Statewide Optical Network Delivers Unmatched Agility and Capacity

State backing and partnership with Cisco establish LONI as a premier cyber infrastructure for research, education, and industry.

EXECUTIVE SUMMARY

Louisiana Optical Network Initiative (LONI)

- Industry: Higher Education, Government, Public Broadcast, Healthcare, and Research
- Location: Baton Rouge, Louisiana (Main Data Center)

BUSINESS CHALLENGE

- Build a statewide network that can meet the needs of higher education, promote collaborative relationships, introduce shared resources, and tie Louisiana into global cyber networks
- Provide world-class responsiveness to short-term needs and changing requirements
- Keep up with the demand for increasing capacity
- Help ensure rapid delivery of new and evolving services

NETWORK SOLUTION

- ROADM-based optical infrastructure providing built-in scalability, flexibility, and easy expansion
- Cisco® Catalyst® 6500 Series core routers, with integrated service-enablement features

BUSINESS RESULTS

- Unprecedented capacity for the growing community of users
- Ability to rapidly reallocate bandwidth as needed, with extensive software-based change control (minimized truck rolls)
- Excellent future technology roadmap for investment protection and a steady stream of new services
- Ability to support a broad range of service types, both today and into the future

Business Challenge

The government, educators, and researchers in Louisiana joined together to ensure that the state could compete in the technological world of the 21st century. As a result, the Louisiana Optical Network Initiative (LONI) was established to fund and manage a US$40-million fiber network, providing access to world-class supercomputer resources and allowing the state to join the growing community that constitutes the National LambdaRail (NLR). The first phase of the LONI deployment has been completed, with many milestones reached:

- More than 1600 km of backbone fiber extend throughout the state.
- LONI serves more than 148,000 students and 12 institutions including Louisiana State University (LSU), LSU Medical Centers in Shreveport and New Orleans, Louisiana Tech University, and Tulane University.
- In-state, external, and Internet peering are provided by:
  - 14 10 Gigabit Ethernet state wavelengths
  - 1 10 Gigabit Ethernet external peering wavelength
  - 3 10 Gigabit Ethernet external peering circuits
  - 4 1 Gigabit Ethernet Internet peering circuits

Unlike many other states that limit NLR access to exclusive supercomputing centers, the LONI Board of Regents is committed to providing statewide and NLR access for a very broad base of educators, public organizations, and researchers in both private and public sectors. The diverse user community requires that LONI be continually evolved to accommodate more organizations and extend to more sites. Since the governor and legislature in Louisiana share a vision for the state's new cyber infrastructure, ten-year funding has been approved for the LONI network. As a result, the LONI technology team can look for long-term solutions and partnerships that will help ensure that the infrastructure remains one of the premier networks in the country while optimally serving its dynamic base of users.

Network Solution

At the outset, the LONI designers identified the major requirements essential to success:

- **Scalability** – The network footprint must continually expand to reach new sites, support the growth in traffic from new users and projects, and enable research that aggressively pushes all of the capacity limitations at every point in the network. The second phase of the deployment, which has just begun, will make the network accessible to an additional 115,000 students and 69 more institutions including hospitals, the state's Department of Transportation (DOT), and the Louisiana Public Broadcasting (LPB) company. All LPB broadcasts will be moved from satellite to the LONI infrastructure.
- **Security** – Real-time broadcasts of classes and other production activities require highly available connections and resources. Research projects need isolated environments where unproven technologies can be deployed and evaluated. The team requires security solutions that allow logical separations to provide the same level of protection as physical separations.
- **Agility** – The nature of these state-run education and research networks is that bandwidth allocation and service provisioning is often temporary and dynamic. The LONI team receives many requests for very fast turn-up of circuits, whether for a short-term event such as a convention or for a new research project. When one project ends, the team must also be able to reallocate that bandwidth without costly network rebuilds or pervasive configuration changes.
- **Cost-efficient management** – The main data center is located at Baton Rouge, on the LSU campus. The centralized administration team must be able to monitor and manage the statewide network within a limited budget.

A Collaborative Solution

To meet these requirements, the LONI team made the decision to partner with Cisco. "Our relationship with Cisco began back in the planning stages for the LONI network," says Charles P. McMahon, director of technology for LONI. "Cisco helped us design a network that can evolve to take advantage of technology breakthroughs, and provide us with unprecedented configuration flexibility. We have also formed a unique research partnership that allows us to contribute to product development and helps Cisco research solutions for the high-performance computing industry. It's a win-win situation, allowing LONI to better serve its community both today and into the future."

