NORDUnet Outlook

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Nordic Infrastructure for Research & Education

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Agenda

1. NORDUnet Network Status
2. Key Technology Development
3. Challenges

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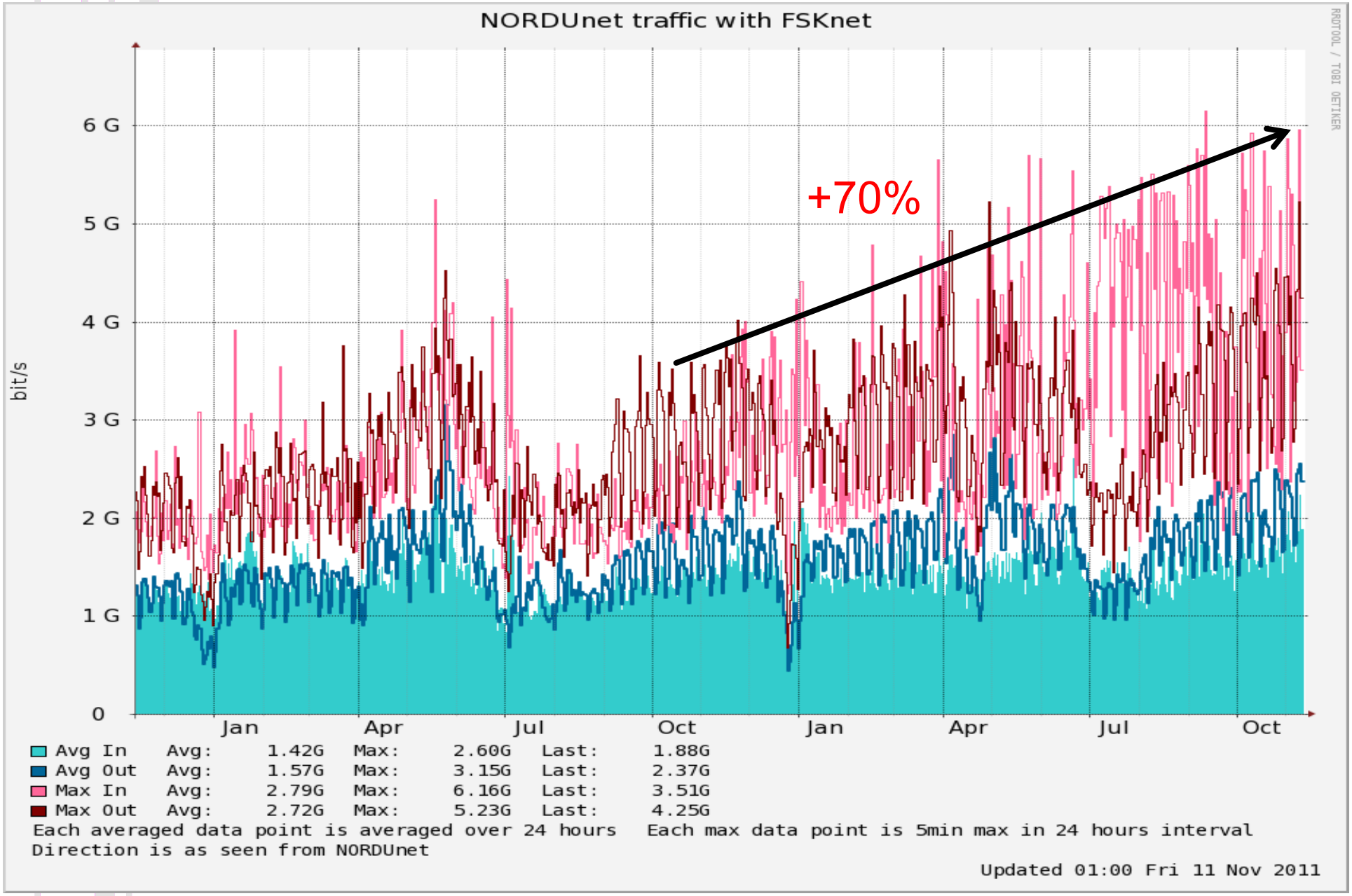
Some Numbers ... FSKnet



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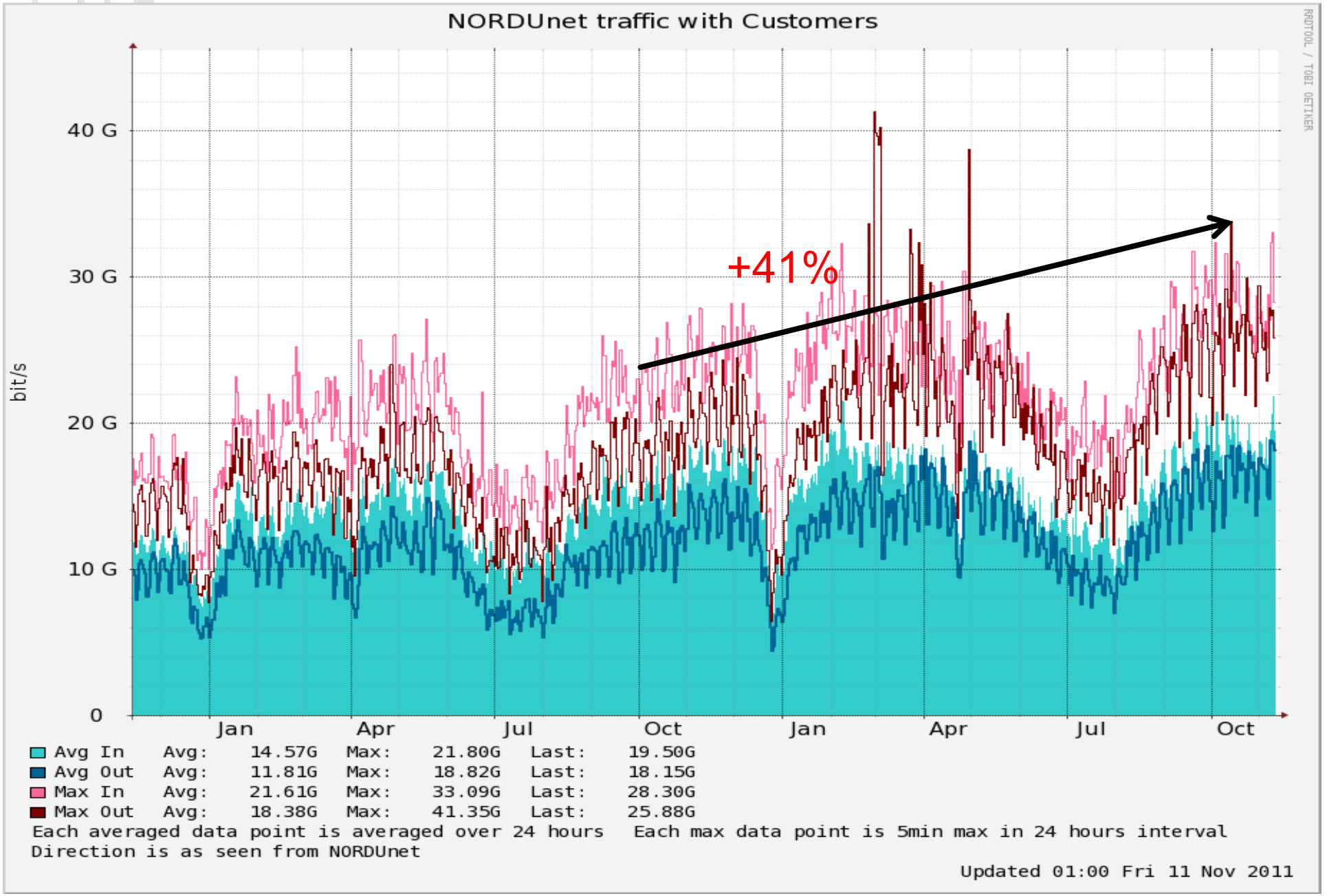
Some Numbers … Nordic NRENs



