REN Design Issues
Internal Structure of a REN

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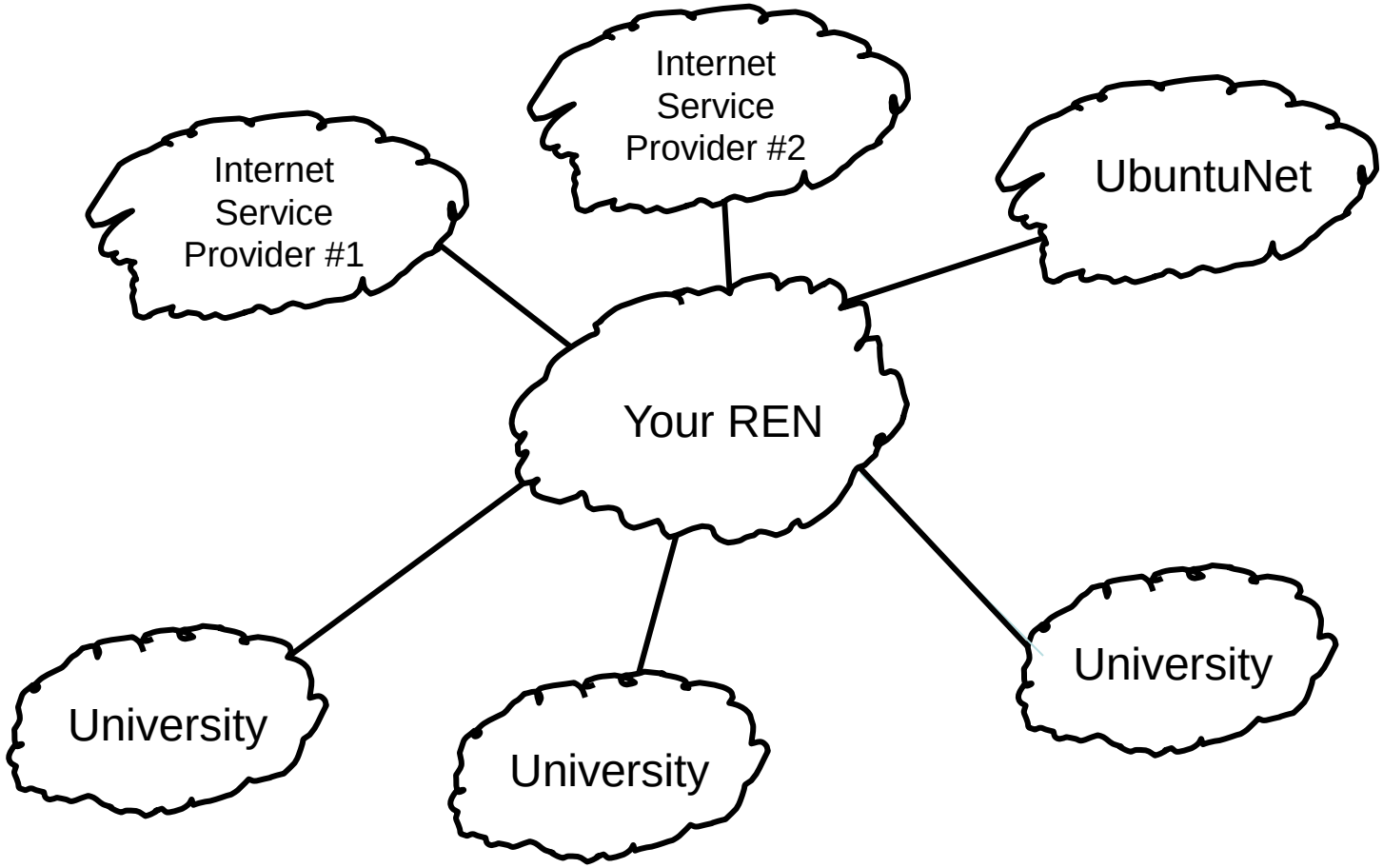
A typical NREN



But what is inside of the NREN?

- What components do you have inside of Your REN?

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- What components do you have inside of Your REN?
  - Routers
  - Connections between routers
  - Switches
  - Servers

