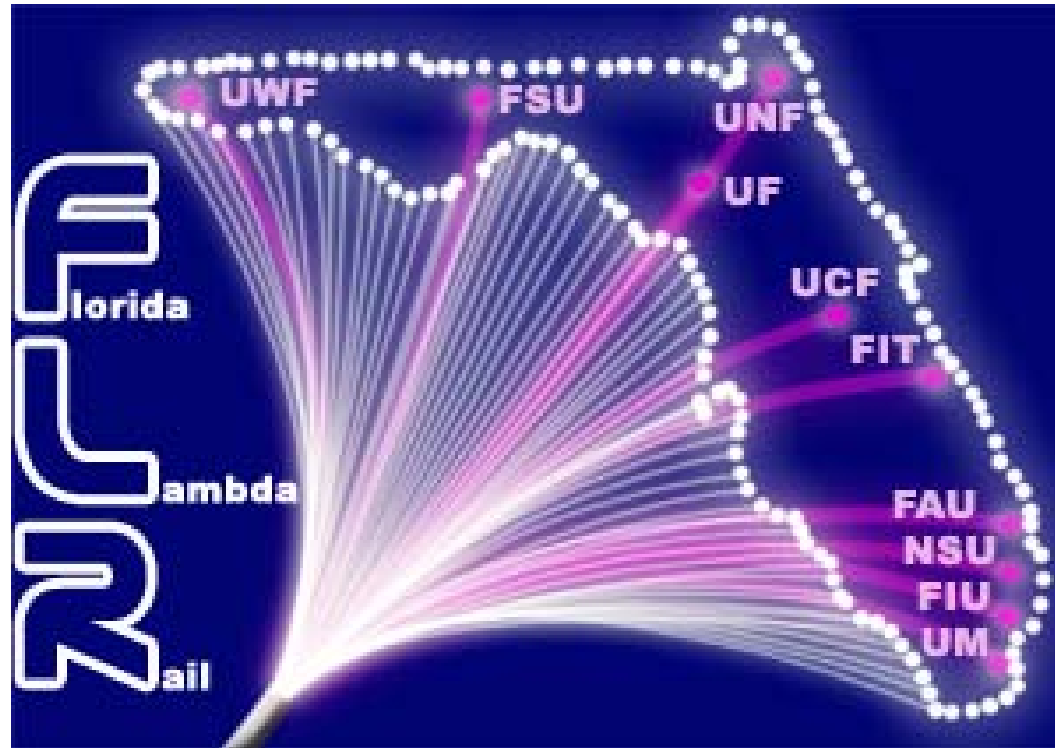
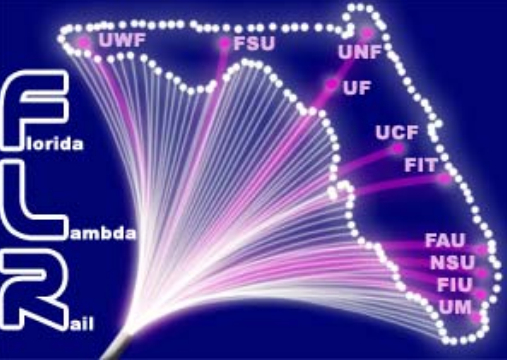


# The Florida LambdaRail Network

The Research and Education Network for Florida



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**Senior Network Architect**  
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[www.flrnet.org](http://www.flrnet.org)

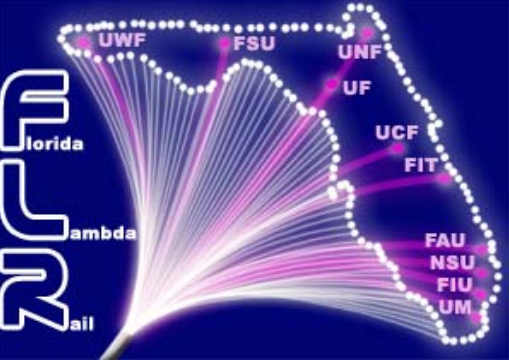


# What is FLR?

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- A high speed research and educational network
- Current Members are FAU, FIT, FIU, FSU, NSU, UCF, UF, UNF, UM, UWF
- Provides commodity Internet service
- Provides Internet2 connectivity
- Provides peering between members and other Providers or Networks
- Provide Optical paths
- Provide Layer2 paths

