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BGP-LS extensions for BIER-TE
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Abstract

BIER-TE forwards and replicates packets based on a BitString in the packet header, but every BitPosition of the BitString of a BIER-TE packet indicates one or more adjacencies.

BGP Link-State (BGP-LS) enables the collection of various topology informations from the network, and the topology informations are used by the PCE to calculate the path and then propagate them onto the BFRs(instead of having each node to calculate on its own) and that can be for both inter-as and intra-as situations.

This document specifies extensions to the BGP Link-state address-family in order to advertise BIER-TE informations.

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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1. Introduction

Bit Index Explicit Replication (BIER)-TE shares architecture and packet formats with BIER as described in [RFC8279]. BIER-TE forwards and replicates packets based on a BitString in the packet header, but every BitPosition of the BitString of a BIER-TE packet indicates one or more adjacencies as described in [RFC9262].

When BIER-TE is enabled in an IGP domain, BIER-TE-related informations will be advertised via IGP. The flooding scope for the IGP extensions for BIER-TE is IGP area-wide. by using the IGP alone it is not enough to construct across multiple IGP Area.

The BGP-LS address-family/sub-address-family have been defined to allow BGP to carry Link-State informations. This document specifies extensions to the BGP Link-state address-family in order to advertise BIER-TE-specific informations, Similar to BGP-LS Advertisement of IGP Traffic Engineering Performance Metric Extensions([RFC8571]). An external component (e.g., a controller/a PCE(see [RFC4655] for PCE-Based Architecture , [RFC5440] for PCEP and [RFC5376] for Inter-AS Requirements for the PCEP.))then can learn the BIER-TE informations in the "northbound" direction and calculate BIER-TE Path and then propagate them onto BFRs (instead of having each BFR to calculate on its own), and that can be for both inter-as and intra-as situations.

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. BGP-LS Extensions for BIER-TE

[I-D.ietf-bier-te-ospf] and [I-D.ietf-bier-te-isis] specifies IGP extensions for distributing the BitPositions configured on a BFR with MPLS and Non-MPLS encapsulation for BIER-TE in a BIER-TE domain. and then external component (e.g., a controller) need to collect the BitPositions configured on a BFR with MPLS and Non-MPLS encapsulation for BIER-TE in the "northbound" direction within the BIER-TE domain.

2.1. Link Attribute TLV

The following Link Attribute TLV is defined:

Type	Description	Section
TBD1	Link-BP	section 3.2

Figure 1

2.1.1. The Link-BP TLV

The Link-BP TLV is defined to advertise a link BitPosition (BP). The informations are derived from Link-BP Sub-TLV of IS-IS (section 2.1 of [I-D.ietf-bier-te-isis]) and OSPF (section 2.1 of [I-D.ietf-bier-te-ospf]). According to different subdomain, the Link-BP TLV may appear multiple times.

The following Link-BP TLV is defined:

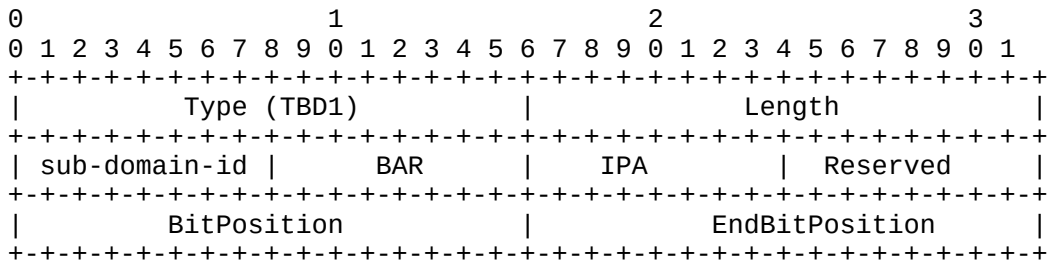

Figure 2

Type: TBD1, see IANA Considerations section.

Length: 2 octets.

Subdomain-id: Unique value identifying the BIER-TE sub-domain, 1 octet.

BAR: A 1-octet field encoding the BIER Algorithm, used to calculate underlay paths to reach BFERs. Values are allocated from the "BIER Algorithms" registry which is defined in [RFC8401].

IPA: A 1-octet field encoding the IGP Algorithm, used to either modify,enhance, or replace the calculation of underlay paths to reach BFERs as defined by the BAR value. Values are from the IGP Algorithm registry.

BitPosition: A 2-octet field encoding the BitPosition locally configured on the link/interface when the Link Type of the link in the Router-Link TLV containing this Sub-TLV is 1 (i.e., Point-to-Point connection to another router) or 2 (i.e., connection to Transit Network or say LAN).

EndBitPosition: A 2-octet field encoding the BitPosition of the connection on the designated Intermediate Systems (Dis) end (ISIS) / designated router (DR) end(OSPFv2 and OSPFv3), as defined in section 2.1 of [I-D.ietf-bier-te-isis] , section 2.1 of [I-D.ietf-bier-te-ospf].

