



# National LambdaRail

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# National LambdaRail

- U.S. national endeavor to secure and run infrastructure for national research & education community
- Base NLR unit is 10 Gbps lambdas -- up to 40 lambdas
- Obtained Level3 fiber – 20 years
- Lighting with Cisco gear
  - **Layer 1 / Optical Network System**
  - **Layer 2 / GigE “transport” infrastructure**
  - **Layer 3 / IP next generation routed network**
- NLR supports Production and Experimental (breakable) infrastructures at each layer



# National LambdaRail Organization

- Board of Directors
  - Member Reps.
- Tom West
  - CEO
- Dave Farber
  - Chief Scientist
- Debbie Montano
  - Director, Development & Operations
- Engineering Committee
  - Dave Reese, chair
- Network Research Council
- Technical Support Services
  - CENIC, IU, MCNC
- Implementation Team
  - Steve Cotter, I2/NLR
  - Cisco, Level3, etc.



# Current NLR Participants

- **Corp for Education Network Initiatives in Calif. (CENIC)**
- **Pacific Northwest GigaPOP (PNWGP)**
- **Pittsburgh Supercomputing Center**
- **Duke (representing coalition of NC universities)**
- **Mid-Atlantic Terascale Partnership**
- **Cisco Systems**
- **Internet2**
- **Florida LambdaRail**
- **Georgia Institute of Technology**
- **Committee on Institutional Cooperation (CIC)**
- **Oak Ridge National Laboratory**



# NLR-Internet2 Collaboration

- Internet2 and NLR are at heart the same community, same faces, same core goals
- One distinguishing characteristic: NLR has OWNED infrastructure to enable MULTIPLE networks and national research projects.
- Internet2 is an important NLR founding member.
- Hybrid Optical & Packet Infrastructure (HOPI)
  - Abilene backbone & NLR lambdas



# Pending NLR Participants

- Lone Star Education and Research Network (LEARN) - Texas
- Cornell University – New York
- SURA – Southeast (association of southern univ.)
- Louisiana
- UCAR/Front Range GigaPOP/Intermountain GigaPOP – (Colorado-Utah-Wyoming)
- New Mexico / Arizona
- Oklahoma



# NLR Infrastructure

- Not a single network but a set of facilities, capabilities and services to build both experimental and production networks at various layers
- Most of the focus so far has been on the massive production DWDM network build out but that would change soon to focus on building the experimental networks



# Initial Wave Configuration

- Initial deployment is 4 10 Gig wavelengths
  - One 10 Gig layer three
  - One 8x1Gig layer two
  - One dedicated to Internet2 HOPI
  - One hot spare





# NLR Layer 3 / IP

- One 10 GE lambda is dedicated to a nationwide IP network
- Requirements and architecture are in the planning stages
- Cisco Routers
- The NLR membership will participate in the design of this network and shape how it will be utilized.



# NLR Layer 2 / GigE

- Deploying nationwide GigE network
  - Cisco 650x and 760x switches.
- 1 10 GE lambda dedicated for Layer 2 infrastructure.
- Providing 1 GE service to all NLR MetaPoPs
- Production GigE service; Experimental GigE networks can be created as separate projects which are to be formulated.
- Finalizing requirements and architecture
- Nationwide GigE network is NEW -- planning initial prototype period to allow for learning & advancing the state of the art.