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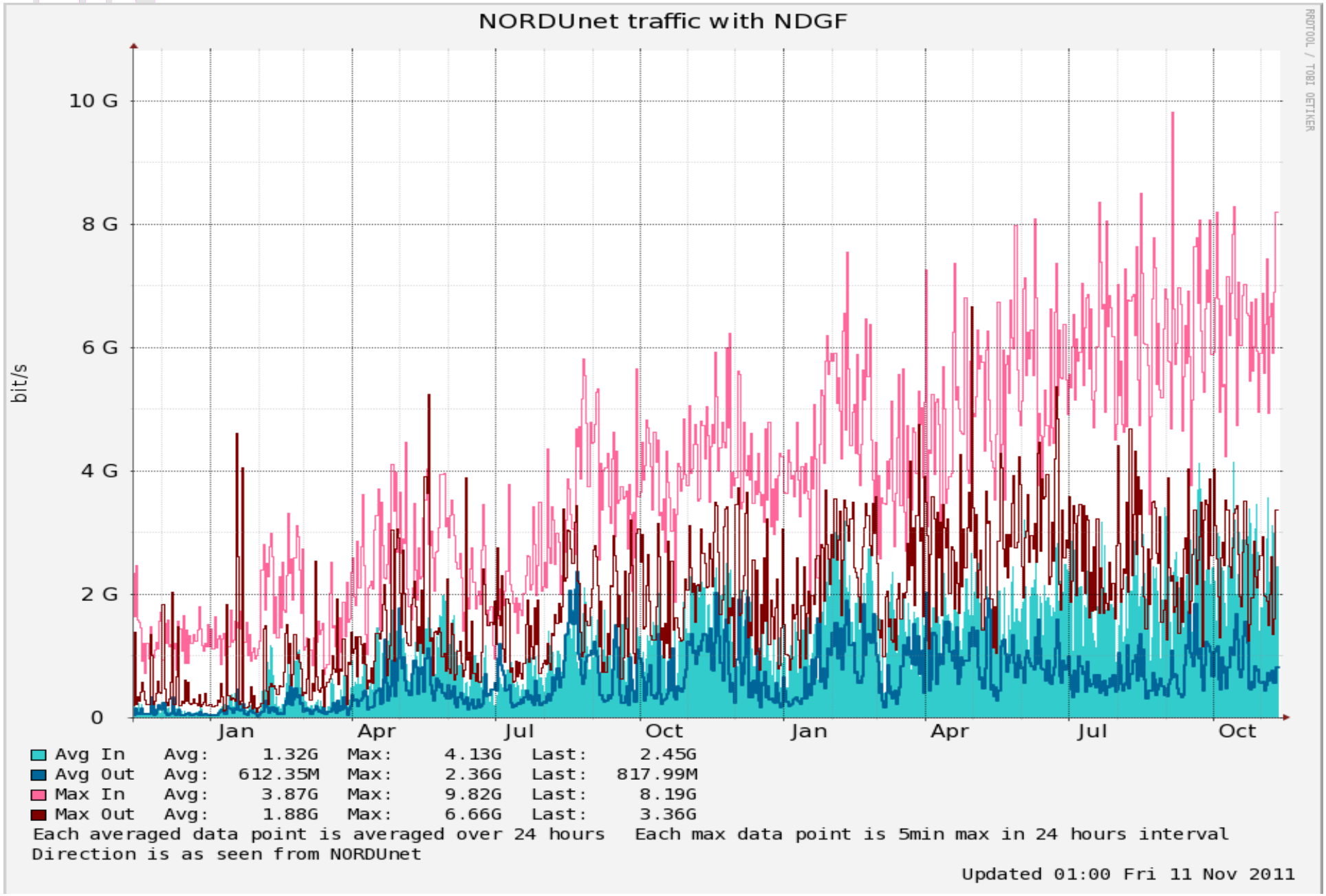
Some Numbers … NDGF



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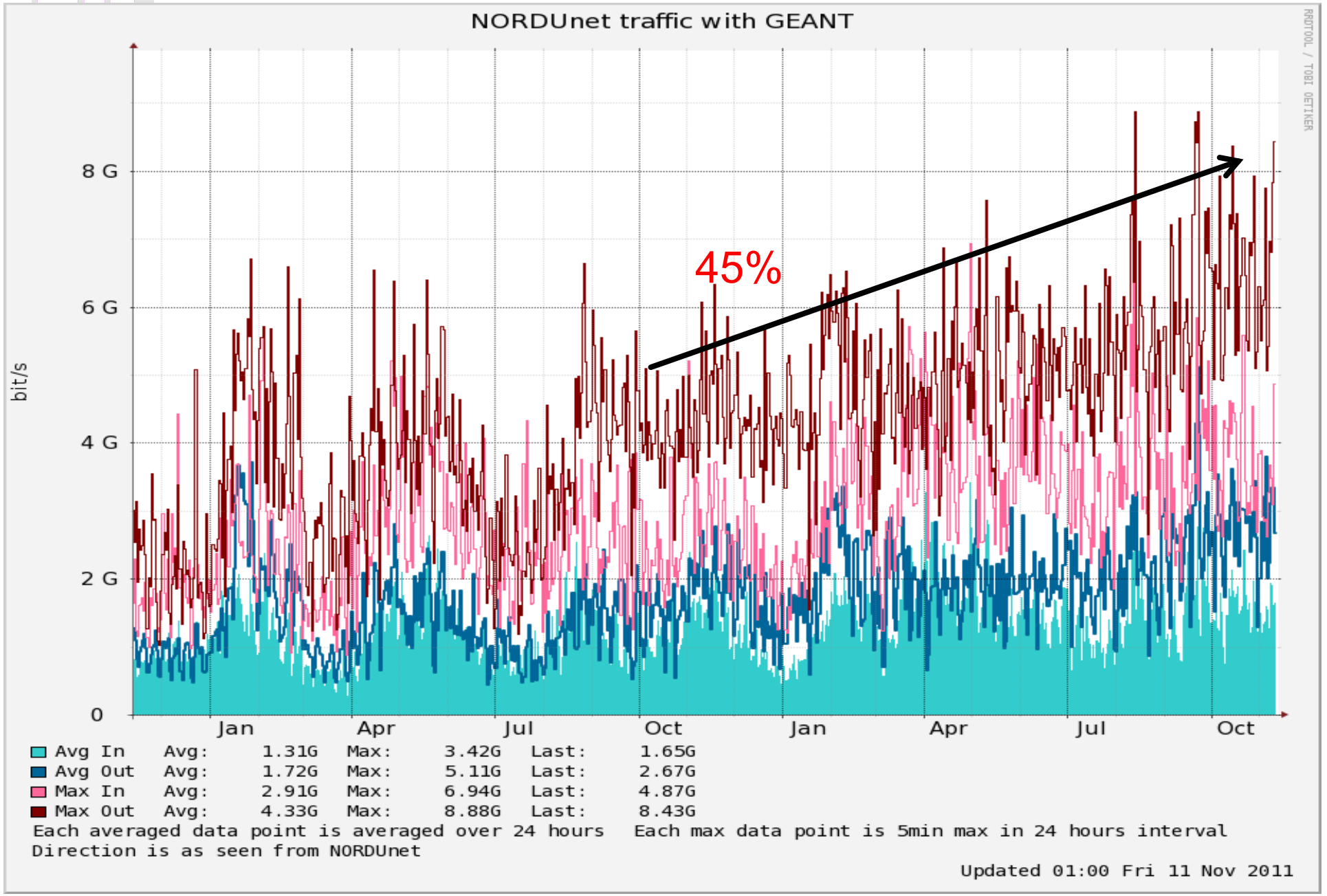
Some Numbers … GN3



