International High Performance Digital Media With Dynamic Optical Multicast

An Experimental Architecture and Prototype Optical Digital Media Service – Demonstration of Current Research Status at the 7th Annual Global LambdaGrid Workshop

Prague, Czech Republic
September 17-18, 2007

Overview

- A Consortium of Research Centers From Around the World Has Formed a Cooperative Partnership To Explore the Key Issues Related to the Challenges and Opportunities Related to Using Lightpaths for High Performance Digital Media (HPDM)
- At the Annual Global LambdaGrid Workshop in Prague, Demonstrations Have Been Designed to Show the Current Project Status (Not Final Results, Products or Services)
- Multiple Sites Require High Performance/High Volume/High Definition Digital Media Streaming Simultaneously Among All Locations (Multi-Point to Multi-Point)
- Traditional L3 Techniques Cannot Be Used for Many Types of High Definition Media
- These Techniques Were Designed for Many Small Information Flows – Not for Large Scale Flows
- This Consortium Is Designing and Developing New L1/L2 Capabilities That Can Provide Large Scale HPDM Service Solutions

GLIF Demonstrations

- This Research Consortium Has Designed and Implemented an International HPDM Testbed (HPDMnet), and It Is Being Used for Experiments and Demonstrations
- A Specific Instantiation of the HPDMnet Testbed Was Created For the Global LambdaGrid Workshop
- Various Architectural Approaches And Technologies, Including Middleware, Are Being Developed and Investigated On Research Testbeds, Including HPDMnet
- Component Technologies Being Showcased Include Optical Multicast, UCLP, HARC and G-Lambda
- The Research Will Continue And Further Demonstrations Are Planned

Selected Demo Techniques Include the Following:

- Dynamic L2 and L1 (lightpath) allocation and adjustment, a particularly important emerging technique
- Capabilities for persistent and dynamic large scale L1/L2 resources, allocated in response to requirements
- Integrated, addressable WAN and LAN paths
- High level path control capabilities signalled by application processes
- Branching HPDM streams by setting parameters through the device control systems (“optical multicast”)
- Individually selecting multiple path options can be individually selected to optimize stream flows
- Reliance on an Architectural framework that assumes an SOA context

The Application Point of View

- This initiative is designed and developing a GLIF service, instantiated at GOLEs that will be usable by any large scale media application
- The service can be customized for a wide range of specialized applications
- Digital media can include visualization, animation, video, imaging, et al
- Media can be of any size or type
- The service will be media protocol coding/decoding agnostic
- Audio channels and Interactivity are also considerations
- This capability provides support that allows for the highest possible quality service

Application Service Considerations

- Application signaling
- GLIF media service discovery, including topology considerations
- Service Use, with monitoring and performance guarantees
- Service termination
- Analysis/reporting
- APIs for integration into other GLIF SOA compliant frameworks.

Example: MusicGrid Lesson

Example:
HD Digital Media Steaming from AIST, Akihabara, Tokyo, Using EL/GL

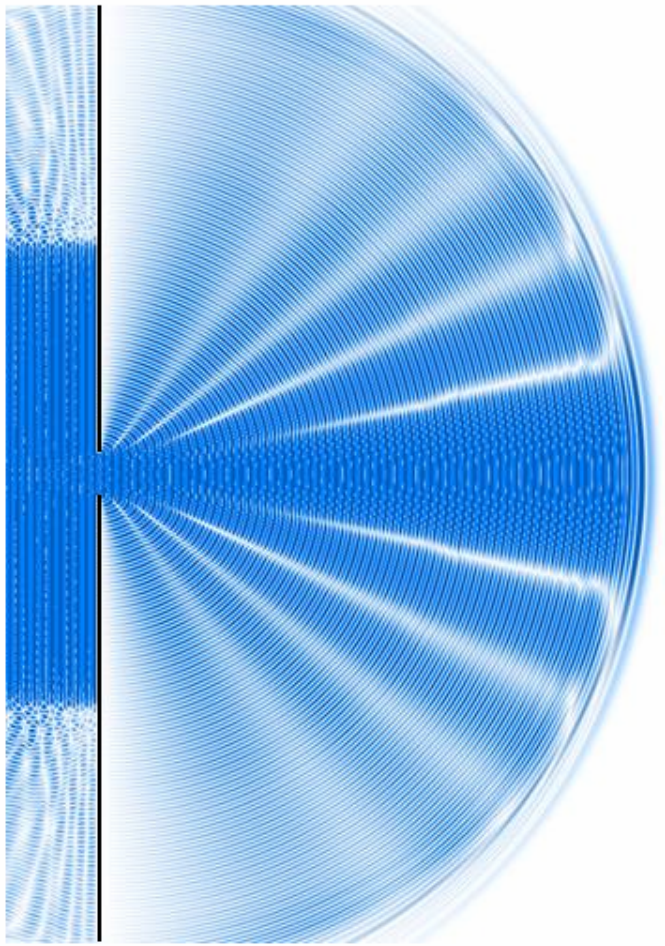
Single Slit Experiments (test 3a) - Microsoft Internet Explorer

File Edit View Favorites Tools Help

NCLT National Center for Learning and Teaching in Nanoscale Science and Engineering

Example: Nanotech Virtual Instrument

This simple educational tool simulates a single slit experiments for parameters such as different slit size and different incident light wavelength.



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

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

Indigo(465 nm)

