

BIER Fast ReRoute

draft-chen-bier-frr-00

Huaimo Chen
Aijun Wang
Gyan S. Mishra
Yanhe Fan
Lei Liu
Xufeng Liu

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Introduction

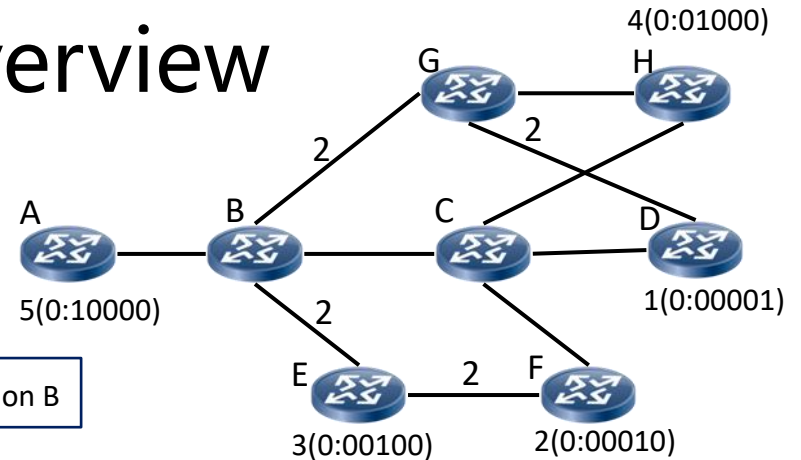
Local Protection Solution (called BIER FRR)

- Fast Re-Route (FRR) protection for transit nodes in BIER domain
- No per-flow state in the core

BIER FRR Overview

BIER Overview

- ✓ BFR has BIRT (Bit Index Routing Table),
- ✓ BIFT derived from BIRT
- ✓ Forwards packets using BIFT



BIRT on B

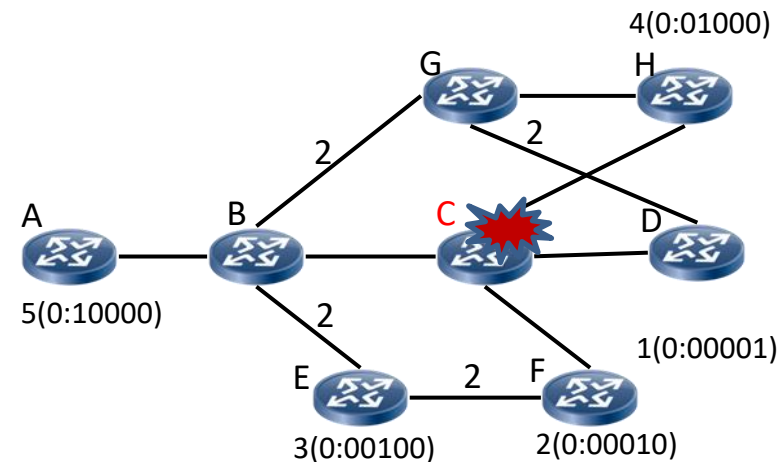
BFR-id (SI:Bitstring)	BFR-Prefix of Dest BFER	BFR-NBR (Next Hop)
1(0:00001)	D	C
2(0:00010)	F	C
3(0:00100)	E	E
4(0:01000)	H	C
5(0:10000)	A	A

BIFT on B

BFR-id (SI:Bitstring)	F-BM	BFR-NBR (Next Hop)
1(0:00001)	01011	C
2(0:00010)	01011	C
3(0:00100)	00100	E
4(0:01000)	01011	C
5(0:10000)	10000	A

BIER FRR Idea

- BFR has FRR-BIRT for each NBR X failure (e.g., on B, FRR-BIRT for G failure, FRR-BIRT for C failure, etc.) having routes **around X**
- FRR-BIFT derived from FRR-BIRT
- Forwards packets using FRR-BIFT for X when X fails (e.g., on B, forwards packets using FRR-BIFT for C when C fails)



