



Presented to APAN31 + GLIF

Feb 23, 2011

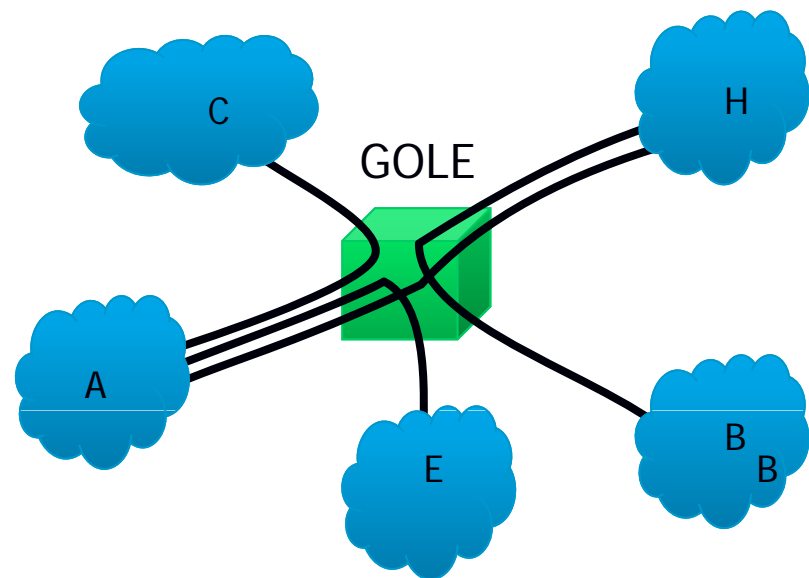
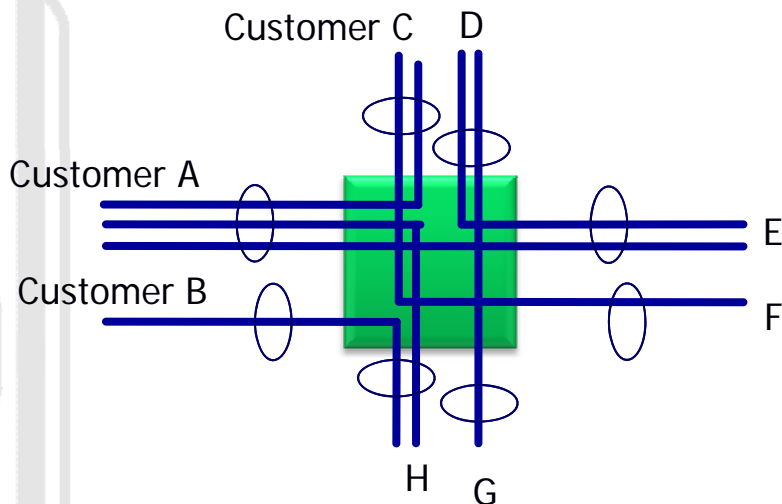
Hong Kong, CN



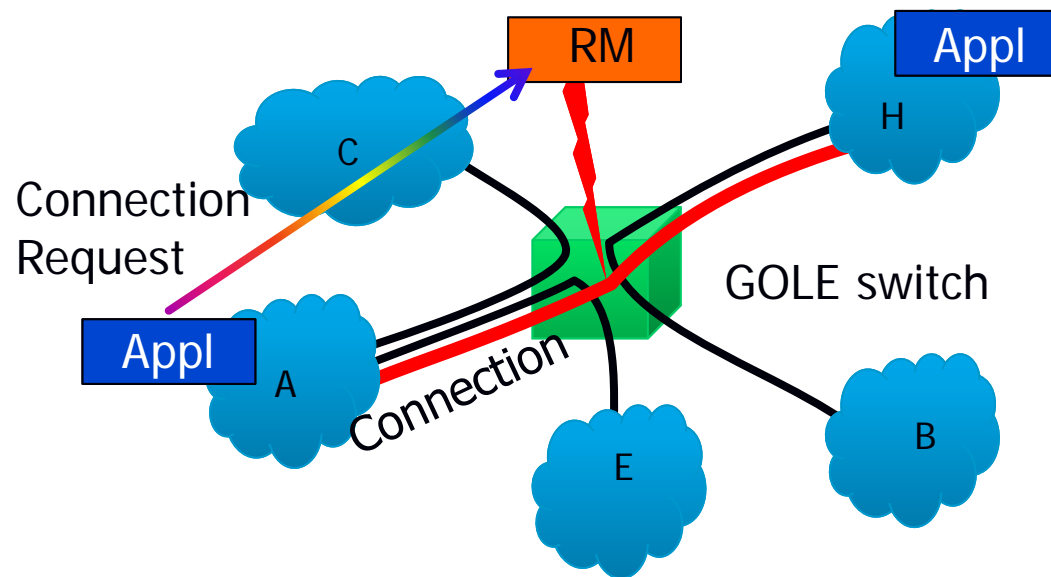
- What is a "GOLE" ?