380 nm 680

2. Choose slit size in multiples of incident wavelength

Aperture size is 5 λ

0.5λ 10λ

3. Run test and watch the animation

Run Test | Animate | Stop

1 15

Frame # 5, time is 115fs

Legend

-2550 0 2550

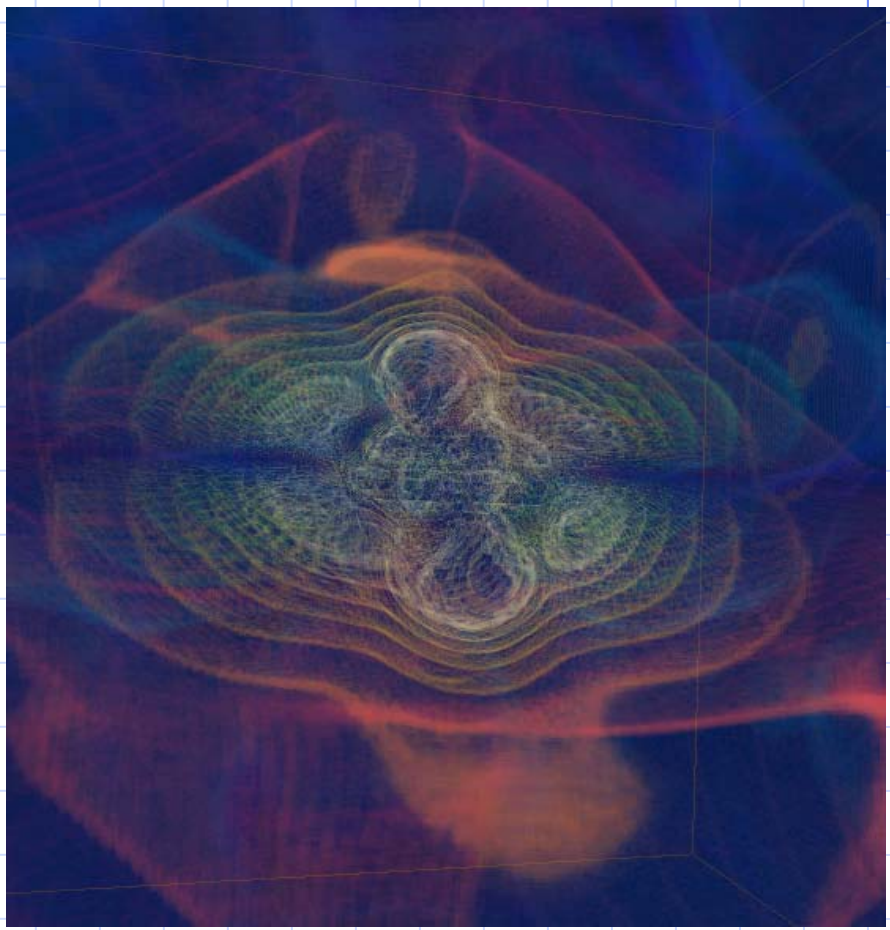
Done

Internet

start | Eudora | Meeting Maker ... | https://www.cc... | Single Slit Exper... | Microsoft Powe... | 99% | 12:01 PM

Example: Enlightened - Visualization of remote data

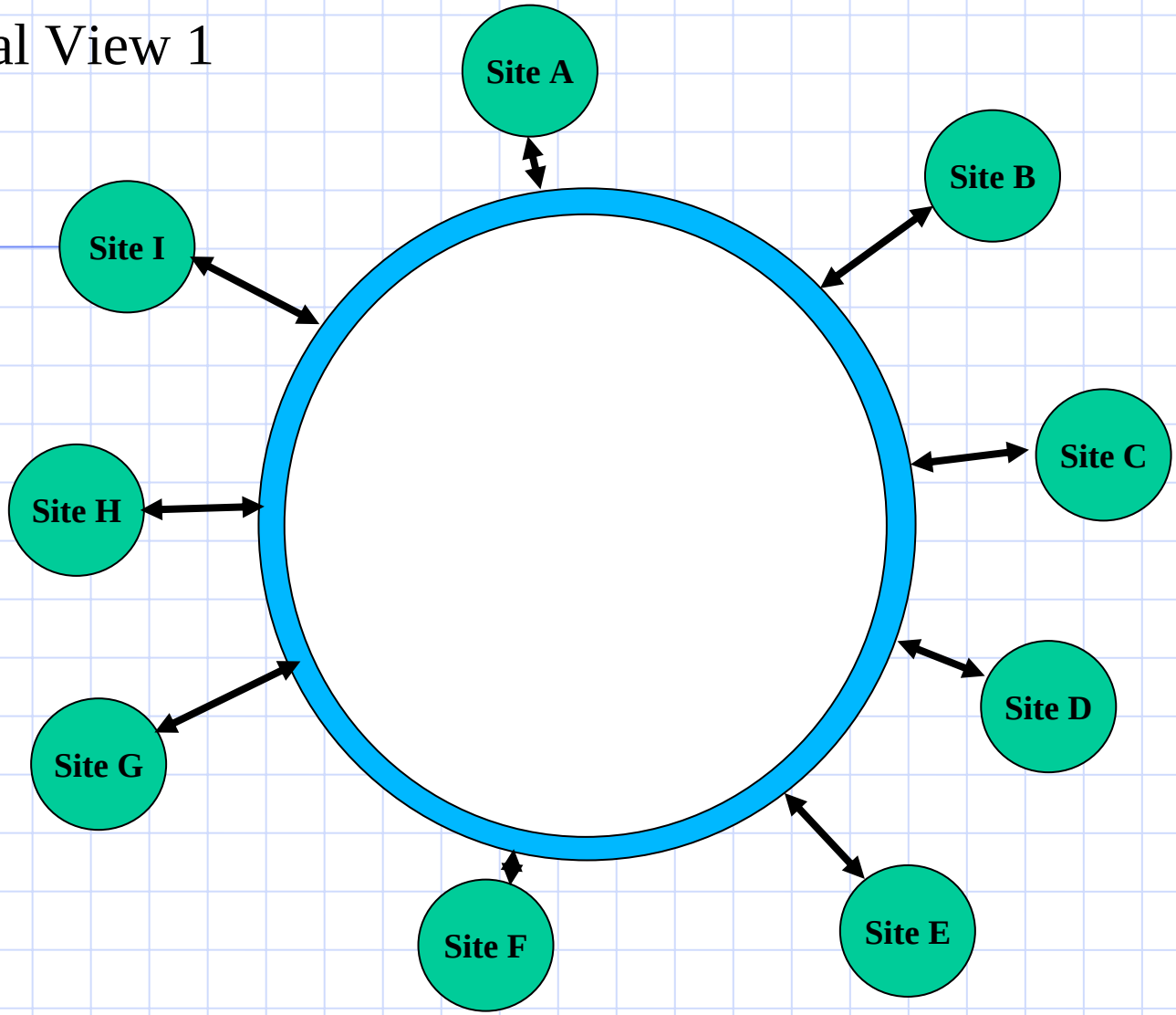
- Data generated by remote simulation
- Here: a black hole simulation
- Need to explore and visualize the dataset
- Enhanced Amira visualization system to take advantage of optical networks



