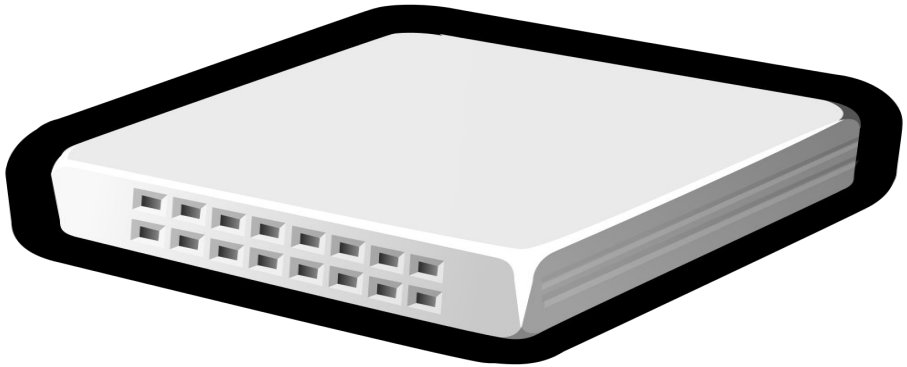
An SDN Framework for Managing Internet Exchange Points

UFMG

Ítalo Cunha
Luis Martins, Dorgival O. Guedes

Internet Exchange Points



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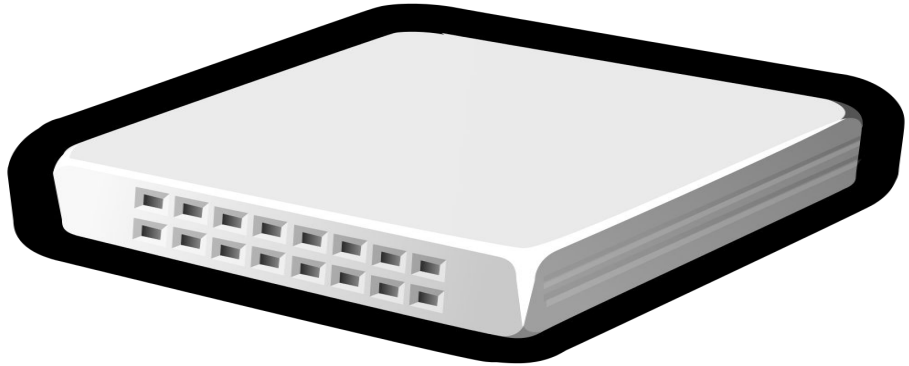


