

# National LambdaRail: Community Update

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NLR Press Releases

# What is NLR?

\* National Leadership Program

Researchers

Blog Postings

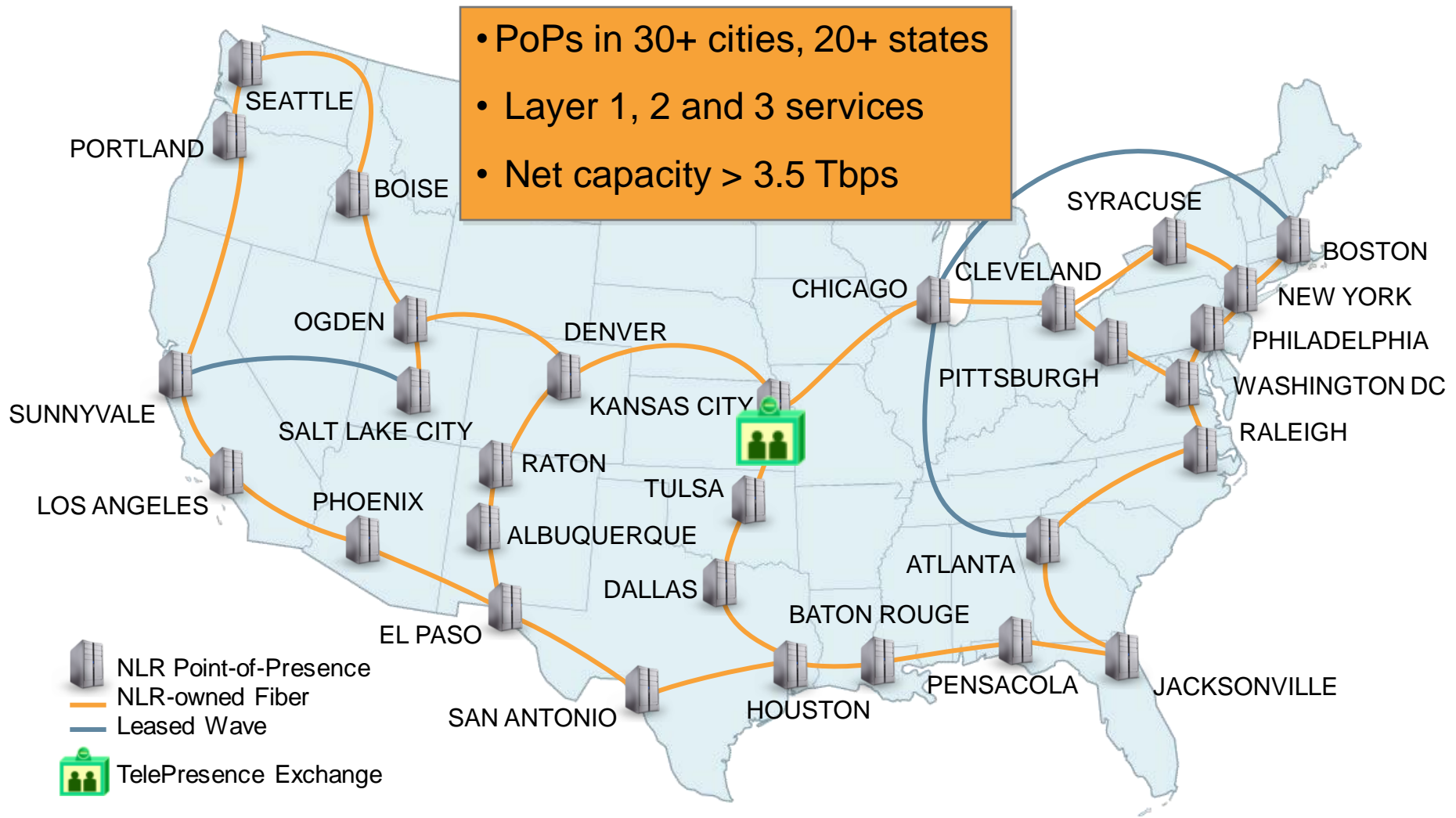




To serve as the strategic network resource for advanced research and education

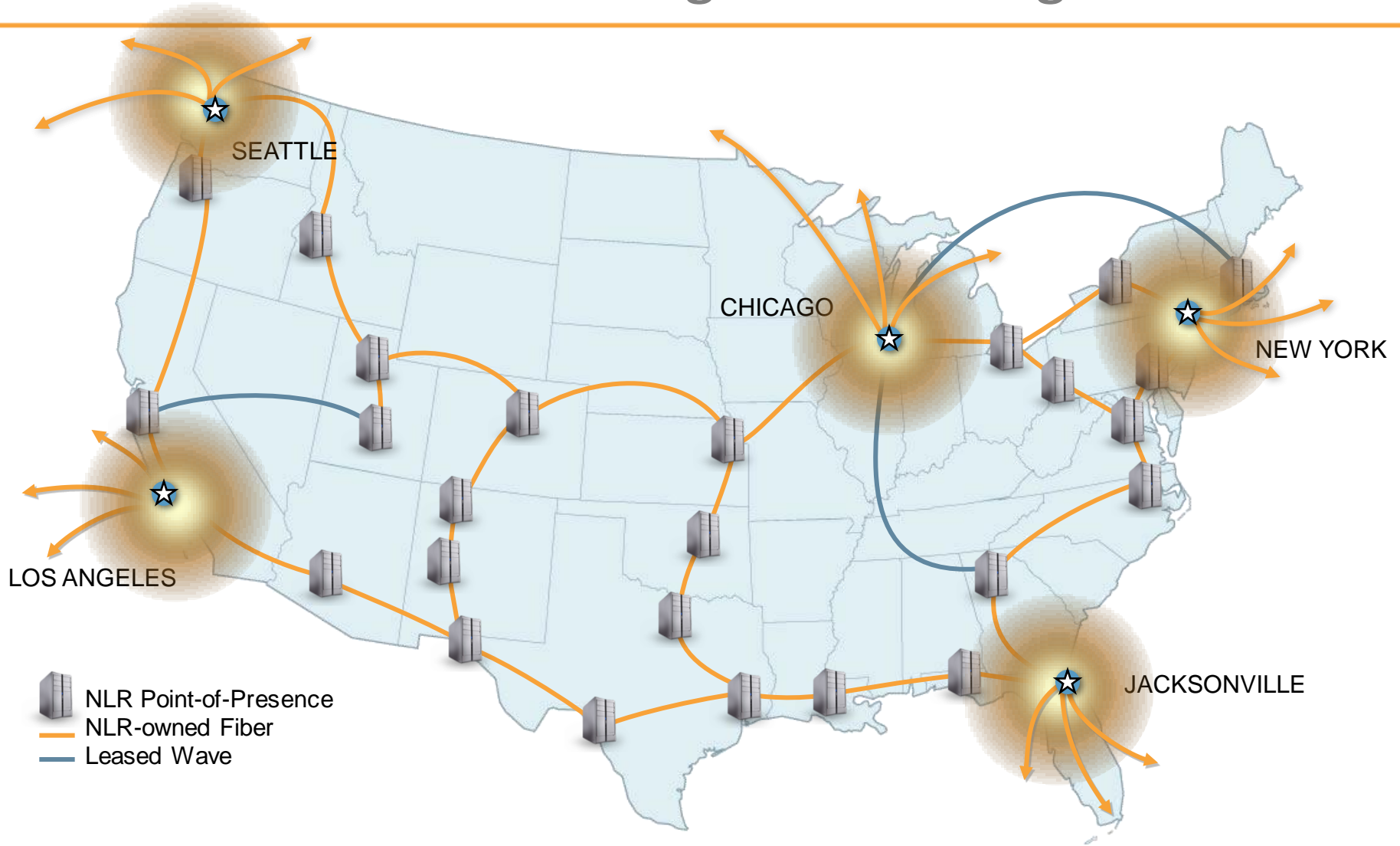


# A High-Performance National Network Owned by Members of the Research and Education Community





# International Peering at 5 Exchanges







# NLR Members: Regional Optical Networks

- CENIC
- Florida LambdaRail
- Front Range GigaPop/University Corporation for Atmospheric Research
- Lonestar Education and Research Network (LEARN)
- Mid-Atlantic Terascale Partners (MATP)/Virginia Tech Foundation
- North Carolina Light Rail
- Oak Ridge National Laboratory
- Oklahoma State Regents for Higher Education
- Pacific Northwest GigaPop
- Pittsburgh Supercomputing Center/University of Pittsburgh
- Southeastern Universities Research Association (SURA)
- Southern Light Rail
- University of New Mexico (on behalf of the State of New Mexico)



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# What's New at NLR?

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# New Options: TelePresence



- NLR operates the R&E Cisco TelePresence Exchange for joint NLR-Internet2 Service

