      Export BGP community information in IP Flow Information Export (IPFIX)
                   draft-li-opsawg-ipfix-bgp-community-02

   Abstract

      This draft specifies an extension to the IPFIX information model
      defined in [RFC7012] to export the BGP community [RFC1997]
      information. Three information elements, bgpCommunity,
      bgpSourceCommunityList and bgpDestinationCommunityList, are
      introduced in this document to carry the BGP community information.
      bgpCommunity, containing exactly one BGP community value, is used to
      consist the list in bgpSourceCommunityList and
      bgpDestinationCommunityList, which are corresponding to a specific
      flow's source IP and destination IP respectively.

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Table of Contents

1. Introduction

   IP Flow Information Export (IPFIX) [RFC7011] provides network
   administrators with traffic flow information using the information
   elements (IEs) defined in [IANA-IPFIX] registries. Based on the
   traffic flow information, network administrators know the amount and
   direction of the traffic in their network, then they can optimize
   their network when needed. For example, they can steer some flows
   from the congested links to the low utilised links.

   [IANA-IPFIX] has already defined the following IEs for traffic flow
   information exporting in different grain: sourceIPv4Address,
   sourceIPv4Prefix, destinationIPv4Address, destinationIPv4Prefix,
   bgpSourceAsNumber, bgpDestinationAsNumber, bgpNextHopIPv4Address,
   etc. In some circumstances, however, especially when traffic
   engineering and optimazation are used in the Tier 1 or Tier 2
   operators' backbone networks, traffic flow information based on these
   IEs is not suitable. Flow information based on IP address or IP
   prefix is much more mediculous. On the contrary, flow information
   based on AS number is too coarse. BGP community [RFC1997], which
   describes a group of routes sharing some common properties, is
   preferablely used for fine granularity traffic engineering

[Community-TE] [RFC4384]. Unfortunately, [IANA-IPFIX] has no IE
defined for BGP community information, yet.

Flow information based on BGP community can be collected by a
mediator defined in [RFC6183]. Mediator is responsible for the
correlation between flow information and BGP community. However no
IEs are defined in [RFC6183] for exporting BGP community information
in IPFIX. Furthermore, to correlate the BGP community with the flow
information, mediator needs to learn BGP routes and lookup in the BGP
routing table to get the matching entry for the specific flow.
Neither BGP route learning nor routing table lookup is trivial for a
mediator. Mediator is mainly introduced to release the performance
requirement for the exporter [RFC5982]. In fact, to obtain the
information for BGP related IEs that have already been defined, such
as bgpSourceAsNumber, bgpDestinationAsNumber, and
bgpNextHopIPv4Address, etc, exporter has to hold the up-to-date BGP
routing table and look up in the BGP routing table. The exporter can
get the community information in the same procedure. So, getting BGP
community information adds no more requirement for exporter. Some
vendors have already implemented this feture in their exporters using
private IEs. So, exporter is RECOMMENDED to export the BGP community
information in IPFIX directly, other than the mediator.

This draft specifies an extension to the IPFIX information model
defined in [RFC7012] to export the BGP community information. Three
IEs, bgpCommunity, bgpSourceCommunityList and
bgpDestinationCommunityList, are introduced to complete this task.
bgpCommunity contains one BGP community value.
BgpSourceCommunityList consists of a list of bgpCommunity
corresponding with the source IP address of a specific flow, and
bgpDestinationCommunityList consists of a list of bgpCommunity
corresponding with the destination IP address of a specific flow.

BgpCommunity, bgpSourceCommunityList and bgpDestinationCommunityList
IEs are applicable for both IPv4 and IPv6 traffic. Both exporter and
mediator can use these three IEs to export BGP community information
in IPFIX.

2. Terminology

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 [RFC2119].

3. BGP Community Information Elements

    In order to export BGP community information along with other flow
    information defined by IPFIX, we need to introduce three new IEs.
    One is bgpCommunity, which is used to identify that the value in this
    IE is BGP community [RFC1997]. The other two are
    bgpSourceCommunityList and bgpDestinationCommunityList. They both
    are basicList [RFC6313] of bgpCommunity. bgpSourceCommunityList and
    bgpDestinationCommunityList are used to export BGP community
    information corresponding to a specific flow's source IP and
    destination IP respectively. Flow information based on BGP community
    can then be accumulated and analysed by the collector or other
    applications.

    The details of these three new introduced IEs are illustrated below,
    including name, ID, type, semantics, description and units.