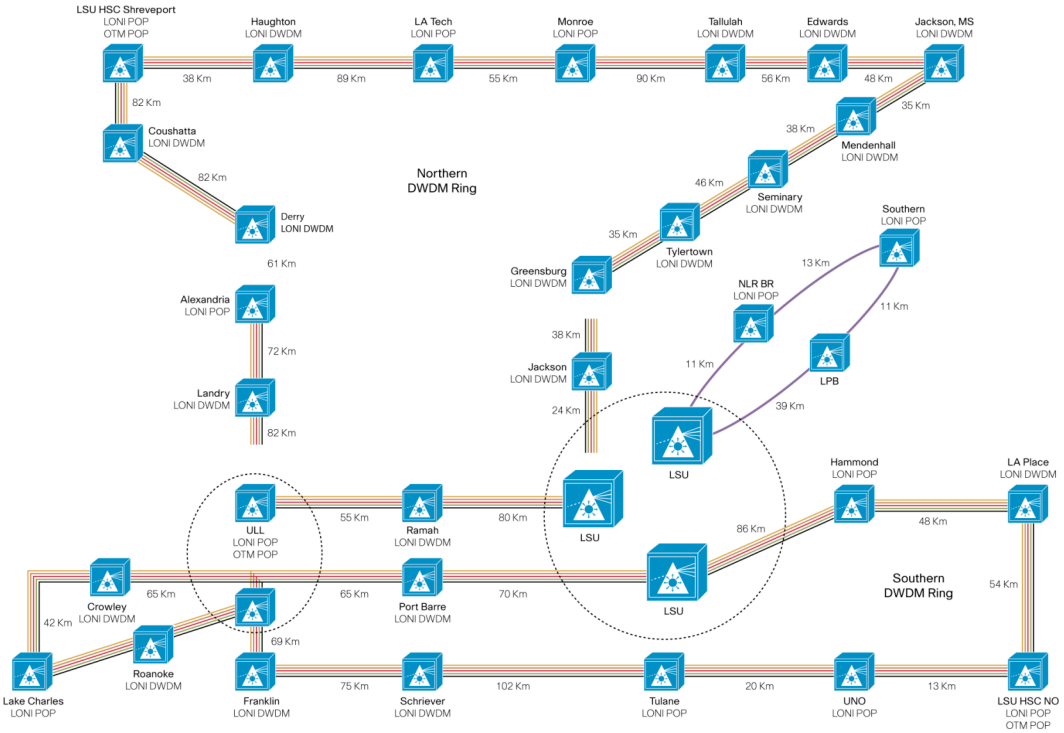
Flexible Two-Degree ROADM Technology

A major factor in the selection of Cisco was the strength of its optical solutions. The LONI infrastructure is built upon Cisco ONS 15454 Multiservice Transport Platforms (MSTPs), with reconfigurable optical add/drop multiplexing (ROADM) technology. A relatively recent innovation, ROADMs have revolutionized how transport networks are designed and managed and have proven to be a key enabler of wavelength services delivery. On day one, a ROADM-enabled dense wavelength-division multiplexing (DWDM) node can scale to 40 wavelengths, each of which can be configured remotely to add, drop, or pass any combination of those wavelengths through each site. This manageability and scalability, combined with automated signal and power management, eliminate the need for truck rolls to intermediate (hoop) locations to enable or redirect services.

ROADMs also demonstrate their capital and operating expense savings as DWDM networks grow beyond four to six wavelengths. The Cisco ROADM maximizes agility and reduces total cost of ownership within high-growth, high-capacity environments such as LONI by offering[1]:

- The ability to easily turn up bandwidth. Circuit provisioning and activation is significantly faster in a ROADM network, and more wavelengths can be added without affecting active services.
- Simplified reconfigurations and reallocation of bandwidth. Manual changes are only required at the origin and destination points; all other provisioning is automatic and controlled using software management capabilities. This eliminates the need for trained engineers to go out to intermediate sites or for manual adjustments to power and signals along transmission paths.

Figure 1. The Louisiana Optical Network Initiative (LONI) Cyber Infrastructure



A Future-Proof Network

As two-degree ROADM networks continue to grow in size and complexity, control over wavelength management, distribution, and cost can be further enhanced through the use of multidegree ROADM technology. With all the benefits of two-degree ROADM technology, multidegree ROADM technology increases flexibility with additional degrees of distribution. A Cisco multidegree ROADM can expand from two to eight degrees of transport, making it possible to converge multiple DWDM rings of traffic and enabling wavelengths to be remotely provisioned across entire networks with limited physical adjustments at only the service endpoints.

