



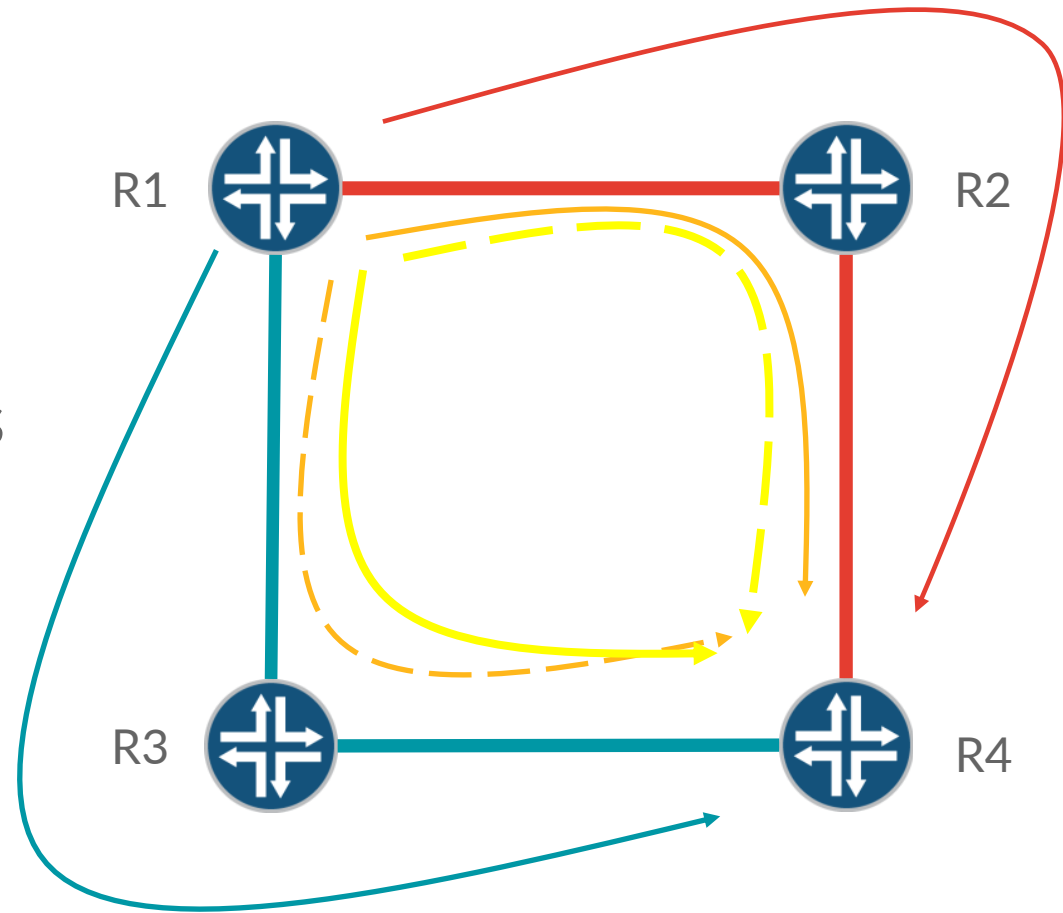
IP-FLEXALGO

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POLICY: A TYPICAL USE-CASE

- Red flows traverse red links
 - And no others
- Orange flows prefer red links
 - But can fail over to blue links
- Blue flows traverse blue links
 - And no others
- **Yellow flows prefer blue links**
 - **But can fail over to red links**



