

StarLight GOLE Update

**Joe Mambretti, Linda Winkler, Alan Verlo
And Other Members of the StarLight
Consortium**

**13th Annual Global LambdaGrid Workshop
& the StarLight International Consortium
Global LambdaGrid Workshop
Singapore**

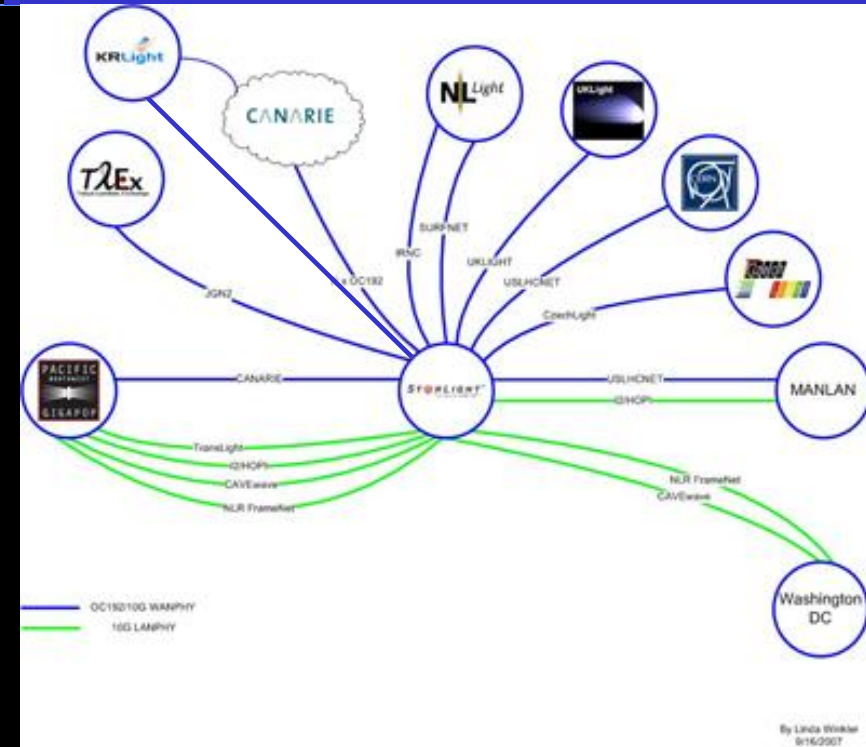
October 2-4, 2013

STARLIGHTSM



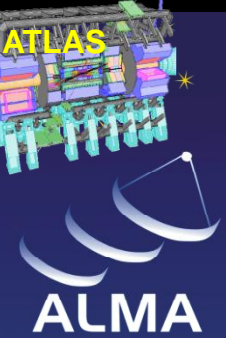
Relatively Current StarLight Infrastructure

Ciena OME, 5410
Calient PXC (L1)
Juniper MX 960 (L2/L3)
Many Lambdas & Collaborators
Many 100 G Paths



<http://wiki.glif.is/index.php/StarLight>

Measurement Servers:
bwctl, owamp, ndt/npad,
perfSONAR



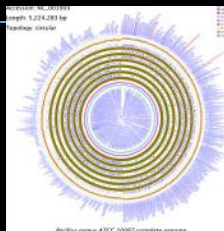
ALMA: Atacama Large Millimeter Array



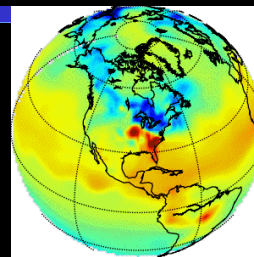
ANDRILL: Antarctic Geological Drilling
www.andrill.org



BIRN: Biomedical Informatics Research Network
www.nbirn.net



CAMERA metagenomics
camera.calit2.net



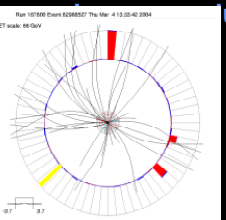
Carbon Tracker
www.esrl.noaa.gov/gmd/ccgg/carbontrack



CineGrid
www.cinegrid.org



LHCONE
www.lhcone.net



DØ (DZero)
www.d0.fnal.gov



GEON: Geosciences Network
www.geongrid.org



GLEON: Global Lake Ecological Observatory Network



OOI-CI
ci.oceanobservatories.org



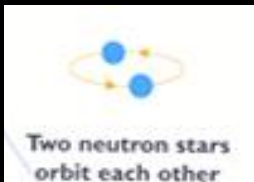
ISS: International Space Station
www.nasa.gov/station