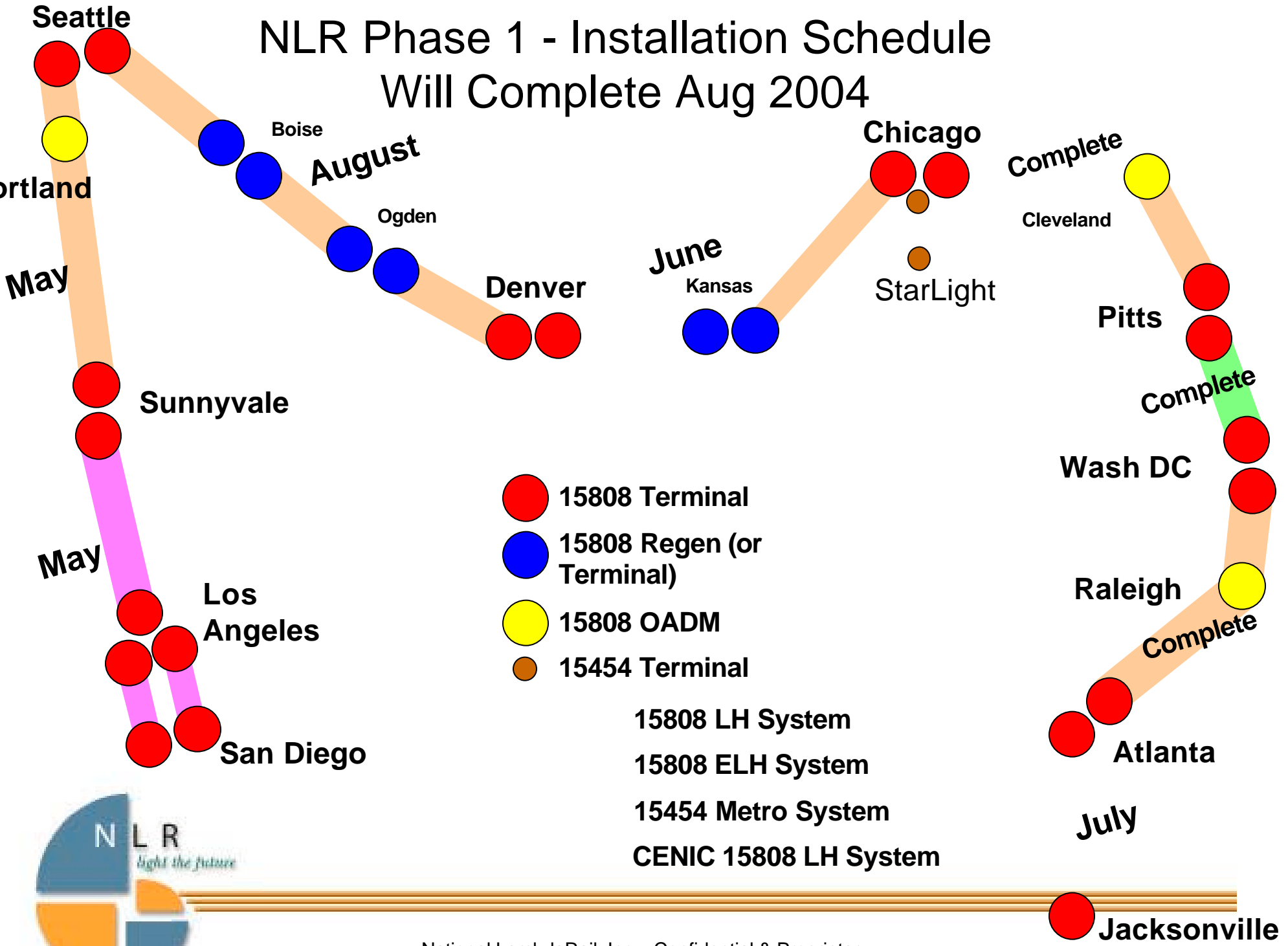
# NLR – Optical Infrastructure - Phase 1



# NLR – Phase 1 + Route to NY & ORNL Waves

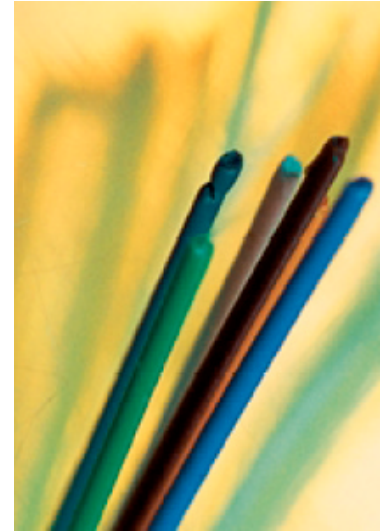


# NLR Phase 1 - Installation Schedule Will Complete Aug 2004



# NLR Southern Route - Priorities

- Build where the members are!
- Obtain fiber assets, just as in the north
- East-West route to complete our ring
- North-South routes for more alternative paths and robust infrastructure
- Base cost of infrastructure plus low incremental wave costs
- Use newer technology -- Cisco 15454



# Cisco Interest in NLR

- Early founder of NLR
- Significant financial contribution enabling NLR to become reality
- Driven by interest in the networking research aiming at tech transfer and commercialization
- Evolution of “Cisco Virtual Labs” concept based on University Research Program (URP)



# NLR Potential Use Examples

Use Examples	Internet BGP visibility		AUP-free Internet service		New routing protocols		Deterministic UltraLight access		XCP reference implementation		ETF distributed backplane		Optical packet switching architecture	
	↑↑		↑↑		↑↑		↑↑		↑↑		↑↑		↑↑	
Infrastructure	Production Routed IP Network		Exp. L3 Networks	Prod. L3 Networks	Experimental L2-3 Networks		Production L2-3 Networks		Experimental L1-3 Networks					
			Production Switched Ethernet											
	Production DWDM Network													
	1st pair Fiber													
	Additional Fiber Pairs													



# NLR Overall

- On track for National Infrastructure Build
- Layers 1, 2 and 3
- Production & Experimental Goals
- Robust Technical Support Services
- Network Research Council
- National and International Cooperation
- Participation and Collaboration



# Business Plan Development

- What is the market for dedicated point-to-point 10Gig Waves?
- How to configure the 1Gig Enet services?
  - Global communities
  - Specialized communitites
  - Point-to-point
  - Dynamic versus Static
- What are the costing and pricing models?





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