Embratel

amazon web services

at&t

COMCAST

facebook

Google

Microsoft

YouTube

Adobe

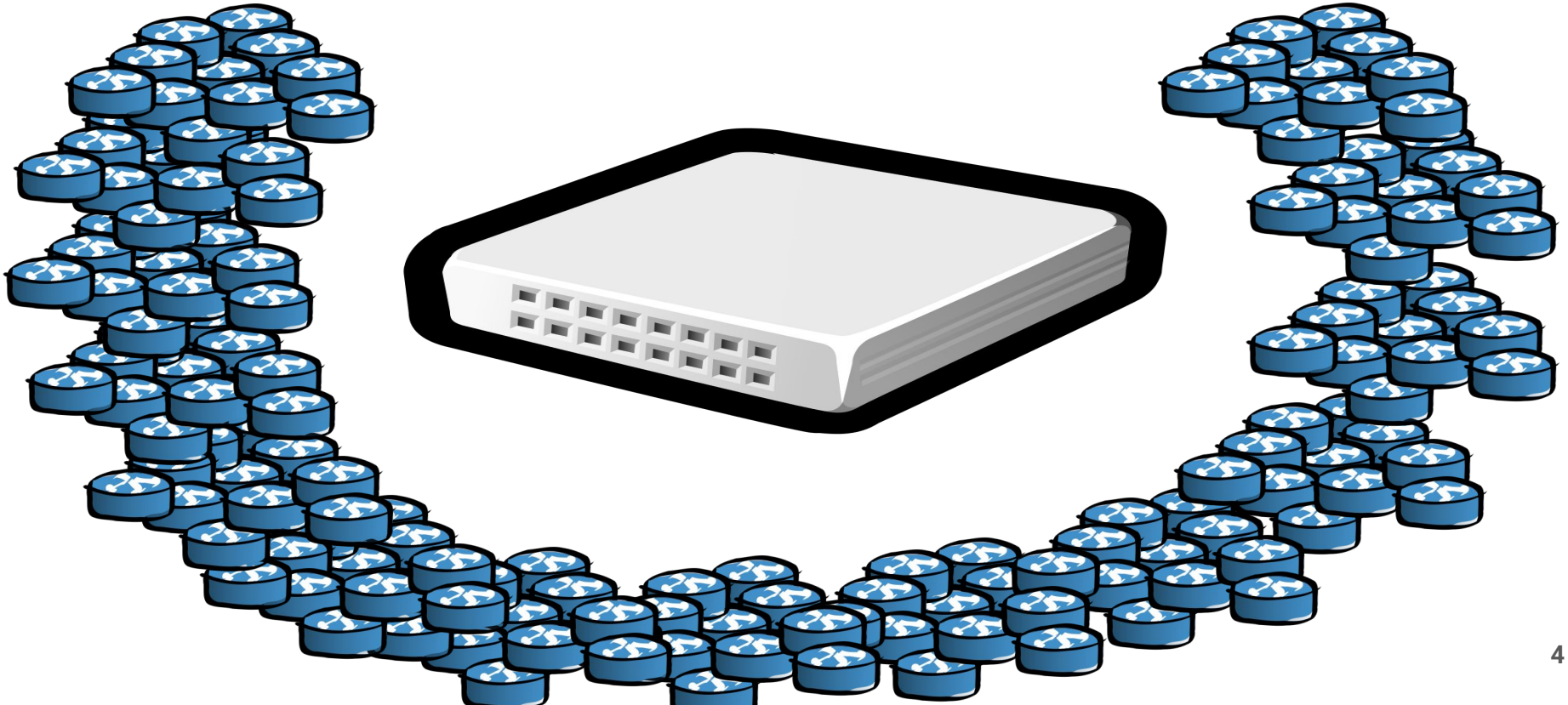
airbnb

NETFLIX

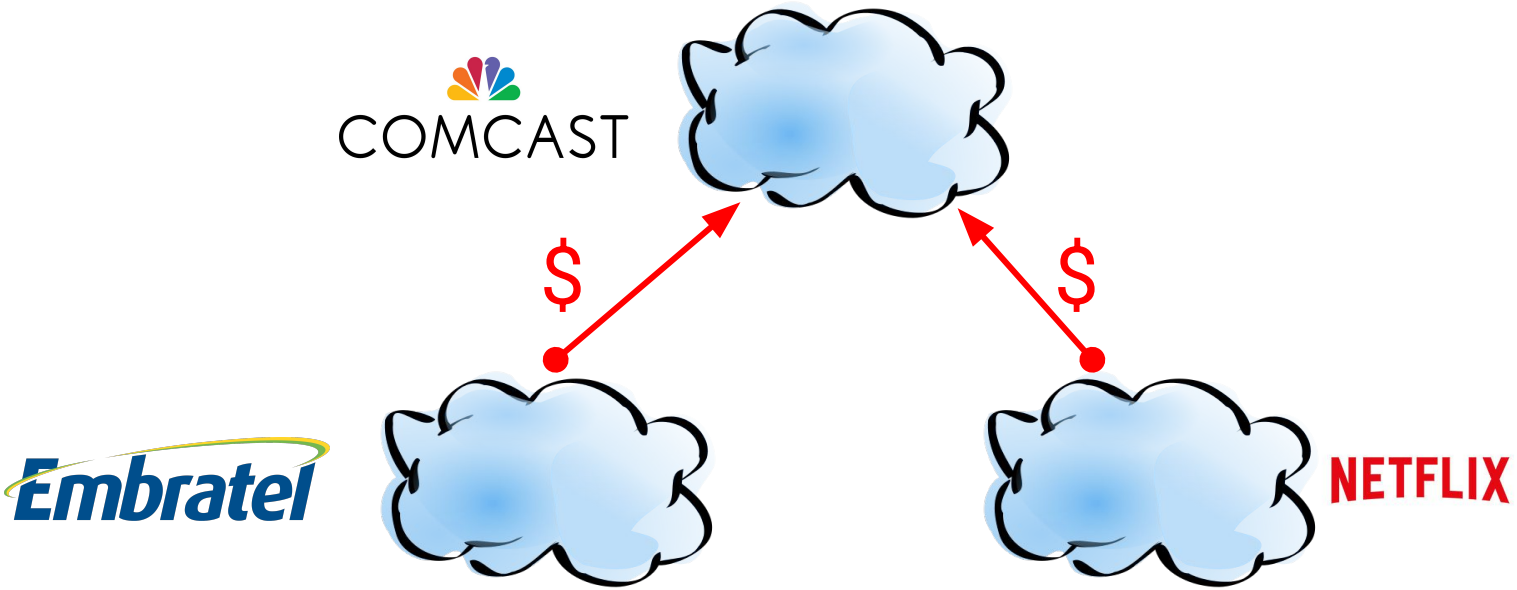
Algar Telecom

verizon

Internet Exchange Points



Why Internet Exchange Points?



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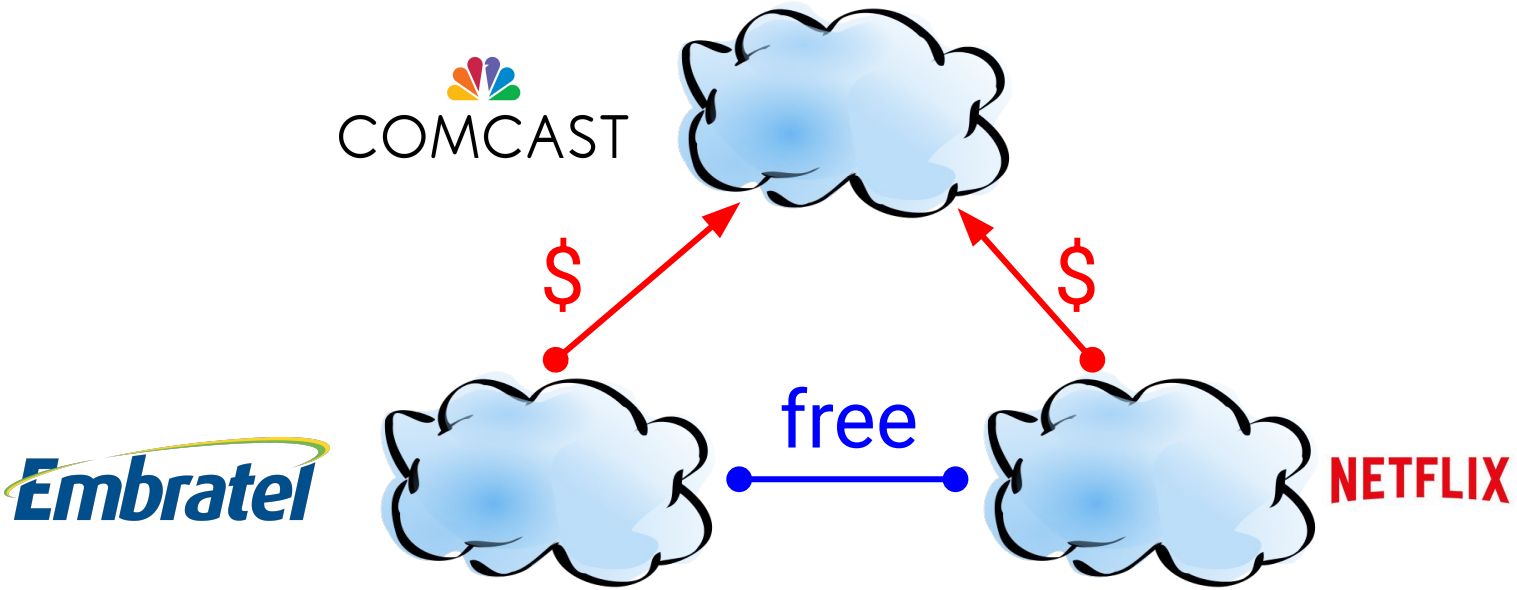