3.1. bgpCommunity

    | ElementID | to be assigned by IANA, 458 is suggested |

    | Name | bgpCommunity |
    |---
    | Data Type | unsigned32 |
    |---
    | Data Type Semantics | identifier |

    | Description | BGP community as defined in [RFC1997] |

    | Units | none |
    |---

                        Figure 1: bgpCommunity

3.2. bgpSourceCommunityList

```
-----------------------------------------------------------------------
|         ElementID       |   to be assigned by IANA, 459 is suggested  |
-----------------------------------------------------------------------
|           Name          |            bgpSourceCommunityList           |
|---------------------------------------------------------------------|
|         Data Type       |      basicList, as specifed in [RFC6313]    |
|---------------------------------------------------------------------|
| Data Type Semantics |                     list                        |
-----------------------------------------------------------------------
|        Description      | zero or more BGP communities corresponding  |
|                         | with source IP address of a specific flow   |
-----------------------------------------------------------------------
|           Units         |                     none                    |
|---------------------------------------------------------------------|
```

Figure 2: bgpSourceCommunityList

3.3. bgpDestinationCommunityList

```
-----------------------------------------------------------------------
|         ElementID       |   to be assigned by IANA, 460 is suggested  |
-----------------------------------------------------------------------
|           Name          |          bgpDestinationCommunityList        |
|---------------------------------------------------------------------|
|         Data Type       |      basicList, as specifed in [RFC6313]    |
|---------------------------------------------------------------------|
| Data Type Semantics |                     list                        |
-----------------------------------------------------------------------
|        Description      | zero or more BGP communities corresponding  |
|                         |with destination IP address of a specific flow|
-----------------------------------------------------------------------
|           Units         |                     none                    |
|---------------------------------------------------------------------|
```

Figure 3: bgpDestinationCommunityList

4. Security Considerations

   This document only defines three new IEs for IPFIX. So, this
   document itself does not directly introduce security issues. The
   same security considerations as for the IPFIX Protocol Specification
   [RFC7011] and Information Model [RFC7012] apply.

5. IANA Considerations

   This draft specifies three new IPFIX IEs, bgpCommunity,
   bgpSourceCommunityList and bgpDestinationCommunityList, to export BGP
   community information along with other flow information.

The Element IDs for these three IEs are solicited to be assigned by IANA. Number 458, 459 and 460 are suggested for bgpCommunity, bgpSourceCommunityList and bgpDestinationCommunityList, respectively.

6. Acknowledgements

The authors would like to thank Benoit Claise and Paul Aitken for discussion and suggestions to promote this document.

7. References

7.1. Normative References

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7.2. Informative References

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Appendix A. Application Example

   In this section, we give an example to show the encoding format for
   the three new introduced IEs.

   Flow information including BGP communities is shown in the below
   table. Suppose we want all the fields to be reported by IPFIX.

```
-------------------------------------------------------------------------
|Source ip|Destination ip |Source BGP community|Destination BGP community|
-------------------------------------------------------------------------
| 1.1.1.1 |   2.2.2.2      |1:1001,1:1002,8:1001|    2:1002,8:1001        |
-------------------------------------------------------------------------
| 3.3.3.3 |   4.4.4.4      |3:1001,3:1002,8:1001|    4:1001,8:1001        |
-------------------------------------------------------------------------
```

