mLDP extension for P2MP/tree based BIER
draft-xie-mpls-ldp-bier-extensions-00

RSVP-TE extension for P2MP/tree based BIER
draft-xie-mpls-rsvp-bier-extensions-00

IETF-101 London

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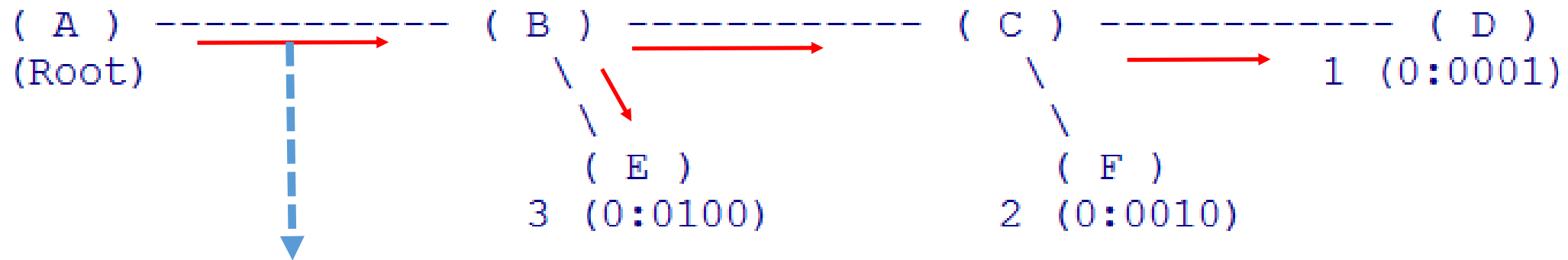Mach Chen (mach.chen@Huawei.com)

Zhenbin Li (lizhenbin@Huawei.com)

Background: P2MP/tree-based BIER

- **<RFC8279/RFC8296> describe an alternative multicast by using a Multicast-specific BIER-header**

- **<draft-xie-bier-mvpn-mpls-p2mp> describe an multicast by using a P2MP/BIER combining.**

- **<RFC6388>: mLDP**

- **<RFC4875>: RSVP-TE for P2MP**

- **Put them together:**

  - **BIER-encapsulation: Multicast-specific packet header, BIER-header**

  - **BIER-Label: Multicast-specific Label, to indicating the following of this label is the left part of the BIER-header.**

  - **mLDP: Multicast-specific protocol, independent of any underlay routing protocol: IGP/BGP/static/…**

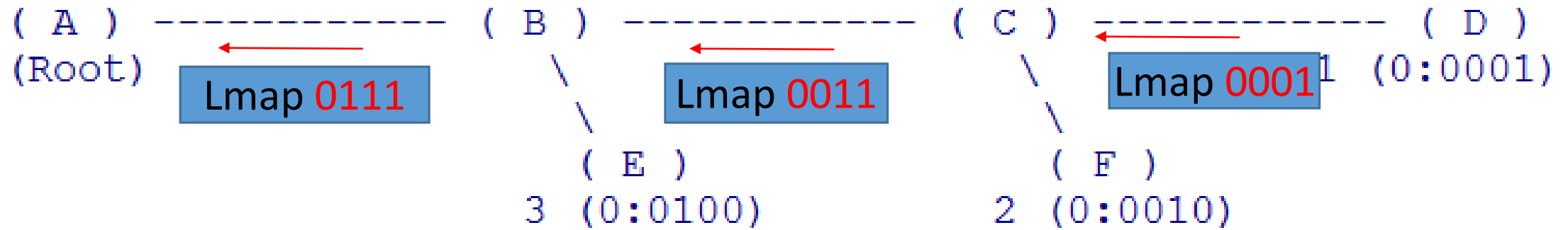 - **RSVP-TE for P2MP: Multicast-specific protocol extension…**

