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High Performance Digital Media Network

High Performance Digital Media Network (HPDMnet): **Dynamically Provisioned** Inter-Domain International Service for **High Performance Digital Media and Other Data Intensive Applications**

Joe Mambretti and the HPDMnet Consortium

10th Annual Lambda Grid Workshop

CERN, Switzerland

October 12-14, 2010

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Overview

- **Several Years Ago, An International Consortium of Research Centers Established a Cooperative Partnership To Address Key Challenges and Opportunities Related to Using Dynamically Provisioned Lightpaths for High Performance Digital Media (HPDM) and Other Data Intensive Applications**

- **Multiple Sites Require Controlled, Deterministic High Performance/High Volume/High Definition Digital Media Streaming Simultaneously Among All Locations (Point-To-Multipoint, Multipoint-To-Point, Multi-Point to Multi-Point)**

- **HPDMnet Is:**
  - **A Network Research Testbed**
  - **A Set of Prototype Services**
  - **A Capability for Digital Media Content**

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Overview

- **Traditional L3 Techniques Cannot Be Used for Many Types of High Definition Media**
- **Traditional 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 Services, Which Can be Used for Any Data Intensive Application, Not Just Digital Media**
- **Key Attributes: Capacity, Flexibility, Quality, "Green"**
- **The Consortium Is Designing a Service Specifically for Implementation at GLIF GOLES, and Related Facilities**
- **The Consortium is Working With Others In the GLIF Consortium on A Common Architecture that Is Defining a New Types of Network Service and Related Network Interface**
- **This Connection-Oriented Service Can Be Dynamically Provisioned**

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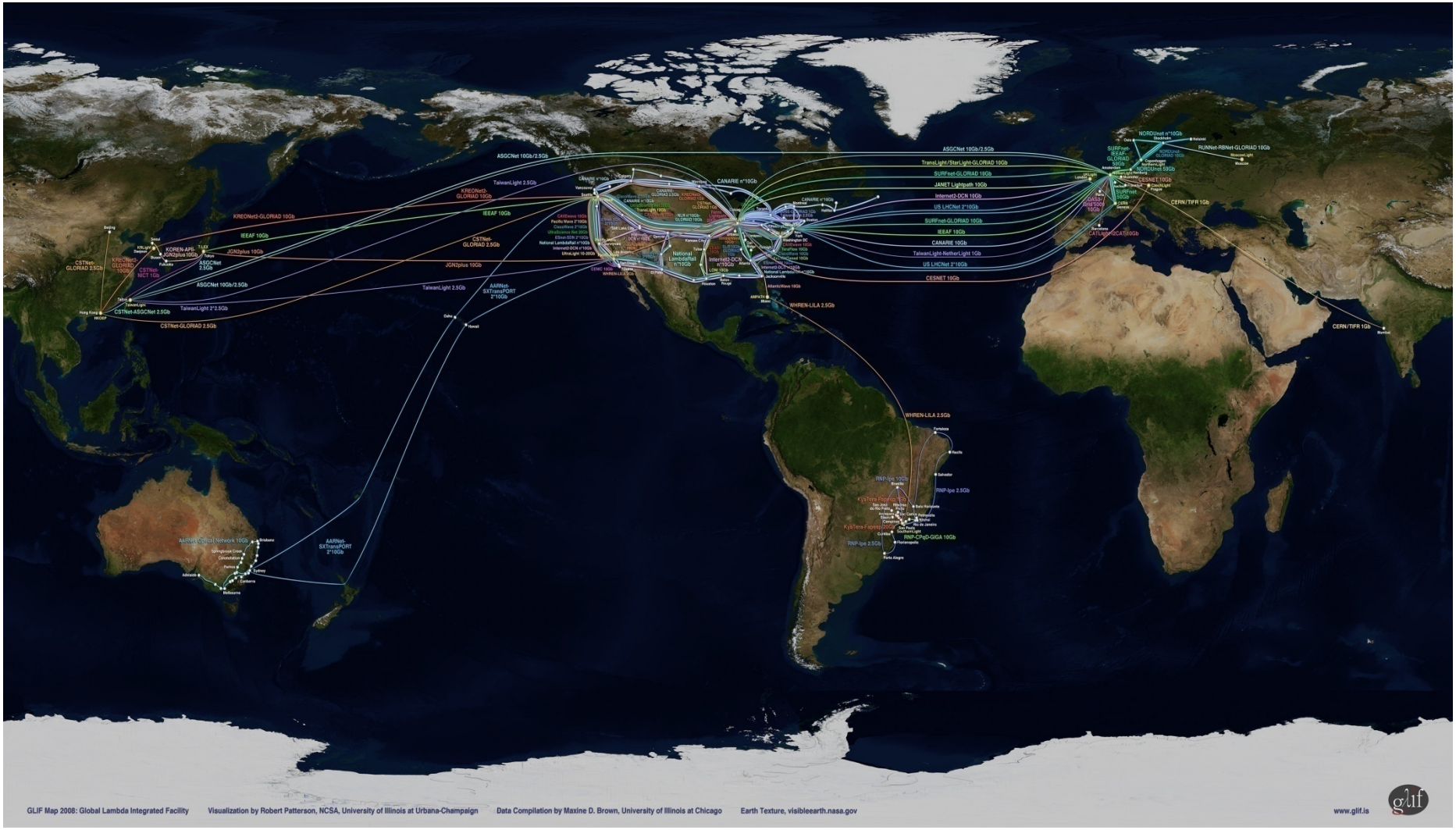
HPDMnet is a GLIF Participant, Global Lambda Integrated Facility



GLIF World-Scale Lambda-based Laboratory for Application and Middleware Development

