Overview of TRILL Active-Active Goals, Challenges, and Proposed Solutions

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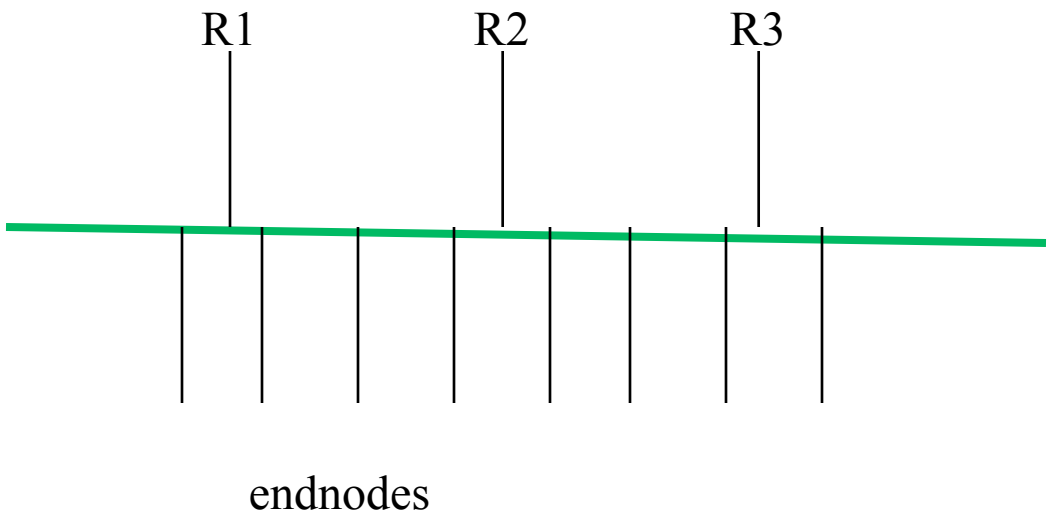
Don’t we have “appointed forwarders”?



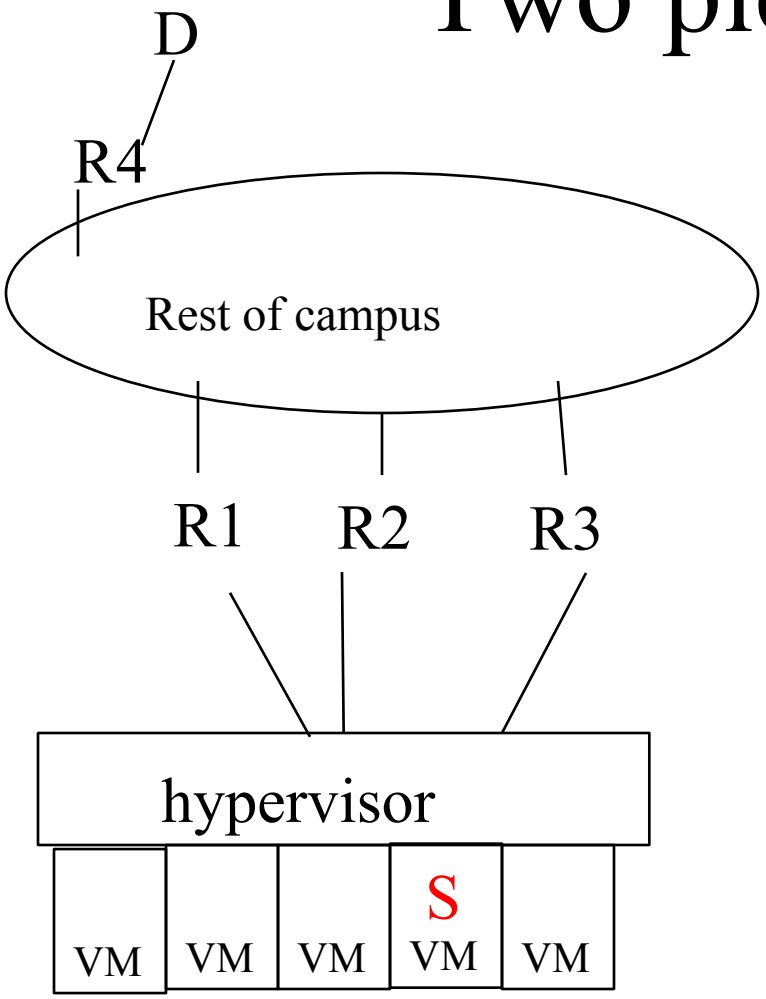
R1, R2, and R3 can all forward. DRB assigns work, based on VLANs
But requires R1, R2, R3 all carefully coordinated, all see all packets

