

BIER
Internet-Draft
Intended status: Standards Track
Expires: June 1, 2019

Z. Zhang
Juniper Networks
November 28, 2018

BIER Penultimate Hop Popping
draft-ietf-bier-php-01

Abstract

Bit Index Explicit Replication (BIER) can be used as provider tunnel for MVPN/GTM [[RFC6514](#)] [[RFC7716](#)] or EVPN BUM [[RFC7432](#)]. It is possible that not all routers in the provider network support BIER and there are various methods to handle BIER incapable transit routers. However the MVPN/EVPN PEs are assumed to be BIER capable - they are BFIRs/BFERs. This document specifies a method to allow BIER incapable routers to act as MVPN/EVPN PEs with BIER as the transport, by having the upstream BFR (connected directly or indirectly via a tunnel) of a PE remove the BIER header and send the payload to the PE.

Requirements Language

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](#).

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This Internet-Draft will expire on June 1, 2019.

Internet-Draft

bier-php

November 2018

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Table of Contents

1.	Terminologies	2
2.	Introduction	2
3.	Specifications	3
4.	Security Considerations	4
5.	IANA Considerations	4
6.	Acknowledgements	5
7.	References	5
	7.1. Normative References	5
	7.2. Informative References	6
	Author's Address	7

[1.](#) Terminologies

Familiarity with BIER/MVPN/EVPN protocols and procedures is assumed. Some terminologies are listed below for convenience.

[To be added].

[2.](#) Introduction

The BIER architecture includes three layers: the "routing underlay", the "BIER layer", and the "multicast flow overlay". The multicast flow overlay is responsible for the BFERs to signal to BFIRs that they are interested in receiving certain multicast flows so that BFIRs can encode the correct bitstring for BIER forwarding by the BIER layer.

MVPN and EVPN are two similar overlays where BGP Auto-Discovery routes for MVPN/EVPN are exchanged among all PEs to signal which PEs need to receive multicast traffic for all or certain flows.

Typically the same provider tunnel type is used for traffic to reach all receiving PEs.

Consider an MVPN/EVPN deployment where enough P/PE routers are BIER capable for BIER to become the preferred the choice of provider tunnel. However, some PEs cannot be upgraded to support BIER forwarding. While there are ways to allow an ingress PE to send traffic to some PEs with one type of tunnel and send traffic to some other PEs with a different type of tunnel, the procedure becomes complicated and forwarding is not optimized.

One way to solve this problem is to use Penultimate Hop Popping (PHP) so that the upstream BFR can pop the BIER header and send the payload "natively" (note that the upstream BFR can be connected directly or indirectly via a tunnel to the PE). This is similar to MPLS PHP though it is the BIER header that is popped. In case of MPLS encapsulation, even the signaling is similar - a BIER incapable router signals as if it supported BIER, but to request PHP at the penultimate hop, it signals an Implicit Null label instead of a regular BIER label as the Label Range Base in its BIER MPLS Encapsulation sub-TLV.

The transition of an existing MVPN/EVPN deployment with traditional provider tunnels to using BIER with some PEs not capable of receiving BIER packets can be incremental. All PEs are first upgraded to support BIER at least in the control plane, with those not capable of BIER forwarding requesting PHP. Then BIER capable ingress PEs independently and incrementally switch to BIER transport.

While the above text uses MVPN/EVPN as example, BIER PHP is applicable to any scenario where the multicast flow overlay edge router does not support BIER.

This works well if a BIER incapable PE only needs to receive multicast traffic. If it needs to send multicast traffic as well, then it must Ingress Replicate to a BIER capable helper PE, who will

in turn relay the packet to other PEs. The helper PE is either a Virtual Hub as specified in [\[RFC7024\]](#) for MVPN and [\[I-D.keyupate-bess-evpn-virtual-hub\]](#) for EVPN, or an AR-Replicator as specified in [\[I-D.ietf-bess-evpn-optimized-ir\]](#) for EVPN.

3. Specifications

The procedures in this section apply only if, by means outside the scope of this document, it is known that the payload after BIER header is MPLS packet with downstream-assigned label at top of stack (i.e., the Proto field in the BIER header is 1). For example, a

label from a Domain-wide Common Block (DCB) is used as specified in [\[I-D.ietf-bess-mvpn-evpn-aggregation-label\]](#).

A BIER incapable router, if acting as a multicast flow overlay router, MUST signal its BIER information as specified in [\[RFC8401\]](#) or [\[I-D.ietf-bier-ospf-bier-extensions\]](#) or [\[I-D.ietf-bier-idr-extensions\]](#), with a PHP sub-sub-TLV included in the BIER sub-TLV attached to the BIER incapable router's BIER prefix to request BIER PHP from other BFRs. The sub-sub-TLV's type is TBD, and the length is 0.

With MPLS encapsulation, the BIER incapable multicast flow overlay router MAY omit the BIER MPLS Encapsulation sub-sub-TLV, or MUST set the Label Range Base in BIER MPLS Encapsulation sub-sub-TLV to Implicit Null Label [\[RFC3032\]](#).

With MPLS encapsulation, if a BFER does not support certain BSL, it MAY still advertise a corresponding BIER MPLS Encapsulation sub-TLV but set the Label Range Base to Implicit Null Label.

If a BFR follows [section 6.9 of \[RFC8279\]](#) to handle BIER incapable routers, it must treat a router as BIER incapable if the Label Range Base advertised by the router is Implicit Null, or if the router advertises a PHP sub-sub-TLV, so that the router is not used as a transit BFR.

If the downstream neighbor for a BIER prefix is the one advertising the prefix with a PHP sub-sub-TLV or with an Implicit Null Label as the Label Range Base in its BIER MPLS Encapsulation sub-sub-TLV, then

when the corresponding BIRT or BIFT entry is created/updated, the forwarding behavior MUST be that the BIER header is removed and the payload be sent to the downstream router without the BIER header, either directly or over a tunnel.

[4.](#) Security Considerations

This specification does not introduce additional security concerns beyond those already discussed in BIER architecture and OSPF/ISIS/BGP extensions for BIER signaling.

[5.](#) IANA Considerations

This document requests a new sub-sub-TLV type value from the "Sub-sub-TLVs for BIER Info Sub-TLV" registry in the "IS-IS TLV Codepoints" registry:

Zhang

Expires June 1, 2019

[Page 4]

Internet-Draft

bier-php

November 2018

Type	Name
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TBD	BIER PHP Request

This document also requests a new sub-TLV type value from the OSPFv2 Extended Prefix TLV Sub-TLV registry:

Type	Name
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TBD	BIER PHP Request

[6.](#) Acknowledgements

The author wants to thank Eric Rosen and Antonie Przygienda for their review, comments and suggestions. The author also wants to thank Senthil Dhanaraj for his suggestion of requesting PHP if a BFER does not support certain BSL.

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Zhang

Expires June 1, 2019

[Page 6]

Internet-Draft

bier-php

November 2018

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Author's Address

Zhaohui Zhang

Juniper Networks

EMail: zzhang@juniper.net