

# **Encapsulation for BIER in Non-MPLS IPv6 Networks**

**draft-xie-bier-ipv6-encapsulation-00**

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**Jingrong Xie**

**Liang Geng**

**Mike McBride**

**Senthil Dhanaraj**

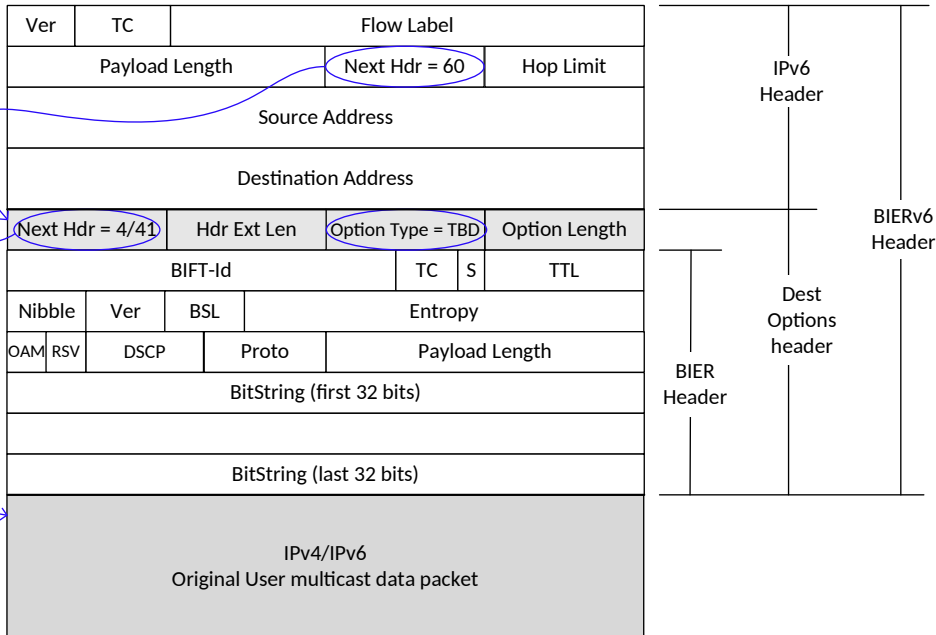
**Gang Yan**

**Yang Xia**

# Status update

- 00 version posted at April 2018, and updated to 02 ever since.
- Renamed from [draft-xie-bier-6man-encapsulation-02] to [draft-xie-bier-ipv6-encapsulation-00]
  - Re-arranged & Updated Sections to make it more readable.
  - Removed the problem-statement part. Spawned new draft [draft-mcbride-bier-ipv6-problem-statement] to detail the problem statement and use cases of BIER in IPv6 environment as suggested IETF103 BIER WG discussion.
  - Removed the dependency on SRH, and use Unicast IPv6 destination address instead.
  - Detailed each field of the encapsulation, notably the IPv6 SA/DA and BIER Proto fields.
  - Detailed the procedures, notably the IPv6-specific forwarding procedures.

# The proposed encapsulation



- Standard BIER header (RFC8296) in standard IPv6 Extension Header (RFC8200).
- New IPv6 option defined, change type 1 -- “Option Data may change en route”.
- IPv6 DA is well-known multicast in general case, and is unicast in special cases.
- IPv6 SA is routable IPv6 unicast, and used to identify a VPN/GTM.

