Designed Routing in BIER Forwarding
draft-zhang-bier-designed-routing-00

BIER WG
IETF94# Yokohama

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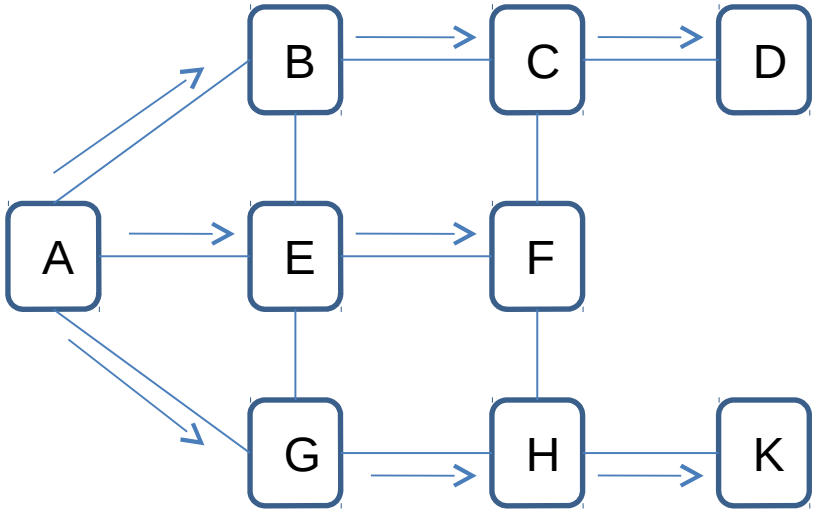
Problem Statement

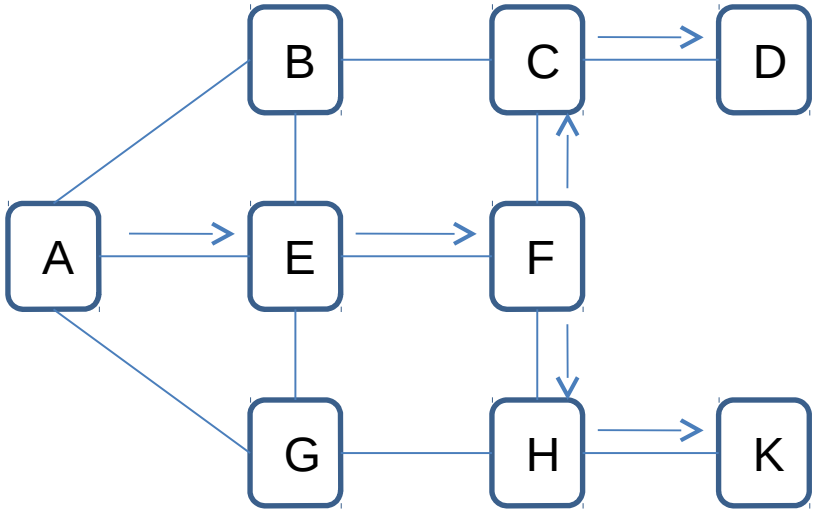
- BIER forwarding(BIER-Arch)



• Suppose a multicast flow, ingress node is A, egress nodes are D, F and K.
• According to the shortest path forwarding, the multicast flow will be forwarded through paths: A—B—C—D; A—E—F, A—G—H—K. Obviously, it is not a optimal route.

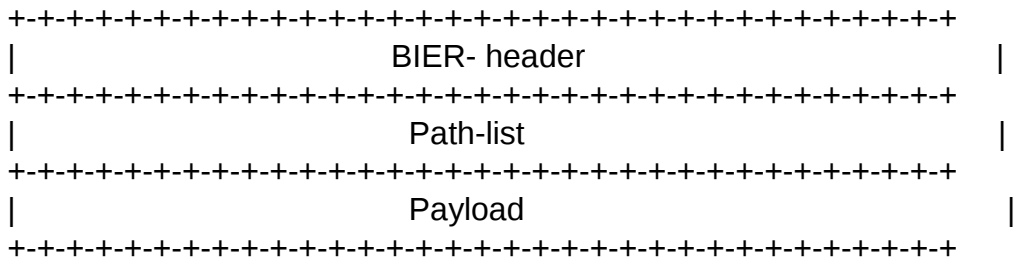
Problem Statement

- BIER forwarding(Optimal)



- The optimal path, A—E—F—C/H—D/K
- Problem: How to forward the packet through the optimal path?