Last Updated: September 16, 2010

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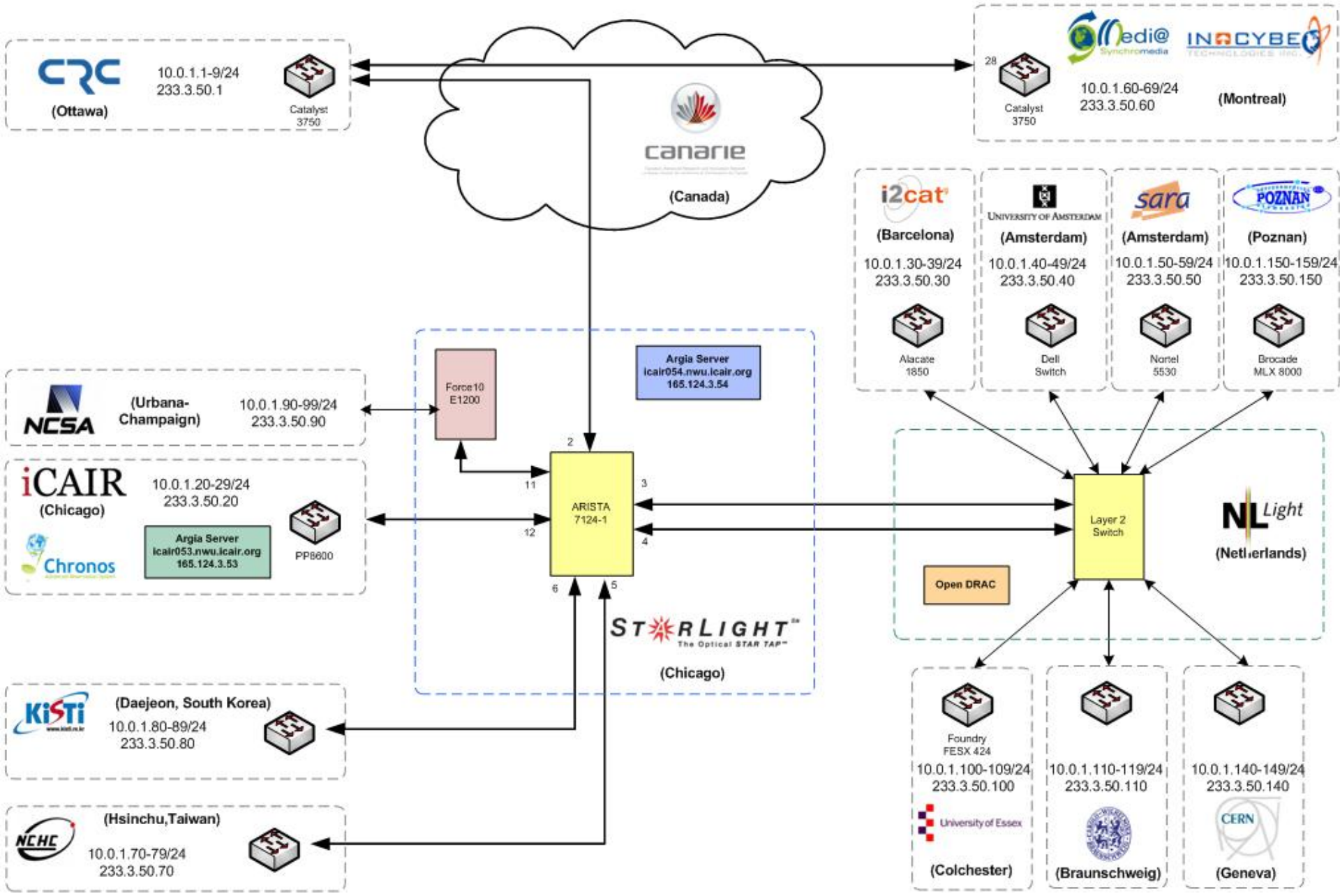
Layer 2 Topology



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Key Motivations (Part I)

- Design and Development of ***Dynamically Provisioned Specialized Services***
  Based on New Services Architecture and Innovative Technology Models – e.g., Connection Oriented Services, Stateful Services

- Meta Context = SOA
  Top Layer Services Are Encapsulated Processes -- Software Objects
  Mid and Low Layer Processes Also Encapsulated As Software Objects, Including Supplemental Utility Processes and External Processes, Enhanced Virtualization With Much Better Methods for Ad Hoc Integration

- Basic Physical Layer Approach = Infrastructure As a Service (IaaS)
  All Physical Resources Are Encapsulated And Integrated As Software Objects

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Key Motivations (Part II)

- Create a Permanent International Experimental Testbed Facility
  Design, Develop, Implement, and Operate a Permanent International Large Scale Experimental Research Testbed, Based on Optical Channels That Provides for Programmable Capabilities, Including Topologies.

- Highly Distributed Connections Control & Management
  Design and Implement Interfaces To Facilitate Creation, Control and Management of Connections/Topologies, Allowing for Highly Distributed Control and Management Processes – *Including Global Topologies Within Desktop Icons Single Click To Instantiate a Global Network!*

- Applications Control & Management
  Allow for Interfaces for Adding Functionality, After Connects Are Established (e.g. CHRONOS, Advance Reservations System)

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Key Motivations (Part III)

- Create a Permanent Service at GLIF GOLEs That Will Provide Capabilities for Data Intensive Applications Using New Services Architecture and Technology Models (Initially a Prototype Service)

- Create Application-Oriented Services - Specialized Application Clients and Processes That Are Network Path/Topology Aware

- Interconnections With Repositories
  Design and Implement Capabilities for Content Resource Discovery and Use

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Virtualizing Networks

- **Networks Can Be Virtualized – Such That They Appear As a Set of Software Resources That Are Accessed by Grid Services**
- **The Virtual Resources Approach Can Be Used To Partition a Network into Multiple Sub-Networks That Can Be Provisioned and Re-configured Within a Single Domain or Across Multiple, Independently Managed Domains**
- **Import Resources From Other Network Domains To Create End-to-End Solutions**
- **Export Resources To External Environments --**
- **Network Administrators Can Create Subsets of Their Network and Give Control of Those Resources To Other Network Providers Or To Their End users**
- **Users Can Also Join or Divide Lightpaths and Give Control and Management of These Private Sub-Networks to Other Users or Organizations**
- **Using the Virtual Resources, These Networks Can Be Reconfigured By the End-User Without Any Interaction By the Network Manager**

Does Software Exist That Can Accomplish These Objectives? –Yes
Demonstrated at Multiple Conferences

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About UCLP / Argia

- Argia = Production Grade Version of UCLP
- Argia = Middleware Allowing 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 Managed Domains
- Users Can Also Join or Divide Lightpaths and Give Complete Control and Management of 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 an Optical Network Manager
- Argia™ Can Be Used for Virtualization and Control of Optical Networks
- http://www.inocybe.ca