Background: P2MP/tree-based BIER

```
( A ) -------------------- ( B ) --------------------  ( C ) --------------------  ( D )
(Root)                          \                          \                        1 (0:0001)
                                 \                          \
                                ( E )                      ( F )
                                3 (0:0100)                 2 (0:0010)
```

Eth 0x8847	Label 200	BIER Header 0101	Payload (S,G)

P2MP/BIER-Label
Changes hop-by-hop

BitString inside
Unchanges hop-by-hop

mLDP extension for P2MP/tree-based BIER

```
( A ) ------------ ( B ) ------------ ( C ) ---------- ( D )
(Root)         <---                <---               <---    1 (0:0001)
      [Lmap 0111]          \    [Lmap 0011]      \    [Lmap 0001]
                            \                     \
                          ( E )                 ( F )
                        3 (0:0100)            2 (0:0010)
```

- **D-->C: Label Mapping(FEC<Root=A, ID=10, BSL=256, SI=0>, Label=400, FBM=0001>)**

- **F-->C: Label Mapping(FEC<Root=A, ID=10, BSL=256, SI=0>, Label=600, FBM=0010>)**

- **C-->B: Label Mapping(FEC<Root=A, ID=10, BSL=256, SI=0>, Label=300, FBM=0011>)**

- **E-->B: Label Mapping(FEC<Root=A, ID=10, BSL=256, SI=0>, Label=500, FBM=0100>)**

- **B-->A: Label Mapping(FEC<Root=A, ID=10, BSL=256, SI=0>, Label=200, FBM=0111>)**

mLDP extension for P2MP/tree-based BIER

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|      Type       |    Length                     |ID(High 8bits) |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                 ID(Low 24bits)                  |Reserve|BS Len |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Set Identifier |
+-+-+-+-+-+-+-+-+
Type: TBD. Need to be less than 255.
Length: 6
ID: A 32-bit integer, same as RFC6388.
BS Len: Bit String Length
Set Identifier: as defined in RFC8279.

