BGP Link-State Extensions for Seamless BFD
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Abstract

   [RFC7880] defines a simplified mechanism to use Bidirectional
   Forwarding Detection (BFD) with large portions of negotiation aspects
   eliminated, thus providing benefits such as quick provisioning as
   well as improved control and flexibility to network nodes initiating
   the path monitoring. The link-state routing protocols (IS-IS, OSPF
   and OSPFv3) have been extended to advertise the Seamless BFD (S-BFD)
   Discriminators.

   This draft defines extensions to the BGP Link-state address-family to
   carry the S-BFD Discriminators information via BGP.

Requirements Language

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

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1. Introduction

[RFC7880] defines a simplified mechanism to use Bidirectional Forwarding Detection (BFD)[RFC5880] with large portions of negotiation aspects eliminated, thus providing benefits such as quick provisioning as well as improved control and flexibility to network nodes initiating the path monitoring.

[RFC7883] defines a mean of advertising one or more S-BFD Discriminators using the IS-IS Router Capability TLV. [RFC7884] defines a new OSPF Router Information (RI) TLV that allows OSPF routers to flood the S-BFD discriminator values associated with a target network identifier. This mechanism is applicable to both OSPFv2 and OSPFv3.

The link-state routing protocols (IS-IS, OSPF and OSPFv3) have been
extended to advertise the S-BFD Discriminators. But flooding based
propagation of the S-BFD Discriminators using IGPs is limited by the
perimeter of the IGP domain. For advertising the S-BFD
Discriminators which span across IGP domains (e.g. multiple ASes),
the Border Gateway Protocol (BGP) is better suited as its propagation
perimeter is not limited like the IGPs.

This draft defines extensions to the BGP Link-state address-family to
carry the S-BFD Discriminators information via BGP.

2. Terminology

This memo makes use of the terms defined in [RFC7880].

3. Problem and Requirement

Seamless MPLS [I-D.ietf-mpls-seamless-mpls] extends the core domain
and integrates aggregation and access domains into a single MPLS
domain. In a large network, the core and aggregation networks can be
organized as different autonomous systems. Although the core and
aggregation networks are segmented into different autonomous systems,
but an E2E LSP will be created using hierarchical-labeled BGP LSPs
based on iBGP-labeled unicast within each AS, and eBGP-labeled
unicast to extend the LSP across AS boundaries. Meanwhile, the
customer will see only two service-end points in the Seamless MPLS
network. In order to detect the possible failure quickly and protect
the network/trigger re-routing, BFD MAY be used for the Service Layer
(e.g. for MPLS VPNs, PW) and the Transport Layer, so the need
arises that the BFD session has to span across AS domain.

The link-state routing protocols (IS-IS, OSPF and OSPFv3) have been
extended to advertise the S-BFD Discriminators. But flooding based
propagation of the S-BFD Discriminators using IGPs is limited by the
perimeter of the IGP domain. For advertising the S-BFD
Discriminators which span across IGP domains (e.g. multiple ASes),
the Border Gateway Protocol (BGP) is better suited as its propagation
perimeter is not limited like the IGPs. This draft defines
extensions requirement to the BGP Link-state address-family to carry
the S-BFD Discriminators information via BGP.

4. BGP-LS Extensions for S-BFD Discriminators Exchanging

The BGP-LS NLRI can be a node NLRI, a link NLRI or a prefix NLRI.
The corresponding BGP-LS attribute is a node attribute, a link
attribute or a prefix attribute. BGP-LS [RFC7752] defines the TLVs
that map link-state information to BGP-LS NLRI and BGP-LS attribute.

This document adds additional BGP- LS attribute TLVs to encode the
S-BFD Discriminators information.

[RFC7880] defines the following TLVs to encode the S-BFD
Discriminators information.

