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                 BGP Link-State Extensions for Seamless BFD
                  draft-ietf-idr-bgp-ls-sbfd-extensions-06

Abstract

   Seamless Bidirectional Forwarding Detection (S-BFD) 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 and OSPF) 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.

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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   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on April 25, 2022.

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1. Introduction

   Seamless Bidirectional Forwarding Detection (S-BFD) [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.

   For monitoring of a service path end-to-end via S-BFD, the headend
   node (i.e. Initiator) needs to know the S-BFD Discriminator of the
   destination/tail-end node (i.e. Responder) of that service. The
   link-state routing protocols (IS-IS, OSPF and OSPFv3) have been
   extended to advertise the S-BFD Discriminators. With this a
   Initiator can learn the S-BFD discriminator for all Responders within

its IGP area/level, or optionally within the domain. With networks
being divided into multiple IGP domains for scaling and operational
considerations, the service endpoints that require end to end S-BFD
monitoring often span across IGP domains.

BGP Link-State (BGP-LS) [RFC7752] enables the collection and
distribution of IGP link-state topology information via BGP sessions
across IGP areas/levels and domains. The S-BFD discriminator(s) of a
node can thus be distributed along with the topology information via
BGP-LS across IGP domains and even across multiple Autonomous Systems
(AS) within an administrative domain.

This draft defines extensions to BGP-LS for carrying the S-BFD
Discriminators information.

1.1. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and
"OPTIONAL" in this document are to be interpreted as described in BCP
14 [RFC2119] [RFC8174] when, and only when, they appear in all
capitals, as shown here.

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 ASes. Although the core and aggregation
networks are segmented into different ASes, an end-to-end label
switched path (LSP) can be created using hierarchical BGP signaled
LSPs based on internal-BGP (IBGP) labeled unicast within each AS, and
external-BGP (EBGP) labeled unicast to extend the LSP across AS
boundaries. This provides a seamless MPLS transport connectivity for
any two service end-points across the entire domain. In order to
detect failures for such end to end services and trigger faster
protection and/or re-routing, S-BFD MAY be used for the Service Layer
(e.g. for MPLS VPNs, pseudowires, etc.) or the Transport Layer
monitoring. This creates the need for setting up S-BFD session
spanning across AS domains.

In a similar Segment Routing (SR) [RFC8402] multi-domain network, an
end to end SR Policy [I-D.ietf-spring-segment-routing-policy] path
may be provisioned between service end-points across domains either

via local provisioning, or by a controller or signalled from a Path
Computation Engine (PCE) [RFC4655] . Monitoring using S-BFD can
similarly be setup for such a SR Policy.

Extending the automatic discovery of S-BFD discriminators of nodes
from within the IGP domain to cross an administrative domain using
BGP-LS enables creating S-BFD sessions on demand across IGP domains.
The S-BFD discriminators for service end point nodes MAY be learnt by
the PCE or a controller via the BGP-LS feed that it gets from across
IGP domains, and it can signal or provision the remote S-BFD
discriminator on the Initiator on demand when S-BFD monitoring is
required. The mechanisms for the signaling of the S-BFD
discriminator from the PCE/controller to the Initiator and setup of
the S-BFD session are outside the scope of this document.

Additionally, the service end-points themselves MAY also learn the
S-BFD discriminator of the remote nodes themselves by receiving the
BGP-LS feed via a route reflector (RR) [RFC4456] or a centralized BGP
Speaker that is consolidating the topology information across the
domains. The Initiator can then itself setup the S-BFD session to
the remote node without a controller/PCE assistance.

While this document takes examples of MPLS and SR paths, the S-BFD
discriminator advertisement mechanism is applicable for any S-BFD
use-case in general.

4. BGP-LS Extensions for S-BFD Discriminator

The BGP-LS [RFC7752] specifies the Node NLRI for advertisement of
nodes and their attributes using the BGP-LS Attribute. The S-BFD
discriminators of a node are considered as its node level attribute
and advertised as such.

This document defines a new BGP-LS Attribute TLV called the S-BFD
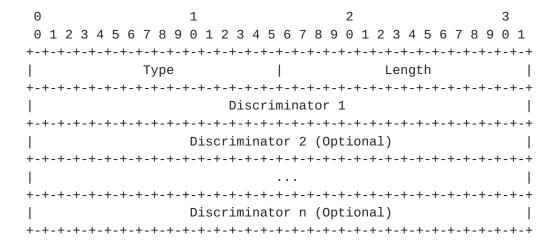Discriminators TLV, and its format is as follows:

```
 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 1: S-BFD Discriminators TLV

   where:

o Type: 1032 (early allocation by IANA)

o Length: variable. Minimum of 4 octets and increments of 4 octets
   there on for each additional discriminator

o Discriminators : multiples of 4 octets, each carrying a S-BFD
   local discriminator value of the node. At least one discriminator
   MUST be included in the TLV.

   The S-BFD Discriminators TLV can be added to the BGP-LS Attribute
   associated with the Node NLRI that originates the corresponding
   underlying IGP TLV/sub-TLV as described below. This information is
   derived from the protocol specific advertisements as below..

o IS-IS, as defined by the S-BFD Discriminators sub-TLV in
   [RFC7883].

o OSPFv2/OSPFv3, as defined by the S-BFD Discriminators TLV in
   [RFC7884].

   When the node is not running any of the IGPs but running a protocol
   like BGP, then the locally provisioned S-BFD discriminators of the
   node MAY be originated as part of the BGP-LS attribute within the
   Node NLRI corresponding to the local node.

5. IANA Considerations

   This document requests assigning code-points from the registry "BGP-
   LS Node Descriptor, Link Descriptor, Prefix Descriptor, and Attribute
   TLVs" based on table below which reflects the values assigned via the

early allocation process. The column "IS-IS TLV/Sub-TLV" defined in
the registry does not require any value and should be left empty.

