Workgroup: Network Working Group
Internet-Draft:
draft-chen-bier-anycast-label-00
Published: 5 November 2023
Intended Status: Standards Track
Expires: 8 May 2024
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BIER Anycast MPLS Label

Abstract

This document provides a method to reduce packet loss when failures occur at BIER transit or egress nodes or link.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

When failures occur at transit or egress BIER node, there is no fast recovery or protecting mechanism currently. The recovery duration depends on how fast the unicast algorithm can re-calculate the new path. The new available path can only be generated in this way called 'hard convergence'. In this document, a fast failover method is designed for BIER to generate an alternative path for flow in advance by allocating and transmitting additional BIER MPLS label.

In [RFC8279], BIER MPLS label was assigned locally to identify different set of [Sub-domain, SI, BSL] and therefore can identify different instances of BIER Forwarding Table. In this document, a BFR node will be assigned two MPLS Labels called 'Anycast' and 'Bypass' MPLS Label. Anycast MPLS Label will be used to represent the site, while bypass MPLS label will only be used within each site to ensure the forwarding function.

The BIER Forwarding Table will also be modified to record two different out interfaces for single target BFR-id.

2. Terminology

The terminology used in this document is the terminology defined in[RFC8279], [RFC8296] and [RFC8556].

For convenience of description, the abbreviations used in this document is listed below.

BIER: Bit Index Explicit Replication

BGP: Border Gateway Protocol

IGP: Interior gateway protocol

BFR: Bit-Forwarding Router

BFR-ID: Bit-Forwarding Router ID

BFR-Prefix: Bit-Forwarding Router Prefix

BFR-NBR: Bit-Forwarding Router Neighbor

BIRT: Bit index routing table

BIFT: Bit index forwarding table

F-BM: Forwarding Bit Mask

MPLS: Multiprotocol Label Switching

3. Egress Protection

3.1. Anycast and Bypass MPLS Label

As shown in the following figure, one customer device is multihomed to two BFERs in order to perform egress protection. Two BFERs are deployed in the same egress site. Different BFR-ids and BFR-prefixes are configured. However, they are assigned with same Anycast MPLS label and different Bypass MPLS labels. The same Anycast label can be used to specify the egress site. The Bypass MPLS label works as the traditional MPLS label to ensure the normal behavior of BIER forwarding function within the site. They are advertised by BIER-Info Sub-Tlv in BIER prefix. BIER prefix carrying Anycast MPLS label is called Anycast BIER Prefix. After receiving BIER prefix, BIER MPLS Label will be contained in BIER Forwarding Table to instruct forwarding data packet.

Figure 1: BIER Egress Site Deployment

3.2. Advertisement of MPLS Label

[RFC8401] defines BIER Info Sub-TLV to advertise BIER parameters such as BFR-id, subdomain-id. The key field of the Sub-TLV is BIER prefix. Within the Sub-TLV, sub-sub-TLV is contained and it carries MAX-SI, BSL and MPLS Label. The sub-sub-TLV is modified in this document so that both MPLS Labels can be advertised.