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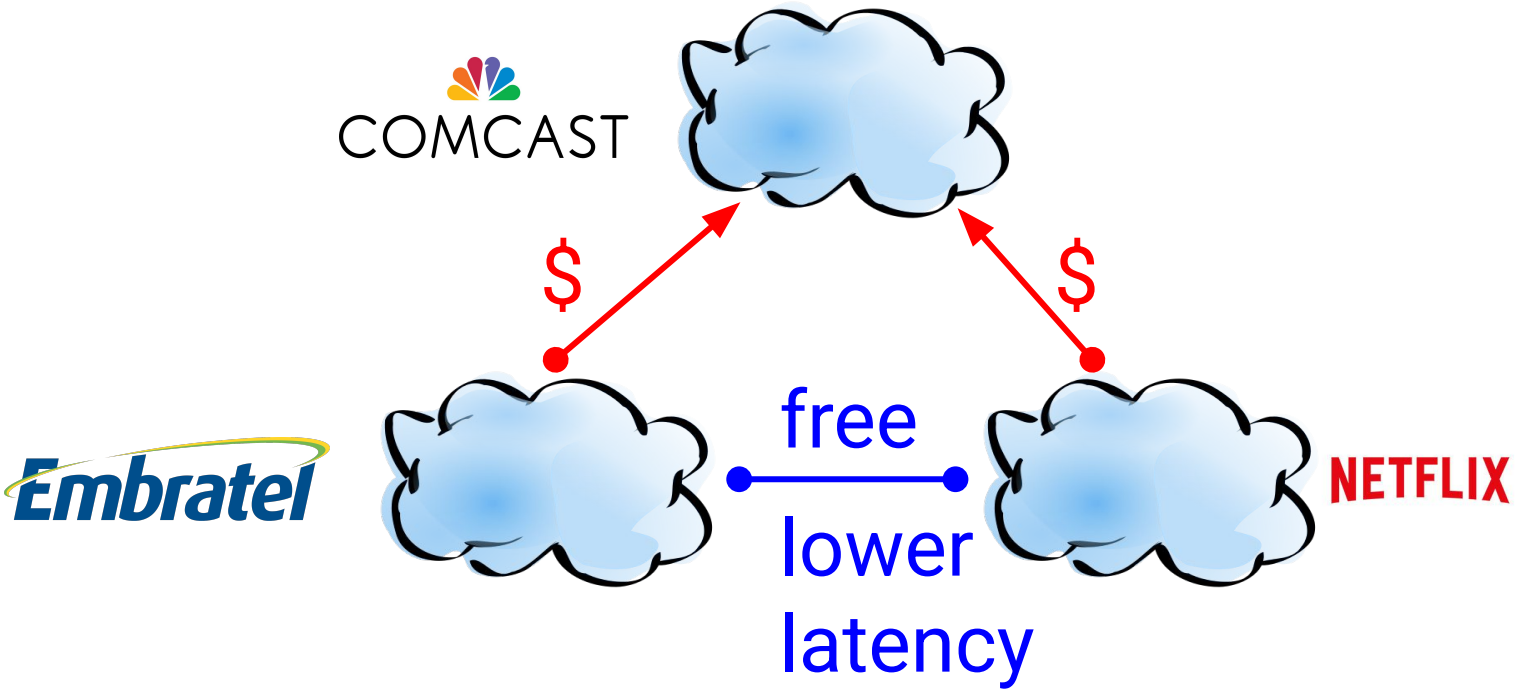
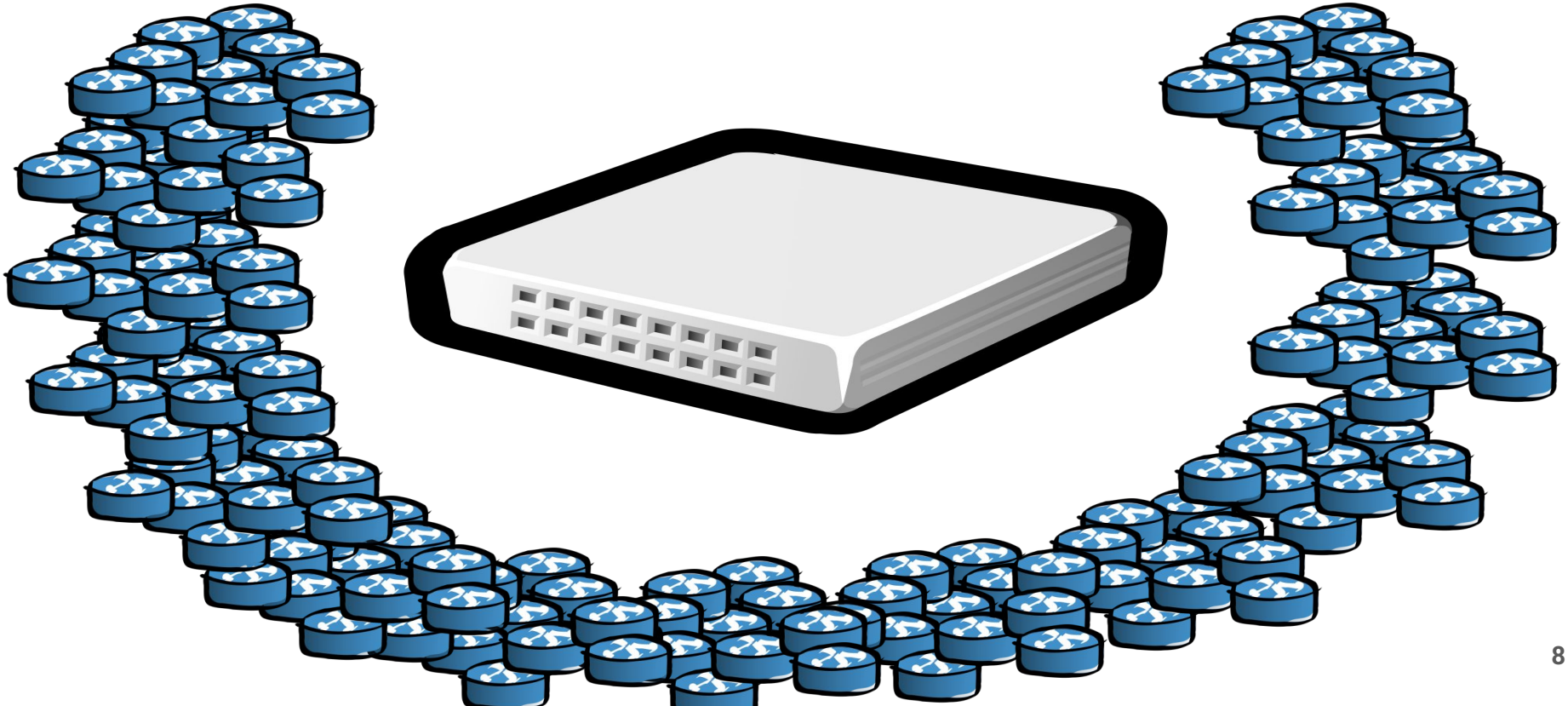
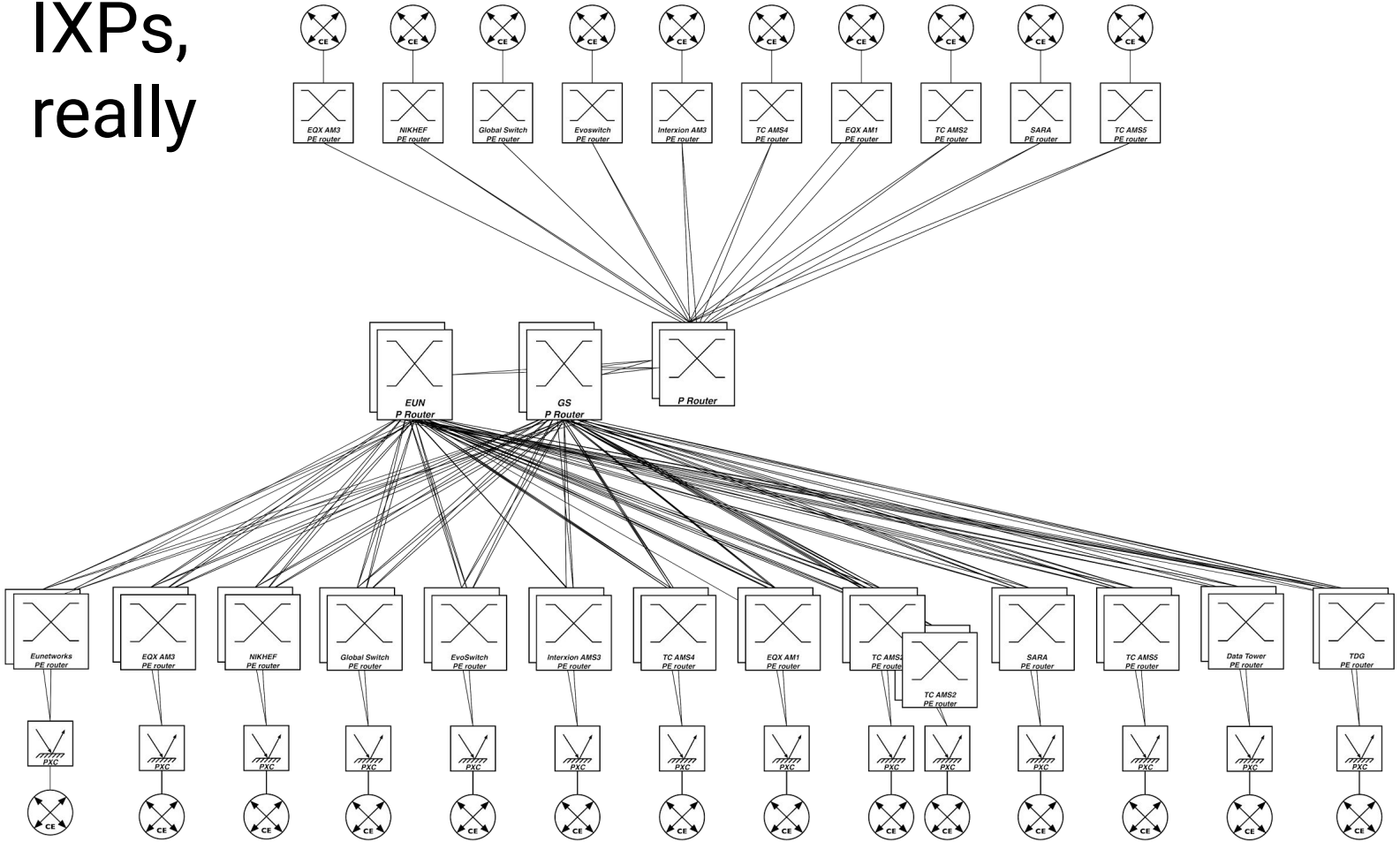


