Workgroup: Network Working Group
Internet-Draft:
draft-ietf-bier-mldp-signaling-over-bier-02
Published: 7 March 2023
Intended Status: Informational
Expires: 8 September 2023
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M-LDP Signaling Through BIER Core

Abstract

Consider an end-to-end Multipoint LDP (mLDP) network, where it is desirable to deploy BIER in a segment of this network. It might be desirable to deploy BIER with minimal disruption to the mLDP network or a redesign of the network.

This document describes a procedure needed for mLDP tunnels to be signaled over and stitched through a BIER core, allowing LDP routers to run traditional mLDP services through a BIER core.

Status of This Memo

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1. Introduction

Some operators that are using mLDP P2MP LSPs for their multicast transport would like to deploy BIER technology in some segments of their network. This draft explains a method to signal mLDP services through a BIER domain, with minimal disruption and operational impact to the mLDP domain.

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 [RFC2119].

2.1. Definitions

Some of the terminology specified in [RFC8279]is replicated here and extended by necessary definitions:

BIER:

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

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 Bit Map into the packet. Each BFIR must have a valid BFR-id assigned. BFIR is a term used for data plane packet forwarding.

BFER:

Bit-Forwarding Egress Router, A router that participates in Bit Index Forwarding as leaf. Each BFER must have a valid BFR-id assigned. BFER is a term used for data plane packet forwarding.

BBR:

BIER Boundary router. The router between the LDP domain and BIER domain.

IBBR:

Ingress BIER Boundary Router. The ingress router from a signaling point of view. It maintains mLDP adjacency toward the LDP domain and determines if the Multipoint LDP FEC needs to be signaled across the BIER domain via Targeted LDP.

EBBR:

Egress BIER Boundary Router. The egress router in a BIER domain from signaling point of view. It terminates the targeted LDP signaling through the BIER domain. It also keeps track of all IBBRs that are part of this P2MP tree

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, all BFERs and BFIRs need to be assigned a BFR-id.

ILM:

MPLS Incoming Label Map.

3. mLDP Signaling Through BIER domain

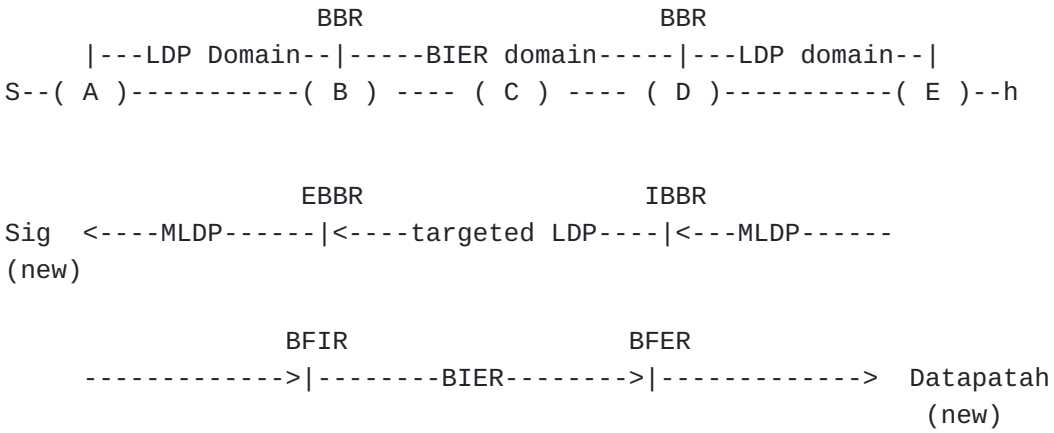

Figure 1: BIER boundary router

As per figure 1, point-to-multipoint and multipoint-to-multipoint LSPs established via mLDP [RFC6388] can be signaled through a bier domain via Targeted LDP sessions. This procedure is explained in [RFC7060] (Using LDP Multipoint Extension on Targeted LDP Sessions).

This document provides details and defines some needed procedures.

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3.1. Ingress BBR procedure

In Figure 1, the Ingress BBR (IBBR) is connected to the mLDP domain on downstream and a BIER domain on the upstream. To connect the LDP domains via BIER domain, IBBR needs to establish a targeted LDP session with EBBR closest to the root of the P2MP or MP2MP LSP. To do so IBBR will follow procedures in [RFC7060] in particular section 6 "Targeted mLDP with Multicast Tunneling".

The Target LDP session can be established manually via configuration or via automated mechanism.

3.1.1. Automatic tLDP session Creation

tLDP sessions can be signaled automatically from every IBBR to the appropriate EBBR. When mLDP FEC arrives at the IBBR from LDP domain, IBBR can automatically start a tLDP session to the EBBR closest to the root node. Both IBBR and EBBR should be in auto-discovery mode and react to the arriving tLDP signaling packets (i.e. targeted hellos, keep- alives etc...) to establish the session automatically.

The root node address in the mLDP FEC can be used to find the EBBR. To identify the EBBR, the same procedures as [RFC7060] section 2.1 can be used or the procedures as explained in the [draft-ietf-bier-pim-signaling] appendix A.

3.1.2. ECMP Method on IBBR

If the IBBR finds multiple equal cost EBBRs on the path to the root, it can use a vendor specific algorithm to choose between the EBBRs. These algorithms are beyond the scope of this draft. As an example the IBBR can use the lowest EBBR IP address to establish its mLDP signaling to.

3.2. Egress BBR procedure

The Egress BBR (EBBR) is connected to the upstream mLDP domain. The EBBR should accept the tLDP session generated form the IBBR. It should assign a unique "upstream assigned label" for each arriving FEC generated by the IBBRs.