[1] "The Business Case for ROADM Technology," by Network Strategy Partners, LLC, is available at: http://cisco.com/application/pdf/en/us/guest/products/ps2006/c1244/cdccont_0900aecd8052b792.pdf

Phase 2 Expansion

The LONI team recently began the second phase of the network deployment, introducing more wavelengths and expanding the network to more sites to support an increasing user base. Additional Cisco ONS 15454 MSTPs, Cisco Catalyst 6500 Series, and Cisco 3650s will allow the network to reach almost 70 new organizations. The build out includes the addition of:

- 4 10 Gigabit Ethernet state wavelengths
- A 10 Gigabit Ethernet external peering wavelength
- A 1 Gigabit Ethernet Internet peering circuit
- 77 Metro-Ethernet circuits
- 400 km of backbone fiber

Business Results

With phase 2 under way, LONI has proven to be a revolutionary resource for the state of Louisiana and a growing number of national and international collaborators in the high-performance computing and networking industries. Within the higher education community, the build out is enabling more external connections with other high-speed cyber infrastructures (for example, NLR, Internet2, Texas' LoneStar, Florida LandaRail, and SOX in Atlanta) and out-of-state schools. Plans are being developed within Louisiana to add many of the K–12 parish school systems and the community college system to LONI.

"The flexibility of our network allows us to serve our communities in a broad and deep fashion," says McMahon. "The Cisco platforms give us very fast activations and flexibility in terms of wavelengths, routing, and reallocation of bandwidth. We have so many situations where we need to deploy wavelengths for a limited period of time, and we can respond to these requests very quickly and cost-effectively." For example, LONI helps research projects redeploy or share wavelengths as needed. In classrooms, professors use LONI to broadcast uncompressed video to students at out-of-state schools. One circuit was deployed twice a week so that a professor at the University of Arkansas could teach a class at Louisiana Tech. In between class broadcasts, the circuit was allocated for experiments or conference broadcasts. "We can control where a wavelength is dropped by changing just the endpoints," explains Lonnie Leger, director of networking at LONI. "The Cisco ROADM technology makes our jobs much simpler, and results in a very nimble infrastructure."

LONI also shines when it comes to capacity. The phase 2 LONI build-out can accommodate hundreds of thousands of new users over the upcoming years. LONI's capacity is a resource that is being shared by vital public and private organizations. Besides LPB moving to LONI, the Louisiana DOT will also be moving their operations onto the optical infrastructure. Command centers that manage emergency response, video feeds for weather centers, and all of the other DOT network traffic will be backhauled onto LONI to provide faster, most cost-effective delivery of content between agency entities. Phase 2 helps ensure that capacity will continue to grow as needed.

"It's all about service acceleration," says McMahon. "We have to be able to provide rapid response to last-minute requests. LONI delivers the capacity for many large-scale events and projects. While project planning may span years, specific network requirements are often defined only in the last couple weeks. Now, with Cisco ROADMs and fast service turnup, we can help more people turn their visions into reality even within these very tight timelines."

Next Steps

Since the Cisco ONS 15454 platform can serve as either a MSTP or a Multiservice Provisioning Platform (MSPP), LONI can easily evolve to take advantage of built-in multiservice interface options for the delivery of voice, video, and storage services as needed in the future. The LONI technology teams are also introducing the new Cisco XPonders to the Cisco MSTPs to gain faster provisioning and increased flexibility with the ability to add wavelengths in 10G increments.

PRODUCT LIST

Routing and Switching

- Cisco Catalyst® 6500 Series Switches (core and aggregation)

Optical Networking

- Cisco ONS 15454 Multiservice Transport Platform with ROADM cards and XPonders

Technical Implementation

Figures 2 and 3 show additional details about the LONI peering capabilities.

