GLIF Automated GOLE Pilot Project and NSI

LHCONE Meeting

Jan 30/31, 2012

Lawrence Berkeley Labs, US

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Outline

- Purpose of this presentation is to present the GLIF Automated GOLE facility to the LHCONE community
- And to propose the facility for testing and evaluation of the LHCONE “open exchange” architecture

- Outline:
  - GLIF Automated GOLE Pilot Project:
    - What is it? how does it work?
    - 2012 Goals for GOLEs
  - Network Service Interface:
    - What is it? how does it work? Why should LHCONE care?
  - AutomatedGOLE as a proving ground for LHCONE

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The Automated GOLE Fabric

The GLIF Automated GOLE Pilot Project was initiated in 2010 to provide a global fabric of Open Lightpath Exchanges for the express purpose of maturing dynamic provisioning software, demonstrating the value of GOLEs to emerging network service models, and to develop a set of BCP for these services.

What is the AG "Fabric"?

- The Automated GOLE *fabric* includes many facilities:
  - Exchange Points (& "distributed" facilities)
  - Inter-exchange transport links
  - Networks
    - GOLEs link networks together …
  - Organizations that are willing to contribute people, facilities, hdw/sfw, etc.
  - Users/applications entities
  - …

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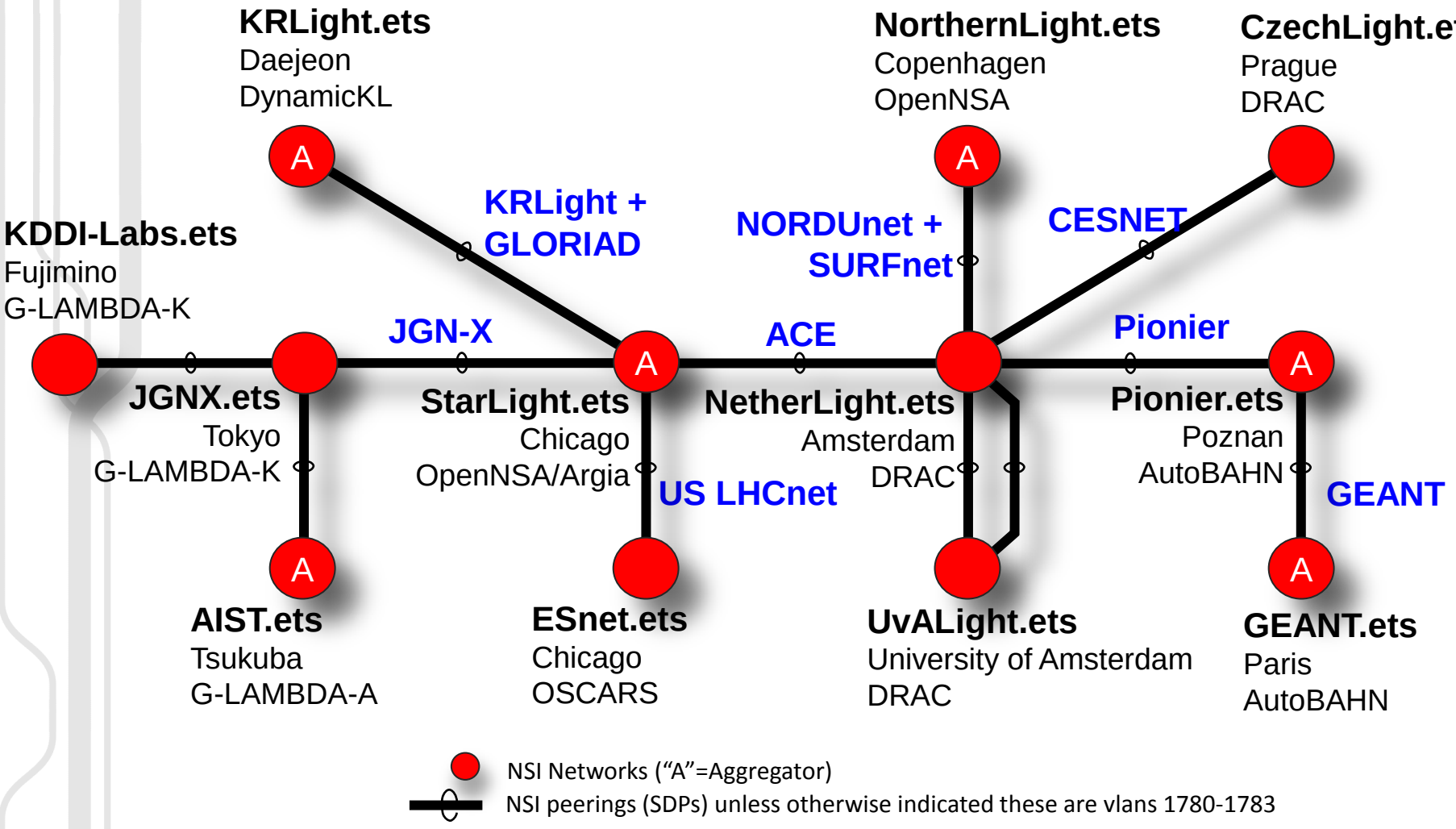
Current AutomatedGOLE + NSI

Demo NetworkSupercomputing 2011



Automation by NSI:

- Software Implementations
  - ***OpenNSA*** – NORDUnet (Copenhagen, DK)
  - ***OpenDRAC*** – SURFnet (Amsterdam, NL)
  - ***G-LAMBDA-A*** - AIST (Tsukuba, JP)
  - ***G-LAMBDA*-K** – KDDI Labs (Fujimino, JP)
  - ***AutoBAHN*** – GEANT (Poznan, PL)
  - ***DynamicKL*** – KISTI (Daejeon, KR)
  - ***OSCARS**** – ESnet (Berkeley, US)
- Hardware/NRMs covered:
  - Juniper / "JunOS" : L2 & MPLS provisioning - **OpenNSA**
  - Brocade: L2 switching - **AutoBAHN**, OpenNSA(CY12Q1)
  - Ciena (Nortel) SDH & L2 switching – **OpenDRAC**
  - Dell L2, NTT optical: **G-LAMBDA-A**
  - Force10: L2 switching – OpenNSA (CY12Q1)
  - Argia: L2 Switching - **OpenNSA**
  - Ciena NMS – DRAC (TBD)