            Figure 4: Flow information including BGP communities

A.1. Template Record

```
 0                   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 = 24         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|        Template ID = 256        |        Field Count = 4       |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0|    SourceIPv4Address = 8      |        Field length = 4      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0| DestinationIPv4Address = 12   |        Field length = 4      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0| bgpSourceCommunityList = 459  |     Field length = 0xFFFF    |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|0| bgpDestinationCommunityList   |     Field length = 0xFFFF    |
| |          = 460                |                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
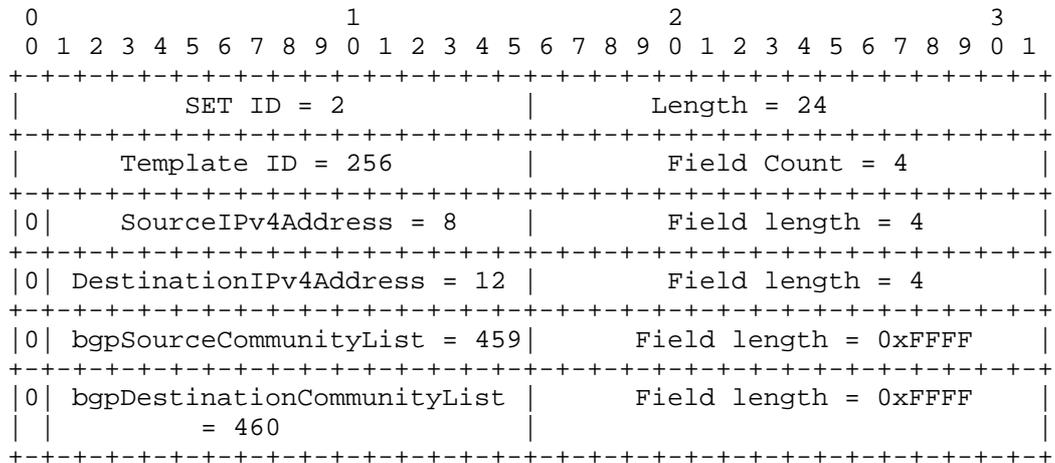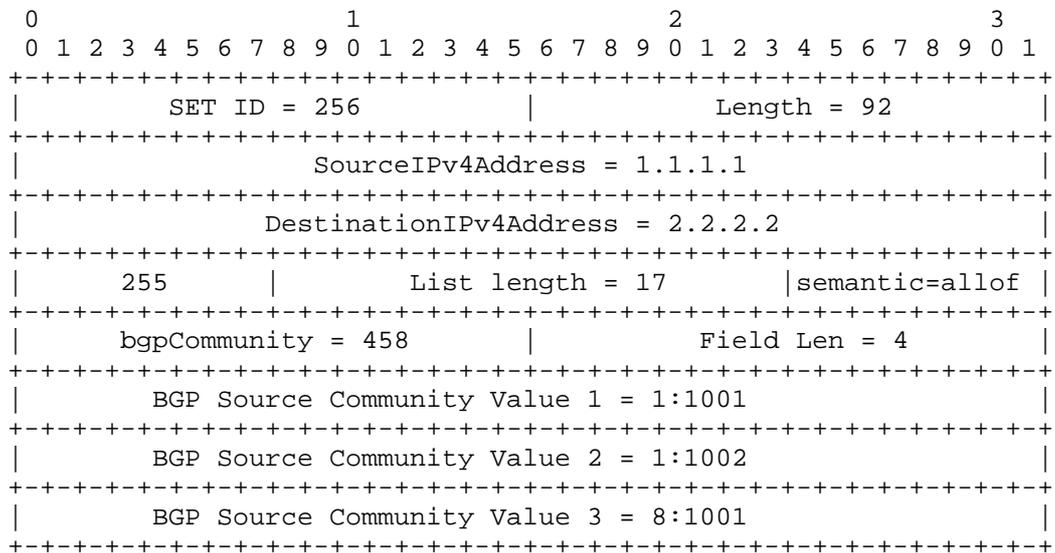
Figure 5: Template Record Encoding Format

In this example, the Template ID is 256, which will be used in the
data record. The field length for bgpSourceCommunityList and
bgpDestinationCommunityList is 0xFFFF, which means the length of this
IE is variable, the actual length of this IE is indicated by the list
length field in the basic list format as per [RFC6313].

A.2. Data Set

The data set is represented as follows:

```
 0                   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 = 256         |          Length = 92         |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                  SourceIPv4Address = 1.1.1.1                   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                DestinationIPv4Address = 2.2.2.2               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     255       |        List length = 17       |semantic=allof |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|     bgpCommunity = 458          |         Field Len = 4        |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         BGP Source Community Value 1 = 1:1001                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         BGP Source Community Value 2 = 1:1002                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         BGP Source Community Value 3 = 8:1001                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

```
|      255      |         List length = 13      |semantic =allof|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|        bgpCommunity = 458      |             Field Len = 4     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         BGP Destination Community Value 1 = 2:1002            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         BGP Destination Community Value 2 = 8:1001            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                  SourceIPv4Address = 3.3.3.3                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|               DestinationIPv4Address = 4.4.4.4               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      255      |         List length = 17      |semantic =allof|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|        bgpCommunity = 458      |             Field Len = 4     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         BGP Source Community Value 1  = 3:1001               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         BGP Source Community Value 2  = 3:1002               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         BGP Source Community Value 3  = 8:1001               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      255      |         List length = 13      |semantic =allof|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|        bgpCommunity = 458      |             Field Len = 4     |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         BGP Destination Community Value 1 = 4:1001            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|         BGP Destination Community Value 2 = 8:1001            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 6: Data Set Encoding Format

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