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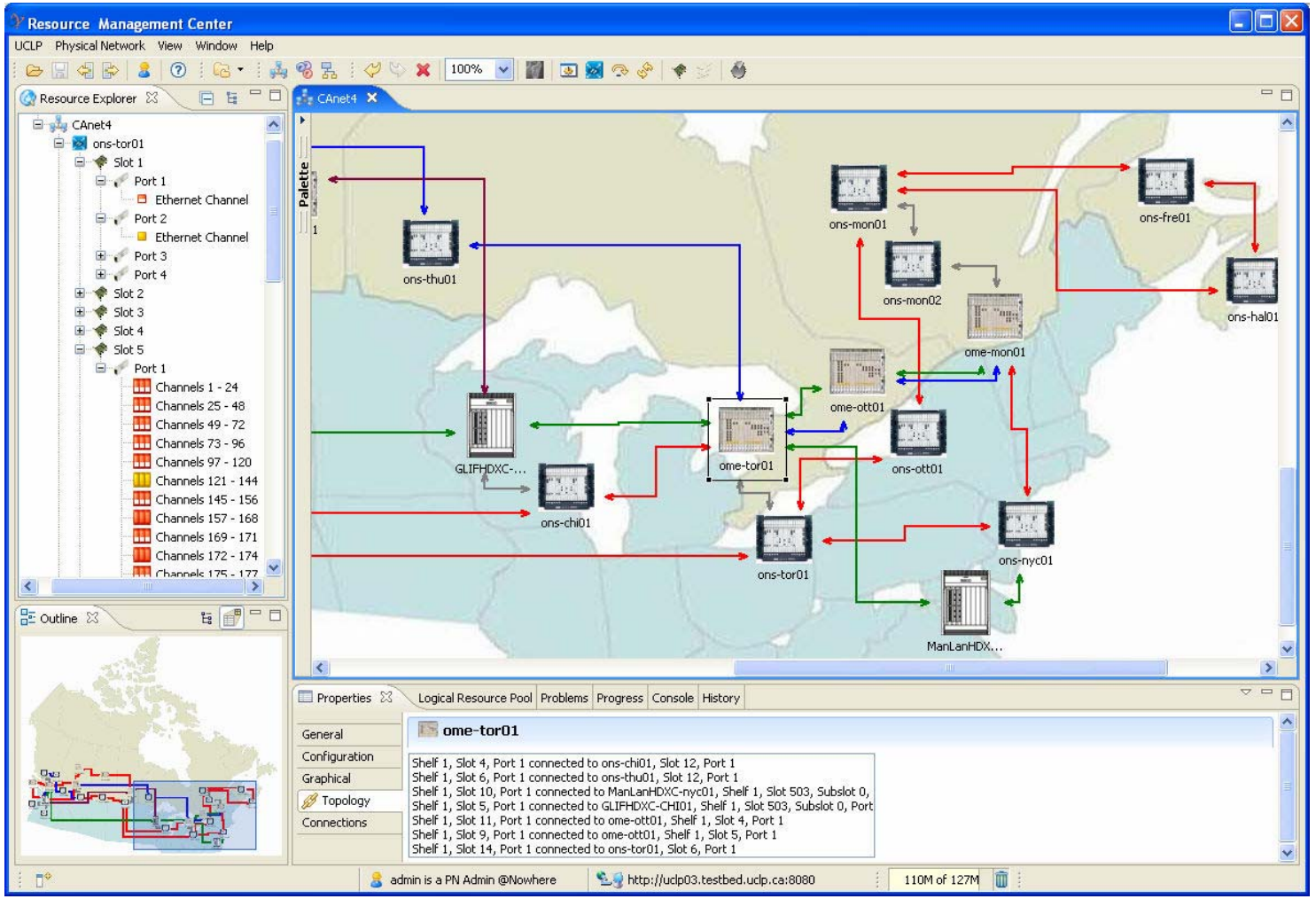
Physical Domain Management

- Manage Networks With Traditional NMS Functionalities



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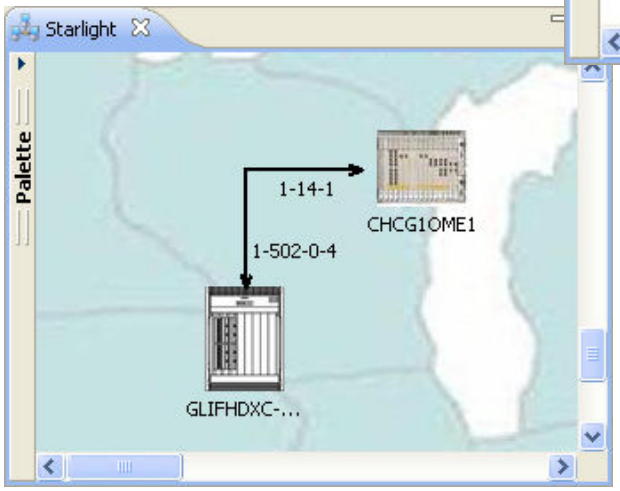
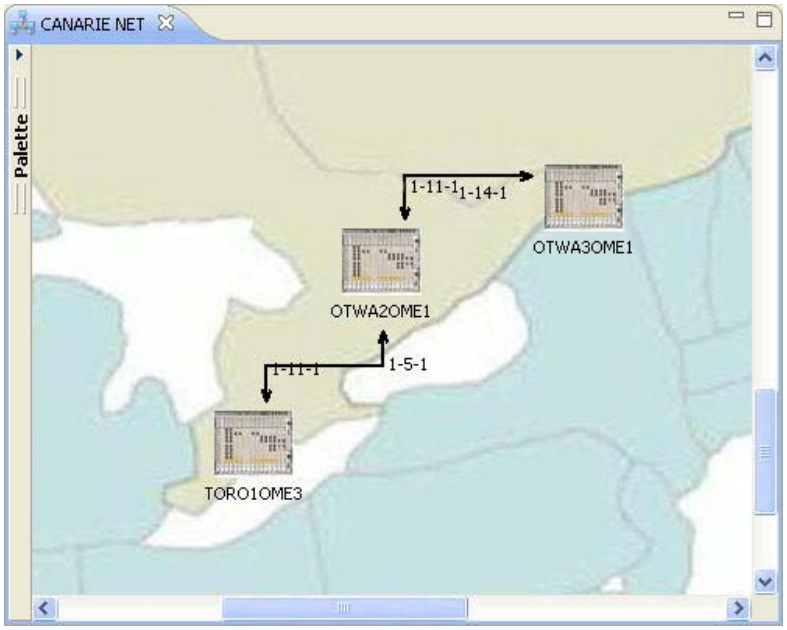
Multi-Domain Control

- The Network Admins First Create Physical Network for Their Domain.
- Today, There Are Four Domains in the HPDMnet under the Control of Argia-- Pacific Wave GOLE, STARLight GOLE, CANARIE Net and Nortel Networks