NORTEL

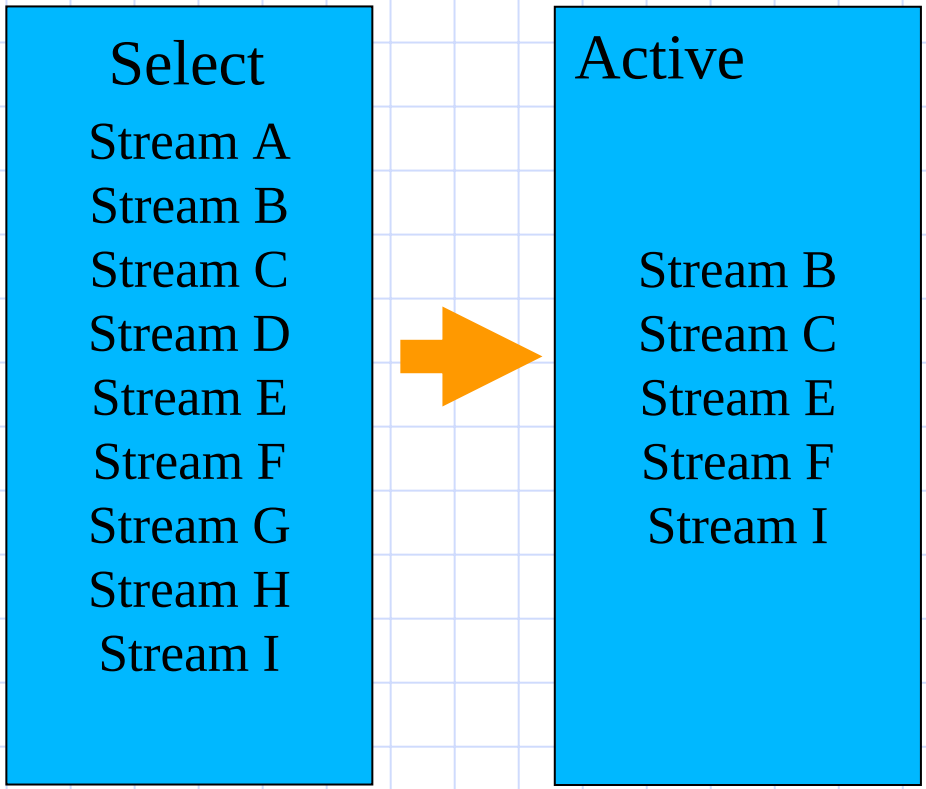
Displays: Multiple Monitors, Tiled Displays, Etc.

Logical View 1



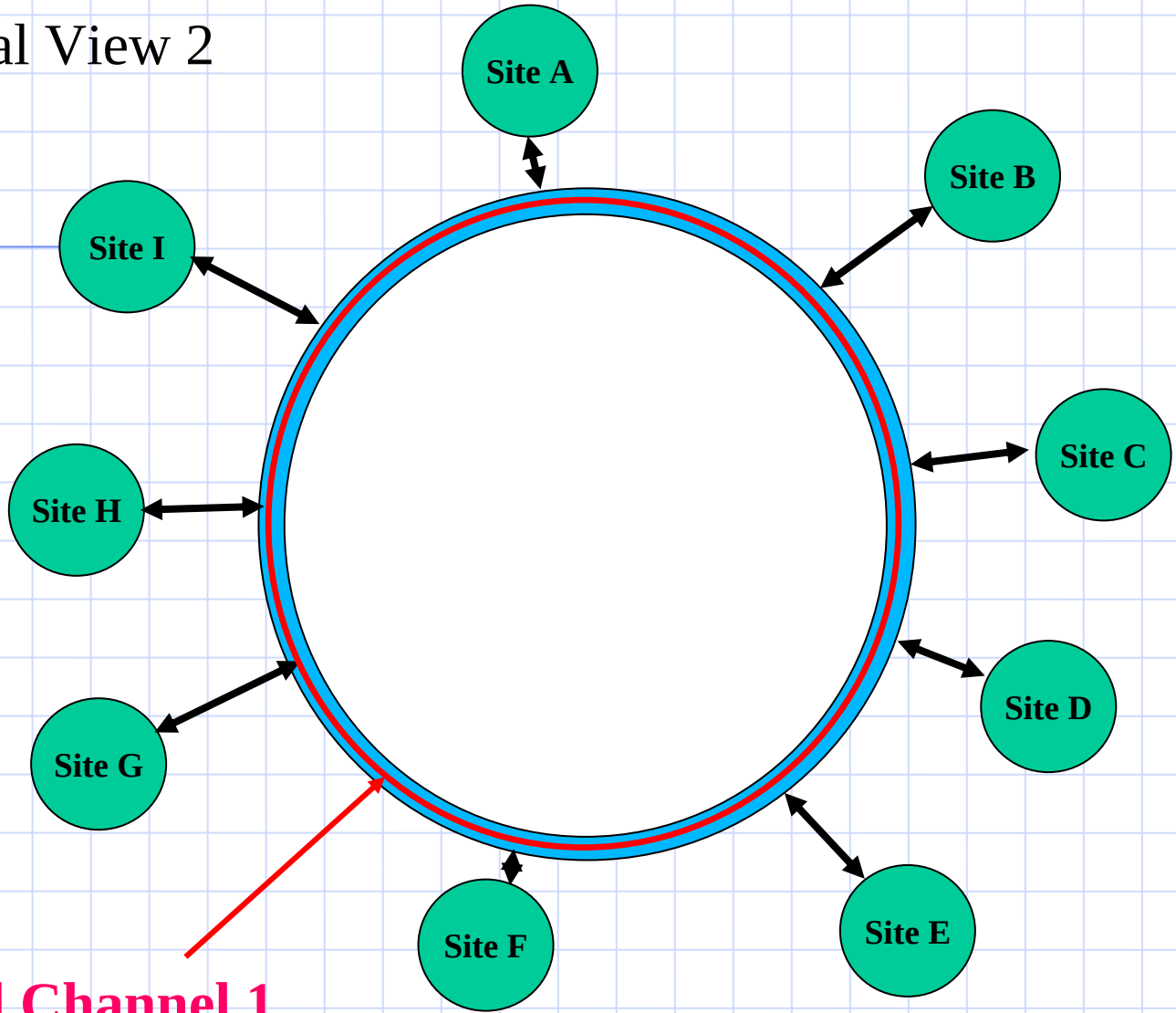
Each site can send and receive multiple streams

Logical Interface



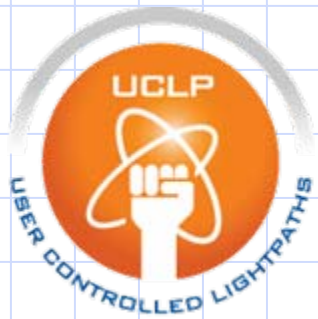
Note “Stream” – Not Site – Each Site Can Support Many-to-Many

