BIER Egress Protection

draft-chen-bier-egress-protect-00

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Introduction

BIER Egress Protection (EP)

• Fast protection for egress nodes in BIER domain

• No per-flow state in the core
BIER Egress Protection (EP) Idea

1. Configure backup egress to protect an egress (e.g., H is configured to protect D on D)
2. Egress distributes its backup to its neighbors (e.g., D distributes “H backup D” to C and G)
4. Forwards packets using EP-BIFT for egress (e.g., D) when egress fails, to backup egress, sending packets to CE receiver.
Build EP-BIRTs

- Each neighbor of egress Y has an EP-BIRT: EP-BIRT for Y
  (e.g., C and G are neighbors of D, C has EP-BIRT for D, G has EP-BIRT for D)

- EP-BIRT for Y has route to Y’s backup egress without going Y (as Y fails), and backup information for Y
  (e.g., EP-BIRT for D on C has route to H without going D as D fails, backup information for D is \{EP=1, BE-BFER = H\}, meaning D as egress is protected by backup egress H)

Building EP-BIRT for Y on BFR (e.g., building EP-BIRT for D on C)

1. Copy BIRT to EP-BIRT for Y,
2. Add backup information to EP-BIRT for Y

Row with BFER = Y and BFR-NBR = Y has backup information \{EP=1, BE-BFER=BFR-id of backup egress\}. Each of other rows has \{EP=0, BE-BFER=NULL\}. 
Building **EP-BIRT** for **D** on BFR C

1. **Copy BIRT to EP-BIRT for D**

<table>
<thead>
<tr>
<th>BFR-id (SI:Bitstring)</th>
<th>BFR-Prefix of Dest BFER</th>
<th>BFR-NBR (Next Hop)</th>
<th>EP-BIRT for D copied from BIRT</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(0:00001)</td>
<td>D</td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>2(0:00010)</td>
<td>F</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>3(0:00100)</td>
<td>E</td>
<td>F</td>
<td></td>
</tr>
<tr>
<td>4(0:01000)</td>
<td>H</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>5(0:10000)</td>
<td>A</td>
<td>B</td>
<td></td>
</tr>
</tbody>
</table>

2. **Add backup information to EP-BIRT for D**

<table>
<thead>
<tr>
<th>BFR-id (SI:Bitstring)</th>
<th>BFR-Prefix of Dest BFER</th>
<th>BFR-NBR (Next Hop)</th>
<th>{EP, BE=BFER} (Backup info)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1(0:00001)</td>
<td>D</td>
<td>D</td>
<td>EP=1, BE=BFER=H</td>
</tr>
<tr>
<td>2(0:00010)</td>
<td>F</td>
<td>F</td>
<td>EP=0, BE=BFER=0</td>
</tr>
<tr>
<td>3(0:00100)</td>
<td>E</td>
<td>F</td>
<td>EP=0, BE=BFER=0</td>
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<td>4(0:01000)</td>
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</tr>
<tr>
<td>5(0:10000)</td>
<td>A</td>
<td>B</td>
<td>EP=0, BE=BFER=0</td>
</tr>
</tbody>
</table>

Row with **BFER = D** and **BFR-NBR = D** has **{EP=1, BE=BFER=H}**
EP-BIFTs

EP-BIFT is derived from EP-BIRT (similar to BIFT from BIRT)

Rows with same SI,BFR-NBR and backup information, have F-BM = OR of BitStrings in rows

C forwards packets using EP-BIFT for D when D fails

Packets to D are sent to backup egress H, delivering them to CE
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 EP-BIFT for the sub-domain using
        Packet’s SI and BitString as the key/index
        IF EP == 1 {
            clears bit k in Packet’s BitString; // BFR k is PE-BFER
            adds bit j in Packet’s BitString; // BFER j is BE-BFER
        }
        ELSE {
            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
}

When egress k fails, if it is protected (EP==1), then
packet to k is not sent to k (by clearing bit k), but
Is sent to k’s backup egress j (by adding bit j)
Next Steps

* Welcome comments