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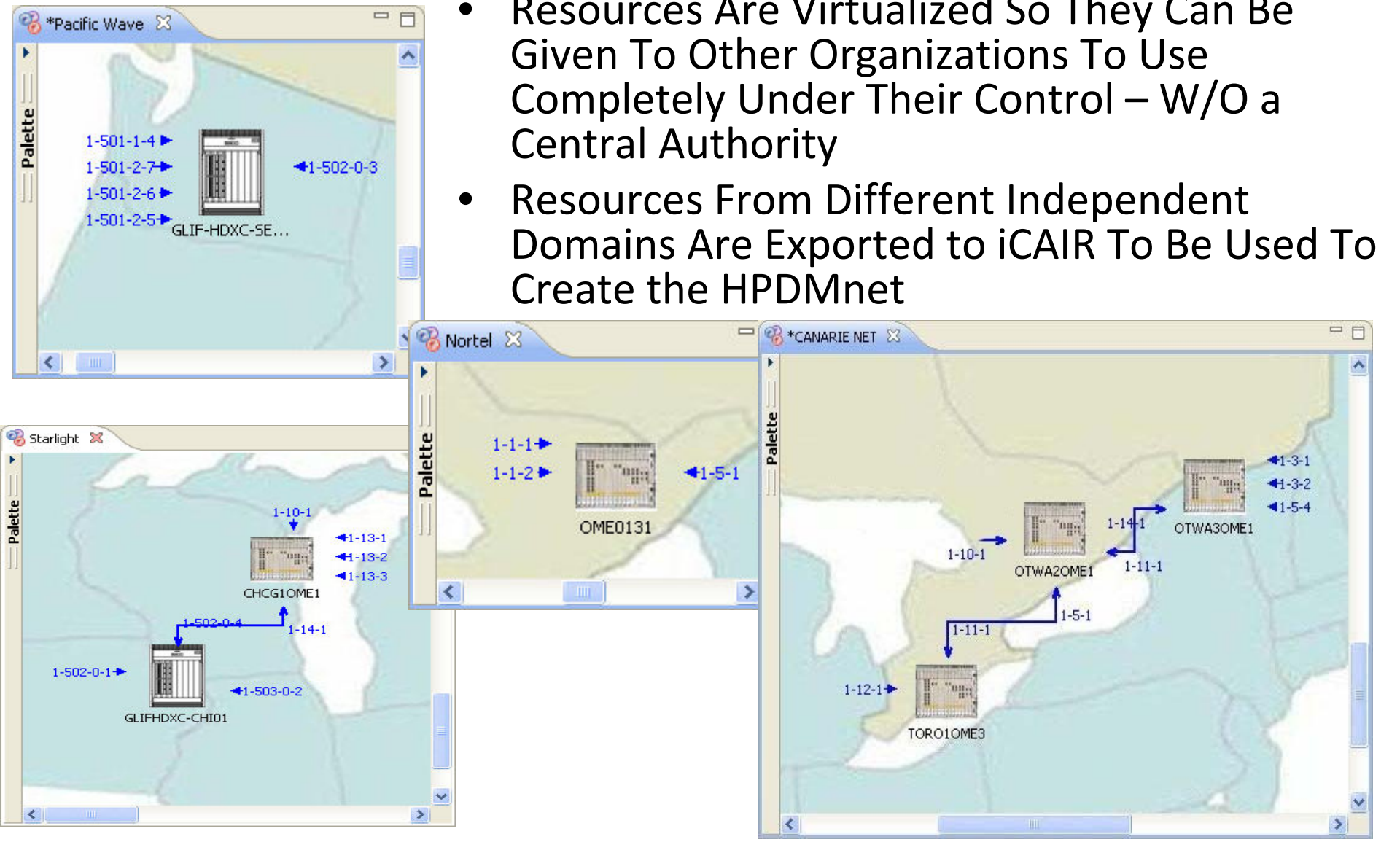
Creating Virtual Resources

- Resources Are Virtualized So They Can Be Given To Other Organizations To Use Completely Under Their Control – W/O a Central Authority
- Resources From Different Independent Domains Are Exported to iCAIR To Be Used To Create the HPDMnet



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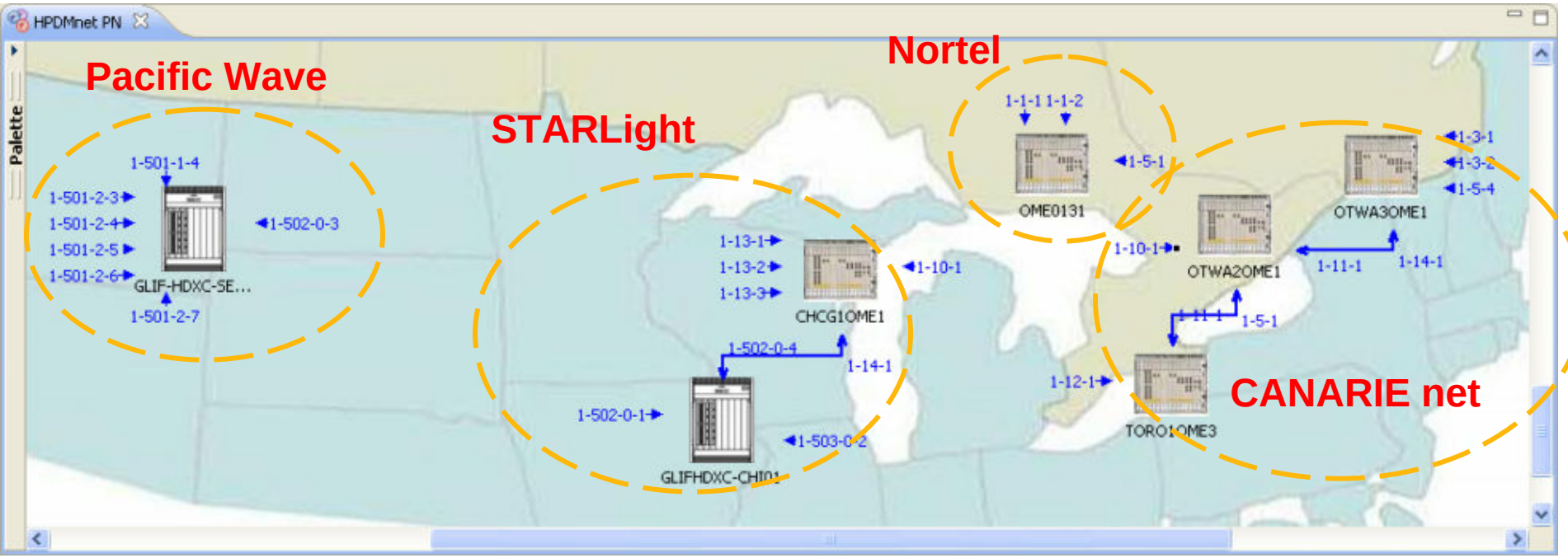
Import Virtual Resources

