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AutomatedGOLE Pilot Project and the NSI Interoperability Plugfest

GLIF Summer 2011

Rio de Janeiro, BR

Sep 13, 2011

Jerry Sobieski

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Automated GOLE activities

- The AutoGOLE project has a three fold mission:
  - Provide a deployment testbed for advanced automated network technologies and services,
  - Provide a technically advanced global fabric for early adopter applications
  - Develop a set of best common practice for an eco-system integrated global automated lightpath services.
- There are currently three key thrusts in which the Automated GOLE project can contribute to the global emergence of connection oriented services:
  - Inter-domain provisioning and signalling protocols
  - Integrated, heterogeneous, and distributed topology management
  - Common service definitions and transport switching technology
- The project has demonstrate a basic ability to establish interdomain connections across the GOLE infrastructure using automated systems:
  - Fenius software:
    - GLIF Geneva (Oct 2010) and
    - GLIF Hong Kong (Feb 2011), and
    - NORDUnet Conf (Reykjavik, Jun 2011)
  - The FENIUS agents have set up 30,000+ connections since January 2011.
  - FENIUS was a successful proof of concept project, but has some fundamental limitations.
- The NSI framework has leveraged the experience of FENIUS (and other similar efforts) to define a more comprehensive and long term protocol.
  - The Automated GOLE project has been focused on deploying the NSI as soon as possible. But even NSI is missing pieces..

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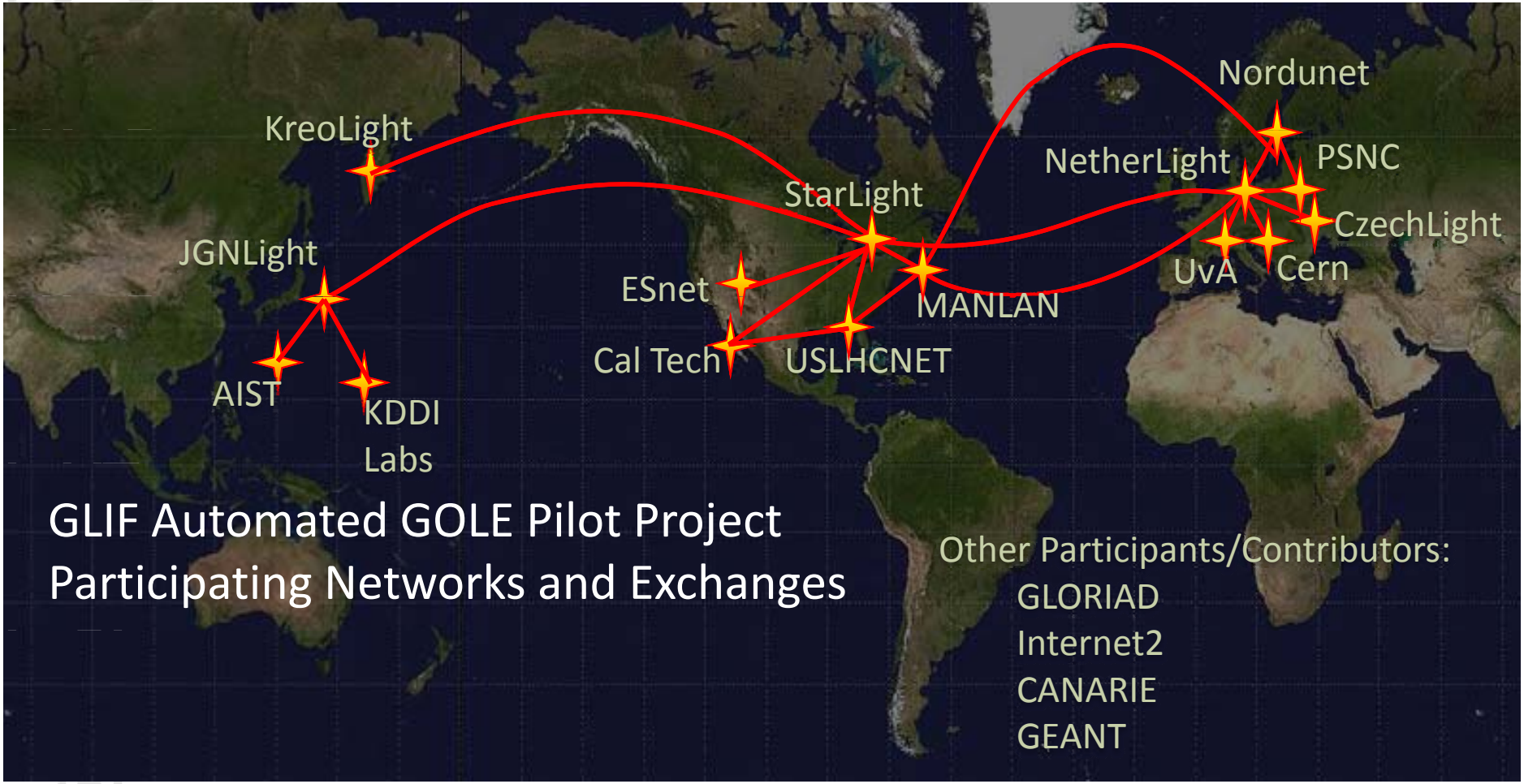
AutoGOLE Fabric (Sep 2011)