2011 AutoGOLE Progress…

- 2011 Fall accomplishments:
  - **GLIF Summer W/S** (Sep, Rio de Janeiro)
    - The "Rio Plugfest" -First demonstration of NSI standards based software
  - Migrated GOLE fabric from FENIUS to NSI
    - AutoGOLE and NSI WG are working now very closely: consensus, dev., testing…
  - **Future Internet Assembly** (Oct, Poznan)
    - First NSI/hardware provisioning across subset of the GLIF AutoGOLE facilities
  - **Supercomputing 2011** (Nov, Seattle)
    - Full AutoGOLE +NSI/hardware + Visualization tools

AutoGOLE Objectives for 2012…

- Keep NSI/Automated GOLE operationally available – ready for testing, [some] demos,…
- More NSI feature development, deployment, test …
  - Hardware Backends: Force10, Brocade, OpenFLOW, transport layers
  - Several participating facilities are awaiting OSCARS+NSI completion…
  - Expanded [pre-production] deployment of AutoBAHN+NSI over/within the AutoGOLE environment
- Robustness – incorporate alternate paths:
  - X-EU: NDN->UvA, PIONIER (eta CY12Q1)
  - X-NA: StarLight->SEA (eta CY12Q1)
  - X-ATL: NDN->StarLight (eta CY12Q2)
  - P-Wave (eta ~Q3?),
  - X-PAC: DAE-TOK? LAX-DAE? HKG? SIN? SYD? BEJ?

AutoGOLE Objectives for 2012…

- Expand participation (pre-production service evaluation):
  - GLORIAD-US (SEA: eta CY12Q1)
  - WIX (WDC eta CY12Q2)
  - P-Wave/PNWG and RNP beginning testing now, in AG by ~H2 (?)
  - Would like to see:
    - ION, Esnet, USLHCnet, AMPATH,
- Build toward production BCPs:
  - NORDUnet plans a ***production*** NSI capability in CY2012…
  - SURFnet plans a ***production*** NSI capability in CY2012…
  - Anticipate others to do likewise as service models mature
  - Need to address *service* design and configuration
- Applications:
  - NEXPRES – EVLBI (testing from OSO to JIVE in CY12Q1)
  - CO-Universe – HD video
  - **LHCONE – HEP**
  - Others in works (under the radar) and still looking for others …

2012 Events

- AutoGOLE project uses major conferences to set targets/milestones for introducing new/additional features
  - Features/capabilities are incrementally rolled out and demonstrated at these events – certain features sets in Spring, others in Fall.
  - Spring features will include enhanced topology management, enhanced connectivity/reach,…
  - Fall demonstrations will feature early NSI v2.0 implementations…

- **Internet2 SMM** Washington D.C. Apr 2012
- **Future Internet Assembly** Aalborg,DK May 2012
- **TERENA** Reykjavik, IS May 2012

…Summer, then:

- **NORDUnet** Conference (at least *we* think this is a major conference) Oslo Sep 2012
- **GLIF 2012** Chicago,US Oct 2012
- **Supercomputing 2012** Salt Lake City, US Nov 2012

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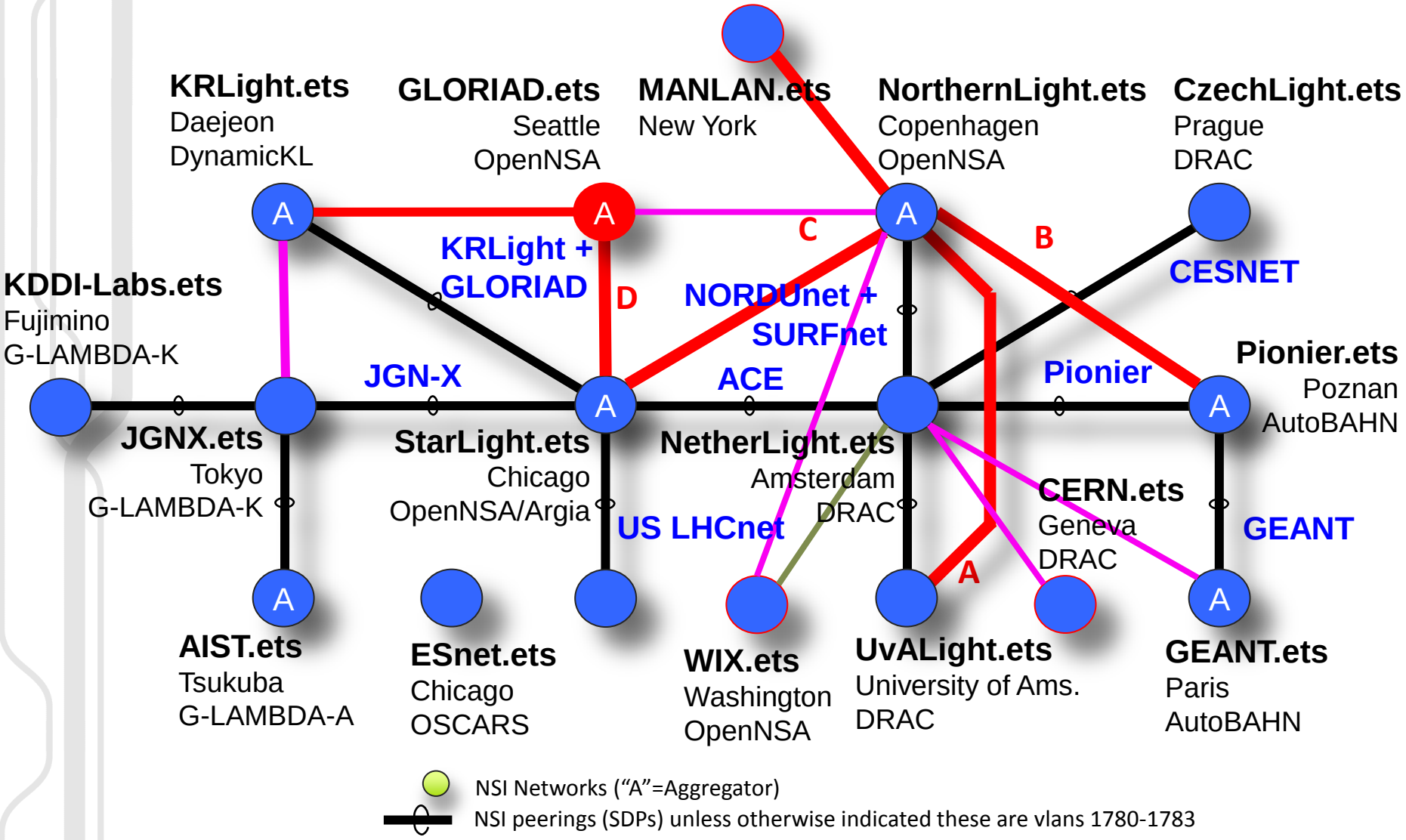
DESIRED AUTOMATED GOLE + NSI

