                     Exporting Type Information for
         IP Flow Information Export (IPFIX) Information Elements

Abstract

   This document describes an extension to the IP Flow Information
   Export (IPFIX) protocol, which is used to represent and transmit data
   from IP flow measurement devices for collection, storage, and
   analysis, to allow the encoding of IPFIX Information Model properties
   within an IPFIX Message stream. This enables the export of extended
   type information for enterprise-specific Information Elements and the
   storage of such information within IPFIX Files, facilitating
   interoperability and reusability among a wide variety of applications
   and tools.

Status of This Memo

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

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1. Introduction

   IP Flow Information Export (IPFIX) provides a template mechanism for
   the flexible description of Data Records, by defining a record as a
   collection of Information Elements defined in an IANA registry,
   However, these Templates provide limited information about the type
   of described data; indeed, they encode only the size of the fields
   defined by these Information Elements. There presently exists no
   mechanism to provide full type information for these Information
   Elements, as is defined for the Information Elements in the IPFIX
   Information Model [RFC5102].

   This especially limits the interoperability of enterprise-specific
   Information Elements. It is not possible to use analysis tools on
   IPFIX records containing these partially defined Information Elements
   that have not been developed with a priori knowledge of their types,
   since such tools will not be able to decode them; these tools can
   only treat and store them as opaque octet arrays. However, if richer
   information is available, additional operations such as efficient
   storage, display, and limited analysis of records containing
   enterprise-specific Information Elements become possible, even for
   Collecting Processes that have not been specifically developed to
   understand them.

   This document defines a general mechanism to encode the full set of
   properties available for the definition of Information Elements
   within the IPFIX Information Model inline within an IPFIX Message
   stream using IPFIX Options. This mechanism may be used to fully
   define type information for Information Elements used within a
   message stream, without resorting to an external reference or
   reliance on out-of-band configuration, thereby improving the
   interoperability of enterprise-specific Information Elements.

   Note that the solution described in this document is not intended as
   a replacement for registration with IANA of generally useful
   Information Elements. It introduces overhead and does not lead to
   real interoperability as provided by standardization. Therefore, we
   highly recommend standardizing all new generally useful Information
   Elements by registering them with IANA. Standardization is
   straightforward, and the type information that needs to be specified
   in order to support the proposed solution provides a perfect basis
   for the description required for standardizing the Information
   Element.

   It might happen that an Information Element previously described by
   the mechanism in this document later becomes an IANA-registered,
   standard Information Element. In such environments, old and new
   versions of the Information Element can coexist. A translation

between Information Elements expressed by the described solution and
standardized Information Elements is therefore not necessary and is
out of scope for this document.

1.1. IPFIX Documents Overview

"Specification of the IP Flow Information Export (IPFIX) Protocol for
the Exchange of IP Traffic Flow Information" [RFC5101] (informally,
the IPFIX Protocol document) and its associated documents define the
IPFIX Protocol, which provides network engineers and administrators
with access to IP traffic flow information.

"Architecture for IP Flow Information Export" [RFC5470] (the IPFIX
Architecture document) defines the architecture for the export of
measured IP flow information out of an IPFIX Exporting Process to an
IPFIX Collecting Process, and the basic terminology used to describe
the elements of this architecture, per the requirements defined in
"Requirements for IP Flow Information Export" [RFC3917]. The IPFIX
Protocol document [RFC5101] then covers the details of the method for
transporting IPFIX Data Records and Templates via a congestion-aware
transport protocol from an IPFIX Exporting Process to an IPFIX
Collecting Process.

"Information Model for IP Flow Information Export" [RFC5102]
(informally, the IPFIX Information Model document) describes the
Information Elements used by IPFIX, including details on Information
Element naming, numbering, and data type encoding.

This document references the Protocol and Architecture documents for
terminology and extends the IPFIX Information Model to provide new
Information Elements for the representation of Information Element
properties. It draws data type definitions and data type semantics
definitions from the Information Model; the encodings of these data
types are defined in [RFC5101].

2. Terminology

Terms used in this document that are defined in the Terminology
section of the IPFIX Protocol [RFC5101] document are to be
interpreted as defined there.

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

3. Type Information Export

   This section describes the mechanism used to encode Information
   Element type information within an IPFIX Message stream. This
   mechanism consists of an Options Template Record used to define
   Information Element type records, and a set of Information Elements
   required by these type records. We first specify the necessary
   Information Elements, followed by the structure of the Options
   Template describing the type records.