Logical View 2



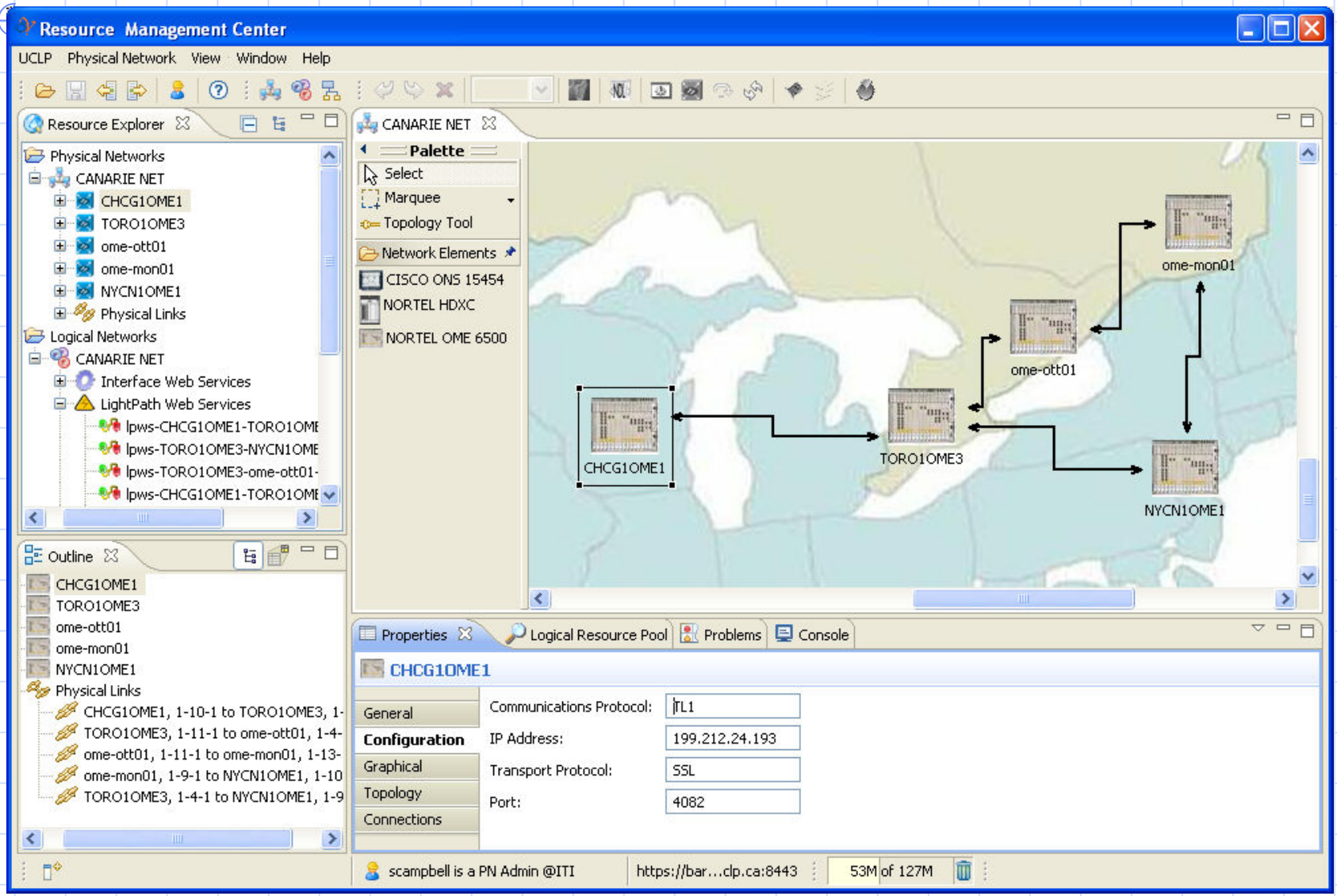
About UCLP / Argia

- Argia is a production grade version of UCLP
- Argia is middleware that allows end-users (people or applications) to treat network resources as software objects and provision and re-configure lightpaths within a single domain or across multiple, independently managed domains
- Users can also join or divide lightpaths and hand off control and management of these private sub-networks to other users or organizations
- Argia enables the virtualization of a network that can be reconfigured by the end-user without any interaction by the optical network manager
- http://www.inocybe.ca