DEMO NETWORK 2012-Q3/Q4



The Network Service Interface

- "Network Service Interface" is a framework for inter-domain provisioning of *connection-oriented* services.
- NSI is being standardized within the Open Grid Forum (OGF)
  - The NSI Framework document was issued in 2010-Dec.
  - The NSI Connection Service Protocol v1.0draft was issued 2011-Aug and is being finalized.
  - NSI-CS v2 eta 2012-H2
  - NSI Topology eta 2012-H2

NSI Framework

- The NSI Framework
  - *Technology agnostic (!!)*
  - The NSI architecture describes a generalized notion of a "Connection Service" …i.e. these are not VLANs, or SDH circuits, or LSPs, ports, or switches…
  - NSI does not expect or require specific intra-domain transport technologies
  - It is secure by design, giving each agent full authority over their local processes and policies
  - Allows the connection "Service" to be defined by those users and providers that will be using and supporting it.
- The "NSI Framework":
  - It specifies an abstract model of a network "Connection"
  - It specifies an abstract NSI "Topology" model over which Connections are established
  - It defines a "Network Service Agent" (NSA) that represents each network service region, and participant in the protocol
  - It specifies a high level protocol between NSAs to enable inter-domain service management.

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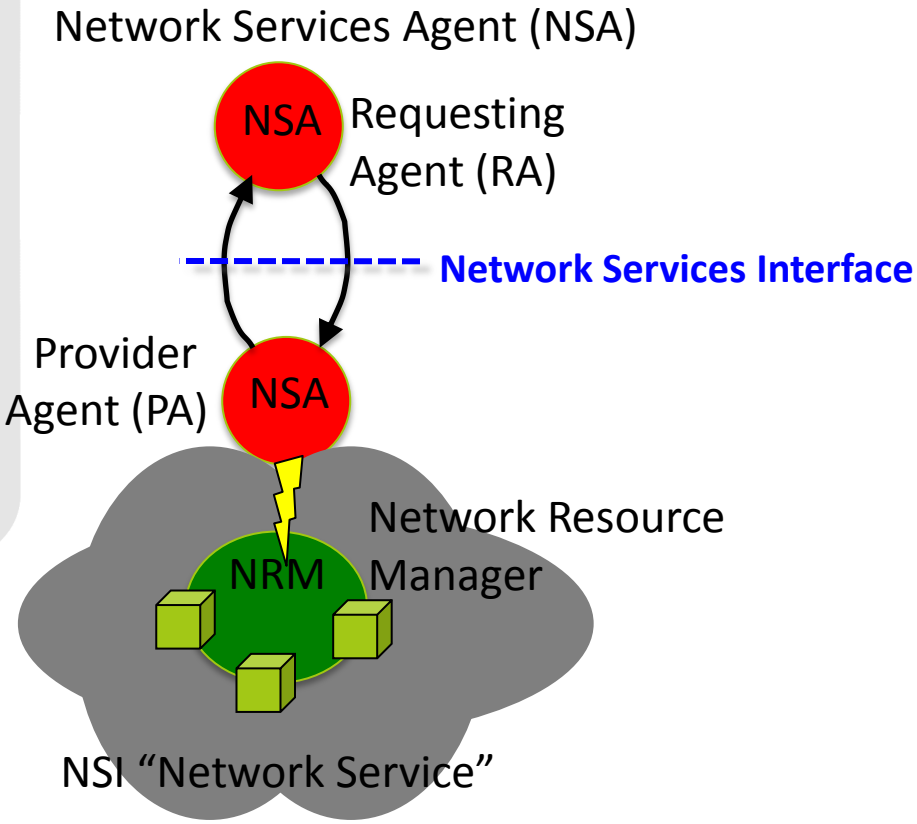
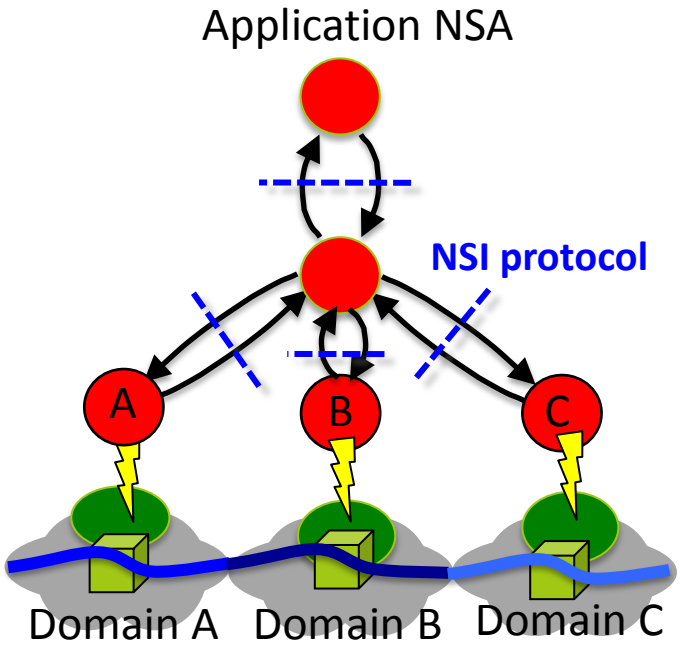
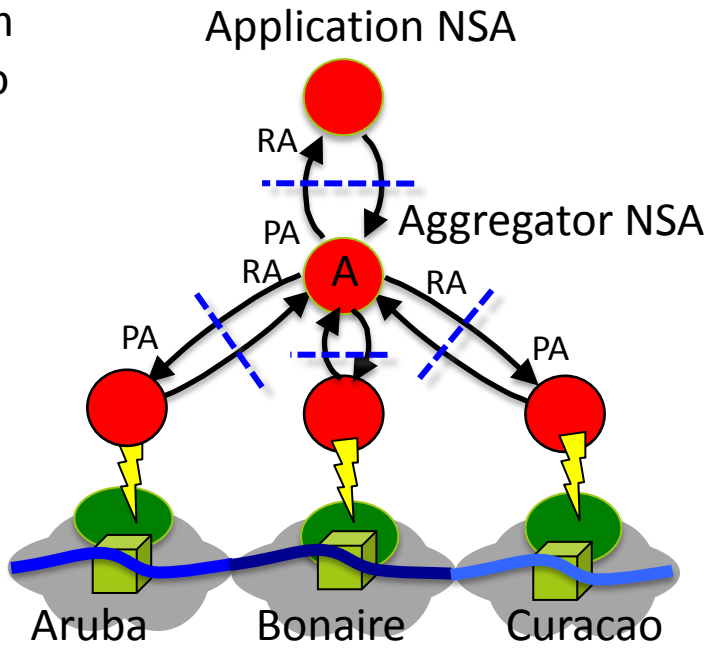
A Basic Overview:





The Network Service Agent

- A Network Service Agent is associated with every NSI Network domain:
  - It acts as **Provider Agent (PA)** when receiving service requests from other NSAs (peer networks or user clients)
  - It can act as a **Requesting Agent (RA)** to farm out portions of the resource management to other NSAs (networks)
  - It interacts with an internal Network Resource Manager (NRM) to reserve network resources within its own network domain (this interaction is NRM specific.)
- NSAs "aggregators" decompose a request into segments that can then be delegated to other domains

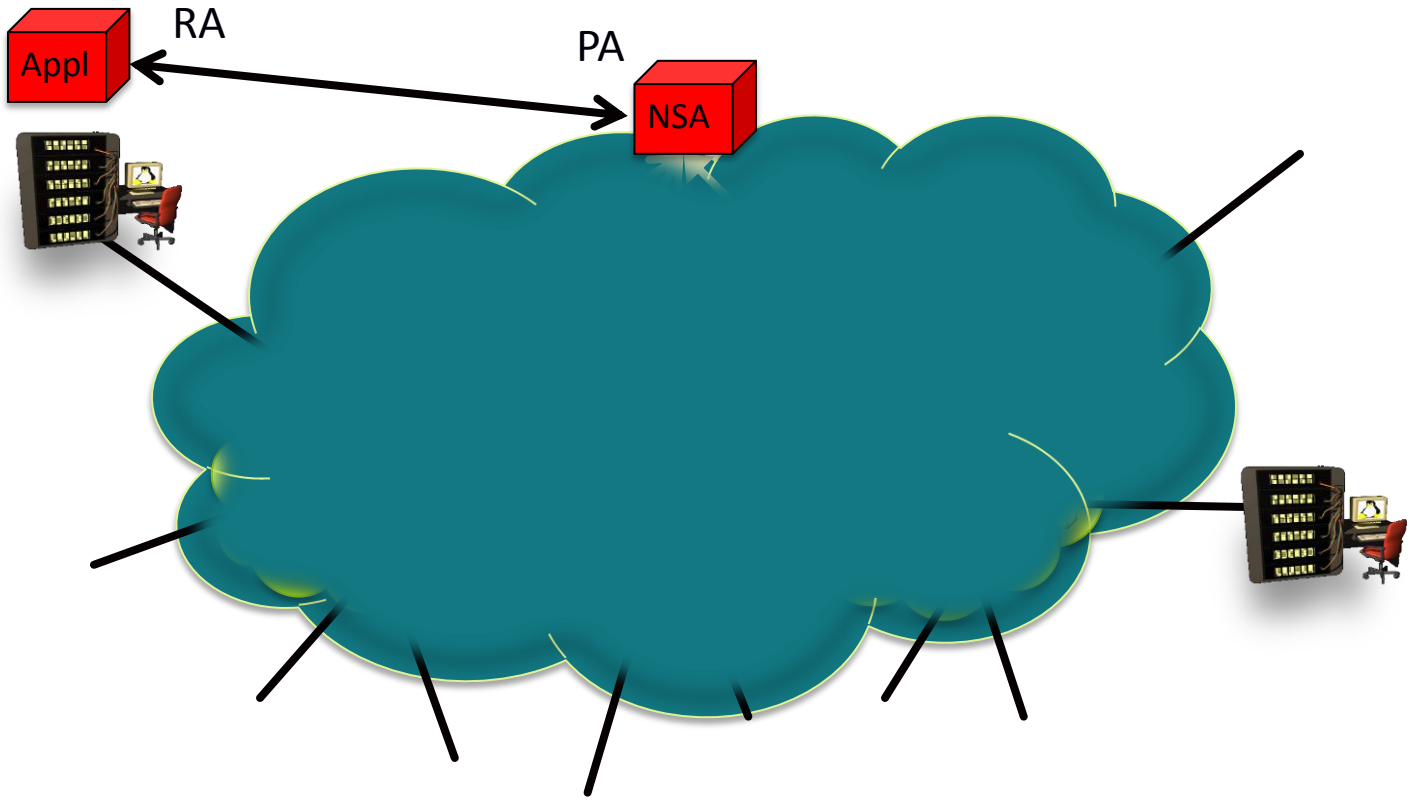


NSI Connection Service

- The NSI Connection Service (NSI-CS) is the first protocol defined under the NSI Framework
  - NSI-CS specifies a set of basic primitives and functional capabilities that create and manage a NSI Connection through its life cycle.
- NSI-CS Features:
  - Supports: **Reserve**, **Provision**, **Release**, **Terminate**, and **Query** primitives.
  - Supports conventional “chain” signaling but also incorporates novel “tree” signaling - providing greater flexibility and control to the Requesting Agent
  - Allows book-ahead scheduling of connections.
  - Allows service providers to define common service specifications to aid in end to end service interoperability

