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OSPF 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 OSPF protocol extension required for BIER with MPLS encapsulation.

Status of This Memo

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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. Neither does BIER explicitly require a 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 routers participating in BIER within a given BIER domain to exchange some BIER specific information among themselves. BIER architecture allows link-state routing protocols to perform the distribution of these information. In this document we describe extensions to OSPF to distribute BIER specific information for the case where BIER uses MPLS encapsulation as described in [I-D.wijnands-mpls-bier-encapsulation].

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].

2. Flooding of the BIER Information in OSPF

All the BIER specific information that a BIER router needs to advertise to other BIER routers are associated with the BFR-Prefix, a unique (within a given BIER domain), routable IP address that is assign to each BIER router as described in section 2 of [I-D.wijnands-bier-architecture].

Given that the BIER information is associated with the prefix, the OSPF Extended Prefix Opaque LSA [I-D.ietf-ospf-prefix-link-attr] is used to flood BIER related information.

2.1. The BIER Sub-TLV

A new Sub-TLV of the Extended Prefix TLV (defined in [I-D.ietf-ospf-prefix-link-attr]) is defined for distributing BIER information. The new Sub-TLV is called BIER Sub-TLV. Multiple BIER Sub-TLVs may be included in the Extended Prefix TLV.

BIER Sub-TLV has the following format:

```
 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            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|  BS Length    |     MT-ID     |             BFR-id            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                      Sub-TLVs (variable)                      |
+-                                                             -+
|                                                               |
```

Type: TBD

Length: 4 bytes

BS Length: A 1 octet field encoding the supported BitString length associated with this BFR-prefix. The values allowed in this field are specified in section 3 of [I-D.wijnands-mpls-bier-encapsulation].

MT-ID: Multi-Topology ID (as defined in [RFC4915]).

BFR-id: A 2 octet field encoding the BFR-id, as documented in section 2 [I-D.wijnands-bier-architecture]. If the BFR-id is zero, it means, the advertising router is not advertising any BIER-id.

If multiple BIER Sub-TLVs are present, all having the same BS Length and MT-ID values, first one MUST be used and subsequent ones MUST be ignored.

2.2. The BIER MPLS Encapsulation Sub-TLV

BIER MPLS Encapsulation Sub-TLV is a sub-TLV of the BIER Sub-TLV. BIER MPLS Encapsulation Sub-TLVIt is used in order to advertise MPLS specific information used for BIER. It MUST appear only once in the BIER Sub-TLV.

BIER MPLS Encapsulation Sub-TLV has the following format:

```
 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            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Lbl Range Size |                Label Range Base               |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Type: TBD

Length: 4 bytes

Label Range Size: A 1 octet field encoding the label range size of the label range.

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

The "label range" is the set of labels beginning with the label range base and ending with (label range base)+(label range size)-1. A unique label range is allocated for each BitStream length and Multi-Topology ID. These labels are used for BIER forwarding

as described in [I-D.wijnands-bier-architecture] and [I-D.wijnands-mpls-bier-encapsulation].

The size of the label range is determined by the number of Set Identifiers (SI) (section 2 of [I-D.wijnands-bier-architecture]) that are used in the network. Each SI maps to a single label in the label range. The first label is for SI=0, the second label is for SI=1, etc.

2.3. Flooding scope of BIER Information

Flooding scope of the OSPF Extended Prefix Opaque LSA [I-D.ietf-ospf-prefix-link-attr] that is used for advertising BIER Sub TLV is set to area. If (and only if) a single BIER domain contains multiple OSPF areas, OSPF must propagate BIER information between areas. The following procedure is used in order to propagate BIER related information between areas:

When an OSPF ABR advertises a Type-3 Summary LSA from an intra-area or inter-area prefix to all its connected areas, it will also originate an Extended Prefix Opaque LSA, as described in [I-D.ietf-ospf-prefix-link-attr]. The flooding scope of the Extended Prefix Opaque LSA type will be set to area-scope. The route-type in the OSPF Extended Prefix TLV is set to inter-area. When determining whether a BIER Sub-TLV should be included in this LSA ABR will:

- look at its best path to the prefix in the source area and find the advertising router associated with the best path to that prefix.

- determine if such advertising router advertised a BIER Sub-TLV for the prefix. If yes, ABR will copy the information from such BIER MPLS Sub-TLV when advertising BIER MPLS Sub-TLV to each connected area.

3. Security Considerations

Implementations must assure that malformed TLV and Sub-TLV permutations do not result in errors which cause hard OSPF failures.

4. IANA Considerations

The document requests two new allocations from the OSPF Extended Prefix sub-TLV registry as defined in [I-D.ietf-ospf-prefix-link-attr].

BIER Sub-TLV: TBD

BIER MPLS Encapsulation Sub-TLV: TBD

5. Acknowledgments

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6. Normative References

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