

# Next Generation Open Communications Exchanges

**Joe Mambretti, Director, ([j-mambretti@northwestern.edu](mailto:j-mambretti@northwestern.edu))**

**International Center for Advanced Internet Research ([www.icaair.org](http://www.icaair.org))**

**Director, Metropolitan Research and Education Network ([www.mren.org](http://www.mren.org))**

**Partner, StarLight/STAR TAP, PI-OMNINet ([www.icaair.org/omninet](http://www.icaair.org/omninet))**

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# Open Communications Exchanges

- **Next Generation Digital Communications Facilities Are Emerging As Open Multi-Service Exchanges (\*Lights).**
- **Legacy Peering Exchanges, e.g., Circa 1993, Were Based On L3 Peering**
- **New Facilities Allow For Peering At Any OSI Layer, Including L1**
- **Peering Can Be Autonomous (No Central Authority Is Required As Intermediary)**
- **Open Exchanges Provide Multiple Services Not Available From Carriers, e.g., Optical Layer Peering, Grid Services, Services Based on New Protocols, Experimental Services, Etc.**
- **Common Service Definitions, Policy Based Access Control Methods, Signaling Protocols, etc. Are Being Developed.**

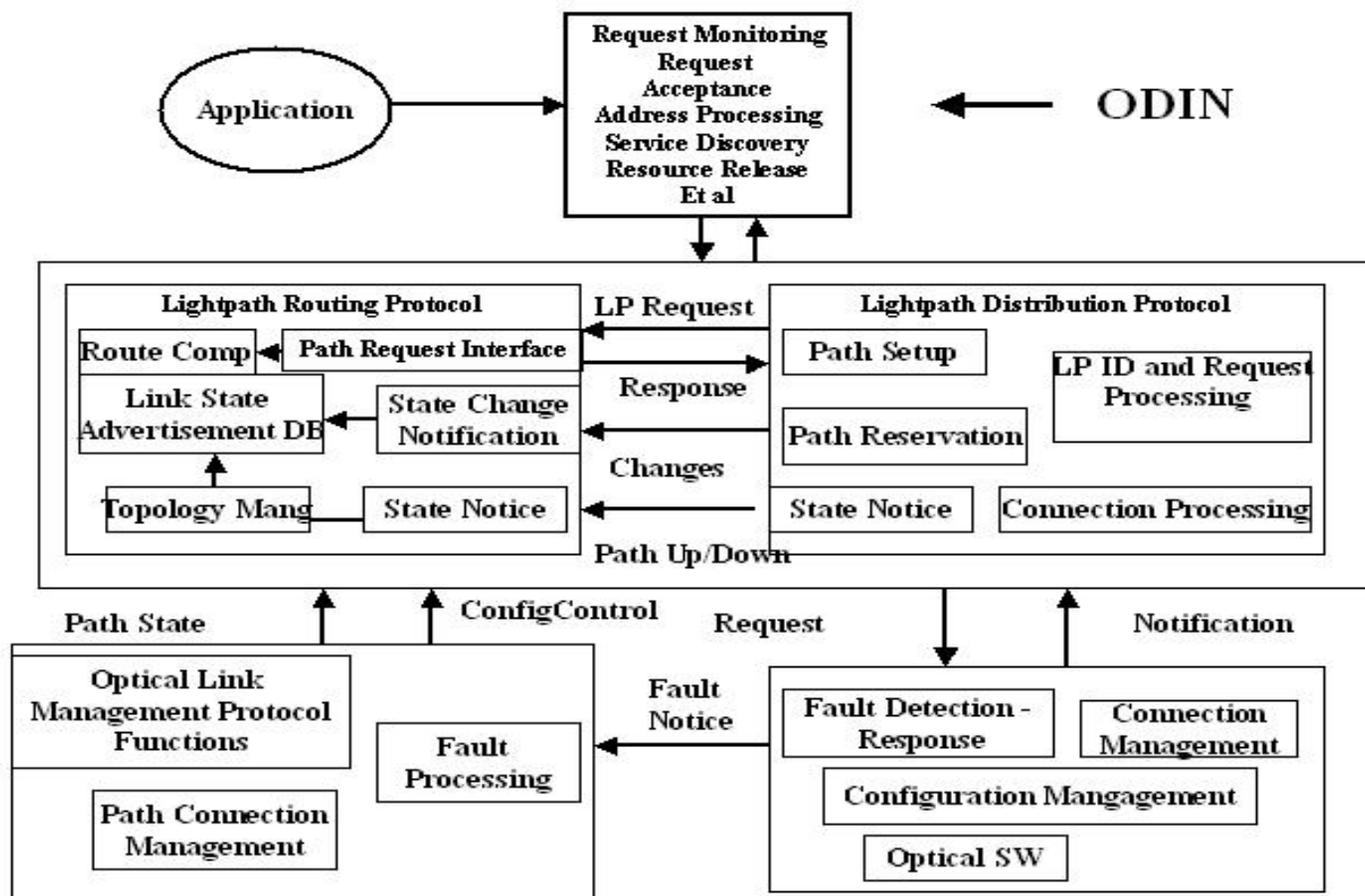


# Open Communications Exchanges

- **New Services: Interdomain Services Enabled By Multi-Domain Control Planes for L1 and L2**
- **L2 Hierarchical Services**
- **Edge Process, Including Application Enabled, Dynamic Topology Provisioning Including at L1**