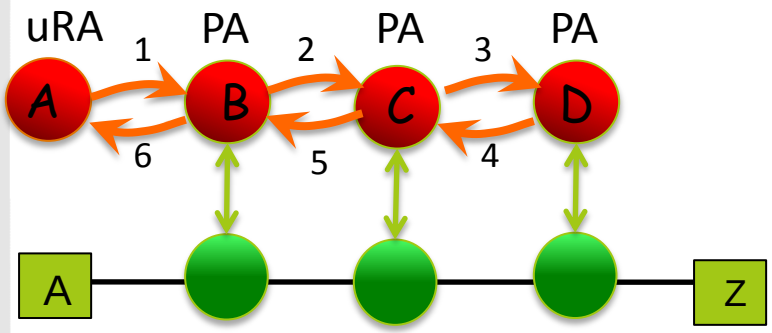
How NSI-CS Works…

The user application

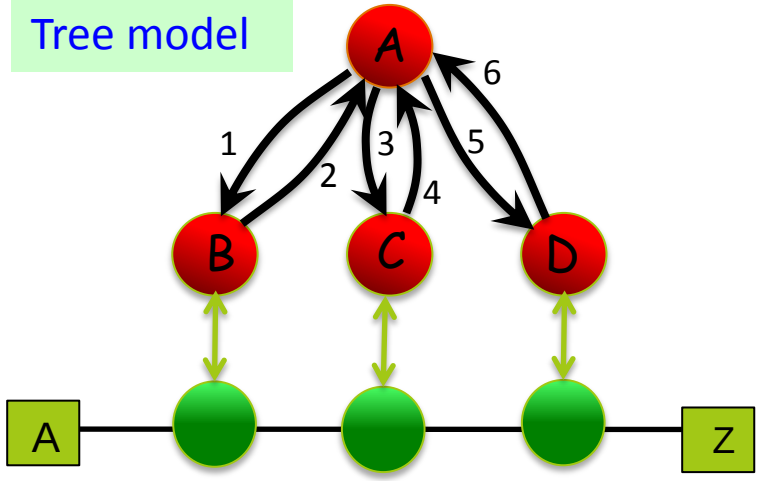


NSI Request Segmentation

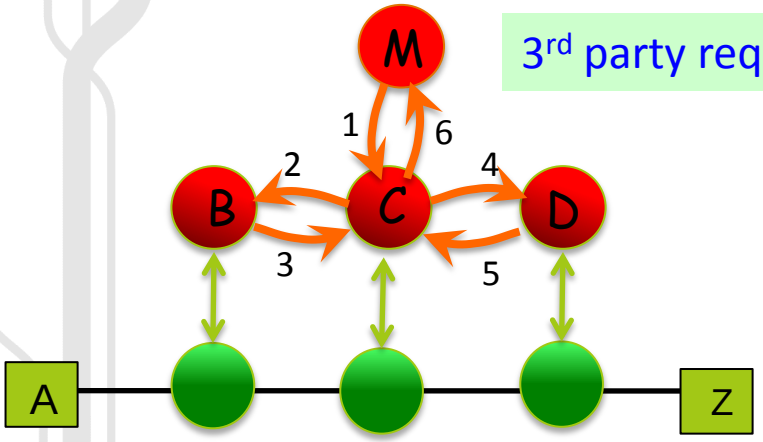
Chain model

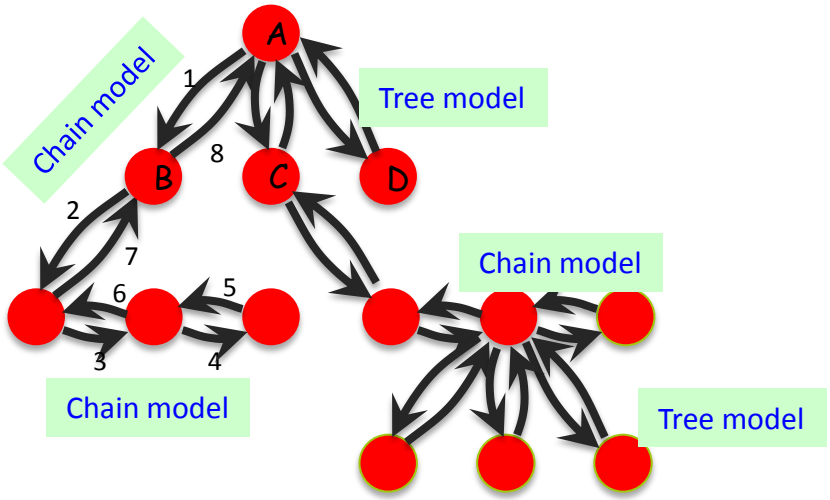


Tree model



3rd party request





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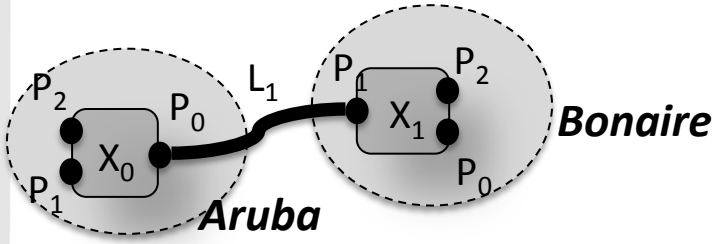
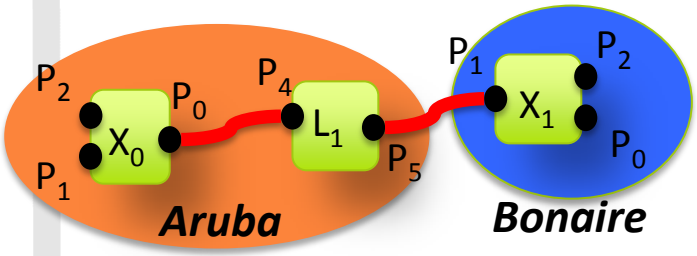
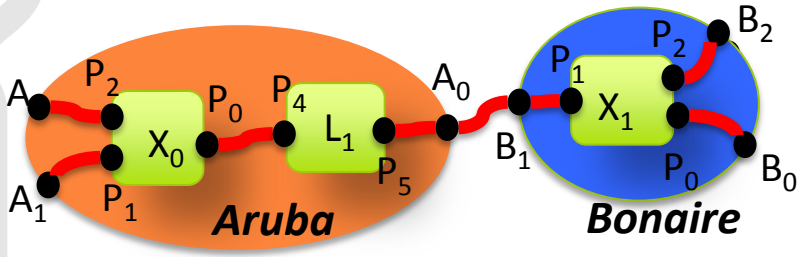
Abstract NSI Topology Model

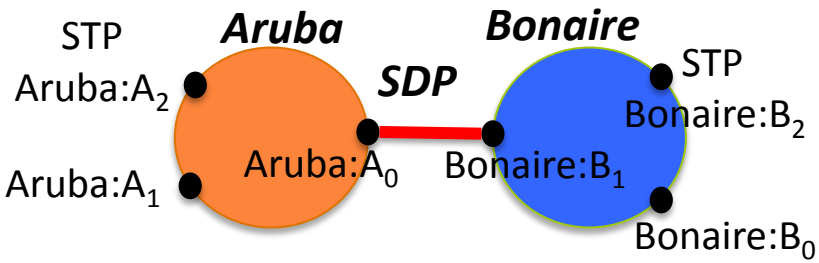


Conventional physical infrastructure – Networks, switches, ports, and links

The physical topology is translated to a derivative "resource graph" consisting of resources, and stitching relations







