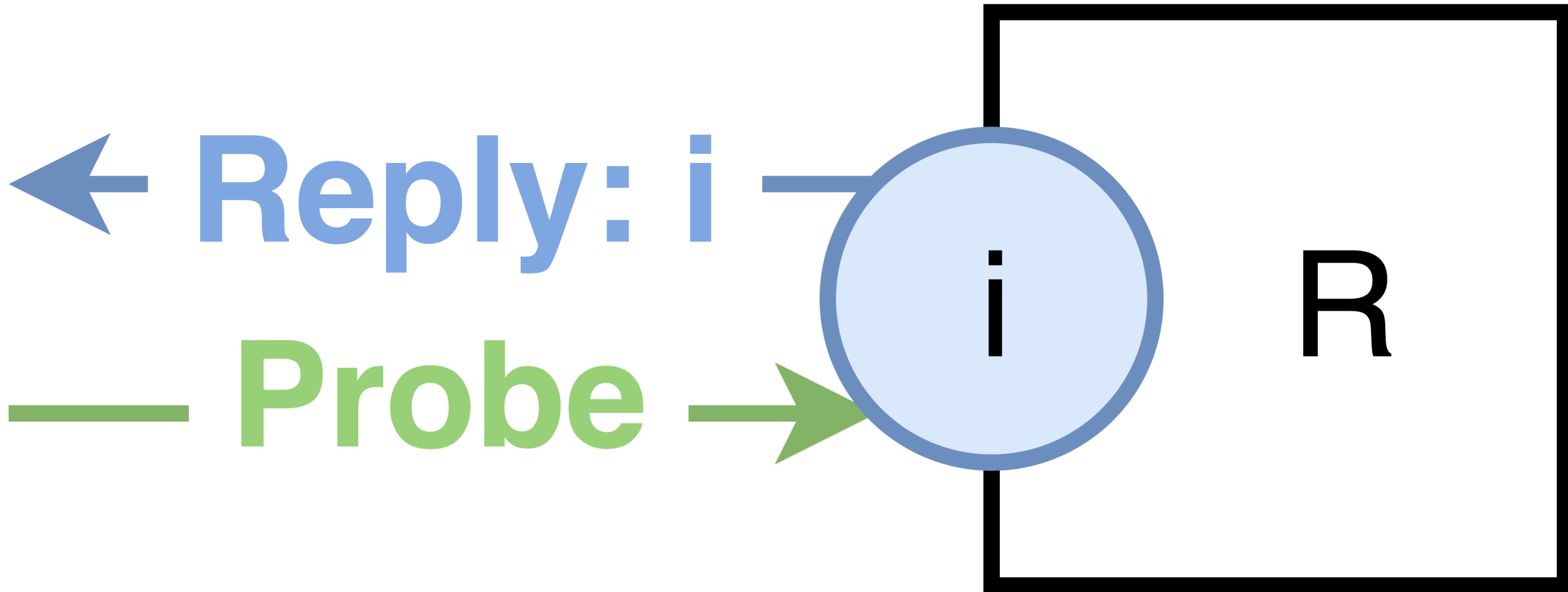


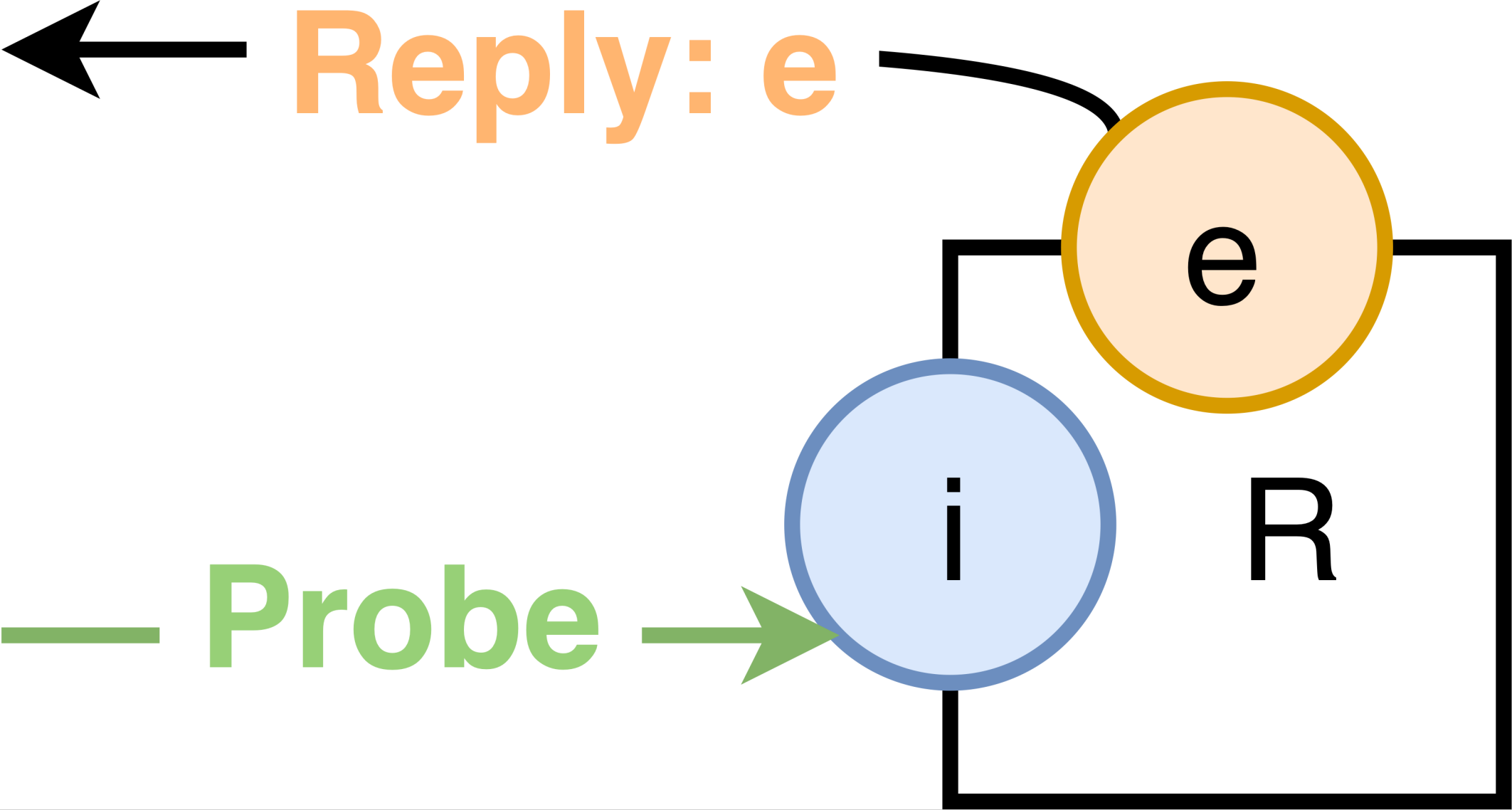
Layer 3 VPNs and Traceroute

Alex Marder, Matthew Luckie, Bradley Huffaker,
kc claffy, Jonathan M. Smith

Expected Response Types: Ingress

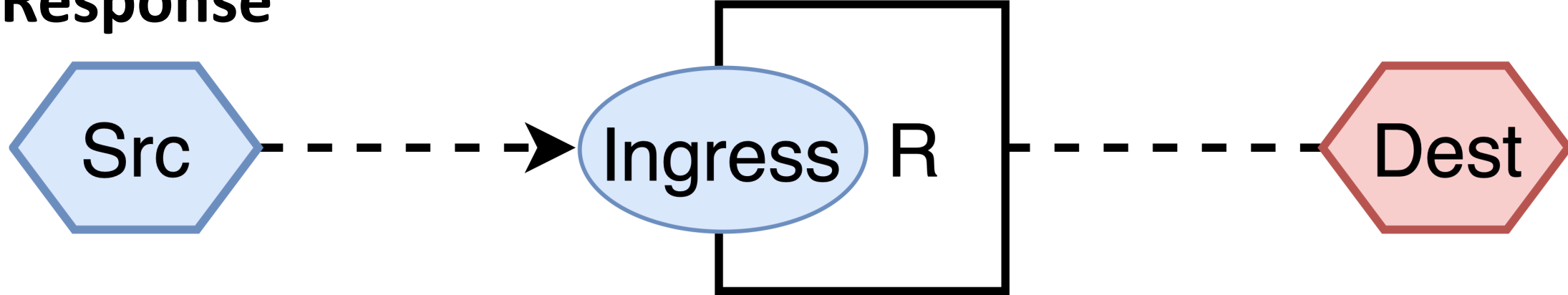


Expected Response Types: Egress