IXPs lets you peer with hundreds of networks



Source: AMS-IX

IXPs, really



IXPs are complex infrastructures

- Strict scalability and reliability requirements
  - Redundancy
  - Top-of-the-line equipment
- Hundreds of networks with different policies
- Shared broadcast domain

IXP challenges

- Single broadcast domain, limited layer-2 utilization
- Reliance on proprietary solutions
- Failures and incompatibilities
- Misconfigurations and abuse

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- MAC table overflow

Different IXP business models

- For-profit IXPs (US)
- Not-for-profit IXPs (Europe)
- Free-of-charge IXPs (Brazil)

Different IXP business models

- For-profit IXPs (US)
  - Charge proportional to bandwidth utilization
- Not-for-profit IXPs (Europe)
  - Block unauthorized or malicious traffic
- Free-of-charge IXPs (Brazil)
  - Prevent IXP members from interconnecting their sites

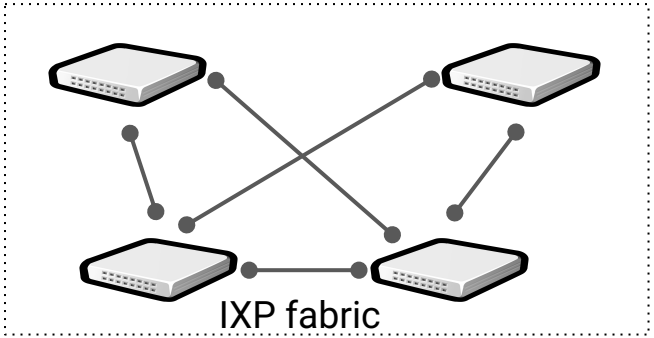
IXPs are in full control of the infrastructure

SDIX: Software Defined Internet Exchange

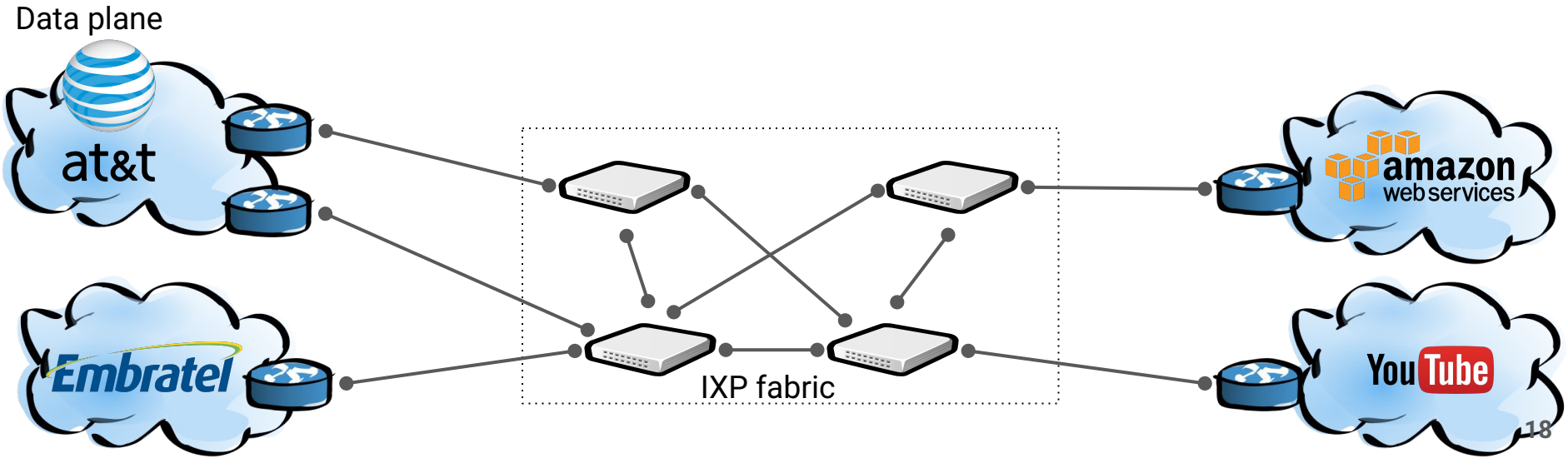
- Flexibility to accommodate different business models
- Ease IXP management
- Reduce misconfigurations
- Improve security by supporting richer policies