2.2. Node Attributes TLVs

The following Node Attribute TLVs are defined:

Type	Description	Section
TBD2	Routed-BP	section 3.3
TBD3	Localdecap-BP	section 3.4
TBD4	BIER-TE MPLS Encapsulation	section 3.3
TBD5	BIER-TE Non-MPLS Encapsulation	section 3.4

Figure 3

2.2.1. The Routed-BP TLV

The Routed-BP TLV is defined to advertise a forward routed BitPosition (BP). The informations are derived from Node BPs TLV and Routed-BP Sub-TLV of IS-IS (section 2.1 of [I-D.ietf-bier-te-isis]) and OSPF (section 2.1 of [I-D.ietf-bier-te-ospf]). According to different subdomain, the Routed-BP TLV may appear multiple times.

The following Routed-BP TLV is defined:

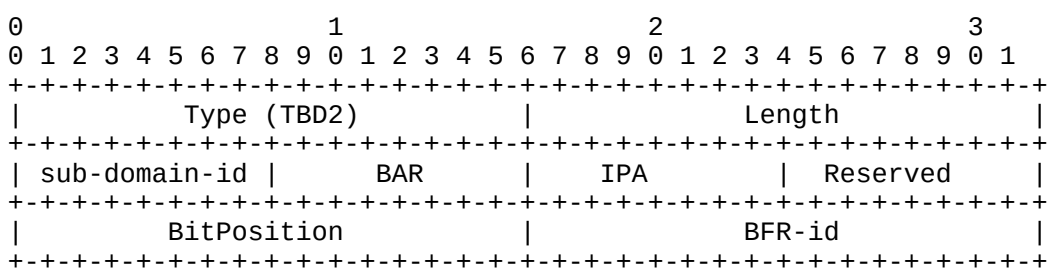

Figure 4

Type: TBD2, see IANA Considerations section.

Length: 2 octets.

Subdomain-id: Unique value identifying the BIER-TE sub-domain, 1 octet.

BAR: A 1-octet field encoding the BIER Algorithm, used to calculate underlay paths to reach BFERs. Values are allocated from the "BIER Algorithms" registry which is defined in [RFC8401].

IPA: A 1-octet field encoding the IGP Algorithm, used to either modify,enhance, or replace the calculation of underlay paths to reach BFERs as defined by the BAR value. Values are from the IGP Algorithm registry.

BitPosition: A 2-octet field encoding the BitPosition configured on a BFR for a forward routed adjacency to a remote BFR.

BFR-id: A 2-octet field encoding the BFR-id of the remote BFR.

2.2.2. The Localdecap-BP TLV

The Localdecap-BP TLV is defined to advertise a localdecap BitPosition (BP). The informations are derived from Node BPs TLV and Localdecap-BP Sub-TLV of IS-IS (section 2.1 of [I-D.ietf-bier-te-isis]) and OSPF (section 2.1 of [I-D.ietf-bier-te-ospf]). According to different subdomain, the Routed-BP TLV may appear multiple times.

The following Localdecap-BP TLV is defined:

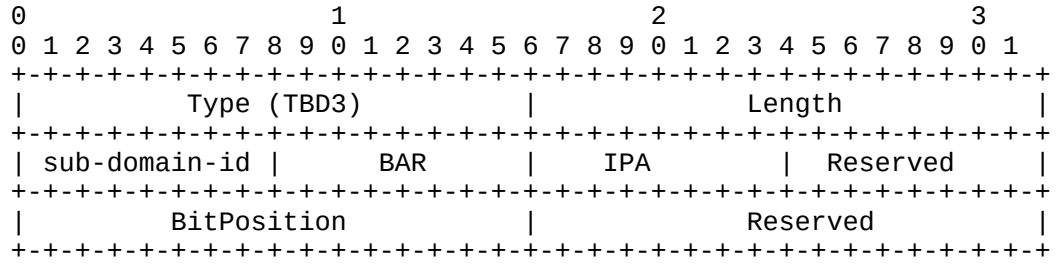

Figure 5

Type: TBD3, see IANA Considerations section.

Length: 2 octets.

Subdomain-id: Unique value identifying the BIER-TE sub-domain, 1 octet.

BAR: A 1-octet field encoding the BIER Algorithm, used to calculate underlay paths to reach BFERs. Values are allocated from the "BIER Algorithms" registry which is defined in [RFC8401].

IPA: A 1-octet field encoding the IGP Algorithm, used to either modify,enhance, or replace the calculation of underlay paths to reach BFERs as defined by the BAR value. Values are from the IGP Algorithm registry.

BitPosition: A 2-octet field encoding the localdecap BitPosition configured on a BFR.

2.2.3. BIER-TE MPLS Encapsulation TLV

The BIER-TE MPLS Encapsulation TLV is used in order to advertise MPLS specific informations used for BIER-TE. It MAY appear multiple times. The informations are derived from BIER-TE MPLS Encapsulation Sub-TLV of OSPF (section 2.3.1 of [I-D.ietf-bier-te-ospf]).