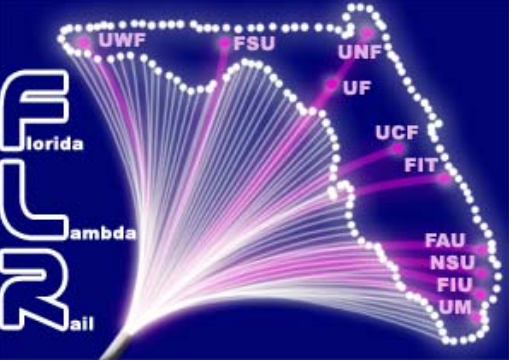


# What is FLR?

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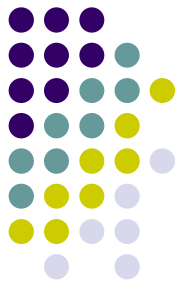


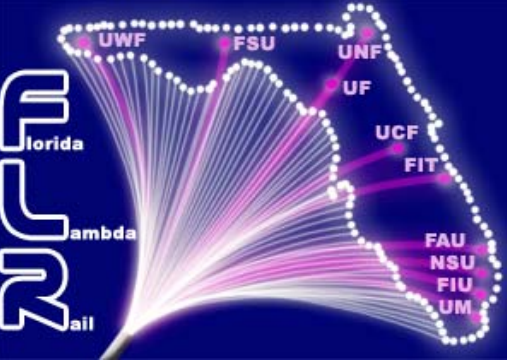
- Member Owned
- Member Managed
- Member Funded



# Timeline

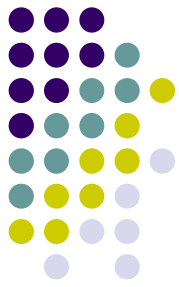
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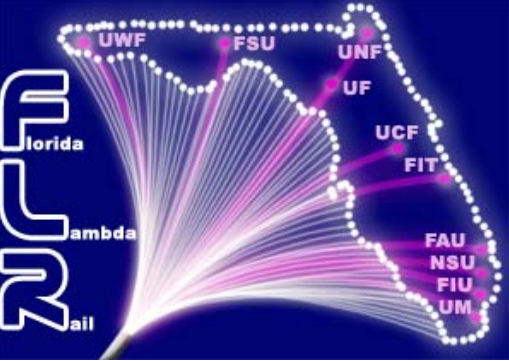
# How Did We Get Here

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## Major Focus Areas

- Fiber
- Optical and Transport Equipment
- Network Design
- Network Implementation
- Network Operations Center and Network Management.