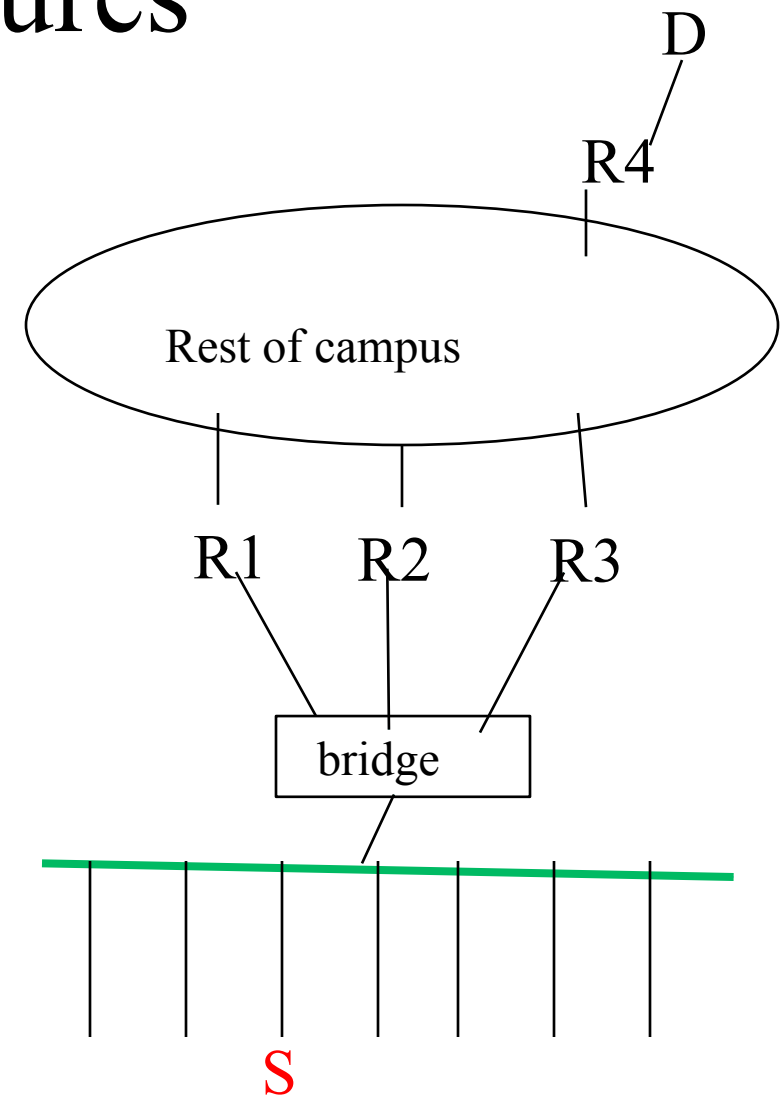
The active-active stuff being discussed in different

The “active-active” stuff

- Multiple RBridges, {R1, R2, R3} attached to a bunch of endnodes
- But when a packet is forwarded from the bunch of endnodes, only one of {R1, R2, R3} sees that packet
- And {R1, R2, R3} cannot easily talk to each other (they are not on a common link)

Two pictures





(Presumed) Rules for forwarding upwards

- Same “flow” go to the same next hop
- Otherwise, basically random
- Multidestination might go to any of the next hops
- And nothing is forwarded (by hypervisor or bridge) between the up-links

Goals (“would be nice”)

- Probably we won’t find any solutions that meet all the goals

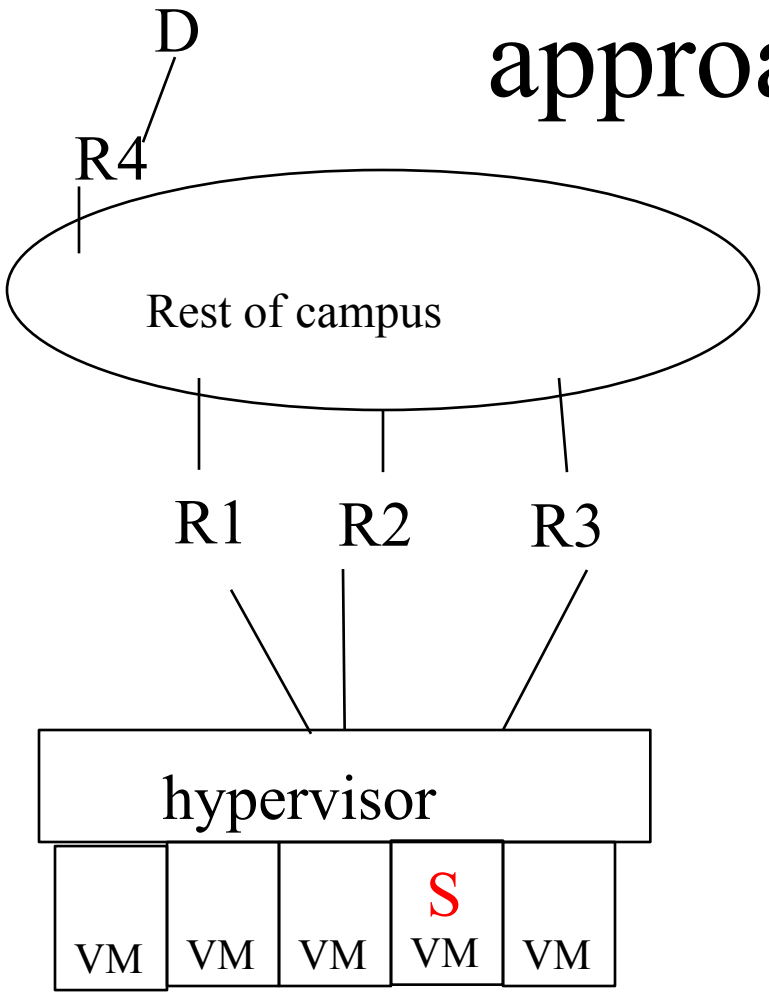
Goals ("would be nice")

