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Cisco-Specific Information Elements Reused in IP Flow Information Export (IPFIX)

Abstract

This document describes some additional IP Flow Information Export (IPFIX) Information Elements in the range of 1-127, which is the range compatible with field types used by NetFlow version 9 in RFC 3954, as specified in the IPFIX Information Model in RFC 7012.

Status of This Memo

This document is not an Internet Standards Track specification; it is published for informational purposes.

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Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc7270.

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1. Introduction

Section 4 of [RFC7012] defines the IPFIX Information Elements (IEs) in the range of 1-127 to be compatible with the NetFlow version 9 fields, as specified in "Cisco Systems NetFlow Services Export Version 9" [RFC3954]. As [RFC3954] was published in 2004, it does not contain all NetFlow version 9 field types in the range of 1-127. The question was asked whether IPFIX Devices should exclusively report the IANA IPFIX IEs [IANA-IPFIX]. In other words, when upgrading from a NetFlow Metering Process to an IPFIX Metering Process, should the IPFIX Devices stop reporting IEs specific to NetFlow version 9 that were not registered in IANA [IANA-IPFIX]?

This document is intended to fill the gap in this IE range. It describes some additional IPFIX Information Elements in the range of 1-127, which is the range compatible with field types used by NetFlow version 9 in [RFC3954], as specified in the IPFIX Information Model [RFC7012]. With this, IPFIX implementations could export all the Information Elements specified in IANA [IANA-IPFIX], regardless of the range.

This document follows the rules in "Guidelines for Authors and Reviewers of IP Flow Export (IPFIX) Information Elements" [RFC7013]. This document does not extend [RFC3954]. The IPFIX Protocol [RFC7011] has its own Information Model ([RFC7012] and IANA [IANA-IPFIX]), which is extensible upon application to IANA, subject to expert review by IE-DOCTORS [RFC7013]. This document extends the IPFIX Information Model.

2. Terminology

IPFIX-specific terminology used in this document is defined in Section 2 of [RFC7011]. As in [RFC7011], these IPFIX-specific terms have the first letter of a word capitalized when used in this document.

3. Information Elements Overview

The following Information Elements are discussed in the sections below:

ID	Name	ID	Name
34	samplingInterval	84	samplerName
35	samplingAlgorithm	87	flagsAndSamplerId
38	engineType	89	forwardingStatus
39	engineId	92	srcTrafficIndex
43	ipv4RouterSc	93	dstTrafficIndex
48	samplerId	100	className
49	samplerMode	102	layer2packetSectionOffset
50	samplerRandomInterval	103	layer2packetSectionSize
51	classId	104	layer2packetSectionData

Table 1

4. Information Elements

4.1. samplingInterval

Description:
Deprecated in favor of 305 samplingPacketInterval. When using sampled NetFlow, the rate at which packets are sampled -- e.g., a value of 100 indicates that one of every 100 packets is sampled.

Abstract Data Type: unsigned32

ElementId: 34

Semantics: quantity

Status: deprecated

Units: packets

4.2. samplingAlgorithm

Description:
Deprecated in favor of 304 selectorAlgorithm. The type of algorithm used for sampled NetFlow:

1 - Deterministic Sampling,

2 - Random Sampling.

The values are not compatible with the selectorAlgorithm IE, where "Deterministic" has been replaced by "Systematic count-based" (1) or "Systematic time-based" (2), and "Random" is (3). Conversion is required; see "Packet Sampling (PSAMP) Parameters" [IANA-PSAMP].

Abstract Data Type: unsigned8

ElementId: 35

Semantics: identifier

Status: deprecated

4.3. engineType

Description:
Type of flow switching engine in a router/switch:

RP = 0,

VIP/Line card = 1,

PFC/DFC = 2.

Reserved for internal use on the Collector.

Abstract Data Type: unsigned8

ElementId: 38

Semantics: identifier

Status: deprecated

4.4. engineId

Description:
Versatile Interface Processor (VIP) or line card slot number of the flow switching engine in a router/switch. Reserved for internal use on the Collector.

