

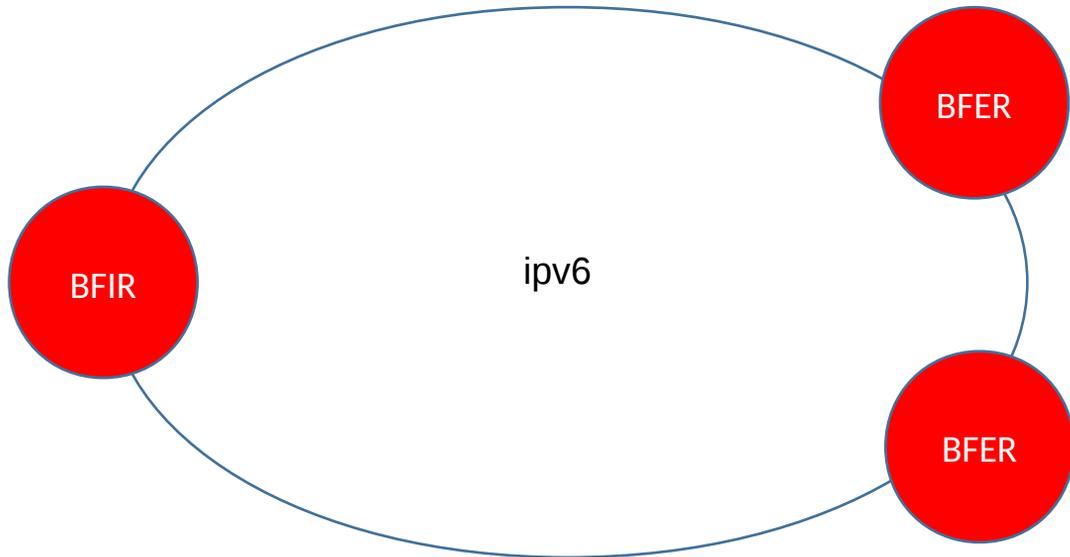
**Problem Statement of BIER IPv6 Encapsulation  
draft-mcbride-bier-ipv6-problem-statement-01**

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# Replicate bier packets from BFIR to BFERs across v6



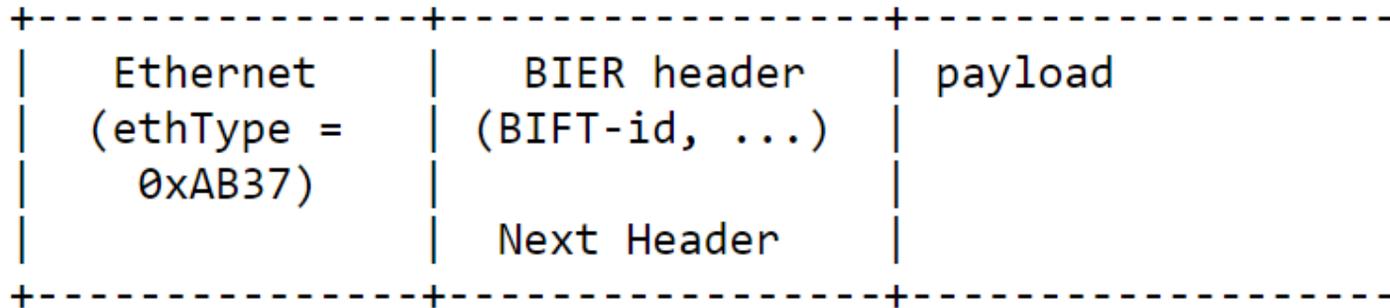
# Concerns worth noting

- There is consideration to use IPv6 natively, e.g, SRv6 in SPRING, as an option to support unicast services like FRR/VPN.
  - It is happening now.
- In such IPv6 network, called Non-MPLS IPv6 network, there is consideration to have an option of BIER IPv6 encapsulation.
  - There has been many efforts to have an option of IPv6 encapsulation for years.
  - The WG had chattered to work on BIER-IPv6 if
    - coordinated with the 6MAN WG. //This may start by BIER Chairs after adoption.
    - with understood applicability. //This is the draft want to help on.
  - It may be helpful to conclude whether the applicability is understood, and what's the work need to do.