# Next Header values cover current BIER

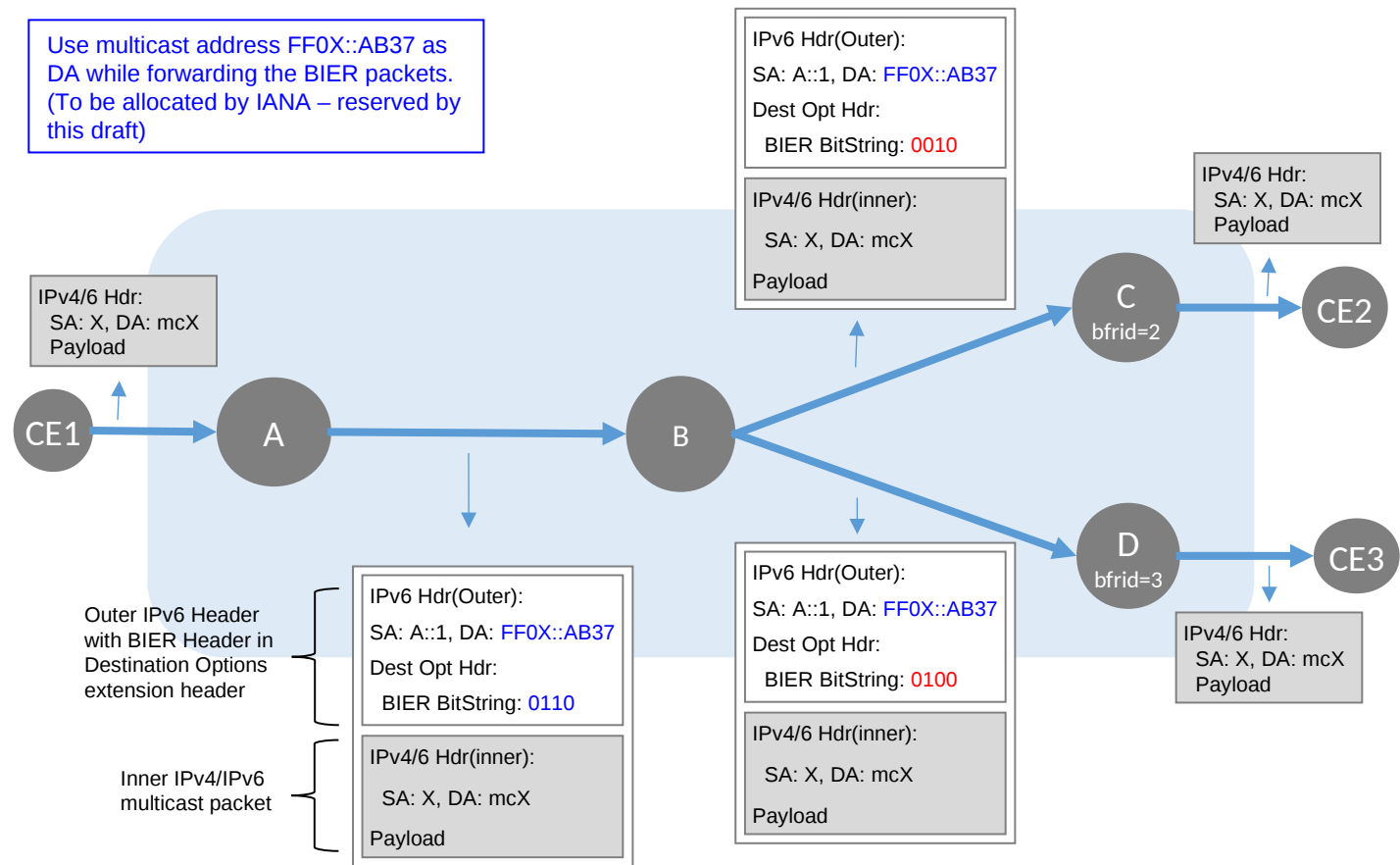
- 'Proto' field in BIER Header ---- replaced by 'Next Header' in IPv6 Dest Option Header.
  - BIER Proto=1, indicating downstream-assigned MPLS payload, use Next Header value 137
  - BIER Proto=2, indicating upstream-assigned MPLS payload,
    - use IPv6 SA to identify the MVPN.
    - use Next Header value 4 or 41 to indicate IPv4/IPv6 payload.
  - BIER Proto=3, indicating Ethernet payload, use Next Header value TBD.
    - Value 97 can be used but it has an extra 2 octets.
    - A new value is better since Ethernet in IPv6 is common in SRv6-L2VPN too.
  - BIER Proto=4, indicating IPv4 payload, use Next Header value 4
  - BIER Proto=5, indicating BIER-OAM, use Next Header value 58
    - BIER-PING need some adaption to IPv6.
  - BIER Proto=6, indicating IPv6 payload, use Next Header value 41

# Forwarding Procedure

- Normal BIER forwarding as required by RFC8279.
  - All steps ( from step 1 to step 8 ) defined in section 6.5 of RFC8279 apply.
  - Walk through the BitString to determine the BFR-NBR(s) to copy packets to.
  - May change the BitString when copy packet to a BFR-NBR.
    - BIER option type have chg flag 1 for this purpose.
- Some “IPv6-specific” forwarding procedures required for this encapsulation.
  - IPv6 SA - Routable unicast IPv6 address (normally BFIR IPv6 Prefix).
  - IPv6 DA – BIER multicast address (FF0X::AB37) or Unicast address (BFR-Prefix).
    - BIERv6 packet (IPv6 header with BIER Option type) is dropped if the DA is not one of the above.
  - Nodes which support BIERv6, obtain the standard non-MPLS BIER header in the BIER Option type and perform the BIER forwarding as specified by RFC8279.