            Figure 2: P2MP BIER LSP Identifer
```

- P2MP BIER LSP Identifier = (ID, BS Len, Set Identifier). The right two fields are add for BIER.
- The (BS Len, Set Identifier) in BIER TLV, and the (BS Len, Set Identifier) in LSP ID, are the same.

mLDP extension for P2MP/tree-based BIER

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|1|1|       BIER TLV (TBD)          |              Length          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|             Reserved                          |BS Len |Set Identifier |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                F-BM   (first 32 bits)                             ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
~                                                                  ~
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
~                F-BM   (last 32 bits)                             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
Type: TBD.
Length: Length
BSL: Bit String Length
Set Identifier: as defined in RFC8279.
F-BM: Forwarding Bit Mask
```
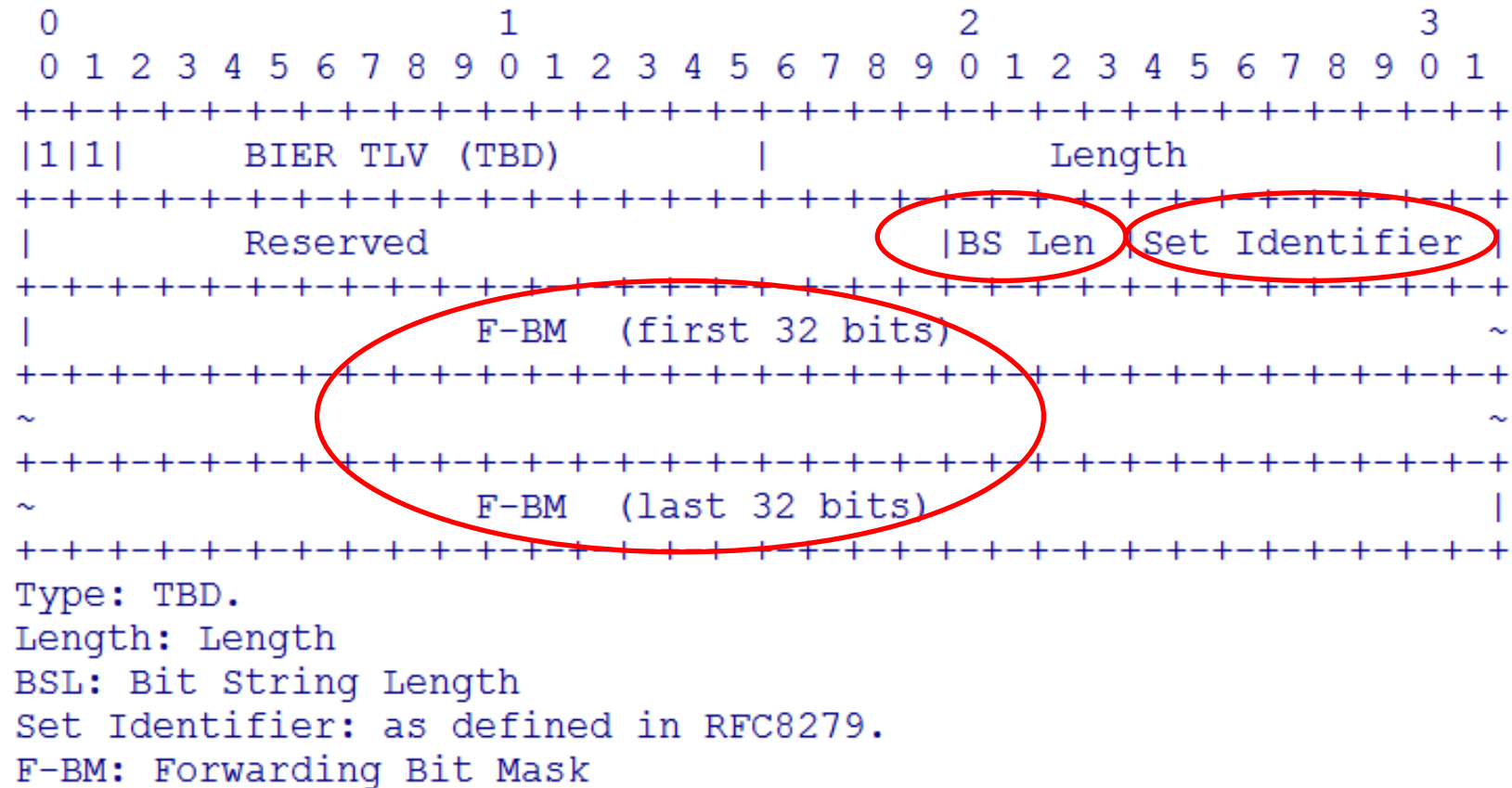
Figure 3: BIER TLV