- All up-links active
- If S sends to distant node D, D → S traffic should enter S via link closest to D, regardless of which up-link was used for path S → D
- Have D → S traffic take same path as S → D traffic (note: directly conflicts with above goal)
- R4 (or D) shouldn't keep changing its mind about which RB S is connected to
- Packets for a flow should stay in order

Goals ("would be nice")

- No need to change entire campus at once (perhaps only need to change {R1, R2, R3}, maybe R4.
- Works with all existing silicon
- RPF check on multi-destination works (doesn't falsely drop packets)

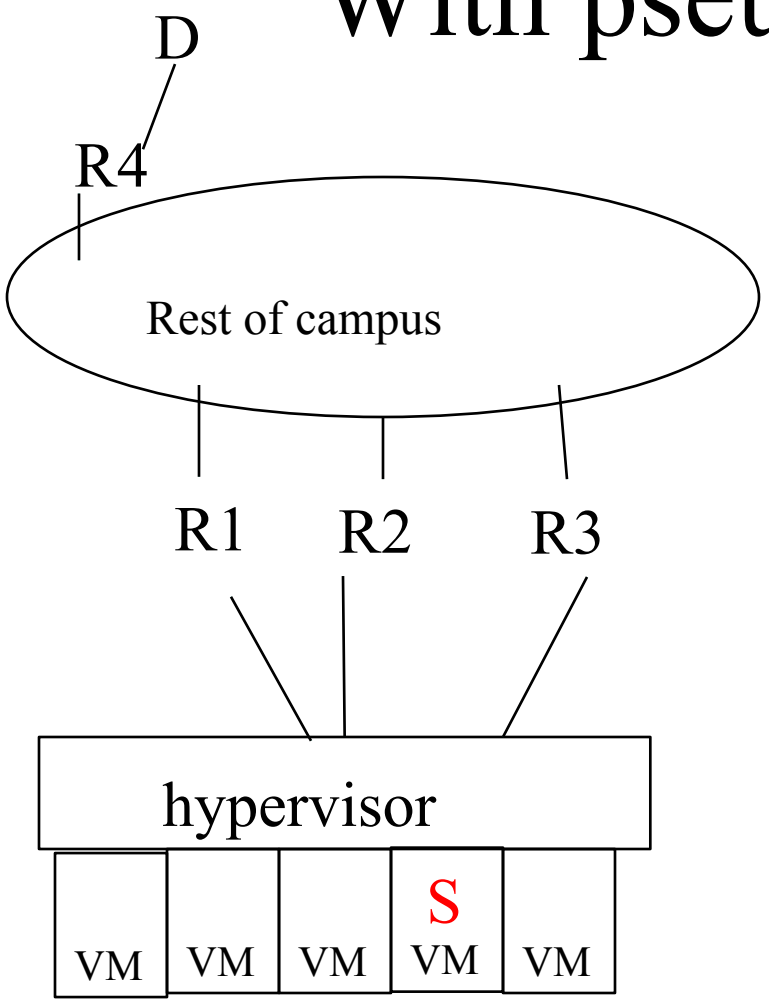
What's wrong with naïve approach?



When S sends via R1, "first RB" field=R1, etc.

