Export BGP community information in IP Flow Information Export (IPFIX)
draft-ietf-opsawg-ipfix-bgp-community-03

Abstract

   This draft updates RFC7012 IPFIX information model by introducing
   several information elements to enable IPFIX to export the BGP
   community information, including BGP standard community defined in
   RFC1997, BGP extended community defined in RFC4360, and BGP large
   community defined in RFC8092. Network traffic flow information can
   then be accumulated and analysed at the granularity specified by the
   BGP communities, which is suitable for and needed by some traffic
   optimization applications located in IPFIX collector, SDN controller
   or PCE (Path Computation Element).

Status of This Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

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   This Internet-Draft will expire on April 20, 2018.

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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 shift some flows
from the congested links to the low utilized links through a SDN
controller or PCE [RFC4655].

[IANA-IPFIX] has already defined the following IEs for traffic flow
information exporting in different granularities: sourceIPv4Address,

sourceIPv4Prefix, destinationIPv4Address, destinationIPv4Prefix,
bgpSourceAsNumber, bgpDestinationAsNumber, bgpNextHopIPv4Address,
etc. In some circumstances, however, especially when traffic
engineering and optimization are executed in the Tier 1 or Tier 2
operators' backbone networks, traffic flow information based on these
IEs may not be suitable. Flow information based on IP address or IP
prefix may provide much too fine granularity for a large network. On
the contrary, flow information based on AS number may be too coarse.
BGP community [RFC1997], which describes a group of routes sharing
some common properties, is preferably used for traffic engineering at
the proper granularity [Community-TE] [RFC4384]. There is no IE
defined for BGP community information in [IANA-IPFIX] yet.

Flow information based on BGP community may 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 perform lookup in
the BGP routing table to get the matching entry for 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 perform lookup in the BGP routing table. The
exporter can obtain the BGP community information in the same
procedure, thus exporting BGP community information adds no more
requirement for exporter. It is RECOMMENDED that the BGP community
information be exported by the exporter directly using IPFIX.

This draft introduces new IEs to extend the IPFIX information model
defined in [RFC7012] to export the BGP community information,
including BGP standard community defined in [RFC1997], BGP extended
community defined in [RFC4360], and BGP large community defined in
[RFC8092]. Flow information, including packetDeltaCount,
octetDeltaCount [RFC7012] etc, can then be accumulated and analysed
by the collector or other applications, such as SDN controller or PCE
[RFC4655], at the granularity specified by BGP community , which is
useful for traffic engineering or traffic optimization applications,
especially in the backbone network.

The IEs introduced in this document are applicable for both IPv4 and
IPv6 traffic. Both exporter and mediator can use these 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. IEs for BGP Standard Community

   [RFC1997] defines the BGP Communities attribute, called BGP Standard
   Community in this document, which describes a group of routes sharing
   some common properties. BGP Standard Communities are treated as 32
   bit values as stated in[RFC1997].

   In order to export BGP standard community information along with
   other flow information defined by IPFIX, three new IEs are
   introduced. One is bgpCommunity, which is used to identify that the
   value in this IE is a BGP standard community. The other two are
   bgpSourceCommunityList and bgpDestinationCommunityList, which are
   both basicList [RFC6313] of bgpCommunity, and are used to export BGP
   standard community information corresponding to a specific flow's
   source IP and destination IP respectively.

   The detailed information of the three new IEs are shown in the
   following sections.

3.1. bgpCommunity

```
------------------------------------------------------------------------
|      ElementID        |             to be assigned by IANA           |
|----------------------------------------------------------------------|
|        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          |
|--------------------------------------------------------------------|
|         Name         |             bgpSourceCommunityList          |
|--------------------------------------------------------------------|
|      Data Type       |       basicList, as specified 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          |
|--------------------------------------------------------------------|
|         Name         |          bgpDestinationCommunityList        |
|--------------------------------------------------------------------|
|      Data Type       |       basicList, as specified 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. IEs for BGP Extended Community

[RFC4360] defines the BGP Extended Communities attribute, which
provides a mechanism for labeling the information carried in BGP.
Each Extended Community is encoded as an 8-octet quantity with the
format defined in [RFC4360].

In order to export BGP Extended Community information together with
other flow information by IPFIX, three new IEs are introduced. The
first one is bgpExtendedCommunity, which is used to identify that the
value in this IE is a BGP Extended Community. The other two are
bgpSourceExtendedCommunityList and

bgpDestinationExtendedCommunityList, which are both basicList
[RFC6313] of bgpExtendedCommunity, and are used to export the BGP
Extended Community information corresponding to a specific flow's
source IP and destination IP respectively.

The detailed information of the three new IEs are shown in the
following sections.

4.1. bgpExtendedCommunity