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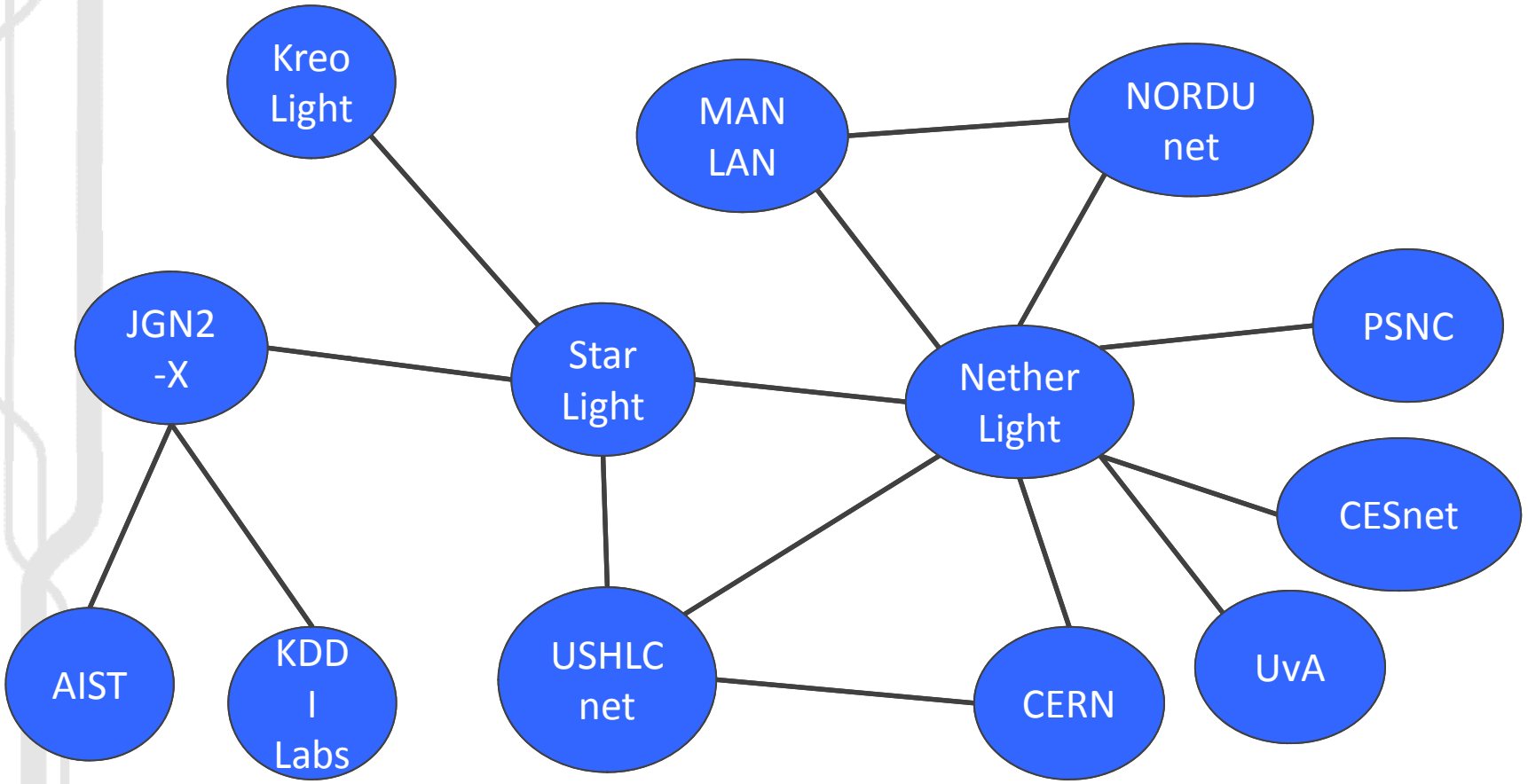
The Automated GOLE Fabric