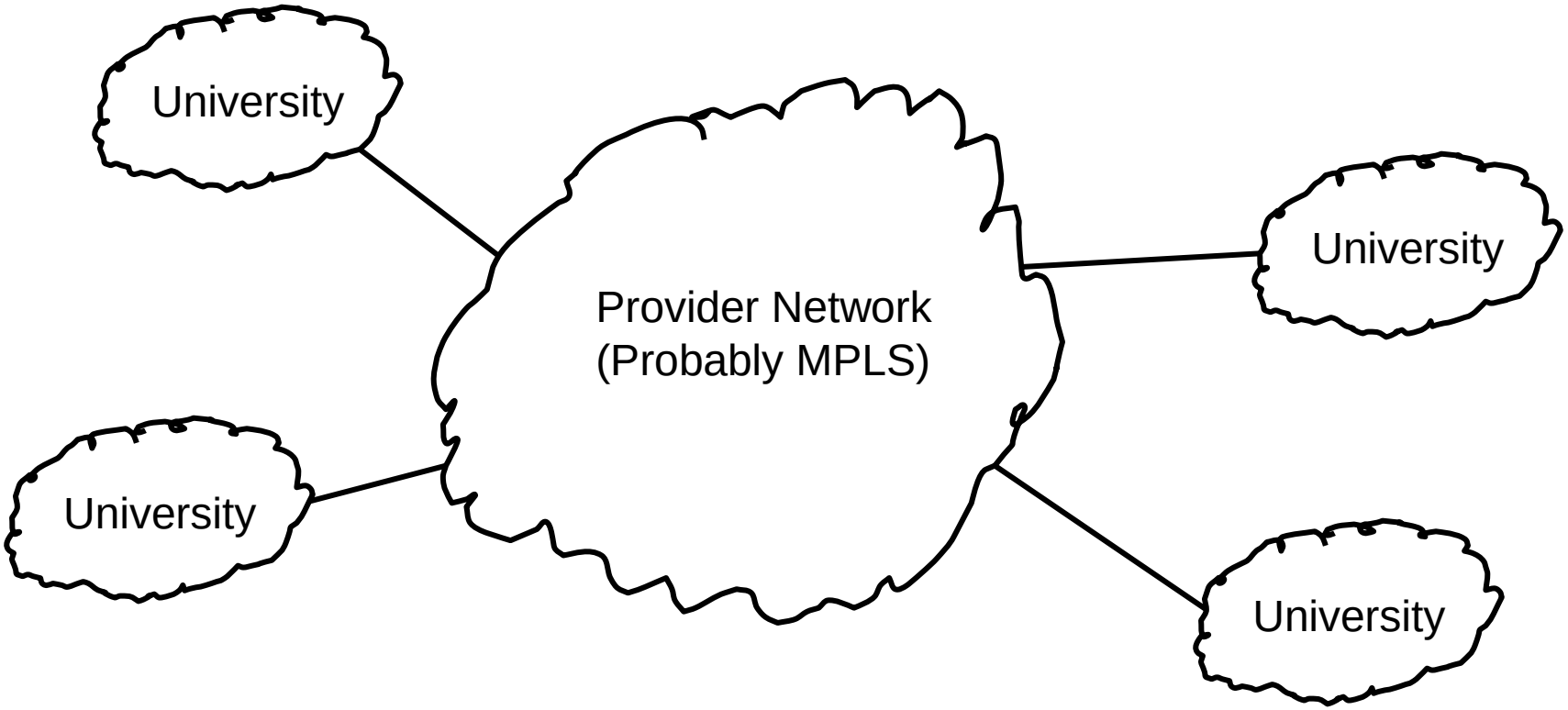
NREN Components

- Routers
  - Traditional routers, but maybe more powerful with more memory so you can run BGP
- Connections (many types)
  - Traditional SONET point-to-point (E1, STM1)
  - Dark fiber
  - Wireless point-to-point
  - Hybrid networks

Hybrid Networks

- Provider uses basic components to simulate some type of private network
  - You as the customer sees the connection typically as an Ethernet connection
  - Carriers can use MPLS and/or VLANs and switches to simulate an Ethernet Local Area Network