## GLIF Open Lightpath Exchange

- GOLEs are telecommunications exchange points that offer "policy free" cross-connects among the exchange point customers.
- "Policy free" cross-connects mean that there are no conditions imposed by the Exchange Point governing whom can crossconnect to whom.



- *Automated GOLEs:*
  - Utilize software based Resource Managers (RMs) to provision the cross-connects – rather than human operations and engineering personnel.
  - The RMs interact with application software to remove the MITM (man in the middle)
  - Dramatically reduces provisioning time
  - Increases accuracy



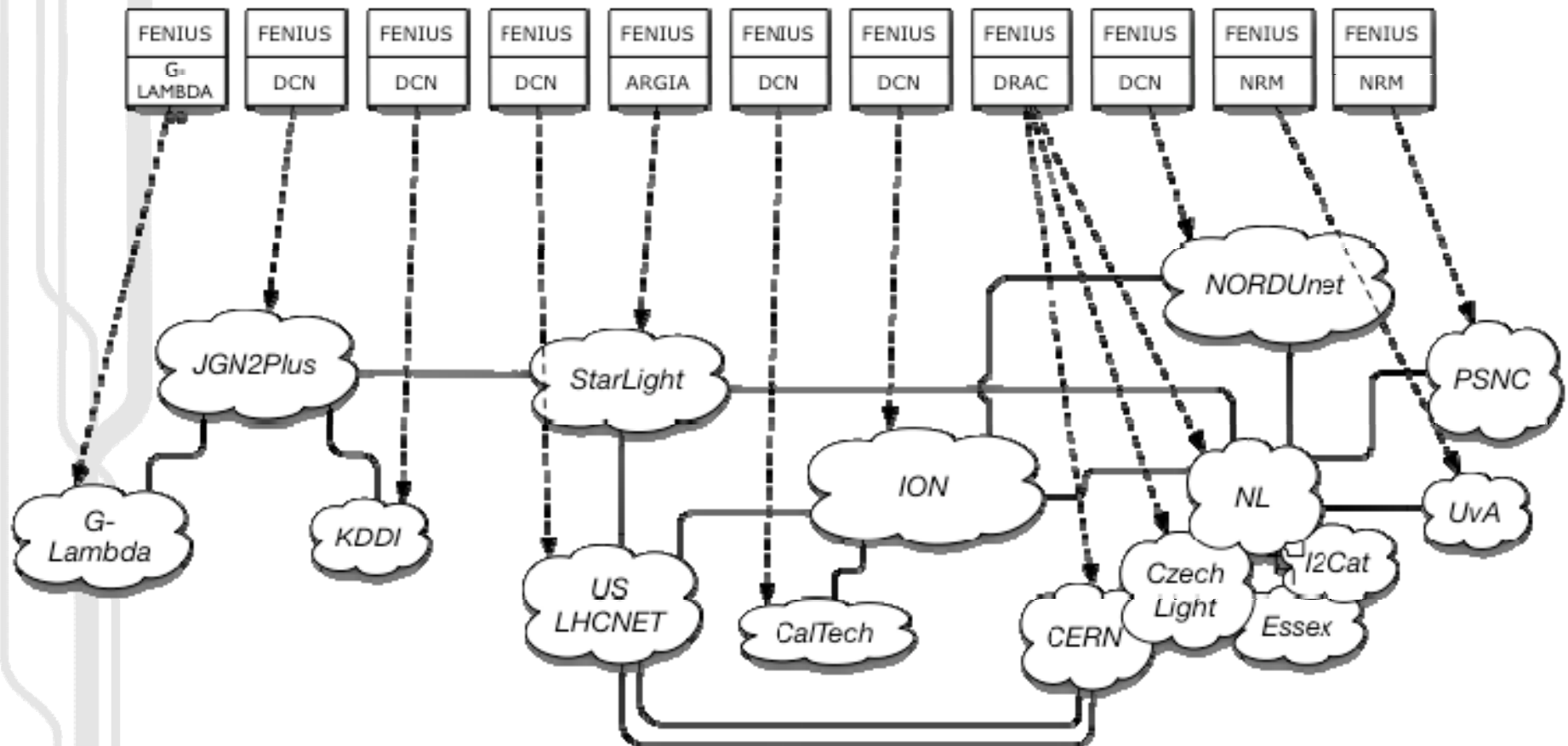
# GLIF Automated GOLE Pilot Project

- Motivation: GLIF participants see the writing on the wall:
  - Connection oriented (i.e. "Performance Guaranteed") [network] services must become an integral part of our services portfolio.
  - The growing community of GOLE operators have been exploring PG/lightpath services for many years, and now see automating the provisioning process as critical to delivering these services in the future.
- The Pilot Project was conceived to push the required automation technologies forward.

- Purpose: forward vision...
  - Organize the GLIF community to construct a global fabric of interconnected GOLEs
  - Incrementally deploy and refine real, persistent, multi-domain, multi-service, performance guaranteed and dynamically provisioned lightpath services over this fabric...
  - Provide a persistent global fabric of automated PG services for real research applications
  - Develop a set of best practices for the engineering, operation, and policy administration of these services
- The Automated GOLE TF was established by GLIF in 2009
  - Current sunset is end of 2011 – perhaps the participants will wish to continue the effort if it shows continued usefulness...

- ESnet
- CANARIE
- NORDUnet
- NetherLight
- StarLight
- JGN2plus
- USLHCNET
- CERN
- CalTech
- KDDI
- G-Lambda
- MANLAN
- Internet2/ION
- UvA
- University of Essex
- CzechLight
- I2CAT