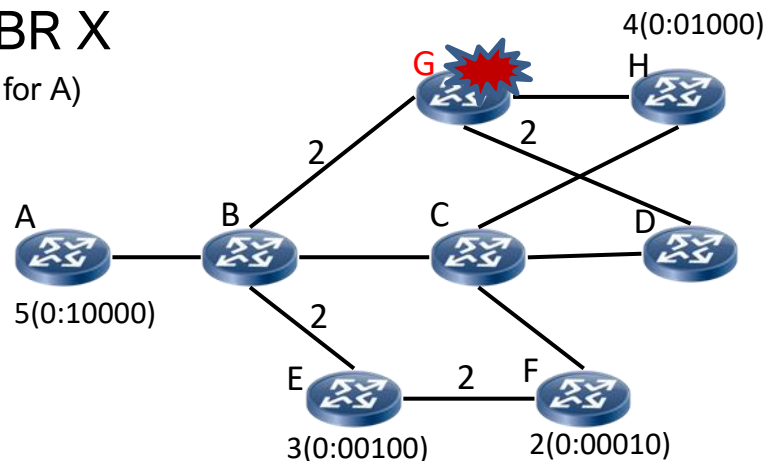
BIER FRR Details – FRR-BIRTs

- Every BFR has an FRR-BIRT for each its NBR X

(e.g., B has FRR-BIRT for G, FRR-BIRT for C, FRR-BIRT for E, and FRR-BIRT for A)

- FRR-BIRT for X has a route to each BFER **without going X** (as X fails)

(e.g., FRR-BIRT for G on B has route to H by C **without going G** as G fails)



Building FRR-BIRT for X on BFR (e.g., building FRR-BIRT for G on B)

1. Copy BIRT to FRR-BIRT for X
2. Change BFR-NBR **X** in FRR-BIRT for X to a **Backup Next Hop (BNH)**, protecting X. (If no BNH for X, X may be changed to NULL.)

BNH is Loop-Free Node-Protecting Alternate (**LFA**) to protect against the failure of **X** and link from the BFR to X.

BIER FRR Details – FRR-BIRTs Example

Building FRR-BIRT for **C** on BFR B

1. Copy BIRT to FRR-BIRT for **C**

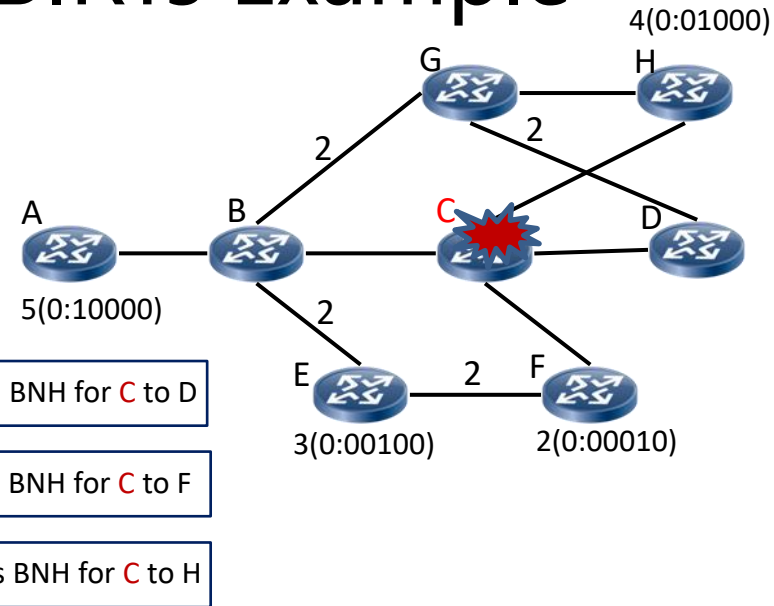
FRR-BIRT for **C**
copied from BIRT

BFR-id (SI:Bitstring)	BFR-Prefix of Dest BFER	BFR-NBR (Next Hop)
1(0:00001)	D	C
2(0:00010)	E	C
3(0:00100)	E	E
4(0:01000)	H	C
5(0:10000)	A	A