The NSI model assigns authoritative ownership of all physical components to one network or the other.

Technology agnostic inter-domain Service Termination Points ("STP"s) are defined and mapped logically to internal physical components. External relations are NSI Service Demarcation Points ("SDP"s).

By hiding all internal structure and only exposing inter-domain STPs and their peering SDP relations, we arrive at the basic NSI Topology Model of networks, STPs, and the SDPs that indicate inter-domain adjacency.

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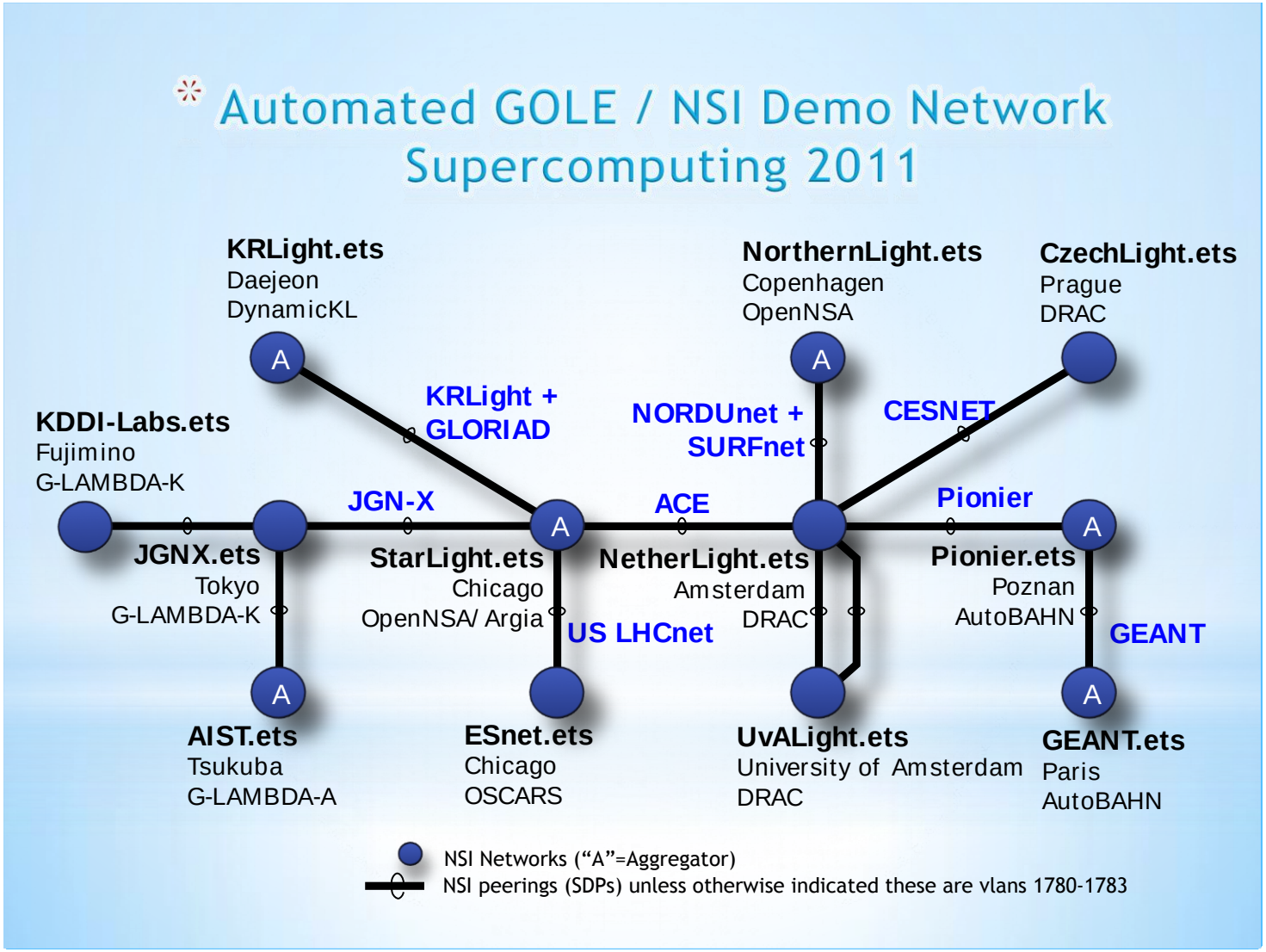
The NSI Demo at SC2011