New participants:

- KreoLight
- CESnet
- GLORIAD (providing transport for KreoLight from SEA->CHI)

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Update: NSI-CS deployment

- **NSI deployment**
  - Since Hong Kong, the AutoGOLE effort has been focused on deployment of NSI as the common provisioning protocol across the AG fabric.
  - NSI is now an OGF standard, and offers a much more comprehensive scalable distributed architecture for automated interdomain provisioning.
  - The NSI deployment has been delayed as we wait for NSI software to be available… Software is in development now and we expect early GOLE deployments 2011Q4.
  - The AG participants are looking now to SC2011 (Nov Seattle) to demonstrate NSI-CS across real GOLE physical infrastructure.

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Update: Topology

- **Topology construction**
  - A Topology map is a prerequisite for automated path finding - and automated Path Finding is fundamental requirement for any "automated" end-to-end connection service.
  - **A collaborative effort among the NSI WG, the DToX TF, and the Automated GOLE project**, has defined very simple NSI compliant inter-domain ontology for use within the NSI Interop demo here at Rio.
  - This "Rio" NSI Topology is described using OWL – an RDF/XML based grammar. The NSI ontology is sufficient to allow the NSI development and early deployment to proceed.
  - The AG participants have also been exploring the use of the "SNE" graphical editor (UvA) to capture topology in a visual fashion and auto-generate an RDF data file from that graphical representation. This has proven very useful for early small topo maps, but it needs to be enhanced to enable more sophisticated manipulation of the graphical objects.
  - This has been an important accomplishment. We now have a beachhead for expanding and refining a topology "strategy" the AutomaedGOLE fabric.

Current Focus

- **Service state presentation/display tool.**
  - We are looking to develop a more scalable and targetted service status presentation tool.
    - The Automated Pinger (Canarie) display, developed as a quick interim demo display has scaling challenges (!)
  - We are exploring the “Automated Earth” (KDDI-Labs) display, to project the path and status of selected circuits on a Google Earth map in real time.
  - We are hoping to adapt the new tool to leverage the NSI framework and protocol – using NSI processes to discover technical characteristics of each connection, and doing so under authorized and secure access control.