CLASS
www.class.noaa.gov



IVOA: International Virtual Observatory
www.ivoa.net



LIGO
www.ligo.org



WLCG
lcg.web.cern.ch/LCG/public/



PRAGMA
Pacific Rim Applications and Grid Middleware Assembly
www.pragma-grid.net



TeraGrid
www.teragrid.org



OSG
www.opensciencegrid.org



Globus Alliance
www.globus.org



SKA
www.skatelescope.org



Sloan Digital Sky Survey
www.sdss.org



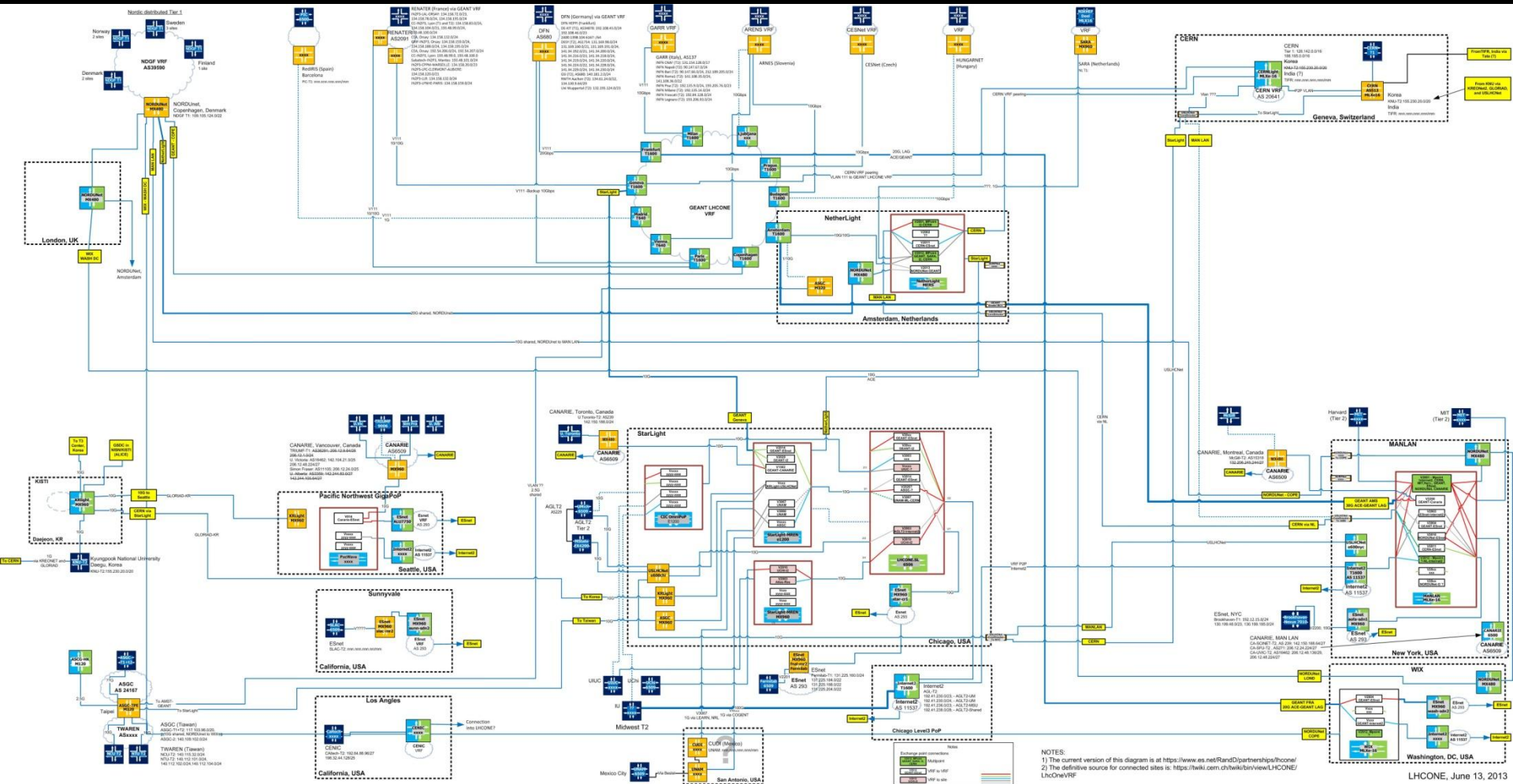
XSEDE
www.xsede.org



StarLight Supports All Major Data Intensive Science Projects

Compilation By Maxine Brown STARLIGHTSM

LHCONE



LHCONE, June 13, 2013

Multiple Network Research Testbeds

- **Multiple Large Scale Network Research Testbeds**
 - International
 - National
 - Regional
 - State-Wide
 - Metro
 - Local



StarLight 100 Gbps/Tbps Initiatives

- **StarLight Has Established Several Initiatives That Are Directed At Creating Networking Services, Architecture, Technology, and Networks Based on 100 Gbps and Higher Service, Including Tbps**
- **Foundation Research Is Based On Earlier Experience With Dynamic Lightpath Technologies**
- **100 Gbps = More Than Capacity (e.g., Dynamic Control Over Channel Segments, Customization)**

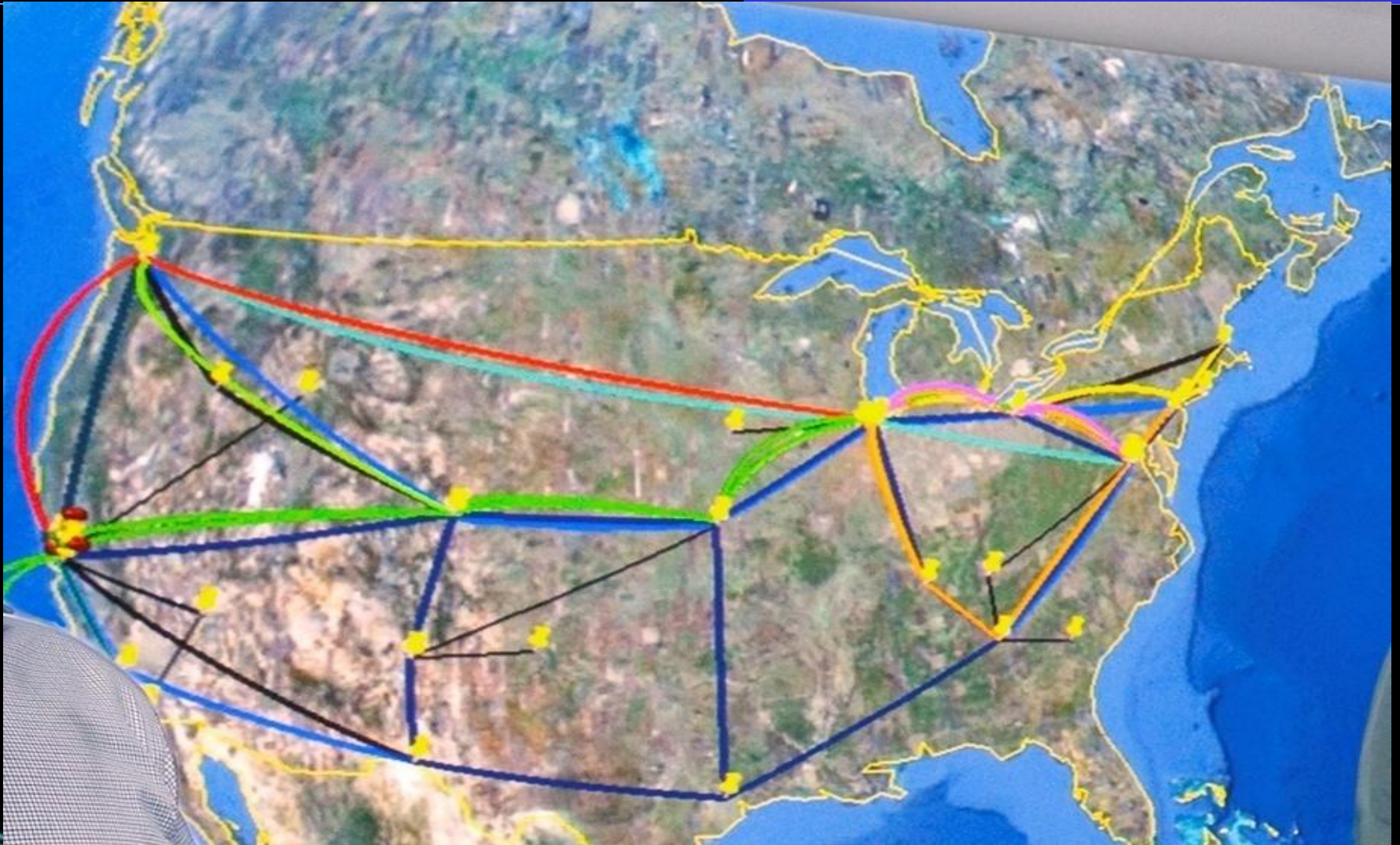


StarWave: A Multi-100 Gbps Exchange Facility

- **StarWave, A New Advanced Multi-100 Gbps Exchange Facility and Services Implemented Within the StarLight International/National Communications Exchange Facility**
 - **StarWave Was Implemented In 2011 To Provide Services To Support Large Scale Data Intensive Science Research Initiatives**
- **StarWave Will Support Multiple SC13 Demonstrations**