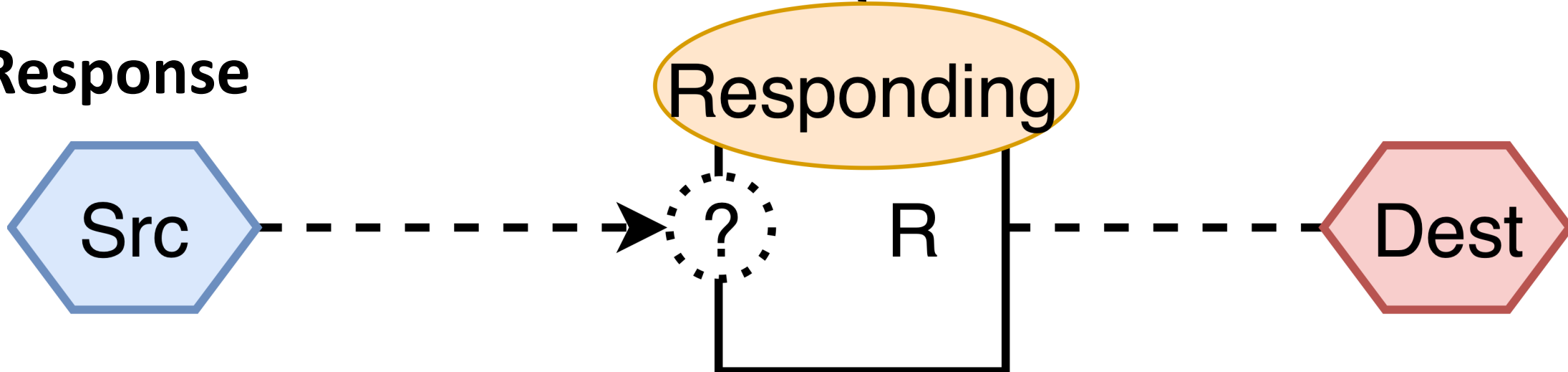


Responses Face the Traceroute Source

Ingress Response

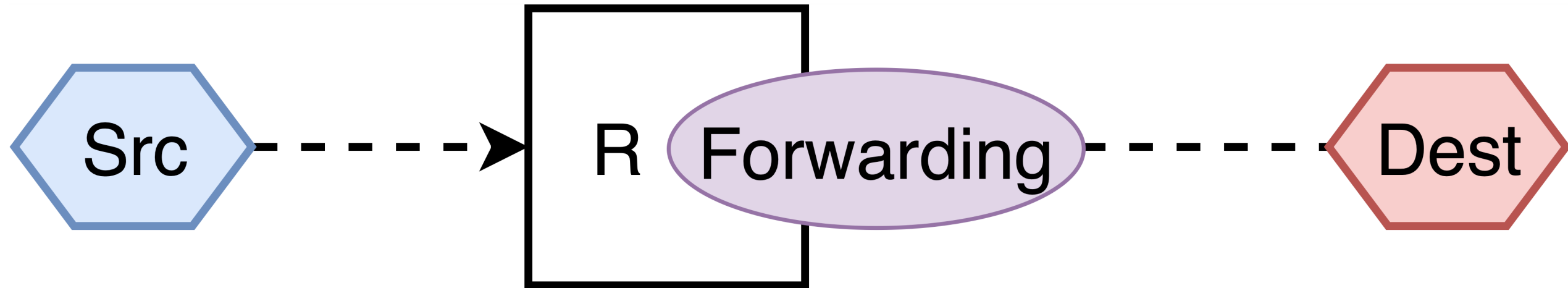


Egress Response



Responses *Do Not* Face Destination

- We don't expect the interface that would have forwarded the probe to the destination