   Note that Information Element type records require one Information
   Element, informationElementId, that is defined in the Packet Sampling
   (PSAMP) Information Model [RFC5477]. This Information Element
   supports references only to IANA-defined Information Elements; the
   privateEnterpriseNumber Information Element is required alongside
   informationElementId to describe enterprise-specific Information
   Elements.

3.1. informationElementDataType

   Description: A description of the abstract data type of an IPFIX
      information element. These are taken from the abstract data types
      defined in Section 3.1 of the IPFIX Information Model [RFC5102];
      see that section for more information on the types described
      below. This field may take the values defined in Table 1 below.

```
              +-------+----------------------+
              | Value | Description          |
              +-------+----------------------+
              |   0   |  octetArray          |
              |   1   |  unsigned8           |
              |   2   |  unsigned16          |
              |   3   |  unsigned32          |
              |   4   |  unsigned64          |
              |   5   |  signed8             |
              |   6   |  signed16            |
              |   7   |  signed32            |
              |   8   |  signed64            |
              |   9   |  float32             |
              |  10   |  float64             |
              |  11   |  boolean             |
              |  12   |  macAddress          |
              |  13   |  string              |
              |  14   |  dateTimeSeconds     |
              |  15   |  dateTimeMilliseconds|
              |  16   |  dateTimeMicroseconds|
              |  17   |  dateTimeNanoseconds |
              |  18   |  ipv4Address         |
              |  19   |  ipv6Address         |
              +-------+----------------------+
```

               Table 1: IE Data Type Values

      These types are registered in the IANA IPFIX Information Element
      Data Type subregistry. This subregistry is intended to assign
      numbers for type names, not to provide a mechanism for adding data
      types to the IPFIX Protocol, and as such requires a Standards
      Action [RFC5226] to modify.

   Abstract Data Type: unsigned8

   ElementId: 339

   Status: current

   Reference: Section 3.1 of the IPFIX Information Model [RFC5102]

3.2. informationElementDescription

   Description: A UTF-8 [RFC3629] encoded Unicode string containing a
      human-readable description of an Information Element. The content
      of the informationElementDescription MAY be annotated with one or
      more language tags [RFC4646], encoded in-line [RFC2482] within the
      UTF-8 string, in order to specify the language in which the

description is written. Description text in multiple languages
MAY tag each section with its own language tag; in this case, the
description information in each language SHOULD have equivalent
meaning. In the absence of any language tag, the "i-default"
[RFC2277] language SHOULD be assumed. See the Security
Considerations (Section 4) for notes on string handling for
Information Element type records.

Abstract Data Type: string

ElementId: 340

Status: current

3.3. informationElementName

Description: A UTF-8 [RFC3629] encoded Unicode string containing
the name of an Information Element, intended as a simple
identifier. See the Security Considerations (Section 4) for notes
on string handling for Information Element type records.

Abstract Data Type: string

ElementId: 341

Status: current

3.4. informationElementRangeBegin

Description: Contains the inclusive low end of the range of
acceptable values for an Information Element.

Abstract Data Type: unsigned64

Data Type Semantics: quantity

ElementId: 342

Status: current

3.5. informationElementRangeEnd

Description: Contains the inclusive high end of the range of
acceptable values for an Information Element.

   Abstract Data Type: unsigned64

   Data Type Semantics: quantity

   ElementId: 343

   Status: current

3.6.   informationElementSemantics

   Description: A description of the semantics of an IPFIX Information
      Element. These are taken from the data type semantics defined in
      Section 3.2 of the IPFIX Information Model [RFC5102]; see that
      section for more information on the types described below. This
      field may take the values in Table 2 below. The special value
      0x00 (default) is used to note that no semantics apply to the
      field; it cannot be manipulated by a Collecting Process or File
      Reader that does not understand it a priori.

```
                    +-------+--------------+
                    | Value | Description  |
                    +-------+--------------+
                    |   0   |   default    |
                    |   1   |   quantity   |
                    |   2   |   totalCounter |
                    |   3   |   deltaCounter |
                    |   4   |   identifier   |
                    |   5   |   flags      |
                    +-------+--------------+
```

                      Table 2: IE Semantics Values

      These semantics are registered in the IANA IPFIX Information
      Element Semantics subregistry. This subregistry is intended to
      assign numbers for semantics names, not to provide a mechanism for
      adding semantics to the IPFIX Protocol, and as such requires a
      Standards Action [RFC5226] to modify.