- The (BS Len, Set Identifier) in BIER TLV, and the (BS Len, Set Identifier) in LSP ID, are the same.
- P2MP Leaf should compute the F-BM using (BFR-ID, BS Len, Set Identifier).
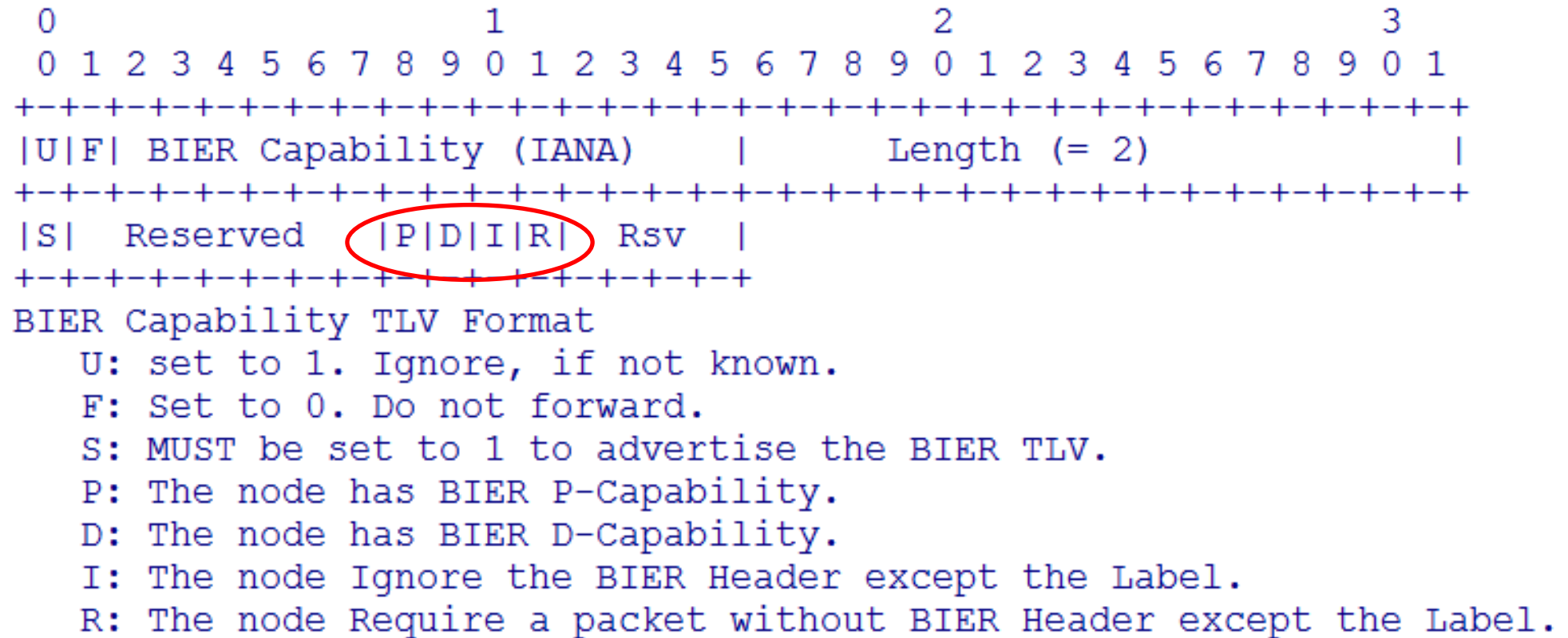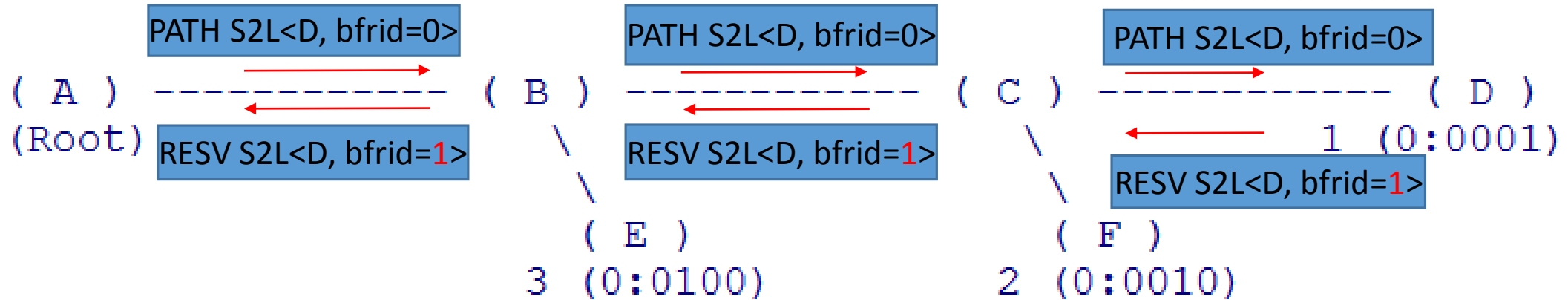
mLDP extension for P2MP/tree-based BIER