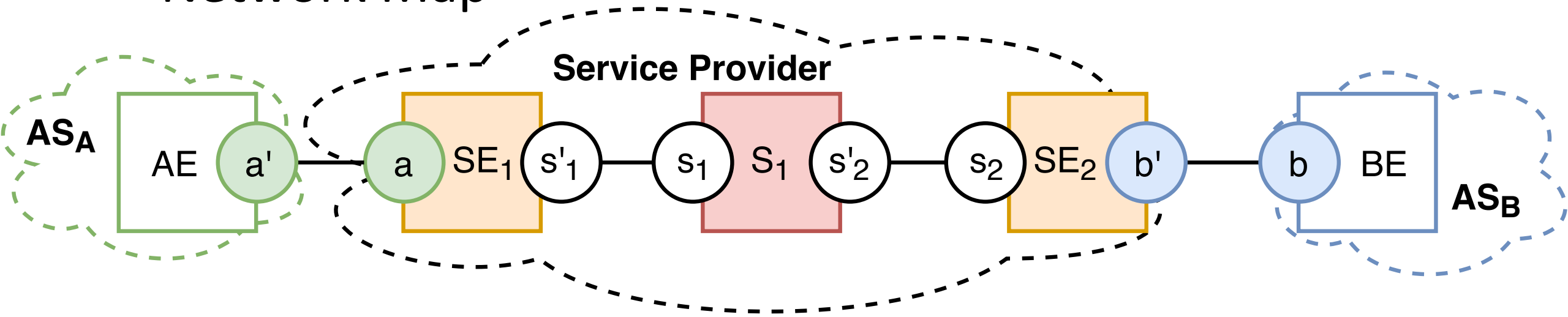
What is a Layer 3 VPN?

- Virtual IP networks that share the same physical infrastructure
 - VPN uses ISP backbone but separate forwarding tables
- Common uses
 - Connect customer sites together
 - Enable high bandwidth connection to cloud