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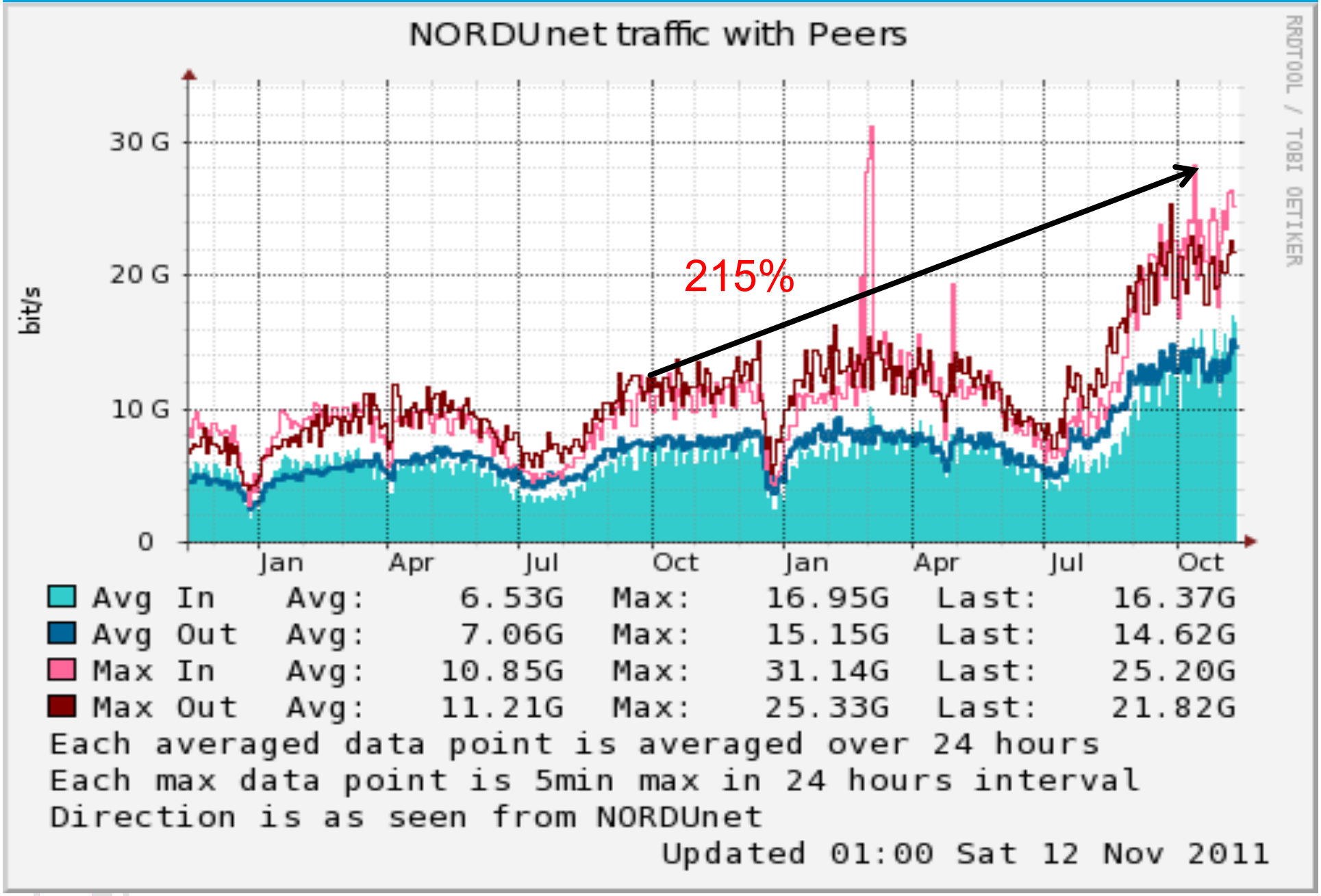
Some Numbers ... Peering



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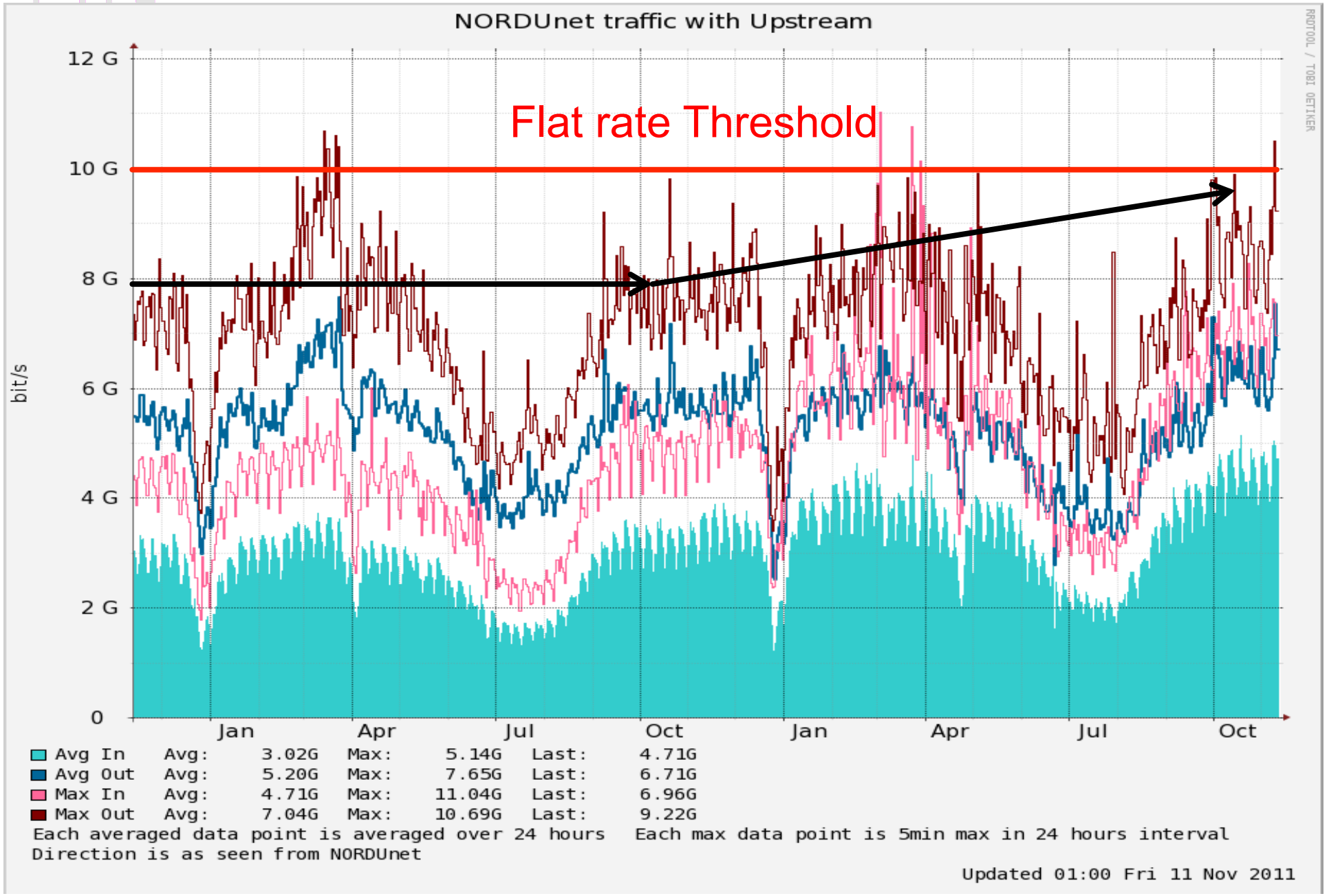
Some Numbers ... Global Transit



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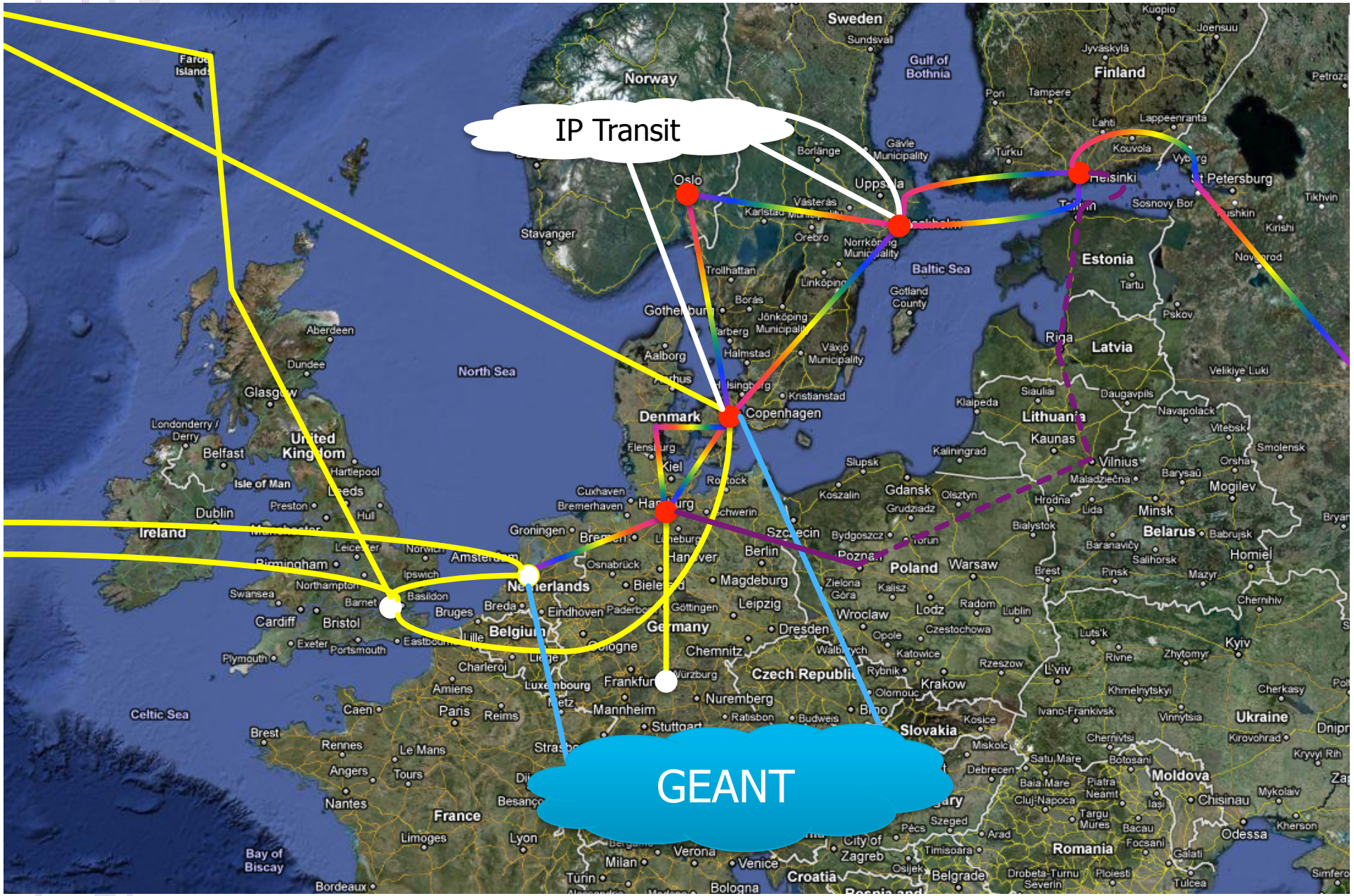
NORDUnet Europe 2011