   Abstract Data Type: unsigned8

   ElementId: 344

   Status: current

   Reference: Section 3.2 of the IPFIX Information Model [RFC5102]

3.7. informationElementUnits

   Description: A description of the units of an IPFIX Information
      Element. These correspond to the units implicitly defined in the
      Information Element definitions in Section 5 of the IPFIX
      Information Model [RFC5102]; see that section for more information
      on the types described below. This field may take the values in
      Table 3 below; the special value 0x00 (none) is used to note that
      the field is unitless.

```
         +-------+---------------+---------------------------+
         | Value | Name          | Notes                     |
         +-------+---------------+---------------------------+
         |   0   |   none        |                           |
         |   1   |   bits        |                           |
         |   2   |   octets      |                           |
         |   3   |   packets     |                           |
         |   4   |   flows       |                           |
         |   5   |   seconds     |                           |
         |   6   |   milliseconds|                           |
         |   7   |   microseconds|                           |
         |   8   |   nanoseconds |                           |
         |   9   |   4-octet words |  for IPv4 header length |
         |  10   |   messages    |   for reliability reporting |
         |  11   |   hops        |   for TTL                 |
         |  12   |   entries     |   for MPLS label stack    |
         +-------+---------------+---------------------------+
```

                     Table 3: IE Units Values

      These types are registered in the IANA IPFIX Information Element
      Units subregistry; new types may be added on a First Come First
      Served [RFC5226] basis.

   Abstract Data Type: unsigned16

   ElementId: 345

   Status: current

   Reference: Section 5 of the IPFIX Information Model [RFC5102]

3.8. privateEnterpriseNumber

   Description: A private enterprise number, as assigned by IANA.
      Within the context of an Information Element Type record, this
      element can be used along with the informationElementId element to
      scope properties to a specific Information Element. To export

type information about an IANA-assigned Information Element, set
the privateEnterpriseNumber to 0, or do not export the
privateEnterpriseNumber in the type record. To export type
information about an enterprise-specific Information Element,
export the enterprise number in privateEnterpriseNumber, and
export the Information Element number with the Enterprise bit
cleared in informationElementId. The Enterprise bit in the
associated informationElementId Information Element MUST be
ignored by the Collecting Process.

Abstract Data Type: unsigned32

Data Type Semantics: identifier

ElementId: 346

Status: current

Reference: Sections 3.2 and 3.4.1 of the IPFIX Protocol [RFC5101];
   Section 8.2.3 of the PSAMP Information Model [RFC5477].

3.9. Information Element Type Options Template

The Information Element Type Options Template attaches type
information to Information Elements used within Template Records, as
scoped to an Observation Domain within a Transport Session. This
provides a mechanism for representing an IPFIX Information Model
inline within an IPFIX Message stream. Data Records described by
this template are referred to as Information Element type records.

In deployments in which interoperability across vendor
implementations of IPFIX is important, an Exporting Process exporting
data using Templates containing enterprise-specific Information
Elements SHOULD export an Information Element type record for each
enterprise-specific Information Element it exports. Collecting
Processes MAY use these type records to improve handling of unknown
enterprise-specific Information Elements. Exporting Processes using
enterprise-specific Information Elements to implement proprietary
features MAY omit type records for those Information Elements.

Information Element type records MUST be handled by Collecting
Processes as scoped to the Transport Session in which they are sent;
this facility is not intended to provide a method for the permanent
definition of Information Elements.

Similarly, for security reasons, type information for a given
Information Element MUST NOT be redefined by Information Element type
records, and a Collecting Process MUST NOT allow an Information

Element type record to replace its own internal definition of an
Information Element. Information Element type records SHOULD NOT be
duplicated in a given Observation Domain within a Transport Session.
Once an Information Element type record has been exported for a given
Information Element within a given Transport Session, all subsequent
type records for that Information Element MUST be identical.
Information Elements for which a Collecting Process receives
conflicting semantic or type information MUST be ignored.

Note that while this template MAY be used to export information about
any Information Element, including those registered with IANA,
Exporting Processes SHOULD NOT export any type records that could be
reasonably assumed to duplicate type information available at the
Collecting Process. This mechanism is not intended as a replacement
for Exporting and Collecting Processes keeping up to date with
changes to the IANA registry; such an update mechanism is out of
scope for this document.