L3 VPN: Traceroute Example

Traceroute

Network Map

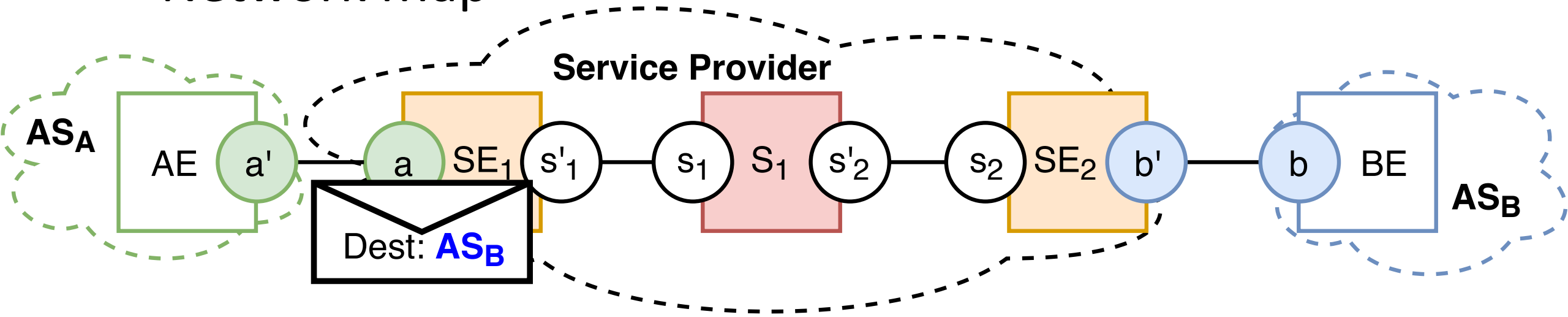


L3 VPN: Packet Sent From AS_A to AS_B

Traceroute

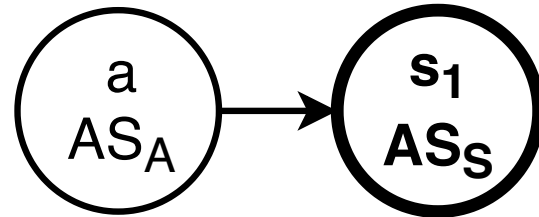


Network Map

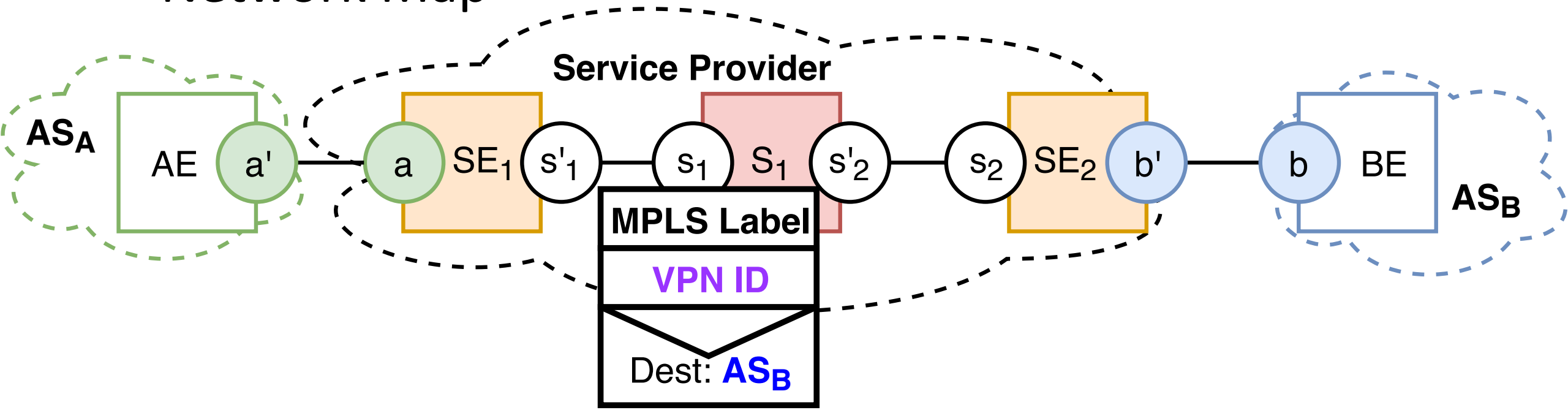


L3 VPN: Traceroute Starts Normally

Traceroute

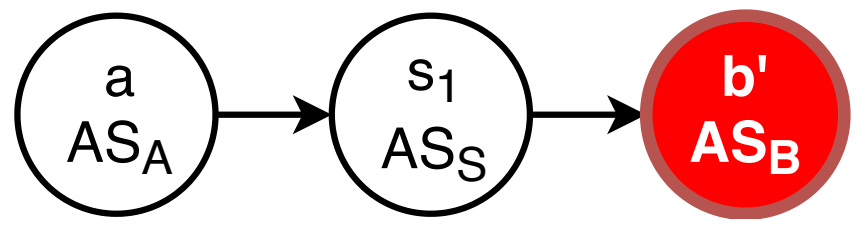


Network Map

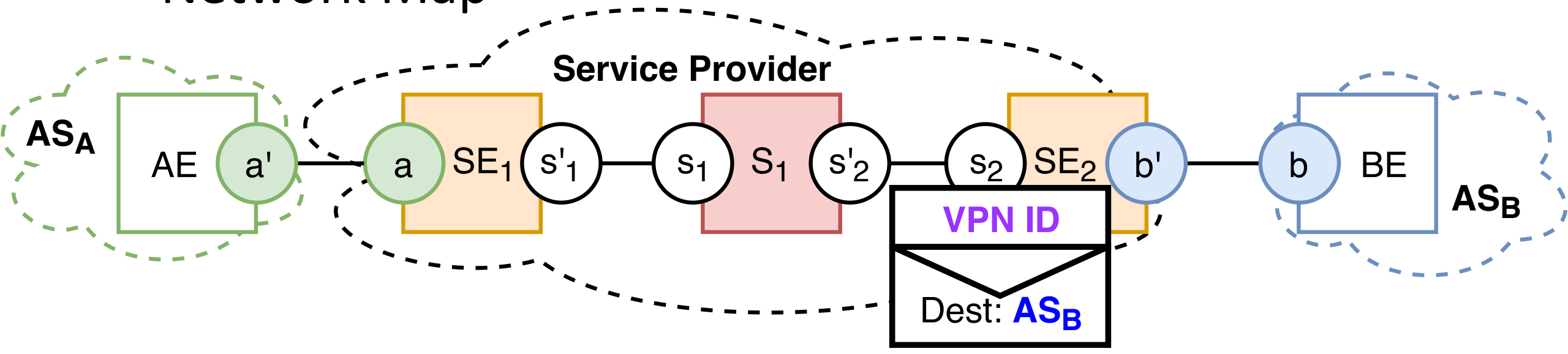


L3 VPN: Egress Virtual Forwarding (VRF)