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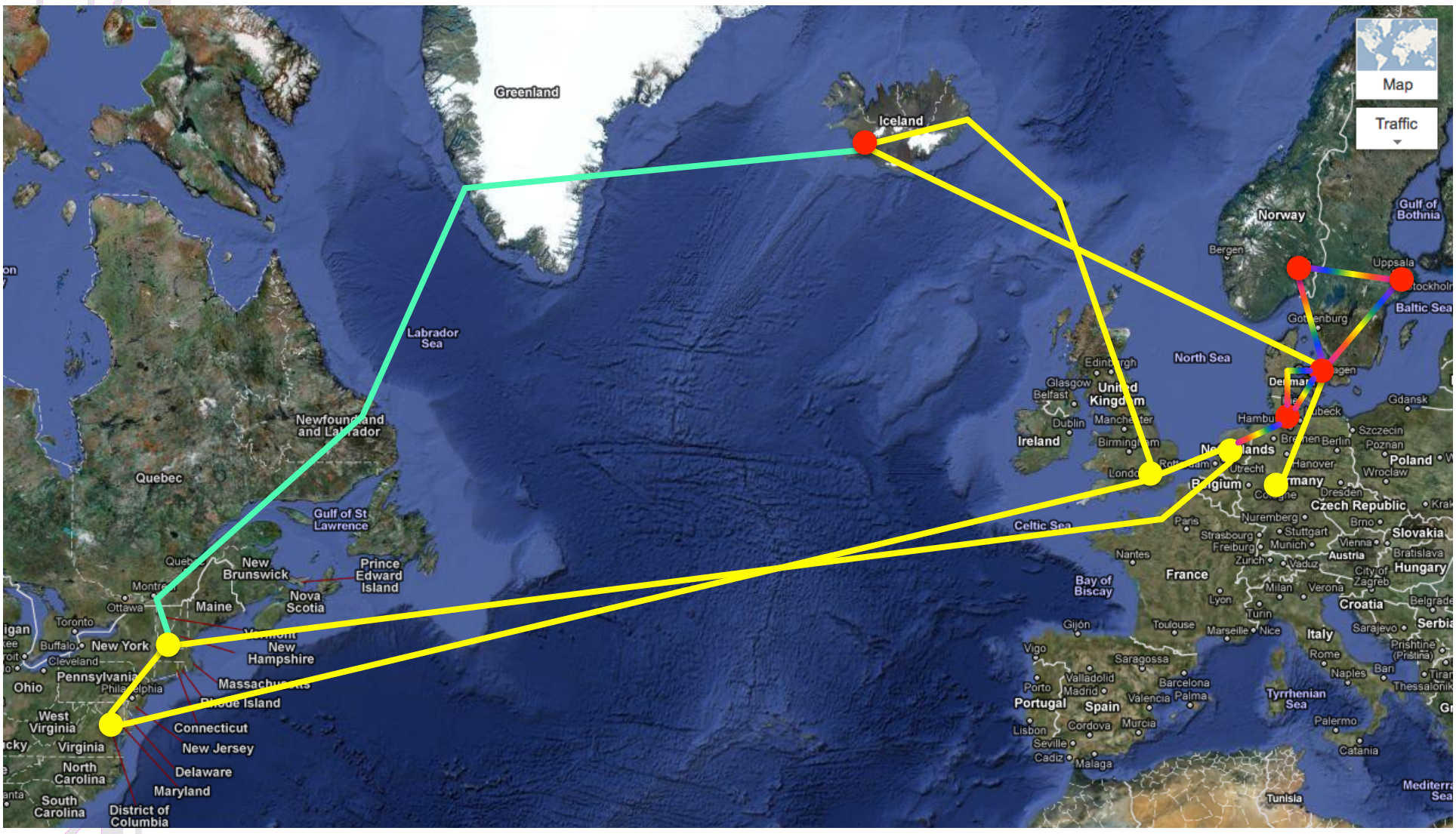
NORDUnet Atlantic 2011



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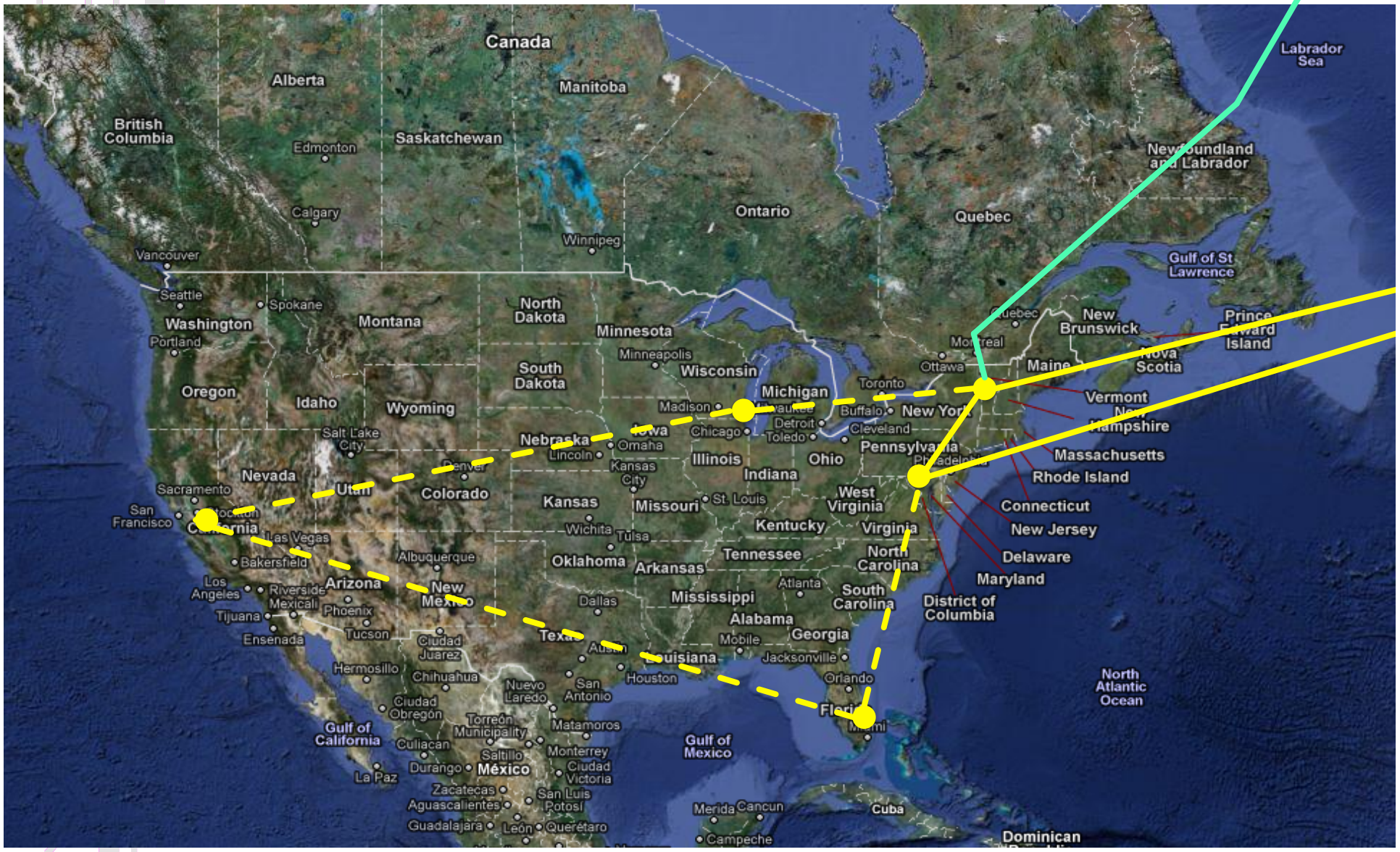
NORDUnet Americas 2011+