Solution

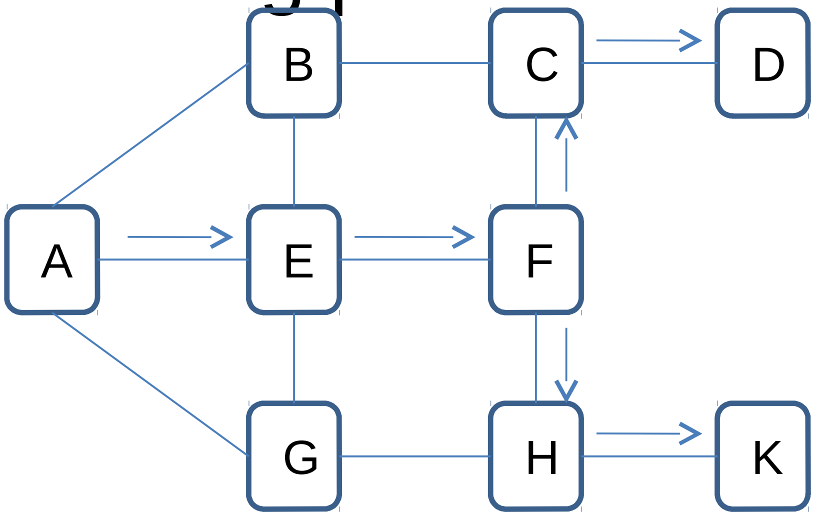


- The packet will be encapsulated by path-list.
- There is a flag in the BIER header, it indicate that there is a path-list b ehind the BIER header.
- The path-list format is a new type TLV.

- The packet will be forwarded by the nodes according to the BIER forw arding table and the path-list.
- Every node on the path-list will treat the path-list in special method.

Solution Statement

- Forwarding packet



Path-list:
A
|
E
level1
|
F
level2
|
C/H
level3
|
D/K
level4

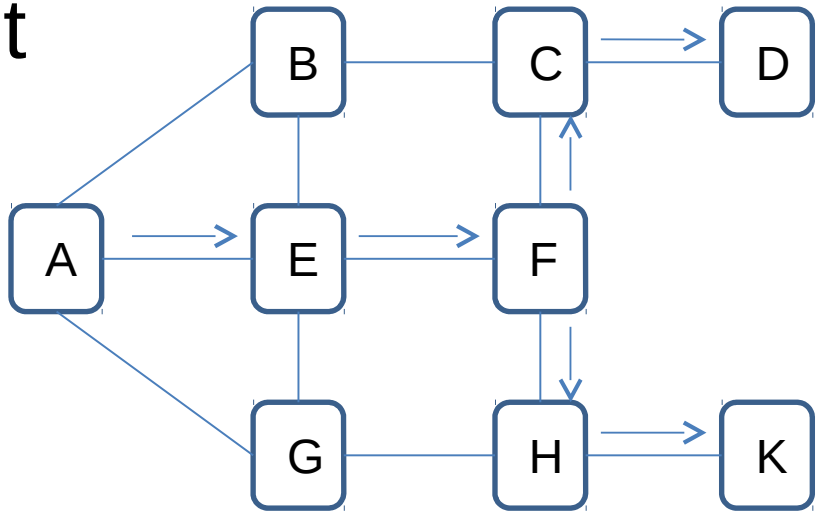
The path-list is encapsulated:

```
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |      Current level :1              |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
    |      Bit String Length              |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
+-+
    |      level : 1     |              Bit String : E
 |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
+-+
    |      level : 2     |              Bit String : F
 |
    +-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-
+-+
```

- For the ingress node A: Level1, E; Level2, F; Level3, C/H; Level4, D/K.
- The nodes are classified by the distance from the ingress node.
- Use a flag in Reserved field to indicate that there is a path-list behind the BIER header.