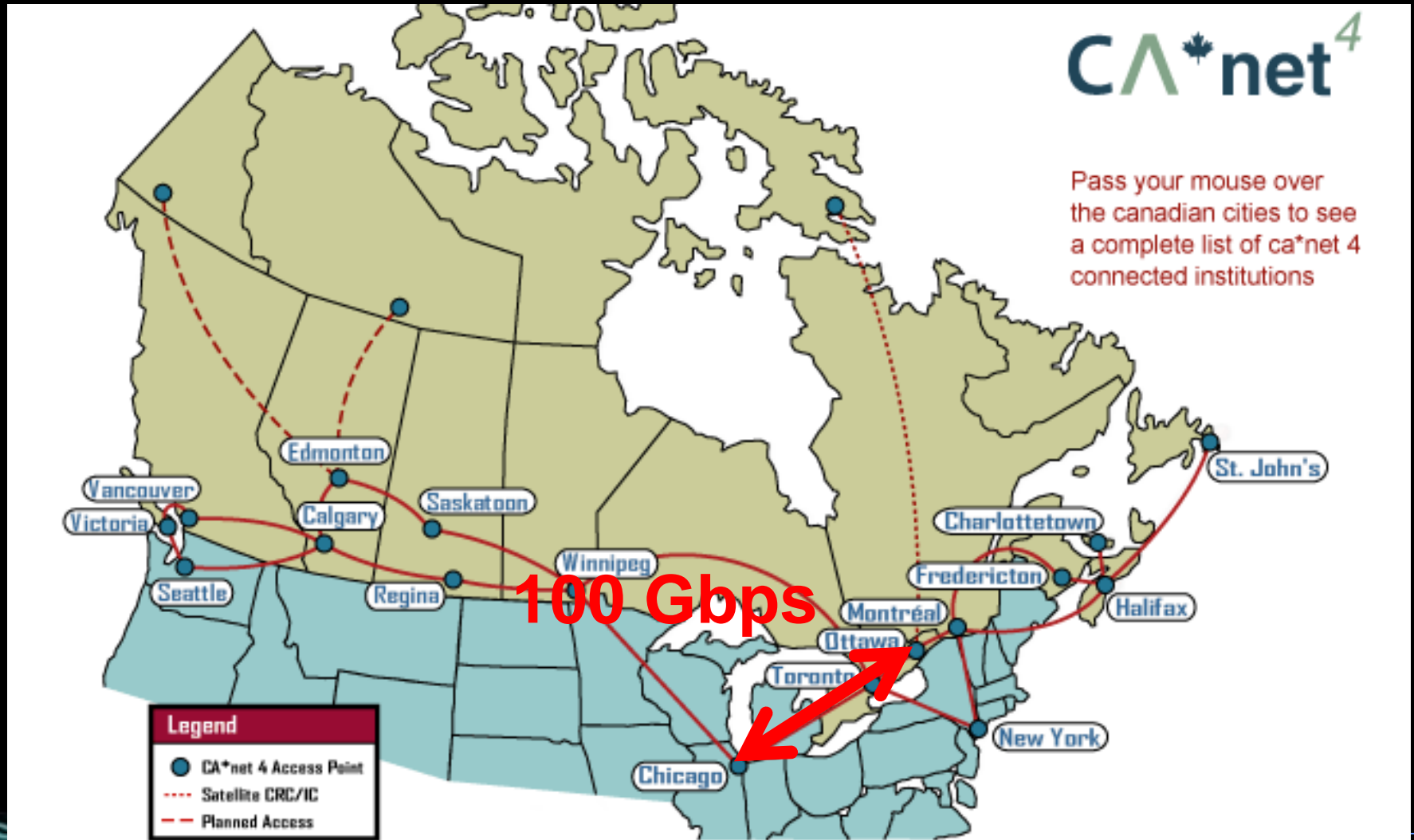
DOE ESnet Advanced Networking Initiative: 100 Gbps



Source : ESnet

STARLIGHTSM

CA*net/Ciena/StarLight/iCAIR 100 Gbps Testbed 1st Implemented In Sept 2010, Implemented Periodically Since



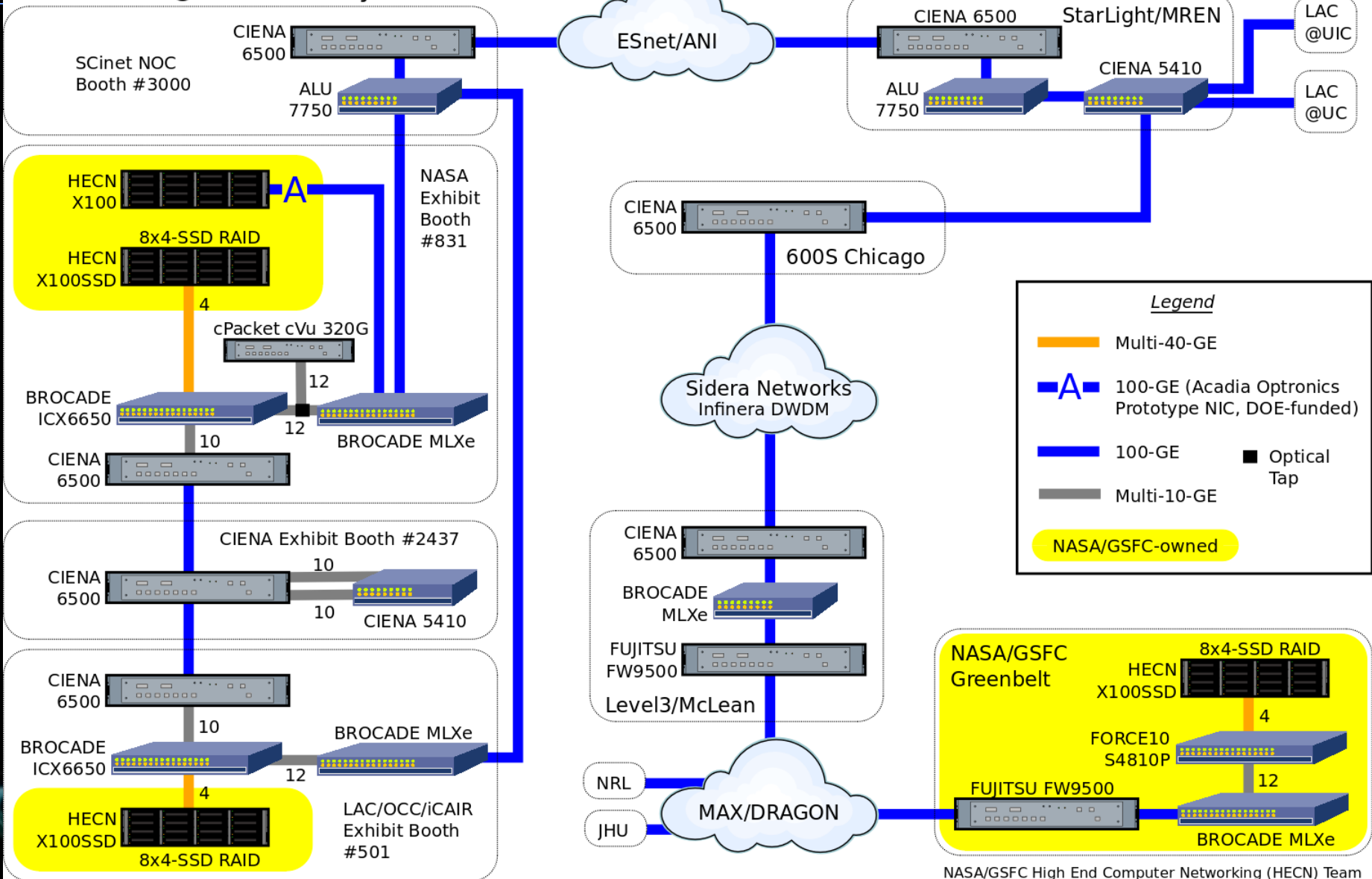
Source: CANARIE

STARLIGHTSM

Evaluations/Demonstrations of 100 Gbps Disk-to-Disk File Transfer Performance using OpenFlow Across LANs & WANs

An SC12 Collaborative Initiative Among NASA and Several Partners

SC12@Salt Lake City



IRNC:ProNet: TransLight/StarLight

July 2010- August 2014

Tom DeFanti, Maxine Brown, Joe Mambretti, Tajana Rosing

Calit2, University of California, San Diego

Electronic Visualization Lab, University of Illinois at Chicago

**International Center for Advanced Internet Research, Northwestern
University**

**20 years of NSF-Funded High-Performance
International Networking for
Advanced Applications**

1995-2014!