Abstract Data Type: unsigned8

ElementId: 39

Semantics: identifier

Status: deprecated

4.5. ipv4RouterSc

Description:
This is a platform-specific field for the Catalyst 5000/Catalyst 6000 family. It is used to store the address of a router that is being shortcut when performing MultiLayer Switching.

Abstract Data Type: ipv4Address

ElementId: 43

Semantics: default

Status: deprecated

Reference:
[CCO-MLS] describes MultiLayer Switching.

4.6. samplerId

Description:
Deprecated in favor of 302 selectorId. The unique identifier associated with samplerName.

Abstract Data Type: unsigned8

ElementId: 48

Semantics: identifier

Status: deprecated

4.7. samplerMode

Description:
Deprecated in favor of 304 selectorAlgorithm. The values are not compatible: selectorAlgorithm=3 is random sampling. The type of algorithm used for sampling data: 1 - Deterministic, 2 - Random Sampling. Use with samplerRandomInterval.

Abstract Data Type: unsigned8

ElementId: 49

Semantics: identifier

Status: deprecated

4.8. samplerRandomInterval

Description:
Deprecated in favor of 305 samplingPacketInterval. Packet interval at which to sample -- in case of random sampling. Used in connection with the samplerMode 0x02 (random sampling) value.

Abstract Data Type: unsigned32

ElementId: 50

Semantics: quantity

Status: deprecated

4.9. classId

Description:
Deprecated in favor of 302 selectorId. Characterizes the traffic class, i.e., QoS treatment.

Abstract Data Type: unsigned8

ElementId: 51

Semantics: identifier

Status: deprecated

4.10. samplerName

Description:
Deprecated in favor of 335 selectorName. Name of the flow sampler.

Abstract Data Type: string

ElementId: 84

Status: deprecated

4.11. flagsAndSamplerId

Description:
Flow flags and the value of the sampler ID (samplerId) combined in one bitmapped field. Reserved for internal use on the Collector.

Abstract Data Type: unsigned32

ElementId: 87

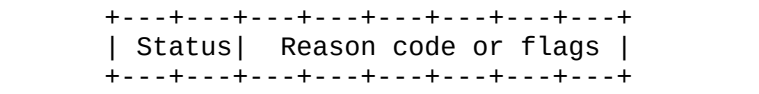
Semantics: identifier

Status: deprecated

4.12. forwardingStatus

Description:
This Information Element describes the forwarding status of the flow and any attached reasons. The reduced-size encoding rules as per [RFC7011] apply.

The basic encoding is 8 bits. The future extensions could add one or three bytes. The layout of the basic encoding is as follows:



Status:

00b = Unknown
01b = Forwarded
10b = Dropped
11b = Consumed

Reason Code (status = 01b, Forwarded)

01 000000b = 64 = Unknown
01 000001b = 65 = Fragmented
01 000010b = 66 = Not Fragmented

Reason Code (status = 10b, Dropped)

10 000000b = 128 = Unknown
10 000001b = 129 = ACL deny
10 000010b = 130 = ACL drop
10 000011b = 131 = Unroutable
10 000100b = 132 = Adjacency
10 000101b = 133 = Fragmentation and DF set
10 000110b = 134 = Bad header checksum
10 000111b = 135 = Bad total Length
10 001000b = 136 = Bad header length
10 001001b = 137 = bad TTL
10 001010b = 138 = Policer
10 001011b = 139 = WRED
10 001100b = 140 = RPF
10 001101b = 141 = For us
10 001110b = 142 = Bad output interface
10 001111b = 143 = Hardware

```
      Reason Code (status = 11b, Consumed)

      11 000000b = 192 = Unknown
      11 000001b = 193 = Punt Adjacency
      11 000010b = 194 = Incomplete Adjacency
      11 000011b = 195 = For us

      Examples:

        value : 0x40 = 64
        binary: 01000000
        decode: 01        -> Forward
                  000000  -> No further information

        value : 0x89 = 137
        binary: 10001001
        decode: 10        -> Drop
                  001001  -> Fragmentation and DF set
```

Abstract Data Type: unsigned32

ElementId: 89

Semantics: identifier

Status: current

Reference:
See "NetFlow Version 9 Flow-Record Format" [CCO-NF9FMT].