```
+---------------+--------------------------+----------+
| Code Point    | Description              | Length   |
+---------------+--------------------------+----------+
|     1032      | S-BFD Discriminators TLV | variable |
+---------------+--------------------------+----------+
```

6. Manageability Considerations

This section is structured as recommended in [RFC5706].

The new protocol extensions introduced in this document augment the
existing IGP topology information that was distributed via [RFC7752].
Procedures and protocol extensions defined in this document do not
affect the BGP protocol operations and management other than as
discussed in the Manageability Considerations section of [RFC7752].
Specifically, the malformed NLRIs attribute tests in the Fault
Management section of [RFC7752] now encompass the new TLVs for the
BGP-LS NLRI in this document.

6.1. Operational Considerations

No additional operation considerations are defined in this document.

6.2. Management Considerations

No additional management considerations are defined in this document.

7. Security Considerations

The new protocol extensions introduced in this document augment the
existing IGP topology information that was distributed via [RFC7752].
Procedures and protocol extensions defined in this document do not
affect the BGP security model other than as discussed in the Security
Considerations section of [RFC7752]. More specifically the aspects
related to limiting the nodes and consumers with which the topology
information is shared via BGP-LS to trusted entities within an
administrative domain.

Advertising the S-BFD Discriminators via BGP-LS makes it possible for
attackers to initiate S-BFD sessions using the advertised
information. The vulnerabilities this poses and how to mitigate them
are discussed in [RFC7752].

8. Acknowledgements

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9. References

9.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
           Requirement Levels", BCP 14, RFC 2119,
           DOI 10.17487/RFC2119, March 1997,
           <https://www.rfc-editor.org/info/rfc2119>.

[RFC7752] Gredler, H., Ed., Medved, J., Previdi, S., Farrel, A., and
           S. Ray, "North-Bound Distribution of Link-State and
           Traffic Engineering (TE) Information Using BGP", RFC 7752,
           DOI 10.17487/RFC7752, March 2016,
           <https://www.rfc-editor.org/info/rfc7752>.

[RFC7880] Pignataro, C., Ward, D., Akiya, N., Bhatia, M., and S.
           Pallagatti, "Seamless Bidirectional Forwarding Detection
           (S-BFD)", RFC 7880, DOI 10.17487/RFC7880, July 2016,
           <https://www.rfc-editor.org/info/rfc7880>.

[RFC7883] Ginsberg, L., Akiya, N., and M. Chen, "Advertising
           Seamless Bidirectional Forwarding Detection (S-BFD)
           Discriminators in IS-IS", RFC 7883, DOI 10.17487/RFC7883,
           July 2016, <https://www.rfc-editor.org/info/rfc7883>.

[RFC7884] Pignataro, C., Bhatia, M., Aldrin, S., and T. Ranganath,
           "OSPF Extensions to Advertise Seamless Bidirectional
           Forwarding Detection (S-BFD) Target Discriminators",
           RFC 7884, DOI 10.17487/RFC7884, July 2016,
           <https://www.rfc-editor.org/info/rfc7884>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC
           2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174,
           May 2017, <https://www.rfc-editor.org/info/rfc8174>.

9.2. Informative References

[I-D.ietf-mpls-seamless-mpls]
           Leymann, N., Decraene, B., Filsfils, C., Konstantynowicz,
           M., and D. Steinberg, "Seamless MPLS Architecture", draft-
           ietf-mpls-seamless-mpls-07 (work in progress), June 2014.

   [I-D.ietf-spring-segment-routing-policy]
              Filsfils, C., Talaulikar, K., Voyer, D., Bogdanov, A., and
              P. Mattes, "Segment Routing Policy Architecture", draft-
              ietf-spring-segment-routing-policy-13 (work in progress),
              May 2021.

   [RFC4456] Bates, T., Chen, E., and R. Chandra, "BGP Route
              Reflection: An Alternative to Full Mesh Internal BGP
              (IBGP)", RFC 4456, DOI 10.17487/RFC4456, April 2006,
              <https://www.rfc-editor.org/info/rfc4456>.

   [RFC4655] Farrel, A., Vasseur, J., and J. Ash, "A Path Computation
              Element (PCE)-Based Architecture", RFC 4655,
              DOI 10.17487/RFC4655, August 2006,
              <https://www.rfc-editor.org/info/rfc4655>.

   [RFC5706] Harrington, D., "Guidelines for Considering Operations and
              Management of New Protocols and Protocol Extensions",
              RFC 5706, DOI 10.17487/RFC5706, November 2009,
              <https://www.rfc-editor.org/info/rfc5706>.

   [RFC5880] Katz, D. and D. Ward, "Bidirectional Forwarding Detection
              (BFD)", RFC 5880, DOI 10.17487/RFC5880, June 2010,
              <https://www.rfc-editor.org/info/rfc5880>.

   [RFC8402] Filsfils, C., Ed., Previdi, S., Ed., Ginsberg, L.,
              Decraene, B., Litkowski, S., and R. Shakir, "Segment
              Routing Architecture", RFC 8402, DOI 10.17487/RFC8402,
              July 2018, <https://www.rfc-editor.org/info/rfc8402>.

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