

BIER Workgroup
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PIM Signaling Through BIER Core
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Abstract

Bit Index Explicit Replication (BIER) is an architecture that provides multicast forwarding through a "BIER domain" without requiring intermediate routers to maintain multicast related per-flow state. Neither does BIER require an 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. Such 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 the according set of bits switched on in BIER packet header.

This document describes the procedure needed for PIM Joins and Prunes to be signaled through a BIER core. Allowing PIM routers to run traditional PIM multicast services through a BIER core.

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PIM Stitching Through BIER Core

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[1](#). Introduction

Greenfield deployment of BIER might not be possible for some large network. These networks deploy traditional PIM multicast services in GRT or in mvpn such as multicast vpns [rfc 6037](#). Typically, each portion of these large networks have their own mandates and requirements.

It might be desirable to deploy BIER technology in some part of these networks to replace PIM signaling. In such cases downstream PIM states need to be signaled over BIER core to the source.

This draft explains the procedure to signal PIM joins and prunes through a BIER core, as such enable provisioning of traditional pim services through a BIER core.

It should be noted that these type of BIER deployments are usually with in a single IGP area. As such the procedures in this draft is concentrating on a single BIER IGP area.

[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 [RFC 2119](#) [[RFC2119](#)].

[2.1](#). Definitions

Some of the terminology specified in [I-D. [rfc8279](#)] is replicated here and extended by necessary definitions:

BIER:

Bit Index Explicit Replication (The overall architecture of forwarding multicast using a Bit Position).

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BFR:

Bit Forwarding Router (A router that participates in Bit Index Multipoint Forwarding). A BFR is identified by a unique BFR-prefix in a BIER domain.

BFIR:

Bit Forwarding Ingress Router (The ingress border router that inserts the BM into the packet). Each BFIR must have a valid BFR-id assigned. In this draft BIER will be used for forwarding and tunneling of control plain packet (i.e. PIM) and forwarding dataplane packets. BFIR is term used for dataplane packet forwarding.

BFER:

Bit Forwarding Egress Router. A router that participates in Bit Index Forwarding as leaf. Each BFER must be a BFR. Each BFER must have a valid BFR-id assigned. In this draft BIER will be used for forwarding and tunneling of control plain packet (i.e. PIM) and forwarding dataplain packets. BFIR is term used for dataplain packet forwarding.

BBR:

BIER Boundary router. The router between the PIM domain and BIER domain. Maintains PIM adjacency for all routers attached to it on the PIM domain and terminates the PIM adjacency

toward the BIER domain.

IBBR:

Ingress BIER Boundary Router. The ingress router from signaling point of view. It maintains PIM adjacency toward the PIM domain and determines if PIM joins and prunes arriving from PIM domain need to be signaled across the BIER domain. If so it terminates the PIM adjacency toward the BIER domain and signals the PIM joins/prunes through the BIER core.

EBBR:

Egress BIER Boundary Router. The egress router in BIER domain from signaling point of view. It terminates the BIER packet and forwards the signaled joins and prunes into PIM Domain.

BFT:

Bit Forwarding Tree used to reach all BFERs in a domain.

BIFT:

Bit Index Forwarding Table.

BIER sub-domain:

A further distinction within a BIER domain identified by its unique sub-domain identifier. A BIER sub-domain can support multiple BitString Lengths.

BFR-id:

An optional, unique identifier for a BFR within a BIER sub-domain.

[3. PIM Signaling Through BIER domain](#)

[3.1.](#) Ingress BBR procedure

IBBR will create pim adjacency to all pim routers attach to it toward the pim domain.

When a PIM join or prune for certain (S,G) arrives, the IBBR first determines weather the join or prune is meant for a source that is reachable through the bier domain. As an example, this source is located on a disjoint PIM domain that is reachable through the BIER domain. If so the ibbr will try to resolve the source via an ebbbr closest to the source.

The procedure to find the ebbbr (BFIR from datapath point of view) can be via many mechanisms explained in more detail in upcoming sections.

After discovering the EBBR and its BFR-ID (flooded via IGP BIER extension), the IBBR will construct the BIER header via the BIFT. The signaling packet, in this case the PIM join/prune packet, is encapsulated in the BIER header and transported through BIER domain to EBBR.

On forwarding plane the IBBR will track all the PIM interfaces on the attach pim domain which are interested in a certain (S,G). It creates multicast states for arriving (S,G)s from pim domain, with incoming interface (RPF) as BIER "tunnel" interface and outgoing interface as the pim domain interface(s) on which PIM Join(s) were received on. If there is another PIM Join for the same multicast (S,G) entry on another interface arriving from pim domain, that interface gets added in the outgoing interface list as well.