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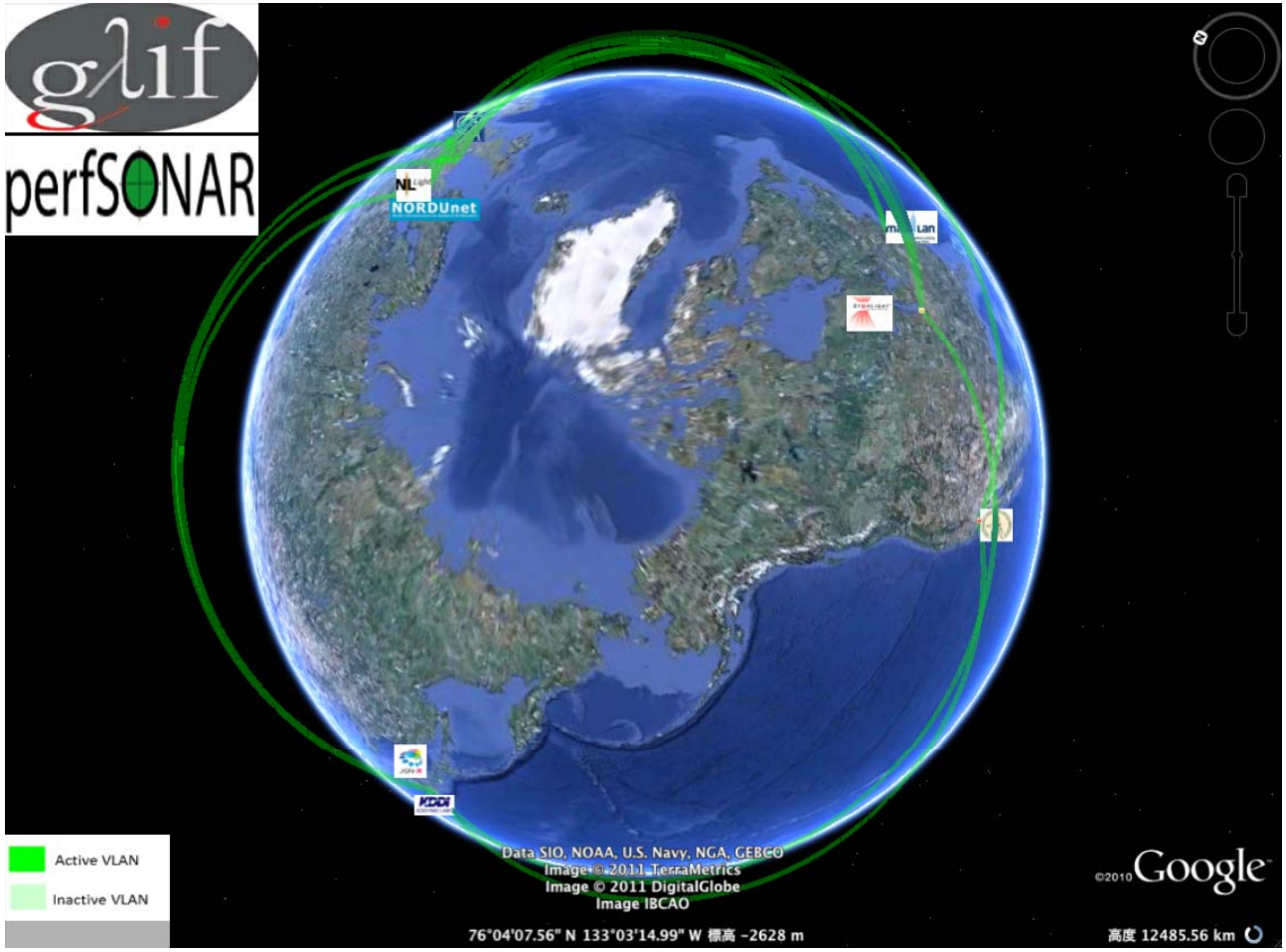
The Automated Earth

A display tool for visual presentation of NSI service instances.