LINK ADVERTISEMENTS

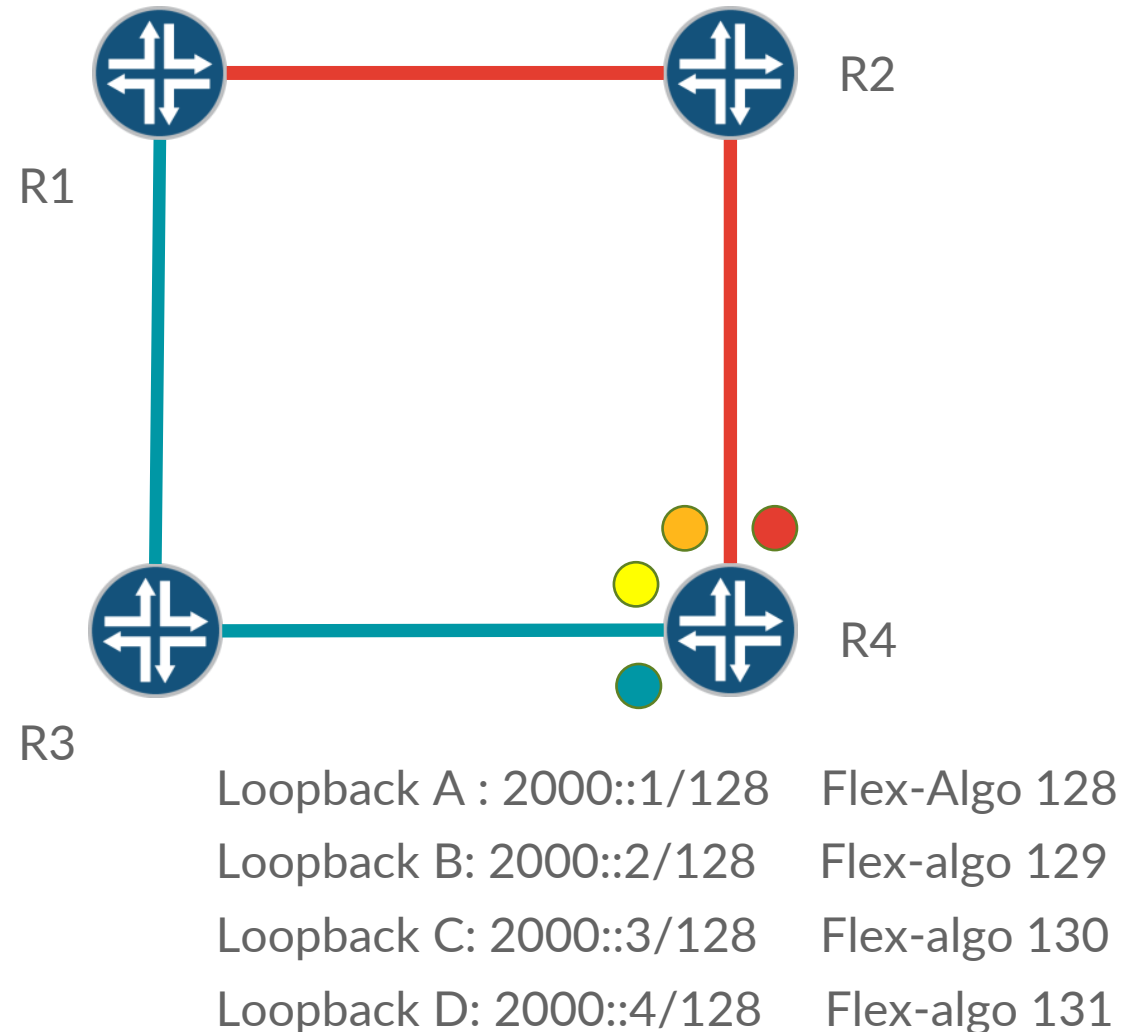
Link	IGP Metric	TE Metric	Administrative Group
R1-R2	200	400	Red
R1-R3	400	200	Blue
R2-R4	200	400	Red
R3-R4	400	200	Blue

FLEXALGO DEFINITIONS (FAD)

FAD	Metric Type	Calculation Type	Constraints
Red	IGP	SPF	Exclude blue
Orange	IGP	SPF	Include all
Blue	TE	SPF	Exclude red
Yellow	TE	SPF	Include all

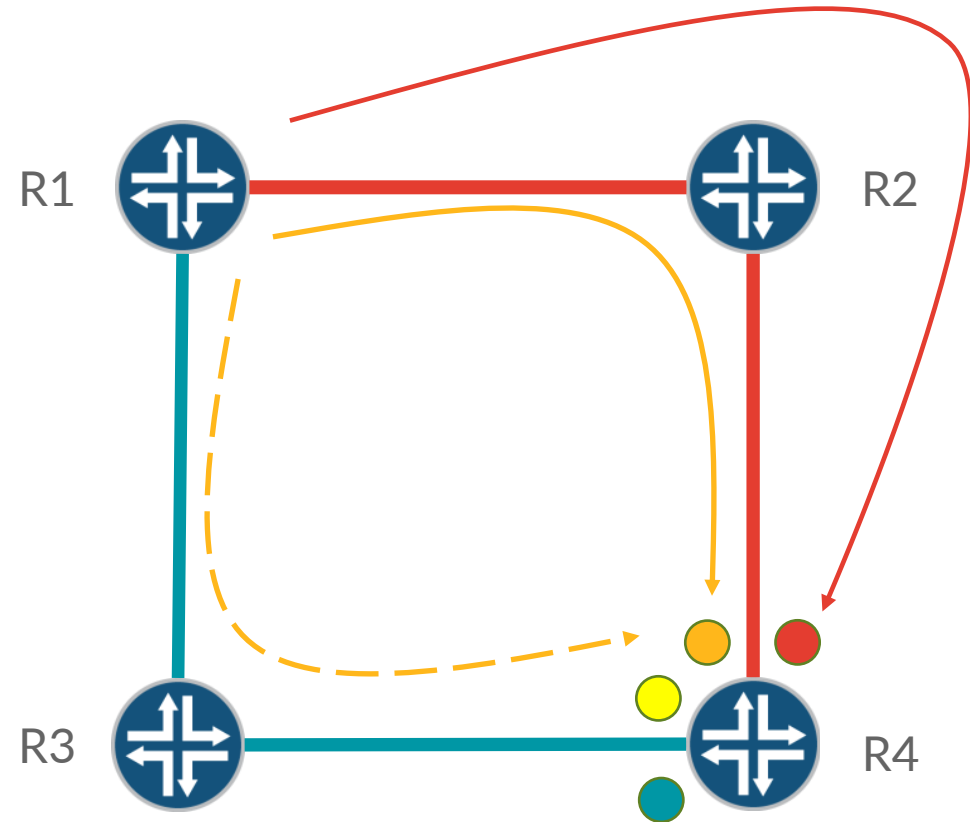
PULLING IT TOGETHER

- R4 advertises four prefixes
 - Loopback A: Red FAD
 - Loopback B: Orange FAD
 - Loopback C: Blue FAD
 - Loopback D: Yellow FAD
- R1 calculates the least-cost path to R4 four times
 - Once for each FAD / prefix