- NLR agreement with Tata Communications brings TelePresence connectivity to 150+ countries

- NLR pioneered the first international, first multi-point TelePresence sessions over an R&E Network





# TelePresence Example: United Nations Cafes





# New Options: Participation by Institutions

Individual Institution \$70k/year

Included Services:

1. Unlimited Layer 3/NLR PacketNet
2. Shared use, non-dedicated Layer 2/NLR FrameNet
3. Dedicated, 1 GE Layer 2 circuit = \$3500
4. R&E TelePresence Exchange Services





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NLR Press Releases

# Examples

Read More

Blog Postings





# California Research Enabled by NLR

## *Large-Scale Network Research:*

- *GENI*
- *OpenFlow*
- *VINI / PlanetLab*
- *TeraGrid*

## *Institution-specific research:*

- *Calit2 and beyond: GreenLight, OptIPuter, CAMERA*

## *Application-based research:*

- *CineGrid*
- *Large Hadron Collider: institutions connect to collider over NLR*

# California Research Enabled by NLR: GENI

***GENI: a virtual laboratory for exploring future internets at scale***

■ *Involved CENIC members include:*

- *UC Berkeley, Davis, Merced, LA, San Diego, Santa Cruz*
- *Stanford (Clean Slate)*
- *USC*
- *LBNL*
- *Caltech*
- *CITRIS, Calit2*



■ *NLR Layer 2 (FrameNet) and Layer 3 (PacketNet) services available to any GENI researcher*

***OpenFlow: an open standard that allows experimental protocols to run on production networks***

▪ *CENIC member institutions carrying out OpenFlow-related research include:*

▪ *Stanford (Clean Slate)*



▪ *UC Berkeley, Davis, Santa Cruz, Merced, San Diego setting up OpenFlow testbed*

▪ *NLR features OpenFlow-enabled nodes at Sunnyvale, Chicago, Houston, and New York*

▪ *CENIC proposal to install OpenFlow-enabled switches at three CalREN nodes to create CA OpenFlow Testbed Network (COTN) to further facilitate this research*

**VINI:** a virtual network infrastructure that allows network researchers to evaluate their protocols and services

**PlanetLab:** a global research network that supports the development of new network services

■ Involved CENIC member institutions include:

- Cal Poly SLO
- Caltech, LBNL
- SJSU, Stanford
- UC (minus SF, Merced)
- Runs over NLR infrastructure



***TeraGrid: the world's largest, distributed cyberinfrastructure for scientific research funded by NSF***

- *Participating CENIC member institutions include the San Diego Supercomputer Center*
- *Uses NLR as backbone network*





# California Research Enabled by NLR at Calit2

**CA Institute for Telecommunications & Information Technology (Calit2):** one of the CA Institutes for Science and Innovation