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|U|F| BIER Capability (IANA)      |       Length (= 2)          |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|S|   Reserved    |P|D|I|R|  Rsv   |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
BIER Capability TLV Format
    U: set to 1. Ignore, if not known.
    F: Set to 0. Do not forward.
    S: MUST be set to 1 to advertise the BIER TLV.
    P: The node has BIER P-Capability.
    D: The node has BIER D-Capability.
    I: The node Ignore the BIER Header except the Label.
    R: The node Require a packet without BIER Header except the Label.
```

Figure 4: BIER Capability

- LDP Hello option to support BIER Forwarding Capability and Error handling
- Refer to <draft-xie-bier-mvpn-mpls-p2mp-01> for the P/D/I/R flags.

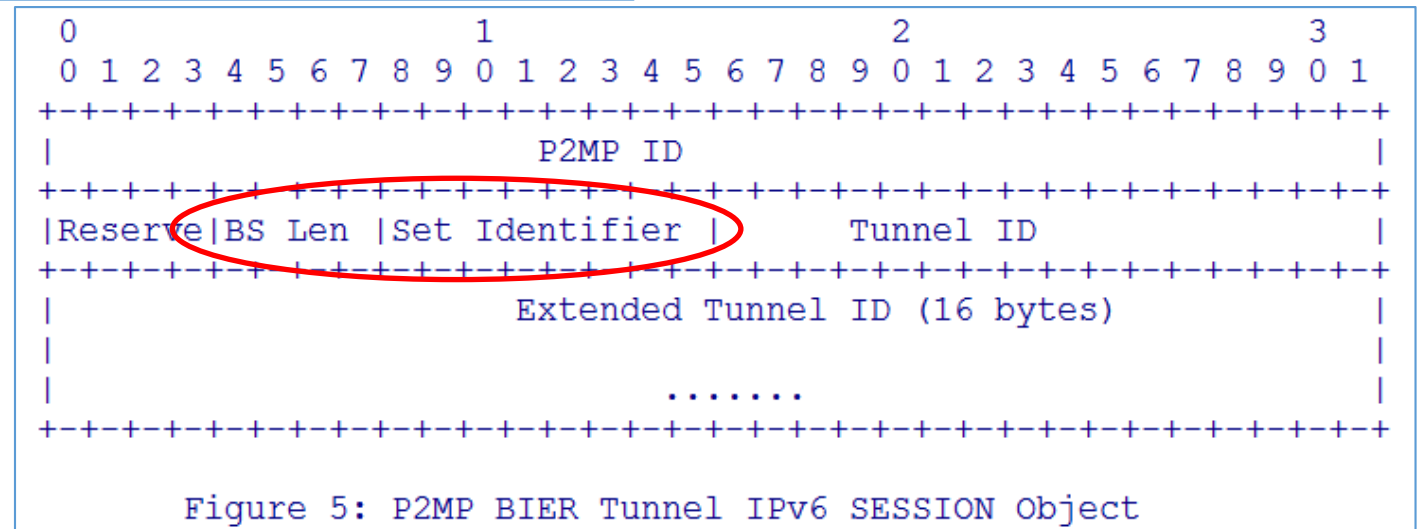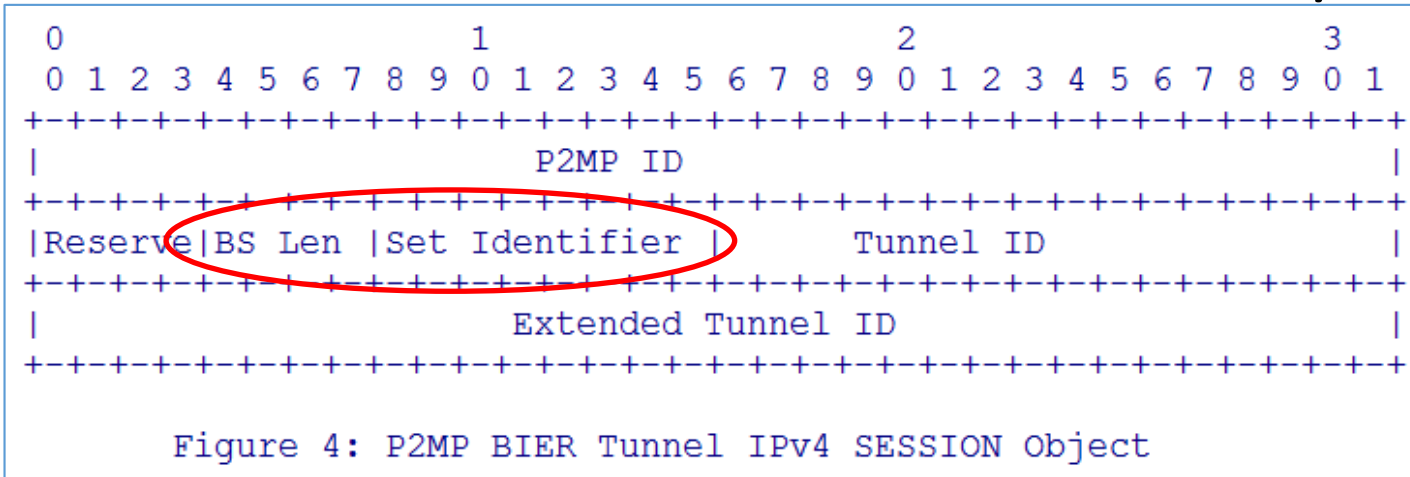# RSVP-TE extension for P2MP/tree-based BIER

- **SubLSPs (A->D/F/E) PATH messages:**

  - **PATH (Session<P2MP_ID, BSL=256, SI=0, TunnelID, ExtTunnelID>, Label_Request, S2L_BIER_SUB_LSP<DestIP=D, BFR-ID=0>)**