Hybrid Networks

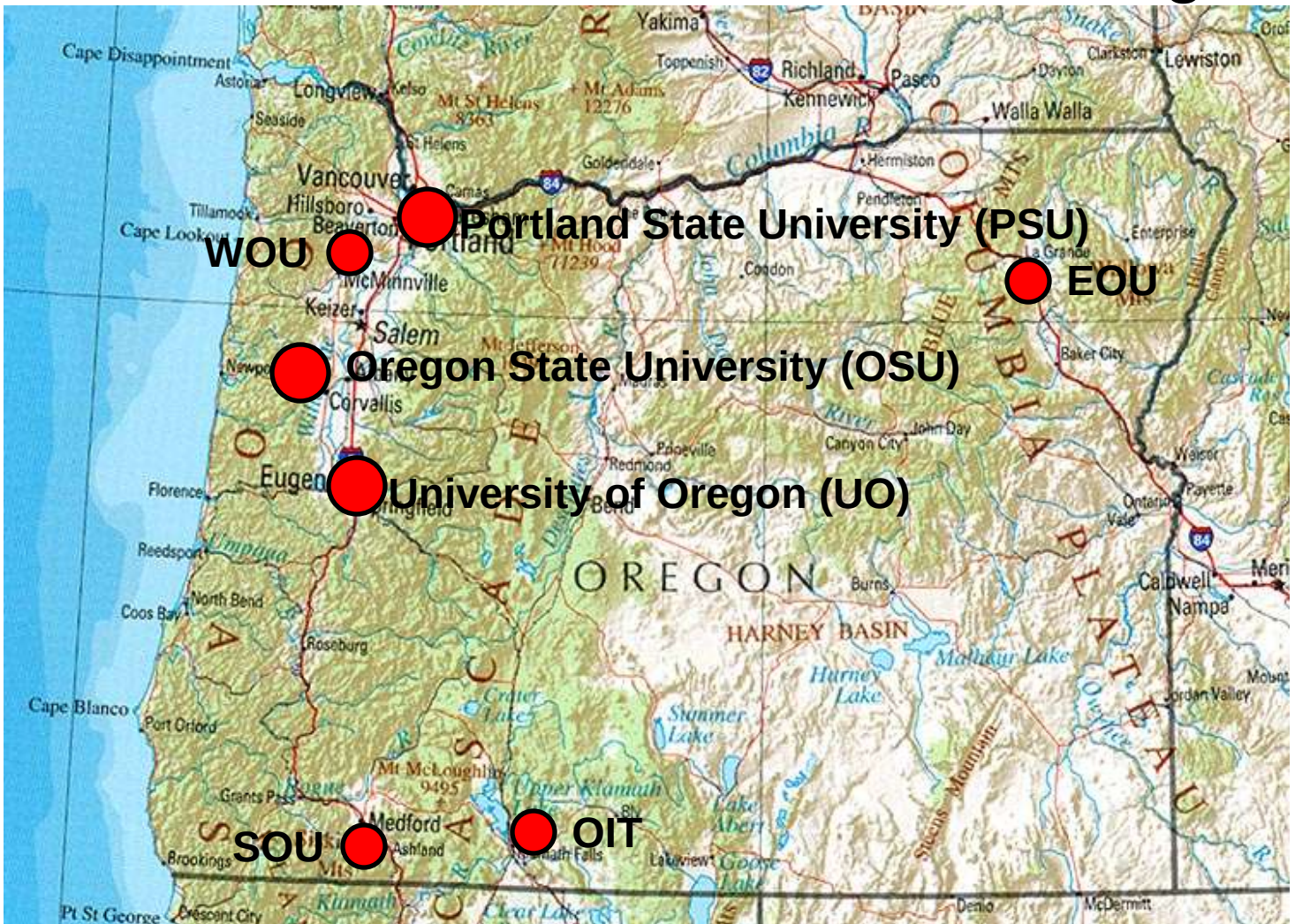


Assembling the Components

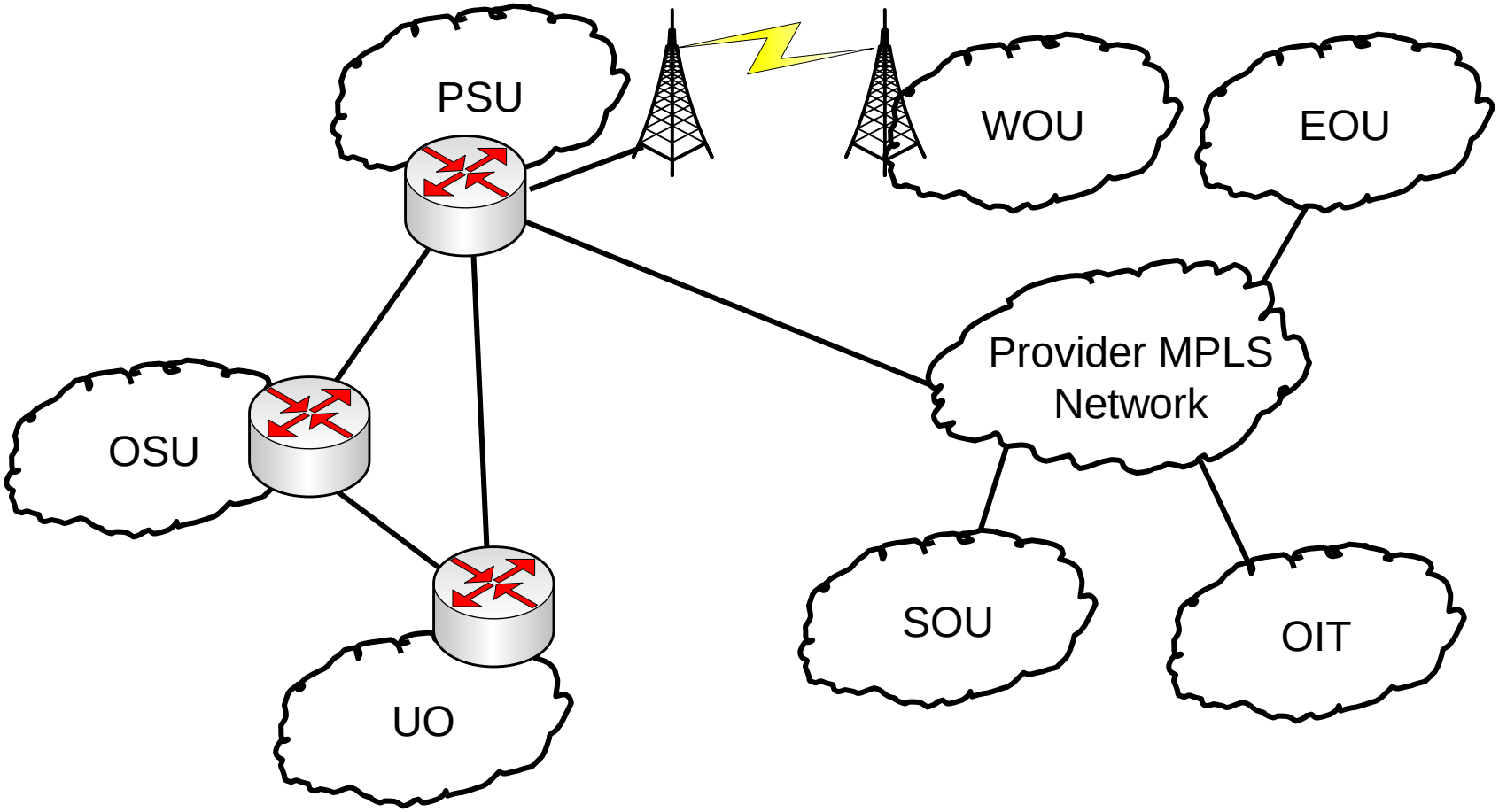
- We have a region to build a network

Assembling the Components

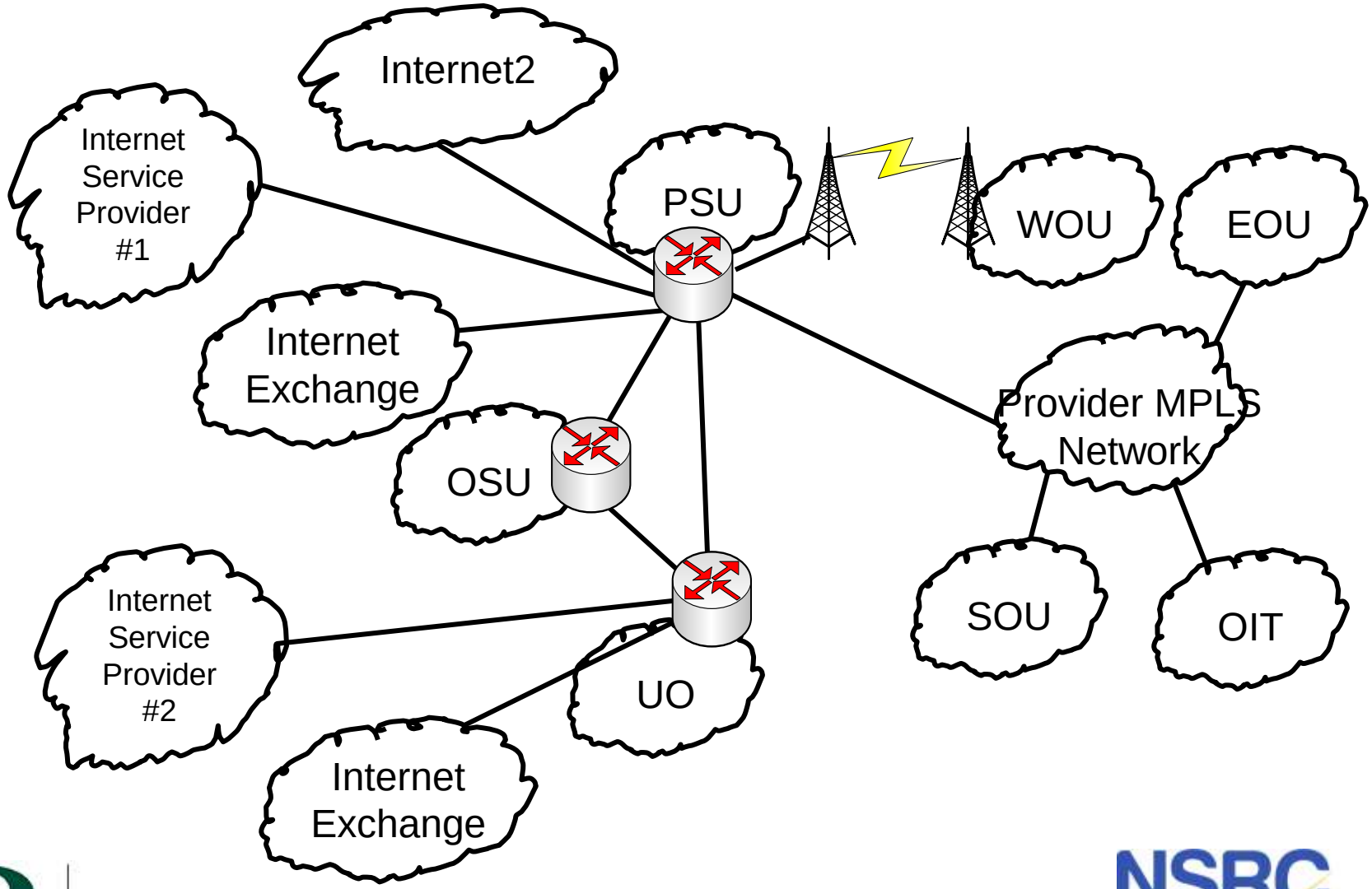