Traceroute

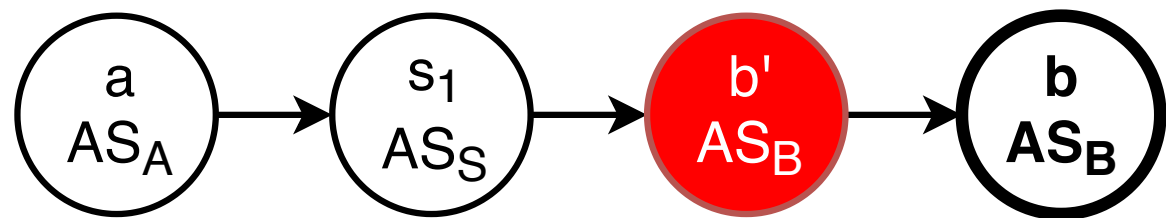


Network Map

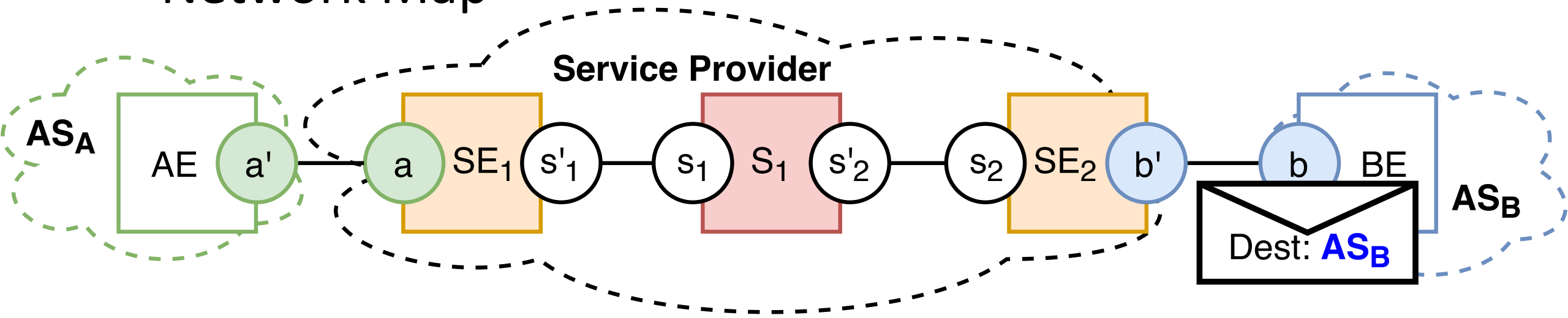


L3 VPN: Ends Normally

Traceroute

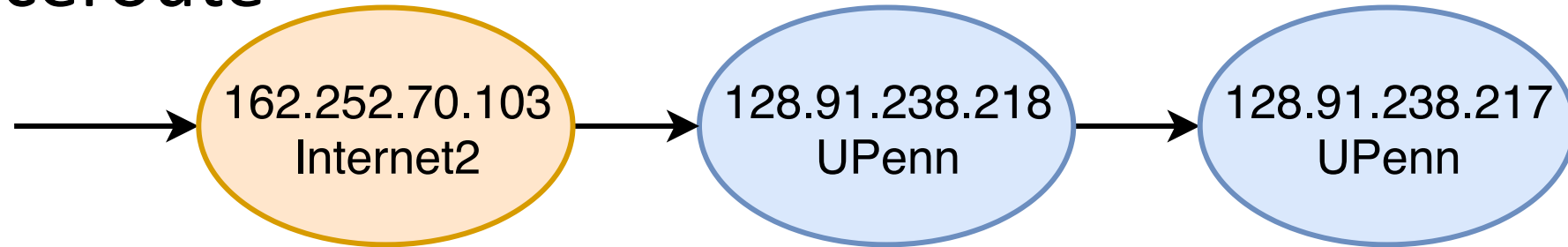


Network Map

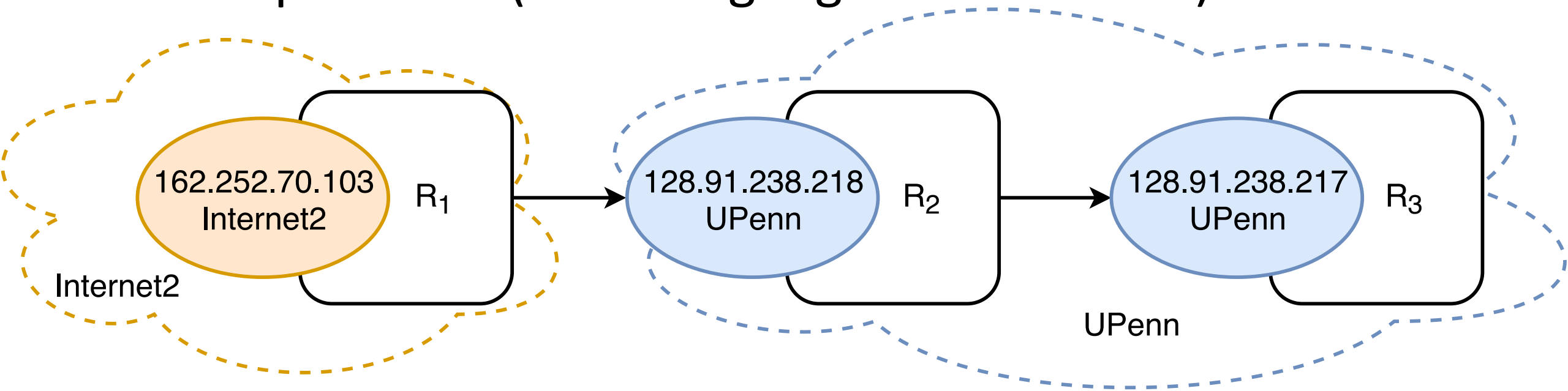


Problem With Conventional Interpretation

Traceroute

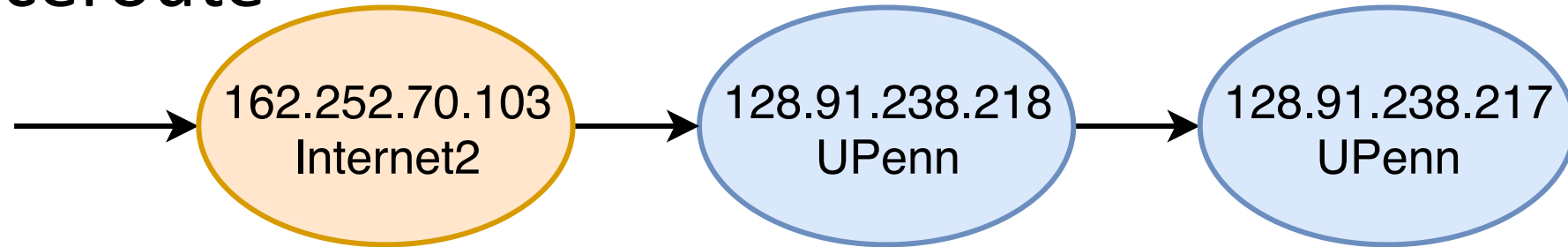


Interpretation (Assuming Ingress Addresses)

