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BGP Link-State extensions for BIER
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Abstract

Bit Index Explicit Replication (BIER) is an architecture that provides optimal multicast forwarding through a "BIER domain" without requiring intermediate routers to maintain any multicast related per-flow state. BIER also does not require any explicit tree-building protocol for its operation. A multicast data packet enters a BIER domain at a "Bit-Forwarding Ingress Router" (BFIR), and leaves the BIER domain at one or more "Bit-Forwarding Egress Routers" (BFERs). The BFIR router adds a BIER header to the packet. The BIER header contains a bitstring in which each bit represents exactly one BFER to forward the packet to. The set of BFERs to which the multicast packet needs to be forwarded is expressed by setting the bits that correspond to those routers in the BIER header.

This document specifies extensions to the BGP Link-state address-family in order to advertising BIER information.

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[1.](#) Introduction

Bit Index Explicit Replication (BIER) is an architecture that provides optimal multicast forwarding through a "BIER domain" without requiring intermediate routers to maintain any multicast related per-flow state. BIER also does not require any explicit tree-building protocol for its operation. A multicast data packet enters a BIER domain at a "Bit-Forwarding Ingress Router" (BFIR), and leaves the BIER domain at one or more "Bit-Forwarding Egress Routers" (BFERs). The BFIR router adds a BIER header to the packet. The BIER header contains a bitstring in which each bit represents exactly one BFER to forward the packet to. The set of BFERs to which the multicast packet needs to be forwarded is expressed by setting the bits that correspond to those routers in the BIER header.

This document specifies extensions to the BGP Link-state address-family in order to advertising BIER-specific. An external component (e.g., a controller) then can collect BIER information in the "northbound" direction within the BIER domain.

2. Conventions used in this document

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-LS Extensions for BIER

Each BFR MUST be assigned a "BFR-Prefix". A BFR's BFR-Prefix MUST be an IP address (either IPv4 or IPv6) of the BFR, and MUST be unique and routable within the BIER domain as described in [section 2 of \[RFC8279\]](#), and then external component (e.g., a controller) need to collect BIER information of BIER routers are associated with the BFR-Prefix in the "northbound" direction within the BIER domain.

Given that the BIER information is associated with the prefix, the BGP-LS Prefix Attribute TLV [[RFC7752](#)] can be used to carry the BIER information. A new Prefix Attribute TLV and Sub-TLV are defined for the encoding of BIER information.

3.1. The BIER TLV

A new Prefix Attribute TLV (defined in [[RFC7752](#)]) is defined for distributing BIER information. The new TLV is called the BIER TLV. The BIER TLVs may appear multiple times.

The following BIER TLV is defined:

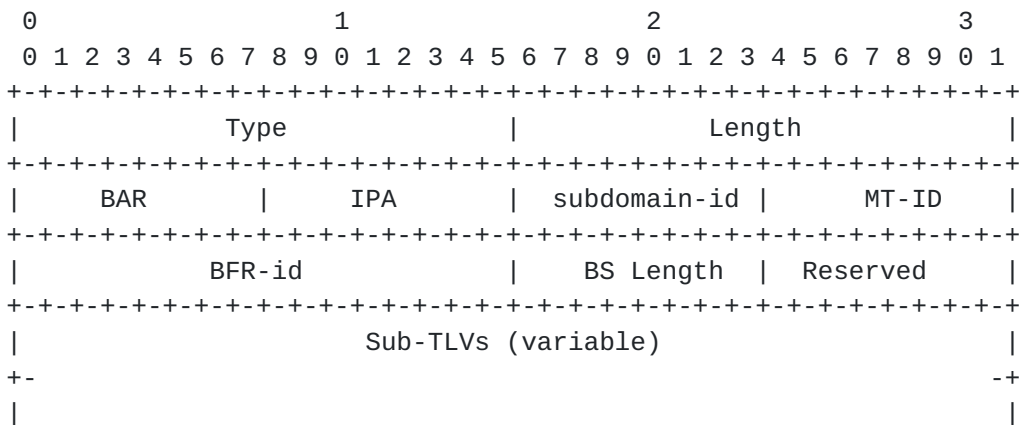


Figure 1

Type: as indicated in IANA Considerations section.

Length: 2 octet.

Reserved: MUST be 0 on transmission, ignored on reception. May be used in future versions.

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.

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

MT-ID: Multi-Topology ID that identifies the topology that is associated with the BIER sub-domain. 1 octet.

BFR-id: A 2 octet field encoding the BFR-id, as documented in [[RFC8279](#)]. If the BFR-id is zero, it means, the advertising router is not advertising any BIER-id. In some environment, BFR-id can be configured by NMS, The BFR-id should be sent to a controller.

BS Length: A 1 octet field encoding the Bitstring length as per [[RFC8296](#)].

If the MT-ID value is outside of the values specified in [[RFC4915](#)], the BIER Sub-TLV MUST be ignored.

3.2. The BIER MPLS Encapsulation Sub-TLV

The BIER MPLS Encapsulation Sub-TLV is a sub-TLV of the BIER TLV. BIER MPLS Encapsulation Sub-TLV is used in order to advertise MPLS specific information used for BIER. It MUST appear multiple times in the BIER TLV as described in [[RFC8444](#)]

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 MPLS Encapsulation Sub-TLV is defined:

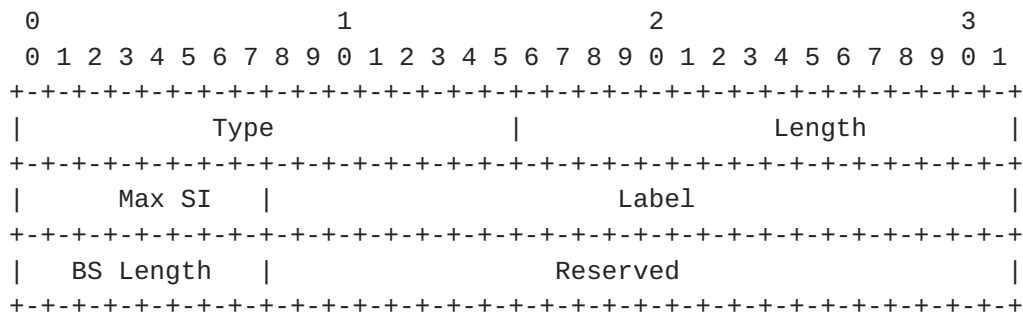


Figure 2

Type: as indicated in IANA Considerations section.

Length: 2 octet.

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.

Label: A 3 octet field, where the 20 rightmost bits represent the first label in the label range.

BS Length: A 1 octet field encoding the Bitstring length as per [RFC8296]

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

4. IANA Considerations

This document requests assigning code-points from the registry for the new Prefix Attribute TLV and Sub-TLV.

TLV Code Point	Description	Value defined
1174(recommend)	BIER	this document

Table 1: The new Prefix Attribute TLV

Sub-TLV	Description	Value
Code Point		
1 (recommend)	BIER MPLS Encapsulation	this document

Table 2: The new Prefix Attribute Sub-TLV

5. Security Considerations

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

6. Acknowledgements

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