- **WSRF Services**
- **Ref: UCLP V2, ODIN, DRAGON, PIN, etc.**
- **New EU Initiatives**
- **Reconfigurable Optical Add Drop Multiplexers Will Be Deployed in Ca\*net4 by Q2, Significant Added Capacity, Flexibility**



# Optical Dynamic Intelligent Network (ODIN)



# Open Communications Exchanges

- **This Model is Being Introduced World-Wide:**
  - **StarLight (Chicago)**
  - **PNWGP (Seattle)**
  - **NetherLight (Amsterdam)**
  - **CA\*net4 (Canada)**
  - **UKLight (London)**
  - **NorthernLight (Stockholm)**
  - **CzechLight (Prague)**
  - **T-LEX (Tokyo)**
  - **Etc.**

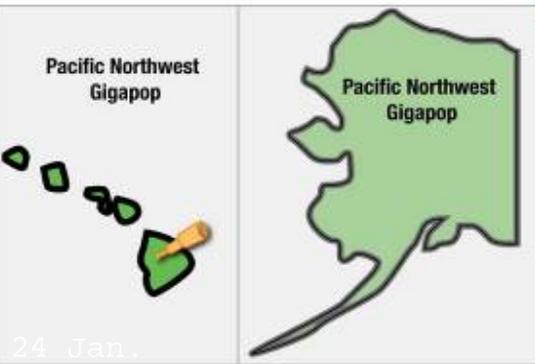
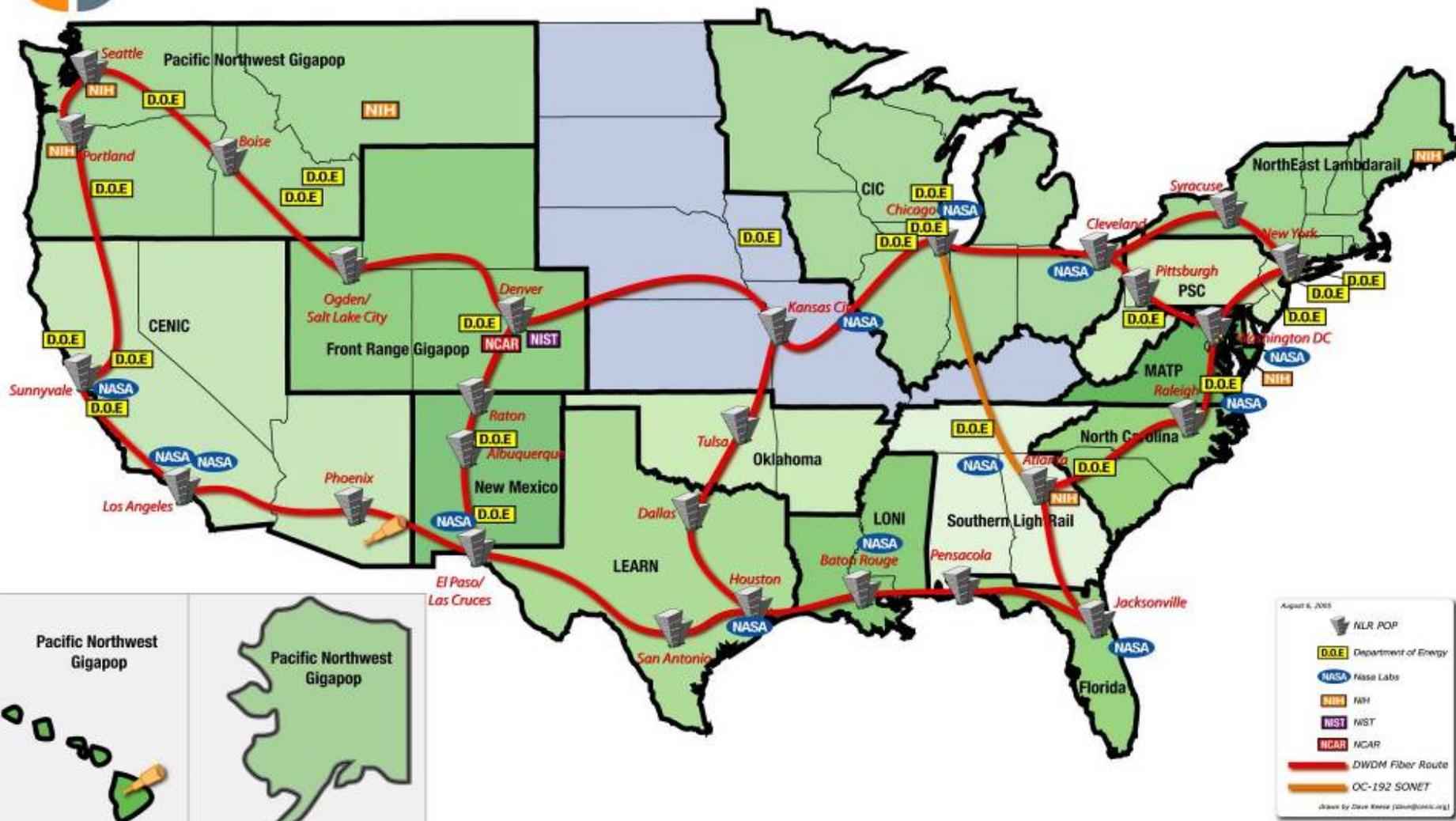