- We have some Customers in this region



A Straw Man Network



Connections to the Outside

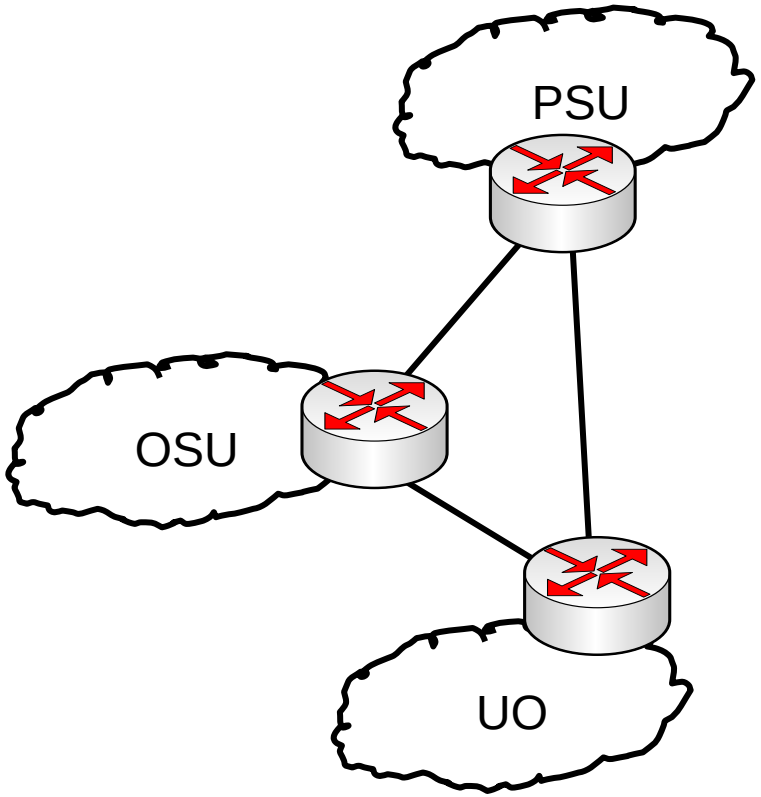


What is a POP?

- POP = Point of Presence
- Location where the REN has equipment that it operates to serve multiple customers
- Often, a POP will be at a customer site
- A POP can have a lot of equipment, including DNS servers, Video Conferencing Multi Conference Units, mail servers, etc.
- A POP must have a router