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Drift og Statistik

- Troubletickets:
  - http://www.nunoc.net/nunocweb/open_trouble_tickets.html
  - http://twitter.com/nordunet
- Netværks Statistik
  - http://stats.nordu.net

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NORDUnet Services

	Reseach Network Connectivity	Global IP transit	OPN Lambda	Cross Border Fibre Coordination	Central NOC	End User NOC	GN3 Project Coordination	Project Hosting & Coordination	Software Development	AAI Community Serrvices	Equipment Hosting	Virtual Server Hosting	Network Media Transcoding & Distribution	Adobe Connect	VCONF MCU Service	WEB based Vconf Service	Telepresence Gateway Service	EU project Coordination	File Sharing Service	Spam Filtering Service	Community Communication
2005																					
FORSKNINGSNETTET	■	■																			
FUNET	■	■																			
Rhnet	■	■																			
SUNET	■	■																			
UNINETT	■	■																			
WAYF																					
NDGF																					
GEANT 3																					
RUNNET																					
NCM																					
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2011																					
FORSKNINGSNETTET	■	■					■			■					■	■					■
FUNET	■	■	■	■			■			■					■	■					■
Rhnet	■	■					■			■					■	■					■
SUNET	■	■	■	■	■	■	■		■	■	■	■	■	■					■	■	■
UNINETT	■	■	■	■			■			■	■			■							■
WAYF					■					■		■									
NDGF	■		■		■			■	■									■			
GEANT 3									■												
RUNNET		■							■		■										
NCM		■						■	■						■	■					
NORDUnet	■	■			■		■	■	■	■	■	■	■		■	■	■	■			■

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Technology Development within the R&E Networking Community

Key emerging trends and the technologies necessary to realize them

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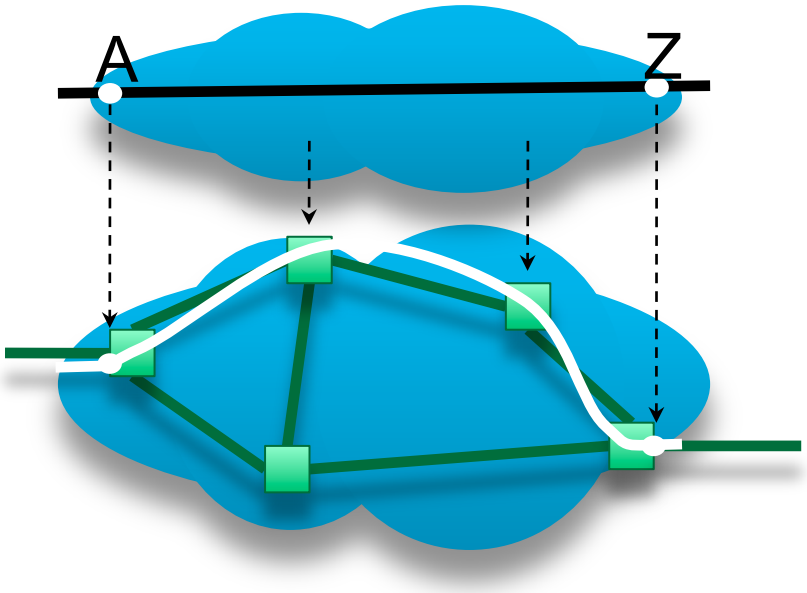
Key emerging trends:

- **Network Virtualization (NV)**
  - Separates logical (service) functionality from physical infrastructure.
  - The virtualization layer maps logical functionality to a physical layout
  - Expresses network functionality as a set of quantifiable service capabilities
  - Example: VLANs provisioned over a switched Ethernet core
- **Network Federation (NF)**
  - Creates a single network entity from a set of independent network resources.
  - Integration of independently contributed (owned/managed) network resources into a single operational/administrative entity.
  - Example: GLORIAD – CSTnet+NORDUnet+Tata+KREOnet, …
  - Differentiates the "Service Provider" from the "Infrastructure Provider"
- Together, NV and NF provide the ability to create flexible network service topologies that span global hardware/transport providers and that can function as a single coherent network service provider.

Network Virtualization

- What it is:
  - The network is presented as a set of services – A set of functions that can be performed, and a set of resources that are manipulated to deliver the requested functionality
  - A service "instance" is the functionality delivered as a result of the service interaction (the service request).



Service request: A "*connection*" - *from A to Z,* with *certain capacity, with certain framing.*

Virtualization layer - the intelligence that maps the request constraints to the available resources…

Physical layer – configures the hardware assets [utimately] realizing the functionality requested.

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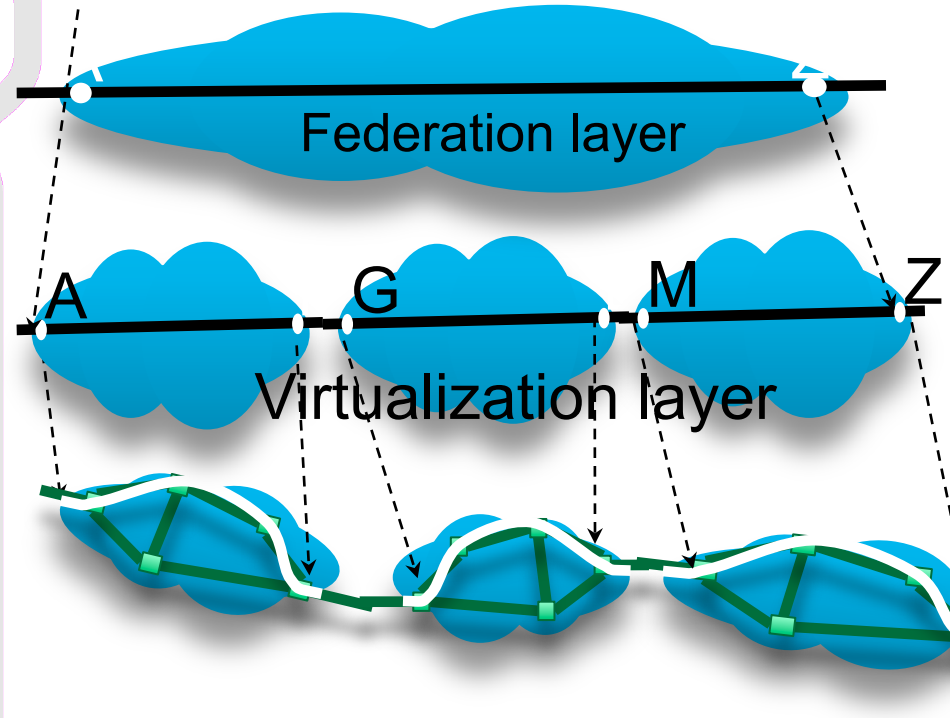
Network Federation

- What it is:
  - Differentiates the Service Provider from the Infrastructure Provider
  - Allows the serivice provider to compose a more sophisticated/comprehensive service environment from a collection of basic infrastructure resources
  - In network federation, the basic resources may be facilities (fiber, switches, colo space, etc) and/or other virtuaized resources (e.g. VLANs, virtual routers, [G]-MPLS LSPs, etc.)
  - Federation allows a common set of administrative and/or management policy and/or procedures to be aplied across the aggregate resources in the federation



Federated Service layer presented to the user and managed by the provider

Services (resources) allocated to the the Service Providers

Hardware (resources) owned/ managed by the resource owners (Infrastructure Providers)

