Abstract

Bit Index Explicit Replication (BIER) [I-D.ietf-bier-architecture] 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. Currently, the data plane of BIER is apt to use BIER-MPLS encapsulation to transmit multicast traffic. However, this document tries to propose a solution name BIER-Lite about how to extend OSPF protocol to support BIER forwarding in non-MPLS underlay network instead of MPLS underlay network.

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1. Introduction

Bit Index Explicit Replication (BIER) [I-D.ietf-bier-architecture] 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.

Currently, the data plane of BIER is defined in BIER-MPLS encapsulation [I-D.ietf-bier-mpls-encapsulation] to transmit multicast traffic in MPLS encapsulation. Admittedly, BIER-MPLS introduces the advantages of MPLS forwarding. However, this requires the underlay network is an MPLS network, and along the path, there need label switching and label lookup. Additionally, every BFR requires per-label forwarding table to assist BIER forwarding. What’s more, prior of that, IGP protocol or BGP protocol requires a precise mechanism to generate these label information, after that, to advertise these label information to form the per-label forwarding table between the label and the bit index forwarding table (BIFT). Sometimes, how to categorize this label information in differentiated MPLS Encapsulation sub-sub-TLV is a difficult decision. And some other times, after the label information advertisement, there may be some redundant label information as well as some redundant label forwarding table because each BFR advertises continuous labels for different Set Identifiers for each combination of Sub-domain and BitStringLength which may be redundant because traffic to some BFERs may not transit this advertising node, especially when these BFERs belonging to the same Set Identifier reside together geographically.

In fact, some multicast scenario may be not in MPLS network, or may be in a relatively simple network. In other words, if BIER forwarding uses IP forwarding instead of MPLS forwarding in these kind of networks, it would be much easier to deploy BIER in current deployment. Of course, if the BIER forwarding is compatible with BIER-MPLS encapsulation forwarding, that would be much more significant.

The following section tries to propose how to extend OSPF protocol to support BIER forwarding in non-MPLS underlay network instead of MPLS underlay network.
And this document names this solution as BIER-Lite.
2. Convention and Terminology

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].

The terms about BIER are defined in [I-D.ietf-bier-architecture].
3. BIER-Lite Sub-TLV in OSPF extension

Given that the BIER-Lite-specific information that a BFR needs to advertise to other BFRs are associated with the BFR-Prefix, the OSPF Extended Prefix Opaque LSA [I-D.ietf-ospf-prefix-link-attr] is used to flood BIER-Lite-specific information.

Here, in order to implement the BIER forwarding in non-MPLS network and simplify the BIER forwarding mentioned in [I-D.ietf-bier-mpls-encapsulation], a new BIER-Lite sub-TLV of the Extended Prefix Opaque LSA is defined to advertise BIER-Lite-specific information, which is illustrated as follow in Figure 1. Multiple BIER-Lite Sub-TLVs may be included in the Extended Prefix TLV.

```
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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|              Type             |             Length            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| Sub-domain-ID |     MT-ID     |              BFR-id           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
| M |            Resvered                       | BSL Identifier|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 1: BIER-Lite Sub-TLV in OSPF extension

Type: indicates BIER-Lite sub-TLV

Length: 8 octet.

Sub-domain-ID: unique value identifying the BIER sub-domain within the BIER domain, as described in section 1 of [I-D.ietf-bier-architecture].

MT-ID: Multi-Topology ID (as defined in [RFC4915]) that identifies the topology that is associated with the BIER sub-domain.

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

M: indicating whether is compatible with BIER MPLS Encapsulation sub-sub-TLV. When M is set to 1, it means if there has BIER MPLS Encapsulation sub-sub-TLV, validating and using the BSL information and label information in BIER MPLS Encapsulation sub-sub-TLV. When M is set to 0, it means validating and using the BSL information in the
BSL Identifier even if there has BIER MPLS Encapsulation sub-sub-TLV and ignoring all the information in BIER MPLS Encapsulation sub-sub-TLV.

BSL Identifier: indicating the BSL the sending BFR supporting.

The sending BFR may support one or several BSLs, as following:

00000001: represents BSL 64 bits;
00000010: represents BSL 128 bits;
00000100: represents BSL 256 bits;
00001000: represents BSL 512 bits;
00010000: represents BSL 1024 bits;
00100000: represents BSL 2048 bits;
01000000: represents BSL 4096 bits;

Each bit represents one BSL. When there are two or more bits set, that means the sending BFR supports more than one BSL. For example, if the BSL Identifier is 00010101, it means the sending BFR supports 1024 bits, 256 bits and 64 bits.

Each BFR sub-domain MUST be associated with a single OSPF topology that is identified by the MT-ID. If the association between BIER sub-domain and OSPF topology advertised in the BIER-Lite sub-TLV is different from the association on the receiving router, BIER-Lite sub-TLV SHOULD be ignored.

On the other hand, the BIER-Lite sub-TLV is a complementation and an extension of current BIER sub-TLV, which encapsulates the BSL information together with the BIER sub-TLV. Additionally, adding an M identifier in the BIER Info sub-TLV to be compatible with current BIER MPLS encapsulation sub-sub-TLV. So, BIER-Lite sub-TLV can also multiplex and extend BIER sub-TLV instead of defining a new TLV.
4. Flooding scope of BIER-Lite Information

Specifically, in [I-D.ietf-bier-isis-extensions], there defines a new BIER Info sub-TLV which is illustrated in Figure 2. Here, extending a VXLAN-specific sub-sub-TLV to current BIER Info sub-TLV for IS-IS, a reference format is illustrated in Figure 3.
5. Considerations on BIER-Lite

TBD.
6. Security Considerations

It will be considered in a future revision.
7. IANA Considerations

This document can request a new allocation from OSPF Extended Prefix sub-TLV registry for BIER-Lite sub-TLV. Or it can multiplex the current BIER sub-TLV and extend M information and BSL Identifier information to current BIER sub-TLV.
8. References

8.1. Normative References


8.2. Informative References


[I-D.ietf-ospf-prefix-link-attr] Psenak, P., Gredler, H., rjs@rob.sh, r., Henderickx, W., Tantsura, J., and A. Lindem, "OSPFv2 Prefix/Link Attribute Advertisement", draft-ietf-ospf-prefix-link-attr-13 (work in progress), August 2015.
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