BIER in IPv6

draft-zhang-bier-bierin6

6MAN WG

IETF108

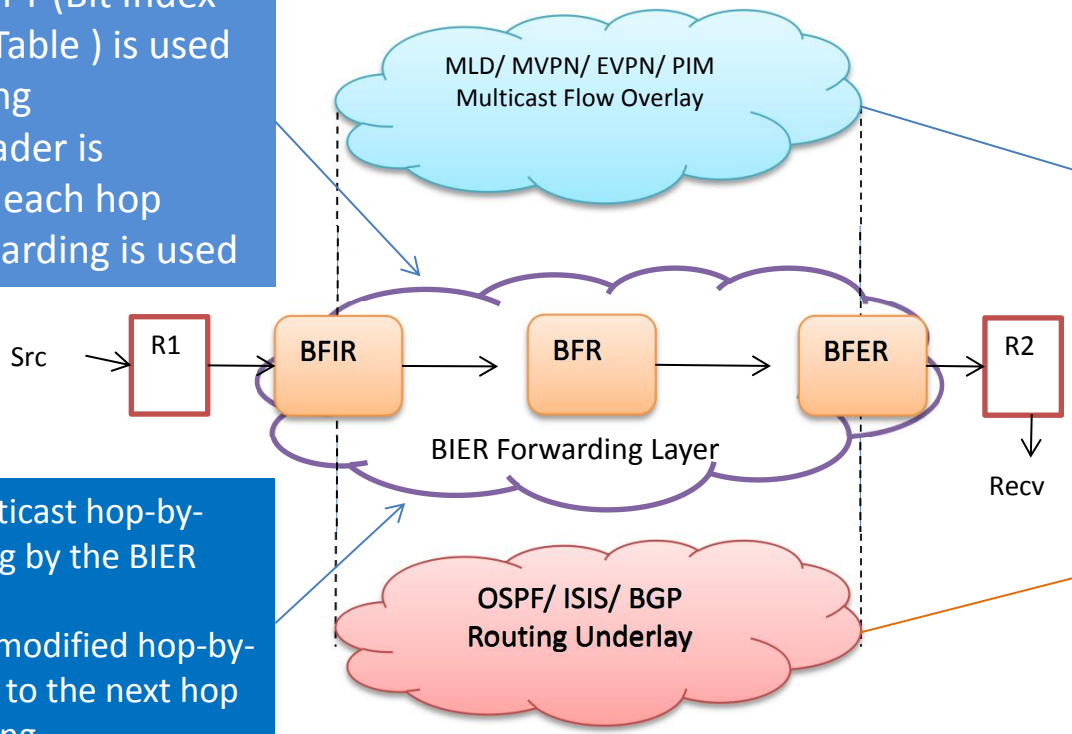
Sandy Zhang	ZTE Corporation
Jeffrey Zhang	Juniper Networks
IJsbrand Wijnands	Cisco Systems
Hooman Bidgoli	Nokia
Mike McBride	Futurewei

BIER (Bit Indexed Explicit Replication)

- BIER is a new technology which can achieve multicast forwarding **without explicitly multicast distribution trees building, and it doesn't require intermediate nodes to maintain any per-flow state**

- RFC8279
- Three layers architecture
  - Multicast Flow Overlay
  - BIER Layer
  - Routing Underlay

- Dedicated BIFT (Bit Index Forwarding Table) is used for forwarding
- The BIER header is modified on each hop
- Unicast forwarding is used