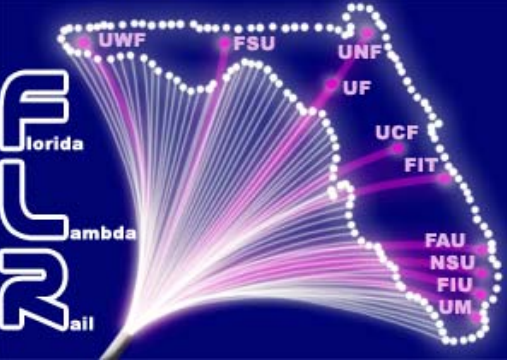


# Fiber

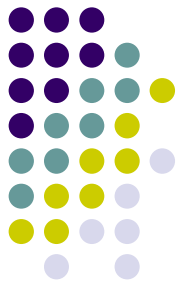
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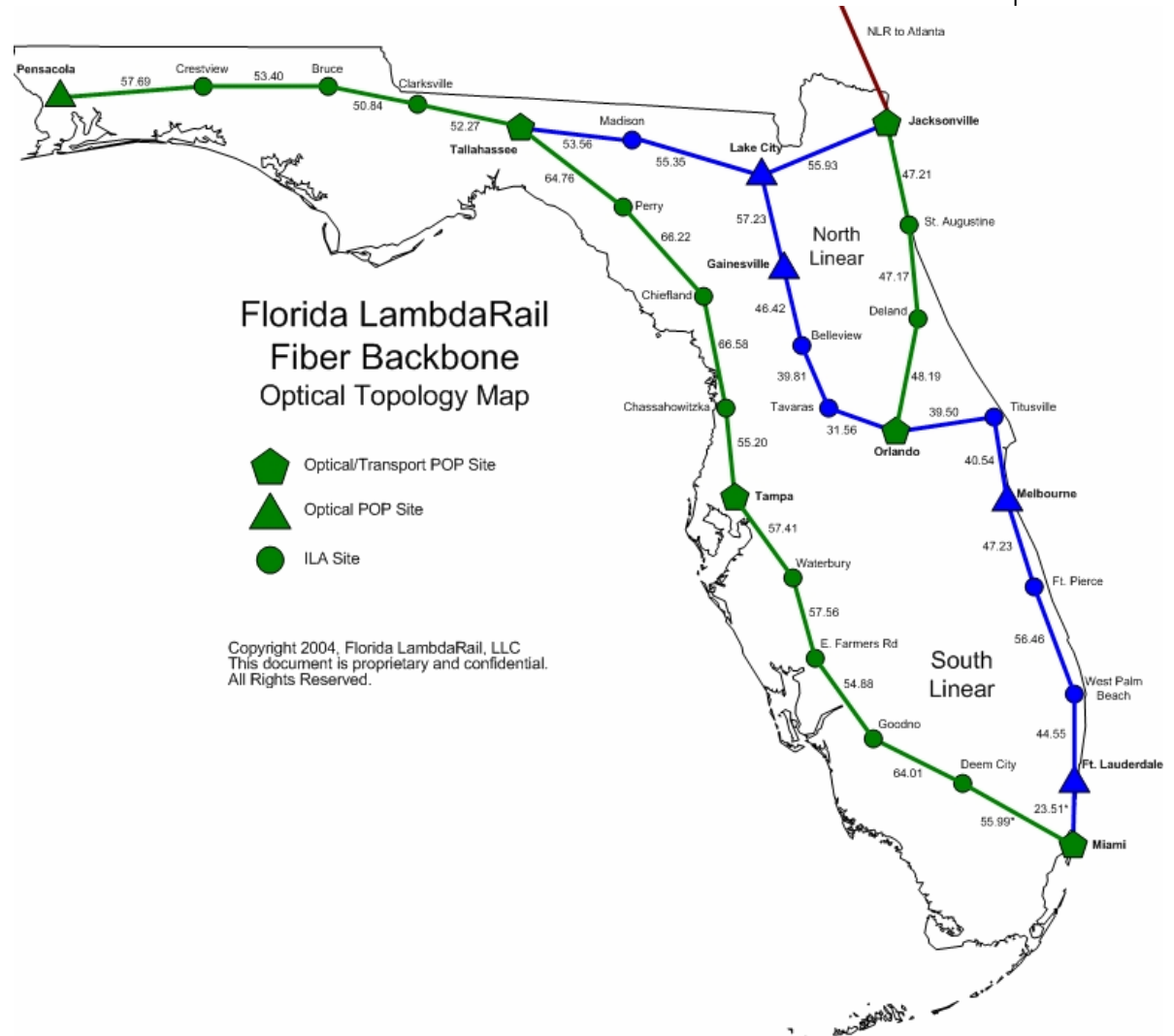
- Generic Design
- The Questions
  - Who
  - Where
  - What
- RFP for Backbone
- RFP for Local Loop

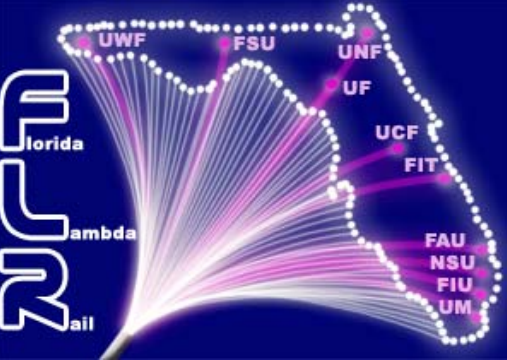


# Fiber



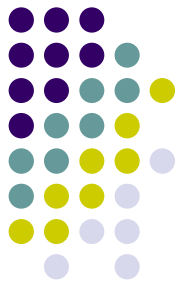
- Obtained from Level 3.
- 1540 Miles of fiber.
- 20 year IRU
- LEAF, and ELEAF fiber