# Draft Purpose

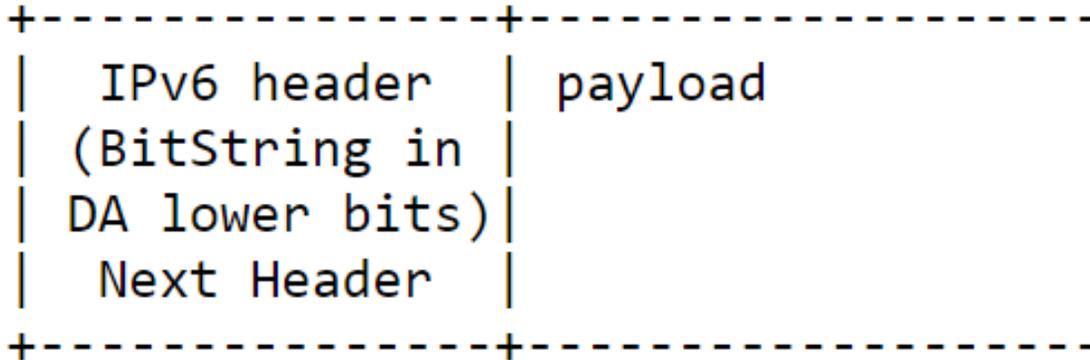
- Describe the problem space of transporting packets, with bier headers, in an IPv6 environment. The ways in which BIER will function in an IPv6 environment is the problem.
- There have been several proposed solutions but there hasn't been a draft which describes the problem.
- This draft is intended to help the BIER WG evaluate the need for an encapsulation that is IPv6-specific through describing the problem and summarizing BIERV6 related solutions.
- Solution summaries start on next slide:

# BIER-ETH encapsulation in IPv6



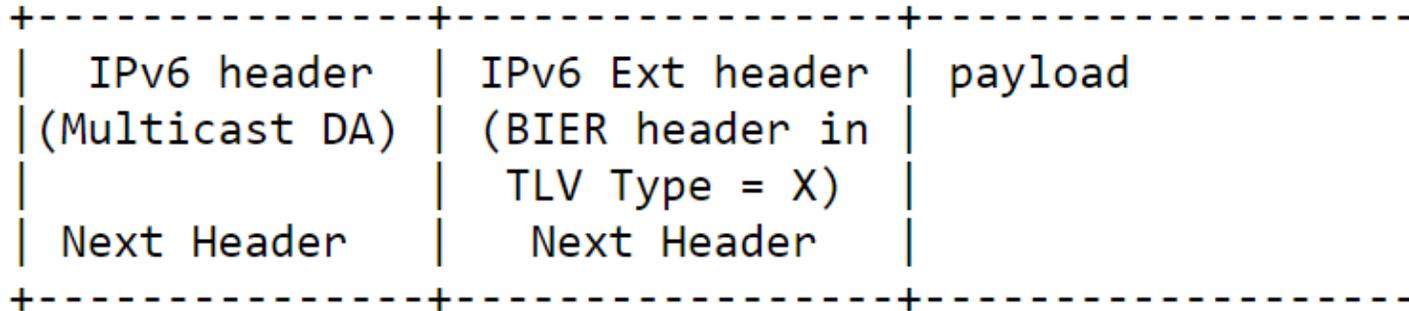
BIER-ETH encap (BIER header for Non-MPLS networks as defined in [[RFC8296](#)]) can be used to transport the multicast data in the IPv6 network by encapsulating the multicast user data payload within the BIER-ETH header. However, using BIER-ETH in IPv6 networks is not considered to be a native IPv6 solution which utilizes the IPv6 header to forward the packet.

# Encode Bitstring in IPv6 destination address



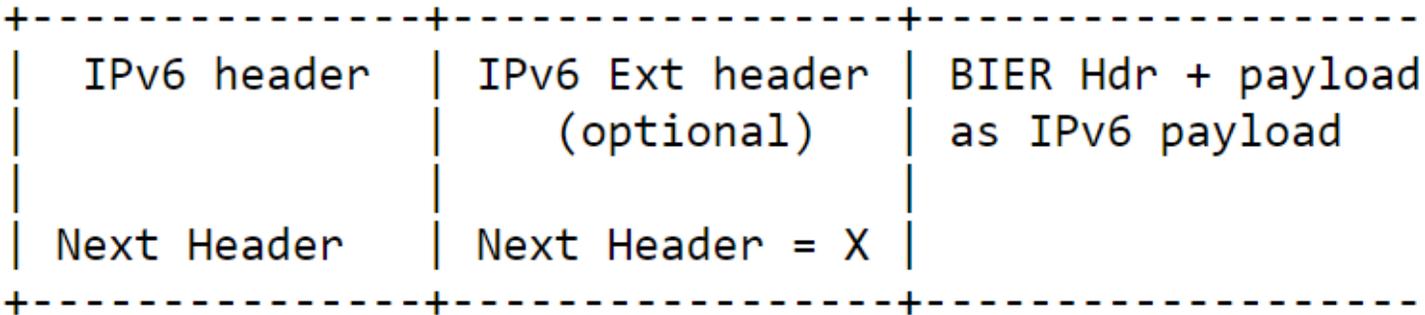
As described in [I-D.**pfister-bier-over-ipv6**], the information required by BIER is stored in the destination IPv6 address. The BIER BitString is encoded in the low-order bits of the IPv6 destination address of each packet. The high-order bits of the IPv6 destination address are used by intermediate routers for unicast forwarding, deciding whether a packet is a BIER packet, and if so, to identify the BIER Sub-Domain, Set Identifier and BitString length. No additional extension or encapsulation header is required. Instead of encapsulating the packet in IPv6, the payload is attached to the BIER IPv6 header and the IPv6 protocol number is set to the type of the payload. If the payload is UDP, the UDP checksum needs to change when the BitString in the IPv6 destination address changes.