The template SHOULD contain the Information Elements in Table 4,
below, as defined in the PSAMP Information Model [RFC5477] and in
this document, above.

IE	Description
informationElementId [scope]	The Information Element identifier of the Information Element described by this type record. This Information Element MUST be defined as a Scope Field. See the PSAMP Information Model [RFC5477] for a definition of this field.
privateEnterpriseNumber [scope]	The Private Enterprise number of the Information Element described by this type record. This Information Element MUST be defined as a Scope Field.
informationElementDataType	The storage type of the specified Information Element.
informationElementSemantics	The semantic type of the specified Information Element.
informationElementUnits	The units of the specified Information Element. This element SHOULD be omitted if the Information Element is a unitless quantity, or a not a quantity or counter.

IE (Continued)	Description (Continued)
informationElementRangeBegin	The low end of the range of acceptable values for the specified Information Element. This element SHOULD be omitted if the beginning of the Information Element's acceptable range is defined by its data type.
informationElementRangeEnd	The high end of the range of acceptable values for the specified Information Element. This element SHOULD be omitted if the end Information Element's acceptable range is defined by its data type.
informationElementName	The name of the specified Information Element.
informationElementDescription	A human-readable description of the specified Information Element. This element MAY be omitted in the interest of export efficiency.

Table 4: IE Type Options

3.10. Data Type and Semantics Restrictions

Note that the informationElementSemantics values defined in Section
3.2 of [RFC5102] are primarily intended to differentiate semantic
interpretation of numeric values, and that not all combinations of
the informationElementDataType and informationElementSemantics
Information Elements are valid; e.g., a counter cannot be encoded as
an IPv4 address. The following are acceptable values of
informationElementSemantics:

o Any value is valid for unsigned informationElementDataType values
   ("unsigned8", "unsigned16", "unsigned32", or "unsigned64").

o Any value except "flags" is valid for signed
   informationElementDataType values ("signed8", "signed16",
   "signed32", or "signed64").

o Any value except "identifier" or "flags" is valid for floating-
   point informationElementDataType values ("float32" or "float64").

  o Only "default" is valid for all other informationElementDataType
   values ("octetArray", "boolean", "macAddress", "string",
   "dateTimeSeconds", "dateTimeMilliseconds", "dateTimeMicroseconds",
   "dateTimeNanoseconds", "ipv4Address", or "ipv6Address").

  Information Element type records containing invalid combinations of
  informationElementSemantics and informationElementDataType MUST NOT
  be sent by Exporting Processes, and MUST be ignored by Collecting
  Processes.

  Future Standards Actions that modify the Information Element Data
  Type subregistry or the Information Element Semantics subregistry
  should contain a Data Type and Semantics Restrictions section such as
  this one to define allowable combinations of type and semantics
  information.

4. Security Considerations

  The same security considerations as for the IPFIX Protocol [RFC5101]
  apply.

  In addition, attention must be paid to the handling of Information
  Element type records at the Collecting Process. Type information
  precedence rules defined above (a Collecting Process' current
  knowledge overrides type records; types are not redefinable during a
  session) are designed to minimize the opportunity for an attacker to
  maliciously redefine the data model.

  Note that Information Element type records may contain two strings
  describing Information Elements: informationElementName and
  informationElementDescription. IPFIX strings on the wire are length-
  prefixed and UTF-8 [RFC3629] encoded, most often within an IPFIX
  variable-length Information Element, which mitigates the risk of
  unterminated-string attacks against IPFIX Collecting Processes.
  However, care should still be taken when handling strings within the
  type system of the Collecting Process.

  First, Collecting Processes should pay particular attention to buffer
  sizes converting between length-prefixed and null-terminated strings.
  Exporting Processes MUST NOT export, and Collecting Processes MUST
  ignore, any informationElementName or informationElementDescription
  content that contains null characters (U+0000) in order to ensure
  buffer and string lengths are consistent.

  Also, note that there is no limit to IPFIX string length beyond that
  inherent in the protocol. The maximum IPFIX string length is 65512
  octets (maximum message length (65535), minus message header (16),
  minus set header (4), minus long variable length field (3)).

