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BIER IPv6 Requirements  
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## Abstract

There have been several proposed solutions with BIER being used in IPv6. But there hasn't been a document which describes the problem and lists the requirements. The goal of this document is to describe the general BIER IPv6 encapsulation problem and detail solution requirements, thereby assisting the working group in the development of acceptable solutions.

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Internet-Draft

BIER IPv6 Requirements

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[1.](#) Introduction

Bit Index Explicit Replication (BIER) [[RFC8279](#)] is an architecture that provides optimal multicast forwarding, without requiring intermediate routers to maintain per-flow state, through the use of a multicast-specific BIER header. [[RFC8296](#)] defines two types of BIER encapsulation: one is BIER MPLS encapsulation for MPLS environments,

the other is non-MPLS BIER encapsulation to run without MPLS. This document describes non-MPLS BIER encapsulation in IPv6 environments. We explain the requirements of transporting multicast flow overlay payload through an IPv6 network underlay using BIER. The solutions

may use IPv6 forwarding plane and may include IPv6 encapsulation and/or generic IPv6 tunnelling.

### 1.1. Requirements Language

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](#)].

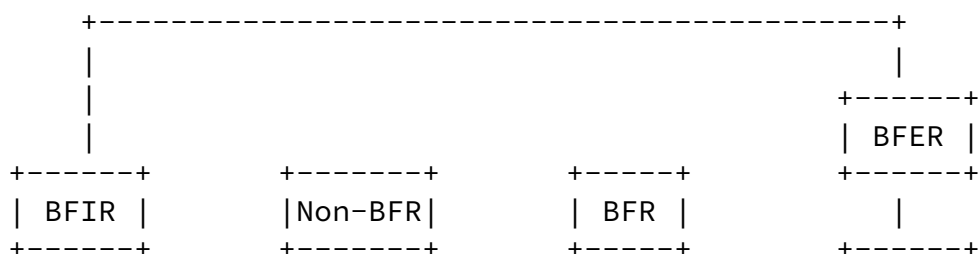
### 1.2. Terminology

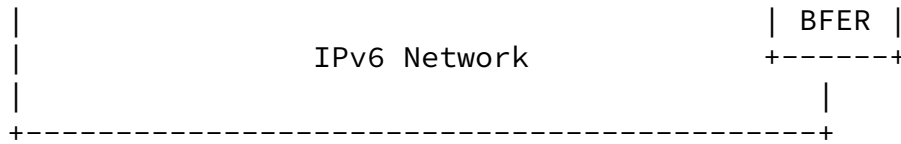
- o BIER: Bit Index Explicit Replication. Provides optimal multicast forwarding through adding a BIER header and removing state in intermediate routers.

## 2. Problem Statement

The problem is how to transport multicast packets, with non-MPLS BIER encapsulation, in an IPv6 environment. We need to determine where to put the BIER header in this IPv6 environment. With IPv6 encapsulation being increasingly used for unicast services, such as VPN or L2VPN, it may be desirable to have IPv6 encapsulation also used in BIER deployments for multicast services such as MVPN. It may also be desirable to not use IPv6 encapsulation except when IPv6 tunneling (native or GRE/UDP-like) is used to transport BIER packets over BIER-incapable routers.

Below is a simple scenario that needs BIER IPv6-based forwarding:





This scenario depicts the need to replicate BIER packets from a BFIR to BFERs across an IPv6 Service Provider core. Inside the IPv6 network, the BIER header is used to direct the packet from one BFR to the next BFRs, and either a IPv6 header or an L2/tunnel header is used to provide reachability between BFRs. The IPv6 environment may include a variety of link types, may be entirely IPv6, or may be dual stack. There may be cases where not all routers are BFR capable in

the IPv6 environment but still want to deploy BIER. Regardless of the environment, the problem is to deploy BIER, with non-MPLS BIER encapsulation, in an IPv6 network.

### [3.](#) Requirements

There are several suggested requirements for BIER IPv6 solutions.

In this document, the requirements are divided into two levels: Mandatory and Optional. The requirement levels are determined based on the following factors:

If the requirement is required for a feature that is likely to be a potential deployment, the requirement level will be considered mandatory.

If the impact of not implementing the requirement may block BIER from been deployed, the requirement level will be considered mandatory.

#### [3.1.](#) Mandatory Requirements

Considering that these mandatory requirements are all well-known to the working group, and practical in normal deployment, they will be listed without a detailed description.

##### [3.1.1.](#) Support various L2 link types

The solution should support various kinds of L2 data link types.

### [3.1.2.](#) Support BIER architecture

The solution must support the BIER architecture.

Supporting different multicast flow overlays, multiple sub-domains, multi-topologies, multiple sets, multiple Bit String Lengths, and deterministic ECMP are considered essential functions of BIER and need to be supported.

### [3.1.3.](#) Support deployment with Non-BFR routers

The solution must support deployments with BIER-incapable routers. This is beneficial to the deployment of BIER, especially in early deployments when some routers do not support BIER forwarding but support IPv6 forwarding.

### [3.1.4.](#) Support OAM

BIER OAM tools like [[I-D.ietf-bier-ping](#)] and [[I-D.ietf-bier-pmmm-oam](#)] should be supported, either directly using existing methods, or by specifying a new method for the same functionality. They are likely to be needed in normal BIER deployment for diagnostics.

## [3.2.](#) Optional Requirements

The requirements in this section are listed as optional, and each requirement is explained with a detailed scenario. Note that fragmentation and IPSEC ESP are not BIER functions, they are provided by the upper IP layer.

### [3.2.1.](#) Support Fragmentation

There are some cases where the Fragmentation/Assembly function is needed for BIER to work in an IPv6 network.

For example, a customer IPv6 multicast packet may be 1280 bytes and is required to be transported through an IPv6 network using BIER. Every link of the IPv6 network is no less than the requisite 1280

bytes [[RFC8200](#)], but the size of the payload that can be encapsulated in BIER (BIER-MTU) is less than 1280 bytes. In this case, it is not the appropriate action for a BFIR to drop the packet and advertise an MTU to the source [[RFC8296](#)]. Instead, some transport mechanism needs to provide the fragmentation and assembly function.

### [3.2.2.](#) Support IPSEC ESP

There are some cases where the IPSEC ESP function may be needed to transport c-multicast packets through an IPv6 network with confidentiality using BIER technology.

A service provider may want to provide additional security SLA to its customer to ensure that the unencrypted c-multicast packet is not altered in the service provider's network. In this case, if the BIER technology is preferred for the multicast service, BIER with IPSEC ESP support may be a candidate solution. On the other hand, the traffic protection may be better provided via IPSEC or MACSEC at multicast flow overlay over and beyond the BIER domain.

## [4.](#) IANA Considerations

Some BIER IPv6 encapsulation proposals do not require any action from IANA while other proposals require new IPv6 Option codepoints from IPv6 sub-registries, new "Next header" values, or require new IP

Protocol codes. This document, however, does not require anything from IANA.

## [5.](#) Security Considerations

There are no security issues introduced by this draft.

## [6.](#) Acknowledgement

Thanks to Eric Rosen for his listed set of initial requirements on the BIER WG mailing list.

## [7.](#) Normative References

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