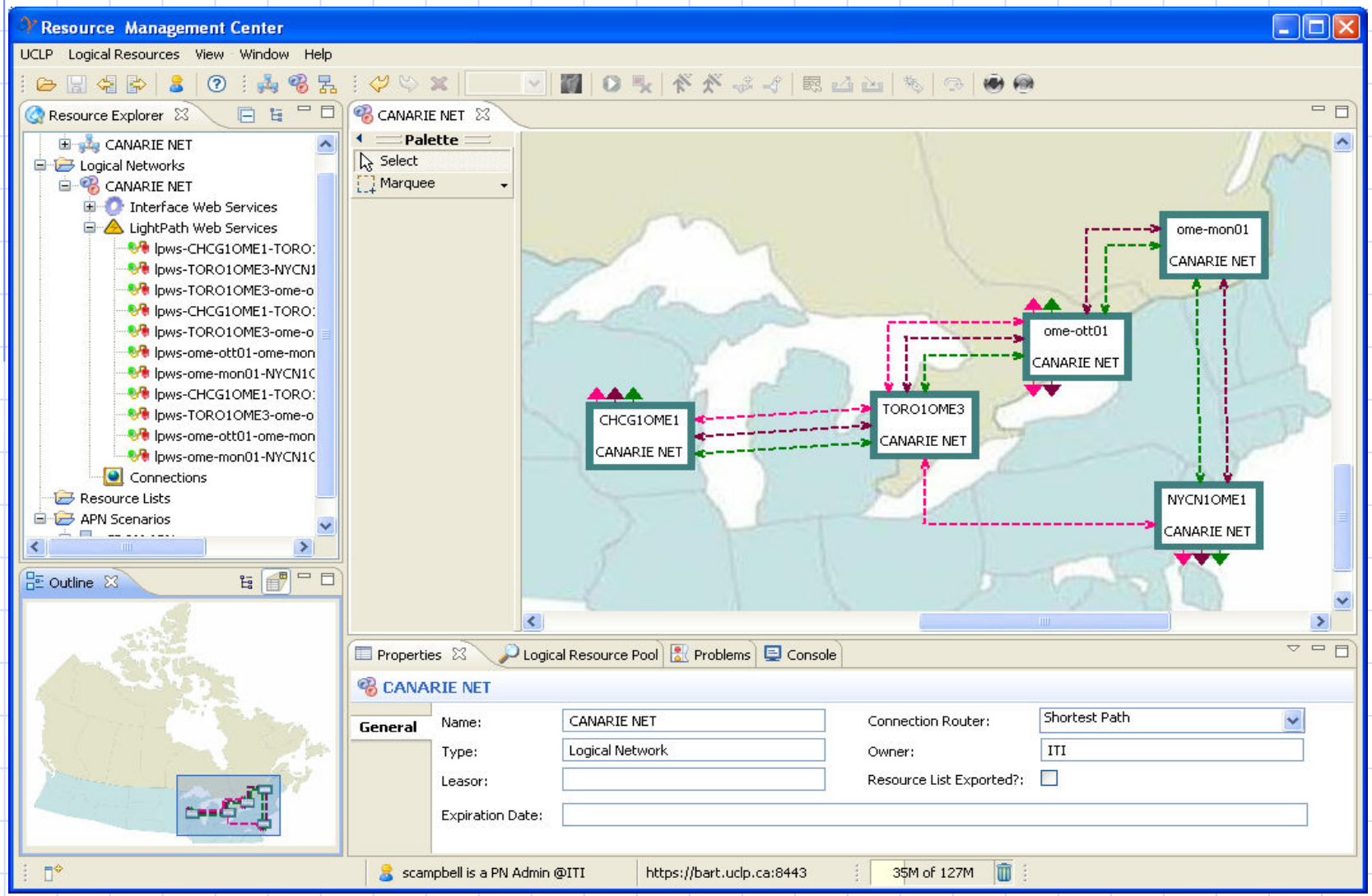
Argia Resource Management Center

- The first step is to create the Physical Network in Argia



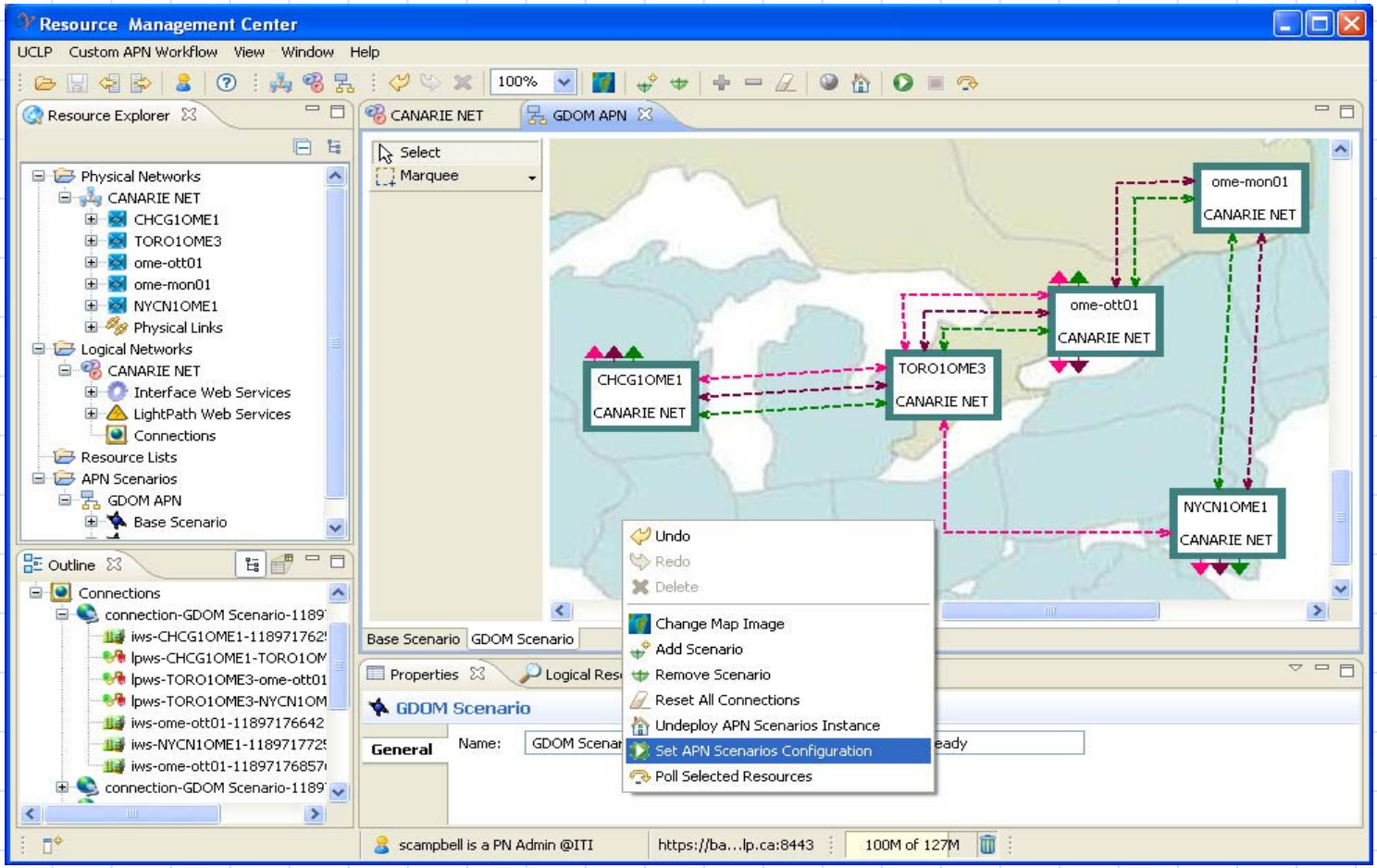
Creating Logical Resources: The Logical Network

- Logical Resources are displayed by the Logical Network Editor. Note that at this point, the network resources have been virtualized, but no connections have been made.