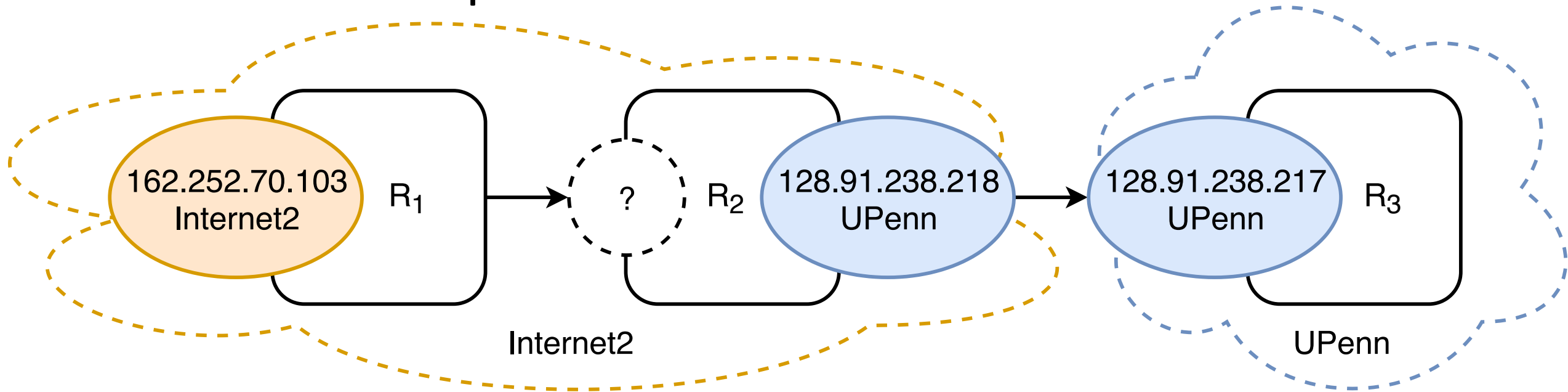


Problem With Conventional Interpretation

Traceroute

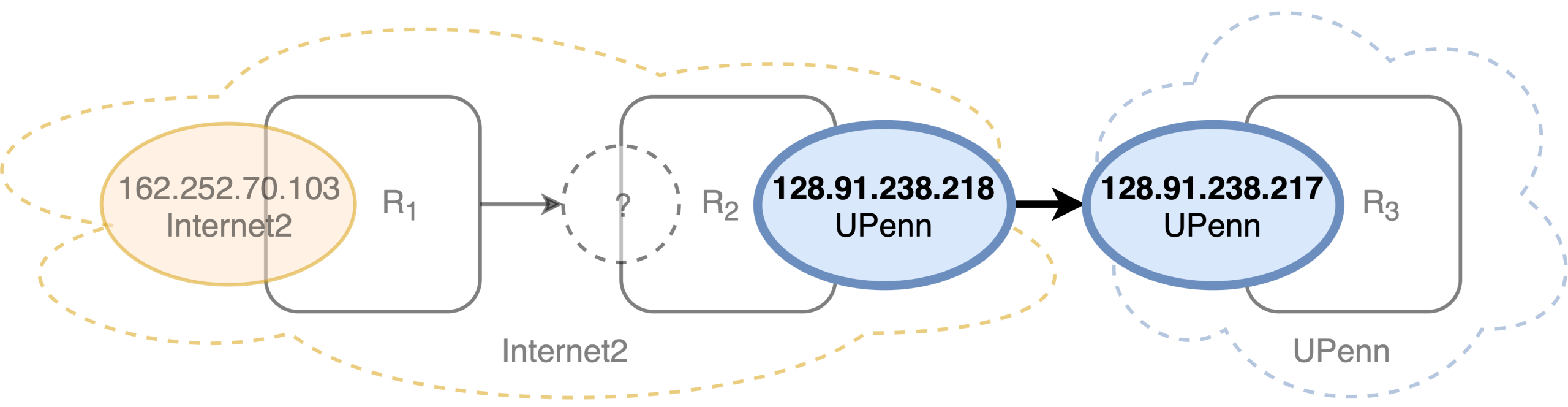


Correct Interpretation



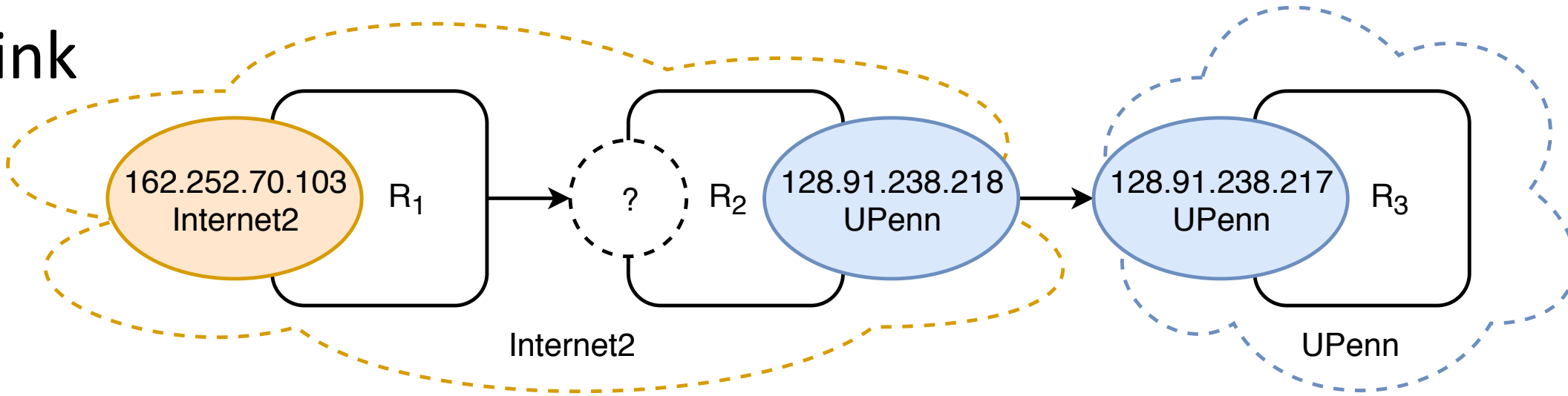
Finding Egress VRF Addresses

Adjacent hops with **consecutive** addresses