Figure 2. The LONI Network, External Peering

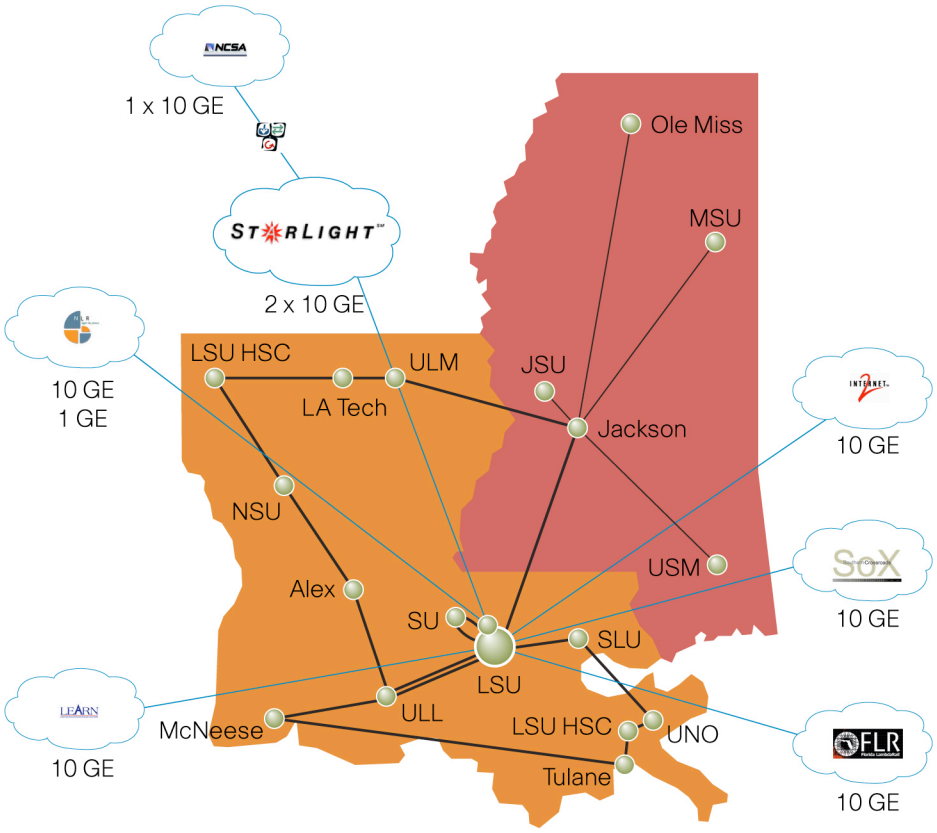
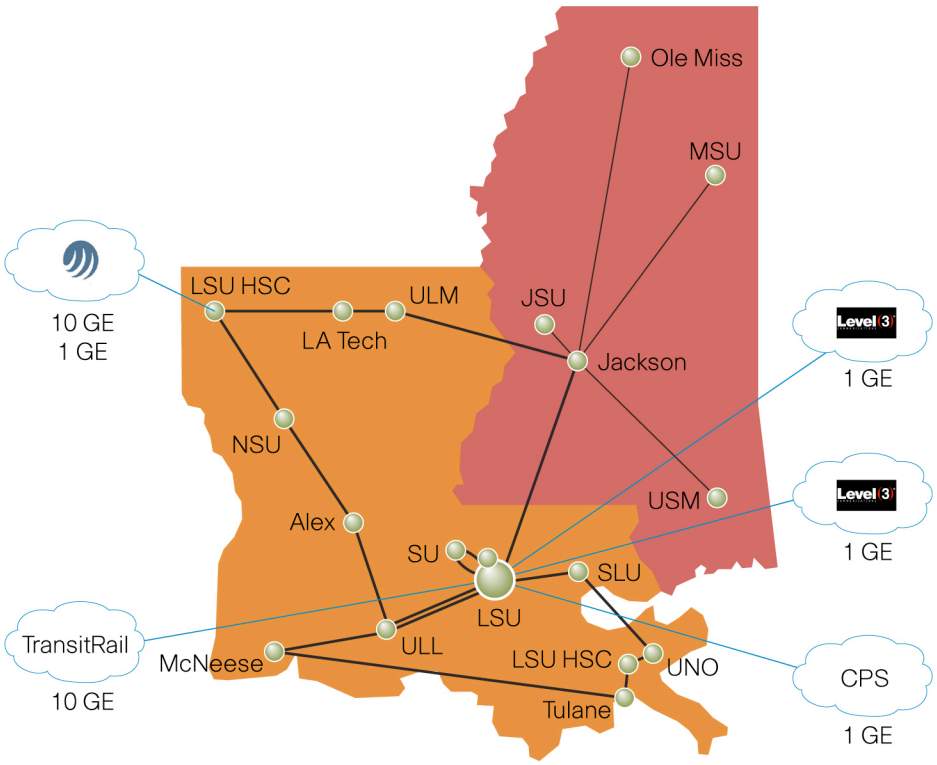


Figure 3. The LONI Network, Internet Peering



For More Information

To find out more about Cisco optical networking solutions, go to: http://www.cisco.com/go/optical

To find out more about Cisco switches, go to: http://www.cisco.com/go/switches

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Singapore

Europe Headquarters
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