Specifically, although the informationElementName of all IANA
Information Elements at the time of this writing is less than about
40 octets, and the informationElementDescription is less than 4096
octets, either of these Information Elements may contain strings up
to 65512 octets long.

5. IANA Considerations

This document specifies several new IPFIX Information Elements in the
IPFIX Information Element registry as defined in Section 3 above.
IANA has assigned the following Information Element numbers for their
respective Information Elements as specified below:

o   Information Element Number 339 for the informationElementDataType
    Information Element

o   Information Element Number 340 for the
    informationElementDescription Information Element

o   Information Element Number 341 for the informationElementName
    Information Element

o   Information Element Number 342 for the
    informationElementRangeBegin Information Element

o   Information Element Number 343 for the informationElementRangeEnd
    Information Element

o   Information Element Number 344 for the informationElementSemantics
    Information Element

o   Information Element Number 345 for the informationElementUnits
    Information Element

o   Information Element Number 346 for the privateEnterpriseNumber
    Information Element

IANA has created an Information Element Data Type subregistry for the
values defined for the informationElementDataType Information
Element. Entries may be added to this subregistry subject to a
Standards Action [RFC5226].

IANA has created an Information Element Semantics subregistry for the
values defined for the informationElementSemantics Information
Element. Entries may be added to this subregistry subject to a
Standards Action [RFC5226].

   IANA has created an Information Element Units subregistry for the
   values defined for the informationElementUnits Information Element.
   Entries may be added to this subregistry on an Expert Review
   [RFC5226] basis.

6. Acknowledgements

   Thanks to Paul Aitken and Gerhard Muenz for the detailed reviews, and
   to David Moore for first raising this issue to the IPFIX mailing
   list. Thanks to the PRISM project for its support of this work.

7. References

7.1. Normative References

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              Export (IPFIX) Protocol for the Exchange of IP Traffic
              Flow Information", RFC 5101, January 2008.

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              10646", STD 63, RFC 3629, November 2003.

   [RFC2277] Alvestrand, H., "IETF Policy on Character Sets and
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   [RFC2482] Whistler, K. and G. Adams, "Language Tagging in Unicode
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   [RFC4646] Phillips, A. and M. Davis, "Tags for Identifying
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   [RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an
              IANA Considerations Section in RFCs", BCP 26, RFC 5226,
              May 2008.

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

7.2. Informative References

   [RFC3917]   Quittek, J., Zseby, T., Claise, B., and S. Zander,
               "Requirements for IP Flow Information Export (IPFIX)",
               RFC 3917, October 2004.

   [RFC5470]   Sadasivan, G., Brownlee, N., Claise, B., and J. Quittek,
               "Architecture for IP Flow Information Export", RFC 5470,
               March 2009.

Appendix A. Examples

   The following example illustrates how the type information extension
   mechanism defined in this document may be used to describe the
   semantics of enterprise-specific Information Elements. The
   Information Elements used in this example are as follows:

   o initialTCPFlags, an example private IE 14, 1 octet, the TCP flags
      on the first TCP packet in the flow.

   o unionTCPFlags, an example private IE 15, 1 octet, the union of the
      TCP flags on all packets after the first TCP packet in the flow.