```
-----------------------------------------------------------------------
|       ElementID       |            to be assigned by IANA           |
|---------------------------------------------------------------------|
|         Name          |             bgpExtendedCommunity            |
|---------------------------------------------------------------------|
|       Data Type       |                 octetArray                  |
|---------------------------------------------------------------------|
| Data Type Semantics   |                  default                    |
|---------------------------------------------------------------------|
|                       |BGP Extended Community as defined in [RFC4360]|
|      Description       |The size of this Information Element is 8     |
|                       |octets.                                      |
|---------------------------------------------------------------------|
|        Units          |                   none                      |
|---------------------------------------------------------------------|
```

Figure 4: bgpExtendedCommunity

4.2. bgpSourceExtendedCommunityList

```
 ------------------------------------------------------------------
|      ElementID       |            to be assigned by IANA         |
|---------------------------------------------------------------- |
|         Name         |        bgpSourceExtendedCommunityList      |
|---------------------------------------------------------------- |
|       Data Type      |      basicList, as specified in [RFC6313]  |
|---------------------------------------------------------------- |
| Data Type Semantics  |                    list                    |
|---------------------------------------------------------------- |
|                      |    zero or more BGP Extended Communities   |
|       Description     |    corresponding with source IP address    |
|                      |             of a specific flow             |
|---------------------------------------------------------------- |
|         Units        |                    none                    |
|---------------------------------------------------------------- |
```

Figure 5: bgpSourceExtendedCommunityList

4.3. bgpDestinationExtendedCommunityList

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

Figure 6: bgpDestinationExtendedCommunityList

5. IEs for BGP Large Community

[RFC8092] defines the BGP Large Communities attribute, which is
suitable for use with all Autonomous System Numbers (ASNs) including
four-octet ASNs. Each BGP Large Community is encoded as a 12-octet
quantity with the format defined in [RFC8092].

In order to export BGP Large Community information together with
other flow information by IPFIX, three new IEs are introduced. The
first one is bgpLargeCommunity, which is used to identify that the
value in this IE is a BGP Large Community. The other two are
bgpSourceLargeCommunityList and bgpDestinationLargeCommunityList,
which are both basicList [RFC6313] of bgpLargeCommunity, and are used
to export the BGP Large Community information corresponding to a
specific flow's source IP and destination IP respectively.

The detailed information of the three new IEs are shown in the
following sections.

5.1. bgpLargeCommunity

```
 ----------------------------------------------------------------------
|      ElementID       |             to be assigned by IANA            |
|---------------------------------------------------------------------|
|        Name          |                bgpLargeCommunity              |
|---------------------------------------------------------------------|
|      Data Type       |                  octetArray                   |
|---------------------------------------------------------------------|
| Data Type Semantics  |                  default                      |
|---------------------------------------------------------------------|
|                      | BGP Large Community as defined in [RFC8092]   |
|      Description      | The size of this Information Element is 12     |
|                      | octets.                                       |
|---------------------------------------------------------------------|
|        Units         |                  none                         |
 ----------------------------------------------------------------------
```

Figure 7: bgpLargeCommunity

5.2. bgpSourceLargeCommunityList