Problem: R4 will return via same up-link (possibly not optimal one), and R4 will keep switching its endnode table for S if traffic from S comes via R2, R3,…

With pseudonode



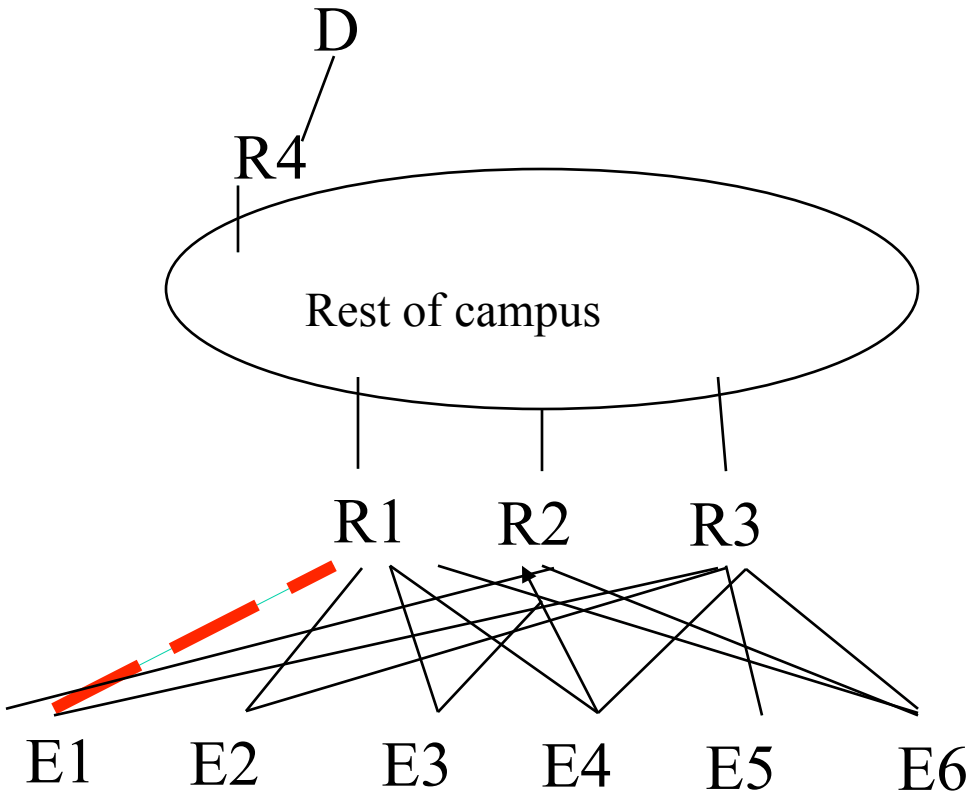
R1, R2, R3 agree (somehow) on a pseudonode nickname for the set of MACs reachable from {R1, R2, R3}, let's say "79"

Always encapsulate with 1st RB=79

Pseudonode

- R1, R2, R3 claim they are attached to “79”
- Use “79” as ingress when receive from their uplink
- All endnodes attached to R1, R2, R3 look like they are reachable via 79

Problem: What if E1's link to R1 dies?