# Add BIER header into IPv6 Extension Header



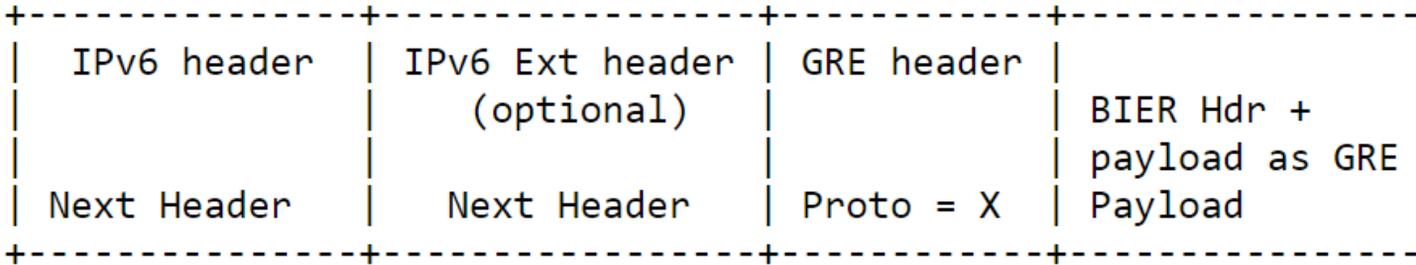
In [I-D.xie-bier-ipv6-encapsulation] an IPv6 BIER Destination Option is carried by the IPv6 Destination Option Header (indicated by a Next Header value 60). It is initialized in a packet sent by an IPv6 BFIR router to inform the following BFR routers in an IPv6 BIER domain to replicate to destination BFER routers hop-by-hop. BIER is generally a hop-by-hop and one-to-many architecture and it is required for a BIER IPv6 encapsulation to include the BIER Header ([RFC8296]) as an IPv6 Extension Header, to pilot the hop-by-hop BIER replication.

# Transport BIER as IPv6 payload



There is a proposal for a transport-independent BIER encapsulation header which is applicable regardless of the underlying transport technology. As described in [I-D.xu-bier-encapsulation] and [I-D.zhang-bier-bierin6], the BIER header, and the payload following it, can be combined as an IPv6 payload, and be indicated by a new Upper-layer IPv6 Next-Header value. A unicast IPv6 destination address is used for the replication and changes when replicating a packet out to a neighbor.

# Tunneling BIER in a IPv6 tunnel



A generic IPv6 Tunnel could be used to encapsulate the bier packet within an IPv6 domain. GRE is a mechanism by which any ethernet payload can be carried by an IP GRE tunnel due to the 16-bits 'Protocol Type' field. Both IPv4 and IPv6 can be used to carry GRE. The Ethernet type codepoint 0xAB37, defined for BIER, can be used in a GRE header to indicate the subsequent BIER header and payload in an IPv6 network.

# The past discussions

- In Sep 2016, there was a suggestion to provide a method of using IPv6 extension header:
  - <https://www.ietf.org/mail-archive/web/bier/current/msg00986.html>
- Again there were some 'requirements' mentioned by this thread:
  - <https://www.ietf.org/mail-archive/web/bier/current/msg00991.html>
  - "it shouldn't require hop-by-hop modification of the IP destination address field,
  - and it shouldn't require the BFRs to inspect layer 4,
  - and it shouldn't require changes to layer 4,
  - and it shouldn't allow a multicast address to be put in the IP source address field,
  - and it shouldn't assume that bits never get set incorrectly,
  - and it shouldn't require changes in source address filtering procedures.
  - In addition, it should be possible to use it to support the entire BIER architecture"

# Request to the WG

- Please join us
- Adoption Request