SDIX Design

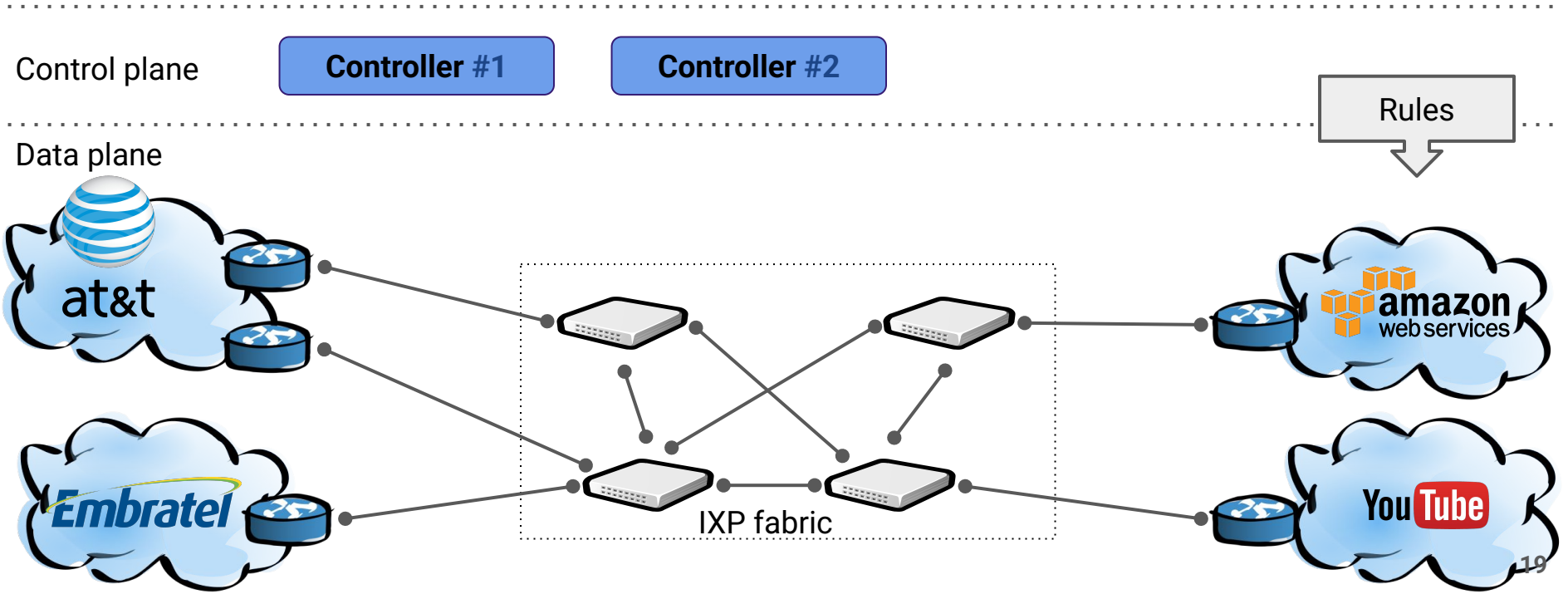
Data plane



SDIX Design


Data plane
at&t
Embratel
IXP fabric
amazon
web services
YouTube

SDIX Design


Control plane
Controller #1
Controller #2
Rules
Data plane
at&t
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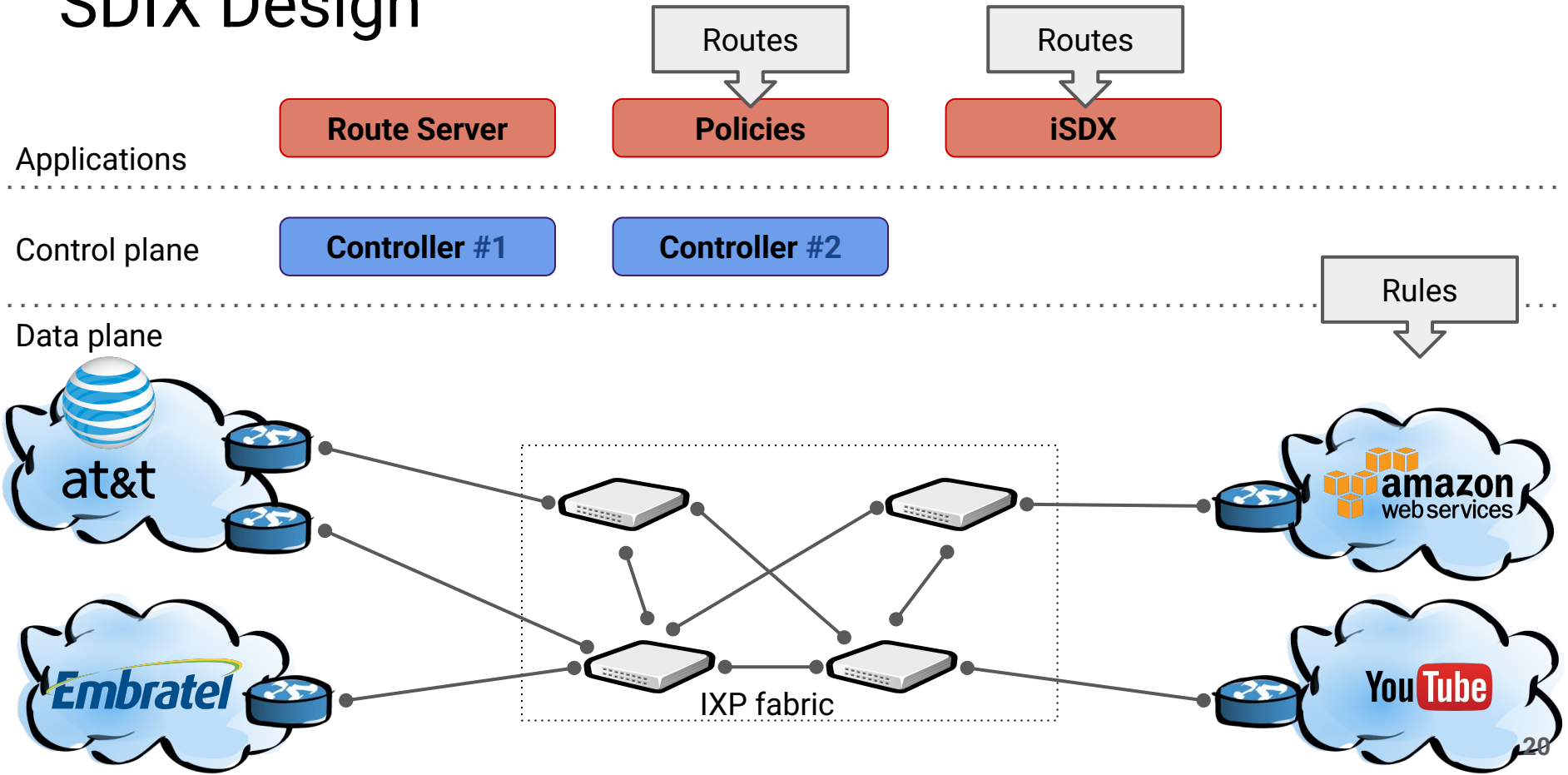
SDIX Design