Thanks to Takatoshi Ikeda (KDDI Labs)

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Hdw Switching Technologies

- The Automated GOLE is also exploring hardware requirements for dynamic circuit services
  - The *Automated* GOLE fabric currently only provides automated *Ethernet* transport services…
    - This is not an inherent limitation in the provisioning software, or the GOLEs, but reflects more the state of the art in service presentation.
    - Service definitions for other transport capabilities and integrated heterogeneous transport pathfinding and provisioning are required
  - Ethernet has many issues that limit its scalability as a dynamically provisioned switching/transport technology:
    - Flat global and limited VLAN space
    - MAC address flooding
    - Limited integrated OAM capabilities
  - We are looking at extensions and/or standards that remove these constraints:
    - Vendor support for “VLAN swapping” and “per port VLANs”
    - 802.1ah/ag (Provider Backbone Bridges)
    - MPLS*
    - …others?

Summary

- NSI deployment and evaluation
- AutoGOLE Topology strategy
  - NSI compliant (inter-domain)
  - Intra-domain strategy
  - Capture & Distribution of AG maps
- Switching technology strategy
- Service Definitions
- Edge tools and Service monitoring explorations
  - Display tools (autoEarth)
  - Orchestration tools (distributed endpoint functions)
- **Demo at Supercomputing 2011 (Nov, Seattle)**

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NSI Interoperability Plugfest

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What is the NSI Plugfest?

- NSI := The OGF “Network Service Interface” specification
  - A framework for a scalable inter-domain service architecture, not just a signaling protocol.
  - And the Connection Service (NSI-CS) protocol doc, a technology agnostic protocol for provisioning connections across

- **The NSI Plugfest is a demonstration of progress towards deployable software incorporating the NSI CS protocol and framework.**

- The objective is to demonstrate the interoperable CS protocol developed independently by multiple organizations
  - Interoperability
  - Identify flaws and/or inconsistencies
  - Identify missing pieces necessary for full fledged services

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Who is participating?

- We have 7 NSI-CS v1.0 implementations:
  - OpenNSA (NORUnet)
  - AutoBAHN (GEANT)
  - DRAC (SURFnet)
  - G-LAMBDA (AIST)
  - G-LAMBDA (KDDI Labs)
  - OSCARS (ESnet)
  - DynamicKL (KISTI)

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How is the Plugfest organized?

- We have defined 4 “Challenges” for each NSI implementation to complete:
  - #1: Self consistent messaging and lifecycle
    - Make sure your NSA can talk to itself and successfully sequence a connection though the life cycle.
  - #2: Cross-NSA messaging and lifecycle
    - Show that your NSA dn other NSAs interpret messaging in the same way through the lifecycle.
  - #3: Multi-domain segmentation
    - Demonstrate the ability to successful segment and reserve a multiple domain service request, again managing connection through the entire lifecycle.
  - #4: Query information access
    - Exercise the authorized access to the NSI service tree information associated with a multi-domain connection.