4.13. srcTrafficIndex

Description:
BGP Policy Accounting Source Traffic Index.

Abstract Data Type: unsigned32

ElementId: 92

Semantics: identifier

Status: current

Reference:
BGP policy accounting as described in [CCO-BGPPOL].

4.14. dstTrafficIndex

Description:
BGP Policy Accounting Destination Traffic Index.

Abstract Data Type: unsigned32

ElementId: 93

Semantics: identifier

Status: current

Reference:
BGP policy accounting as described in [CCO-BGPPOL].

4.15. className

Description:
Deprecated in favor of 335 selectorName. Traffic Class Name, associated with the classId Information Element.

Abstract Data Type: string

ElementId: 100

Status: deprecated

4.16. layer2packetSectionOffset

Description:
Deprecated in favor of 409 sectionOffset. Layer 2 packet section offset. Potentially a generic packet section offset.

Abstract Data Type: unsigned16

ElementId: 102

Semantics: quantity

Status: deprecated

4.17. layer2packetSectionSize

Description:
Deprecated in favor of 312 dataLinkFrameSize. Layer 2 packet section size. Potentially a generic packet section size.

Abstract Data Type: unsigned16

ElementId: 103

Semantics: quantity

Status: deprecated

4.18. layer2packetSectionData

Description:
Deprecated in favor of 315 dataLinkFrameSection. Layer 2 packet section data.

Abstract Data Type: octetArray

ElementId: 104

Status: deprecated

5. Other Information Elements

5.1. Performance Metrics IEs

ElementId: 65 .. 69

Performance metrics will need a consolidation in the industry, based on [RFC6390]. Once this consolidation happens, via a separate document the IEs 65-69 will either be assigned in the IANA registry or their status will be deprecated.

5.2. Application Information IEs

ElementId: 94 .. 96

ElementId: 101

Please refer to [RFC6759].

5.3. IEs Assigned for NetFlow v9 Compatibility

ElementId: 105..127

These element IDs are not covered by this document and are left "as is", i.e., for NetFlow v9 compatibility.

6. IANA Considerations

This document specifies several new IPFIX Information Elements in IANA's "IPFIX Information Elements" registry [IANA-IPFIX] as summarized in Section 3 and detailed in Section 4 above. The following Information Elements have been assigned:

- IE Number 34 for the samplingInterval IE
- IE Number 35 for the samplingAlgorithm IE
- IE Number 38 for the engineType IE
- IE Number 39 for the engineId IE
- IE Number 43 for the ipv4RouterSc IE
- IE Number 48 for the samplerId IE
- IE Number 49 for the samplerMode IE
- IE Number 50 for the samplerRandomInterval IE
- IE Number 51 for the classId IE
- IE Number 84 for the samplerName IE
- IE Number 87 for the flagsAndSamplerId IE
- IE Number 89 for the forwardingStatus IE
- IE Number 92 for the srcTrafficIndex IE
- IE Number 93 for the dstTrafficIndex IE
- IE Number 100 for the className IE
- IE Number 102 for the layer2packetSectionOffset IE
- IE Number 103 for the layer2packetSectionSize IE
- IE Number 104 for the layer2packetSectionData IE

7. Security Considerations

This document specifies the definitions of several Information Elements and does not alter the security considerations of the base protocol. Please refer to the security considerations sections of [RFC3954] and [RFC7012].

8. References

8.1. Normative References

[RFC7011] Claise, B., Trammell, B., and P. Aitken, "Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of Flow Information", STD 77, RFC 7011, September 2013.