POP design

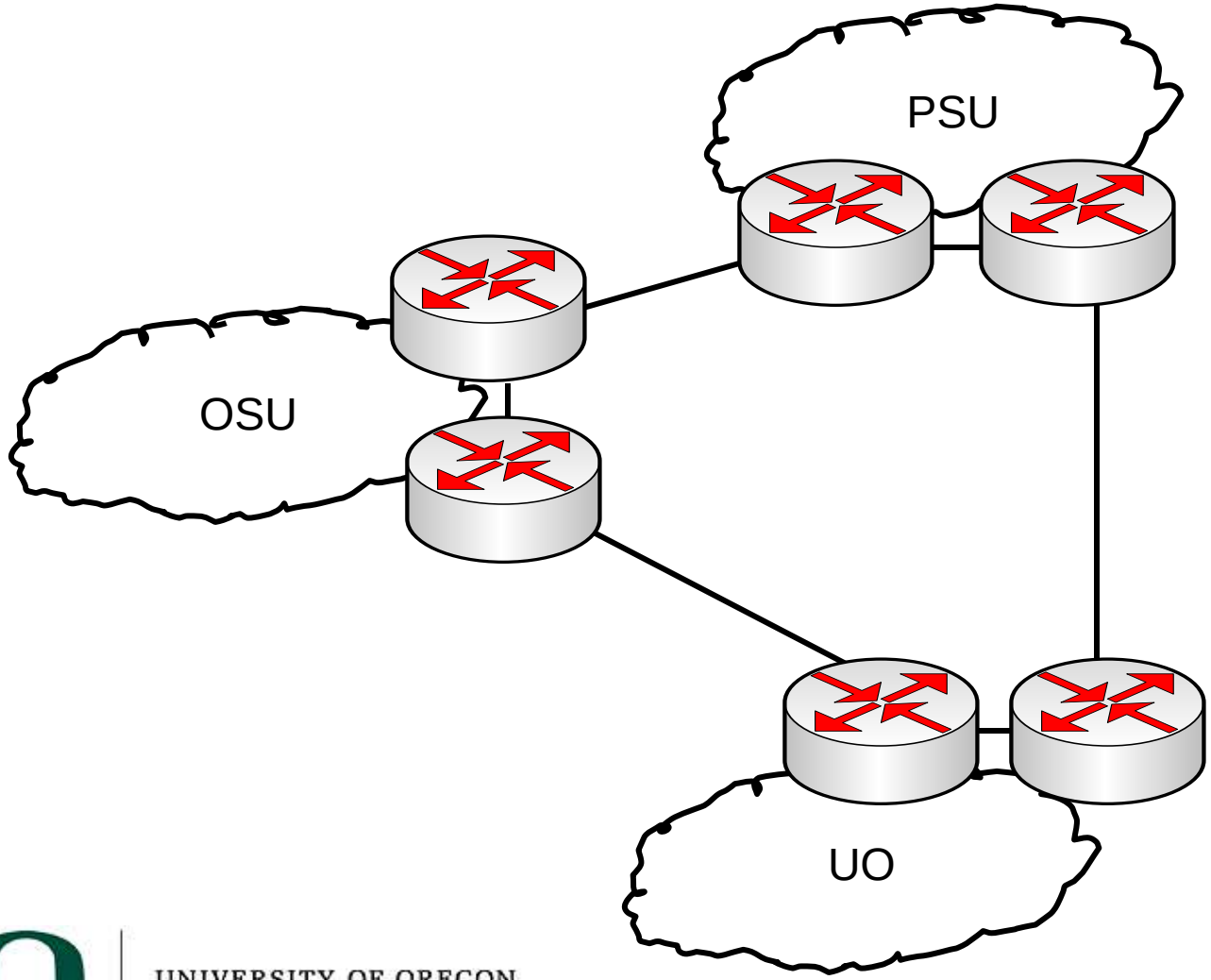
- The most simple POP is single router



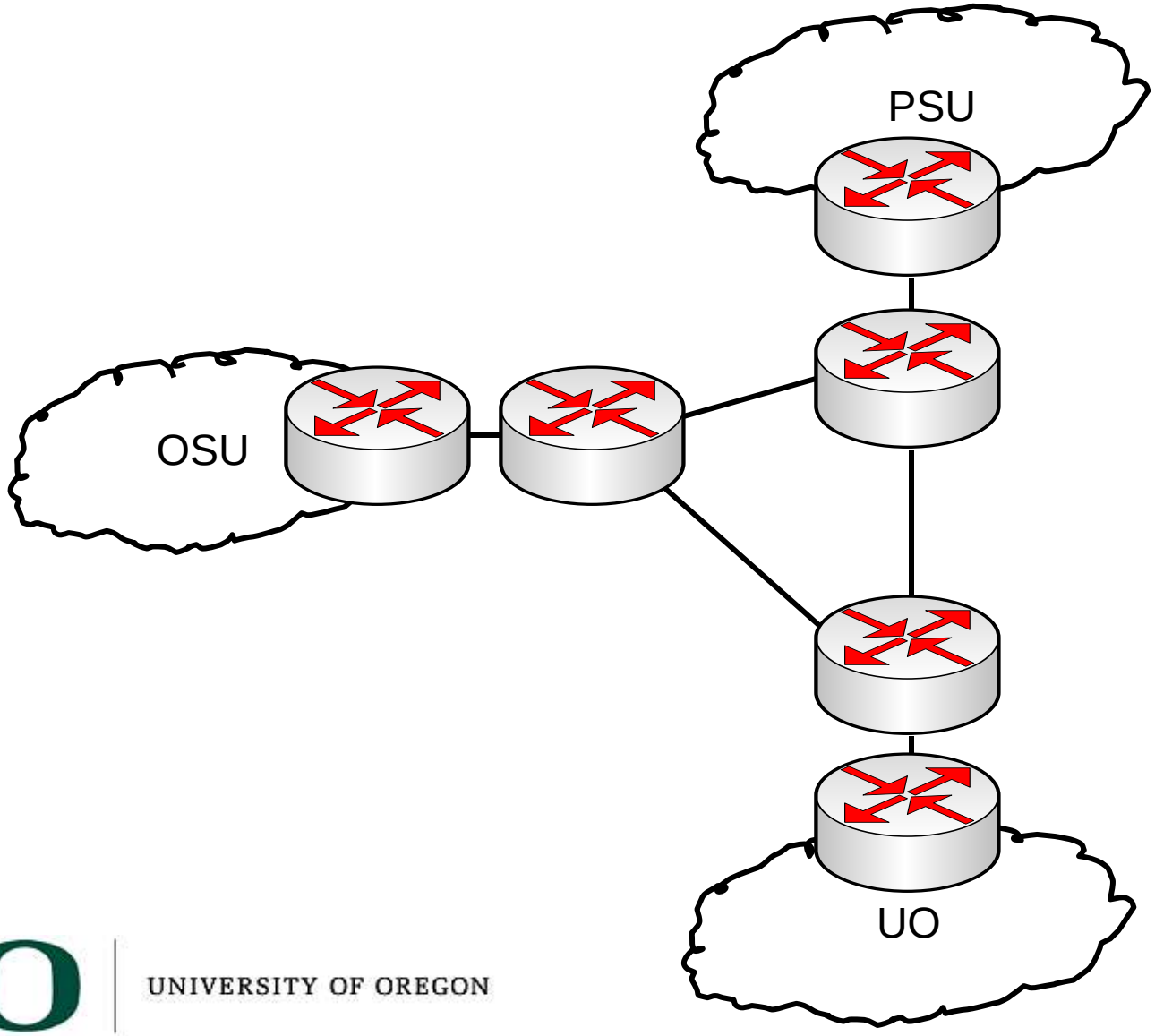
Single Router POP Issues

- Single router is a single point of failure
  - Solution: use multiple routers
- It also means that customers are connected to the same router as you are using to operate your backbone
  - Solution: use different routers for customer access and backbone operations