Solution Statement

- Path-list



• A checks the path list, forwards the packet to level 1 node E, then, changes the current level to 2. The destinatio
is D/F/K.

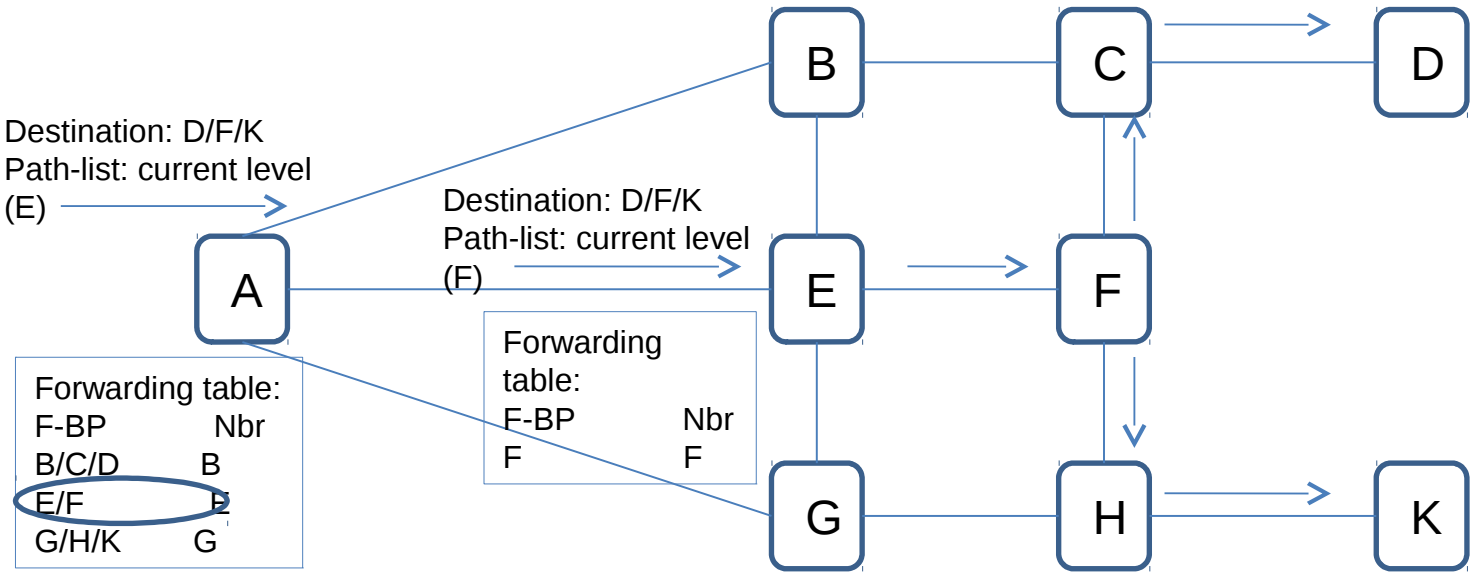
• E checks the path list, forwards the packet to level 2 node F, then, changes the current level to 3. The destinatio
is D/F/K.

• F decapsulates the packet and forwards out.
• F checks the path list, forwards the packet to level 3 node C, then, changes the current level to 4. The destinatio
is D.
• F checks the path list, forwards the packet to level 3 node H, then, changes the current level to 4. The destinatio
is K.

• C checks the path list, forwards the packet to level 4 node D, then, changes the current level to 5. The destinatio
is D.