8.2. Informative References

[CCO-BGPPOL] Cisco, "BGP Policy Accounting and BGP Policy Accounting Output Interface Accounting Features", December 2005, <http://www.cisco.com/en/US/tech/tk365/technologies_tech_note09186a0080094e88.shtml>.

[CCO-MLS] Cisco, "IP MultiLayer Switching Sample Configuration", November 2007, <http://www.cisco.com/en/US/products/hw/switches/ps700/products_configuration_example09186a00800ab513.shtml>.

[CCO-NF9FMT] Cisco, "NetFlow Version 9 Flow-Record Format", May 2011, <http://www.cisco.com/en/US/technologies/tk648/tk362/technologies_white_paper09186a00800a3db9.html>.

[IANA-IPFIX] IANA, "IP Flow Information Export (IPFIX) Entities", <http://www.iana.org/assignments/ipfix/>.

[IANA-PSAMP] IANA, "Packet Sampling (PSAMP) Parameters", <http://www.iana.org/assignments/psamp-parameters/>.

[RFC3954] Claise, B., "Cisco Systems NetFlow Services Export Version 9", RFC 3954, October 2004.

[RFC6390] Clark, A. and B. Claise, "Guidelines for Considering New Performance Metric Development", BCP 170, RFC 6390, October 2011.

[RFC6759] Claise, B., Aitken, P., and N. Ben-Dvora, "Cisco Systems Export of Application Information in IP Flow Information Export (IPFIX)", RFC 6759, November 2012.

[RFC7012] Claise, B. and B. Trammell, "Information Model for IP Flow Information Export (IPFIX)", RFC 7012, September 2013.

[RFC7013] Trammell, B. and B. Claise, "Guidelines for Authors and Reviewers of IP Flow Information Export (IPFIX) Information Elements", BCP 184, RFC 7013, September 2013.