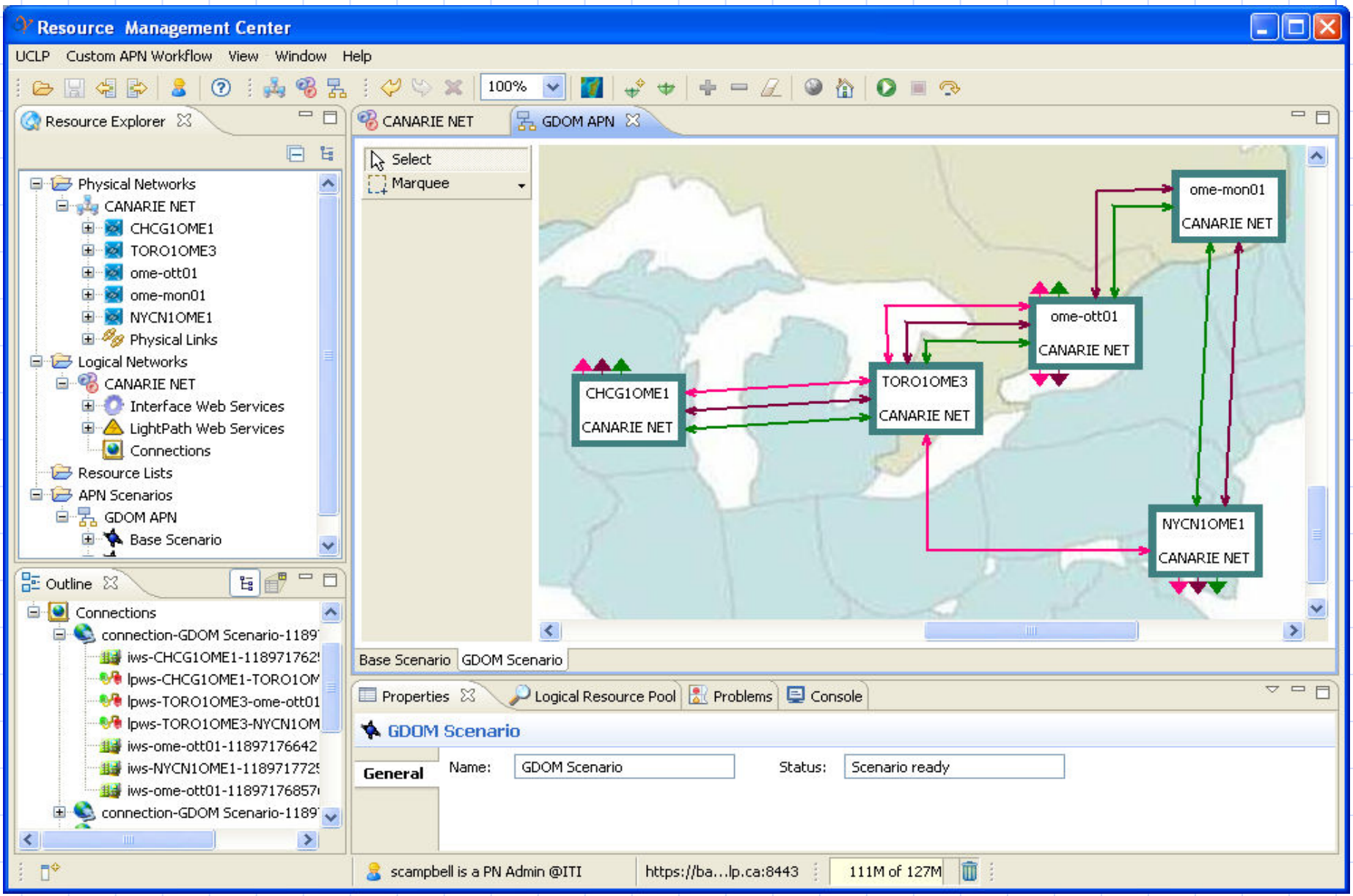


Creating the Multicast Connections: The APN

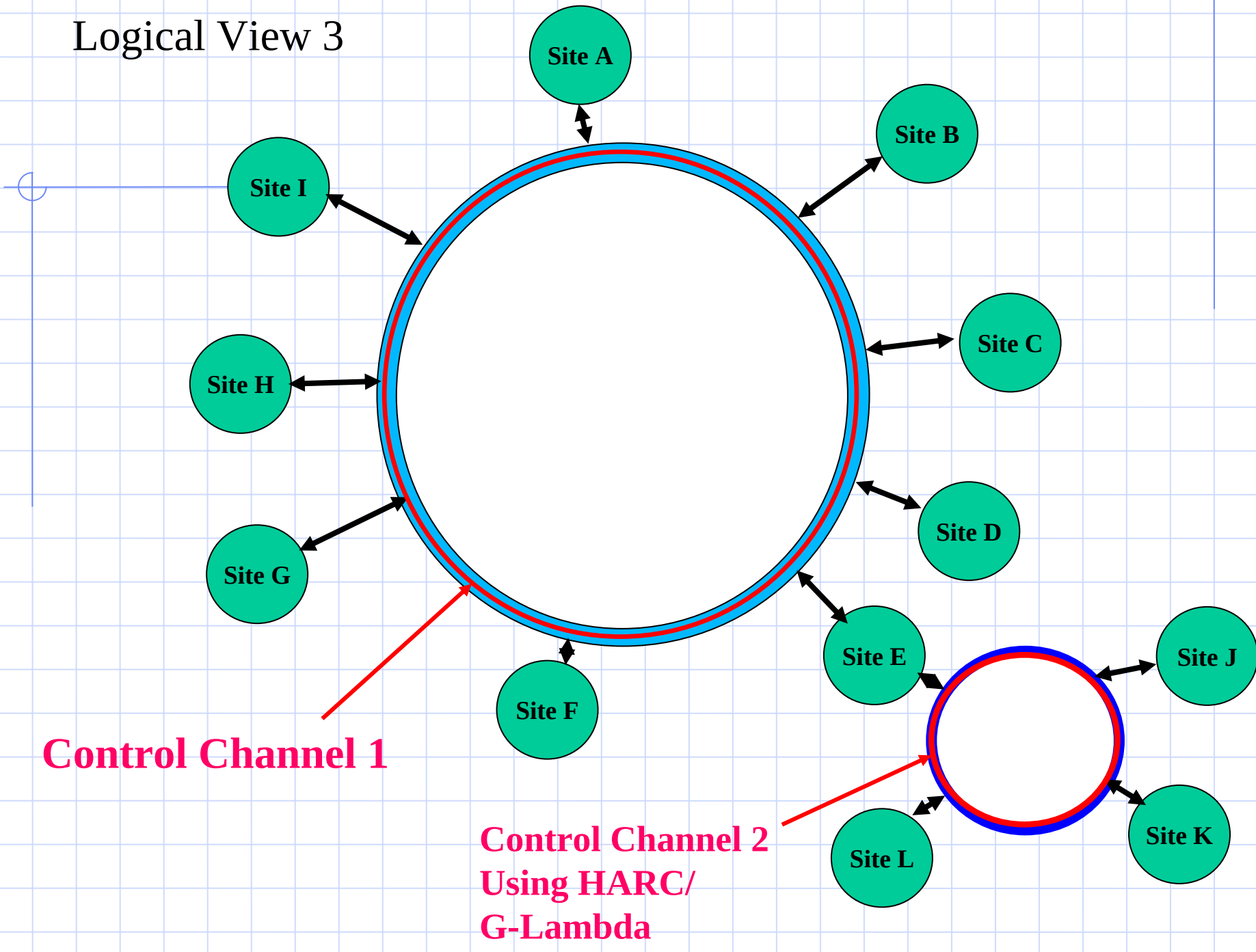
- An Articulated Private Network (APN) is created with the resources from the Logical Network. The topology of the APN is configured (and color coded) to represent the network that will be configured when the APN is executed.
- The APN is deployed as a web service so all of the connections can be made with a single call.