The Playground

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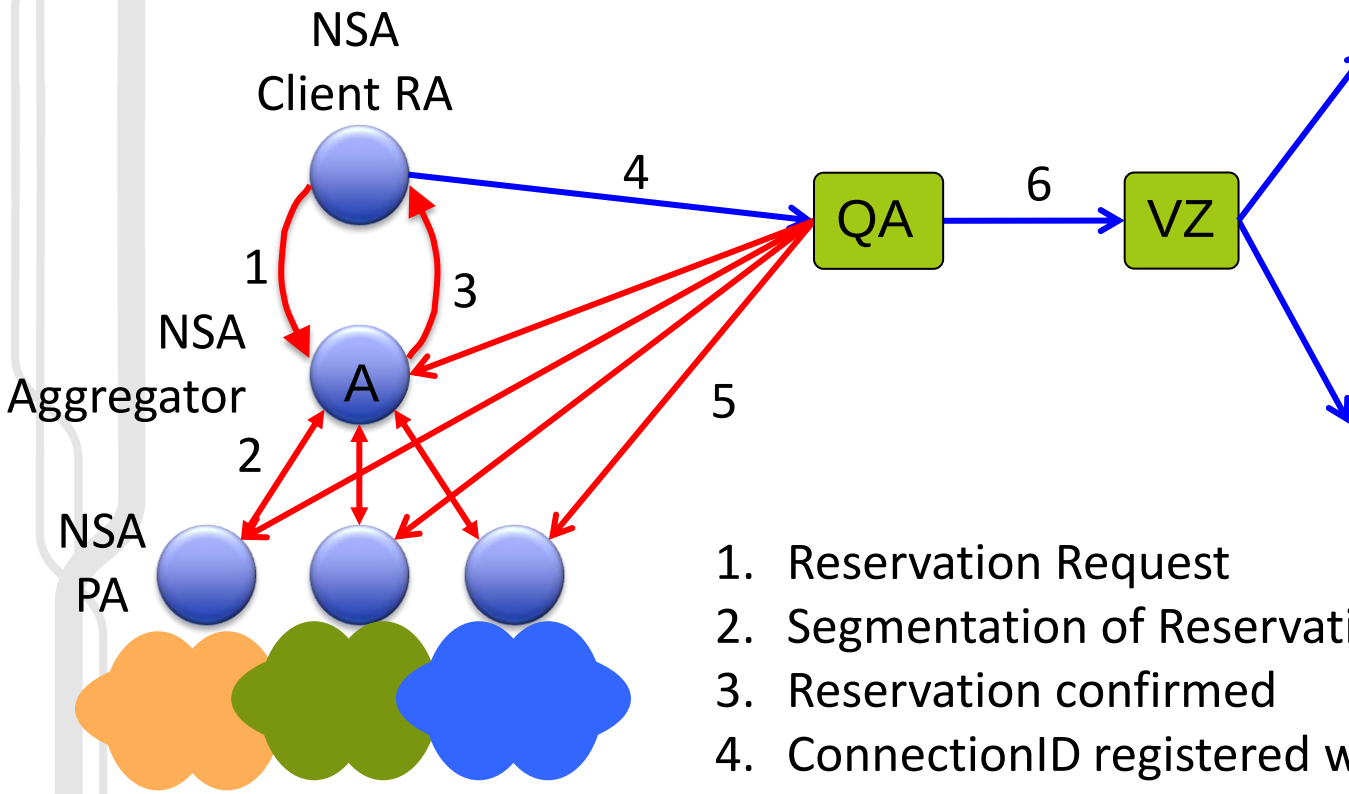
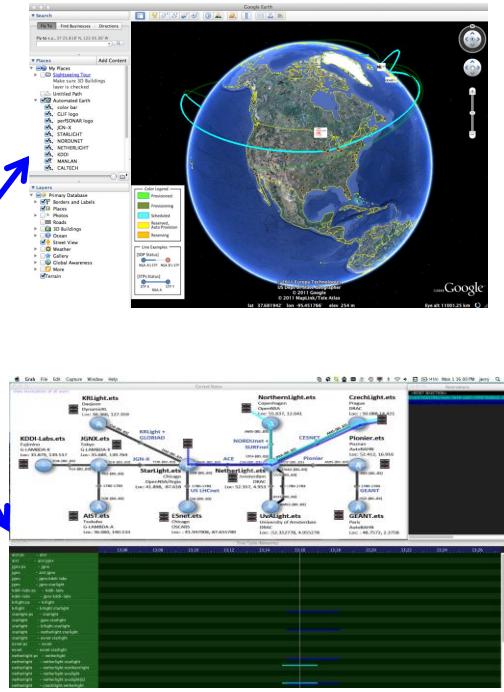
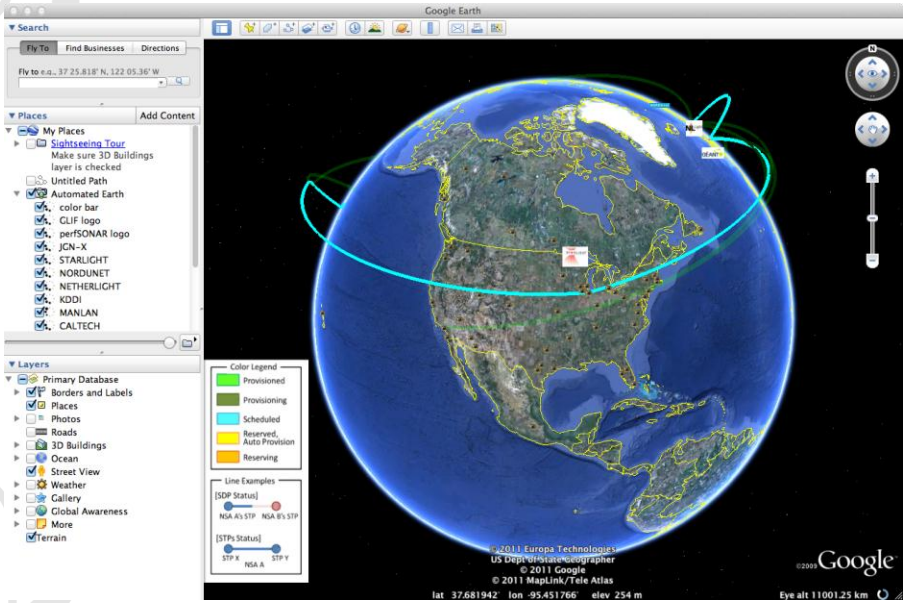
Initial Monitoring & Visualization