The EBBR should follow the [RFC7060] procedures with the following modifications:

- The label assigned by the EBBR cannot be Implicit Null. This is to ensure that the identity of each p2mp and/or mp2mp tunnel in the BIER domain is uniquely distinguished.

- The label can be assigned from a domain-wide Common Block (DCB) [draft-ietf-bess-mvpn-evpn-aggregation-label]

- The Interface ID TLV, as per [RFC6389] should includes a new BIER sub-domain sub- tlv (type TBD)

The EBBR will also generate a new label and FEC toward the root in the LDP domain. The EBBR Should stitch this generated label with the "upstream assigned label" to complete the P2MP or MP2MP LSP.

With the same token the EBBR should track all the arriving FECs and the IBBRs that are generating these FECs. The EBBR will use this information to build the bier header for each set of common FEC arriving from the IBBRs.

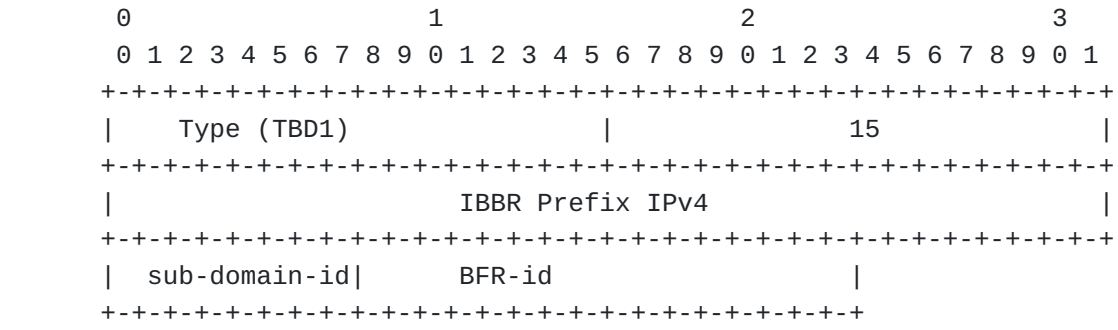
3.2.1. IBBR procedure for arriving upstream assigned label

Upon receiving the "upstream assigned label", the IBBR should create its own stitching instruction between the "upstream assigned label" and the downstream signaled label.

3.2.2. BIER Interface ID TLVs

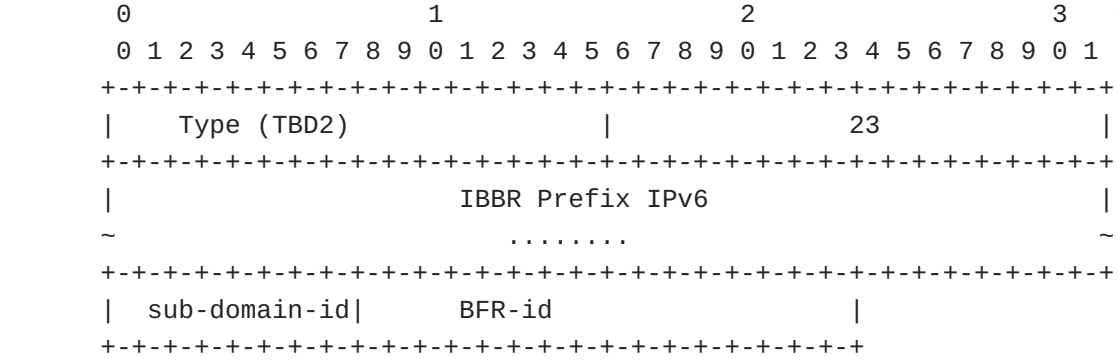
As per [RFC6389] when LDP is used for upstream label assignment,the Interface ID TLV is used for signaling the Tunnel Identifier and it carries sub-TLVs. This document defines two new Interface ID sub-TLVs for BIER.

Below is the Interface ID BIER sub-TLV for IPv4 BIER prefix:



artwork

Below is the Interface ID BIER sub-TLV for IPv6 BIER prefix:



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4. Datapath Forwarding

4.1. Datapath traffic flow

On the BFIR when the MPLS label for P2MP/MP2MP LSP arrives from upstream, a lookup in ILM table is done and the label is swapped with tLDP upstream assigned label. The BFIR will note all the BFERs that are interested in specific P2MP/MP2MP LSP (as per section 3.2). BFIR will put the corresponding BIER header with bit index set for

all the IBBRs interested in this stream. BFIR will set the BIERHeader.Proto = MPLS and will forward the BIER packet into BIER domain.

In the BIER domain, normal BIER forwarding procedure will be done, as per [RFC8279]

The BFERs will receive the BIER packet and will look at the protocol of BIER header, indicating MPLS protocol. The BFER will remove the BIER header and will do a lookup in the ILM table for the upstream assigned label and perform its corresponding action.

It should be noted that these procedures are also valid if BFIR is the ILER and/or BFER is the ELER as per [RFC7060]

5. Recursive FEC

The procedures above also valid for mLDP recursive FEC. The root used to determine the EBBR is the outer root of the FEC. The entire recursive FEC needs to be preserved when it is forwarded via tLDP and the label request.

6. IANA Consideration

IANA maintains a registry of Interface ID Types for use in GMPLS in the registry "Generalized Multi-Protocol Label Switching (GMPLS) Signaling Parameters" and sub-registry "Interface_ID Types"

This document defines and requests a new Interface_ID Type for BIER.

*BIER Interface TLV (Value TBD)

7. Security Considerations

NA

8. Acknowledgments

Acknowledgments Authors would like to acknowledge Jingrong Xie for his comments and help on this draft.

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