IRNC TL/SL 3-Year Deliverables

- Continue enabling multi-national application and middleware experiments on international networks
 - High-Performance Digital Media Network (HPDMnet)
 - iGENI: the GENI-funded international GENI project*
 - SAGE: connecting people and their data at high-res*
 - CineGrid: it's all about visual communications
 - GreenLight International: less watts/terabyte*
 - Science Cloud Communication Services Network (SCCSnet)*: the impending disruption
- Build cooperative partnerships (e.g. MSC-CIEC*)
- Serve GLIF, NLR, and I2 as senior leaders, reviewers
- New services, including many with industrial partners
- Create opportunities for all the REUs we can get*

*Currently also funded by various NSF awards to UCSD/UIC/NU

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TransLight/StarLight

Petascale Science Prototype Services Facility

- **Goal: Prototyping Trans-Atlantic 100 Gbps Architectures, Services, and Emerging Technologies Among Institutions Connected to NetherLight, StarLight, and Other Participating GOLEs in North America and Europe**
- **The TransLight/StarLight Consortium Has Been Awarded a National Science Foundation (NSF) Grant To Establish An Initiative To Design and Implement Network Architectures, Services, Technologies, and Core Capabilities In Support of Big Data Science Over 100 Gbps Trans-Atlantic Paths, Enabling Large-Scale Global Scientific Research Experiments, Instrumentation Access, Collaborations, Data Sharing and High-Resolution Visualization.**



TransLight/StarLight

Petascale Science Prototype Services Facility

- **This Project Will Implement and Experiment With Prototype Services and Capabilities That Have the Potential to Optimize Advanced Networks for Production Science Research, Particularly for Large-Scale Data Transport, Including Persistent, Ultra-Large-Capacity, Real-Time, Long-Duration Streams. These Experiments Will Be Conducted With Multiple National and International Partners.**
- ***Four Major Themes of This Initiative Are To Provide: (a) Large-Scale Network Capacity, Including Support For Extremely High-Volume Individual Data Streams, (b) Network Services and Resource Programmability For This Capacity, (c) Edge Access To These Capabilities, and (d) Exchange Facilities That Can Support These Services and Capabilities.***



Initial Project Workshops

- **Workshop Themes: 100 Gbps Services for Global Data Intensive Science**
- **Chicago, Aug, Sept, Oct: Project Planning**
- **Amsterdam, Sept 16-17: SURFnet, SURFsara, University of Amsterdam**
- **Singapore, Oct 2-4: Side Meetings at Global LambdaGrid Workshop**
- **Denver, Nov 17-22: Planning Joint IRNC 100 Gbps Workshop At SC13**



Global Environment for Network Innovations (GENI)

- **GENI Is Funded By The National Science Foundation's Directorate for Computer and Information Science and Engineering (CISE)**
- **GENI Is a Virtual Laboratory For Exploring Future Internets At Scale.**
- **GENI Is Similar To Instruments Used By Other Science Disciplines, e.g., Astronomers – Telescopes, HEP - Synchrotrons**
- **GENI Creates Major Opportunities To Understand, Innovate and Transform Global Networks and Their Interactions with Society.**
- **GENI Is Dynamic and Adaptive.**
- **GENI Opens Up New Areas of Research at the Frontiers of Network Science and Engineering, and Increases the Opportunity for Significant Socio-Economic Impact.**



US IGNITE Demonstration



The InstaGENI Initiative

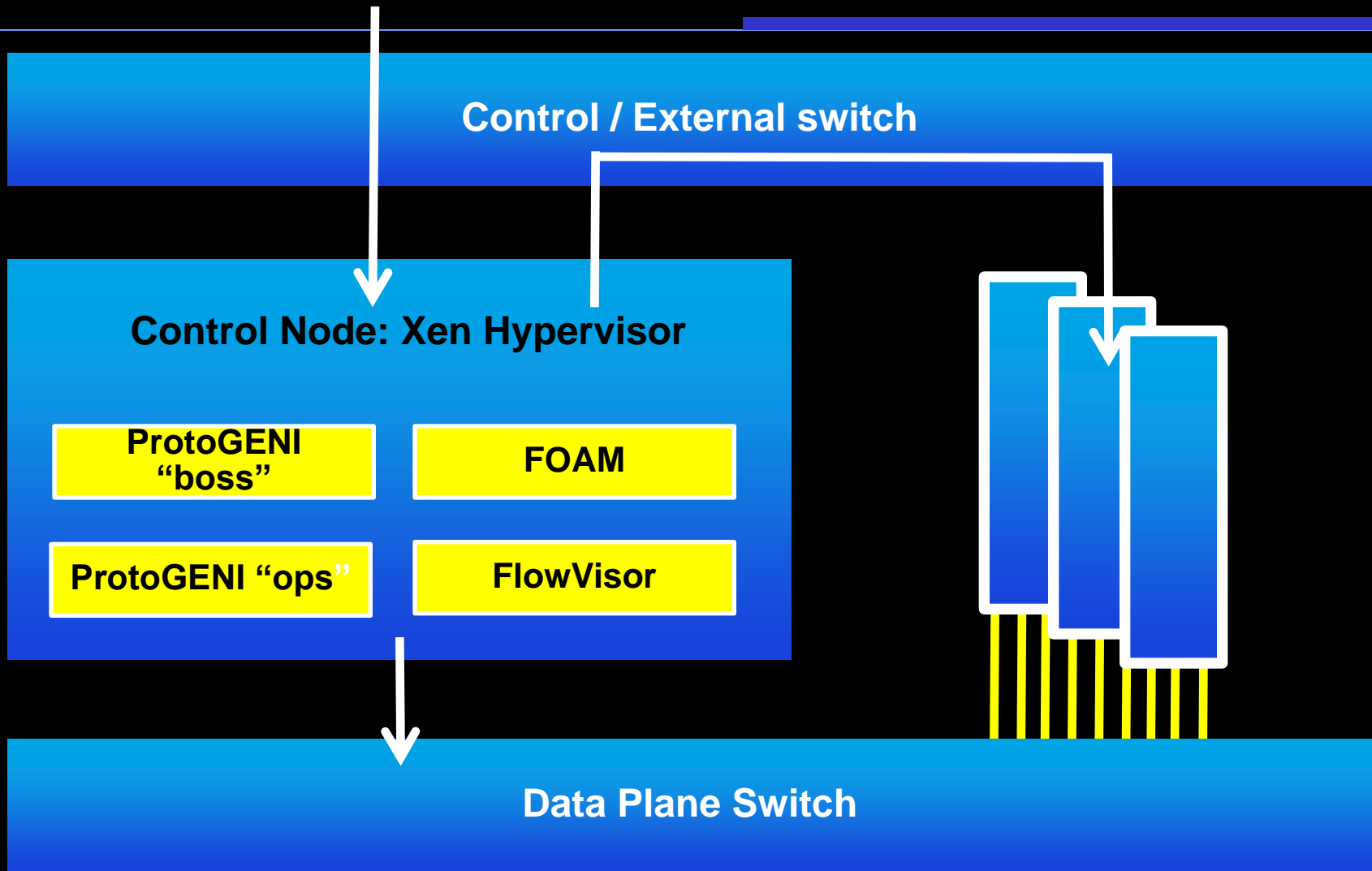
Nick Bastin, Andy Bavier, Joe Mambretti, Rick McGeer, Rob Ricci, Nicki Watts, Jim Chen, Fei Yeh