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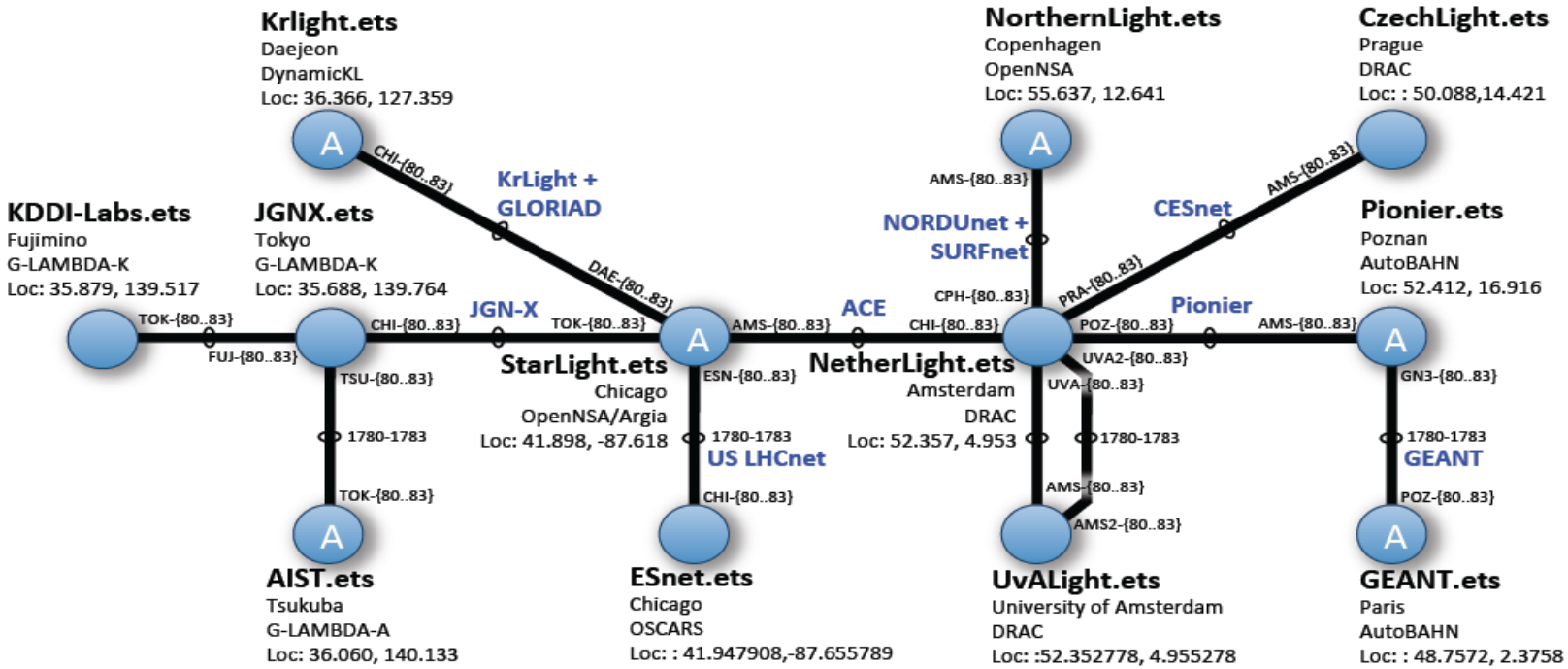
NSI SC11 Demo

Automated GOLE / NSI Demo Network

Supercomputing 2011

Nov 14-17, 2011
Seattle, US



DEMO ....

Visualization

Java web start thing: http://163.220.30.174:8070/monitor.jnlp

Google earth plugin: http://kote-ps-1.ps.jgn-x.jp/ps/autoearth-nsi/

Google earth kml: http://kote-ps-1.ps.jgn-x.jp/ps/autoearth-nsi/AutoMAP.kml

Logs

Starlight: http://nsa.badlab.crc.ca/opennsa.log.html

Northernlight: http://orval.grid.aau.dk:9000/opennsa.log.html

G-Lambda/AIST: http://163.220.30.174:8090/logs/nsi_gl_proxy.txt

dynamicKL: http://203.230.116.202:8080/log

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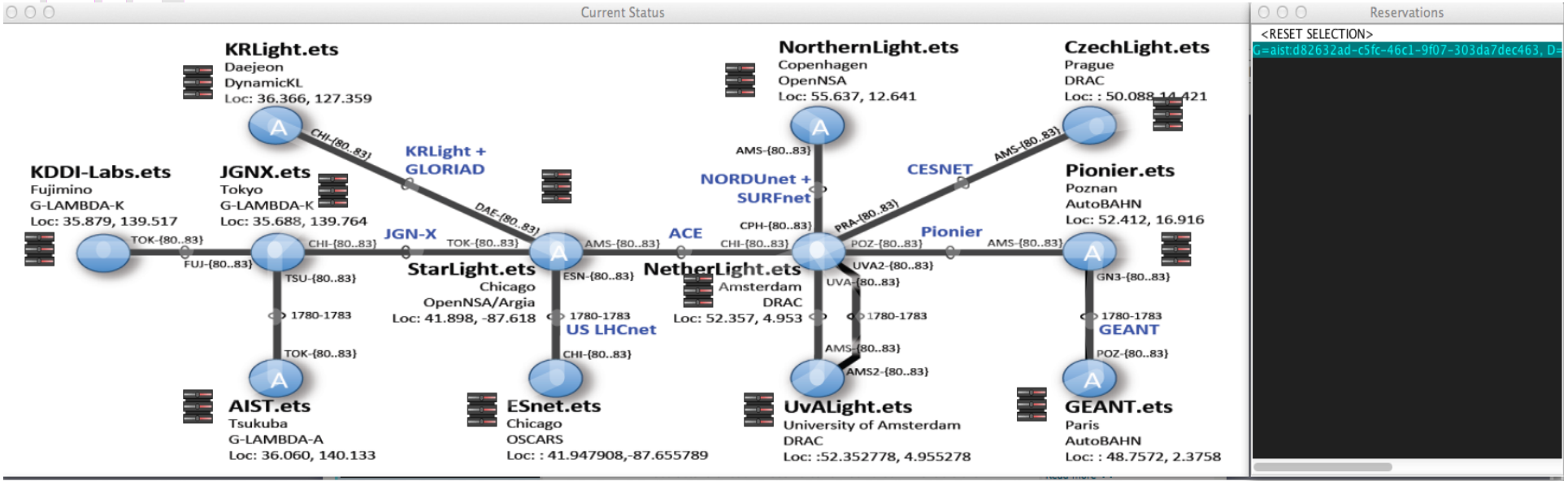
NSI SC11 .



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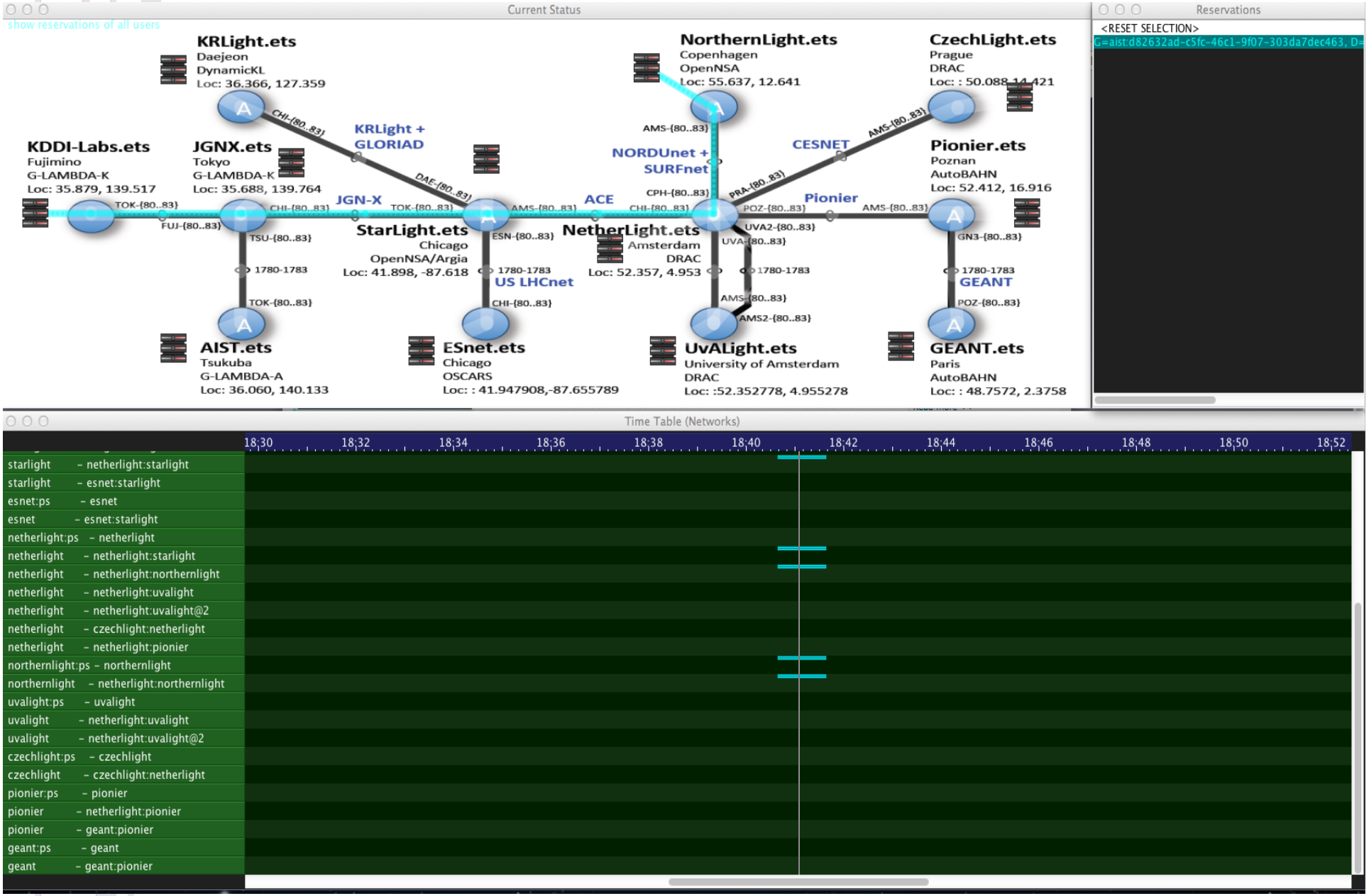
NSI SC11 ..