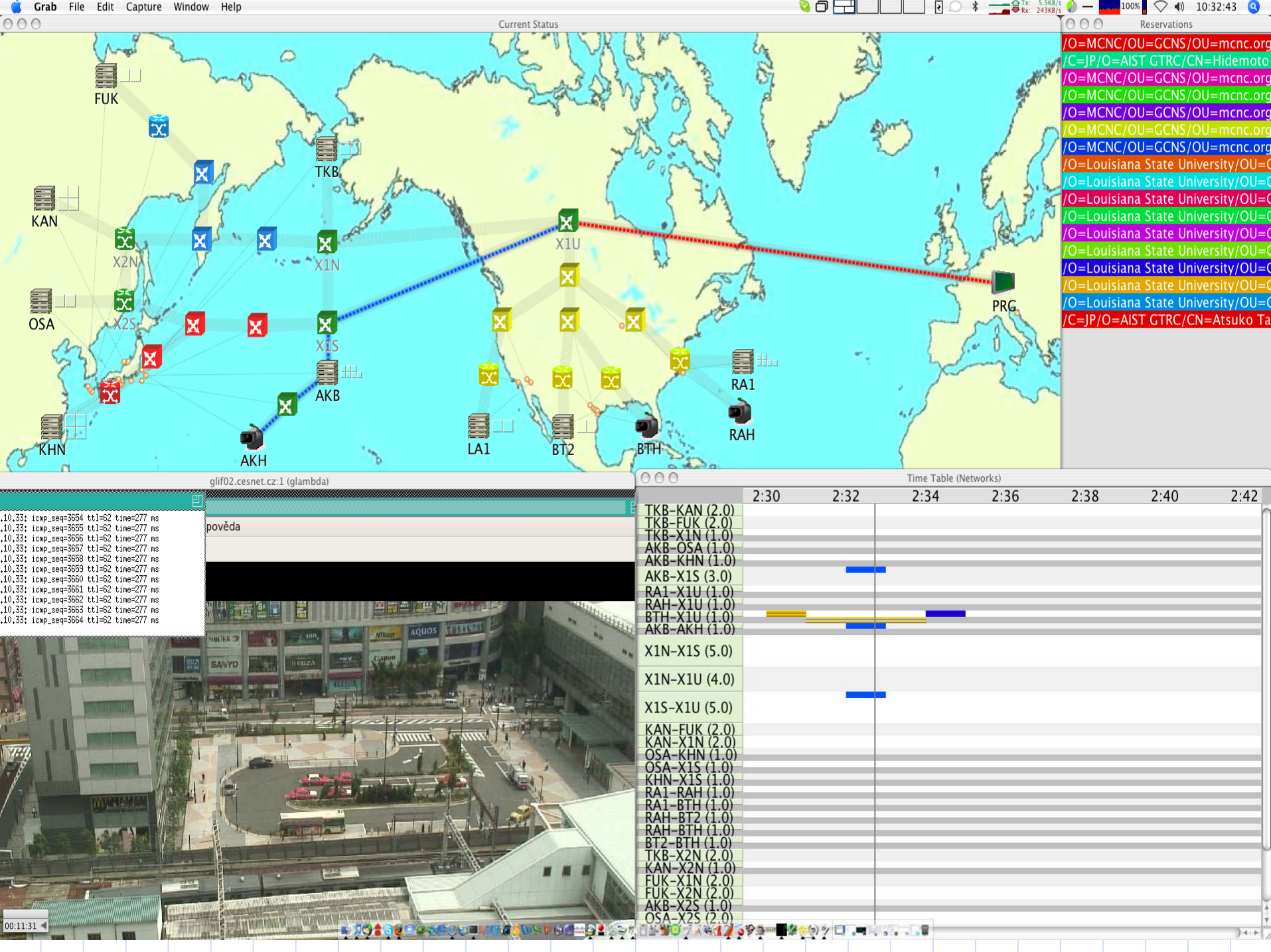


The Connected APN



Logical View 3




Grab File Edit Capture Window Help
10:32:43
Current Status
FUK
TKB
KAN
X2N
X1N
X1U
OSA
X2S
X1S
AKB
KHN
AKH
LA1
BT2
BTH
RA1
RAH
PRG
Reservations
/O=MCNC/OU=GCNS/OU=mcnc.org
/C=JP/O=AIST GTRC/CN=Hidemoto
/O=MCNC/OU=GCNS/OU=mcnc.org
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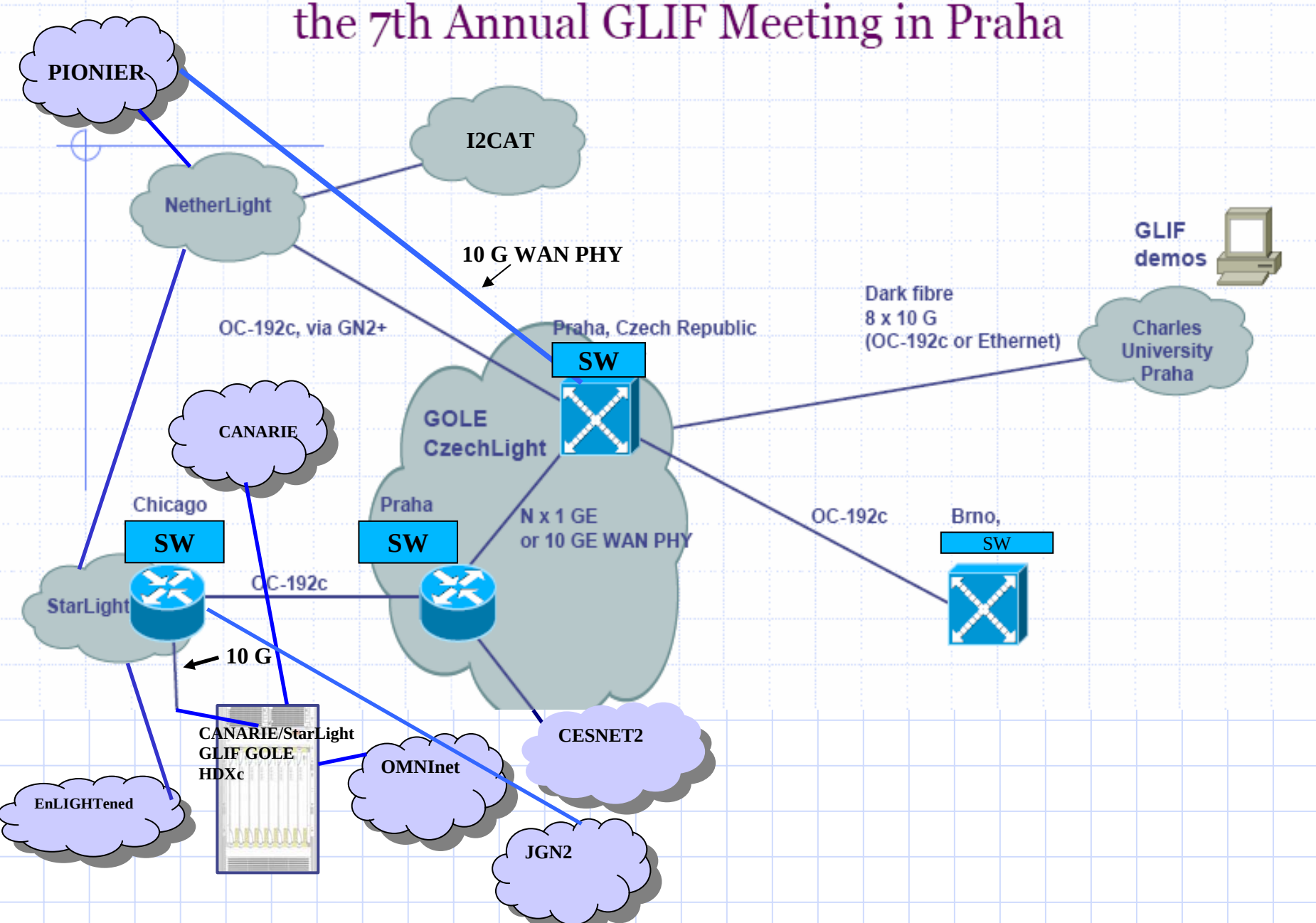
/C=JP/O=AIST GTRC/CN=Atsuko Ta
glif02.cesnet.cz:1 (glambda)
pověda
.10.33: icmp_seq=3654 ttl=62 time=277 ms
.10.33: icmp_seq=3655 ttl=62 time=277 ms
.10.33: icmp_seq=3656 ttl=62 time=277 ms
.10.33: icmp_seq=3657 ttl=62 time=277 ms
.10.33: icmp_seq=3658 ttl=62 time=277 ms
.10.33: icmp_seq=3659 ttl=62 time=277 ms
.10.33: icmp_seq=3660 ttl=62 time=277 ms
.10.33: icmp_seq=3661 ttl=62 time=277 ms
.10.33: icmp_seq=3662 ttl=62 time=277 ms
.10.33: icmp_seq=3663 ttl=62 time=277 ms
.10.33: icmp_seq=3664 ttl=62 time=277 ms
00:11:31
Time Table (Networks)
2:30
2:32
2:34
2:36
2:38
2:40
2:42
TKB-KAN (2.0)
TKB-FUK (2.0)
TKB-X1N (1.0)
AKB-OSA (1.0)
AKB-KHN (1.0)
AKB-X1S (3.0)
RA1-X1U (1.0)
RAH-X1U (1.0)
BTH-X1U (1.0)
AKB-AKH (1.0)
X1N-X1S (5.0)
X1N-X1U (4.0)
X1S-X1U (5.0)
KAN-FUK (2.0)
KAN-X1N (2.0)
OSA-KHN (1.0)
OSA-X1S (1.0)
KHN-X1S (1.0)
RA1-RAH (1.0)
RA1-BTH (1.0)
RAH-BT2 (1.0)
RAH-BTH (1.0)
BT2-BTH (1.0)
TKB-X2N (2.0)
KAN-X2N (1.0)
FUK-X1N (2.0)
FUK-X2N (2.0)
AKB-X2S (1.0)
OSA-X2S (2.0)

Infrastructure and Connectivity for the 7th Annual GLIF Meeting in Praha



Ref:

- Additional Information is available through the presentations on this demonstrations made during the GLIF working group meetings

Demonstration Participants

- **CESNET**
- Jan Radil
