drawn from the Working Group
        Chairs and document editors of the IPFIX and PSAMP Working
        Groups.

        Copyright (c) 2009 IETF Trust and the persons identified as
        the document authors.  All rights reserved. This version
        of this MIB module is part of RFC yyyy; see the RFC itself
        for full legal notices."
-- replace yyyy with actual RFC number & remove this notice

--  Revision history

    REVISION     "200906020900Z"         -- 02 June 2009
    DESCRIPTION
        "Initial version, published as RFC yyyy."
-- replace yyyy with actual RFC number & remove this notice

    ::= { mib-2 zzz }
```

```
-- zzz to be assigned by IANA.

--*****************************************************************
-- Top Level Structure of the MIB
--*****************************************************************

ipfixSelectorObjects     OBJECT IDENTIFIER
    ::= { ipfixSelectorMIB 1 }
ipfixSelectorConformance OBJECT IDENTIFIER
    ::= { ipfixSelectorMIB 2 }

--=================================================================
-- 1: Objects used by all IPFIX implementations
--=================================================================
-----------------------------------------------------------------
-- 1.1: Packet Selector Functions for IPFIX
-----------------------------------------------------------------
ipfixSelectorFunctions OBJECT IDENTIFIER
    ::= { ipfixSelectorObjects 1 }

-----------------------------------------------------------------
-- 1.1.1: Function 1: Selecting All Packets
-----------------------------------------------------------------
ipfixFuncSelectAll OBJECT IDENTIFIER
    ::= { ipfixSelectorFunctions 1 }

ipfixFuncSelectAllAvail OBJECT-TYPE
    SYNTAX      TruthValue
    MAX-ACCESS  read-only
    STATUS      current
    DESCRIPTION
        "This object indicates the availability of the trivial
        function of selecting all packets. This function is always
        available."
    ::= { ipfixFuncSelectAll 1 }

--=================================================================
-- 2: Conformance Information
--=================================================================
ipfixSelectorCompliances OBJECT IDENTIFIER
    ::= { ipfixSelectorConformance 1 }
ipfixSelectorGroups      OBJECT IDENTIFIER
    ::= { ipfixSelectorConformance 2 }

-----------------------------------------------------------------
-- 2.1: Compliance Statements
-----------------------------------------------------------------
ipfixSelectorBasicCompliance MODULE-COMPLIANCE
    STATUS  current
```

```
        DESCRIPTION
            "An implementation that builds an IPFIX Exporter that
            complies to this module MUST implement the objects defined
            in the mandatory group ipfixBasicGroup. The implementation
            of all other objects depends on the implementation of the
            corresponding functionality in the equipment."
        MODULE  -- this module
        MANDATORY-GROUPS {
                ipfixSelectorBasicGroup
        }
        ::= { ipfixSelectorCompliances 1 }

    ----------------------------------------------------------------------
    -- 2.2: MIB Grouping
    ----------------------------------------------------------------------
    ipfixSelectorBasicGroup OBJECT-GROUP
        OBJECTS {
            ipfixFuncSelectAllAvail
        }
        STATUS      current
        DESCRIPTION
            "The main IPFIX objects."
        ::= { ipfixSelectorGroups 1 }

    END
```

---

9. Security Considerations

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There are no management objects defined in this MIB module that have a MAX-ACCESS clause of read-write and/or read-create. So, if these MIB modules are implemented correctly, then there is no risk that an intruder can alter or create any management objects of these MIB modules via direct SNMP SET operations.
Some of the readable objects in these MIB modules (i.e., objects with a MAX-ACCESS other than not-accessible) may be considered sensitive or vulnerable in some network environments. It is thus important to control even GET and/or NOTIFY access to these objects and possibly to even encrypt the values of these objects when sending them over the network via SNMP. These are the tables and objects and their sensitivity/vulnerability:

*ipfixTransportSessionTable - contains configuration data that might be sensitive because objects in this table may reveal information about the network infrastructure

- *ipfixExportTable - contains configuration data that might be sensitive because object in this table may reveal information about the network infrastructure as well

- *ipfixMeteringProcessTable - contains configuration data that might be sensitive because objects in this table may reveal information about the IPFIX Device itself

- *ipfixObservationPointTable - contains configuration data that might be sensitive because objects in this table may reveal information about the IPFIX Device itself and the network infrastructure

- *ipfixSelectorFunctions - currently contains no sensitive data but might want to be secured anyway since it may contain sensitive data in a future version

All other objects and tables contain no data that is considered sensitive.
SNMP versions prior to SNMPv3 did not include adequate security. Even if the network itself is secure (for example by using IPsec), even then, there is no control as to who on the secure network is allowed to access and GET/SET (read/change/create/delete) the objects in these MIB modules.
It is RECOMMENDED that implementers consider the security features as provided by the SNMPv3 framework (see [RFC3410] (Case, J., Mundy, R., Partain, D., and B. Stewart, “Introduction and Applicability Statements for Internet-Standard Management Framework,” December 2002.), section 8), including full support for the SNMPv3 cryptographic mechanisms (for authentication and privacy).
Further, deployment of SNMP versions prior to SNMPv3 is NOT RECOMMENDED. Instead, it is RECOMMENDED to deploy SNMPv3 and to enable cryptographic security. It is then a customer/operator responsibility to ensure that the SNMP entity giving access to an instance of these MIB modules 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.

---

10. IANA Considerations

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

```
Descriptor          OBJECT IDENTIFIER value
----------          ----------------------
ipfixMIB            { mib-2 xxxxx }
ipfixSelectorMIB    { mib-2 zzzzz }
```

Further on the whole IPFIX SELECTOR MIB module is maintained by IANA. Additions to this MIB module are subject to Expert Review [RFC5226] (Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs," May 2008.), i.e., review by one of a group of experts designated by an IETF Area Director. The group of experts MUST check the requested MIB objects for completeness and accuracy of the description. Requests for MIB objects that duplicate the functionality of existing objects SHOULD be declined. The smallest available OID SHOULD be assigned to a new MIB objects. The specification of new MIB objects SHOULD follow the structure specified in Section 6 (Structure of the IPFIX SELECTOR MIB) and MUST be published using a well-established and persistent publication medium. The experts will initially be drawn from the Working Group Chairs and document editors of the IPFIX and PSAMP Working Groups.

---

11. Acknowledgment

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