- Resources are imported by the Argia Administrator at iCAIR



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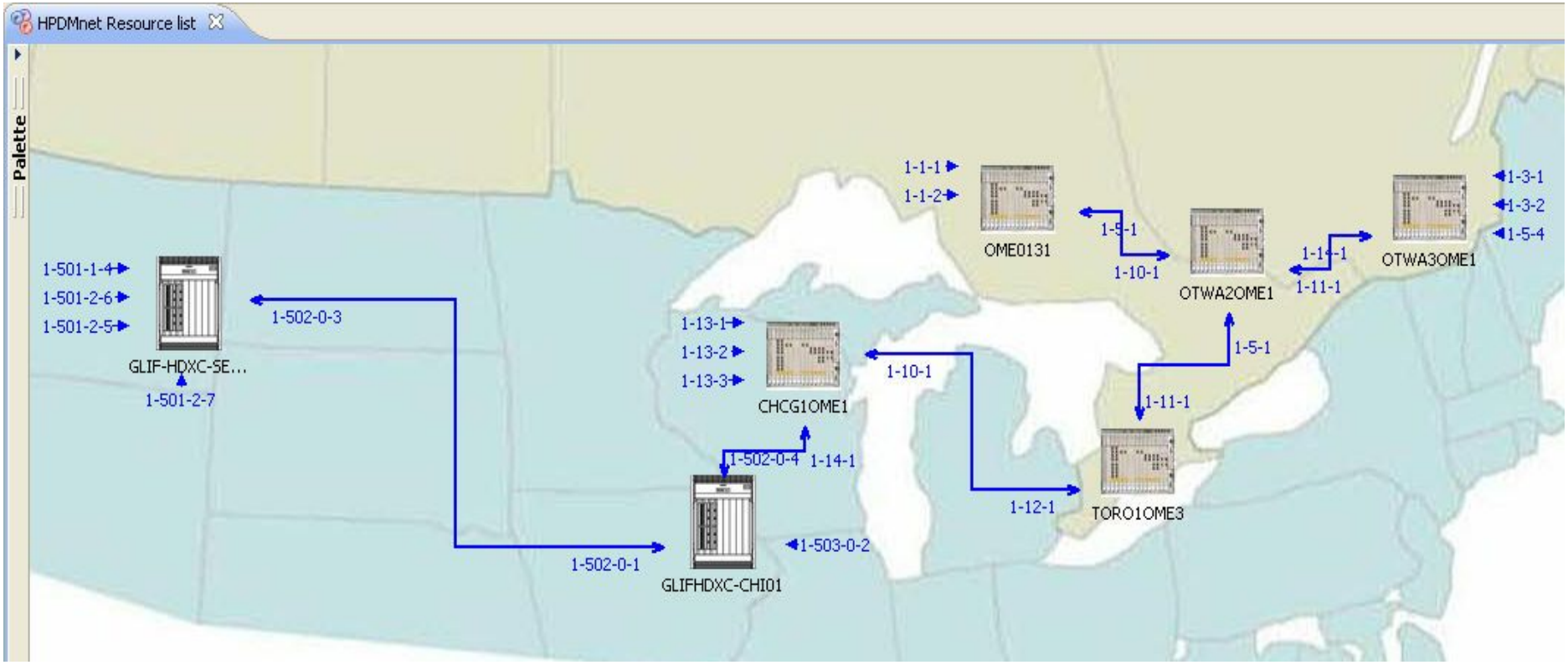
Complete the Resource List: The HPDMnet Testbed !!!

- **Links Are Created Between the Edge Interfaces of Each Domain to Create the Final HPDMnet Resource List**
- **Users of the HPDMnet Can Create Connections, Reserve Resources via Chronos, Partition or Bond Resources, etc., All Without a Need To Contact Network Administrators from Each Domain**



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Login in Chronos

- To Start Using Chronos, Login Is Required.

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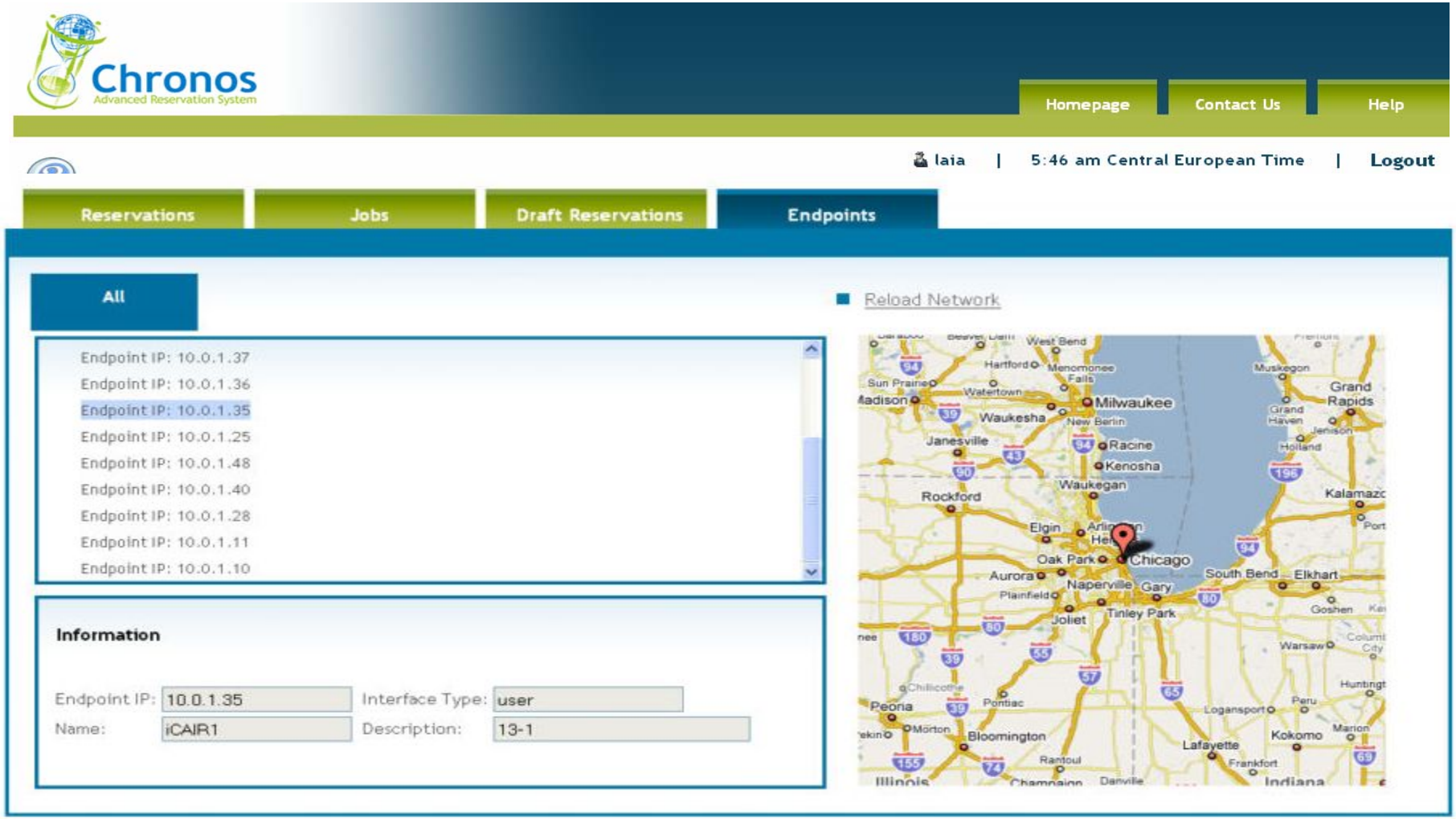
Endpoints View

- In this view you can see the list of the endpoints available.