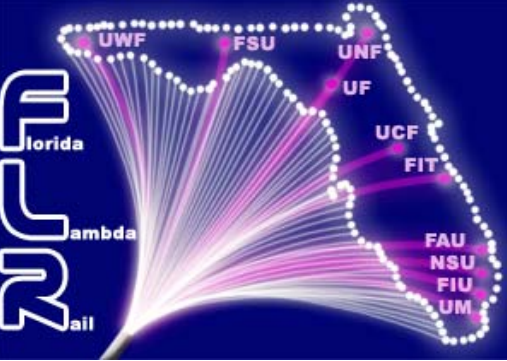


# Equipment

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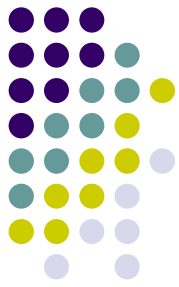


- Optical
  - Cisco 15454
- Transport
  - Cisco Catalyst 7609s with Sup720-3BXL
  - Cisco Catalyst Metro 3550
- Out of Band Management
  - Cisco 2621 routers
  - Cisco 2950 switches
- Servers
  - Dell Servers

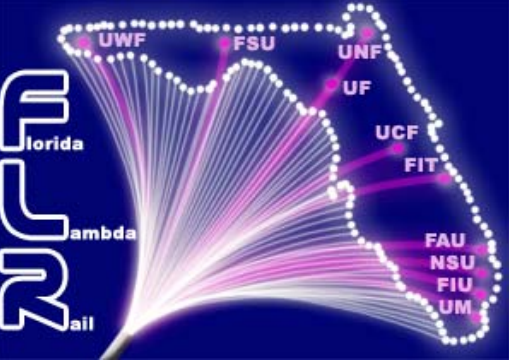


# Standard Rack Layout

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- Picture of rack
- Talk about this being a standard transport layout, etc.

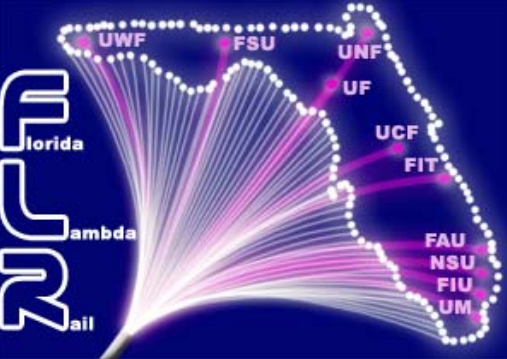


# Network Design

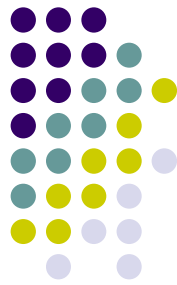
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- Optical
- Transport
- Out of Band

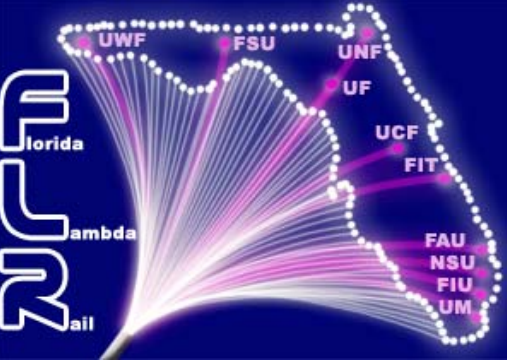


# Optical Network



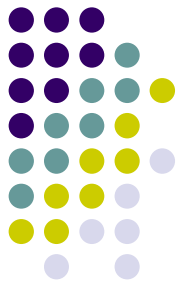
- Composed of Two Linear Paths.
- Cisco 15454
- DWDM Backbone
- CWDM Spur
- 10Gig and 1 Gig waves
- 28 sites
  - 5 Optical/Transport
  - 5 Optical PoP
  - 18 ILA