- UC San Diego and UC Irvine
- Hotbed for 21<sup>st</sup> century ICT-related research

**OptIPuter:** Pioneered the use of optical networks as “backplane” for world-sized computers, linking OptIPortals around the world (visualization clusters)

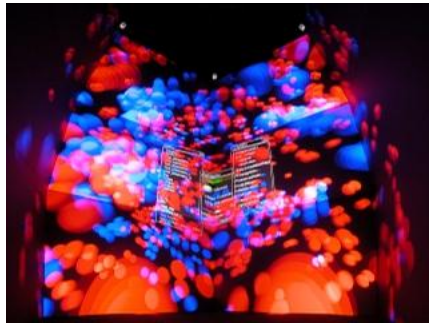
**GreenLight:** Developing energy-efficient computing instrument/datacenter for demanding research arenas

**CAMERA:** Leverages NLR infrastructure to develop computational resources and software tools to decipher the genetic code of life in the oceans, partners with SDSC

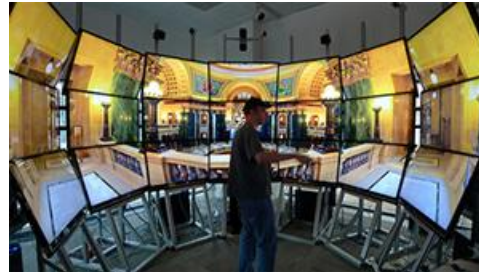


# California Research Enabled by NLR at Calit2

## *OptIPuter – OptIPortal - OptIPlanet*



UCSD StarCave



KAUST NexCave



CICESE, Mexico



OziPortal, Australia



UC Davis Genome Center



UWash OptIPortal

*Dedicated, high-capacity NLR circuits link research teams in California to the OptIPuter/OptIPortal locations worldwide*



# California Research Enabled by NLR at Calit2

## ***Project GreenLight: How to build a green compute facility***

*Modular server facility built to give real-time feedback on energy efficiency of various types of computing clusters with an eye to optimizing hardware, software, cooling, etc.*

*Built for distributed data-intensive research arenas such as ocean research, bioinformatics, meta-genomics, digital media*



*NLR and CENIC provide 5 x 10Gbps WAN and campus network links for Project GreenLight*