PlanetWorks, HP, University of Utah, iCAIR Northwestern

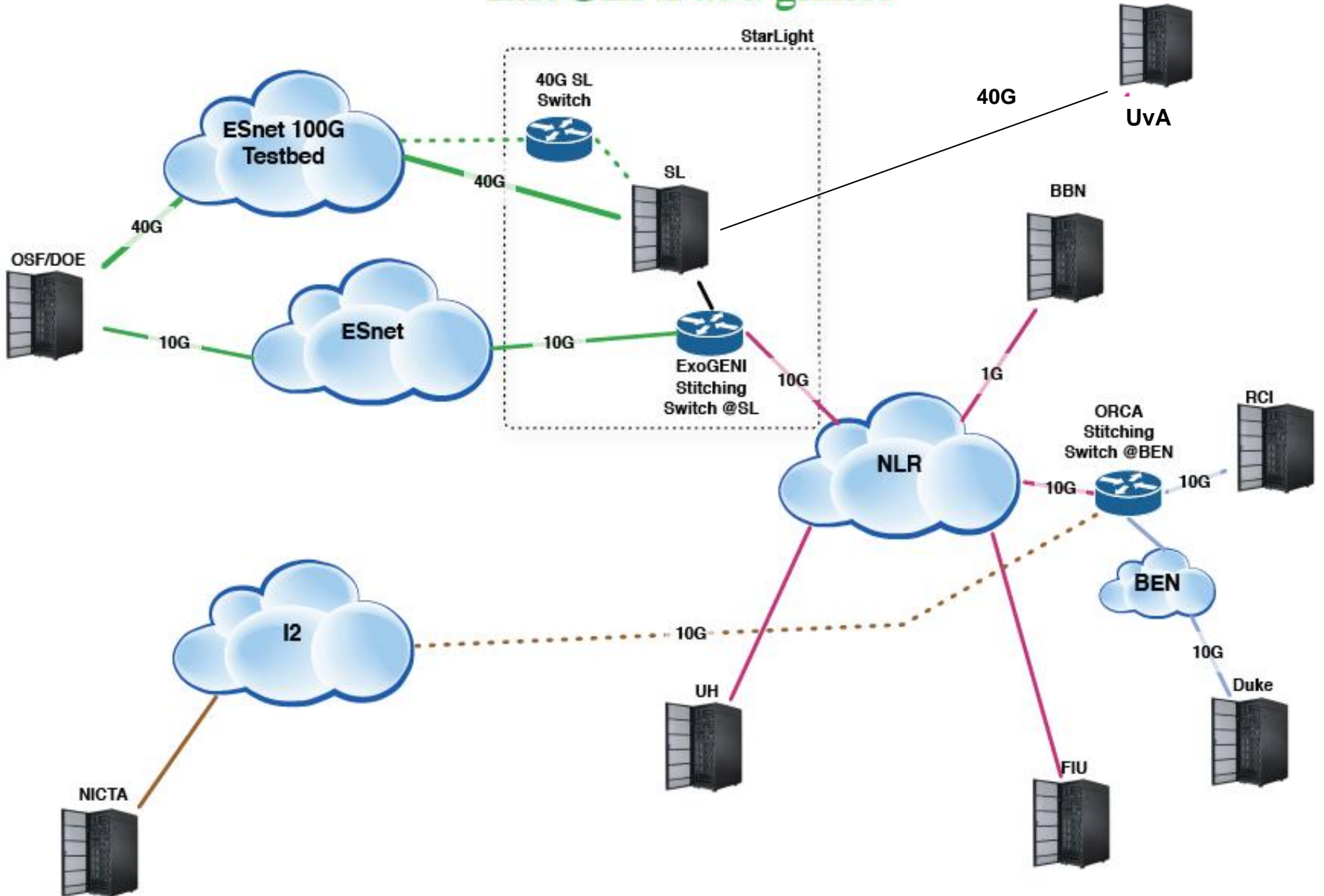
March 13, 2012



Control Infrastructure



ExoGENI at a glance



iGENI: International Global Environment for Network Innovations

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International Center for Advanced Internet Research (www.icaair.org)
Northwestern University
Director, Metropolitan Research and Education Network (www.mren.org)
Partner, StarLight/STAR TAP, PI-OMNINet (www.icaair.org/omninet)

Maxine Brown, Associate Director (maxine@uic.edu)
Electronic Visualization Laboratory (www.evl.uic.edu)
University of Illinois at Chicago

Tom DeFanti, Research Scientist (tdefanti@ucsd.edu)
California Institute for Telecommunications and Information Technology
(www.calit2.net),
University of California, San Diego



iGENI: The International GENI

- The iGENI Initiative Is Designing, Developing, Implementing, and Operating a Major New National and International Distributed Infrastructure.
- iGENI Is Placing the “G” in GENI Making GENI Truly Global.
- iGENI Is Creating a Unique Distributed Infrastructure To Support GLOBAL Research and Development for Next-Generation Network Communication Services and Technologies.
- This Infrastructure Is Being Integrated With Current and Planned GENI Resources.
- iGENI Infrastructure Is Interconnecting Its Resources With Current GENI National Backbone Transport Resources, With Current and Planned GENI Regional Transport Resources, and With International Research Networks and Projects
- iGENI Is Highly Leveraging Existing International Advanced Networking Facilities



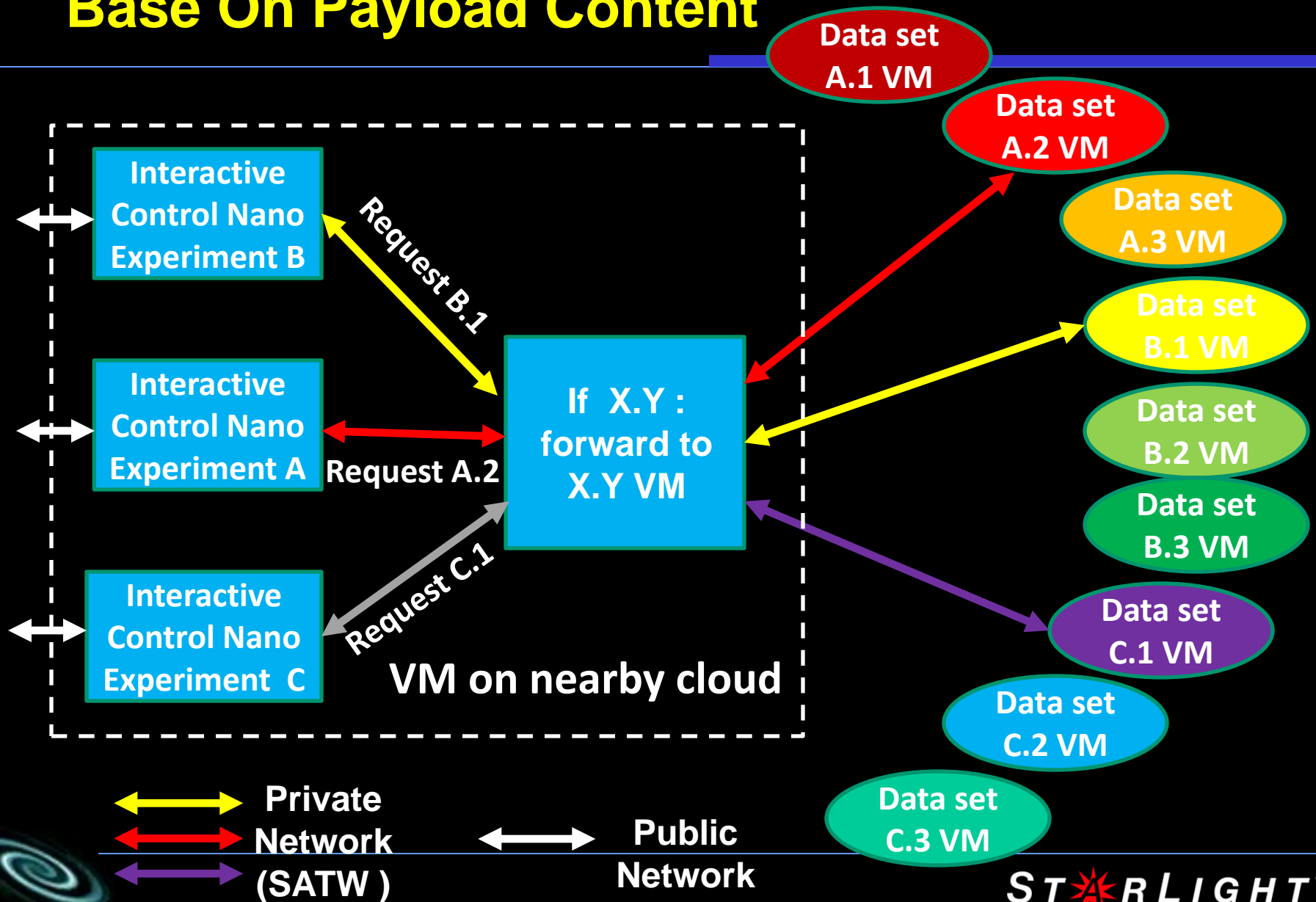
An Advanced International Distributed Programmable Environment for Experimental Network Research: “Slice Around the World” Demonstration