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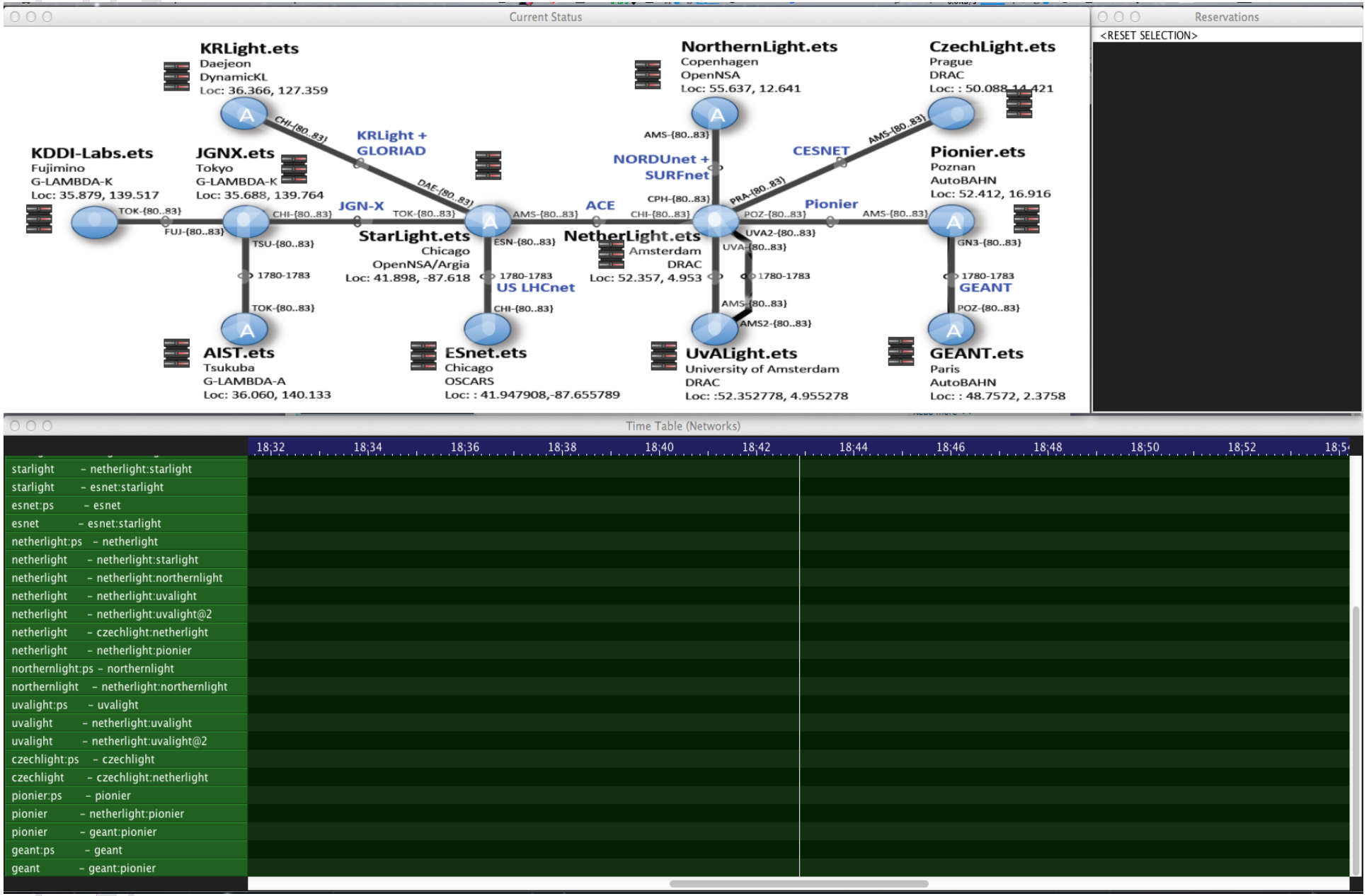
NSI SC11 ...



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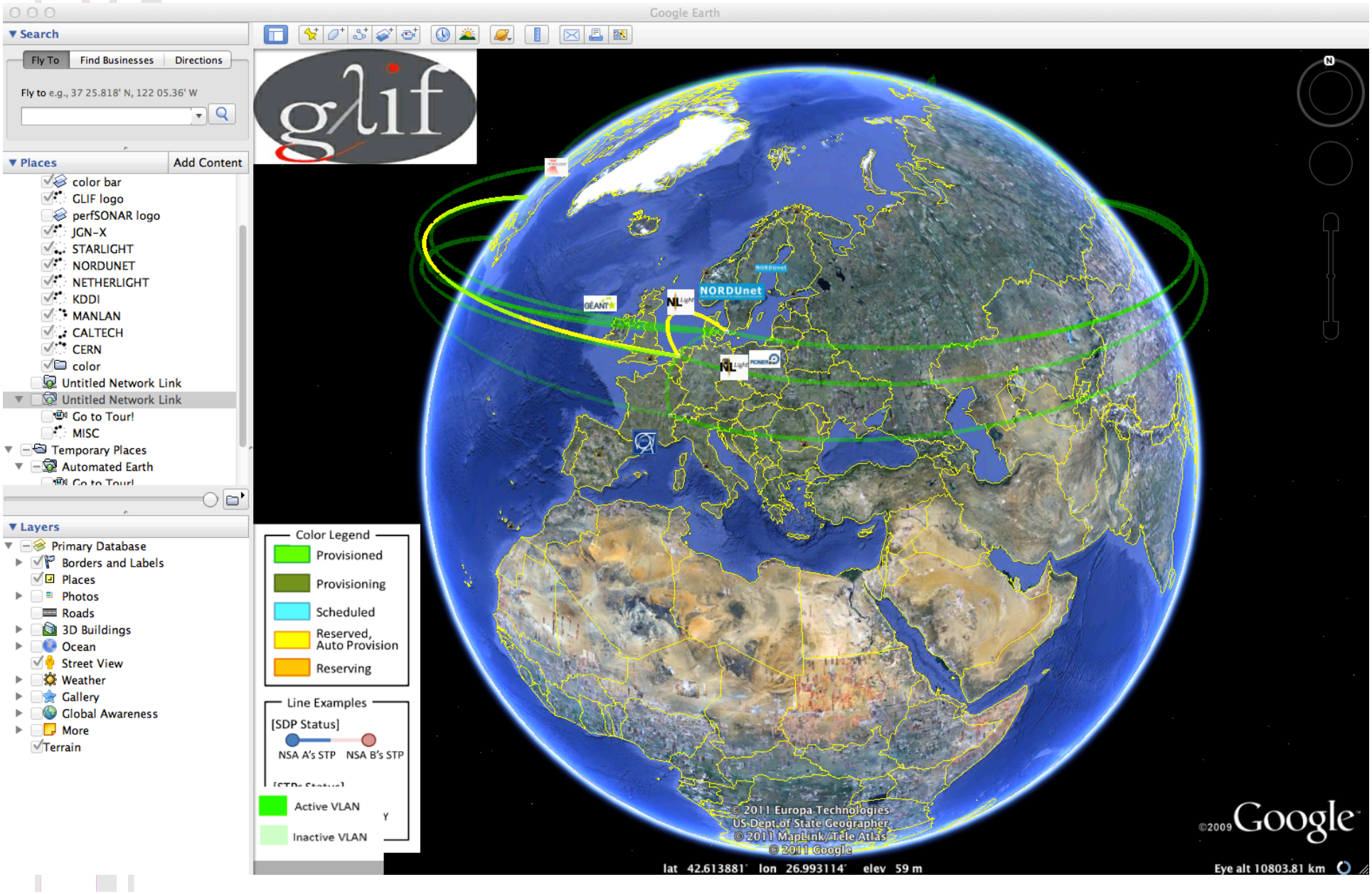
NSI Demo SC11 .



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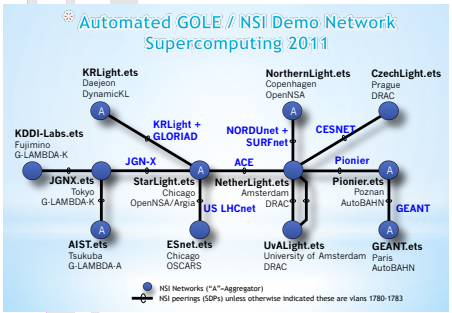
NSI SC11 Event

A demonstration of the NSI Connection Service protocol over the global fabric of Open Lightpath Exchanges at Supercomputing 2011

The Demonstration:

At Supercomputing 2011 the GLIF **Automated GOLE Pilot Project** will be demonstrating the OGF **Network Services Interface** (NSI) architecture for standardized global inter-domain provisioning of high performance network connections.