G is BNH for **C** to D

E is BNH for **C** to F

G is BNH for **C** to H



2. For **each BFER** (e.g., **D, F, H**) with BFR-NBR **C**, get a BNH and change **C** to the **BNH**.

FRR-BIRT for **C**

FRR-BIRT for **C**

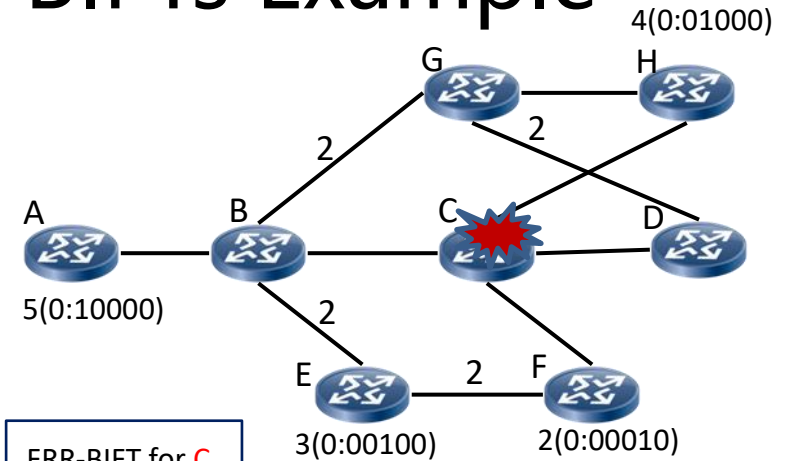
BFR-id (SI:Bitstring)	BFR-Prefix of Dest BFER	BFR-NBR (Next Hop)
1(0:00001)	D	G (from C)
2(0:00010)	E	E (from C)
3(0:00100)	E	E
4(0:01000)	H	G (from C)
5(0:10000)	A	A

BFR-id (SI:Bitstring)	BFR-Prefix of Dest BFER	BFR-NBR (Next Hop)
1(0:00001)	D	G
2(0:00010)	F	E
3(0:00100)	E	E
4(0:01000)	H	G
5(0:10000)	A	A

BIER FRR Details – FRR-BIFTs Example

An FRR-BIFT is derived from an FRR-BIRT (in same way as BIFT from BIRT). E.g.,

FRR-BIFT for C derived from FRR-BIRT for C



FRR-BIRT for C

BFR-id (SI:Bitstring)	BFR-Prefix of Dest BFER	BFR-NBR (Next Hop)
1(0:00001)	D	G
2(0:00010)	F	E
3(0:00100)	E	E
4(0:01000)	H	G
5(0:10000)	A	A

F-BM for D and H
= 00001 OR 01000
= 01001

FRR-BIFT for C
derived from
FRR-BIRT for C

BFR-id (SI:Bitstring)	F-BM	BFR-NBR (Next Hop)
1(0:00001)	01001	G
2(0:00010)	00110	E
3(0:00100)	00110	E
4(0:01000)	01001	G
5(0:10000)	10000	A

00001 OR

01000

B forwards packets using FRR-BIFT for C when C fails

Updated Forwarding Procedure

Packet = the packet received by BFR;

```
FOR each BFER k (from rightmost in Packet's BitString) {  
  IF BFER k is the BFR itself {  
    copies Packet, sends the copy to the multicast  
    flow overlay and clears bit k in Packet's BitString  
  } else {  
    finds the row in FRR-BIFT for the sub-domain using  
    Packet's SI and BitString as the key/index  
    IF BFR-NBR in the row is not NULL {  
      Copies Packet, updates copy's BitString by ANDing  
      it with F-BM in row, sends updated copy to BFR-NBR  
    } // BFR-NBR == NULL, not sent Packet to BFR-NBR  
    updates Packet's BitString by ANDing it with the  
    INVERSE of the F-BM in the row  
  }  
}
```

This update is optional.

For packet to a BFER with no route, packet is dropped if option is used;
Otherwise, packet is sent to failed node.

Next Steps

- Welcome comments