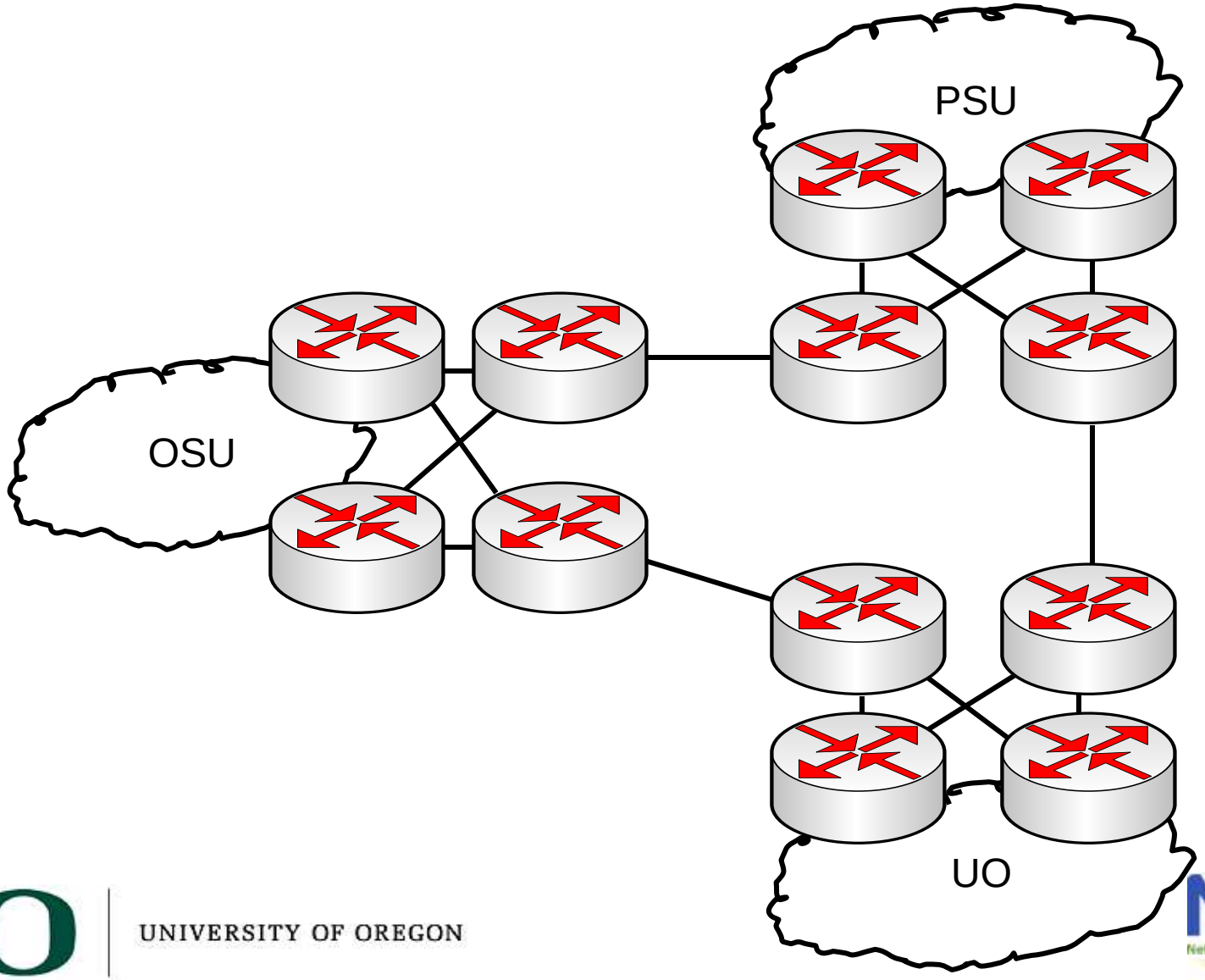
Eliminate Single Point of Failure



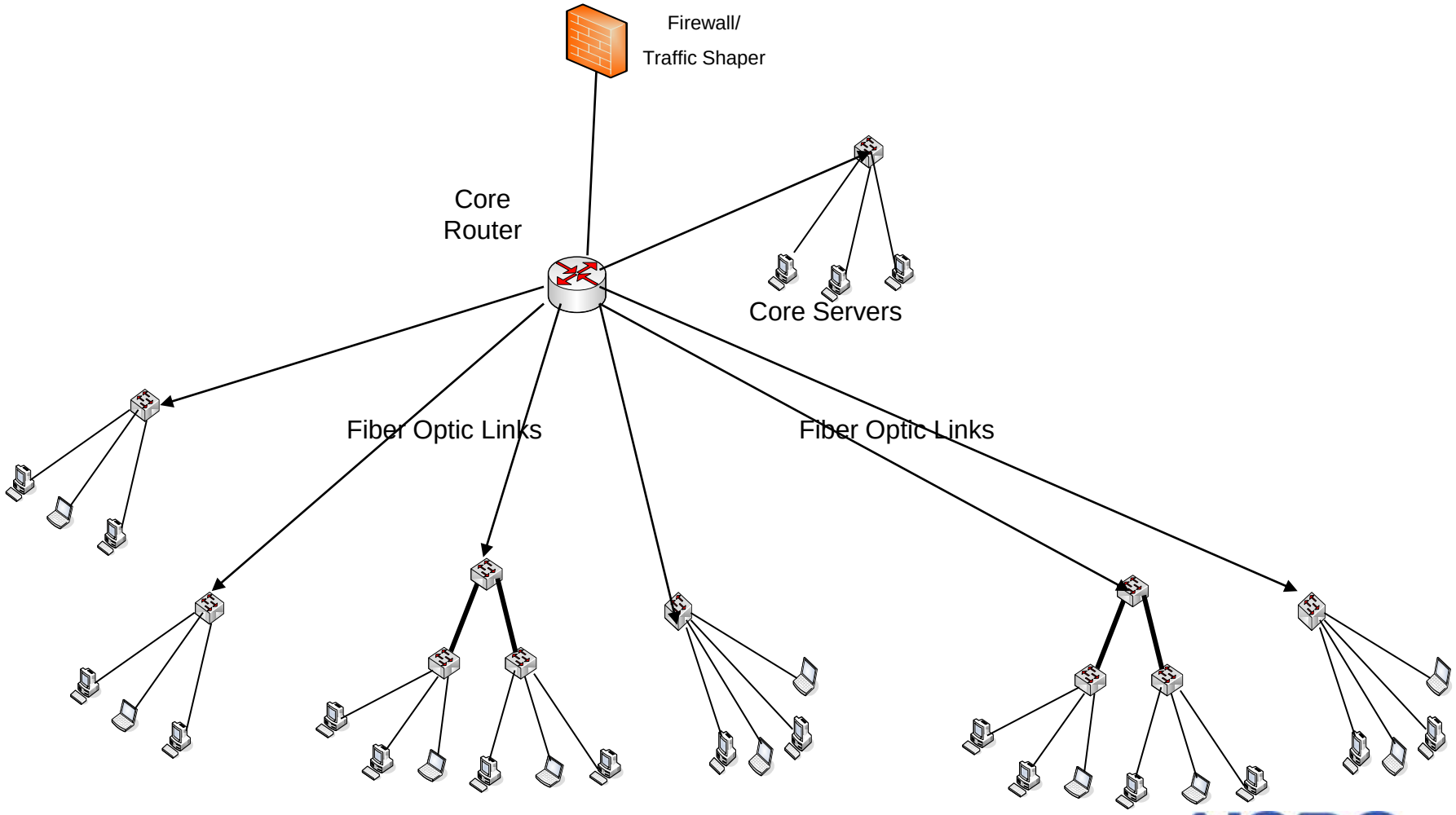
Separate Customer from Backbone



Combine Concepts



Relationship with Campus Net



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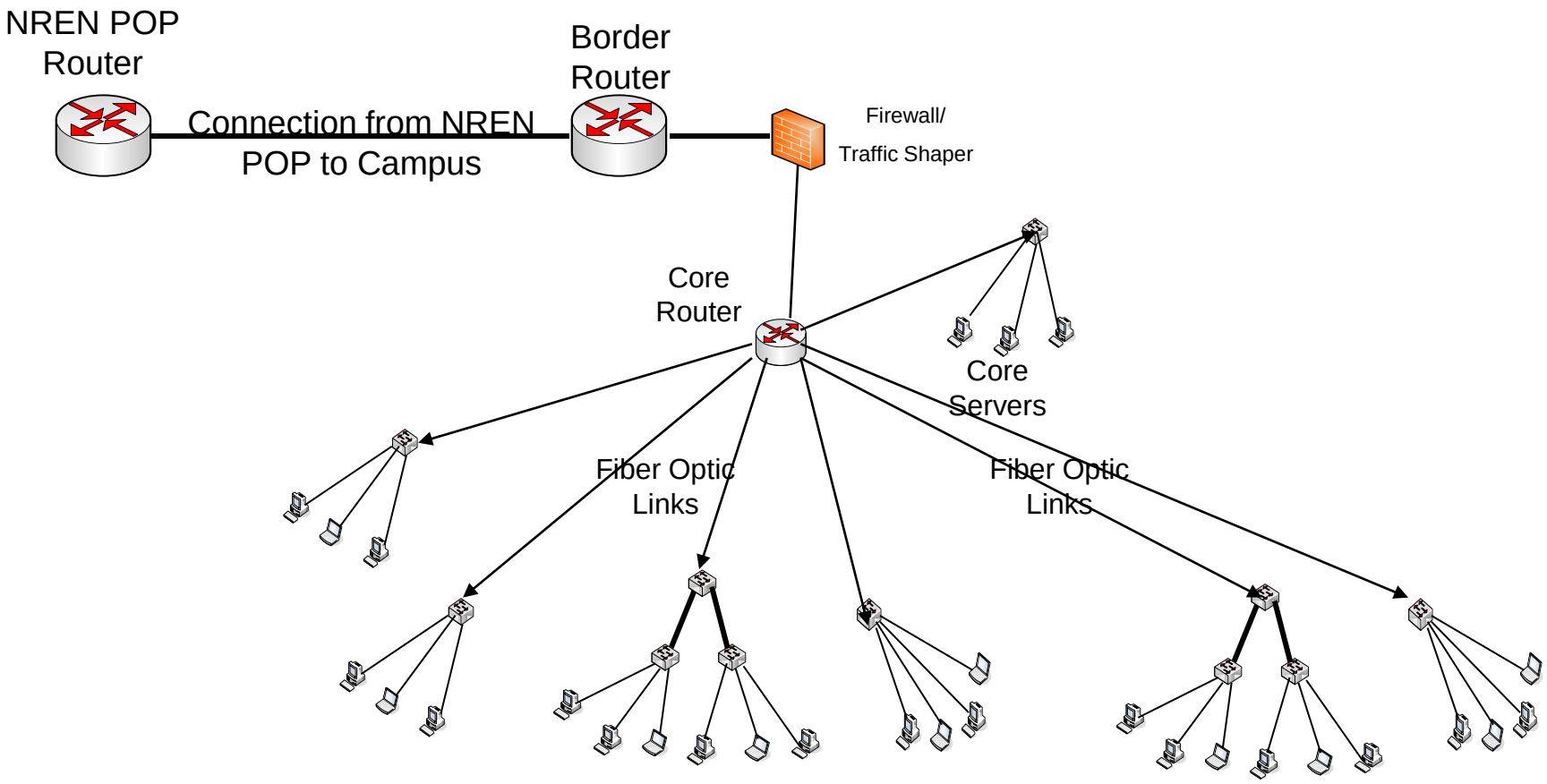

Who Owns the Router on Campus

- Is the router on the campus managed by the NREN or by the campus?
- What are advantages of each?
- NREN managed
  - Easier for NREN to guarantee services
  - Easier to monitor network
- Campus managed
  - Campus may have additional connections

Summary

- Don’t get hung up on designing the perfect NREN – it will continue to change
- Get started with a single router
- An NREN is basically an ISP
  - You can benefit from the experiences of the ISP community
  - Attend AfNOG – it is a great community

Questions?