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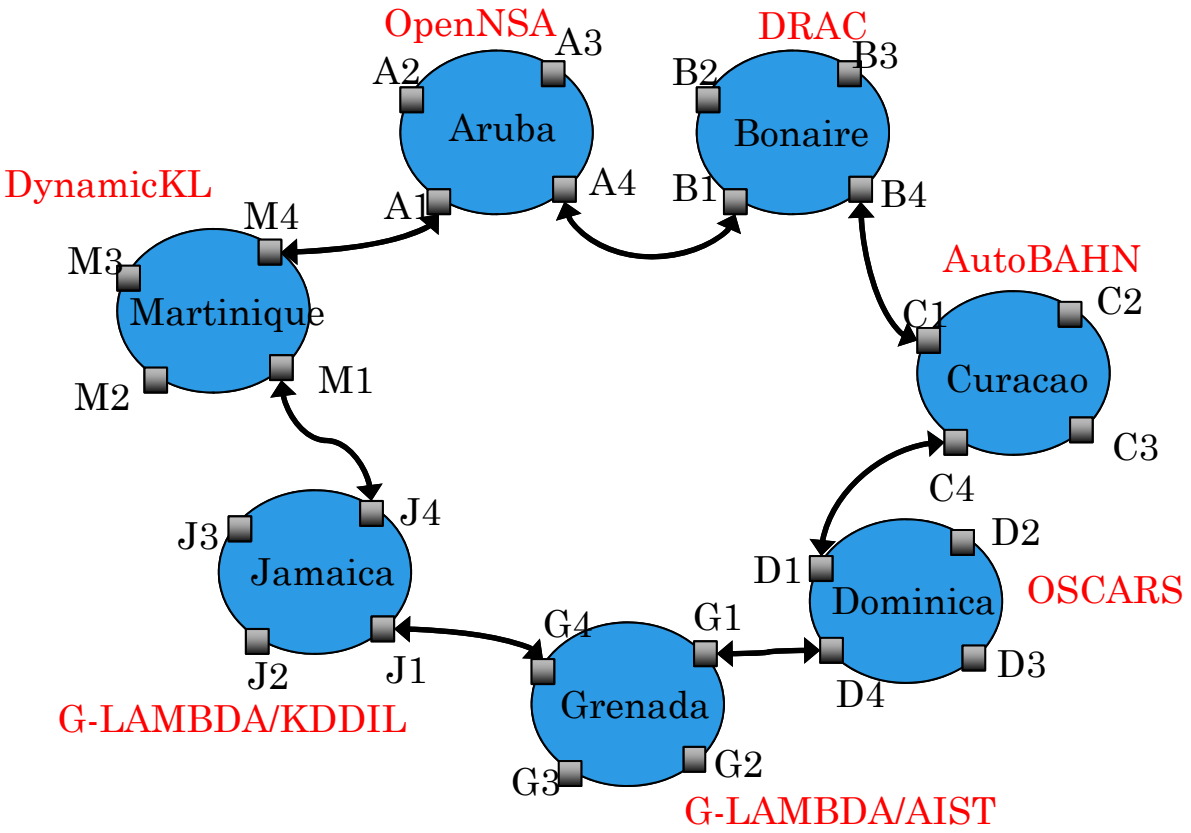
Plugfest Topology

- For the initial NSI protocol testing that is Rio Plugfest, we elected to use an artificial topology:



- This is the “Rio” ring topology.
- Each NSA is allowed to define their internal topology as they see fit as long as it is consistent with this inter-domain view.

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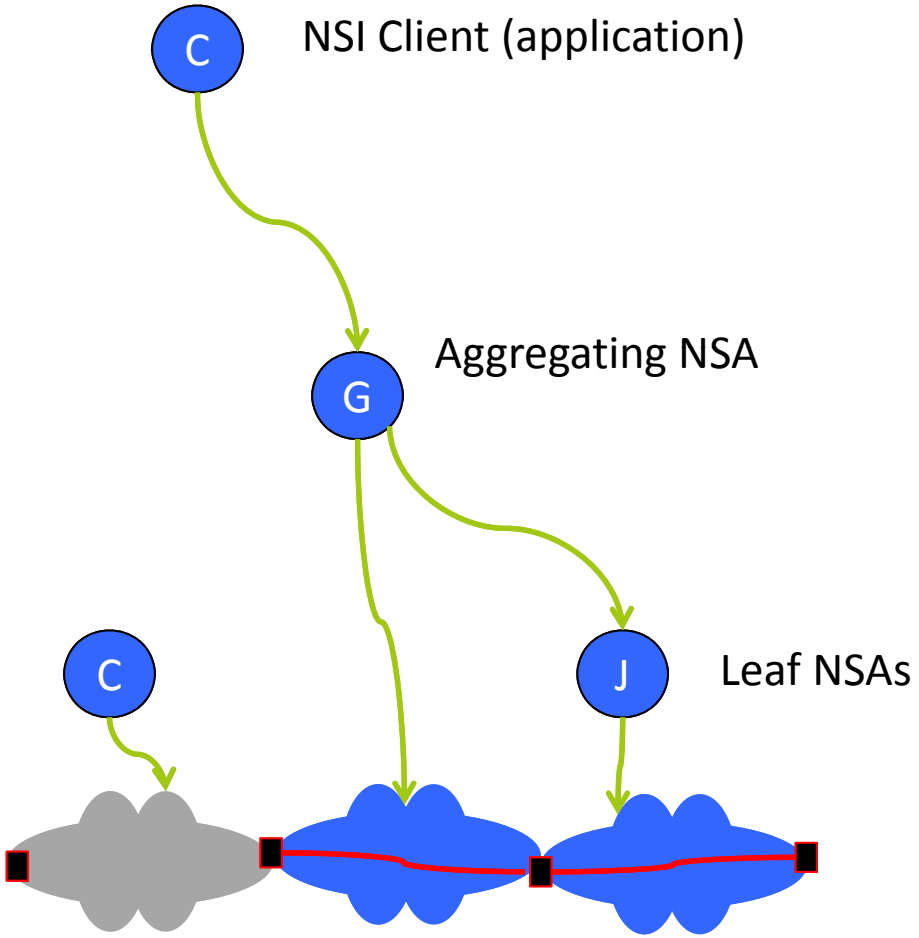
The Challenge #3