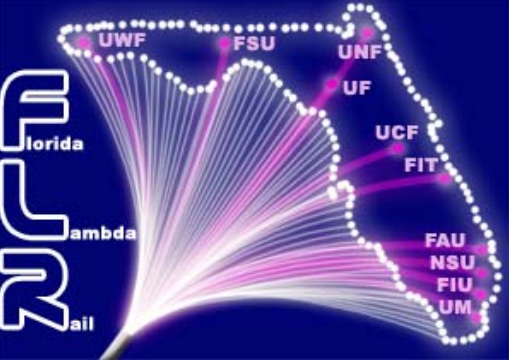


# Transport Network

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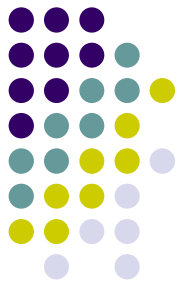


- Five Core Routers
- MPLS Backbone
- Separate VRF for Internet, Internet2, and FLRnet Peering.
- ISIS and BGP for routing on the Backbone
- BGP routing to connectors.
- Each service over a different vlan to connectors.
- Routing decision is made by connectors and sent across the appropriate vlan.

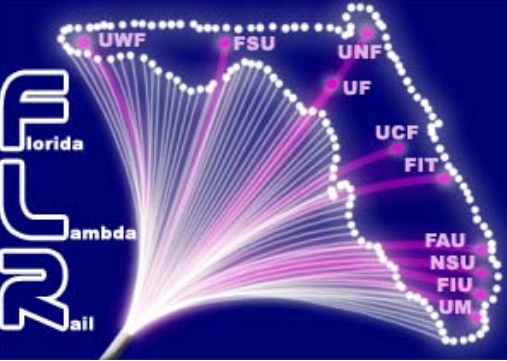


# Transport Network

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- Diagram

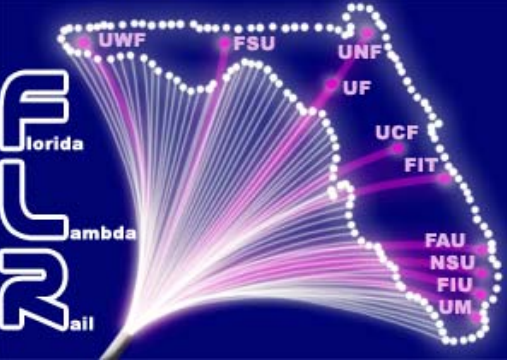


# Out of Band Network

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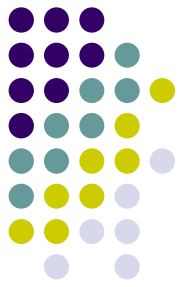


- Able to manage all equipment from Out of band network.
- Uses the UDC on the Cisco 15454s.
- Separate vlan for OBM from the NOC for transport equipment.
- VPN connection through the Internet for backup OBM connectivity.

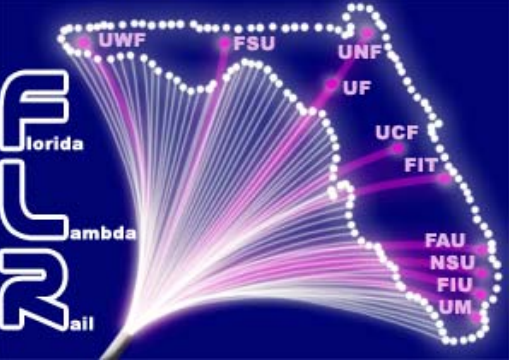


# Network Implementation

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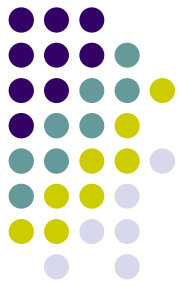


- Fiber testing
- Equipment delivery
- Optical equipment installation and configuration
- Transport equipment installation and configuration
- Connecting members
- Connecting service providers
- Connecting peers
- Research waves