## GLIF Automated GOLE Logical Topology



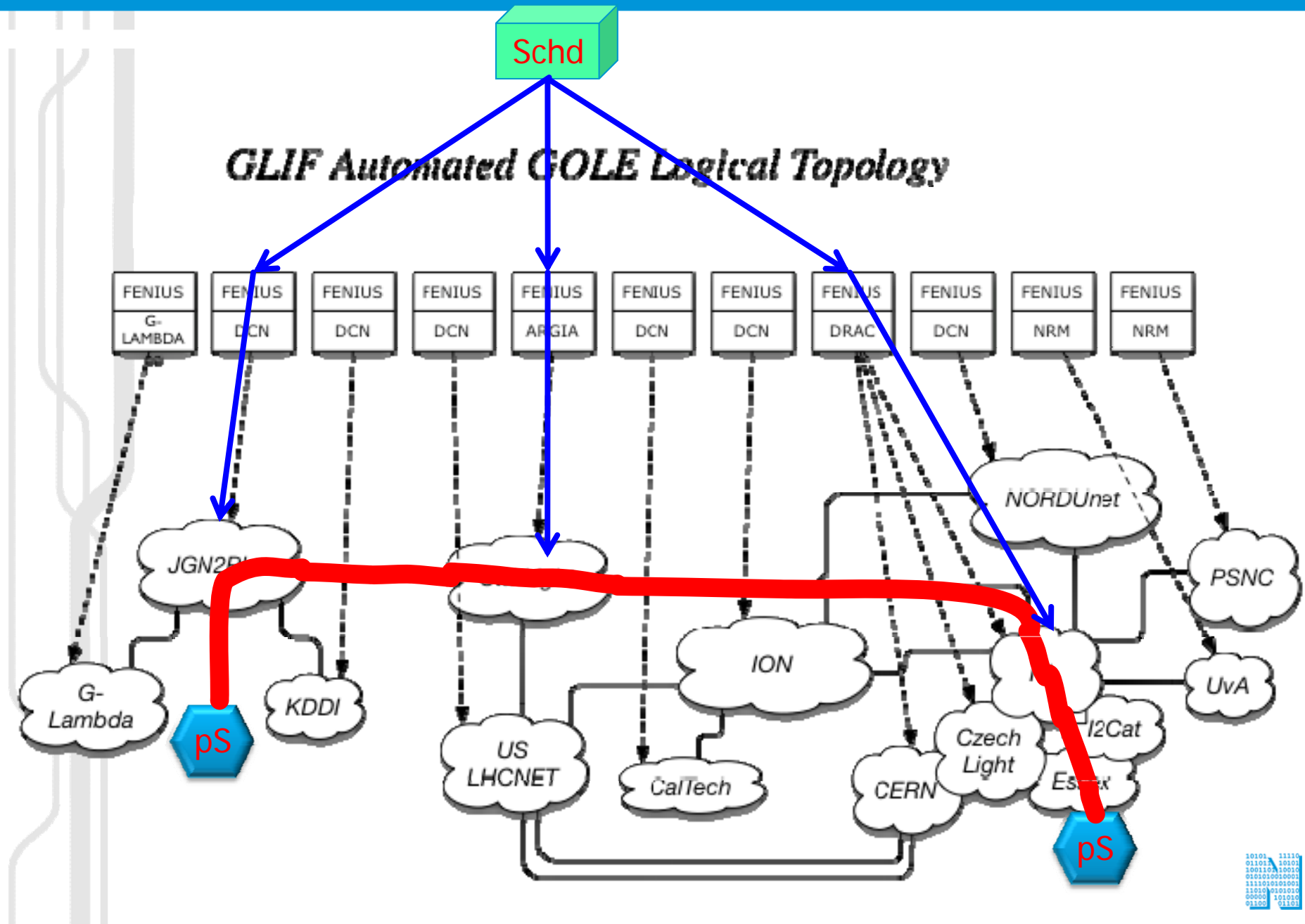
- Due to efforts of former chair John Volbrecht (Internet2):
  - Assembled the first organized Automated-GOLE network.
    - Demonstrated at GLIF Fall2010 - Geneva – Oct 2010
  - The FENIUS protocol translator was deployed -> enabled the first inter-domain automated global VLAN provisioning as part of the 2010 demos
    - Vangelis Chariotakis (Esnet) lead the FENIUS software development effort
    - Thomas Tham (CANARIE) lead the pS "PINGER" demonstration software development
  - Enhanced the demonstration for Supercomputing2010- New Orleans, Nov 2010
- New chair took over Dec 2010: Jerry Sobieski (NORDUnet)
  - Audit of facilities and YADD at APAN/GLIF 2011 in Hong Kong.



- Today's demonstration shows lightpaths being established on a book-ahead (scheduled) basis.
  - The light paths emanate from a perfSonar servers attached to four of the GOLEs
  - A total of 15 circuits are scheduled. A new circuit will be provisioned every minute and will stay in service for 15 minutes.
  - Each of the four originating servers has an IP interface configured with the VLANs of each circuit request.
  - The perfSonar "pinger" tool pings the remote hosts that are expected to be attached at the far end of the connection.
    - The pings fail until the connection appears
  - An independent collector script is running that queries the ping results every 10 seconds. The results are displayed in a web page.