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Plugfest Topology

- With the collaborative efforts of the NSI WG, the GLIF DToX TF, and the Automated GOLE project, we were able to take existing technology and adapt it to fit NSI Topology model for the Plugfest.
  - We are using the RDF based OWL data description language to capture the topology elements and their relationships.
  - And we have used the SNE graphical topology editor to input most of the topo information.
  - Thanks to the ***UvA team*** for the SNE + OWL/RDF and the ***DToX folks*** for their flexibility when it came to modifying their topology to meet the NSI needs.
- For Rio, we manually construct a global topology view and make it available to each NSA for testing.
- The Plugfest topology approach is a hack done for a demo. It lacks a number of important features before we can view it as a long term answer.
  - Topology will be the next key topic for the NSI Working Group

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Plugfest Status

- The NSI implementations are assumed to have completed Challenge #1 – the ability to converse with themselves to manage a connection.
- Nearly all have completed Challenge #2 – meaning they have worked out the low level message transport issues and basic content issues that were not clear from the spec or that exposed bugs in software or libraries.
- We have successfully demonstrated a Challenge #3 reservation request:
  - Aruba -> Granada -> Dominica
  - (OpenNSA) (GLAMBDA-AIST) (OSCARS)
  - Caveat: The whole life cycle needs testing.
- We have partial results on Challenge #4 – simple queries are working in several NSAs.

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Challenge #1 & #2 Matrix

Summary

CP: complete
OK: not complete but almost
NG: not working
N/A: cannot connect

From \ To	OpenNSA	DRAC	AutoBAHN	OSCARS	GL/ AIST	GL/ KDDI-L	DynamicKL
Aruba-OpenNSA	CP	N/A	OK	OK	OK	OK	NG
Bonaire-DRAC	Authentication	OK		OK	OK		
Curacao-AutoBAHN	OK	N/A	CP	NT	CP	CP	NG (first provision is ignored, next one fails)
Dominica-OSCARS	OK	OK	NT	OK	CP	NT	NT
Grenada-GL/AIST	OK	OK	CP	CP	CP	CP	CP
Jamaica-GL/KDDI-L				NT	CP	CP	
Martinique-Dynamic KL	OK	N/A	OK	NT	CP		CP

- https://docs.google.com/document/d/1McNO8NP2bXGjgJTk4hsPDARLNehXEP_I4eNJZE93tM/edit?hl=en

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Results: A snippet of NSI CS