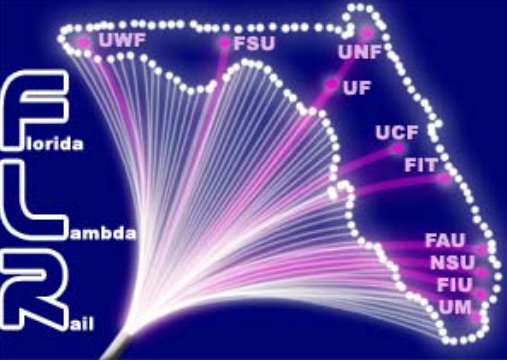


# Fiber Testing

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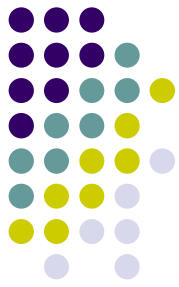


- Testing by Level3
- Testing by Cisco

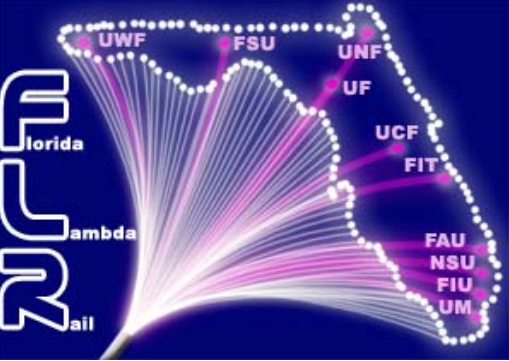


# Optical Equipment

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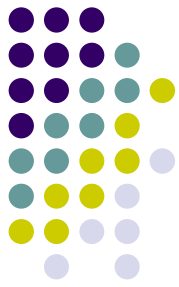


- FLR Delivered the equipment to each site
- Contracted with Cisco for the:
  - Installation of the 15454s
  - Configuration of the 15454s
  - Testing before handover to FLR

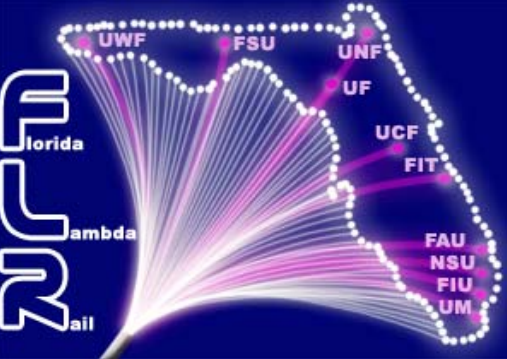


# Transport Equipment

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- Delivered by FLR to each of the transport sites.
- Installed by FLR.
- Configured by FLR.
- Tested by FLR.

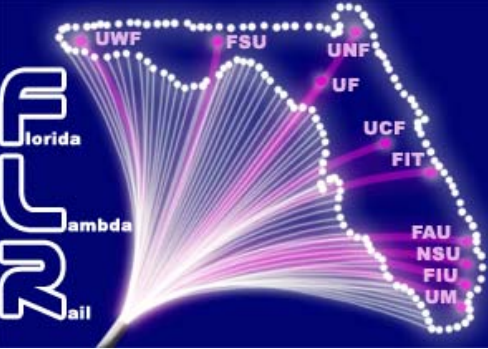


# Connecting Members

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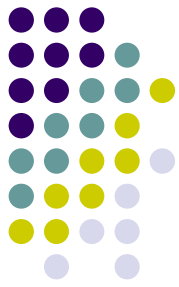


- Each member was responsible for the local loop from their campus to an FLR node.
- Each member will receive a 10G and 1G connection to two different core Routers.
- Each service (Internet, Internet2, FLRnet peering) will be over a different bgp connection and vlan.
- FLR assisted with coordination between Local loop providers and Level3.
- FLR assisted connectors with recommendations on BGP configuration when needed.
- FLR coordinated turn-up and testing of services.

