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Encapsulation and Extension for BIER-TE
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Abstract

This document proposes to extend the BIER packet format and some BIER-TE forwarding rules specified in BIER traffic engineering architecture.

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Table of Contents

1 Introduction

[I-D.eckert-bier-te-arch] specifies BIER-TE: Traffic Engineering for Bit Index Explicit Replication (BIER). It shares part of the architecture with basic BIER as described in [I-D.ietf-bier-architecture], but uses every BitPosition of the BitString of a BIER-TE packet indicates one or more adjacencies instead of a BFER as in BIER.

BIER-TE proposes to share the packet format with BIER. Since it consumes much more BitPositions than BIER, it has scalability issue. For example, the maximum BitString length (BSL) that one BIER-TE packet can carry is 256, which means that one BIER-TE packet cannot pass over 256 numbered adjacencies. This is not a problem in BIER as for BIER all the BitPositions are either BFIRs or BFERs.

To alleviate this issue, one direct way is to allow one packet can travel over more than one Set Indentifier (SI) area. Based on it, this document proposes an encapsulation to solve this issue by extending the BIER packet format specified in [I-D.ietf-bier-mpls-encapsulation] and some BIER-TE forwarding rules in [I-D.eckert-bier-te-arch].

1.1 Terminology

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. BIER-TE Extension

2.1. Set Identifier

As described in [I-D.ietf-bier-architecture], Set Identifier (SI) is used to indicate the set of BFERs that one BIER packet can reach. In this document, SI is the segment area index. The number of adjacencies assigned BitPosition inside one segment area is not larger than the value of BSL.

2.2. Packet Travel Rule

As described in [I-D.eckert-bier-te-arch], packets that need to be sent to BFER in different SI require different BIER packets. If a packet travel from one BFIR to the BFERs with different SIs, the path for that packet can only be scheduled for those adjacencies belonging to the same SI carried by the packet, or some adjacencies may be assigned with multiple BitPosition as described in [I-D.xiong-bier-

te-forwarding].

In this document, a packet is allowed to travel to multiple areas with different SIs. To do that, multiple bitstrings belonging to different SIs may be carried in the packet header. Considering the overhead of the BIER-TE header, the total length of all the bitstrings that a packet can carry is the maximum BSL 4096. For example, if the BSL is 256, then a packet can pass over at most 16 segment areas. If the topology of the network is well planned, this design is sufficient for use.

If all of the BitPosition in one of the Bitstrings are set to 0, it means that the packet will not travel to this area any more. The BFR could remove that BitString when forwarding the packet to the adjacencies.

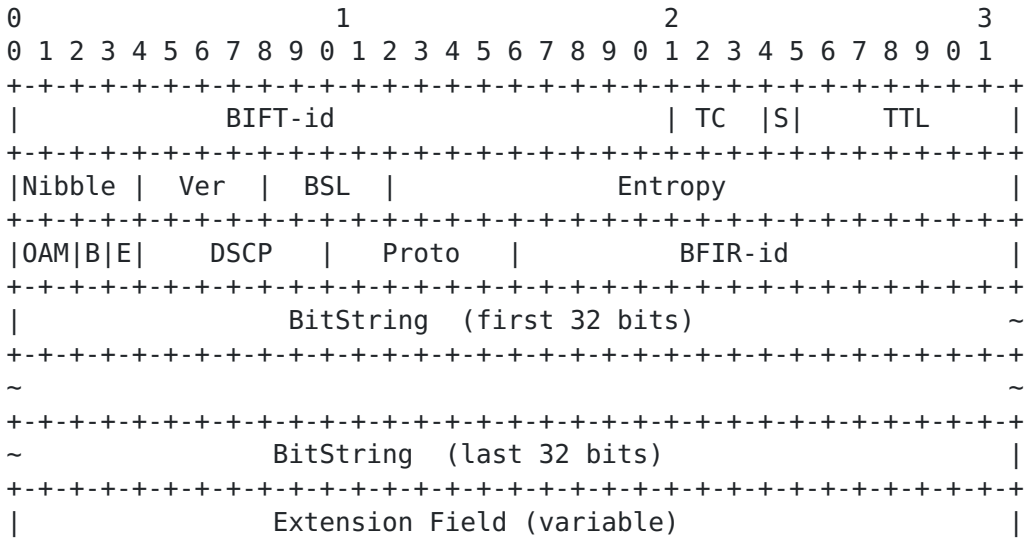
2.3. The Bit Index Forwarding Table (BIFT)

The BIFT is used as described in [I-D.eckert-bier-te-arch], which is indexed by SI:BitPosition.

3. BIER-TE Encapsulation

3.1 Header

The BIER-TE encapsulation is illustrated as following. It reuses the format defined in [I-D.ietf-bier-mpls-encapsulation].

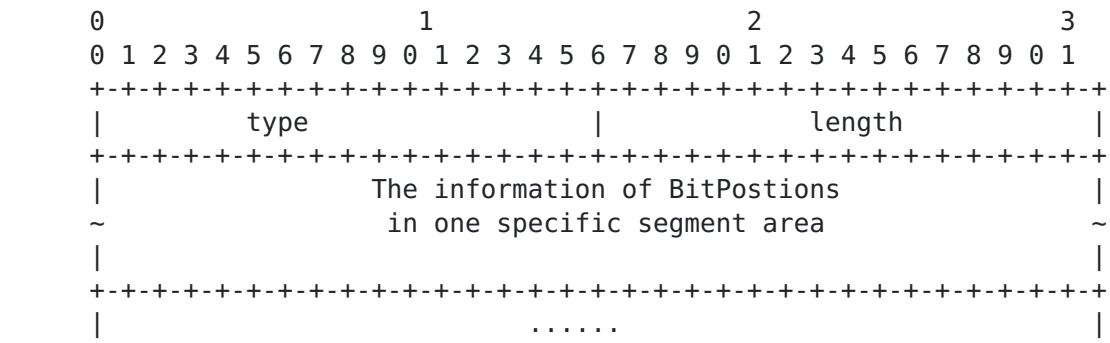


B: This 1-bit field identifies a BIER head(0) or a BIER-TE head(1).