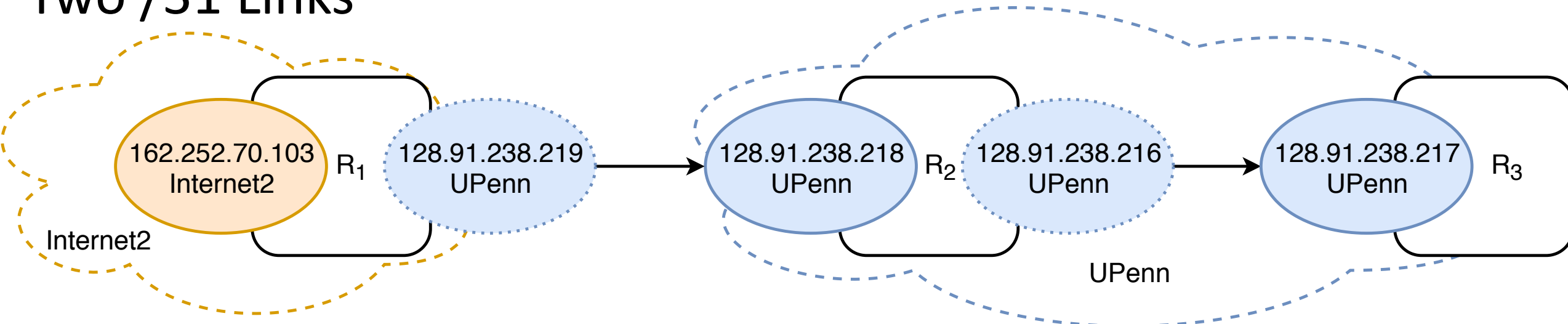


Must Rule Out Two Separate /31s

One /30 Link



Two /31 Links



4 Address Prefixes: Ping Test

128.91.238.216/30

Network

128.91.238.216

Usable
Host
Addresses

128.91.238.217

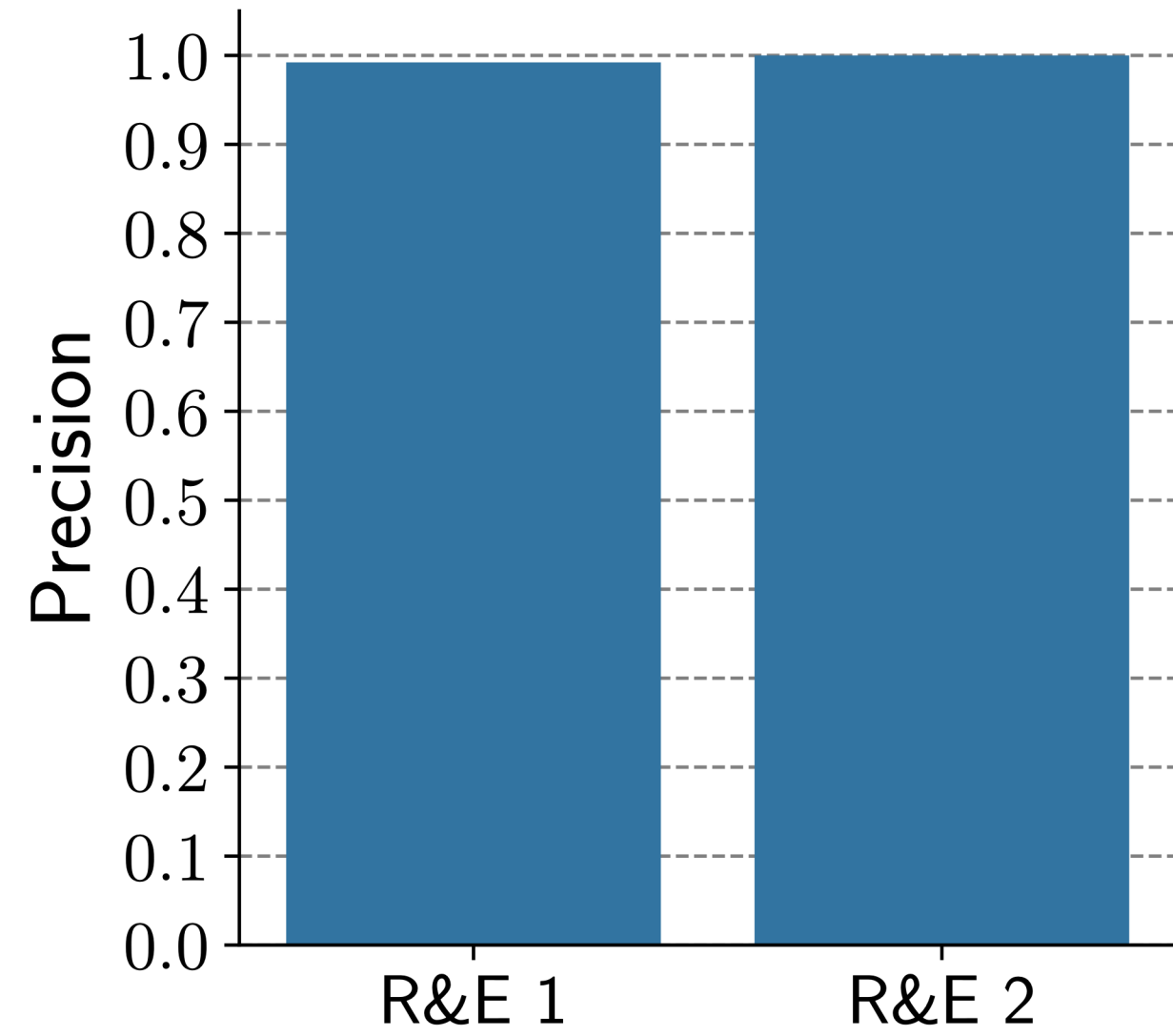