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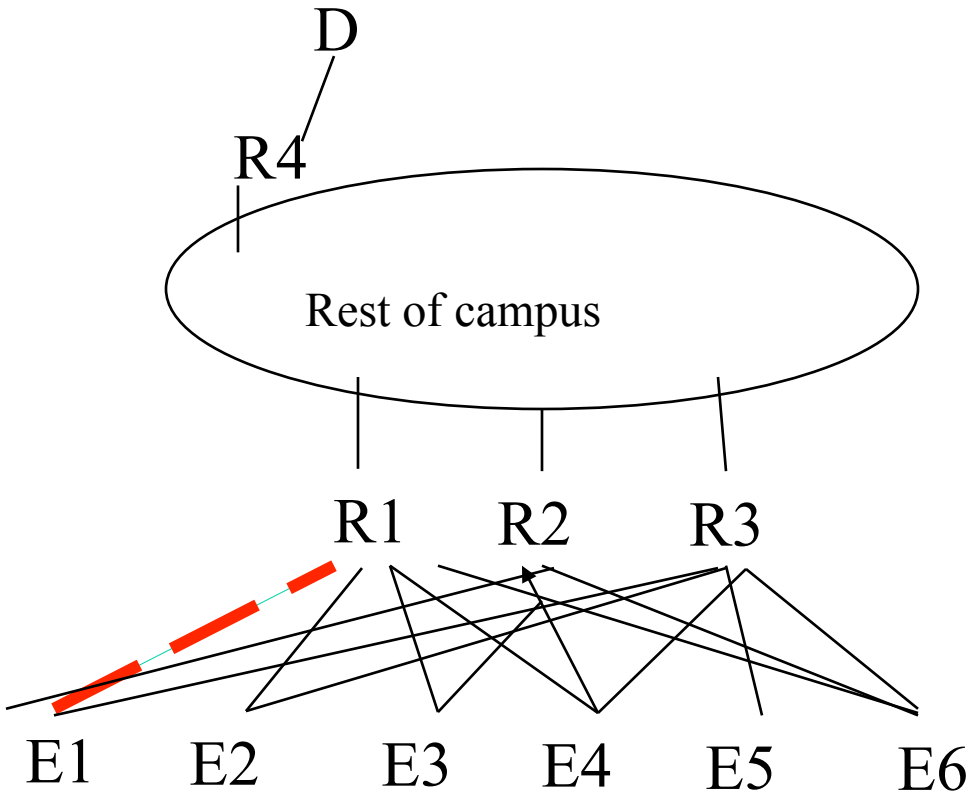
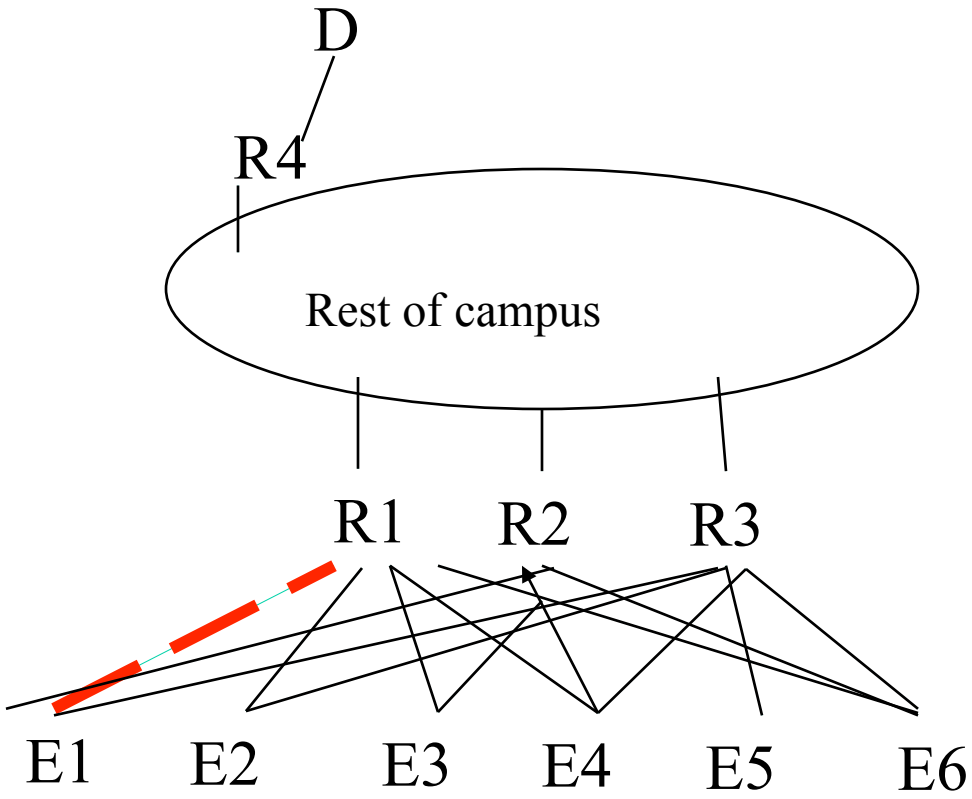


If R3 uses pseudonode "79" when sending to D, return traffic to E1 might go via R1, and fail

Problem: What if E1's link to R1 dies?

