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OSPFv3 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 bit-string 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 describes the OSPFv3 protocol extensions required for BIER.

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[1.](#) Introduction

[I-D.ietf-bier-architecture] introduces and explains BIER 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 bit-string 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.

BIER architecture requires the distribution of BIER specific information among the routers participating within a BIER domain. BIER architecture permits link-state routing protocol to perform the distribution of such information.

[[I-D.ietf-bier-ospf-bier-extensions](#)] proposes the OSPFv2 protocol extensions to distribute BIER specific information. This document describes the OSPFv3 protocol extensions required to advertise BIER specific information.

[2.](#) Conventions used in this document

[2.1.](#) Terminology

BFER - Bit Forwarding Egress Router

BFIR - Bit Forwarding Ingress Router

BFR - Bit-Forwarding Router

BIER - Bit Index Explicit Replication

ECMP - Equal Cost Multi-Path

SI - Set Identifier

[2.2.](#) Requirements notation

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.](#) Flooding of BIER information in OSPFv3

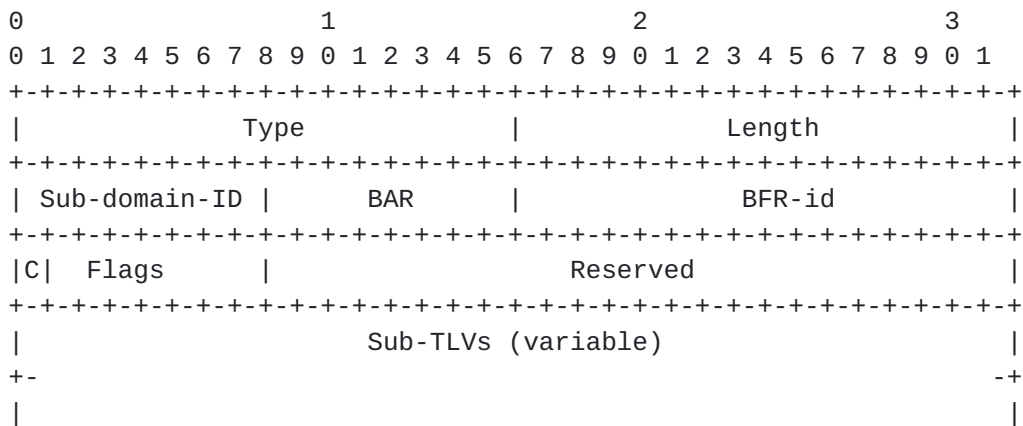
All BIER specific information that a Bit-Forwarding Router (BFR) needs to advertise to other BFRs is associated with a BFR-Prefix. A BFR prefix is a unique (within a given BIER domain) routable IPv4 or IPv6 address that is assigned to each BFR as described in more detail in [[I-D.ietf-bier-architecture](#)].

[[I-D.ietf-ospf-ospfv3-lsa-extend](#)] defines the encoding of OSPFv3 LSA in TLV format that allows to carry additional informations. This section defines the required Sub-TLVs to carry BIER information that is associated with the BFR-Prefix. The Sub-TLV defined in this section MAY be carried in the below OSPFv3 Extended LSA TLVs [[I-D.ietf-ospf-ospfv3-lsa-extend](#)]:

Intra-Area-Prefix TLV

3.1. BIER Sub-TLV

The BIER Sub-TLV has the following format:



BFR-id

A 2 octet field encoding the BFR-id, as documented in [\[I-D.ietf-bier-architecture\]](#). If the BFR is not locally configured with a valid BFR-id, the value of this field is set to invalid BFR-id per [\[\[I-D.ietf-bier-architecture\]](#).

Flags

The C flag (BSL Conversion flag) is set to 1 if the node is capable of imposing a different BSL than the one it received in a BIER encapsulated packet. More details about the usage of this conversion is discussed in Section 2.3 of [\[I-D.ietf-bier-ospf-bier-extensions\]](#). Other flags MUST be set to 0 and receiver MUST ignore the other flags. New flags may be defined in future.

If a BFR advertises the same Sub-domain-ID in multiple BIER sub-TLVs, the BFR MUST be treated as if it did not advertise a BIER sub-TLV for such sub-domain.

All BFRs MUST detect advertisement of duplicate valid BFR-IDs for a given Sub-domain-ID. When such duplication is detected all BFRs advertising duplicates MUST be treated as if they did not advertise a valid BFR-id.

The supported algorithm MUST be consistent for all routers supporting a given BFR sub-domain. A router receiving BIER Sub-TLV advertisement with a BAR which does not match the locally configured value MUST report a misconfiguration for the given BIER sub-domain and MUST ignore such BIER sub-TLV.

[3.2.](#) BIER MPLS Encapsulation Sub-TLV

The BIER MPLS Encapsulation Sub-TLV is a Sub-TLV of the BIER Sub-TLV defined in [Section 3.1](#). This Sub-TLV is used to carry MPLS encapsulation specific information for BIER in MPLS networks.

The BIER MPLS Encapsulation Sub-TLV has the following format:

If same BS length is repeated in multiple BIER MPLS Encapsulation Sub-TLV inside the same BIER Sub-TLV, the BIER sub-TLV MUST be ignored.

Label ranges within all BIER MPLS Encapsulation Sub-TLV inside the same BIER Sub-TLV MUST NOT overlap. If the overlap is detected, the advertising router MUST be treated as if it did not advertise a BIER sub-TLV.

All advertised labels MUST be valid, otherwise the BIER sub-TLV MUST be ignored.

3.3. Flooding scope of BIER Information

The BIER Sub-TLV is included as part of OSPFv3 Extended LSAs as defined in [Section 3](#). The flooding scope of the BIER Sub-TLV is decided by the flooding scope of the Extended LSA carrying the Sub-TLV. Any OSPFv3 router SHOULD include the local BIER information in BIER Sub-TLV and advertise it using Intra-Area-Prefix LSA.

When an OSPFv3 Area Border Router (ABR) originates E-Inter-Area-Prefix-LSA for a Prefix P, it follows the below procedure to propagate the BIER information between areas:

- o Examine if the Prefix P is a BFR-Prefix. This could be done by checking the presence of BIER Sub-TLV in Intra-Area-Prefix-TLV of E-Intra-Area-Prefix-LSA for Prefix P.
- o If the above is TRUE, copy the BIER Sub-TLV to Inter-Area-Prefix TLV.

4. IANA Considerations

The document requests two new allocations from the OSPFv3 Extended-LSA sub-TLV registry as defined in [[I-D.ietf-ospf-ospfv3-lsa-extend](#)].

BIER Sub-TLV: TBD1

BIER MPLS Encapsulation Sub-TLV: TBD2

5. Security Considerations

This document defines additional Sub-TLVs for OSPFv3 Extended-LSAs and does not impose any changes in flooding scope or Path computation.

Implementations must assure that any malformed TLVs or Sub-TLVs must not result in errors that causes hard OSPFv3 failures.

6. Acknowledgement

TBD

7. References

7.1. Normative References

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- [RFC5340] Coltun, R., Ferguson, D., Moy, J., and A. Lindem, "OSPF for IPv6", [RFC 5340](#), DOI 10.17487/RFC5340, July 2008, <<https://www.rfc-editor.org/info/rfc5340>>.

7.2. Informative References

- [I-D.ietf-bier-ospf-bier-extensions]
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