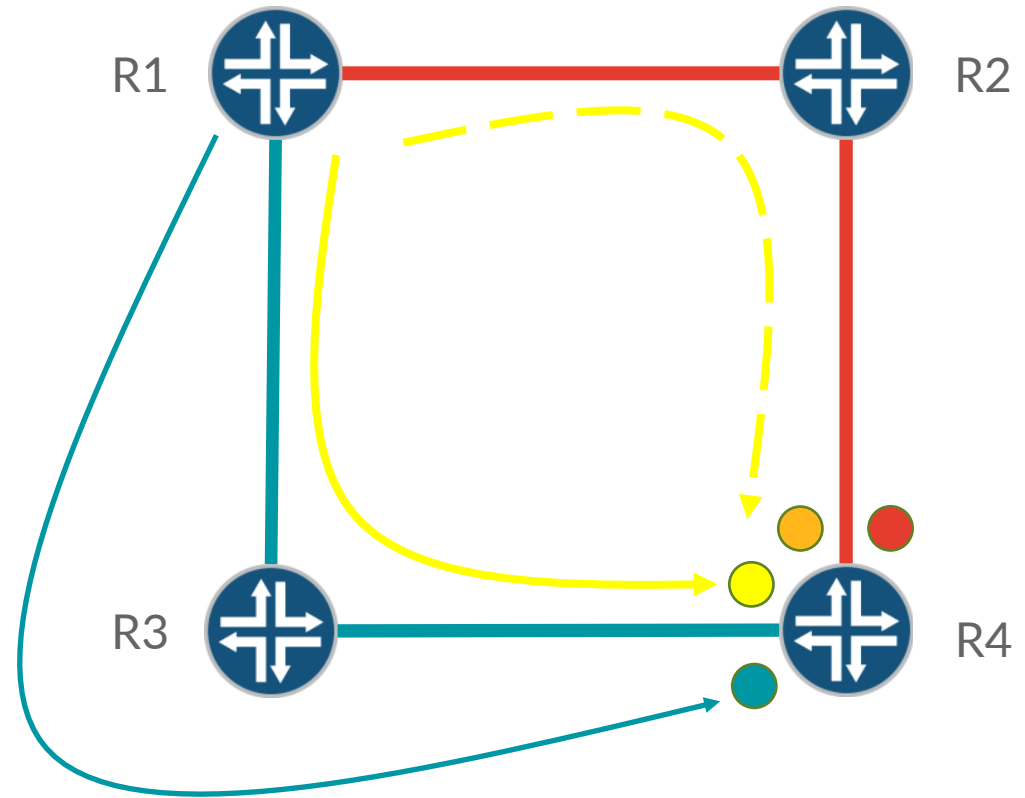
R1 ROUTES TO R4

- Via Prefix A (red)
 - Next Hop is R2
 - No failover, because red FAD excludes blue links
- Via Prefix B (orange)
 - Next Hop is R2
 - Because orange FAD uses IGP metrics
 - Because IGP metrics are lower on red links
 - Failover is R3, because orange FAD includes all links



R1 ROUTES TO R4 (CONTINUED)

- Via Prefix Segment C (blue)
 - Next Hop is R3
 - No failover, because blue FAD excludes red links
- Via Prefix Segment D (yellow)
 - Next Hop is R3
 - Because orange FAD uses TE metrics
 - Because TE metrics are lower on blue links
 - Failover is R2, because yellow FAD includes all links



- Plain IPv4/IPv6 Network
 - No MPLS! No SRv6!
- Multiple Loopbacks
 - Associate each loopback with a Flex-algo
 - Reuse FAD procedures for draft-lsr-flex-algo
 - Reuse computation procedures from draft-lsr-flex-algo
 - Loopbacks corresponding to Flex-algo follow specific path
 - Next-hops for each loopback computed based on that flex-algo
 - Service prefixes carry different loopbacks as protocol next-hops
 - Ip-in-IP tunneling used to carry services



Conclusion

IP FLEXALGO IS POWERFUL

- Many networks require only course-grained TE
 - As in the use-cases described above
- Benefits of deploying IP Flex-algo
 - No MPLS Required
 - No large address blocks per Flex-Algo required
 - No new protocols required, uses only IGP

IP FLEXALGO IS EASY TO OPERATE

- Plain old IP forwarding
 - No tunnels required
 - No MPLS, no IP-in-IP
 - It even works for IPv4
- Plain old IP FIB
 - Standard debugging procedures continue to work
- Multiple instances of familiar constructs
 - FIB constructed from FIBs
 - One FIB per FAD



THANK YOU

JUNIPER
NETWORKS

Engineering
Simplicity