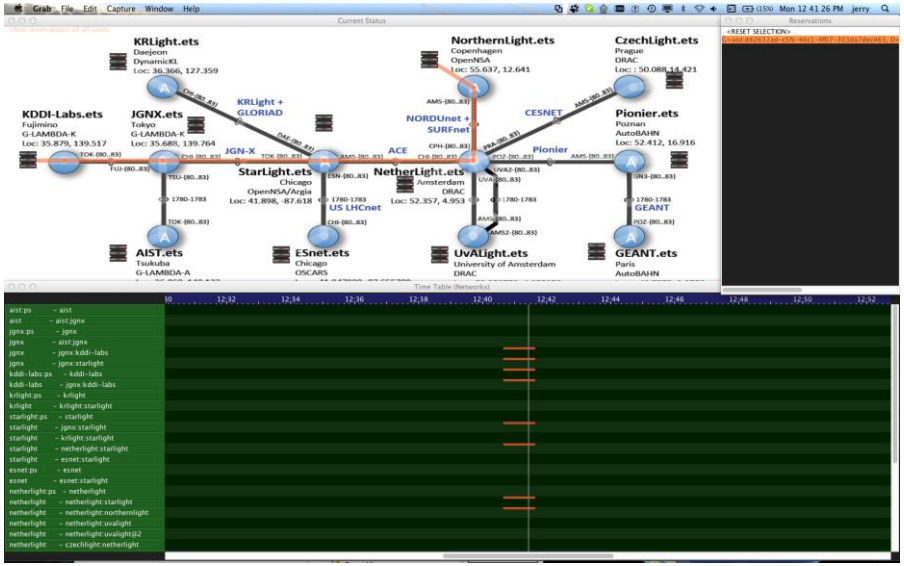


1. Reservation Request
2. Segmentation of Reservation to children
3. Reservation confirmed
4. ConnectionID registered with Query Agent
5. Query Agent walks tree to discover Path and Polls for state (10 sec interval)
6. Path and state info returned to vizualization app.
7. Viz app renders realtime image

Initial monitoring & visualization



"Automated Earth" viz
(Takatoshi Ikeda, KDDI-Labs)



"Status Monitor" viz
(Tomohiro Kudoh, AIST)

Pointers

- **Visualization**
- AIST Java status monitor: http://163.220.30.174:8070/monitor.jnlp
- KDDI Labs Google earth plugin: http://kote-ps-1.ps.jgn-x.jp/ps/autoearth-nsi/
- KDDI Labs Google earth kml: http://kote-ps-1.ps.jgn-x.jp/ps/autoearth-nsiAutoMAP.kml

NSI Development & Road Map

- **OGF NSI-CS version 1.0 is in final draft now**
- Demos:
  - Sep 2011: First NSI CS Interop Plugfest – GLIF 2011 Rio de Janeiro, BR
  - Oct 2011: First NSI Transport Provisioning Future Internet Assembly 2011 Poznan, PL
  - **Nov 2011: Global NSI + AutoGOLE Demonstration Supercomputing 2011 Seattle, US**
- NSI Version 2.0 objectives and feature set is being defined in 2012-Q1, for draft delivery in H2 timeframe…
  - NSI Topology – dynamic distributed topology exchange. Required to automated the local maintenance of local topology and to enable scalable global pathfinding.
  - NSI Performance Verification – An architecture for automated service verification and fault localization/remediation
  - Common Service Definitions – Enabling interoperable transport services

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Key Endorsements

NSI is gaining very broad suppor

I once made a connection thiis long using NSI CS v1.0

Rio plugfest participants

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OGF NSI Working Group

- The OGF NSI WG is an *Open* working group
- This means if *you* have ideas you would like to see incorporated into the NSI framework and/or protocols, please get active in the process:
    - Contact one of the active WG members and pick their brain
    - Join the mailing list, lurk and get up to speed, then join the calls…
    - Contribute – ask, comment, propose…help us sort thru the issues to achieve clarity within the group and consensus within the broader community

Thank You!