```
----------------------------------------------------------------------
|      ElementID      |          to be assigned by IANA              |
|--------------------------------------------------------------------|
|        Name         |        bgpSourceLargeCommunityList           |
|--------------------------------------------------------------------|
|      Data Type      |      basicList, as specified in [RFC6313]    |
|--------------------------------------------------------------------|
| Data Type Semantics |                    list                      |
|--------------------------------------------------------------------|
|                     |      zero or more BGP Large Communities      |
|      Description     |      corresponding with source IP address    |
|                     |              of a specific flow              |
|--------------------------------------------------------------------|
|        Units        |                    none                      |
|--------------------------------------------------------------------|
```

Figure 8: bgpSourceLargeCommunityList

5.3. bgpDestinationLargeCommunityList

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

Figure 9: bgpDestinationLargeCommunityList

6. Operational Considerations

   The maximum length of an IPFIX message is 65535 bytes as per
   [RFC7011] , and the maximum length of a normal BGP message is 4096
   bytes as per [RFC4271]. Since BGP communities, including standard,
   extended, and large communities , are BGP path attributes carried in
   BGP Update messages, the total length of these attributes can not
   exceed the length of a BGP message, i.e. 4096 bytes. So one IPFIX

message with maximum length of 65535 bytes has enough space to fit
all the communities related to a specific flow, both the source IP
and the destination IP related.

[I-D.ietf-idr-bgp-extended-messages] extends the maximum size of a
BGP Update message to 65535 bytes. Then theoretically the BGP
community information related to a specific flow may exceed the
length one IPFIX message. However, according to the information
about the networks in the field, the number of BGP communities in one
BGP route is usually no more than 10. Nevertheless, BGP speakers
that support the extended message SHOULD be careful to export the BGP
communities in the IPFIX message properly, such as only convey as
many communities as possible in the IPFIX message. The collector
which receives an IPFIX message with maximum length and BGP
communities contained in its data set SHOULD be aware that the BGP
communities may be truncated due to limited message space. In this
case, it is RECOMMENDED to configure export policy of BGP communities
on the exporter to limit the BGP communities to be exported, so as to
only export some specific communities,or not to export some specific
communities.

If needed, we may consider to extend the message length of IPFIX
[RFC7011] from 16 bits to 32 bits to solve this problem completely.
The detailed mechanism is out of the scope of this document.

7. Security Considerations

This document only defines three new IEs for IPFIX. 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.

As the BGP community information is deducible by other means, there
are no increased privacy concerns, neither.

8. IANA Considerations

This draft specifies the following IPFIX IEs to export BGP community
information along with other flow information.

The Element IDs for these IEs are solicited to be assigned by IANA.
The following table is for IANA's reference to put in each field in
the registry.

```
 ---------------------------------------------------------------------
|ElementID|          Name          | Data Type|Data Type Semantics|
|-------------------------------------------------------------------|
|   TBA1  |       bgpCommunity     |unsigned32|      identifier   |
```

ElementID	Name	Abstract Data Type	Data Type Semantics
TBA2	bgpSourceCommunityList	basicList	list
TBA3	bgpDestinationCommunityList	basicList	list
TBA4	bgpExtendedCommunity	octetArray	default
TBA5	bgpSourceExtended CommunityList	basicList	list
TBA6	bgpDestinationExtended CommunityList	basicList	list
TBA7	bgpLargeCommunity	octetArray	default
TBA8	bgpSourceLargeCommunityList	basicList	list
TBA9	bgpDestinationLarge CommunityList	basicList	list

ElementID	Description	Units
TBA1	BGP community as defined in [RFC1997]	
TBA2	zero or more BGP communities corresponding with source IP address of a specific flow	
TBA3	zero or more BGP communities corresponding with destination IP address of a specific flow	
TBA4	BGP Extended Community as defined in [RFC4360] The size of this IE is 8 octets	
TBA5	zero or more BGP Extended Communities corresponding with source IP address of a specific flow	
TBA6	zero or more BGP Extended communities corresponding with destination IP address of a specific flow	
TBA7	BGP Large Community as defined in [RFC8092] The size of this IE is 12 octets.	
TBA8	zero or more BGP Large Communities corresponding with source IP address	

```
|          |                of a specific flow           |          |
|----------------------------------------------------------------------|
|          |       zero or more BGP Large communities     |          |
|   TBA9   |    corresponding with destination IP address |          |
|          |                of a specific flow           |          |
|----------------------------------------------------------------------|


 ----------------------------------------------------------------------
|ElementID|  Range   |  References  | Requester | Revision |   date   |
|----------------------------------------------------------------------|
|   TBA1   |          |    RFC1997    |this draft |    0     |          |
|----------------------------------------------------------------------|
|   TBA2   |          |RFC6313,RFC1997|this draft |    0     |          |
|----------------------------------------------------------------------|
|   TBA3   |          |RFC6313,RFC1997|this draft |    0     |          |
|----------------------------------------------------------------------|
|   TBA4   |          |    RFC4360    |this draft |    0     |          |
|----------------------------------------------------------------------|
|   TBA5   |          |RFC6313,RFC4360|this draft |    0     |          |
|----------------------------------------------------------------------|
|   TBA6   |          |RFC6313,RFC4360|this draft |    0     |          |
|----------------------------------------------------------------------|
|   TBA7   |          |    RFC8092    |this draft |    0     |          |
|----------------------------------------------------------------------|
|   TBA8   |          |RFC6313,RFC8092|this draft |    0     |          |
|----------------------------------------------------------------------|
|   TBA9   |          |RFC6313,RFC8092|this draft |    0     |          |
|----------------------------------------------------------------------|
```

Figure 10: IANA Considerations

9. Acknowledgements

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their comments and suggestions to promote this document.
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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 11: 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 12: 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 13: Data Set Encoding Format

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