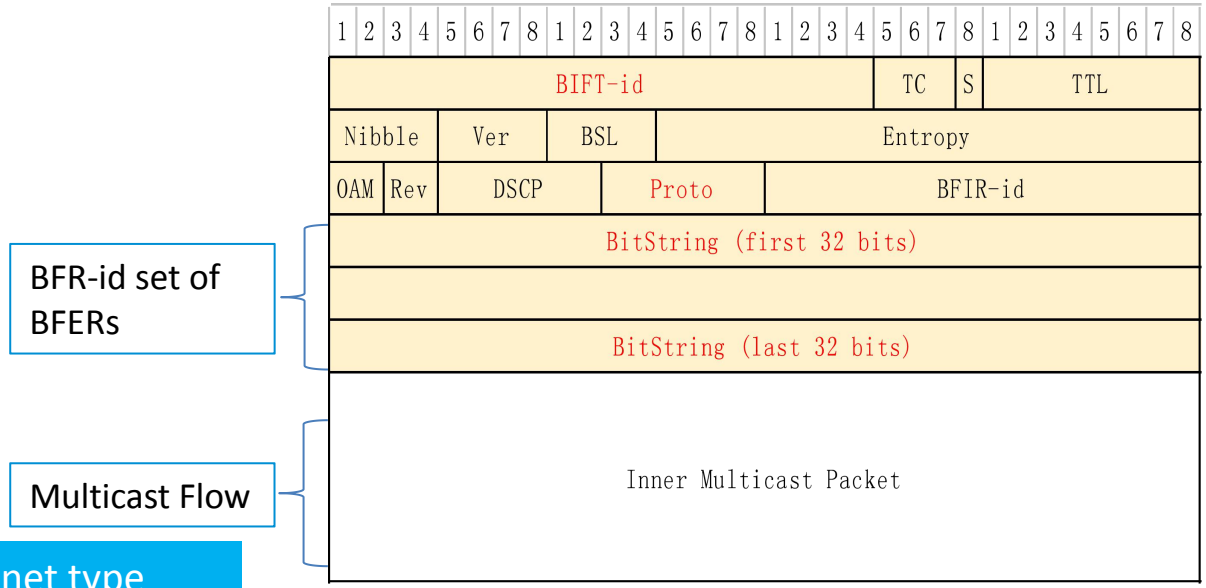
- Multicast Flow Overlay
- Multicast data information (S, G) or (*, G) is exchanged on Edge routers (BFIR and BFER) ONLY.

- Achieving multicast hop-by-hop forwarding by the BIER header.
- The BIFT-id is modified hop-by-hop according to the next hop node advertising.

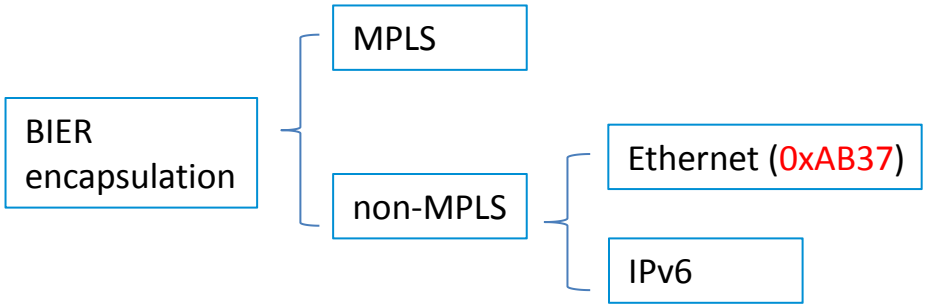
- Routing Underlay
- Depends on OSPF/ISIS or other routing protocols.
- Advertising the information which is used to build BIER Layer, such as BFR-Prefix, BFR-id, etc.

BIER Header (RFC8296)

- The BitString field contains the BFR-id set of BFERs. It's modified on each branch node.
- The BIFT-id is used to locate the BIFT forwarding items. It's advertised by the next hop node.
- The Proto field indicates the payload type of multicast flow: MPLS, IPv4, IPv6, Ethernet, OAM