Routes
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Route Server
Policies
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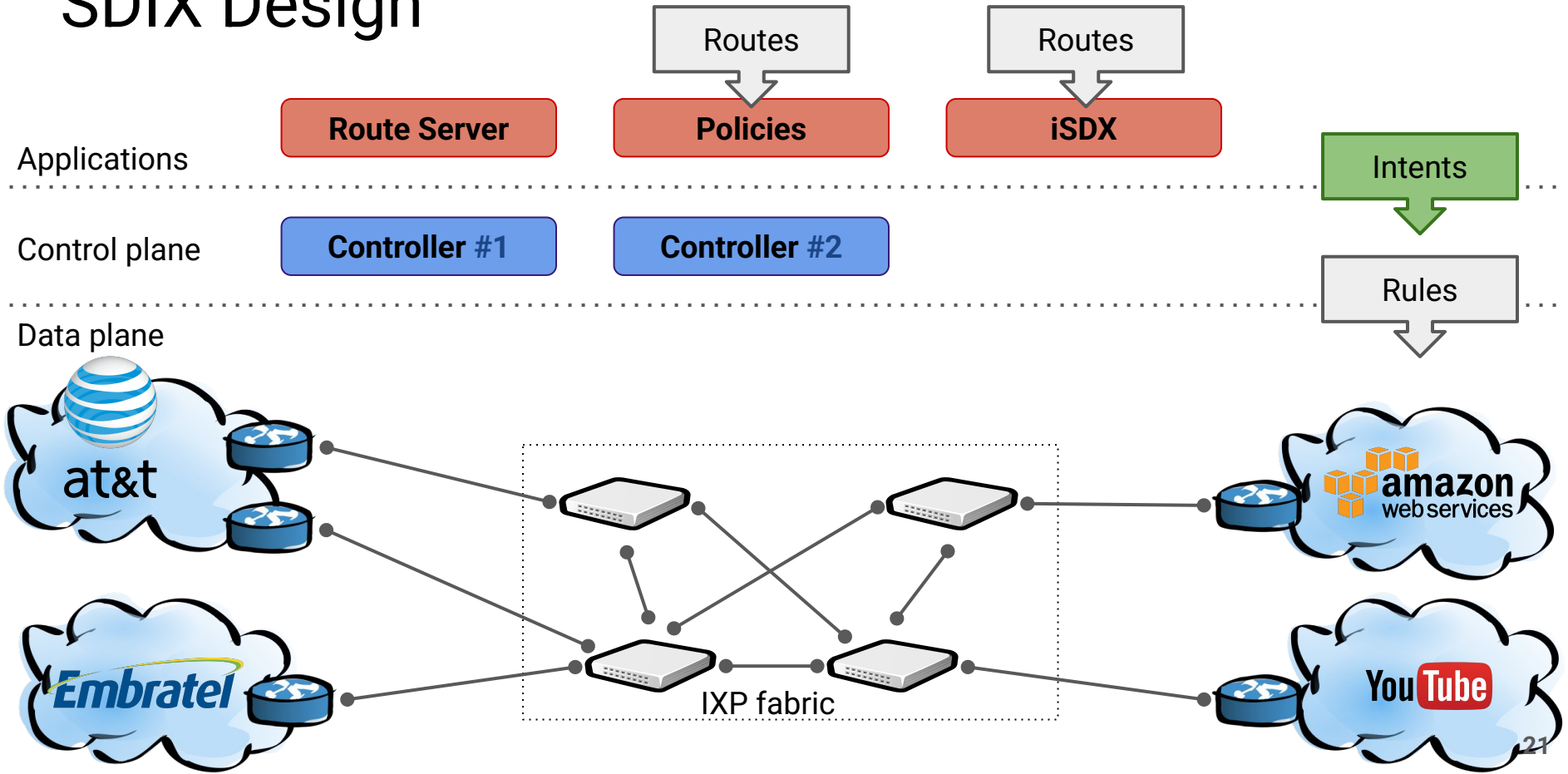
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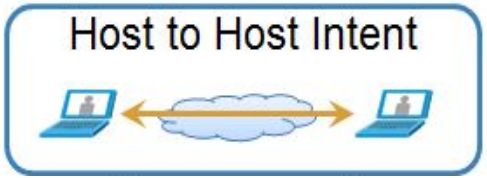
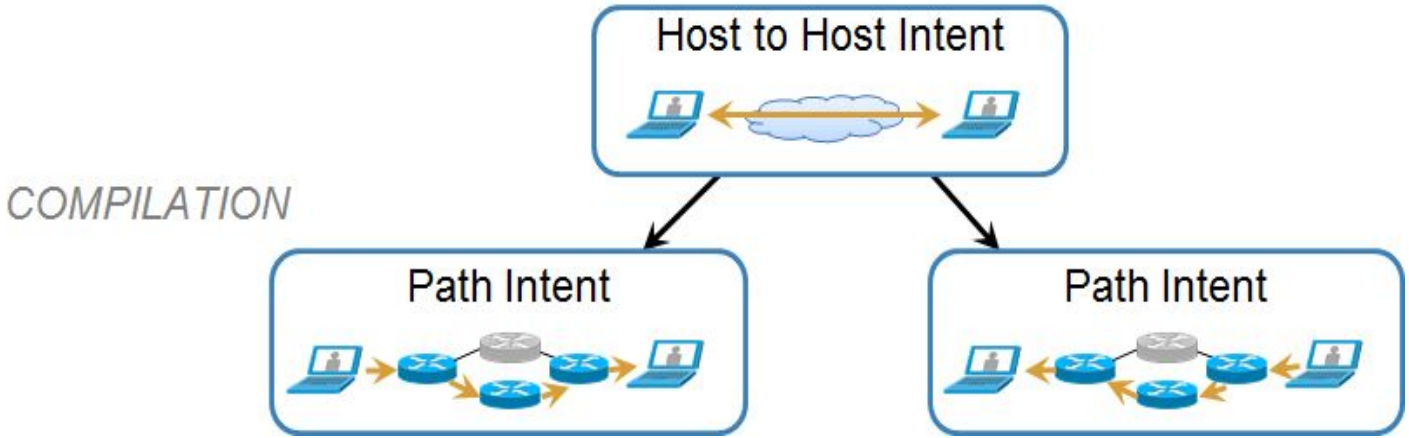
ONOS Intents