The ISIS Router CAPABILITY TLV as defined in [RFC4971] will be used
to advertise S-BFD discriminators. A new Sub-TLV is defined as
described below. S-BFD Discriminators Sub-TLV is formatted as
specified in [RFC5305].

```
                                        No. of octets
         +-----------------------------+
         | Type (20)                   |      1
         +-----------------------------+
         | Length (multiple of 4)      |      1
         +-----------------------------+
         | Discriminator Value(s)      |    4/Discriminator
         :                             :
         +-----------------------------+
         Figure 1: S-BFD Discriminators Sub-TLV for ISIS
```

Inclusion of the S-BFD Discriminators sub-TLV in a Router Capability
TLV is optional. Multiple S-BFD Discriminators sub-TLVs MAY be
advertised by an IS.

[RFC7884] defines the following TLVs to encode the S-BFD
Discriminators information. The format of the S-BFD Discriminator
TLV is 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
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |              Type             |             Length            |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                        Discriminator 1                        |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                   Discriminator 2 (Optional)                 |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                             ...                              |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
   |                   Discriminator n (Optional)                 |
   +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
           Figure 2: S-BFD Discriminators TLV for OSPF
```
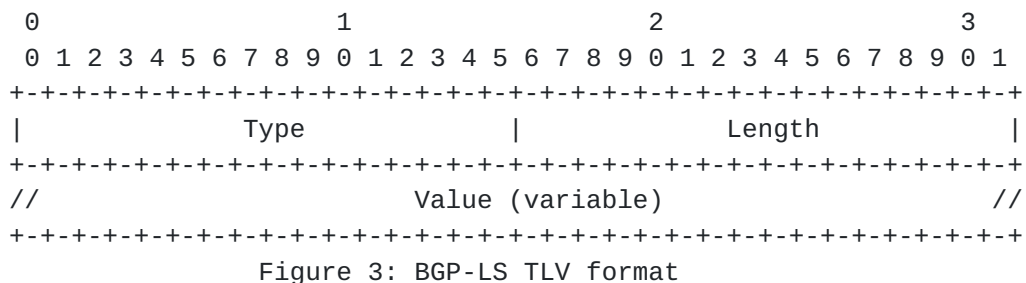
Type - S-BFD Discriminator TLV Type (11)

Length - Total length of the discriminator (Value field) in octets,
not including the optional padding. The Length is a multiple of 4
octets, and consequently specifies how many Discriminators are
included in the TLV.

Value - S-BFD network target discriminator value or values.

Routers that do not recognize the S-BFD Discriminator TLV Type MUST
ignore the TLV. S-BFD discriminator is associated with the BFD
Target Identifier type, which allows de-multiplexing to a specific
task or service.

These TLVs are mapped to BGP-LS attribute TLVs in the following way.
The new information in the Link-State NLRIs and attributes is encoded
in Type/Length/Value triplets.

```
 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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Type             |              Length           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
//                       Value (variable)                      //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```
                  Figure 3: BGP-LS TLV format

The 2 octet Type field values are defined in Table 1. The next 2
octet Length field encodes length of the rest of the TLV. The Value
portion of the TLV is variable and is equal to the corresponding
Value portion of the TLV defined in [RFC7883] and [RFC7884].

The following 'Node Attribute' TLVs are defined:

TLV Code Point	Description	Length	ISIS/OSPF TLV/Sub-TLV
TBD	S-BFD Discriminators	variable	TBD
...	...	...	...

                  Table 1: Node Attribute TLVs

These TLVs can ONLY be added to the Node Attribute associated with
the Node NLRI that originates the corresponding S-BFD Discriminator
TLV.

5. Operations

   Existing BGP and BGP-LS operational procedures apply. No new
   operation procedures are defined in this document.

6. IANA Considerations

   This document requests assigning code-points from the registry for
   BGP-LS attribute TLVs based on table Table 1.

7. Security Considerations

   Procedures and protocol extensions defined in this document do not
   affect the BGP security model. See [RFC6952] for details.

8. Acknowledgements

   The authors would like to thank Nan Wu for his contributions to this
   work.

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