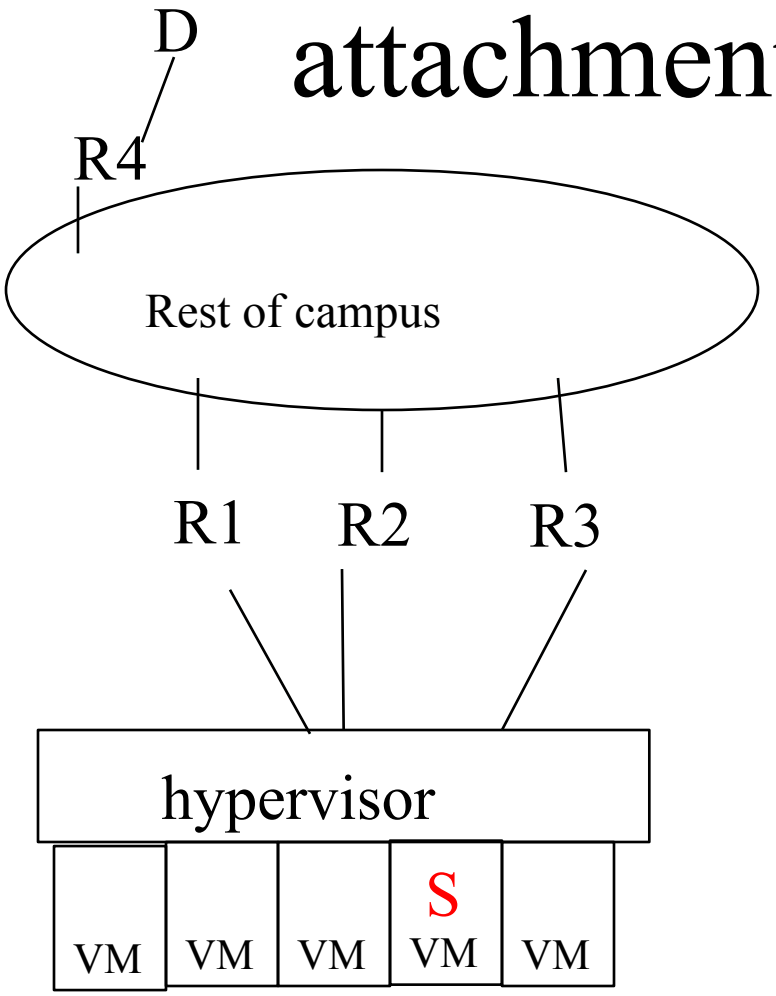


How could R3 detect this, even if there was something sensible for it to do?

Solutions?

- Ignore the problem: “hardly ever happens”
- Have R1 notice somehow and tunnel traffic for E1 to R2 or R3 (even though R1 is still connected to “79” for other endnodes)
- Don’t use pseudonode, and have distant RBs learn multiple addresses for each E, as in
  - E1 reachable via R2 (timestamp), and R3 (timestamp)
  - E2 reachable via R1 (timestamp), R2 (timestamp), and R3 (timestamp)
- ??? Any other possibilities?

Picture for "learn multiple attachments for S"



R4 keeps, for S
S located at
- R1/ last seen T1
- R2/ last seen T2
- R3/last seen T3

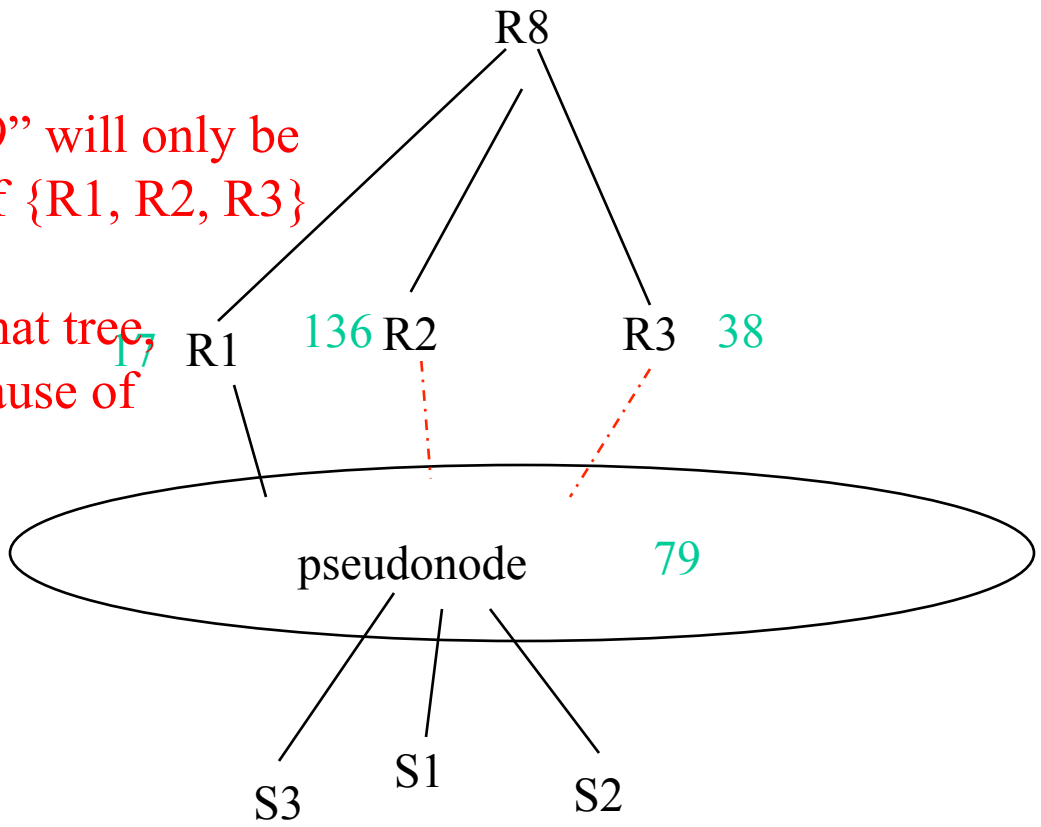
And R1, R2, R3 don't use "79", they use their own nicknames

