NORDUnet
Backgound & Strategy

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NORDUnet
Nordic Infrastructure for Research & Education

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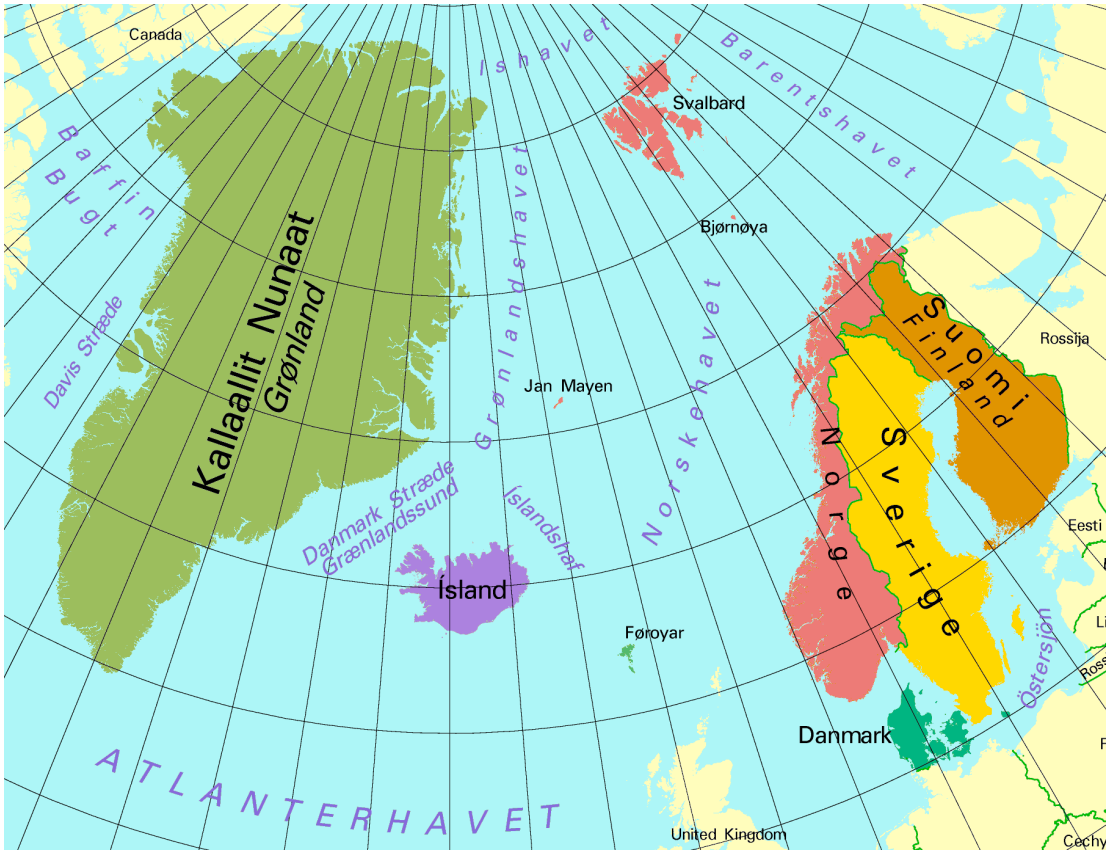
Nordics



	Area	Population	GDP (PPP) Bil. USD	BNP / Capita
Denmark	43.376	5.500.510	204,9	37.251,1
Faroe Island	1.339	48.856	1,0	20.468,3
Greenland	2.166.086	57.600	1,1	19.097,2
Finland	338.145	5.250.275	195,2	37.179,0
Iceland	103.300	306.694	12,2	39.616,0
Norway	323.802	4.660.539	256,5	55.036,6
Sweden	449.964	9.059.651	348,6	38.478,3
	3.426.012	24.884.125	1.019,5	40.967,9

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About NORDUnet

- Owned by the 5 Nordic NREN's
  - Forskningsnettet – Denmark
  - Funet – Finland
  - Rhnet – Iceland
  - SUNET – Sweden
  - UNINETT – Norway
- Cost divided by Nordic BMP Product:

Denmark	€ 2.039.300,00	22,30%
Finland	€ 1.592.500,00	17,50%
Iceland	€ 109.200,00	1,20%
Norway	€ 49.868,00	0,55%
Norway, KD	€ 2.443.532,00	26,85%
Sweden	€ 2.875.600,00	31,60%
TOTALCONTRIBUTIONS	€ 9.110.000,00	100,00%

- Contributions account for 75% of Revenue.
- Decisions is made by consensus despite a formal voting rights structure
- Respect for each others variance in requirements.