   An Exporting Process exporting flows containing these Information
   Elements might use a Template like the following:

```
                         1                   2                   3
     0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |          Set ID = 2           |          Length =  52         |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |        Template ID = 256      |        Field Count = 9        |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |0| flowStartSeconds       150 |        Field Length =  4      |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |0| sourceIPv4Address        8 |        Field Length =  4      |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |0| destinationIPv4Address  12 |        Field Length =  4      |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |0| sourceTransportPort      7 |        Field Length =  2      |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |0| destinationTransportPort 11 |       Field Length =  2      |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |0| octetTotalCount         85 |        Field Length =  4      |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |1| (initialTCPFlags)       14 |        Field Length =  1      |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                   Private Enterprise Number                   |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |1| (unionTCPFlags)         15 |        Field Length =  1      |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |                   Private Enterprise Number                   |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |0| protocolIdentifier       4 |        Field Length =  1      |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
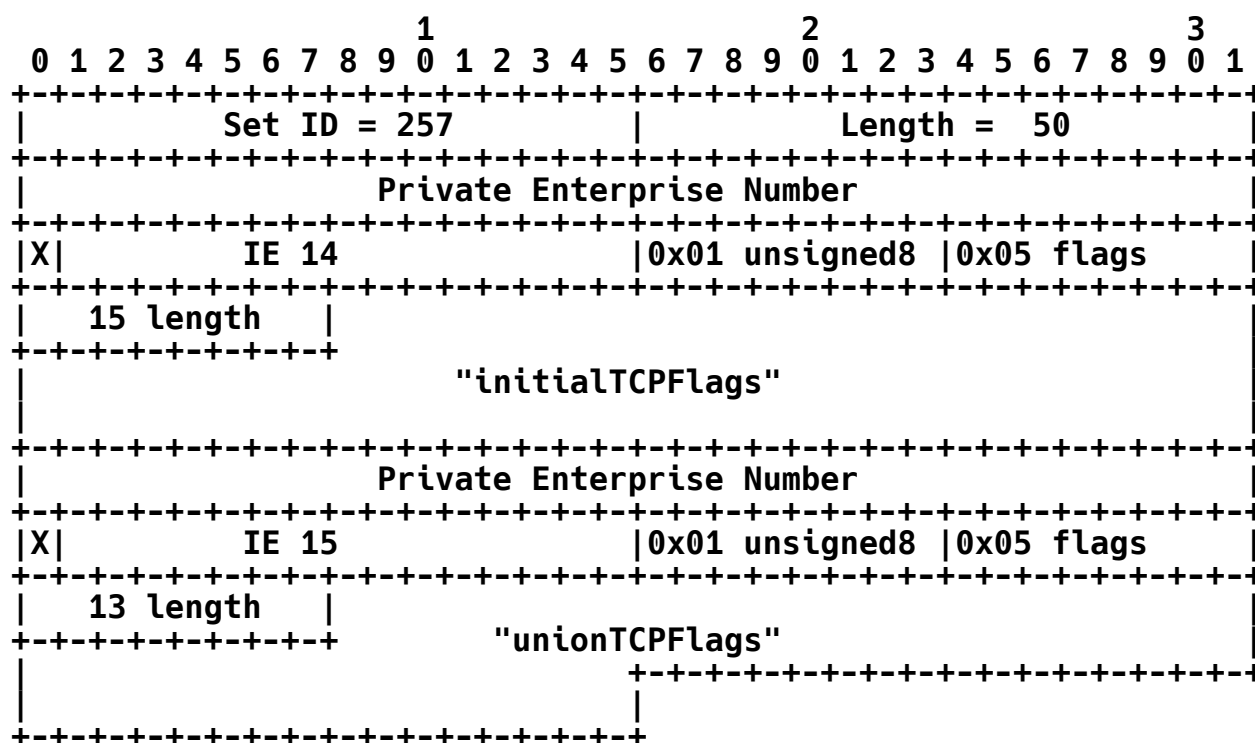
                Figure 1: Template with Enterprise-Specific IEs

However, a Collecting Process receiving Data Sets described by this
Template can only treat the enterprise-specific Information Elements
as opaque octets; specifically, there is no hint to the collector
that they contain flag information. To use the type information
extension mechanism to address this problem, the Exporting Process
would first export the Information Element Type Options Template
described in Section 3.9 above:

```
                      1                   2                   3
  0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |            Set ID = 3         |          Length =  26         |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |        Template ID = 257      |         Field Count = 4       |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |     Scope Field Count = 2     |0| priv.EnterpriseNumber   346 |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |         Field Length = 4      |0| informationElementId    303 |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |         Field Length = 2      |0| inf.El.DataType         339 |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |         Field Length = 1      |0| inf.El.Semantics        344 |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |         Field Length = 1      |0| inf.El.Name             341 |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
 |       Field Length = 65536    |
 +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

        Figure 2: Example Information Element Type Options Template

Then, the Exporting Process would export two records described by the
Example Information Element Type Options Template to describe the
enterprise-specific Information Elements:

```
                 1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|          Set ID = 257         |            Length =  50       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   Private Enterprise Number                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|X|        IE 14           |0x01 unsigned8 |0x05 flags         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  15 length    |                                               |
+-+-+-+-+-+-+-+-+                                               |
|                    "initialTCPFlags"                          |
|                                                               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   Private Enterprise Number                    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|X|        IE 15           |0x01 unsigned8 |0x05 flags         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  13 length    |                                               |
+-+-+-+-+-+-+-+-+          "unionTCPFlags"                      |
|                           +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 3: Type Record Example

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