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Cisco Specific Information Elements reused in IPFIX
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Abstract

This document describes some additional Information Elements of Cisco Systems, Inc. that are not listed in [RFC3954](#).

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1. Introduction

The [section 4 of \[RFC5102\]](#) defines the IPFIX Information Elements in the range of 1-127 to be compatible with the NetFlow version 9 fields, as specified in the "Cisco Systems NetFlow Services Export Version 9" [\[RFC3954\]](#). As [\[RFC3954\]](#) was specified in 2004, it does not contain all NetFlow version 9 specific fields in the range 1-127. The question was asked whether IPFIX Devices should exclusively report the IPFIX IANA IEs [\[IPFIX-IANA\]](#) ? In other words, when upgrading from a NetFlow metering process to an IPFIX Metering Process, should the IPFIX Devices stop reporting NetFlow version 9 specific IEs that were not registered in IANA [\[IPFIX-IANA\]](#) ?

This document is intended to fill the gap in this IE range. That way, IPFIX implementations could export all the IEs specified in IANA, regardless of the range.

2. Terminology

IPFIX-specific terminology used in this document is defined in [Section 2 of \[RFC5101\]](#). As in [\[RFC5101\]](#), 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
+-----+-----+-----+-----+		+-----+-----+-----+-----+	
3	deltaFlowCount	84	samplerName
34	samplingInterval	87	flagsAndSamplerId

35	samplingAlgorithm	89	forwardingStatus
38	engineType	92	srcTrafficIndex
39	engineId	93	dstTrafficIndex
43	ipv4RouterSc	100	className
48	samplerId	102	layer2packetSectionOffset
49	samplerMode	103	layer2packetSectionSize
50	samplerRandomInterval	104	layer2packetSectionData
51	classId		

Table 1

[4. Information Elements](#)

[4.1. deltaFlowCount](#)

Description:

This Information Element specifies the current number of all Flow Records that form the parent population as input to the Flow Selection Process.

Abstract Data Type: unsigned64

ElementId: 3

Semantics: quantity

Status: current

Units: flows

RFC EDITOR NOTE: if the Flow Aggregation for IPFIX document [[I-D.trammell-ipfix-a9n](#)] is published before this, then remove this entry. This Information Element is similar to 'deltaFlowCount' there.

[4.2. 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

[4.3.](#) 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 PSAMP parameters [[PSAMP-IANA](#)].

Abstract Data Type: unsigned8

ElementId: 35

Semantics: identifier

Status: deprecated

[4.4.](#) 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

[4.5.](#) engineId

Description:

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

[4.6.](#) ipv4RouterSc

Description:

This is a platform-specific field for 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: ipv4Address

Status: deprecated

Reference: [[CCO-MLS](#)] describes the MultiLayer Switching.

[4.7.](#) samplerId

Description:

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

Abstract Data Type: unsigned8

ElementId: 48

Semantics: identifier
Status: deprecated

[4.8.](#) 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

[4.9.](#) samplerRandomInterval

Description:

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

Abstract Data Type: unsigned32

ElementId: 50

Semantics: quantity

Status: deprecated

[4.10.](#) classId

Description:

Deprecated in favour of 302 selectorId. Characterizes the traffic class, i.e. QoS treatment.

Abstract Data Type: unsigned8

ElementId: 51

Semantics: identifier

Status: deprecated

[4.11.](#) samplerName

Description:

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

Abstract Data Type: string

ElementId: 84

Status: deprecated

[4.12.](#) 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

[4.13.](#) forwardingStatus

Description:

This Information Element describes the forwarding status of the flow and any attached reasons. The Reduced Size Encoding rules as per [\[RFC5101\]](#) 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:

```
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

Abstract Data Type: unsigned32

ElementId: 89

Semantics: identifier

Status: current

Reference:

See [[CCO-NF9FMT](#)] - NetFlow Version 9 Record Format.

4.14. 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](#)]

[4.15.](#) 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](#)]

[4.16.](#) 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

[4.17.](#) layer2packetSectionOffset

Description:
Layer 2 packet section offset. Potentially a generic packet
section offset.
Abstract Data Type: unsigned16
ElementId: 102
Semantics: quantity
Status: current
EDITOR'S NOTE: [[I-D.kashima-ipfix-data-link-layer-monitoring](#)]
contains a corresponding field 'sectionOffset' with a better
description. One solution is to assign the value 102 for the
'sectionOffset' in [[I-D.kashima-ipfix-data-link-layer-monitoring](#)].

[4.18.](#) layer2packetSectionSize

Description:
Layer 2 packet section size. Potentially a generic packet section
size.

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Abstract Data Type: unsigned16

ElementId: 103

Semantics: quantity

Status: current

EDITOR'S NOTE: [[I-D.kashima-ipfix-data-link-layer-monitoring](#)]

contains a corresponding field 'sectionObservedOctets' with a better description. One solution is to assign the value 103 to 'sectionObservedOctets' in [[I-D.kashima-ipfix-data-link-layer-monitoring](#)].

[4.19.](#) layer2packetSectionData

Description:

Layer 2 packet section data.

Abstract Data Type: octetArray

ElementId: 104

Status: current

EDITOR'S NOTE: [[I-D.kashima-ipfix-data-link-layer-monitoring](#)]

contains a corresponding field 'dataLinkFrameSection' with a better description. One solution is to assign the value 104 to 'dataLinkFrameSection' in [[I-D.kashima-ipfix-data-link-layer-monitoring](#)].

[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: 101

ElementId: 94 .. [97](#)

Please refer to the Export of Application Information in IPFIX
[[I-D.claise-export-application-info-in-ipfix](#)]

[6.](#) IANA Considerations

This document specifies several new IPFIX Information Elements in the

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IPFIX Information Element registry as defined in [Section 3](#) above.
The following Information Elements must be assigned:

- o IE Number 3 for the deltaFlowCount IE
- o IE Number 34 for the samplingInterval IE
- o IE Number 35 for the samplingAlgorithm IE
- o IE Number 38 for the engineType IE
- o IE Number 39 for the engineId IE
- o IE Number 43 for the ipv4RouterSc IE
- o IE Number 48 for the samplerId IE
- o IE Number 49 for the samplerMode IE
- o IE Number 50 for the samplerRandomInterval IE
- o IE Number 51 for the classId IE
- o IE Number 84 for the samplerName IE
- o IE Number 87 for the flagsAndSamplerId IE
- o IE Number 89 for the forwardingStatus IE
- o IE Number 92 for the srcTrafficIndex IE
- o IE Number 93 for the dstTrafficIndex IE
- o IE Number 100 for the className IE
- o IE Number 102 for the layer2packetSectionOffset IE
- o IE Number 103 for the layer2packetSectionSize IE
- o 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 [RFC 3954](#) [[RFC3954](#)] and [RFC 5102](#) [[RFC5102](#)].

However, the export of the sections of the packet payload may

unintentionally change the security assumptions of other protocols.

8. References

8.1. Normative References

[RFC5101] Claise, B., "Specification of the IP Flow Information Export (IPFIX) Protocol for the Exchange of IP Traffic Flow Information", [RFC 5101](#), January 2008.

8.2. Informative References

[CCO-BGPPOL]
Cisco, "BGP Policy Accounting and BGP Policy Accounting Output Interface Accounting Features", <<http://>

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www.cisco.com/en/US/tech/tk365/technologies_tech_note09186a0080094e88.shtml>.

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

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

[I-D.claise-export-application-info-in-ipfix]
Claise, B., Aitken, P., and N. Ben-Dvora, "Export of Application Information in IPFIX", [draft-claise-export-application-info-in-ipfix-05](#) (work in progress), February 2012.

[I-D.kashima-ipfix-data-link-layer-monitoring]
Kashima, S., Nakata, K., and A. Kobayashi, "Information Elements for Data Link Layer Traffic Measurement", [draft-kashima-ipfix-data-link-layer-monitoring-06](#) (work in progress), September 2011.

[I-D.trammell-ipfix-a9n]

Trammell, B., Wagner, A., and B. Claise, "Flow Aggregation for the IP Flow Information Export (IPFIX) Protocol", [draft-trammell-ipfix-a9n-04](#) (work in progress), September 2011.

[IPFIX-IANA]

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

[PSAMP-IANA]

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

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

[RFC5102] Quittek, J., Bryant, S., Claise, B., Aitken, P., and J. Meyer, "Information Model for IP Flow Information Export", [RFC 5102](#), January 2008.

[Appendix A](#). XML Specification of IPFIX Information Elements

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```
<?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="deltaFlowCount" dataType="unsigned64"
    group=""
    dataTypeSemantics="quantity"
    elementId="3" applicability="flow" status="current">
```

```
    <description>
```

```
      <paragraph>
```

```
        This Information Element specifies the current number of all
        Flow Records that form the parent population as input to the
        Flow Selection Process.
```

```
      </paragraph>
```

```
    </description>
```

```

</field>
<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
      <REF:PSAMP-IANA>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>
      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="ipv4Address"
      elementId="43" applicability="flow" status="deprecated">
  <description>
    <paragraph>
      This is a platform-specific field for 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 the 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 sampling data: 1 - deterministic, 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 favour of 305 samplingPacketInterval. Packet
      interval at which to sample - in case of random sampling. Used
      in connection with 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 favour 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 <REF:RFC5101> 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
    </artwork>
  </description>
</field>

```

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 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="current">
    <description>
      <paragraph>
        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="current">
    <description>
      <paragraph>
        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="current">
    <description>
      <paragraph>
        Layer 2 packet section data.

```

```
</paragraph>
</description>
</field>
</fieldDefinitions>
```

[Appendix B.](#) Changes

To be removed by RFC Editor before publication

01: initial revision presented at the IETF meeting.

02: removed "flow" from flowSamplerId, flowSamplerMode, and flowSamplerRandomInterval; updated the related drafts in references; added the "reference" column to the XML definitions; renamed fsFlowEntryTotalCount into deltaFlowCount to keep the naming in sync with [[I-D.trammell-ipfix-a9n](#)]. Also minor changes to formatting and added the IE overview table.

03: updated the references to [draft-claise-export-application-info-in-ipfix](#), slightly tweaked the

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title and removed the unused reference to [draft-ietf-ipfix-flow-selection-tech](#).

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