A Demonstration and Presentation By the Consortium for International Advanced Network Research

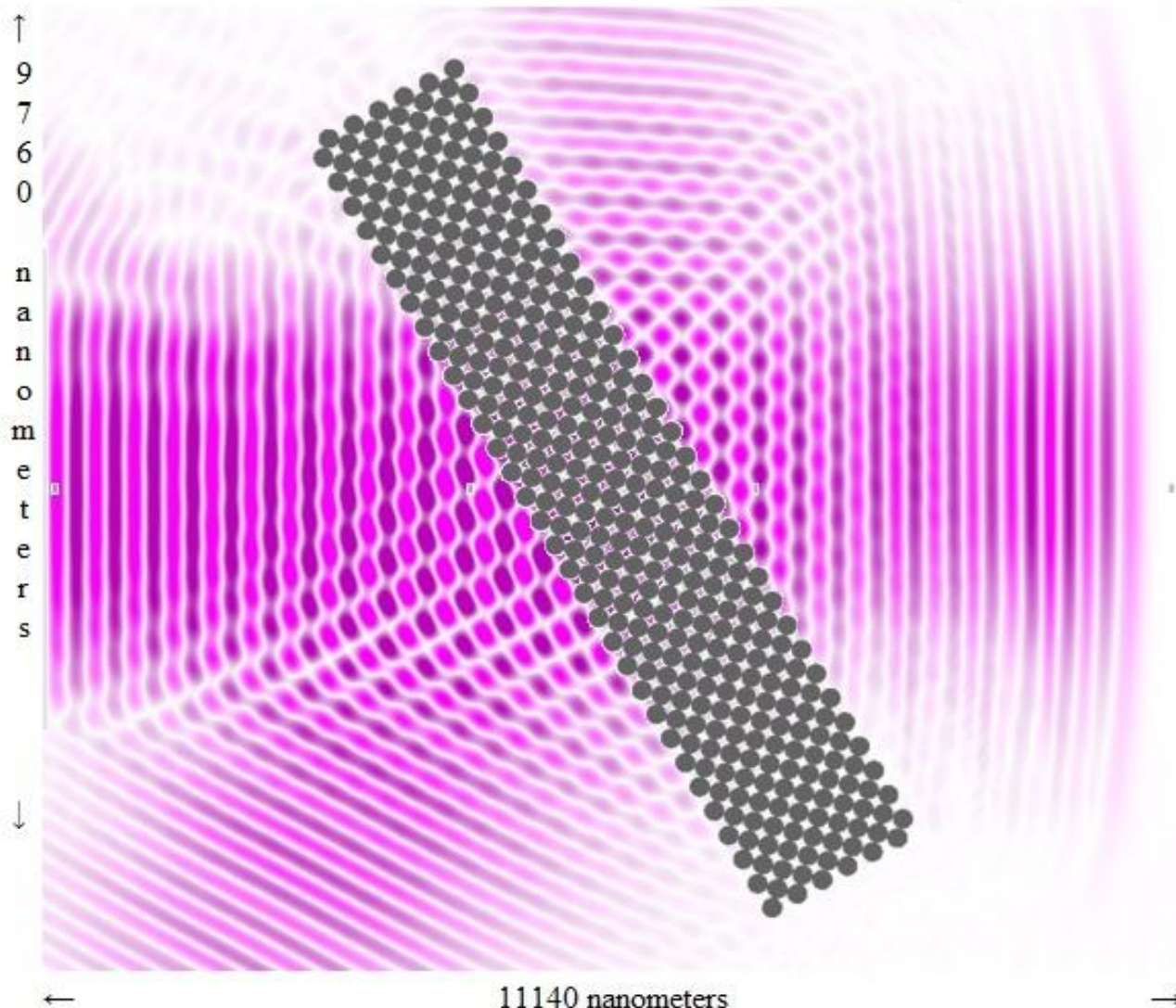
Leads for Participating Organizations: Ilia Baldine, Andy Bavier, Scott Campbell, Jeff Chase, Jim Chen, Cees de Laat, Dongkyun Kim, Te-Lung Liu, Luis Fernandez Lopez, Mon-Yen Lou, Joe Mambretti, Rick McGeer, Paul Muller, Aki Nakao, Max Ott, Ronald van der Pol, Martin Reed, Rob Ricci, Ruslan Smeliansky, Marcos Rogerio Salvador, Myung-Ki Shin, Michael Stanton, Jungling Yu



Slice Using Forwarding Rules Base On Payload Content



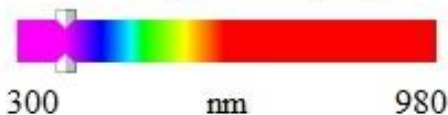
Photonic Band Gap



Click the picture to zoom in (picture will appear in a new window)

1. Choose the color of light source.
Wavelength appears in nm

Violet (nm)