This demonstration will feature the NSI Connection Services (NSI CS) protocol version 1.0 in service across a global fabric of Open Lightpath Exchanges. The Participating GOLEs are Ethernet-switching nodes that use the NSI protocol to re-configure the GOLE switches along a selected path to establish a dedicated VLAN between the two end points. This VLAN can be reserved in advance for a specified time, and is provisioned with dedicated capacity and performance characteristics guaranteed between the two end points.



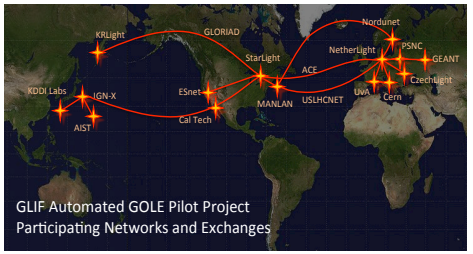
The NSI Framework, standardized with the Open Grid Forum, defines a scalable architecture for inter-domain service interoperability. The NSI Connection Service (NSI CS) protocol defines the messaging exchanged between the NSI domains for managing the life cycle of these connections. The NSI protocol enables users (broadly construed) to construct path specific connections, or to allow the Network Service Agents to dynamically select a path that meets the user's performance, scheduling, and authorization criteria.

The NSI demonstration consists of an array of autonomous "Ethernet Transport Service" (*.ets) domains deployed across the Automated GOLE fabric. Each domain runs a Network Service Agent that interacts with users and peer networks via the NSI Connection Service protocol. The resulting aggregate inter-domain service region can schedule, provision, query, monitor, and ultimately release dedicated point to point VLANs. The demonstrated service transports basic Ethernet frames along a dynamically selected path between the end points.

The NSI Software:

The OGF NSI framework and the CS protocol standard have been independently implemented in software by several of the organizations participating in this demonstration. The software packages and the developing organizations are:

OpenNSA – NORDUnet, Copenhagen, DK
G-LAMBDA-A – AIST, Tsukuba, JP
AutoBAHN – GEANT Project, Poznan, PL
DRAC – SURFnet, Amsterdam, NL
G-LAMBDA-K – KDDI Labs, Fujimino, JP
DynamicKL - KISTI, Daejeon, KR
OSCARS - ESnet, Berkeley, US



The GLIF:

The GLIF (Global Lambda Integrated Facility) is an international community of R&E network service providers and research teams promoting advanced concepts in optical and photonic network services. The GLIF encourages and supports the establishment of GOLEs (GLIF Open Lightpath Exchanges) around the world and the partner contribution of high capacity transport links to interconnect the GOLEs. This distributed pool of switching and transport resources provides a global "expressway" for emerging hybrid technologies such as NSI This global fabric of GOLEs provide "open" peering and cross-connect policies unmediated by the host organizations.

The GLIF **Automated GOLE Pilot Project** leverages these infrastructure resources to provide test bed facilities to support the development of user controlled network services for the scientific research community.

The OGF:

The Open Grid Forum was established to bring together the emerging global Grid Computing community to standardize the means by which globally distributed computing, storage, and instrument resources are integrated into effective applications and workflows. The high performance networking community has engaged with the OGF and is working to standardize the **Network Service Interface** (NSI) Framework as a means for integrating network resources into the grid environment. The NSI will provide users and applications with the ability to dynamically acquire and manage network resources as predictable and deterministic components of the grid infrastructure.

The participating Automated-GOLE Pilot + NSI Demonstration participants and supporters are:

- NORDUnet + NorthernLight (Nordics)
- NetherLight (NL)
- PSNC + Pionier (PL)
- CERNLight (CH)
- CzechLight + CESNET (CZ)
- University of Amsterdam (NL)
- NOVI Project (NL)
- i2CAT (ES)
- GEANT (EU)
- GLORIAD (US)
- StarLight (US)
- Internet2 ION + MANLAN (US)
- ESnet (US)
- CalTech + USLHCnet (US, CH)
- CANARIE (CA)
- AIST (JP)
- JGN-X (JP)
- KDDI Labs (JP)
- KISTI (KR)

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Challenges

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The 15 Challenges

1. *Globalization*
2. *Organization of e-Infrastructure*
3. *Short term ad hoc collaborative projects*
4. *Geographically scattered data sources.*
5. *Increasing amount of managed data*
6. *New groups of users with little technology knowledge*
7. *Mobility*
8. *Social networking*
9. *e-Education*
10. *Cloud Integration*
11. *Security and Data Ownership*
12. *Software Development & IPR*
13. *Network Media distribution*
14. *Public - Private Partnerships*
15. *Green IT & the Environment*

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The NREN towards 2020

With the 15 Challenges it is clear that the NRENs must evolve to meet the constituency requirements by focusing on providing layered service offerings enabling new opportunities for the users.

Therefore it is our opinion that NRENs towards 2020 must assume an approach that encompass the following concepts:

1 The NREN as a Global Network Service Provider

Federation • Open Exchanges • Virtualization • Mobility • Regional Collaboration • CBF.

2 The NREN as a Community Service Provider

Global identity management • e-Campus services • VCONF & Web based collaboration tools • Network attached media distribution • Cloud Services • Social networking

3 The NREN as the e-Science enabler

Enable, Educate & Evangelise the e-Science Plug.

4 The NREN as the e-Education enabler

Enable, Educate & Evangelise the e-Education Plug.

5 The NREN's as an Innovative Framework Provider

Provide and incubation environment that foster innovation of new ideas through removing any technology barrier.

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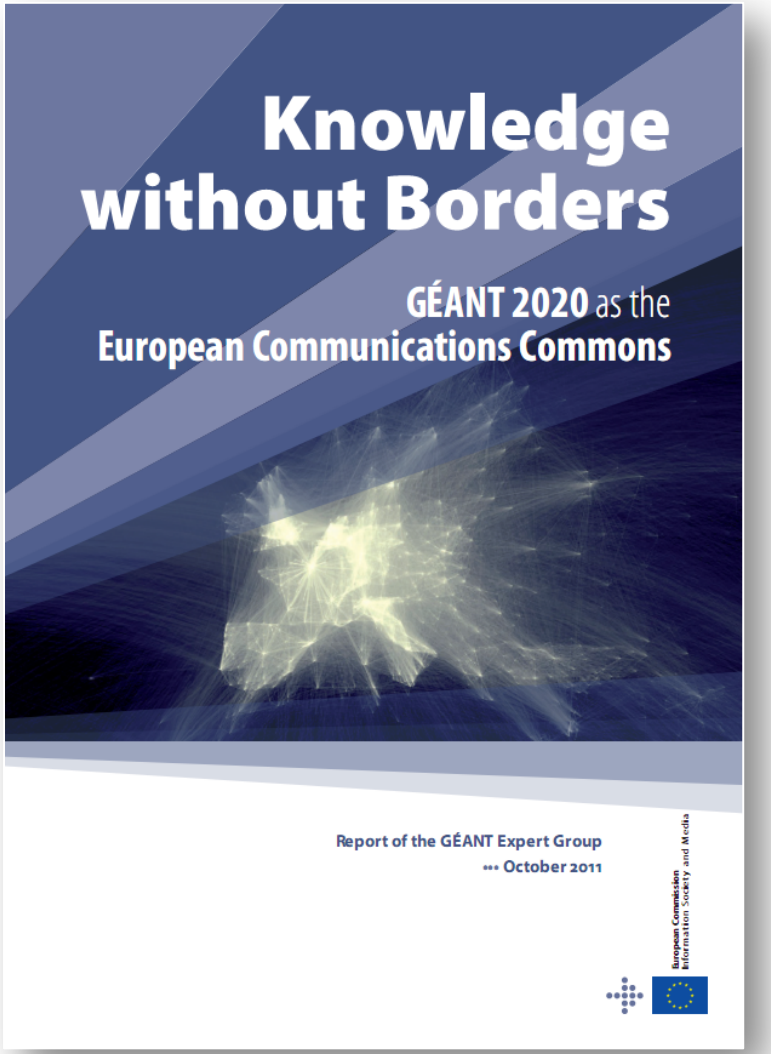
The Vision of GEG

- "GÉANT 2020" is the European communications commons
- where talent anywhere is able to collaborate with their peers around the world and
- to have instantaneous and unlimited access to any resource for knowledge creation, innovation and learning,
- unconstrained by the barriers of the pre-digital world.



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http://wiki.nordu.net