ONOS Intents



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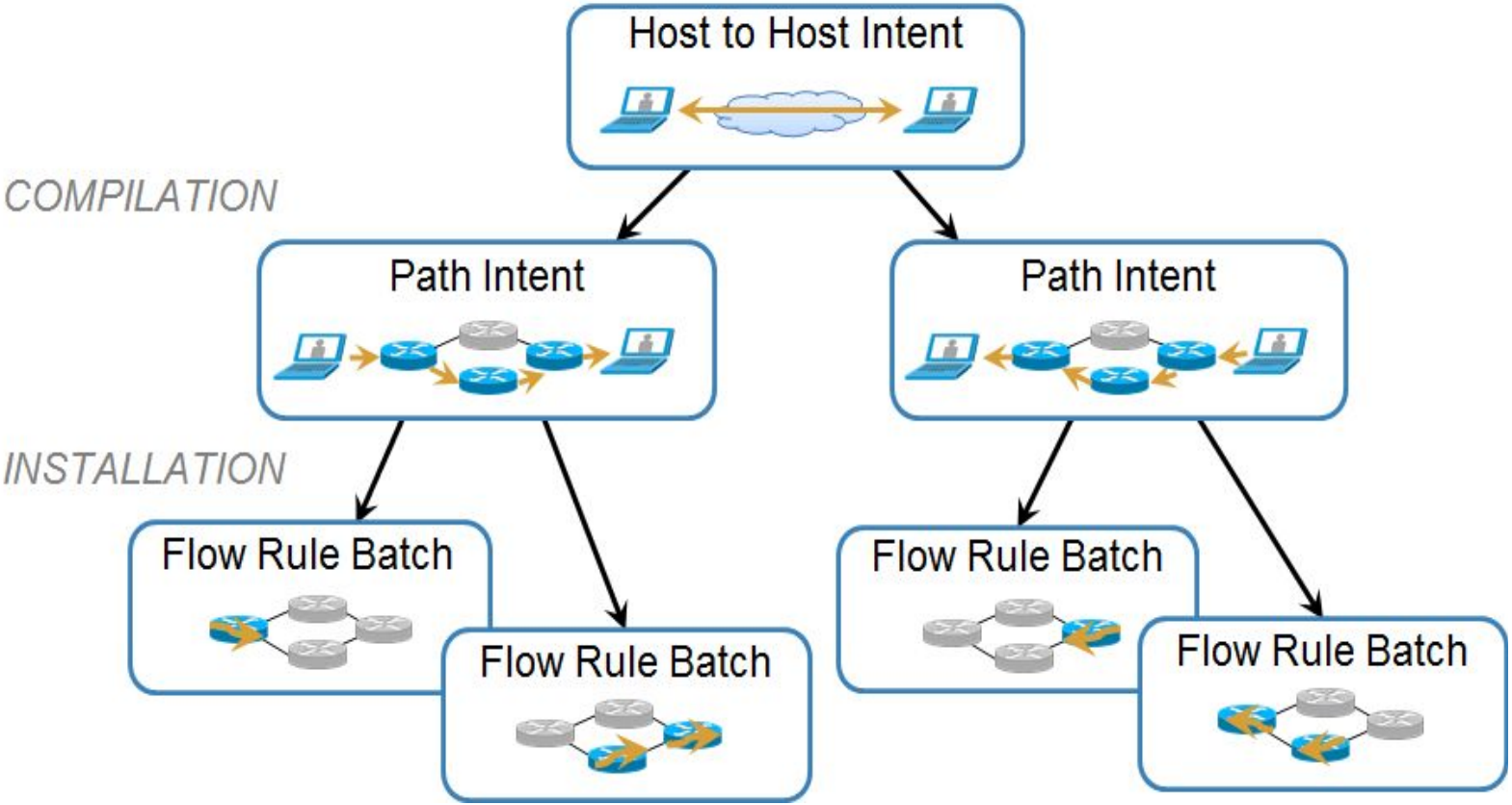
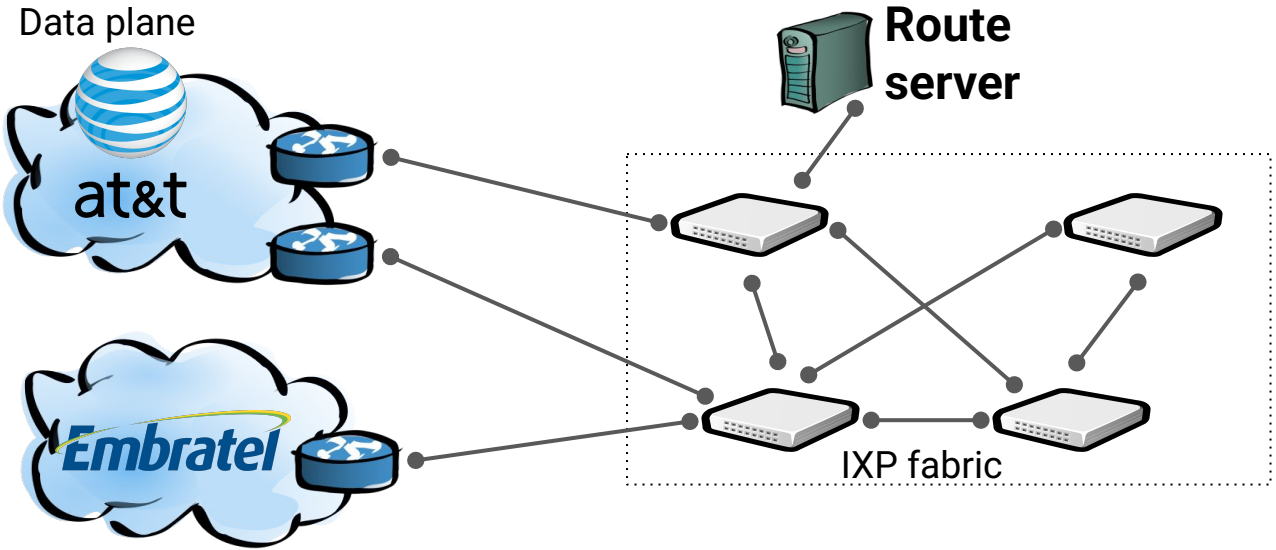


SDIX Policies

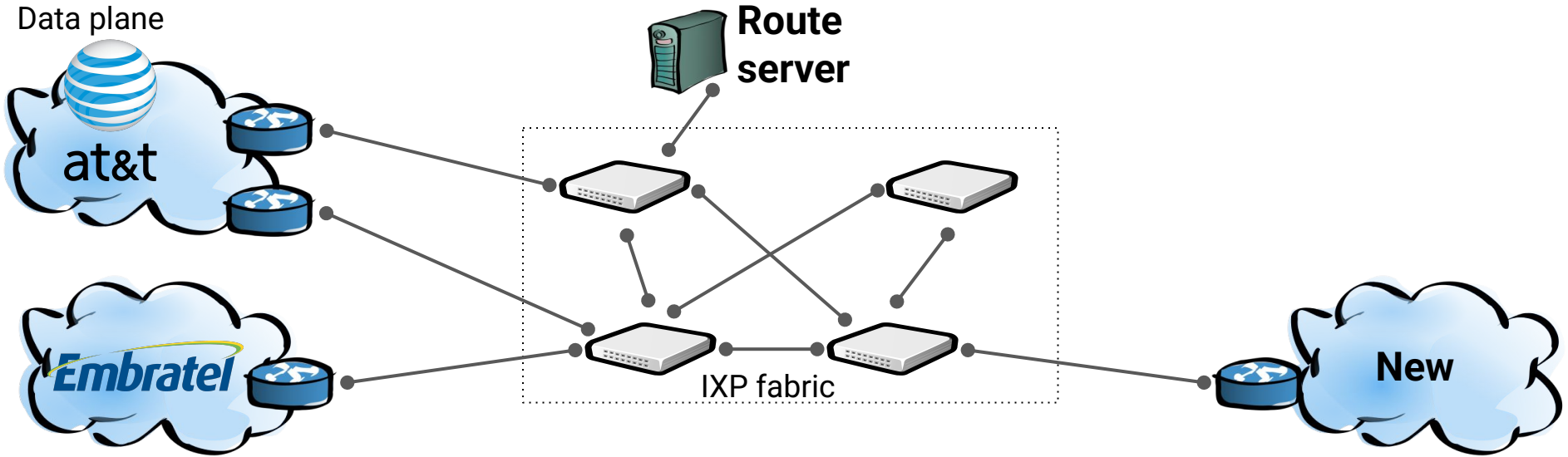
- Route server communication
- Destination MAC forwarding
- Source MAC filtering
- IP longest-prefix forwarding
- Best path forwarding
- VLAN translation