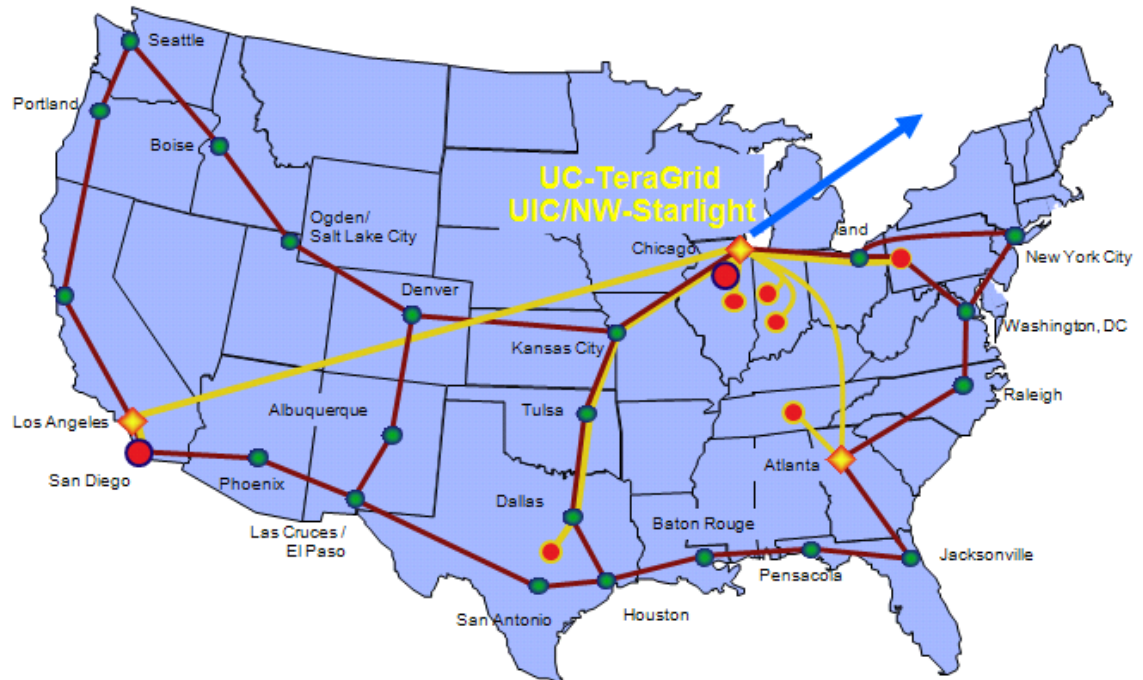


# California Research Enabled by NLR at Calit2

## **CAMERA:** Community Cyberinfrastructure for Advanced Marine Microbial Ecology Research and Analysis

Massive marine genome sequencing project

Houses vast amounts of genetic data made available worldwide



NLR and TeraGrid provides cyberinfrastructure backbone for US researchers in CA and beyond



# California Research Enabled by NLR: CineGrid

***CineGrid***: worldwide organization dedicated to high-quality digital media over advanced optical networks

- *CENIC member participants include*
  - *San Francisco State University*
  - *Calit2 (UC San Diego and UC Irvine)*
  - *USC*
  - *Naval Postgraduate School*
- *Connection between Chicago and CA via Cisco CaveWave deployed over NLR*

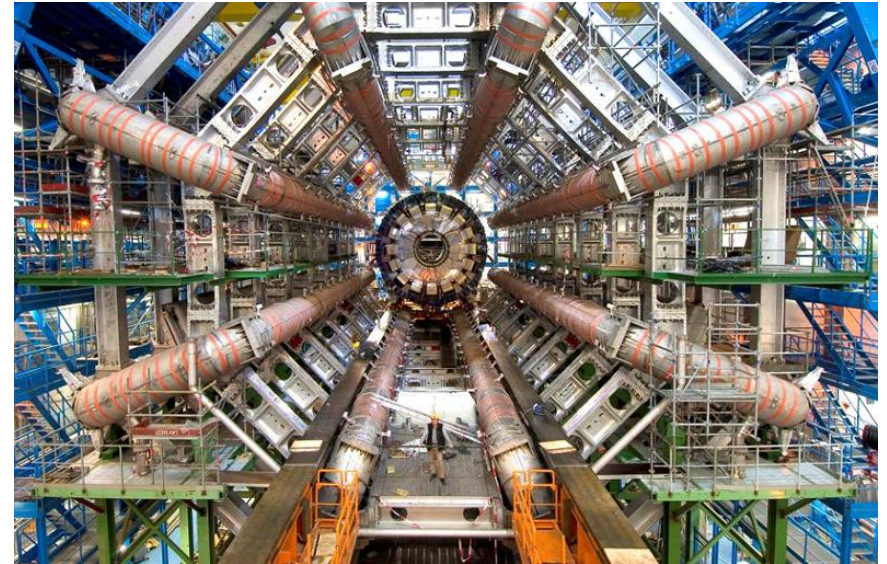




# California Research Enabled by NLR: LHC

## ***US/LHC: DoE-funded US Large Hadron Collider Network***

- *CENIC member participants include*
  - *Caltech, Cal Poly SLO, LBNL, SLAC*
  - *UC Davis, LA, Riverside, Santa Barbara, San Diego, Irvine, Santa Cruz*
- *Leverages the NLR platform to connect US institutions to the Collider in Geneva*



[www.nlr.net](http://www.nlr.net)



NATIONAL LAMBDA RAIL