Appendix A. XML Specification of IPFIX Information Elements

```
<?xml version="1.0" encoding="UTF-8"?>

<fieldDefinitions xmlns="urn:ietf:params:xml:ns:ipfix-info"
             xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
             xsi:schemaLocation="urn:ietf:params:xml:ns:ipfix-info
             ipfix-info.xsd">

  <field name="samplingInterval" dataType="unsigned32"
           group=""
           dataTypeSemantics="quantity"
           elementId="34" applicability="flow" status="deprecated">
    <description>
     <paragraph>
     Deprecated in favor of 305 samplingPacketInterval.  When using
     sampled NetFlow, the rate at which packets are sampled --
     e.g., a value of 100 indicates that one of every 100 packets
     is sampled.
     </paragraph>
    </description>
  </field>
  <field name="samplingAlgorithm" dataType="unsigned8"
           group=""
           dataTypeSemantics="identifier"
           elementId="35" applicability="flow" status="deprecated">
    <description>
     <paragraph>
     Deprecated in favor of 304 selectorAlgorithm.  The type of
     algorithm used for sampled NetFlow: 1 - Deterministic Sampling,
     2 - Random Sampling.  The values are not compatible with the
     selectorAlgorithm IE, where "Deterministic" has been replaced
     by "Systematic count-based" (1) or "Systematic time-based" (2),
     and "Random" is (3).  Conversion is required; see
     [IANA-PSAMP] PSAMP parameters.
     </paragraph>
    </description>
  </field>
  <field name="engineType" dataType="unsigned8"
           group=""
           dataTypeSemantics="identifier"
           elementId="38" applicability="flow" status="deprecated">
    <description>
     <paragraph>
     Type of flow switching engine in a router/switch: RP = 0,
     VIP/Line card = 1, PFC/DFC = 2.  Reserved for internal use on
     the Collector.
     </paragraph>
```

```
      </description>
    </field>
    <field name="engineId" dataType="unsigned8"
           group=""
           dataTypeSemantics="identifier"
           elementId="39" applicability="flow" status="deprecated">
      <description>
       <paragraph>
       Versatile Interface Processor (VIP) or line card slot number of
       the flow switching engine in a router/switch.  Reserved for
       internal use on the Collector.
       </paragraph>
      </description>
    </field>
    <field name="ipv4RouterSc" dataType="ipv4Address"
           group=""
           dataTypeSemantics="default"
           elementId="43" applicability="flow" status="deprecated">
      <description>
       <paragraph>
       This is a platform-specific field for the Catalyst 5000/Catalyst
       6000 family.  It is used to store the address of a router that
       is being shortcut when performing MultiLayer Switching.
       </paragraph>
      </description>
      <reference>
       http://www.cisco.com/en/US/products/hw/switches/ps700/
       products_configuration_example09186a00800ab513.shtml
       describes MultiLayer Switching.
      </reference>
    </field>
    <field name="samplerId" dataType="unsigned8"
           group=""
           dataTypeSemantics="identifier"
           elementId="48" applicability="flow" status="deprecated">
      <description>
       <paragraph>
       Deprecated in favor of 302 selectorId.  The unique identifier
       associated with samplerName.
       </paragraph>
      </description>
    </field>
    <field name="samplerMode" dataType="unsigned8"
           group=""
           dataTypeSemantics="identifier"
           elementId="49" applicability="flow" status="deprecated">
      <description>
       <paragraph>
```

```
        Deprecated in favor of 304 selectorAlgorithm.  The values are
        not compatible: selectorAlgorithm=3 is random sampling.  The
        type of algorithm used for sampled NetFlow: 1 - Deterministic
        Sampling, 2 - Random Sampling.  Use with samplerRandomInterval.
        </paragraph>
      </description>
    </field>
    <field name="samplerRandomInterval" dataType="unsigned32"
           group=""
           dataTypeSemantics="quantity"
           elementId="50" applicability="flow" status="deprecated">
      <description>
       <paragraph>
       Deprecated in favor of 305 samplingPacketInterval.  Packet
       interval at which to sample -- in case of random sampling.  Used
       in connection with the samplerMode 0x02 (random sampling) value.
       </paragraph>
      </description>
    </field>
    <field name="classId" dataType="unsigned8"
           group=""
           dataTypeSemantics="identifier"
           elementId="51" applicability="flow" status="deprecated">
      <description>
       <paragraph>
       Deprecated in favor of 302 selectorId.  Characterizes the
       traffic class, i.e., QoS treatment.
       </paragraph>
      </description>
    </field>
    <field name="samplerName" dataType="string"
           group=""
           dataTypeSemantics=""
           elementId="84" applicability="flow" status="deprecated">
      <description>
       <paragraph>
       Deprecated in favor of 335 selectorName.  Name of the flow
       sampler.
       </paragraph>
      </description>
    </field>
    <field name="flagsAndSamplerId" dataType="unsigned32"
           group=""
           dataTypeSemantics="identifier"
           elementId="87" applicability="flow" status="deprecated">
      <description>
       <paragraph>
       Flow flags and the value of the sampler ID (samplerId) combined
```