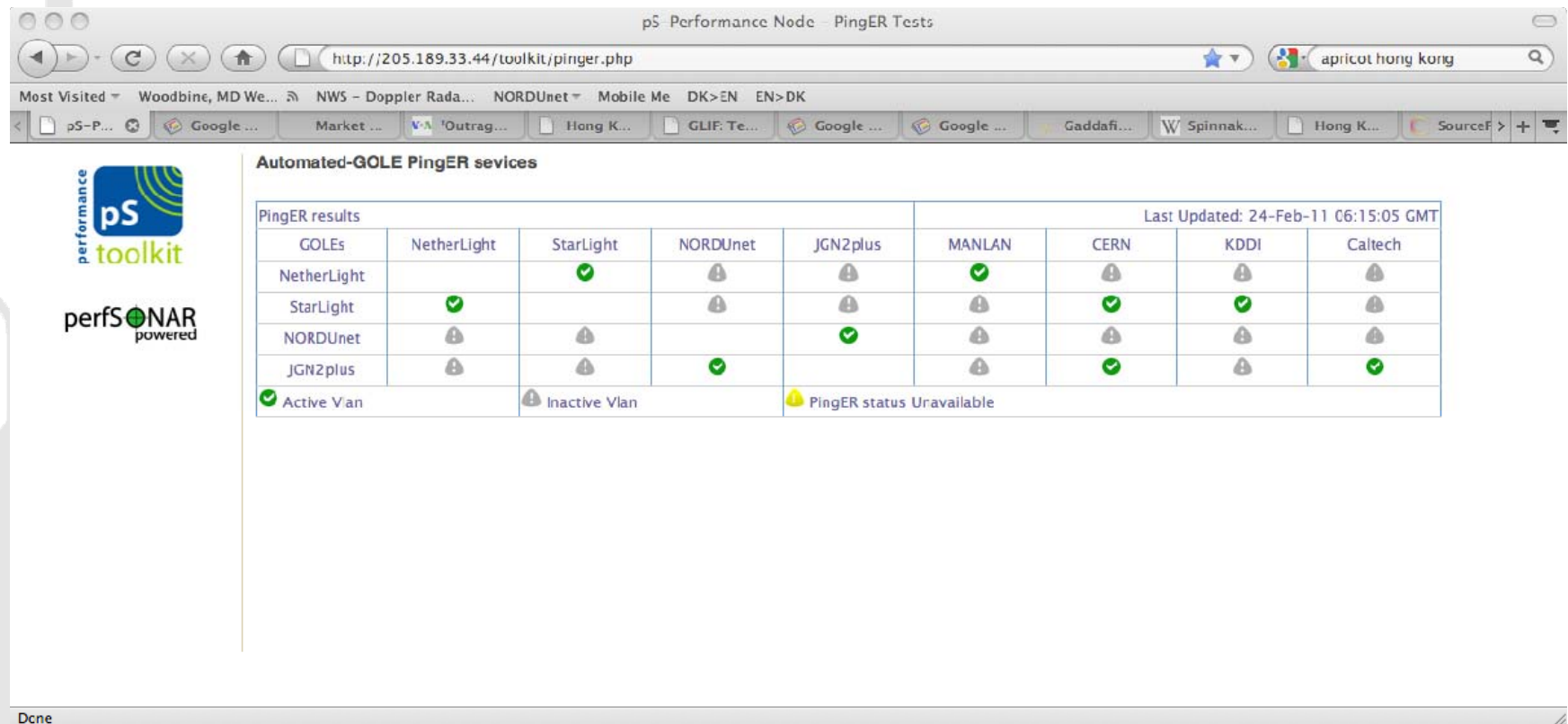
# NORDUnet

Nordic infrastructure for Research & Education



## Pinger Display

<http://205.189.33.44/toolkit/pinger.php>



**Automated-GOLE PingER services**

pingER results

Last Updated: 24-Feb-11 06:15:05 GMT

GOEs	NetherLight	StarLight	NORDUnet	JGN2plus	MANLAN	CERN	KDDI	Caltech
NetherLight		✓	⚠	⚠	✓	⚠	⚠	⚠
StarLight	✓		⚠	⚠	⚠	✓	✓	⚠
NORDUnet	⚠	⚠		✓	⚠	⚠	⚠	⚠
JGN2plus	⚠	⚠	✓		⚠	✓	⚠	✓
Active Vlan	⚠ Inactive Vlan		⚠ PingER status Unavailable					