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NORDUnet Strength

- Good Collaborate Regional Nordic Method
- Nordics Appear bigger than the sum of individual countries
- Secure sufficient funding to larger scale international projects.
- Significant collective purchasing power.
- Operational Economy of scale.
- The region (including arctic) is in more interesting than the individual country.
- Facilitates and administer participation in EU Projects.

NORDUnet Strategy Drivers

Key strategy drivers

- Globalization and International Competition

  To push the scientific borders further Global Collaboration is necessary and to pool global resources and knowledge fx. CERN, eVLBI GLEON, GENI, CINEGRID etc. This raises the competition between international scientists and institutions.

- Cross Boarder Collaboration

  To be a recognized as participant in Global Research Projects it requires that national and regional institutions collaborate and pool resources. The Nordic NREN experience is that a coordinating and facilitating interregional coordination body add significant value to the national efforts as a common level play ground.

- Network Paradigm shift – Federated Networking

  In addition to the general usage of the network the requirements for specialized high capacity E2E connections are rapidly increasing. This requires a new approach to inter network and inter organizational provisioning and coordination.

- Dependencies of various disciplines

  In addition to the paradigm shift in networking the interdependencies between multiple disciplines like Networking, Storage, GRID, AAI etc. raises the international and inter regional coordination challenges to a new complexity level.

NORDUnet Vision

"NORDIC Infrastructure for Research and Education"

- NORDUnet shall provide a common world-class network infrastructure, services, support and collaboration platform for the Nordic NRENs and research and education community.
- NORDUnet shall likewise facilitate other common eInfrastructure as requested by the Nordic national eInfrastructure stakeholders.

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NORDUnet Mission

The NORDUnet mission builds on the following five pillars:

1) Connectivity

NORDUnet shall build and operate a world-class network infrastructure for the Nordic research and educational community.
NORDUnet shall achieve this through shared infrastructure or bilateral collaboration where it makes strategic, operational and financial sense.

2) Coordination of network research and development

NORDUnet shall actively monitor network research activities and development projects coordinating and facilitating Nordic involvement and participation.
NORDUnet shall actively facilitate best practice and lead knowledge sharing within the Nordic NREN community.

3) Network & eInfrastructure Services

NORDUnet shall build and operate network and other eInfrastructure services in response to the individual needs of Nordic NREN's taking advantage of operational synergies.

4) International Representation

NORDUnet shall, on behalf of the Nordic NREN's, act as the Nordic representative towards GÉANT and DANTE bodies.
NORDUnet may act as the Nordic representative or as a coordinator of important issues and proxies towards other international bodies as applicable.

5) Operational Paradigm

NORDUnet shall operate according to best practices within corporate governance, corporate culture and pursue the best possible utilization of all NORDUnet resources.
NORDUnet shall facilitate both common and individual services as long as they are financially neutral to other NORDUnet activities.

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NORDUnet Core Values

Collaboration

NORDUnet shall constantly strive to facilitate co-operation between the Nordic NRENs and international partners.

Customer-focused

NORDUnet shall develop its services according to the needs of the Nordic NRENs.

Knowledge sharing

NORDUnet strives to be a professional and highly competent partner for the Nordic NRENs and our international partners. It is a core component of our efforts to be highly skilled and trustworthy experts in all aspects of networking technology and related services. It is our job to provide services, perform research and testing, and disseminate information and knowledge towards the Nordic NREN community and our international partners.

Inspiring Workplace

The NORDUnet workplace shall be characterized by well-motivated personnel that are continuously encourage staff in participating in personal and professional development. NORDUnet encourages an open and flexible workplace with significant personal and professional freedom where individuals take active responsibility for the continuous development of the NORDUnet team and our services towards our customers. NORDUnet has an equal opportunity employment policy where people no matter what race, sex, religion etc. can be employed measured solely on their personal and professional capability of contributing to the NORDUnet Nordic Team and the goals of the NORDUnet organization.

Efficiency

as a Nordic provider of Network and eInfrastructure services NORDUnet shall always strive to maximize the utilization of all NORDUnet resources.