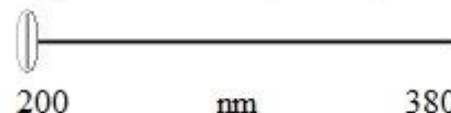


Magnitude



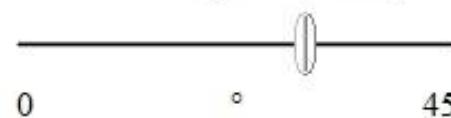
2. Choose particle size in nanometers

particle size is nm



3. Choose incident angle in degrees

Incident angle is °



4. Watch the animation



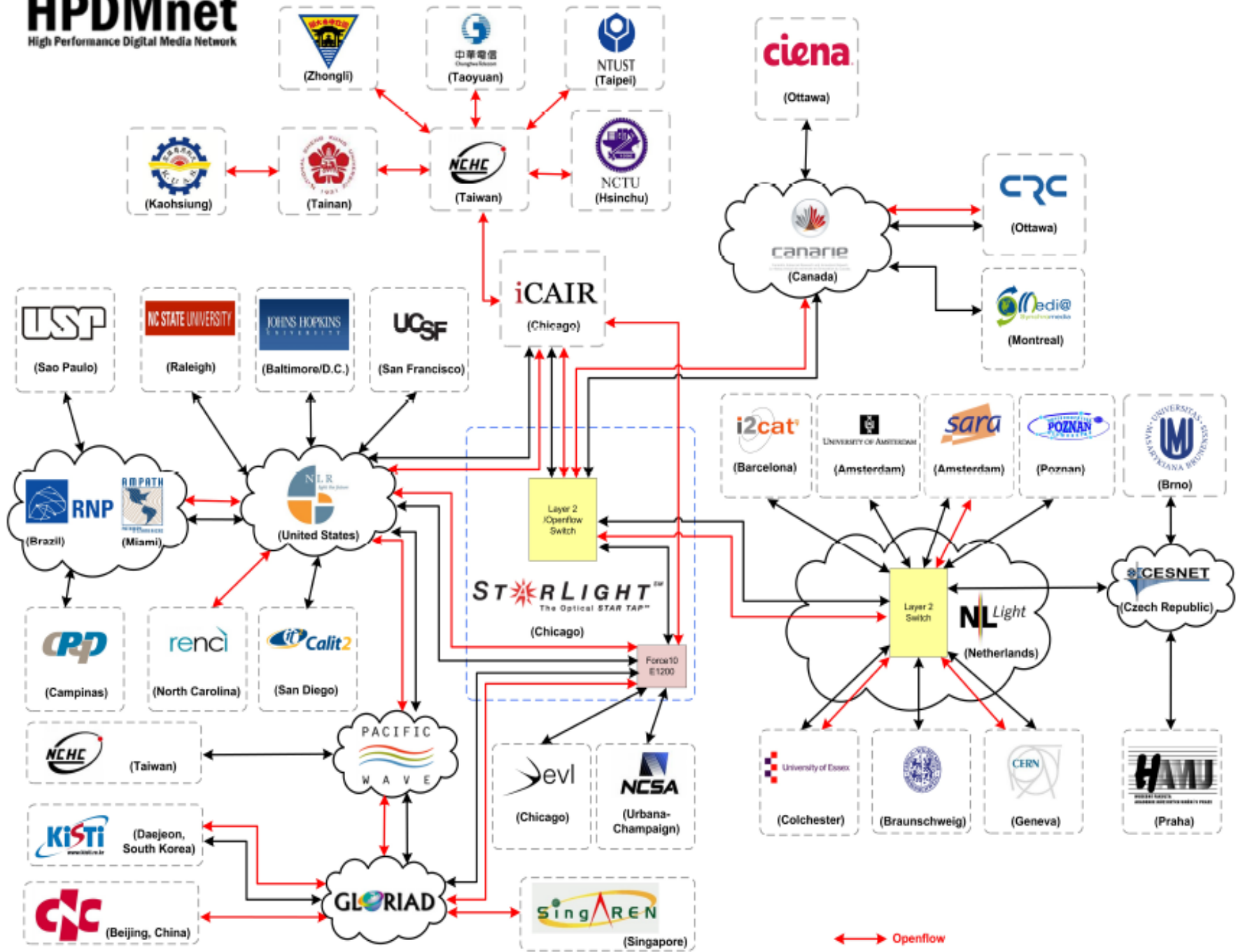
1

Frame # 13 , time is 39 fs

15

HPDMnet

High Performance Digital Media Network



↔ Openflow
↔ High Performance Digital Media



- Three Continents Networked Music and Dance Performance - Prague(CZ)-Barcelona(ES)-Salvador(BR)-Daejeon(KR)