performance pS toolkit

perfSONAR powered

Dcne

- Automated provisioning alone does not a “service” make:
  - We urgently need smart path finding...
  - ...Which means we urgently need valid and standardized topology information
  - Automated end point registration processes
  - Just delivering a connection to the end point does not make it useful E2E....
    - Intelligent orchestration of distributed applications is required
    - Agents, protocols, and APIs are needed to dynamically interact with the application and configure end systems.
  - Existing service verification and monitoring processes are not automated sufficiently nor appropriately for these emerging PG services.

- Application developers cannot [easily] use the existing provisioning tools
  - The APIs are incomplete, complex, and poorly defined
  - Deployment and installation of software is onerous
- GOLEs, like airplanes, deteriorate if you don't use them
  - Certificates expire, software gets updated (in some places, and not in others), assets get used or re-allocated
  - Implication: Do we need an "operational" aspect to the auto-GOLE fabric? (monitoring and exercising, PoC, ...? )
- There is no formal "service architecture" (yet)
  - We must express the service model to the app developers in a way that allows them to extrapolate how it *could* be used..(!!)

- Detailed planning and realistic analysis of technology maturity is crucial going in...
  - Adhoc systems design (while sometimes necessary) is not a substitute for detailed advanced engineering.
- **We need additional software and systems experts**
  - We have a single point of failure in Vangelis (!) – as we transition to NSI we need to insure that we have broader support for the operational systems that we deploy.
  - We need code writers.

- Deployment of NSI CS 1.0 is the foremost objective in 2011
  - The OGF Network Service Interface (NSI) WG has developed a framework for deployment and interoperation of Network Services.
  - The NSI Connection Service draft protocol standard v1.0 is scheduled to be available at end of March 2011.
  - We hope to have three initial implementations. SURFnet, Esnet, and NORDUnet have made noises...hopefully...
  - Target demonstration at Supercomputing 2011 – Nov 2011, Seattle; dress rehearsal at GLIF Fall 2011 – Sep 2011, Rio

- **Topology Exchange**
  - Fundamental next step... prerequisite for intelligent path finding.
  - We will be working closely with the GLIF DToX WG to
    - Adopt a common [interim] topo description format
    - Develop rules for coherent autonomous topology processing in a distributed environment
    - Develop a communication model for distribution and exchange of topology
- **End System Orchestration**
  - End systems in distributed, multi-species applications must coordinate dynamic configuration processes.
  - We will be looking at potential models for such services
    - Must include: network layer address negotiation, network service performance verification, long term application management, etc.



- **Dynamic End System Registration**
  - Simple, fool-proof/resistent mapping of new end systems to the network edge Service Termination Point (STP) to which it is connected.
    - “Magically”, when a system is attached to a GOLE port, an autonegotiation will take place to register the name, port information, and other pertinent topology information.
    - This will improve ease of use for users, and address existing scaling issues for network operations teams.
  - We want to simplify the management of the end systems – this is critical to user adoption. Simple, simple, simple.
    - Ideally, we want a Plug-n-Play analogy for Automated GOLEs.
    - These autoconfiguration capabilities should also apply to GOLEs connecting to other GOLEs.

- We have a massive and growing commitment of GOLEs that want to participate in this effort! This is GOOD!
  - 14 GOLES and probably 100,000 km of transport links!!!
- We need a coordinated approach to developing the software capabilities of a more mature service environment
- ***We need software development.***
  - We can coordinate and federate these efforts, but to move forward we need to write code. Meetings, conf calls, and powerpoints are not enough.
- There is still a lot of design and architecting needed – this will be challenging and fun, but we need also to balance this with *implementation* of emerging consensus.

- If you or your organization are interested in participating in the Automated-GOLE Pilot Project, contact:
  - [Automatedgole-pilot@internet2.edu](mailto:Automatedgole-pilot@internet2.edu)
  - Or
  - [jerry@nordu.net](mailto:jerry@nordu.net)