G-LAMBDA AIST Log: **http://163.220.30.174:8090/logs/nsi_gl_proxy.log**

2011-09-12 22:34:32.429 +0900 INFO finish auto commit of Coallocator-0912133102-COMMAND-32-for-Coallocator-0912133102-RESERVE-32
2011-09-12 22:34:32.468 +0900 INFO end provisionBeforeStart for connId=urn:uuid:ed811582-dd43-11e0-83ff-00144f20a8d2
2011-09-12 22:34:32.468 +0900 INFO Change State: RESERVED -> AUTO_PROVISION, connId=urn:uuid:ed811582-dd43-11e0-83ff-00144f20a8d2
2011-09-12 22:36:54.714 +0900 WARN nsi.checkSessionSecurityis true, but missing SessionSecurityAttr in the received request. Allow it just for demo!
2011-09-12 22:36:54.715 +0900 INFO Change State: INITIAL -> RESERVING, connId=urn:uuid:43914672-dd44-11e0-a711-00144f20a8d2
2011-09-12 22:36:54.715 +0900 INFO start reservation for connId=urn:uuid:43914672-dd44-11e0-a711-00144f20a8d2
2011-09-12 22:36:54.716 +0900 INFO
[ReservationRequestType received]
CorrelationId urn:uuid:43914b9a-dd44-11e0-a711-00144f20a8d2
replyTo http://orval.grid.aau.dk:7080/NSI/services/ConnectionService
RequesterNSA urn:ogf:network:nsa:Aruba-OpenNSA
ProviderNSA urn:ogf:network:nsa:Grenada-GLAMBDA-AIST
sessionSecurityAttr null
GlobalReservationId urn:uuid:43913f92-dd44-11e0-a711-00144f20a8d2
description Test Connection
ConnectionId urn:uuid:43914672-dd44-11e0-a711-00144f20a8d2
ServiceParams
Schedule
start Mon Sep 12 13:40:43 GMT+00:00 2011
end Mon Sep 12 13:45:43 GMT+00:00 2011
duration null
Bandwidth
Desired 1000
Minimum null
Maximum null
Path
direction BIDIRECTIONAL
srcSTP
stpId urn:ogf:network:stp:Grenada:G1
stpSpecAttrs null
stpList null
destSTP
stpId urn:ogf:network:stp:Grenada:G3
stpSpecAttrs null
2011-09-12 22:36:54.716 +0900 INFO start Glambda create for connId=urn:uuid:43914672-dd44-11e0-a711-00144f20a8d2
2011-09-12 22:36:54.739 +0900 INFO start Glambda reserve for connId=urn:uuid:43914672-dd44-11e0-a711-00144f20a8d2
2011-09-12 22:36:54.763 +0900 INFO start Glambda waitCommandStatus(PREPARED) for connId=urn:uuid:43914672-dd44-11e0-a711-00144f20a8d2

Reservation request

NSAs

End points of the connection

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Issues and Lessons Learned

- Topology is critical, and
  - A more thoroughly comprehensive and *standardized* NSI Topology model is required.
  - A distributed topology management scheme is necessary
  - Better integration with local topology is necessary.
- Several hacks appeared in the WSDL as result of adhoc optimizations/mods not part of the standard:
  - Separate contact information for PA functions of the NSA and the RA functions of the NSA. This continues to cause considerable confusion.
  - Use of SOAP and replyTo to route NSI message sequencing…
- Several message elements need review – the spec was clear, but the implementation revealed functional layer violations
  - Header fields requesterNSA/providerNSA
  - Some surprises in message serialization (race conditions)
- Many important features were disabled in order to show message exchange and basic processing
  - Ex: Secure messaging, resource allocation, hardware interfaces, information elements within messages, etc.
- Service definitions need to be carefully designed and engineered in the field to take advantage of the NSI automation capabilities.
- [even simple] Interdomain PathFinders are [still] lacking…

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Next up: Supercomputing

- The Automated GOLE project plans a demo using NSI CS v1.0 across real infrastructure for SC2011 (Nov 2011, Seattle)
  - ~8 weeks from now!!
- Things we need:
  - Full life cycle processes for all participating NSAs
  - Functioning NRMs integrated with the NSA, and covering real GOLE hardware
  - A viable “service definition” that is engineered in each GOLE to be compatible and consistent with NSI framework and CS protocol
  - CS v1.0 errata

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Come see NSI at GLIF Rio !!

- The NSI development/interop/demo will be running continuously during the GLIF conference
- Please wander through at your convenience and inquire about the progress…