128.91.238.218

128.91.238.219

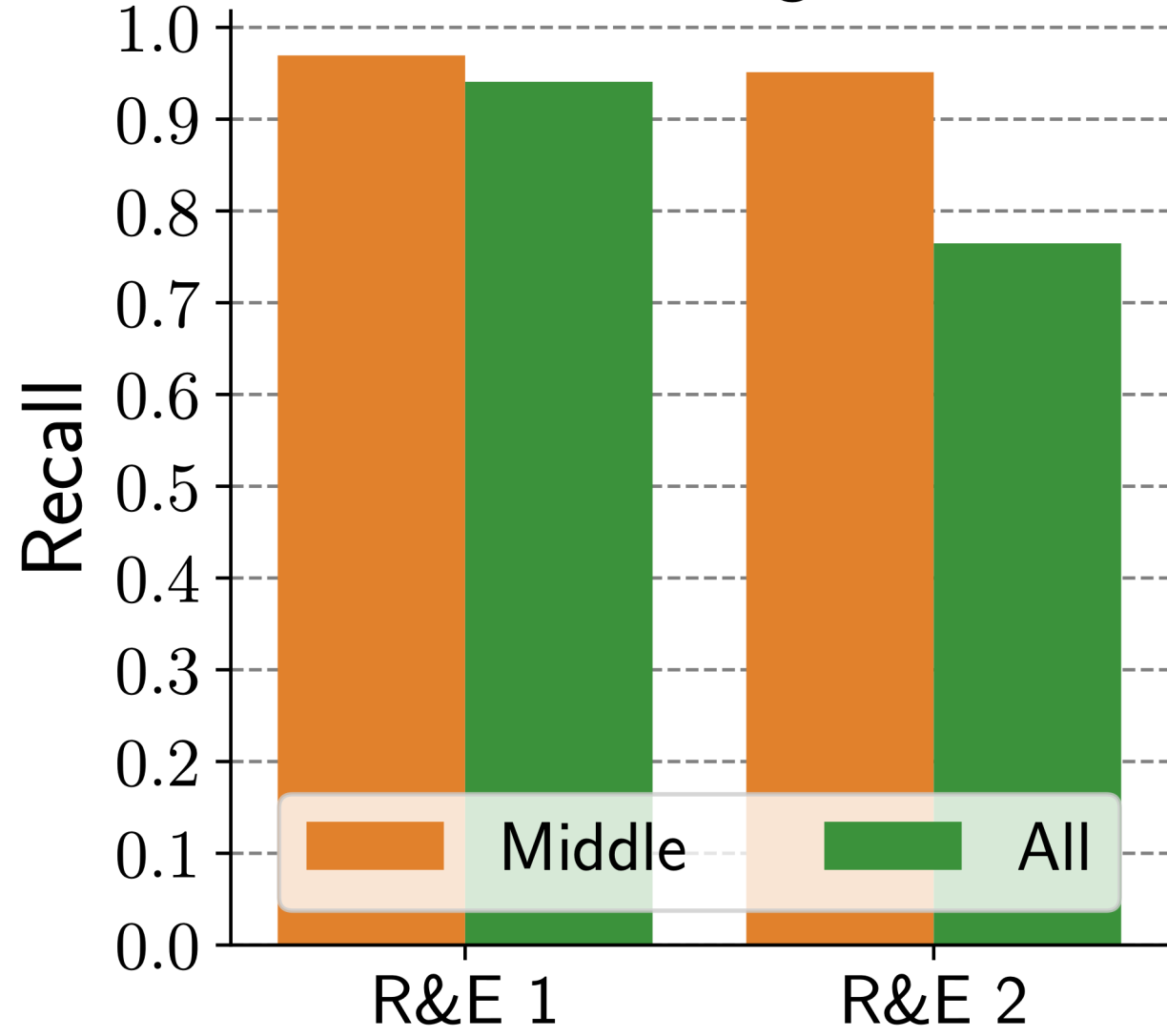
Broadcast

Results

Correctness



Coverage



Conclusion

- Watch out for egress VRF addresses
 - 6% of middle addresses in ITDK traceroutes
- We can detect them
 - An hopefully account for them