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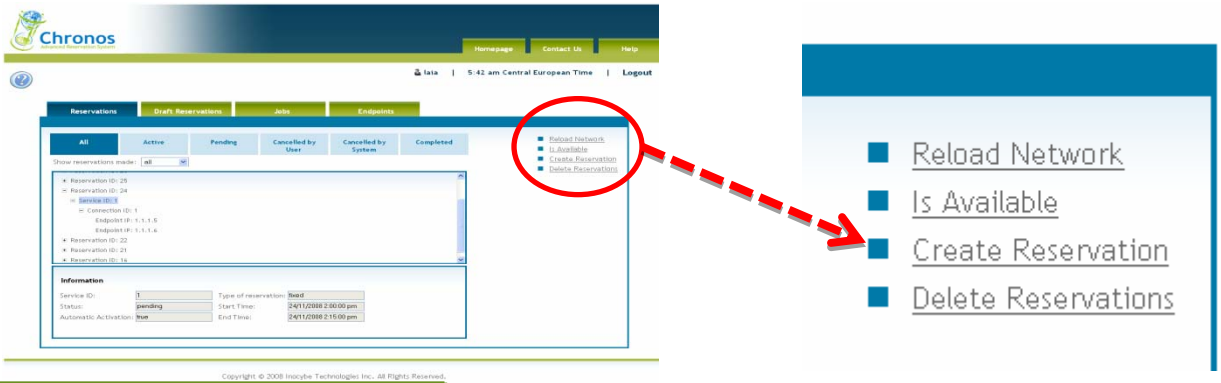
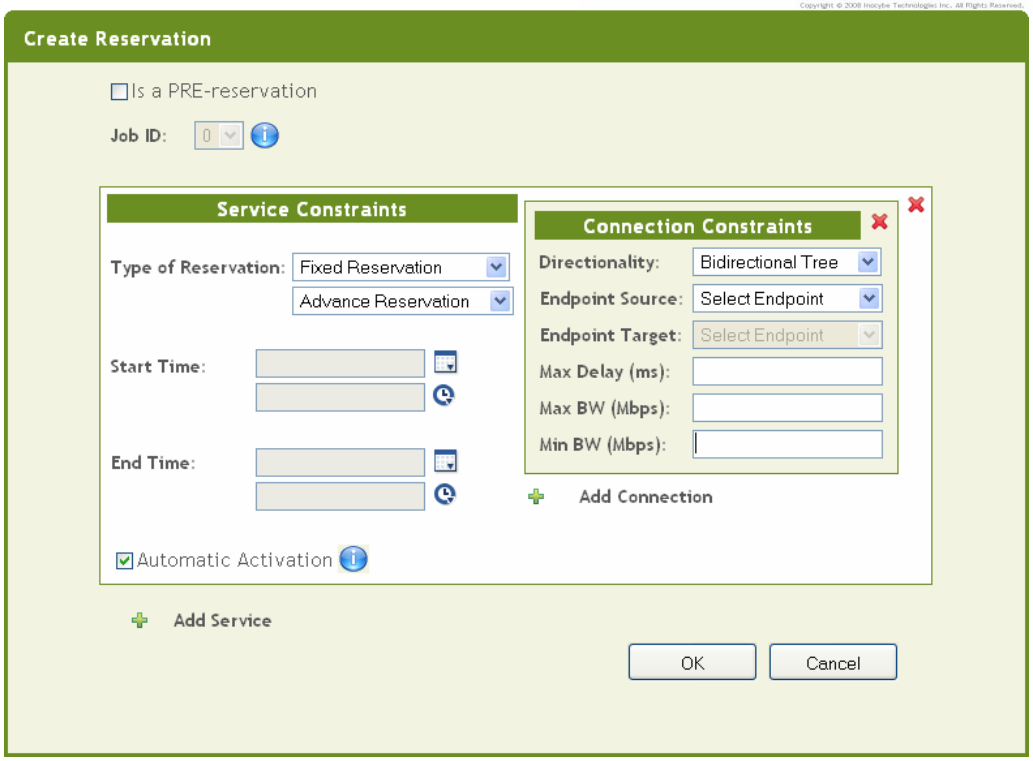
Creating a Reservation

- Click on ‘Create Reservation’





- This Form Is Opened
- All the Fields Must Be Filled-In
  - Source
  - Target
  - Bandwidth
  - Delay (not used currently)

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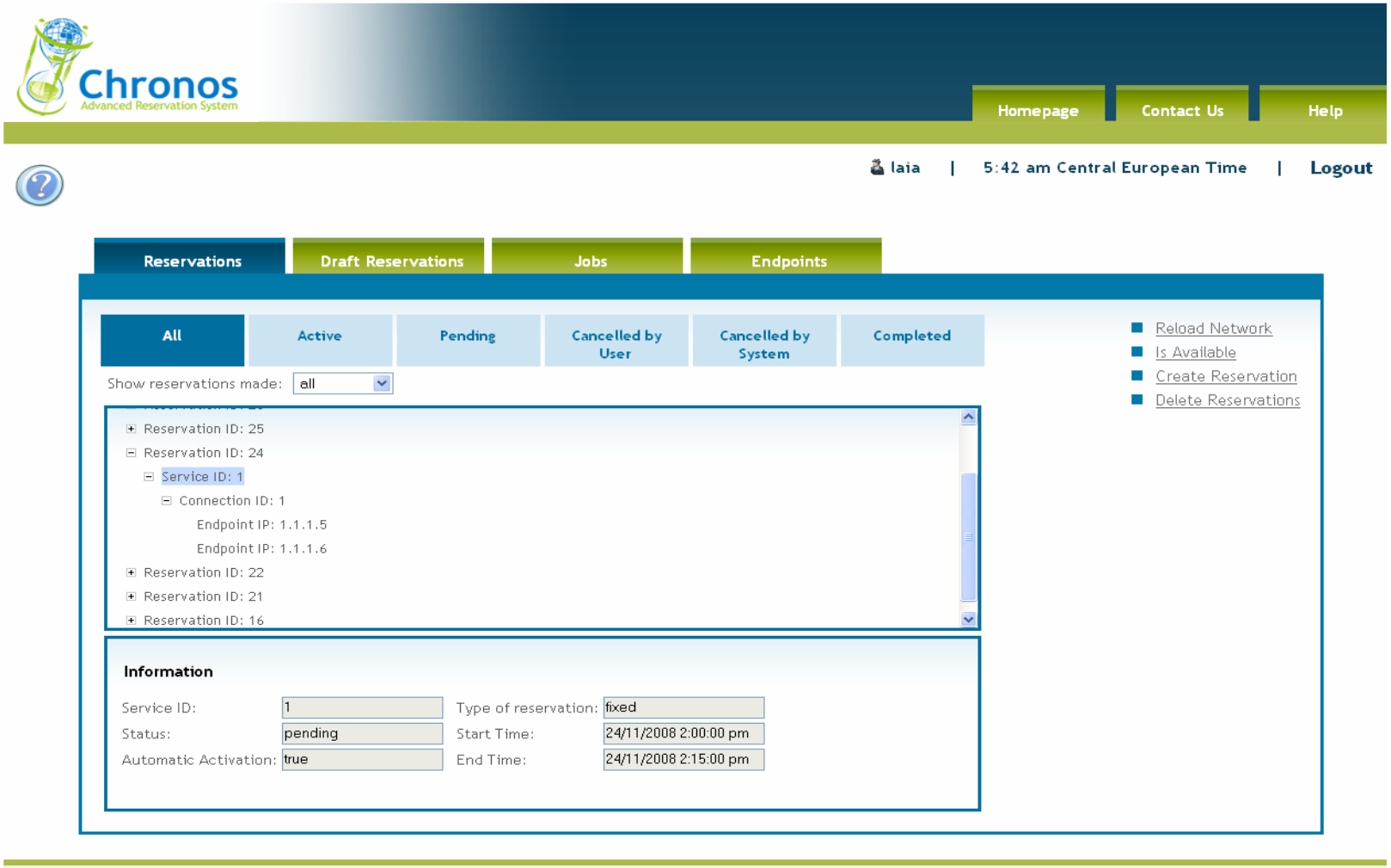
Reservations View