E: This 1-bit field identifies weather there is a extension field following the head.

3.2. Header Extension

The header extension is illustrated as following.



This header extension uses TSV structure. The information of the BitPositions in one specific segment area (SI) is only carried in one TSV.

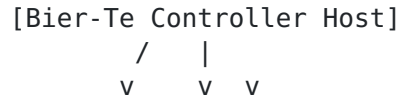
Type: 16 bits It defines the type of the extension. In this document, the type of TBD is specified.

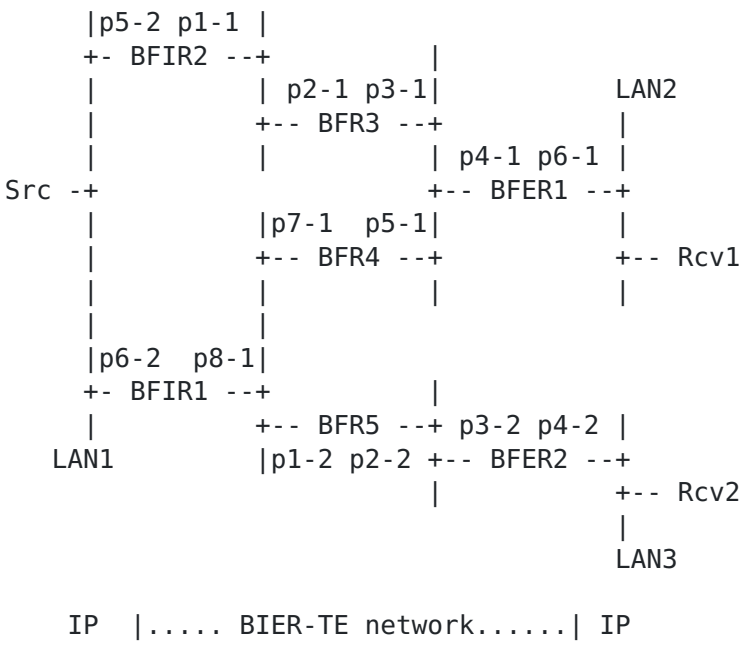
Length: 16 bits It indicates the total octets of the information of BitPostions in one specific segment area.

Information of BitPostions in one specific segment area: This contains the information of the BitString in the specific segment area other than the previous header. In this document, the details of this field doesn't specified. It could be several BitStrings belonging to different segment areas populated together or It could be another BIER header nested in this extension. In the latter case, it will be easier for BFRs to pop the unused header.

4. BIER-TE Forwarding Example

Here, the same example from [I-D.eckert-bier-te-arch] is used as following. Assume the BSL is 8 (The BSL of 8 is used only in this example). pXX-Y indicate the BitPosition-SI assigned by the BIER-TE controller host to adjacencies in the BIER-TE topology.





Traffic needs to flow from BFIR2 towards Rcv1, Rcv2. The controller determines it wants to pass across the following paths:

```
                -> BFER1 ---------------> Rcv1
    BFIR2 -> BFR3
                -> BFR4 -> BFR5 -> BFER2 -> Rcv2
```

The BitString is set up in BFIR2 with 2 sets of BitStrings: S1:(p2, p4, p5, p6); S2:(p1, p3, p4). BFIR2 forwards based on that BitString.

BFR4 has the following BIFT:
p8-1: forward_connected(BFIR1) P1-2: forward_connected(BFR5)

BFR5 sees the sets of BitStrings: S1: (0...0); S2:(p3, p4). It pops the BitString of S1 and forward the packet out to BFER2.

Other forwarding rules are similar to those specified in [I-D.eckert-bier-te-arch].

5 Security Considerations

TBD

6 IANA Considerations

TBD.

7 References

7.1 Normative References

[KEYWORDS] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[I-D.eckert-bier-te-arch] Eckert, T., Cauchie, G., Braun, W., and M. Menth, "Traffic Engineering for Bit Index Explicit Replication BIER-TE", draft-eckert-bier-te-arch-05 (work in progress), June 2017.

[I-D.ietf-bier-architecture] Wijnands, I., Rosen, E., Dolganow, A., Przygienda, T., and S. Aldrin, "Multicast using Bit Index Explicit Replication", draft-ietf-bier-architecture-08 (work in progress), September 2017.

[I-D.ietf-bier-mpls-encapsulation] Wijnands, I., Rosen, E., Dolganow, A., Tantsura, J., Aldrin, S., and I. Meilik, "Encapsulation for Bit Index Explicit Replication in MPLS and non-MPLS Networks", draft-ietf-bier-mpls-encapsulation-10 (work in progress), October 2017.

7.2 Informative References

[I-D.zcxh-bier-te-forwarding] Zhu, Y., Chen, H., Xiong, Q., and F. Hu, "BIER-TE Forwarding", draft-zcxh-bier-te-forwarding-00 (work in progress), October 2017.

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