Solution Statement

- Forwarding algorithm

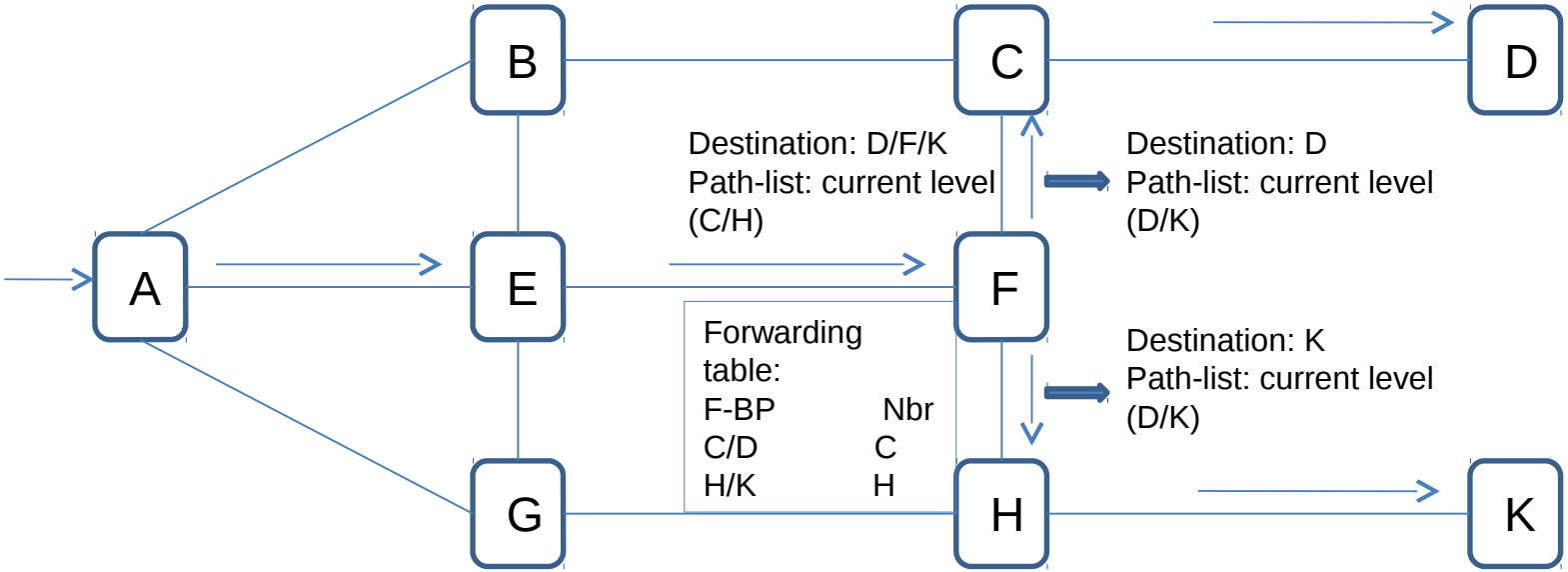


• A finds that it should forward the packet to E according to the path-list, A picks the item “E/F” which next-hop is E out from the forwarding table;
• A uses the destination ”D/F/K” AND the item “E/F”. Gets the result and INVERSE it, then AND the destination, gets the “Resv-nodes” which includes “D/K”.
• A uses the destination ”D/F/K” AND the item “E/F”, and OR the “Resv-nodes””D/K”, then forwards the packet to E.
• The process in E is similar.

PS, What are “Resv-nodes”?
• When node forwards packet according to the picked items in BIER forwarding table, some of the destination may be lost. We should get them back. These lost nodes named “Resv-nodes”.

Solution Statement

- Forwarding algorithm



•When the packet reaches F, because F is one of the egress nodes, F decapsulates the packet and forwards out. The destination changes to “D/K”;