- In this view you can see the list of the reservations created.



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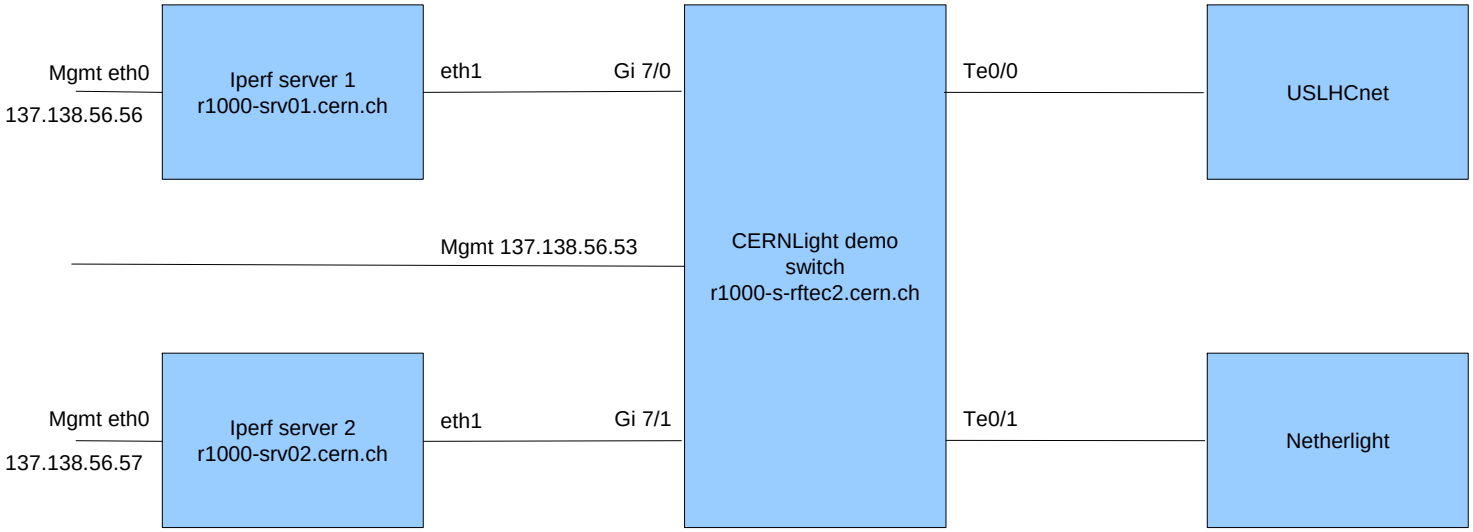
CERNLight



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AAAS Demonstrations Feb 2009

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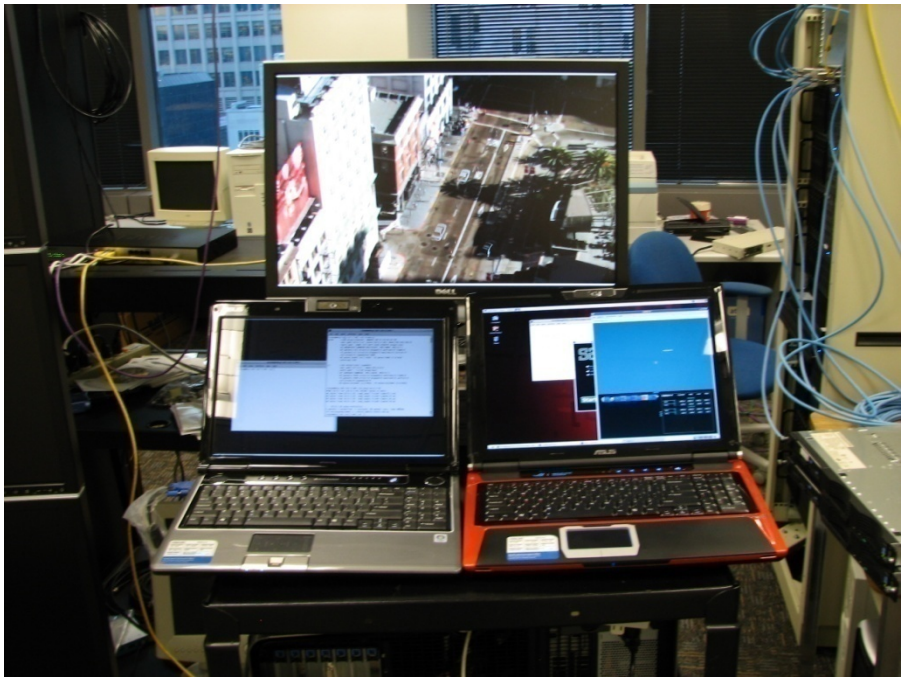
4K Digital Media Over HPDMnet

4K Digital Media Over HPDMnet “Almost" 7X24.



iCAIR Can Access HD/4K Content From 4K EVL or UvA Servers. BTW: SAGE Is Supported on a Laptop!

