

OSPF  
Internet-Draft  
Intended status: Standards Track  
Expires: April 21, 2016

P. Psenak, Ed.  
N. Kumar  
IJ. Wijnands  
Cisco  
A. Dolganow  
Alcatel-Lucent  
T. Przygienda  
Ericsson  
J. Zhang  
Juniper Networks, Inc.  
S. Aldrin  
Google, Inc.  
October 19, 2015

**OSPF Extensions For BIER**  
**draft-ietf-bier-ospf-bier-extensions-01.txt**

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

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any

time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on April 21, 2016.

## Copyright Notice

Copyright (c) 2015 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

## Table of Contents

<a href="#">1.</a>	<a href="#">Introduction</a>	<a href="#">2</a>
<a href="#">2.</a>	<a href="#">Flooding of the BIER Information in OSPF</a>	<a href="#">3</a>
<a href="#">2.1.</a>	<a href="#">The BIER Sub-TLV</a>	<a href="#">3</a>
<a href="#">2.2.</a>	<a href="#">The BIER MPLS Encapsulation Sub-TLV</a>	<a href="#">4</a>
<a href="#">2.3.</a>	<a href="#">Flooding scope of BIER Information</a>	<a href="#">5</a>
<a href="#">3.</a>	<a href="#">Security Considerations</a>	<a href="#">6</a>
<a href="#">4.</a>	<a href="#">IANA Considerations</a>	<a href="#">6</a>
<a href="#">5.</a>	<a href="#">Acknowledgments</a>	<a href="#">6</a>
<a href="#">6.</a>	<a href="#">Normative References</a>	<a href="#">6</a>
	<a href="#">Authors' Addresses</a>	<a href="#">7</a>

## [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                               |
|                               |                               | |
|                               |                               |
| Sub-domain-ID | MT-ID | BFR-id |
|                               |                               |
|                               Sub-TLVs (variable)              |
+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+---+
|                               |

```

Type: TBD

Length: variable







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 [\[I-D.wijnands-mpls-bier-encapsulation\]](#).

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 Sub-domain-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.

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

Label ranges within all BIER MPLS Encapsulation Sub-TLV inside the same BIER Sub-TLV SHOULD NOT overlap. If the overlap is detected, overlapping BIER MPLS Encapsulation Sub-TLV SHOULD be ignored.

### **[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. To allow BIER deployment in a multi-area environment, 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

The authors would like to thank Rajiv Asati, Christian Martin, Greg Shepherd and Eric Rosen for their contribution.

### 6. Normative 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.
- [I-D.wijnands-bier-architecture]  
Wijnands, I., Rosen, E., Dolganow, A., and T. Przygienda, "Multicast using Bit Index Explicit Replication", [draft-wijnands-bier-architecture-00](#) (work in progress), September 2014.
- [I-D.wijnands-mpls-bier-encapsulation]  
Wijnands, I., Rosen, E., Dolganow, A., and J. Tantsura, "Encapsulation for Bit Index Explicit Replication in MPLS Networks", [draft-wijnands-mpls-bier-encapsulation-00](#) (work in progress), September 2014.



[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), DOI 10.17487/RFC2119, March 1997, <<http://www.rfc-editor.org/info/rfc2119>>.

[RFC4915] Psenak, P., Mirtorabi, S., Roy, A., Nguyen, L., and P. Pillay-Esnault, "Multi-Topology (MT) Routing in OSPF", [RFC 4915](#), DOI 10.17487/RFC4915, June 2007, <<http://www.rfc-editor.org/info/rfc4915>>.

#### Authors' Addresses

Peter Psenak (editor)  
Cisco  
Apollo Business Center  
Mlynske nivy 43  
Bratislava 821 09  
Slovakia

Email: [ppsenak@cisco.com](mailto:ppsenak@cisco.com)

Nagendra Kumar  
Cisco  
7200 Kit Creek Road  
Research Triangle Park, NC 27709  
US

Email: [naikumar@cisco.com](mailto:naikumar@cisco.com)

IJsbrand Wijnands  
Cisco  
De Kleetlaan 6a  
Diegem 1831  
Belgium

Email: [ice@cisco.com](mailto:ice@cisco.com)

Andrew Dolganow  
Alcatel-Lucent  
600 March Rd.  
Ottawa, Ontario K2K 2E6  
Canada

Email: [andrew.dolganow@alcatel-lucent.com](mailto:andrew.dolganow@alcatel-lucent.com)



Tony Przygienda  
Ericsson  
300 Holger Way  
San Jose, CA 95134  
USA

Email: antoni.przygienda@ericsson.com

Jeffrey Zhang  
Juniper Networks, Inc.  
10 Technology Park Drive  
Westford, MA 01886  
USA

Email: zzhang@juniper.net

Sam Aldrin  
Google, Inc.  
1600 Amphitheatre Parkway  
Mountain View, CA  
USA

Email: aldrin.ietf@gmail.com