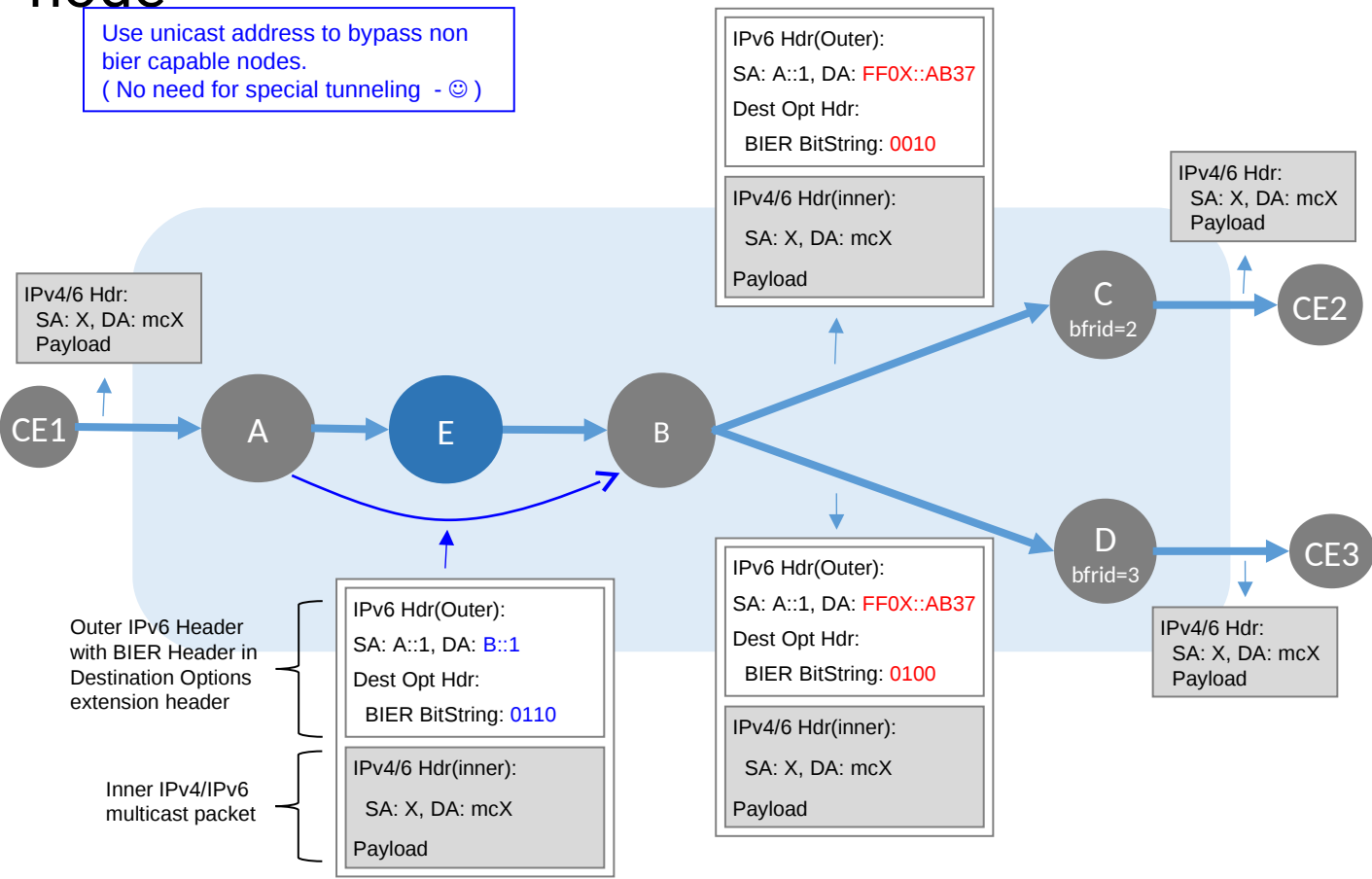
# The General case: Use Multicast DA

Use multicast address FF0X::AB37 as DA while forwarding the BIER packets.  
(To be allocated by IANA – reserved by this draft)