[3.2.](#) Procedure to determine EBBR on IBBR

As it was explained in previous section, IBBR needs to determine the EBBR closest to the source. This is needed to encode the BIER header BitString field for forwarding of the signaling packet. There can be many mechanism to determine the EBBR. This section explain some routing methods that can be used to achieve this. It should be noted that in most cases the BIER domain is a single IGP area. The PIM

domains are part of the same IGP area as BIER domain(single area) or are stitched to the BIER domain via an ABR or ASBR. in either case the BBRs are all located in the same area as bier domain.

[3.2.1.](#) SPF

On IBBR SPF procedures can be used to find the EBBR closest to the source.

Assuming the BIER domain is consist of all BIER forwarding routers, SPF calculation can be used to find the source. A post process can find the EBBR (BFR closes to the source) by walking the SPT starting from the source and finding the first Vertex that is a BFR.

[3.2.1.2.](#) Route summarization

An IGP area could be a BIER sub-domain. In this case the EBBRs and IBBRs could be ABRs (or non-ABRs). If the route to the source is a summarized/leaked route by an ABR, the advertising router field for the summarized route identifies the EBBR.

[3.2.1.3.](#) Constrain shortest path first

In some cases the BIER domain contains non bier forwarding routers. It might be desirable to find a SPT with only BFR routers. In this case CSPF can be used to find the path trough the BIER domain via BFR only routers. In this case the constrain is to find the path to the source using BFRs.

[3.2.2.](#) Indirect next-hop

On IBBR the source can be resolved via EBBR. Once EBBR is identified, its BIER prefix-id and bfr-id is determined. This information can be used to build the BIER header with EBBR bit-index. The next-hop of the source on IBBR can be set to EBBR via multiple methods, including Static Route and BGP.

[3.2.2.1.](#) Static Route

On IBBR there can be a static route configured for the source, with

At this point the end-to-end multicast traffic flow setup is complete.

[4. Datapath Forwarding](#)

[4.1. BFIR tracking of \(S,G\)](#)

For a specific Source and Group, BFIR (EBBR) should track all the interested BFERs via arriving PIM signaling from BIER Domain. BFIR should build its multicast tree with incoming interface (IIF) as PIM interface (in PIM domain) and out going interfaces OIFs set as the <SD, BFR-ID> of the interested BFERs (in BIER Domain).

[4.2. Datapath traffic flow](#)

When the multicast data traffic arrives on the BFIR (EBBR) the router will find all the interested BFERs for that specific (S,G). The router then constructs the BIERHeader.BitString with all the BFER interested in the group and will forward the packet to the BIER domain. The BFER(s) will accept the packets and remove the BIER header and forward the multicast packet as per pre-build multicast state for (G) and its outgoing interfaces.

[5. PIM-ASM behavior](#)

In case of PIM ASM the procedure for LEAFs joining RP is same as above. The unicast (source registration) traffic from source to RP will be flooded throughout the BIER domain as regular unicast traffic without BIER involvement.

[6. Applicability to MVPN](#)

With just minor changes, the above procedures apply to MVPN as well, with BFIR/BFER/EBBR/IBBR being VPN PEs.

All the PIM related procedures, and the determination of EBBR happens in the context of a VRF, following procedures for PIM-MVPN.

When a PIM packet arrives from PIM domain attached to the vrf (IBBR), and it is determine that the source is reachable via the vrf through the BIER domain, a PIM signaling message is sent via BIER to the EBBR. In this case usually the PE terminating the PIM-MVPN is the

EBBR. A label is imposed before the BIER header is imposed, and the "proto" field in the BIER header is set to 1 (for "MPLS packet with downstream-assigned label at top of stack"). The label is advertised by the EBBR/BFIR to associate incoming packets to its correct VRF. In many scenarios a label is already bound to the VRF loopback address on the EBBR/BFIR and it can be used.

When a multicast data packet is sent via BIER by an EBBR/BFIR, a label is imposed before the BIER packet is imposed, and the "proto"

field in the BIER header is set to 1 (for "MPLS packet with downstream-assigned label at top of stack"). The label is assigned to the VPN consistently on all VRFs [[draft-zzhang-bess-mvpn-evpn-aggregation-label](#)].

If the more complicated label allocation scheme is needed for the data packets as specified in [[draft-zzhang-bess-mvpn-evpn-aggregation-label](#)], then additional PMSI signaling is needed as specified in [[RFC6513](#)].

To support per-area subdomain in this case, the ABRs would need to become VPN PEs and maintain per-VPN state so it is unlikely practical.

[7](#). IANA Considerations

This document contains no actions for IANA.

[8](#). Security Considerations

TBD

[9](#). References

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[10](#). Acknowledgments <Add any acknowledgements>

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