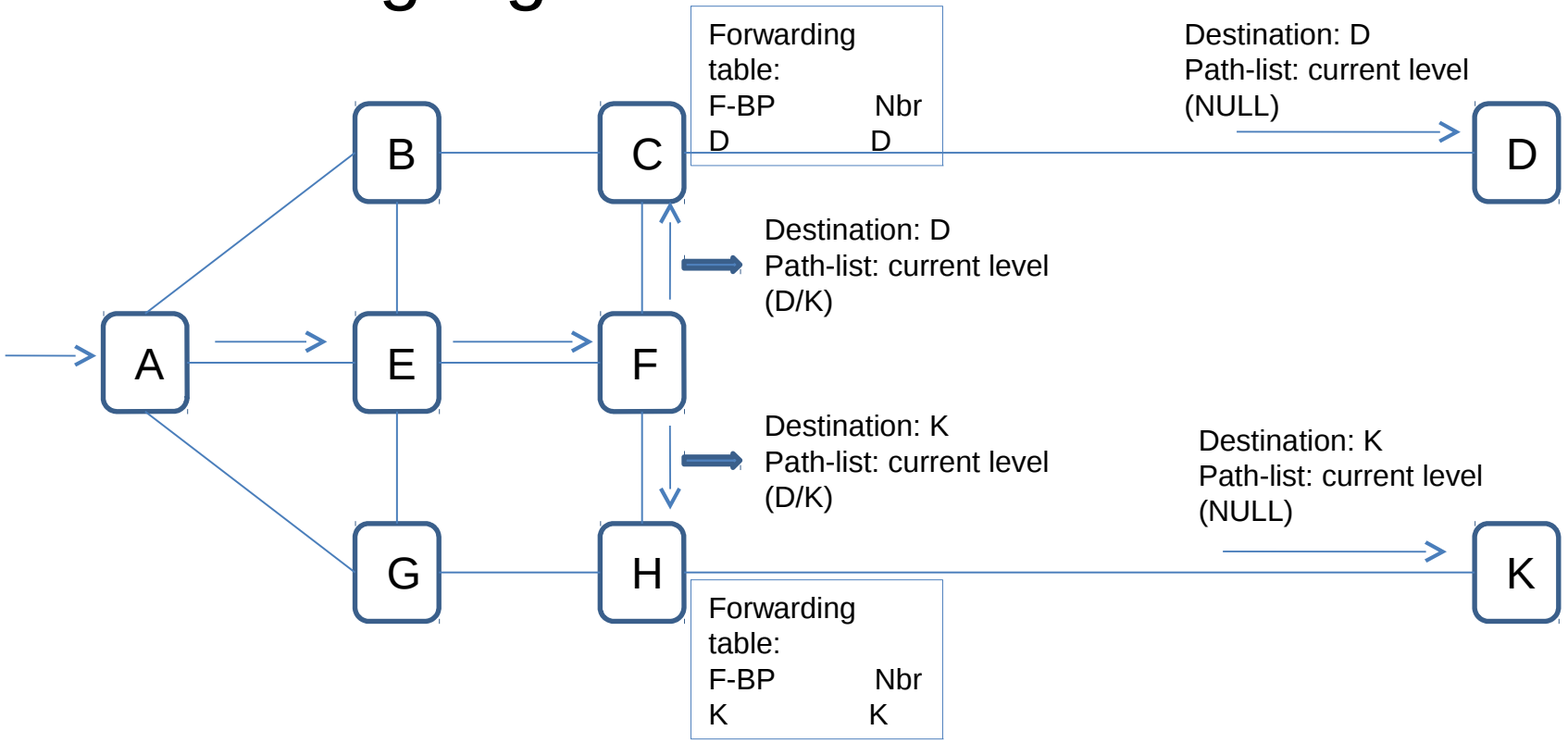
• F picks out two items, “C/D” which next-hop is C; “H/K” which next-hop is H.

• F uses the destination “D/K” AND the item “C/D”, gets “D”; F uses the “D/F/K” AND the item “H/K”, get “K”. Mix the two result, gets “D/K”. Then INVERSE the mixed result, AND the destination “D/K”, then the “Resv-nodes” is NULL.

• F uses the destination D AND the item”C/D”, gets the result, OR the “Resv-nodes”, gets “D”, then forwards the packet to D.

Solution Statement

- Forwarding algorithm



- The packet reaches C, C picks out the items “D” which next-hop is D.
- C uses the destination “D” AND the item “D”, gets “D”; Then INVERSE the result, AND the destination “D”, then the “Resv-nodes” is NULL.
- C uses the destination “D” AND the item ”D”, gets the result, OR the “Resv-nodes”, get “D”, then forwards the packet to D.
- The process in H is similar.

- Advantage

• The forwarding table is the same as the table that is defined in BIER-Arch.

• The bitstring in path-list is the same as the bitstring that is defined in BIER-Arch.

• When the crossover node is as close as possible to the egress nodes, the forwarding will be most efficient.

- Any comments are welcome

Thanks!