Another problem with pseudonode: RPF check on multicast

Multidestination frames, pseudonode nickname, and the RPF check

For each tree, “79” will only be attached to one of {R1, R2, R3}

If R2 injects on that tree, R8 will drop because of RPF check



Potential solutions (assuming R3 not attached to any tree, but R1 and R2 are)

- R3 refuses to use link(s) to “79” at all (disables its port)
- R3 continues to work, but only for unicast; if a packet must be multidestination from “79”, R3 tunnels to R1 or R2
- On multicast, R3 sends, but uses “R3” for ingress instead of “79”
- Use a bit in the TRILL header to mean “I’m in multiple places” (turn off MAC flip-flop panic, or keep multiple RB attachments)
- Let’s look at pros and cons of each approach

R3 disables the port completely

- Pro: simple
- Con: very sad

R3 tunnels multidestination to R1 or R2

- Pro:
  - Simple
  - Doesn’t change anyone except {R1, R2, R3}
- Cons:
  - Maybe some silicon doesn’t support this?
  - Extra hops

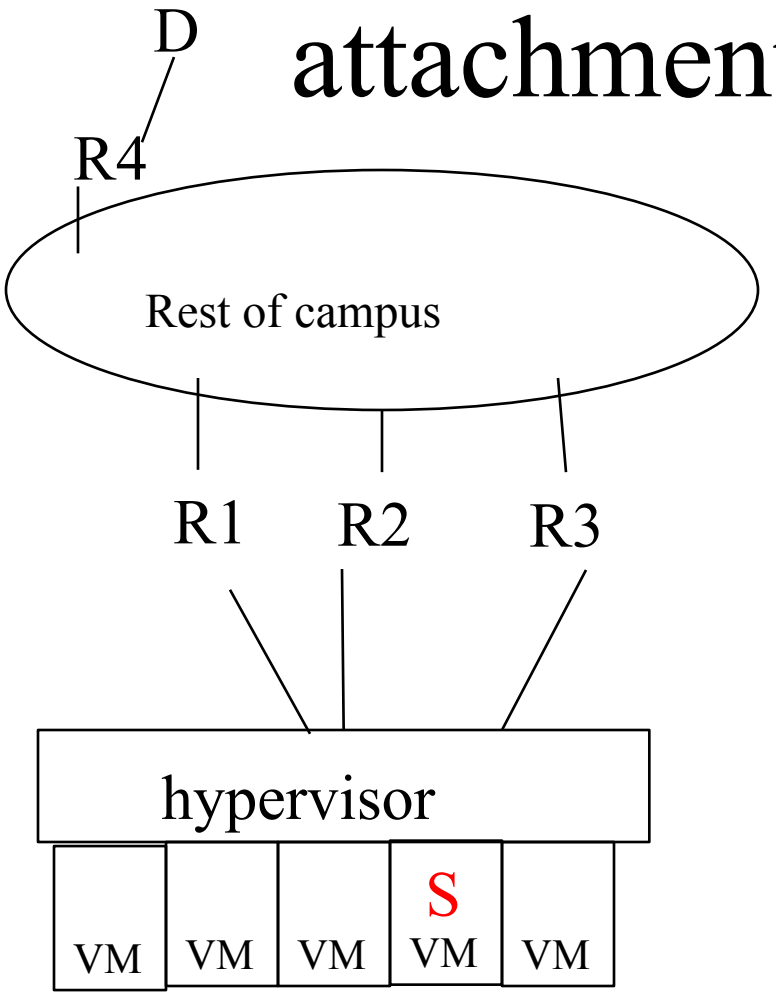
R3 uses its own nickname for multidestination ingress

- Pros
  - Simple
  - Doesn't change anyone except {R1, R2, R3}
- Cons
  - (distant) R8 sometimes learns (S,79) (on unicast), sometimes (S,R3) (multidestination through R3)

No pseudonode; learn multiple attachments

- Change (all) edge RBs to cope with E being attached to multiple places (R1, R2, and R3)
- Keeps separate timestamp for each learned attachment
- When sending to S, choose any (say nearest, or load split based on flows) of R1, R2, R3

Picture for "learn multiple attachments for S"