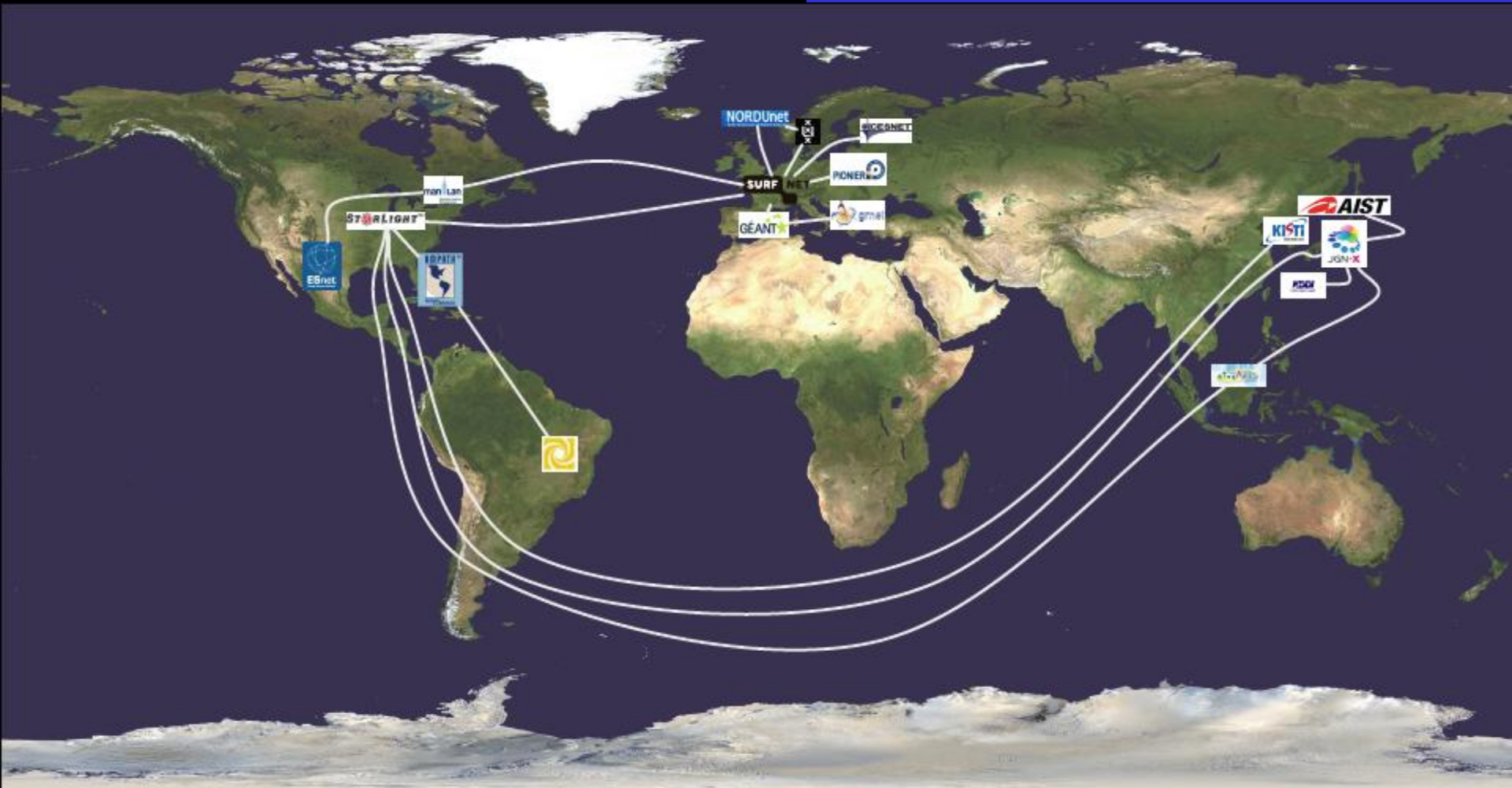
Aug. 21st, 2013

APAN e-Culture WG

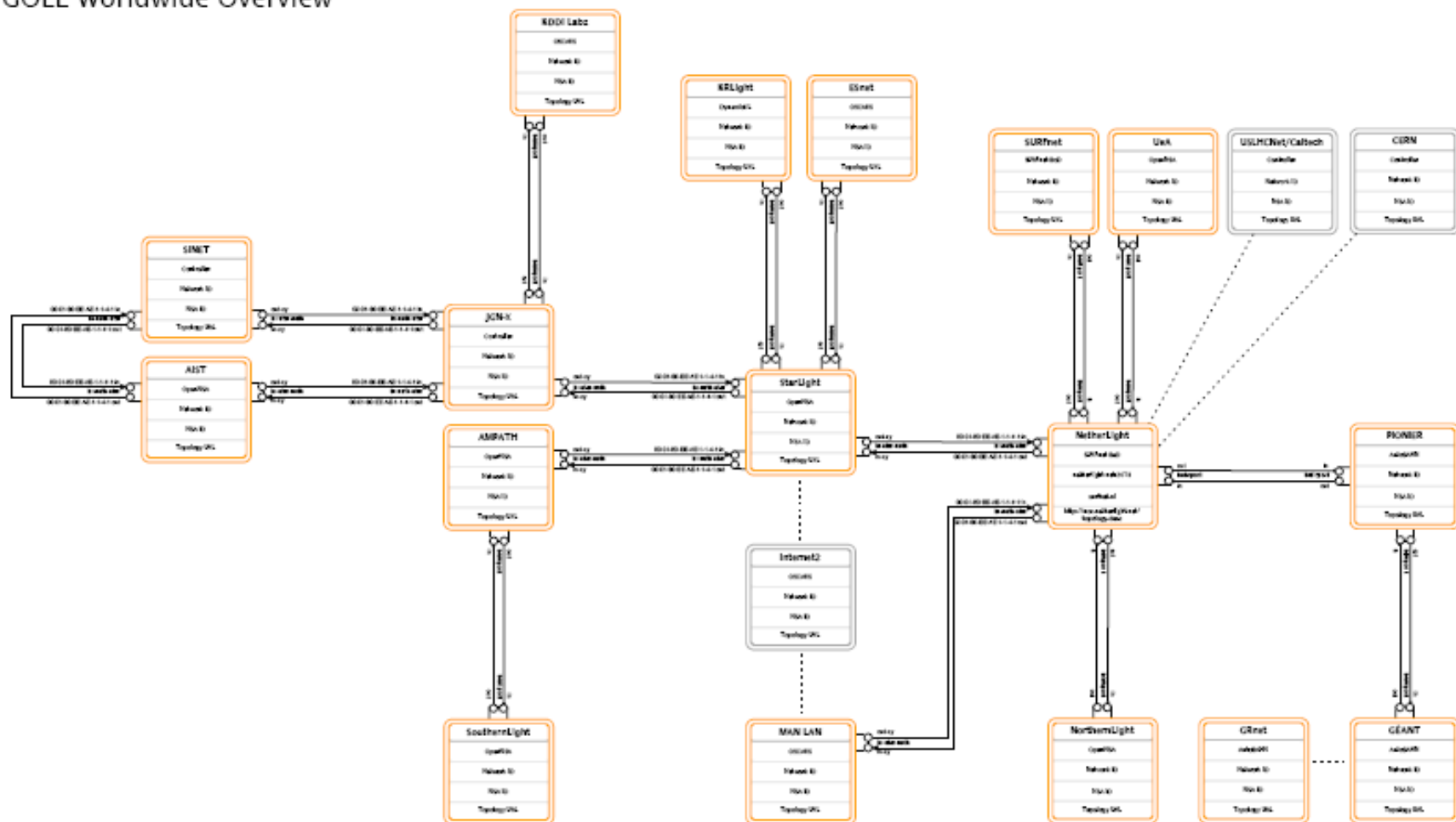


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GLIF AutoGOLE Initiative Oct 2013



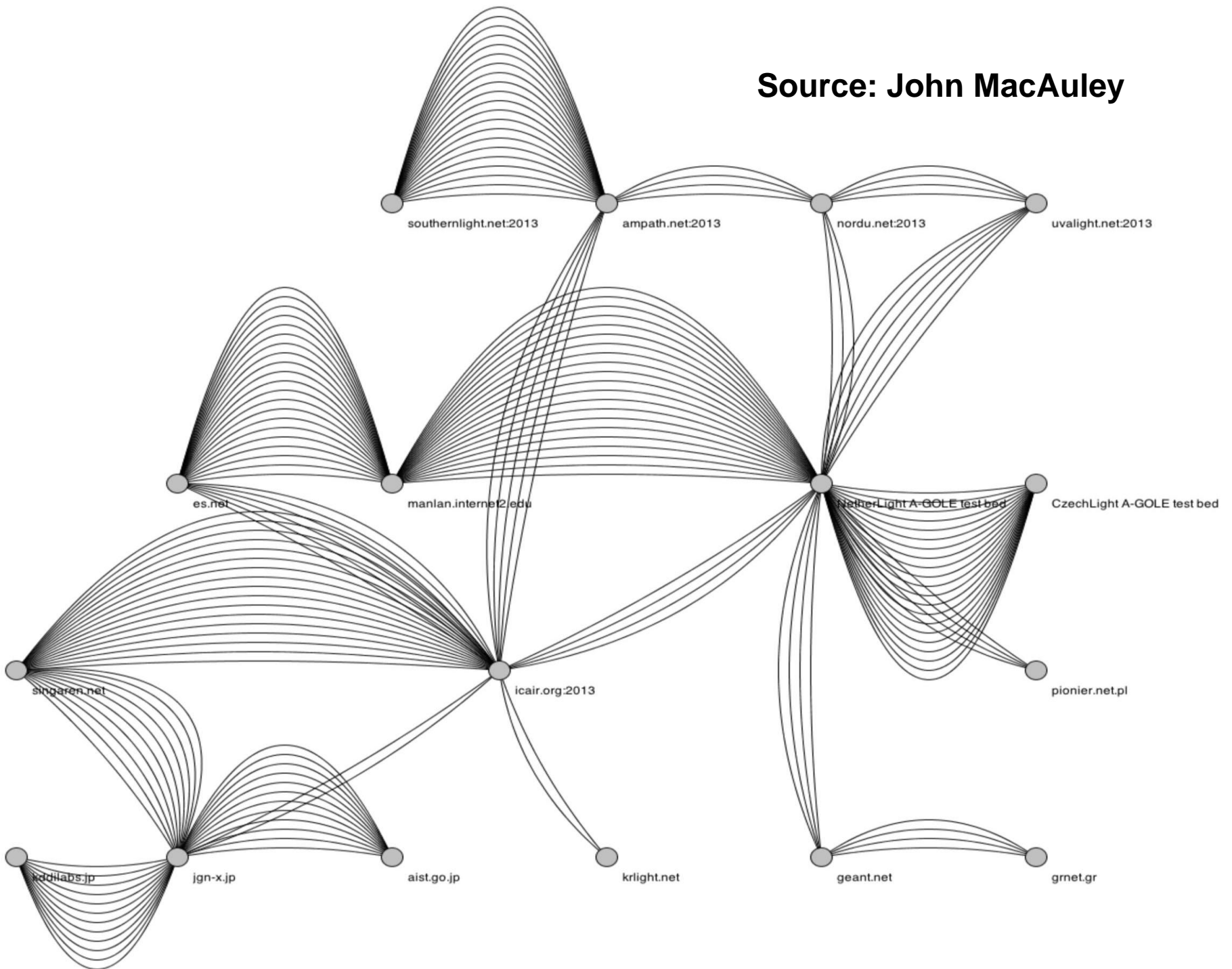
Automated GOLE Worldwide Overview



Legend



Source: John MacAuley



StarLight/StarWave/MREN Continually Progressing Forward!



Contact Us

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Linda Winkler (MCS/ANL)

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www.startup.net/starlight



www.startup.net/starlight

Thanks to the NSF, DOE, NASA
Universities, National Labs,
International Partners,
and Other Supporters



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