```
        in one bitmapped field.  Reserved for internal use on the
        Collector.
        </paragraph>
       </description>
     </field>
     <field name="forwardingStatus" dataType="unsigned32"
            group=""
            dataTypeSemantics="identifier"
            elementId="89" applicability="flow" status="current">
       <description>
        <paragraph>
        This Information Element describes the forwarding status of the
        flow and any attached reasons.  The reduced-size encoding rules
        as per [RFC7011] apply.
        </paragraph>
        <artwork>
           The basic encoding is 8 bits.  The future extensions
           could add one or three bytes.  The layout of the basic
           encoding is as follows:

             MSB -   0   1   2   3   4   5   6   7   - LSB
                 +---+---+---+---+---+---+---+---+
                 | Status|  Reason code or flags |
                 +---+---+---+---+---+---+---+---+
           Status:

           00b = Unknown
           01b = Forwarded
           10b = Dropped
           11b = Consumed

           Reason Code (status = 01b, Forwarded)

           01 000000b = 64 = Unknown
           01 000001b = 65 = Fragmented
           01 000010b = 66 = Not Fragmented

           Reason Code (status = 10b, Dropped)

           10 000000b = 128 = Unknown
           10 000001b = 129 = ACL deny
           10 000010b = 130 = ACL drop
           10 000011b = 131 = Unroutable
           10 000100b = 132 = Adjacency
           10 000101b = 133 = Fragmentation and DF set
           10 000110b = 134 = Bad header checksum
           10 000111b = 135 = Bad total Length
           10 001000b = 136 = Bad header length
```

```
          10 001001b = 137 = bad TTL
          10 001010b = 138 = Policer
          10 001011b = 139 = WRED
          10 001100b = 140 = RPF
          10 001101b = 141 = For us
          10 001110b = 142 = Bad output interface
          10 001111b = 143 = Hardware

          Reason Code (status = 11b, Consumed)

          11 000000b = 192 = Unknown
          11 000001b = 193 = Punt Adjacency
          11 000010b = 194 = Incomplete Adjacency
          11 000011b = 195 = For us

          Examples:

            value : 0x40 = 64
            binary: 01000000
            decode: 01     -> Forward
                  000000  -> No further information

            value : 0x89 = 137
            binary: 10001001
            decode: 10     -> Drop
                  001001  -> Fragmentation and DF set
       </artwork>
      </description>
      <reference>
       See http://www.cisco.com/en/US/technologies/tk648/tk362/
       technologies_white_paper09186a00800a3db9.html -
       NetFlow Version 9 Flow-Record Format.
      </reference>
    </field>
    <field name="srcTrafficIndex" dataType="unsigned32"
           group=""
           dataTypeSemantics="identifier"
           elementId="92" applicability="flow" status="current">
      <description>
       <paragraph>
       BGP Policy Accounting Source Traffic Index.
       </paragraph>
      </description>
      <reference>
       BGP policy accounting as described in
       http://www.cisco.com/en/US/tech/tk365/
       technologies_tech_note09186a0080094e88.shtml
      </reference>
```

```
    </field>
    <field name="dstTrafficIndex" dataType="unsigned32"
           group=""
           dataTypeSemantics="identifier"
           elementId="93" applicability="flow" status="current">
      <description>
       <paragraph>
       BGP Policy Accounting Destination Traffic Index.
       </paragraph>
      </description>
      <reference>
       BGP policy accounting as described in
       http://www.cisco.com/en/US/tech/tk365/
       technologies_tech_note09186a0080094e88.shtml
      </reference>
    </field>
    <field name="className" dataType="string"
           group=""
           dataTypeSemantics=""
           elementId="100" applicability="flow" status="deprecated">
      <description>
       <paragraph>
       Deprecated in favor of 335 selectorName.  Traffic Class Name,
       associated with the classId Information Element.
       </paragraph>
      </description>
    </field>
    <field name="layer2packetSectionOffset" dataType="unsigned16"
           group=""
           dataTypeSemantics="quantity"
           elementId="102" applicability="flow" status="deprecated">
      <description>
       <paragraph>
       Deprecated in favor of 409 sectionOffset.
       Layer 2 packet section offset.  Potentially a generic packet
       section offset.
       </paragraph>
      </description>
    </field>
    <field name="layer2packetSectionSize" dataType="unsigned16"
           group=""
           dataTypeSemantics="quantity"
           elementId="103" applicability="flow" status="deprecated">
      <description>
       <paragraph>
       Deprecated in favor of 312 dataLinkFrameSize.
       Layer 2 packet section size.  Potentially a generic packet
       section size.
```

```
        </paragraph>
       </description>
     </field>
     <field name="layer2packetSectionData" dataType="octetArray"
            group=""
            dataTypeSemantics=""
            elementId="104" applicability="flow" status="deprecated">
       <description>
        <paragraph>
        Deprecated in favor of 315 dataLinkFrameSection.
        Layer 2 packet section data.
        </paragraph>
       </description>
     </field>
   </fieldDefinitions>
```

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