- Vladimir Trestik
- Jan Furman
- Jan Nejman
- Stanislav Sima
- Michal Krsek
- Michal Martin
- Lada Altmanov

- **Communications Research Centre**
- Michel Savoie
- Bobby Ho
- Hanxi Zhang
- Scott Campbell

Demonstration Participants (Cont.)

- **Canarie**
  - Bill St Arnaud
  - Herve Guy
  - Darcy Quesnel
  - Jun Jian
  - Thomas Tam
- **i2CAT**
  - Artur Serra
  - Sergi Figuerola
  - Berenguer Vilajoliu
  - Eduard Grasa
  - Francisco Iglesias
- **Inocybe**
  - Mathieu Lemay
- **LONI**
  - Lonnie Leger
  - Ben Blundell
  - Charles McMahon

Demonstration Participants (Cont.)

- **Louisiana State University**
  - Andrei Hutanu
  - Jon MacLaren
  - Dan Katz
  - Gabrielle Allen
  - Ed Seidel

- **National Institute of Industrial Science and Technology (AIST)**
  - Tomohiro Kudoh
  - Atsuko Takefusa
  - Hidemoto Nakada

- **Nortel**
  - Rodney Wilson
  - Éric Bernier
  - Dave Yeung
  - Wai-Chau Hui
  - Michael Ward
  - Ted Swinwood
  - Inder Monga

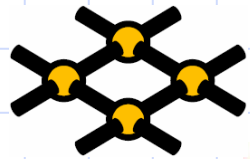
Demonstration Participants (Cont)

- **Masaryk University**
- Petr Holub

- **MCNC**
- Lina Battestilli
- Gigi Karmous-Edwards
- John Moore
- Yufeng Xin
- Steve Thorpe
- Syam Sundar

- **Northwestern University**
- Joe Mambretti
- Jim Chen
- Fei Yeh

Demonstration Participants (Cont.)

- **SARA**
  - Pieter de Boer
  - Ronald van der Pol
  - Jorrit Adriaanse
  - Paul Wielinga
  - Mark Meijerink
- **StarLight**
  - Linda Winkler
  - Alan Verlo
- **SURFnet**
  - Kees Negers
  - Erik-Jan Bos
  - Bram Peetersh
- **University van Amsterdam**
  - Cees de Laat
  - J.P. Velders
  - Paola Grosso
  - Jeroen Roodhart

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