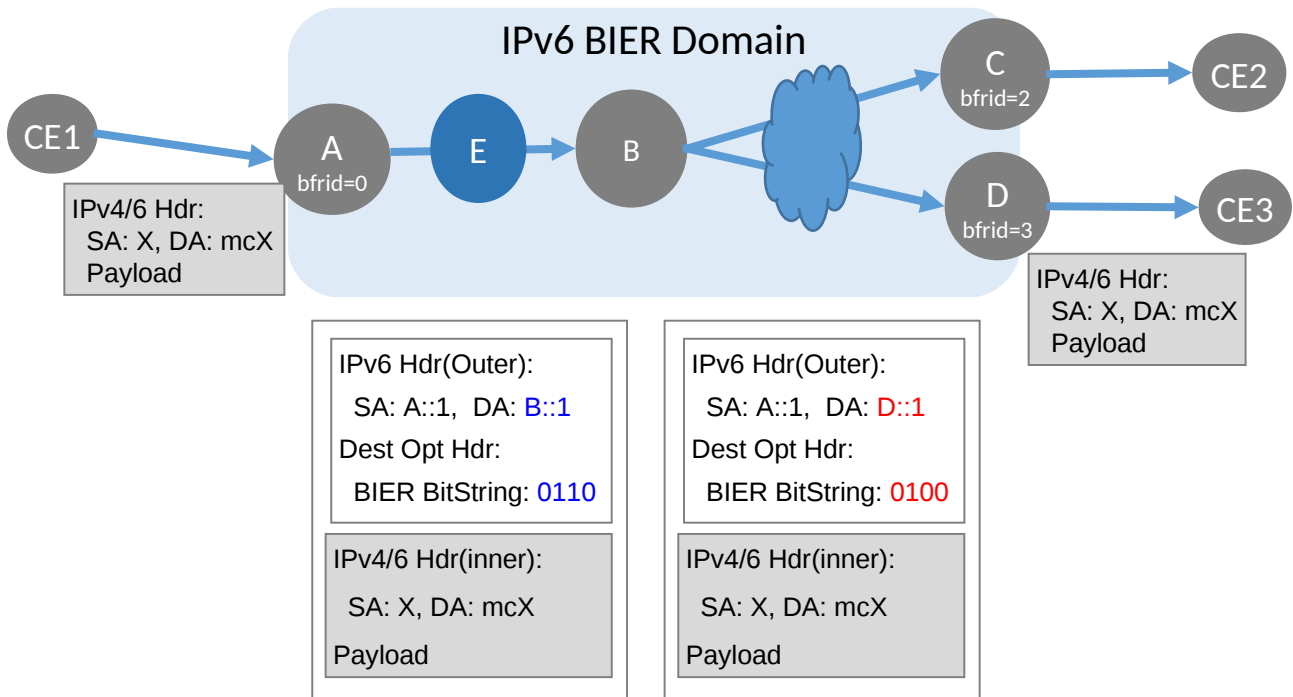
# Unicast DA Case 1: To bypass non-capable node

Use unicast address to bypass non bier capable nodes.  
( No need for special tunneling - 😊 )



# Unicast DA case-2:

This is an Unicast-Unicast case.





# Why is the encapsulation

- Why use IPv6 Destination Option Header ?
  - [RFC8200] Defining [new IPv6 extension headers is not recommended](#), unless there are no existing IPv6 extension headers that can be used by specifying a new option for that IPv6 extension header.
  - [RFC8200] it is [recommended that the Destination Options header is used](#) to carry optional information that must be examined only by a packet's destination node(s), because they provide better handling and backward compatibility.
  - **IPv6 Destination Option Header is not only feasible, but also the recommended one in RFC8200.**
- Why use well-known multicast address as IPv6 DA for general case ?
  - [RFC8200] Extension headers are not processed until the packet reaches the node (or [each of the set of nodes, in the case of multicast](#)) identified in the Destination Address field of the IPv6 header.
  - **This can not only simplify the forwarding, but also match the general concept of Replication.**
- Why use Next Header instead of BIER Proto in IPv6 encapsulation ?
  - Use of Next Header to indicate the format of the payload is more general IPv6 usage.
  - Better backward compatibility, e.g., enable offline tools to know the payload type.

# BIERv6(L3) and BIER-ETH(L2.5) Brief Comparison

- Hop-by-hop replication
  - L3 BIER uses L3 multicast DA/MAC, and doesn't change hop-by-hop.
  - L2.5 BIER uses unicast MAC, and change hop-by-hop.
- Multi-hop replication
  - L3 BIER uses L3 unicast DA, without introducing tunnel handling.
    - Consider unicast-multicast, multicast-unicast, unicast-unicast replication.
  - L2.5 BIER uses L3 unicast tunnel (in Non-MPLS network).
    - May need more cost on tunnel endpoint encapsulation/decapsulation.
    - May need more filtering of L2.5 packets, since tunnel allows L2.5 packet, various L2.5 packets may come from the tunnel.
    - May need more control-plane to advertise the tunnel endpoint info like <draft-ietf-isis-encapsulation-cap>.
    - May need more packet length and header cascading using GRE/UDP.
    - May not be able to use the IPv6 SA to identify a VPN, while having to use IPv6 for tunneling.

# Request to the WG

- Please join us
- Adoption Request

Thank you !