# National Lambda Rail (NLR)

- In the US the NLR Is a Key Resource for Open Exchanges
- NLR National Fabric Has Been Established And Is Operational
- Potential For Required Multiple National Lightpaths (Only Such Scalable Multi-Layer National R&E Fabric Today)
- Continuing Extensions via RONS
- AUP-Free
- New: Layer 3 Services, .com, .gov, .edu and International Peering and Exchange Go Become Operational in Q2
- Pacific Wave, StarLight, SoX, et al



# National LambdaRail Architecture



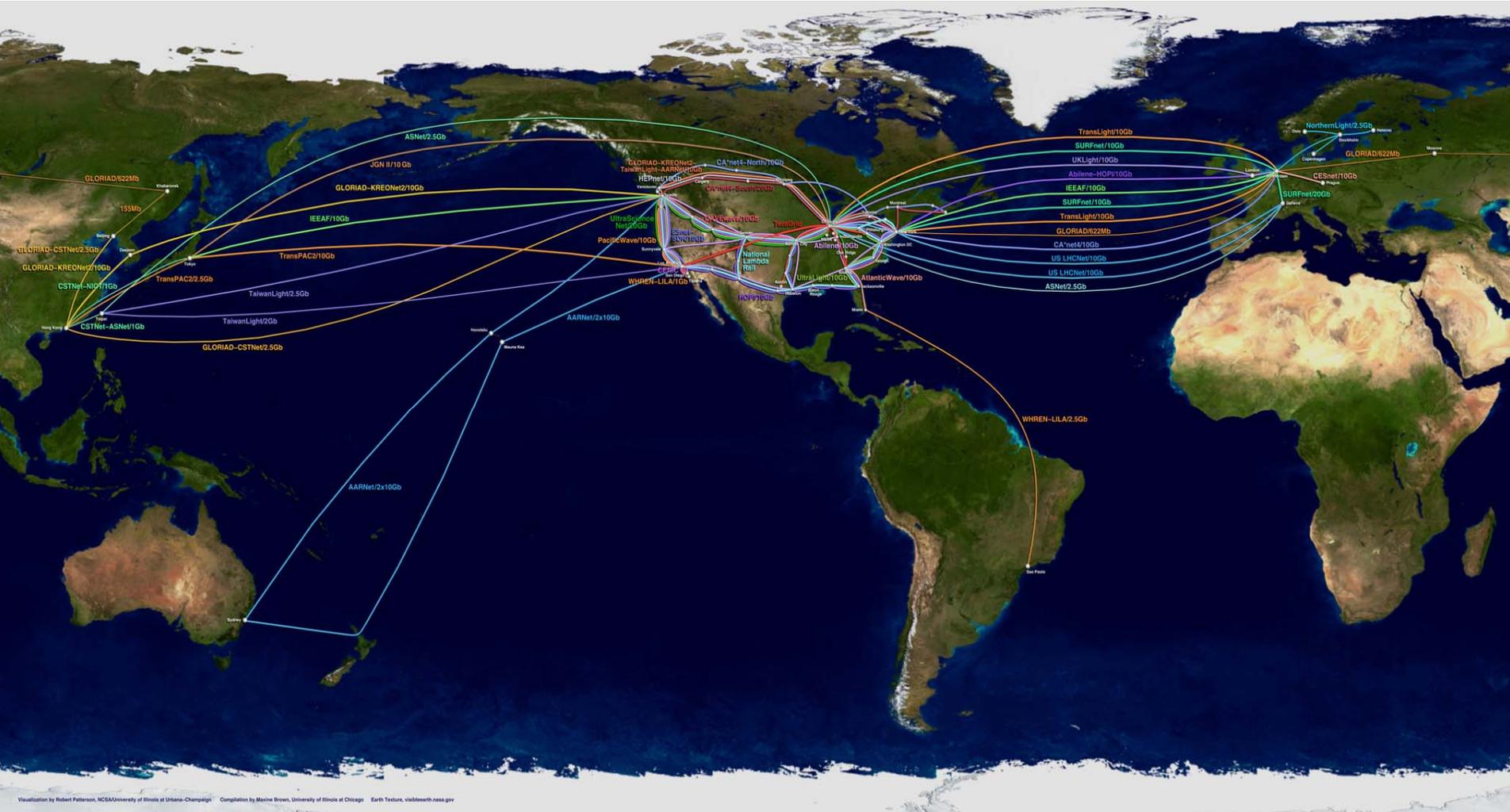
24 Jan.

# Global Lambda International Facility (GLIF)

- GLIF is a consortium of institutions, organizations, consortia and country National Research & Education Networks who voluntarily share optical networking resources and expertise to develop the *Global LambdaGrid* for the advancement of scientific collaboration and discovery
- GLIF Has Established An Initiative To Define Open Exchange Points
- GLIF Open Lightpath Exchanges (GOLES)
- GLIF is under the leadership of SURFnet and University of Amsterdam in The Netherlands.
- [www.glif.is](http://www.glif.is)