  - **PATH (Session<P2MP_ID, BSL=256, SI=0, TunnelID, ExtTunnelID>, Label_Request, S2L_BIER_SUB_LSP<DestIP=F, BFR-ID=0>)**

  - **PATH (Session<P2MP_ID, BSL=256, SI=0, TunnelID, ExtTunnelID>, Label_Request, S2L_BIER_SUB_LSP<DestIP=E, BFR-ID=0>)**

- **SubLSPs (A->D/F/E) RESV messages:**

  - **D->C: RESV (Session<P2MP_ID, BSL=256, SI=0, TunnelID, ExtTunnelID>, LABEL, S2L_BIER_SUB_LSP<DestIP, BFR-ID=1>)**

  - **F->C: RESV (Session<P2MP_ID, BSL=256, SI=0, TunnelID, ExtTunnelID>, LABEL, S2L_BIER_SUB_LSP<DestIP, BFR-ID=2>)**

  - **E->B: RESV (Session<P2MP_ID, BSL=256, SI=0, TunnelID, ExtTunnelID>, LABEL, S2L_BIER_SUB_LSP<DestIP, BFR-ID=3>)**

RSVP-TE extension for P2MP/tree-based BIER

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            P2MP ID                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Reserve|BS Len |Set Identifier |        Tunnel ID              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                       Extended Tunnel ID                      |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

       Figure 4: P2MP BIER Tunnel IPv4 SESSION Object
```

