CE6390 – HW2
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1. DVMRP
    a) IN RPB, these are the parent router for each LAN w.r.t. S,
        LAN a: R9
        LAN b: R8
        LAN c: R4
        LAN d: R6
        LAN e: R2
        LAN f: R3
        LAN g: R1
        LAN h: R3
        LAN i: S
    b) Leaf LANs
        LAN a, b and g are leaf LANs and only LAN b and LAN g will be truncated.
    c) Non-membership reports,
        The parents of LAN b and g (R8 and R1, respectively) will first send non-membership reports to their parent LANs (LAN d and e). Also, R7 and R5 will send NMR since they are leaf routers (no children)
    d) Multicast message
        Multicast messages will be seen in the following LANS
        - LAN i, LAN f, LAN h, LAN d, LAN e and LAN a. (LAN c will be truncated by the NMR from R7)

2. DVMRP

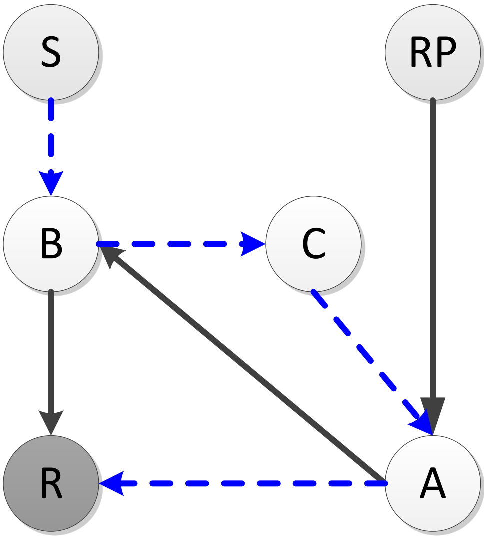
Since we are not using DV (with split horizon and poisoned reverse) for our unicast protocol, our mechanism for determining parent router for each LAN will be changed. Also, we will need something else to determine whether there is another router listening on my “child” LAN. So they would have to create special message to exchange such information between routers on a same LAN.

3. MOSPF

This is what will be cached by the routers once S starts sending multicast messages to R’s. (Note that I used LAN# to denote iff).

R1: (S, G, e, {(g, ∞)}), (S, G, g, {(e, 0)})
R2: (S, G, e, {(h, 3)}), (S, G, h, {(e, 0)})
R3: (S, G, f, {(h, 1), (i, ∞)}), (S, G, h, {(f, 2), (i, ∞)}), (S, G, i, {(f, 2), (h, 1)})
R4: (S, G, c, {(e, 0)}), (S, G, e, {(c, 2)})
R5: (S, G, d, {(e, 0)}), (S, G, e, {(d, 1)})
R6: (S, G, d, {(f, 2)}), (S, G, f, {(d, 1)})
R7: (S, G, b, {(c, 1)}), (S, G, c, {b, 1})
R8: (S, G, a, {(b, 2), (d, 1)}), (S, G, b, {(a, 0), (d, 1)}), (S, G, d, {(a, 0), (b, 2)})
R9: (S, G, a, {(d, 1)}), (S, G, d, {a, 1})

4. PIM



Let's consider the above diagram. The SPT tree is shown by the dashed line and RPT is shown by the solid line. As we can observe, there is a loop formed among A, B and C. Once B receives a packet from S, it recognizes that SPT is active, and send packets to both R and C. Yet, B will prune itself from RPT (which will cause A to also prune itself from RPT – but we can assume that there are other receivers attached to A). Since B is forwarding packets to both R and C. Especially, packets forwarded to C will be forwarded again to A then be forwarded to R again (but A will not send to B, since B pruned itself from RPT). So, at the end, R will receive duplicate copies in this case

5. Inter-domain multicast

a) Steps for a receiver to receive multicast packet via SPT

1. Receiver R, say at AS D, joins RP at AS D (we denote this RP(G, D))
2. Sender S, say at AS A, joins RP at AS A.
3. MSDP informs other RP's about S through Source Active (SA) message.
4. RP(G, D) joins SPT, rooted at DR of S.
5. If desired (which we do in this case), DR of R also joins SPT of S and prunes itself from RPT rooted at DR of S.
6. Now R receives multicast message from S via optimal path from R to S (NOT S to R)

b) i) when the router receives Join(*, X), it will forward Join(*, X) to the next-hop router to RP(X)

ii) There is no such thing as Join(*, Y), so it will be ignored.

iii) When the source sends multicast to X, the router will determine whether it is from SPT or RPT. If came from RPT, it will only forward the message via RPT. If came from SPT, it will forward the packet to both SPT and RPT.

iv) When the router receives a multicast message from the channel (S, Y), it will forward the message to all the routers who subscribed to this channel and runs IGMPv3)

6. AODV

No, loop cannot be formed. Let us assume that loop is formed among nodes, A -> B -> C -> A.
From the protocol, we know that seq(A)≤seq(B)≤seq(C) and hop-count(A) > hop-count(B) > hop-count(C). Even if seq(A) can be equal to seq(C), hop-count(C) cannot be greater than hop-count(A). So, whether a router forgot about D or not, C->A path cannot exist.

7. DSR

Assuming that optimum path always yield shortest delay for all packets, we can find the optimum path from source to destination. We can simply send the source the RREQ that was received the first. Yet, we cannot assume that optimum path will always deliver the packet the first.
Also, the network topology is very dynamic. The optimum path at the time of RREQ might not be one anymore.

8. MPLS

a) If destination-based forwarding, all we need to care is next-hop router. So it is better to merge labels to save space.
b) Each LSR can use explicit routing so that at destination, it can figure out the source of the message.