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iCAIR HPDMnet Demonstration at SC09 Portland Oregon

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VirtuLab Tile Display: Directly Connected To National 10 Gbps Testbed With Core at the StarLight Facility

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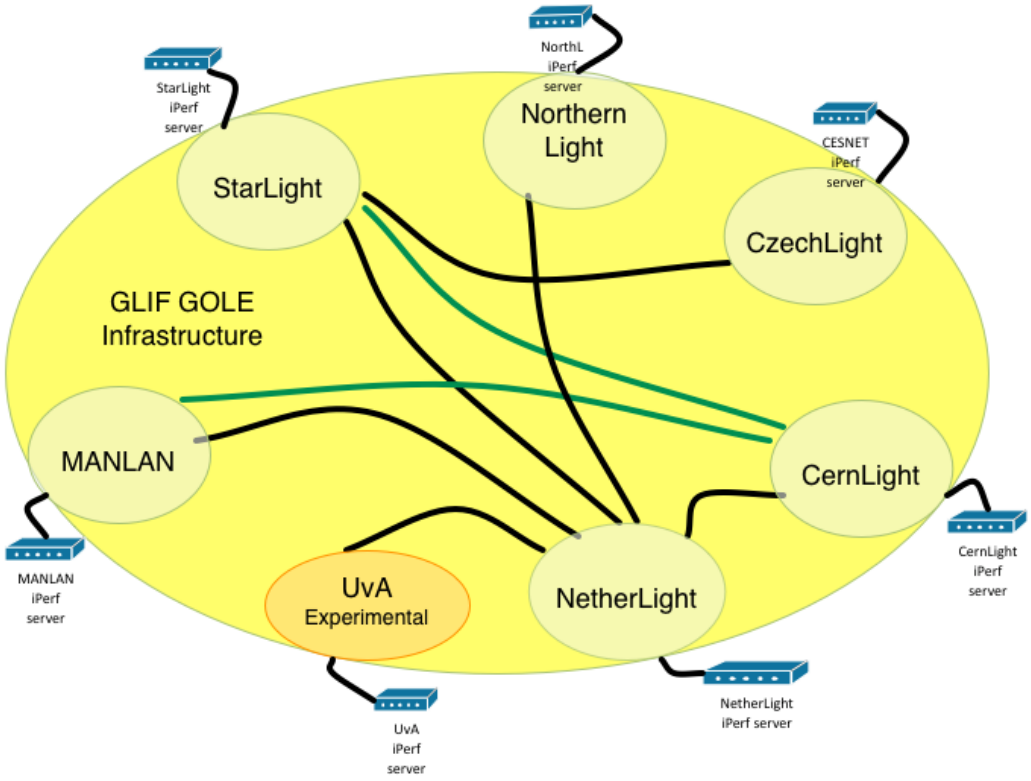
Demonstration: Integration of Fenius and Argia Global Lambda Grid Workshop CERN 2010



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Poznan 4k Initiative Demo at Global Lambda Grid Workshop CERN 2010

Bartosz Belter and Colleagues

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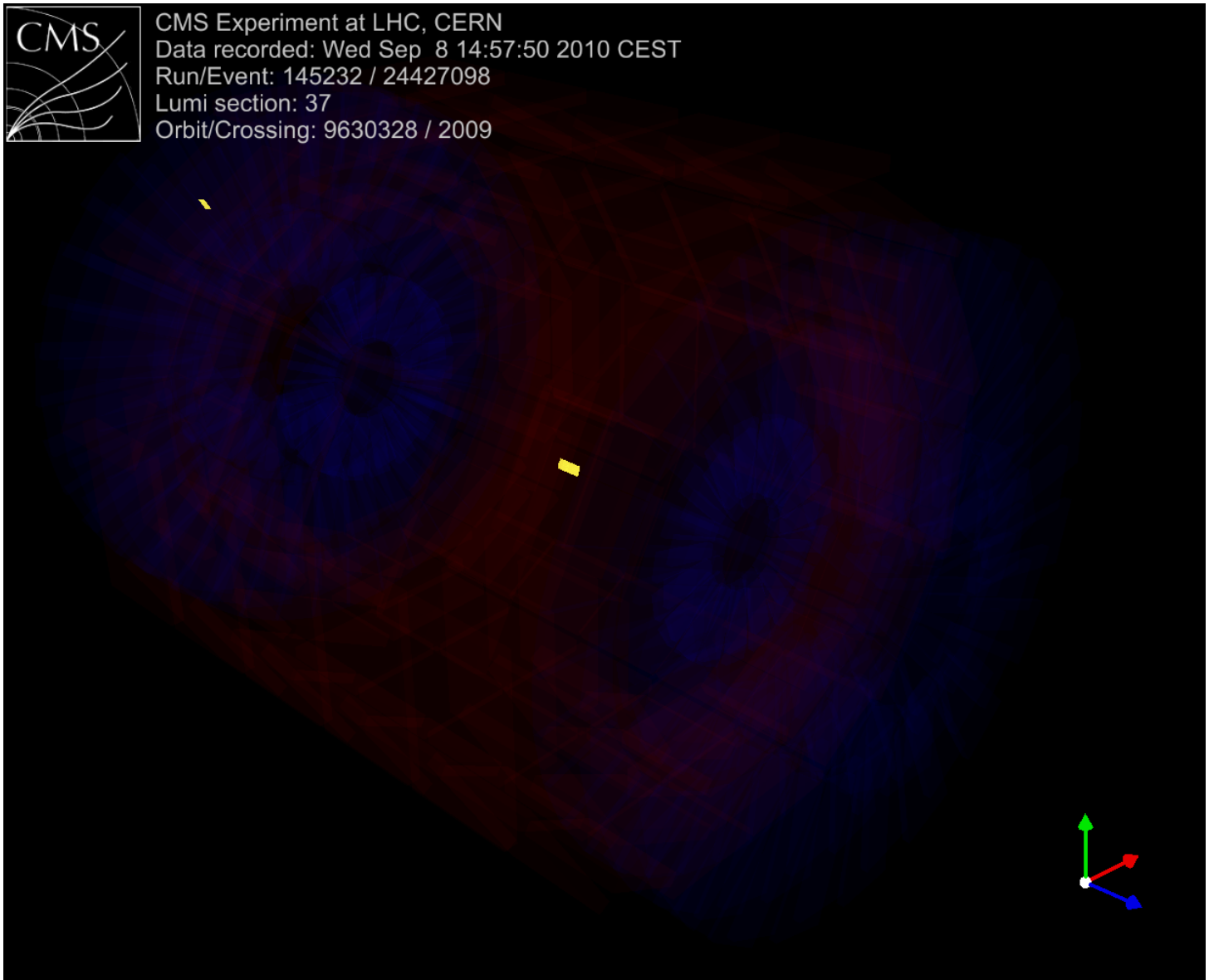
CERN Fireworks Demo at Global Lambda Grid Workshop CERN 2010



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Further Information

Ref: www.hpdmnet.org

Joe Mambretti, iCAIR Inc.
j-mambretti@northwestern.edu
Hervé Guy, CANARIE Inc. herve.guy@canarie.ca;