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                            P2MP ID                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|Reserve|BS Len |Set Identifier |        Tunnel ID              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                  Extended Tunnel ID (16 bytes)                |
|                                                               |
|                          .......                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+

       Figure 5: P2MP BIER Tunnel IPv6 SESSION Object
```

- P2MP BIER Tunnel IPv4/IPv6 SESSION Object = (P2MP ID, BS Len, Set Identifier, TunnelID, Extended Tunnel ID)
- The (BS Len, Set Identifier) used for calculating P2MP-BIFTs.

RSVP-TE extension for P2MP/tree-based BIER

```
<Path Message> ::=          <Common Header> [ <INTEGRITY> ]
                            [ [<MESSAGE_ID_ACK> | <MESSAGE_ID_NACK>] ...]
                            [ <MESSAGE_ID> ]
                            <SESSION> <RSVP_HOP>
                            <TIME_VALUES>
                            [ <EXPLICIT_ROUTE> ]
                            <LABEL_REQUEST>
                            [ <PROTECTION> ]
                            [ <LABEL_SET> ... ]
                            [ <SESSION_ATTRIBUTE> ]
                            [ <NOTIFY_REQUEST> ]
                            [ <ADMIN_STATUS> ]
                            [ <POLICY_DATA> ... ]
                            <sender descriptor>
                            [<S2L BIER sub-LSP descriptor list>]
    <S2L BIER sub-LSP descriptor list> ::= <S2L BIER sub-LSP descriptor>
                                           [ <S2L BIER sub-LSP descriptor list> ]
    <S2L BIER sub-LSP descriptor> ::= <S2L_BIER_SUB_LSP>
                                      [ <P2MP_SECONDARY_EXPLICIT_ROUTE> ]

                        Figure 2: PATH Message
```
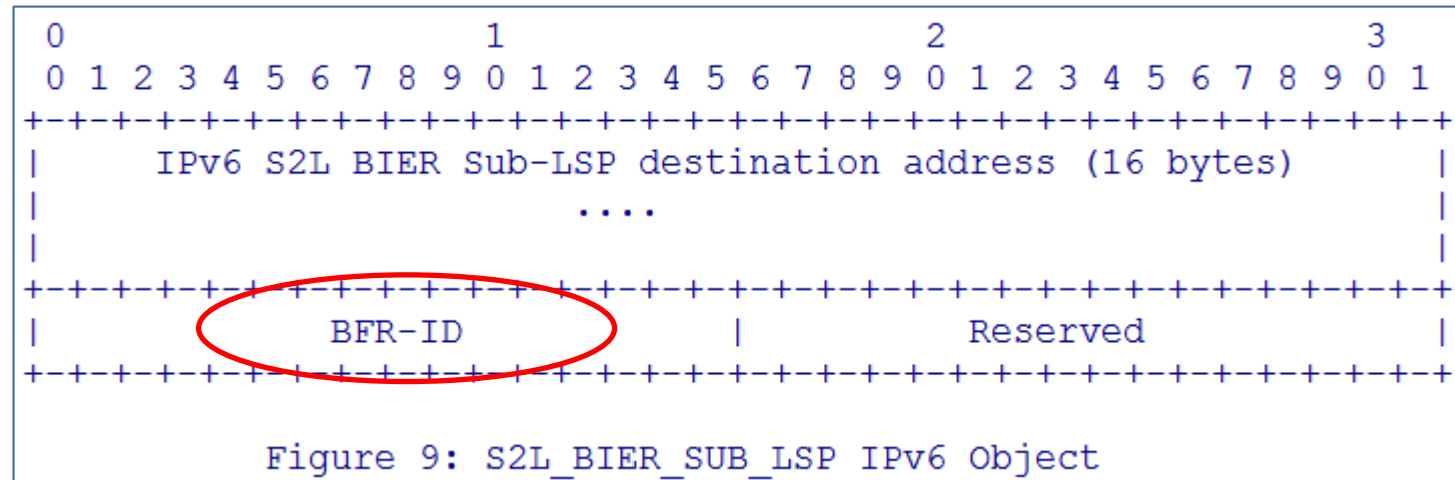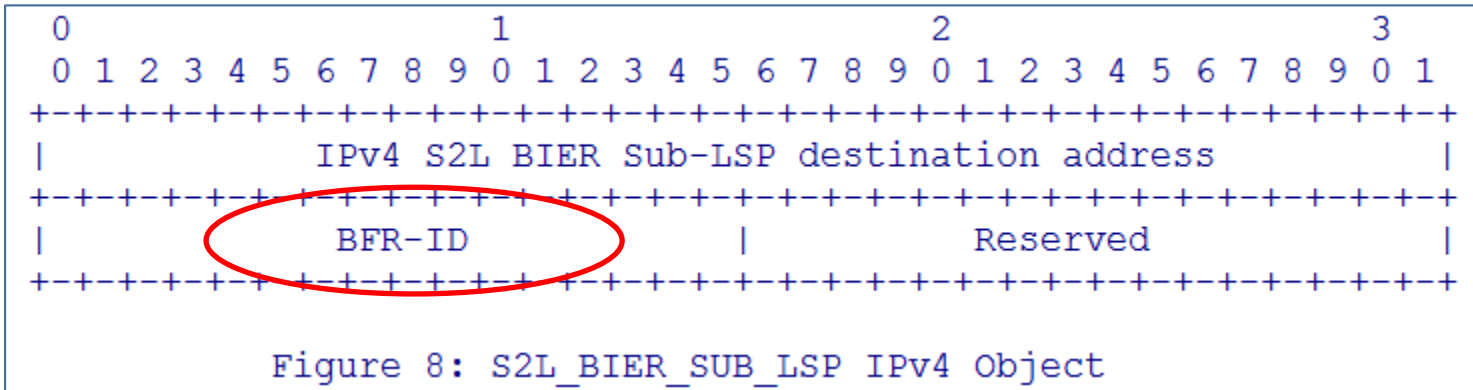
- PATH message, has a Sub-LSP descriptor list of <S2L_BIER_SUB_LSP>, which include the Leaf DestIP.

RSVP-TE extension for P2MP/tree-based BIER