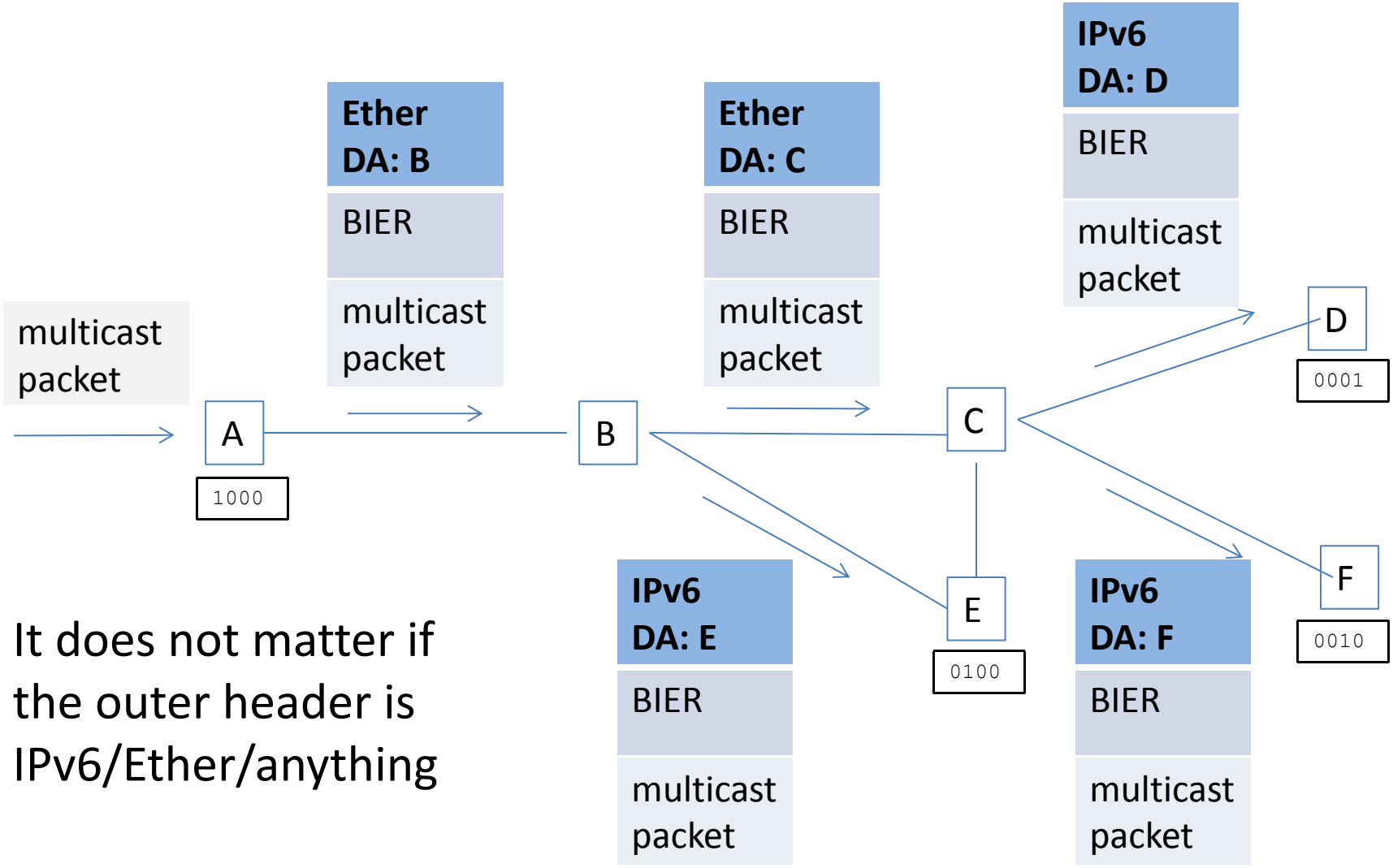


- If silicon (chip) supports BIER Ethernet type recognizing, Ethernet encapsulation can be used directly. If not, MPLS or IPv6 can be used.
- For MPLS, the bottom label is also the BIFT-id in BIER header.
- For IPv6, BIER protocol number is used to indicate the following BIER header, a indicator of BIFT-id is also used to locate BIFT items.
- MPLS and IPv6 encap can also be used to travel across BIER incapable nodes.