In some environment, each router allocates its labels, and advertises it to the controller.That solution is simpler as the controller does not need to deal with label allocation. If the controller has to deal with Label allocation , there needs to be a (global) range carved out such there are no conflicts. We can avoid all that by having the router allocate the BIER Label range and advertise it to the controller.

The following the BIER-TE MPLS Encapsulation TLV is defined:

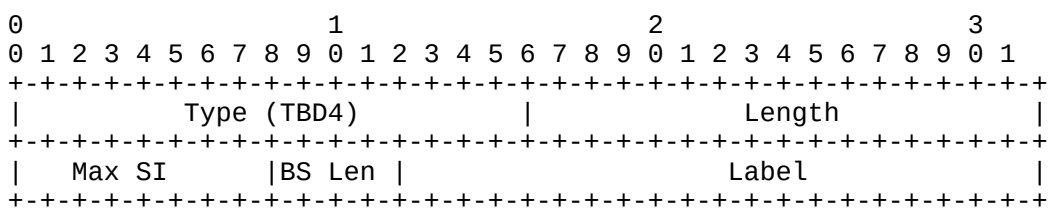

Figure 6

Type: TBD4, see IANA Considerations section.

Length: 4.

Max SI: A 1-octet field encoding the maximum Set Identifier(as defined in [RFC8279]), used in the encapsulation for this BIER subdomain for this BitString length.

BS Len: A 4-bit field field encoding the Bitstring length as per [RFC8296].

Label: First label of the range, 20 bits. The labels are as defined [RFC8296]. The 4 leftmost bits MUST be ignored.

BS length in multiple MPLS Encapsulation TLV associated with the same BIER-TE information TLV MUST NOT repeat, otherwise only the first MPLS Encapsulation TLV with such BS length MUST be used and any subsequent MPLS Encapsulation TLVs with the same BS length MUST be ignored.

2.2.4. BIER-TE Non-MPLS Encapsulation TLV

The BIER-TE Non-MPLS Encapsulation TLV is used in order to advertise Non-MPLS encapsulation(e.g. ethernet encapsulation) capability and other associated parameters of the encapsulation. It MAY appear multiple times. The informations are derived from BIER-TE Non-MPLS Encapsulation Sub-TLV of OSPF (section 2.3.2 of [I-D.ietf-bier-te-ospf]).

The following the BIER-TE Non-MPLS Encapsulation TLV is defined:

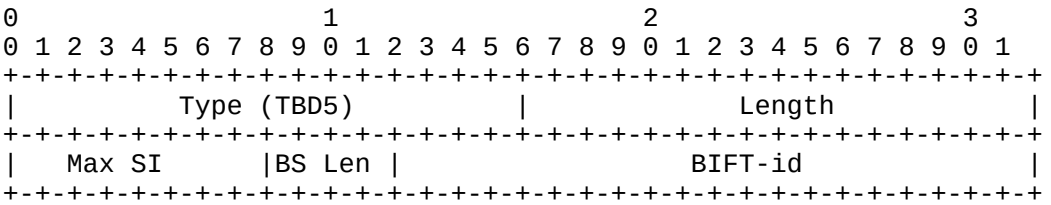

Figure 7

Type: TBD5, see IANA Considerations section.

Length: 4.

Max SI:A 1-octet field encoding the maximum Set Identifier(as defined in [RFC8279]), used in the encapsulation for this BIER subdomain for this BitString length.

The "BIFT-id range" is the set of 20-bit values beginning with the BIFT-id and ending with (BIFT-id + (Max SI)). A unique BIFT-id range is allocated for each BitString length and sub-domain-id. These BIFT-id's are used for BIER forwarding as described in [RFC8279])and [RFC8296].

Local BitString Length (BS Len): A 4-bit field encoding the Bitstring length as per [RFC8296].

BIFT-id:A 20bit field encoding the first BIFT-id of the BIFT-id range. The BIER-id are as defined in [I-D.ietf-bier-lsr-non-mpls-extensions].

3. IANA Considerations

IANA maintains a registry group called "BGP-LS NLRI and Attribute TLVs" in the "Border Gateway Protocol - Link State (BGP-LS) Parameters" registry group.

The following TLV codepoints are suggested (for early allocation by IANA):

Code Point	Description	Value defined in
TBD1	Link-BP	this document
TBD2	Routed-BP	this document
TBD3	Localdecap-BP	this document
TBD4	BIER-TE MPLS Encapsulation	this document
TBD5	BIER-TE Non-MPLS Encapsulation	this document

Table 1

4. Security Considerations

Procedures and protocol extensions defined in this document do not affect the BGP security model. See the "Security Considerations"section of [RFC4271] for a discussion of BGP security. Security considerations for acquiring and distributing BGP-LS information are discussed in [RFC9552].

5. Acknowledgements

TBD.

6. Normative References

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