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

Rest of campus

R1 R2 R3

hypervisor

VM VM VM VM VM

Rest of campus

R1 R2 R3

bridge

S
(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 \(\rightarrow\) S traffic should enter S via link closest to D, regardless of which up-link was used for path S \(\rightarrow\) D  
- Have D \(\rightarrow\) S traffic take same path as S \(\rightarrow\) 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,…

Rest of campus

R1   R2   R3

hypervisor

VM  VM  VM  VM  VM
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 1^{st} 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?
Problem: What if E1’s link to R1 dies?

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
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
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?

Make 79 my child in tree #3

Make 79 my child in tree #2
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