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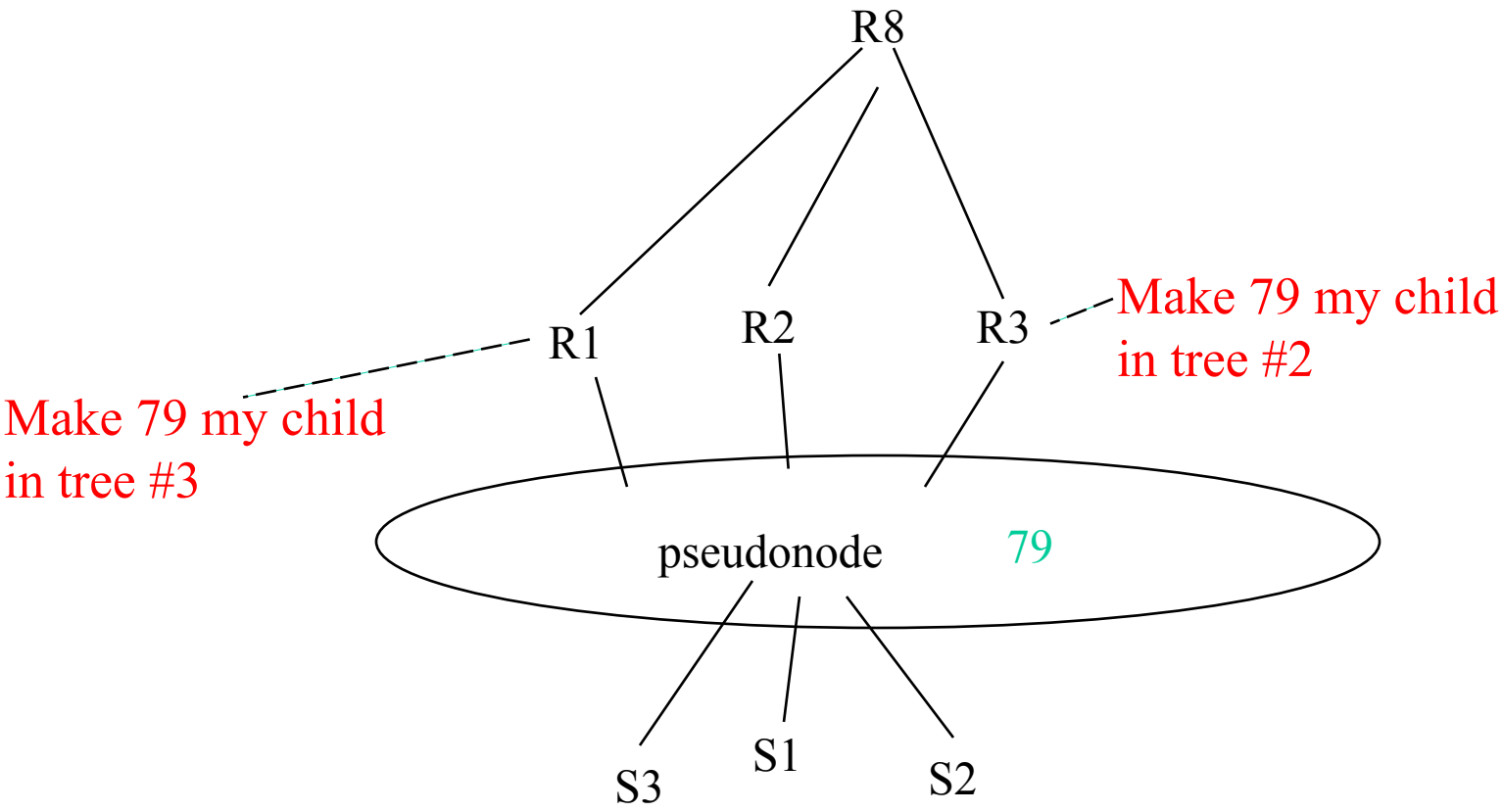
Learn Multiple attachments

- Pros
  - Less, or no, configuration required
  - Allows {R1, R2, R3} to use any multicast tree
  - No problem if E1's uplink to R1 fails
- Cons
  - Requires edge RBs to keep track of multiple attachment points for endnodes; and separately time them out; disable flip-flop panic

What's the "affinity" thing?

- It's a new TLV in IS-IS that says "for these trees, put this nickname as a child of me"

What does it do and what doesn't it do?



What does it do?

- If you have at least as many trees as up-links…
- And you configure everything properly…
- And all RBs in the campus implement this new thing…
- You will be assured that each of the uplinks has at least one tree to send on

What does it not do?

- Still have the problems mentioned earlier in the presentation
  - if fewer trees than uplinks
  - if misconfiguration
  - If one of the uplinks from some set of endnodes fails
- Requires as many trees as active uplinks. Each tree requires significant state and computation

And note: It requires all RBs in the campus to understand this new TLV and compute trees accordingly

Questions from me

- How many trees do people want?
- How many uplinks do people want?
- Do we care if an RB can't use all the campus trees?
- Do we care about misconfiguration?
- Are we worried about the problem of some uplinks failing?

Conclusions

- Lots of different aspects, and nothing addresses all of them at the same time…we can do mix and match
- No perfect solution