```
<Resv Message> ::=      <Common Header> [ <INTEGRITY> ]
                        [ [<MESSAGE_ID_ACK> | <MESSAGE_ID_NACK>] ... ]
                        [ <MESSAGE_ID> ]
                        <SESSION> <RSVP_HOP>
                        <TIME_VALUES>
                        [ <RESV_CONFIRM> ]  [ <SCOPE> ]
                        [ <NOTIFY_REQUEST> ]
                        [ <ADMIN_STATUS> ]
                        [ <POLICY_DATA> ... ]
                        <STYLE> <flow descriptor list>

<flow descriptor list> ::= <FF flow descriptor list>
                         | <SE flow descriptor>

<FF flow descriptor list> ::= <FF flow descriptor>
                            | <FF flow descriptor list>
                              <FF flow descriptor>

<SE flow descriptor> ::= <FLOWSPEC> <SE filter spec list>

<SE filter spec list> ::= <SE filter spec>
                        | <SE filter spec list> <SE filter spec>

<FF flow descriptor> ::= [ <FLOWSPEC> ] <FILTER_SPEC> <LABEL>
                        [ <RECORD_ROUTE> ]
                        [ <S2L BIER sub-LSP flow descriptor list> ]

<SE filter spec> ::=      <FILTER_SPEC> <LABEL> [ <RECORD_ROUTE> ]
                        [ <S2L BIER sub-LSP flow descriptor list> ]

<S2L BIER sub-LSP flow descriptor list> ::=
                        <S2L BIER sub-LSP flow descriptor>
                        [ <S2L BIER sub-LSP flow descriptor list> ]

<S2L BIER sub-LSP flow descriptor> ::= <S2L BIER SUB LSP>
                        [ <P2MP_SECONDARY_RECORD_ROUTE> ]

                        Figure 3: RESV Message
```

- RESV message, has a flow descriptor list of <S2L_BIER_SUB_LSP>, which include the Leaf BFR-ID.

RSVP-TE extension for P2MP/tree-based BIER

Figure 8: S2L_BIER_SUB_LSP IPv4 Object

Figure 9: S2L_BIER_SUB_LSP IPv6 Object

- BFR-ID is per sub-domain of a batch P2MPs/Trees. E.g. BFR-ID =1 to 500 while BSL = 256.
- Reference to <RFC8279> for what BFR-ID mean.

Next Step

- Add Capability and Error handling to <rsvp-bier-extension>
  - <mldp-bier-extension> already have such a handling description.

- Get feedbacks and handle Questions/Comments
  - Discuss on mail-list is preferred.

Thanks !