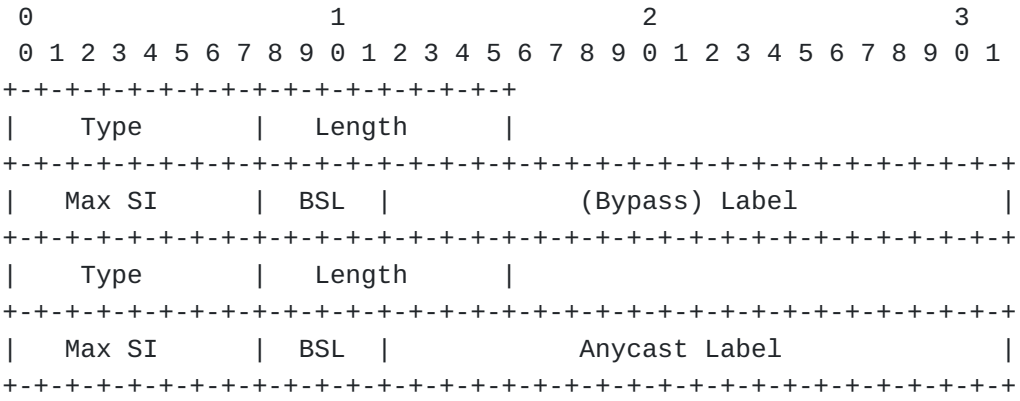

Figure 2: New BIER Sub-sub-TLV

3.3. Establishment of BIER Forwarding Table

After receiving BIER Info Sub-TLV, BFR will parse Bypass MPLS Label and Anycast MPLS Label. The relationship of [BFR-id, Anycast Label, Bypass Label] will be maintained by each BFR. As shown in the figure below, BFR will receive BIER Info Sub-TLVs from BFER-C and BFER-D. The Anycast Label of two BFERs are different with BFR's, but they are same with each other. BFR will combine BFR-id of BFER-C and BFER-D as the one entry in the Bit Index Forwarding Table. Both BFER-C and BFER-D may receive packet.

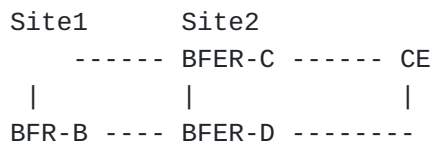

Figure 3: BIER Egress Site Deployment

BFR-B BIFT

F-BM	BFR-NBR	NBR-Label
001	A	Label-1
011	C	AnycastLabel-2
	D	AnycastLabel-2

Figure 4: BFR-B BIFT

When BFR receives BIER data packet, it will locate the BIFT according to the BIFT-id encapsulted in BIER header. If the packet needs to be forwarded to BFR-id 3, it will modify the BIFT-id field as AnycastLabel-2 and then forward it. When BFER-D receives this packet, the packet will be finnaly sent to CE.

BFERs will also advertise their BIER Info Sub-Tlv to each other. When BFER-C receives BFER-D's Sub-sub-TLV, it finds BFER-D has same anycast label and different bypass label, it will encode bypass label into its BIFT as shown below.

BFR-C BIFT

F-BM	BFR-NBR	NBR-Label
001	B	Label-3
100	D	BypassLabel-13

Figure 5: BFR-C BIFT

3.4. Fast Recovery

When link between BFR-B and BFER-D goes down due to certain reason, BFR-B will detect it and forward packet to BFER-C immediately

according to BIFT entry. AnycastLabel-2 will be encapsulated. When BFER-C receives this packet, it will firstly use anycast label to locate corresponding BIFT table. Then it will use BFR-id 3 to look for F-BM and find its neighbor is BFER-D. The bypass label of BFER-D will be encapsulated into data packet header. Then BFER-D will finally receive the packet. No packet will be dropped because the backup out interface has been generated when the anycast and bypass MPLS Labels have been advertised and utilized.

4. Security Considerations

//TODO

5. IANA Considerations

//TODO

6. Acknowledgements

//TODO

7. Normative References

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

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

[RFC8279] Wijnands, IJ., Ed., Rosen, E., Ed., Dolganow, A., Przygienda, T., and S. Aldrin, "Multicast Using Bit Index Explicit Replication (BIER)", RFC 8279, DOI 10.17487/RFC8279, November 2017, <https://www.rfc-editor.org/info/rfc8279>.

[RFC8296] Wijnands, IJ., Ed., Rosen, E., Ed., Dolganow, A., Tantsura, J., Aldrin, S., and I. Meilik, "Encapsulation for Bit Index Explicit Replication (BIER) in MPLS and Non-MPLS Networks", RFC 8296, DOI 10.17487/RFC8296, January 2018, <https://www.rfc-editor.org/info/rfc8296>.

[RFC8401] Ginsberg, L., Ed., Przygienda, T., Aldrin, S., and Z. Zhang, "Bit Index Explicit Replication (BIER) Support via

IS-IS", RFC 8401, DOI 10.17487/RFC8401, June 2018, <https://www.rfc-editor.org/info/rfc8401>.

[RFC8556] Rosen, E., Ed., Sivakumar, M., Przygienda, T., Aldrin, S., and A. Dolganow, "Multicast VPN Using Bit Index Explicit Replication (BIER)", RFC 8556, DOI 10.17487/RFC8556, April 2019, <https://www.rfc-editor.org/info/rfc8556>.

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