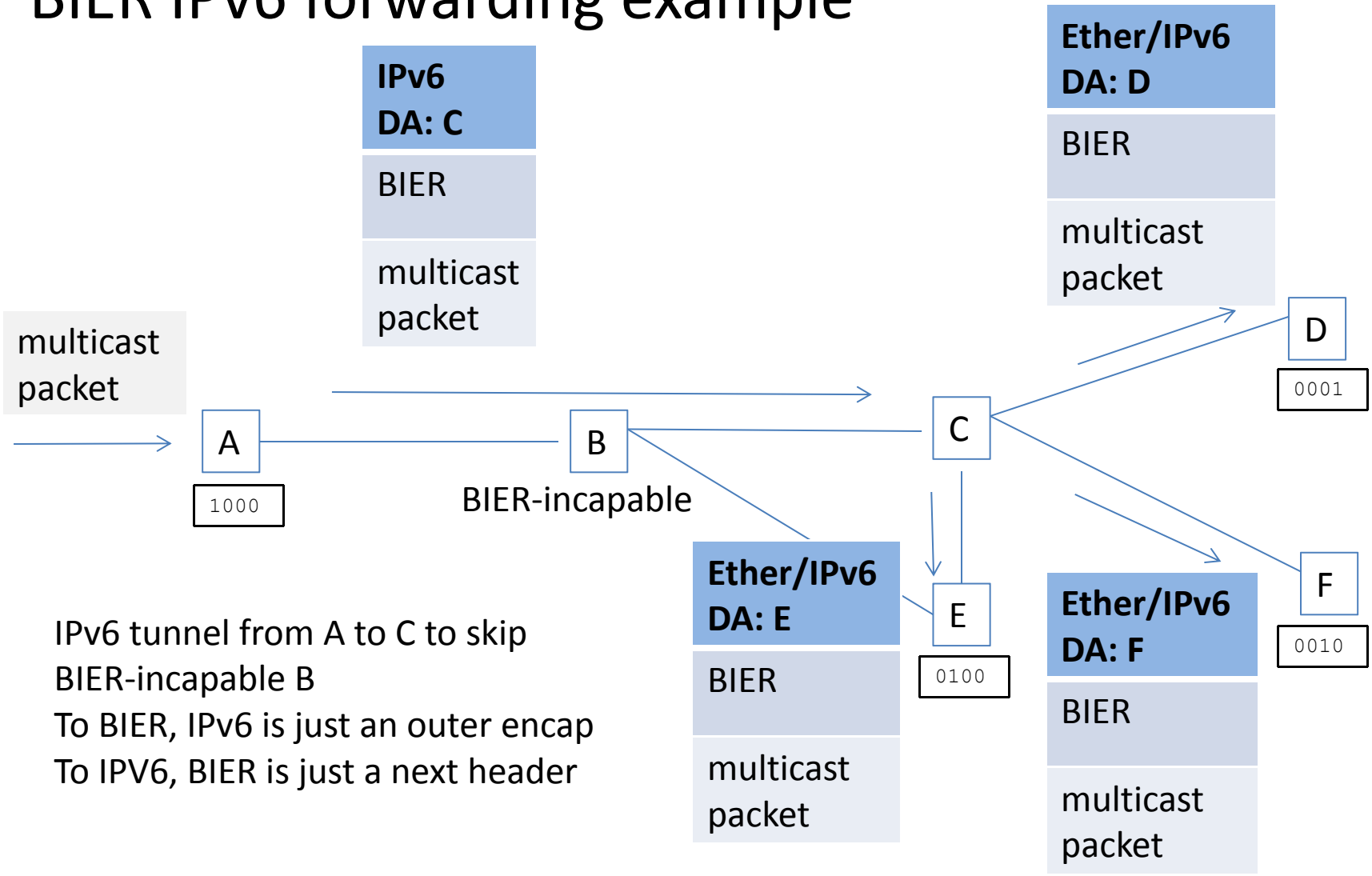
The encapsulation can be changed hop-by-hop according to the next hop node advertisement.

BIER IPv6 forwarding example



It does not matter if the outer header is IPv6/Ether/anything

BIER IPv6 forwarding example



IPv6 tunnel from A to C to skip BIER-incapable B
To BIER, IPv6 is just an outer encap
To IPV6, BIER is just a next header

- BIERin6: The Next Header field in IPv6 header is set to BIER type.
- Protocol number assignment for BIER
- https://www.iana.org/assignments/protocol-numbers/protocol-numbers.xhtml

Summary

- IPv6 and BIER orthogonal to each other
  - To IPv6, BIER is just a next header
    - Like any other payload
  - To BIER, IPv6 is just an outer header
    - Like any other outer encap header, e.g. Ether
- Only need an IPv6 codepoint for BIER as next header
  - Consistent with general BIER architecture
  - Consistent with general IPv6 architecture

IPv6 header details

- For directly connected neighbor
  - The destination address in IPv6 header SHOULD be the neighbor's link-local address on this router's outgoing interface.
  - the source address SHOULD be this router's link-local address on the outgoing interface.
  - the IPv6 TTL MUST be set to 1.
- For non directly connected neighbor
  - The destination address SHOULD be the BIER prefix of the BFR neighbor.
  - The source address SHOULD be this router's BIER prefix.
  - The TTL MUST be large enough to get the packet to the BFR neighbor.
- The Flow label field in the IPv6 packet SHOULD be copied from the entropy field in the BIER encapsulation.

- Many thanks to Tony Przygienda, Nagendra Kumar and Gyan Mishra for their reviewing!
- Any Comments
- Thanks!