New Member Activation in IXPs



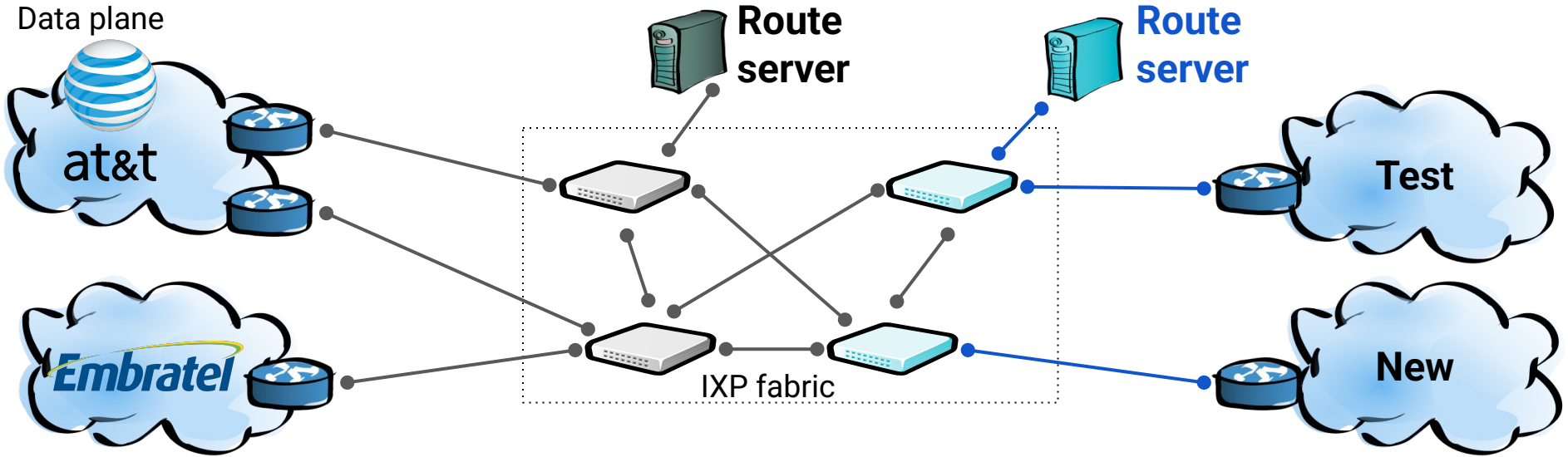
New Member Activation in IXPs

- Cannot simply add new member to fabric
- Quarantine period
  - Test if router can handle enough MAC addresses, uses a single MAC address, has v6 autoconfig disabled, exports only sensible routes, ...



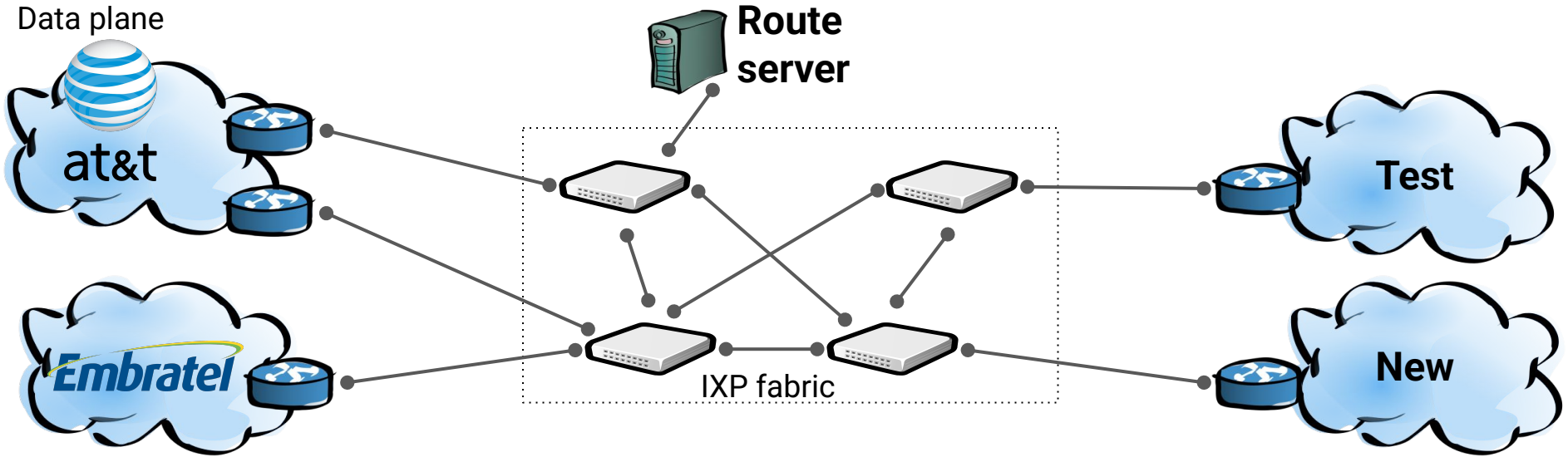
New Member Activation in IXPs

- Cannot simply add new member to fabric
- Quarantine period
- Test VLAN and test route server



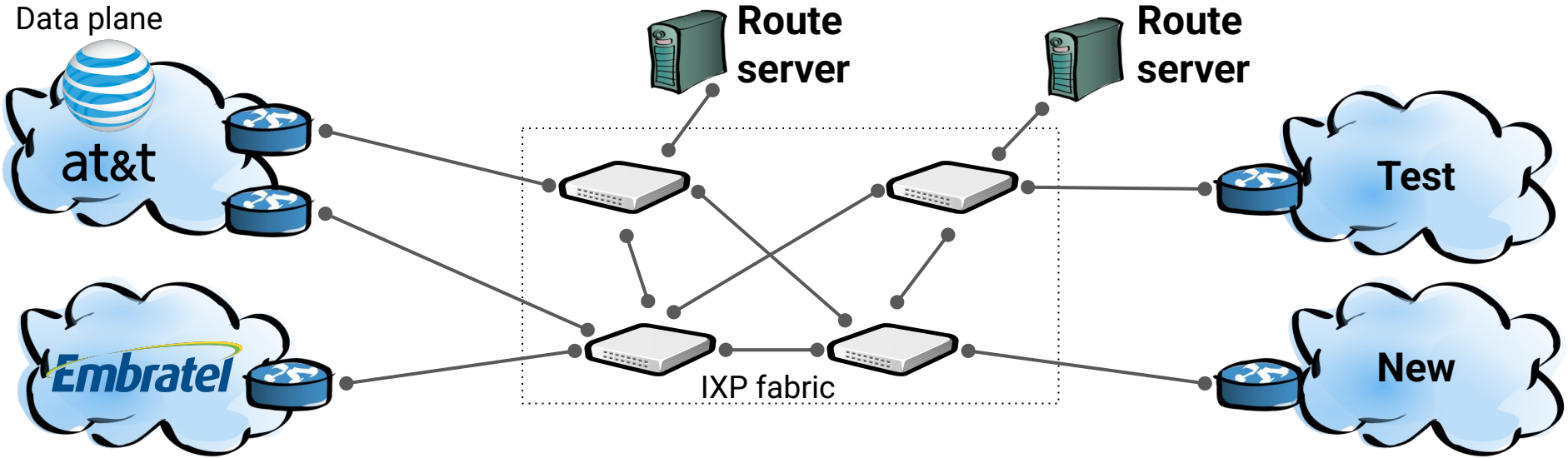
New Member Activation in IXPs

- After tests are complete
- Reconfigure routers to use production VLAN
  - Chance for configuration errors



Member Activation in SDIX

- Create a dedicated domain for testing (similar to VLAN)
- No VLANs: isolate traffic using OpenFlow
- No need for reconfiguration after testing is complete



SDIX Policy Complexity

● Route server communication	O(members * servers)
● Destination MAC forwarding	O(members)
● Source MAC filtering	O(members)
● IP longest-prefix forwarding	O(prefixes)
● Best path forwarding	O(prefixes)
● VLAN translation	O(VLANs)

Conclusion

- SDIX brings software defined networking to IXPs
- Easier management
- Richer policies
  - High abstraction level
  - Exploit ONOS Intents
- Fits existing SDN switches

Questions?

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