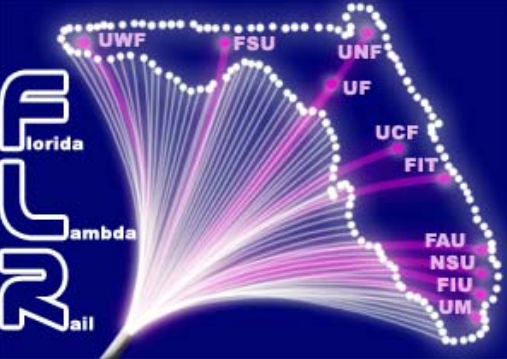


# Connecting to the Internet

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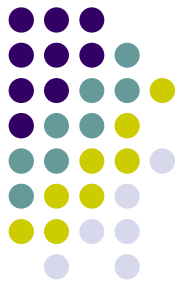


- Internet connectivity is in its own VRF instance.
- Two internet providers.
  - Level3
  - Cogent
- Each provider will have a 1 Gig connection to 2 different FLR core routers. One connection is the primary, the other is backup.
- 500M from each Internet provider to begin with.

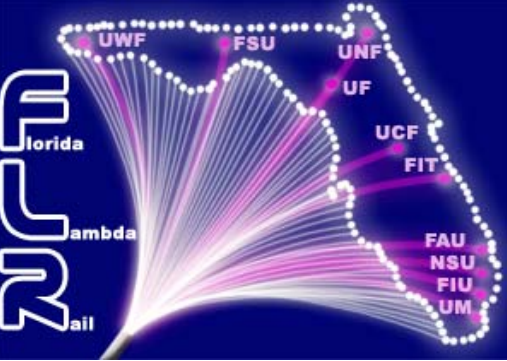


# Connecting to Internet2

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- Internet2 connectivity is in its own VRF instance.
- NLR wave from Jacksonville to SoX in Atlanta
- Share a 10G connection with SoX to Abilene
- FLR and SoX each have a separate vlan on this connection so that we each peer directly with Abilene.
- FLR provides transit for Ampath, on another vlan, so that they peer directly with Abilene.
- Future plans include a backup path to I2, possibly through a reciprocal agreement with another research network.

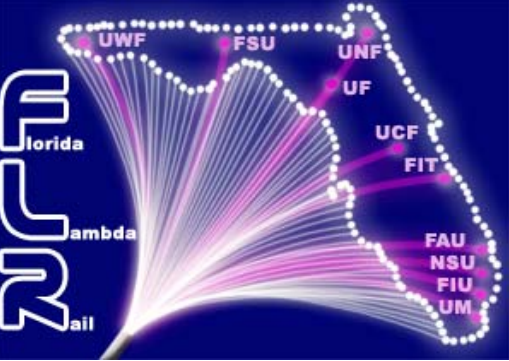


# Connecting to Peers

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- FLRnet Peering connectivity is in its own VRF instance.
- FLR peers with each member.
- FLR peers with SoX Atlanta-IX.
- FLR plans to peer with Ampath.
- FLR is connected to the peering fabric at The NAP of the Americas in Miami and will be looking at additional peering relationships.

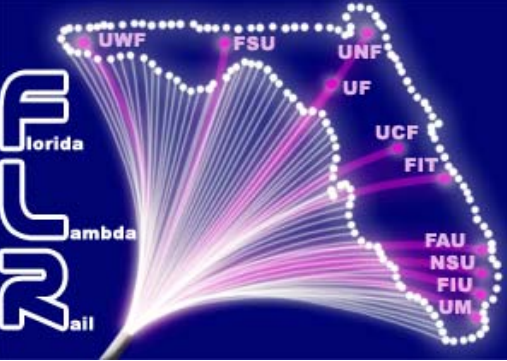


# Research Waves

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- FLR has to capacity to add research lambdas.

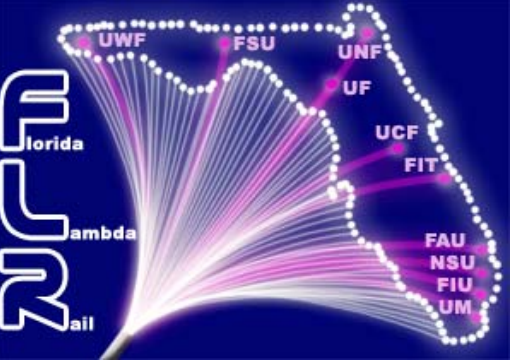


# Network Operations Center

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- 24x7 staffed operations center
- The NOC provides
  - network management
  - Monitoring
  - testing services
  - Problem/Request ticket Dispatching
- Sparing
- Engineering staff



# title

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