# Global Lambda Integrated Facility World Map – Sept 2005



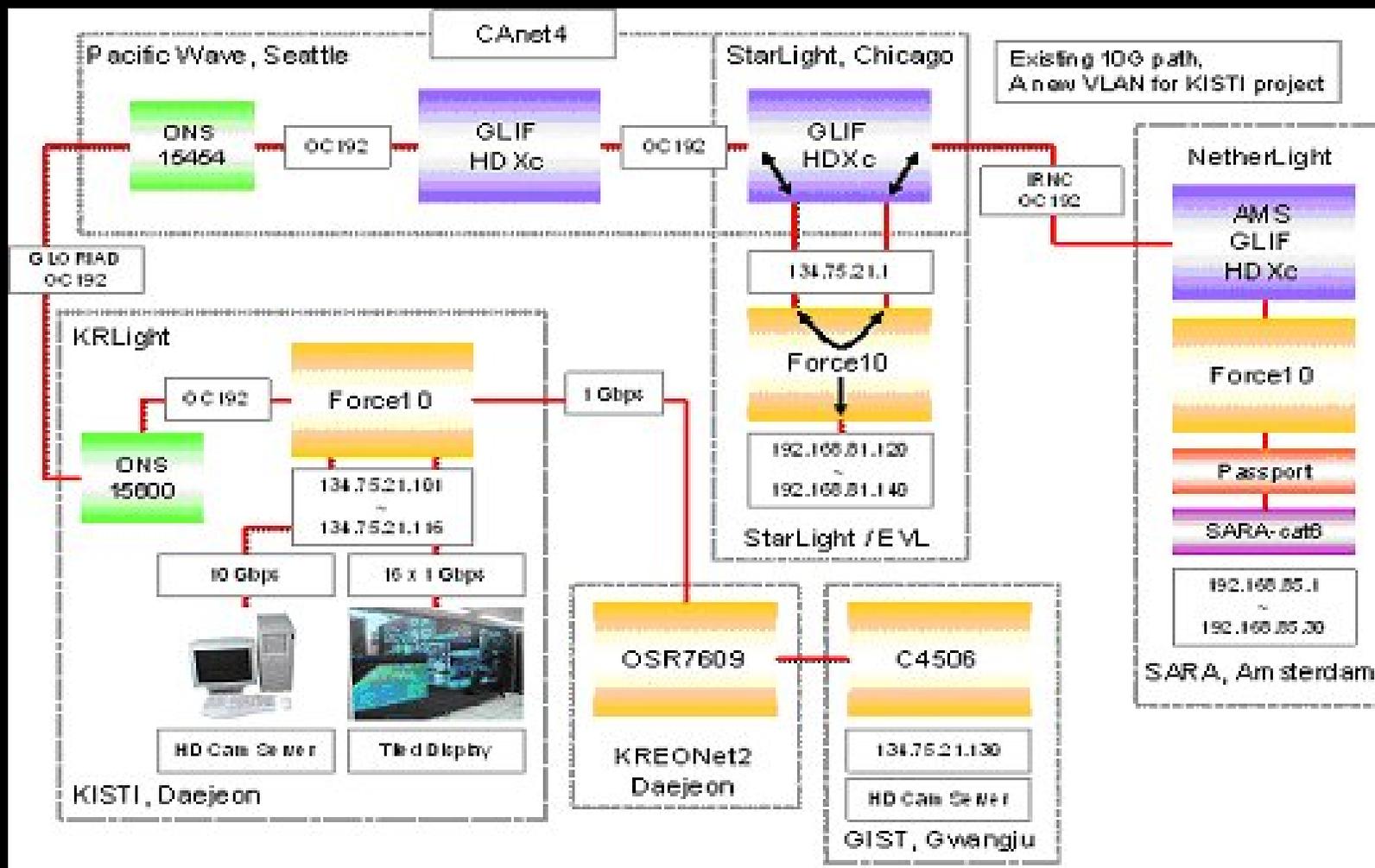
Visualization by Robert Patterson, NCSA/University of Illinois at Urbana-Champaign; Compilation by Maxine Brown, University of Illinois at Chicago; Earth Texture, visitearth.nasa.gov

# Demo Based on GOLEs March 17, 2006

- “GLIF Open Lightpath Exchanges (GOLEs) KRLight, Pacific Northwest Gigapop, StarLight, and NetherLight jointly participated in building global-scale 10 Gbps lightpaths to support large data transfer on the GLVF (Global Lambda Visualization Facility) for the advanced research institutions in Korea, the US, and the Netherlands.”
- “The OptIPuter node in KISTI (Korea Institute of Science and Technology Information) received several HD animations generated by supercomputers from EVL (Electronic Visualization Laboratory, US) and SARA (the Netherlands), and along with live uncompressed HD streaming from GIST (Gwangju Institute of Science and Technology, Korea), total bandwidth usage reached over 3 Gbps.”
- Source: GLIF



# Demonstration Based on GOLEs



# Manifesto: Communications of the ACM (CACM)

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**Special issue: Blueprint for the Future of High-Performance Networking**

- ***Introduction***, Maxine Brown (guest editor)
- ***TransLight: a global-scale LambdaGrid for e-science***, Tom DeFanti, Cees de Laat, Joe Mambretti, Kees Neggers, Bill St. Arnaud
- ***Transport protocols for high performance***, Aaron Falk, Ted Faber, Joseph Bannister, Andrew Chien, Bob Grossman, Jason Leigh
- ***Data integration in a bandwidth-rich world***, Ian Foster, Robert Grossman
- ***The OptIPuter***, Larry Smarr, Andrew Chien, Tom DeFanti, Jason Leigh, Philip Papadopoulos
- ***Data-intensive e-science frontier research***, Harvey Newman, Mark Ellisman, John Orcutt

[www.acm.org/cacm](http://www.acm.org/cacm)

iMode and the Wireless Internet    The Perils of Data Misreporting    The Myths of Diminishing Firms    Security by Obscurity

## COMMUNICATIONS

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BLUEPRINT FOR THE FUTURE OF  
**HIGH-PERFORMANCE  
NETWORKING**



MEASURING  
PRODUCTIVITY IN THE  
SOFTWARE INDUSTRY

GREAT  
PRINCIPLES  
OF COMPUTING

STARLIGHT<sup>SM</sup>