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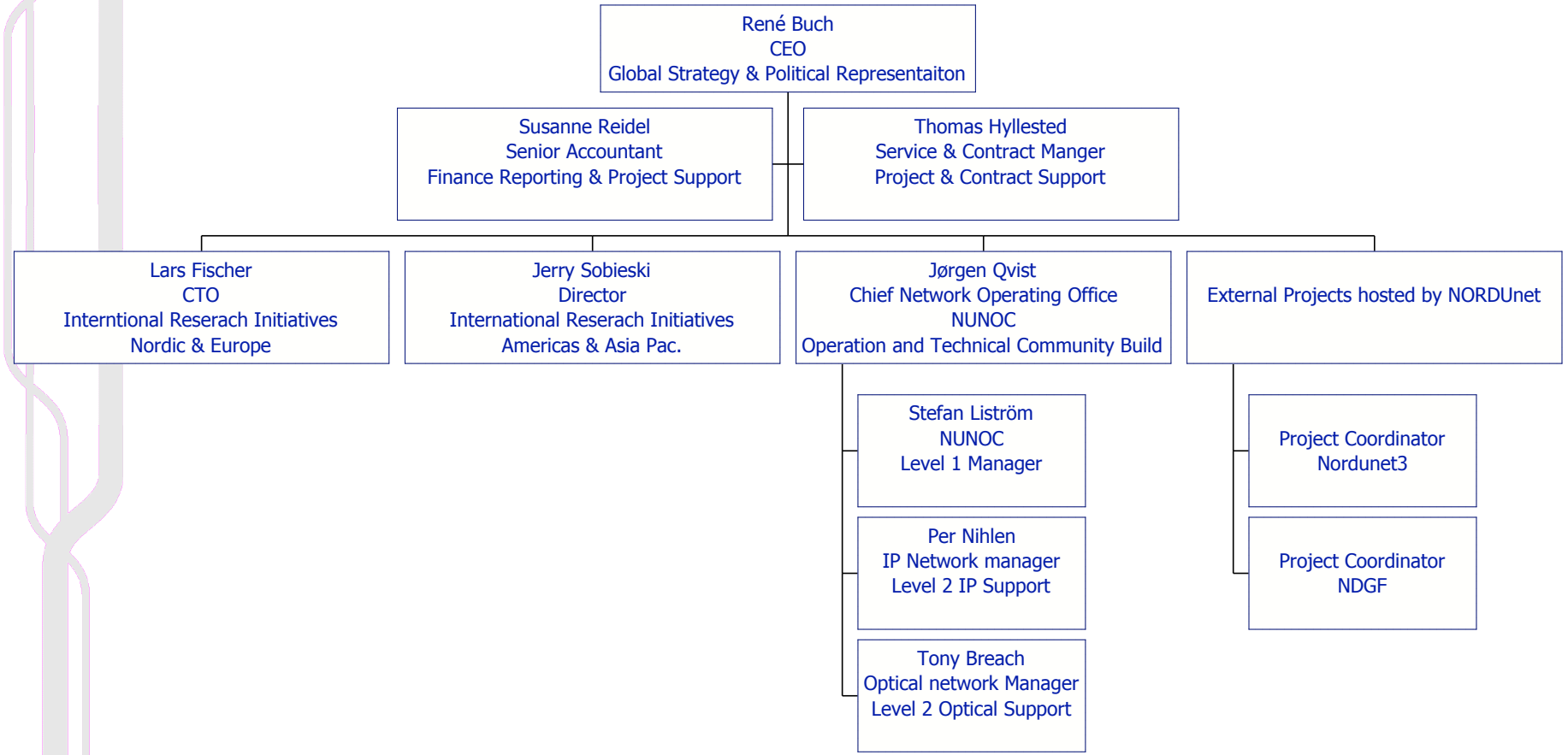
NORDUnet Key Contact Point



http://www.nordu.net/ndnweb/the_nordunet_team.html

NORDUnet Projects
A couple of examples

Example 1: Global HD transmission

- Medical Media HD Live Transmission
  - From Seoul, Korea to Trondheim, Norway
  - Test technologies for HD live medical surgery transmission
  - Viewing laparoscopy surgery in High Definition Video enable doctors to collaborate, learn, and see details normally not available
- Video Streaming
  - 800 Mbps, low jitter required
  - Dedicated 1 GE link Norway – Korea provide by collaboration in GLIF

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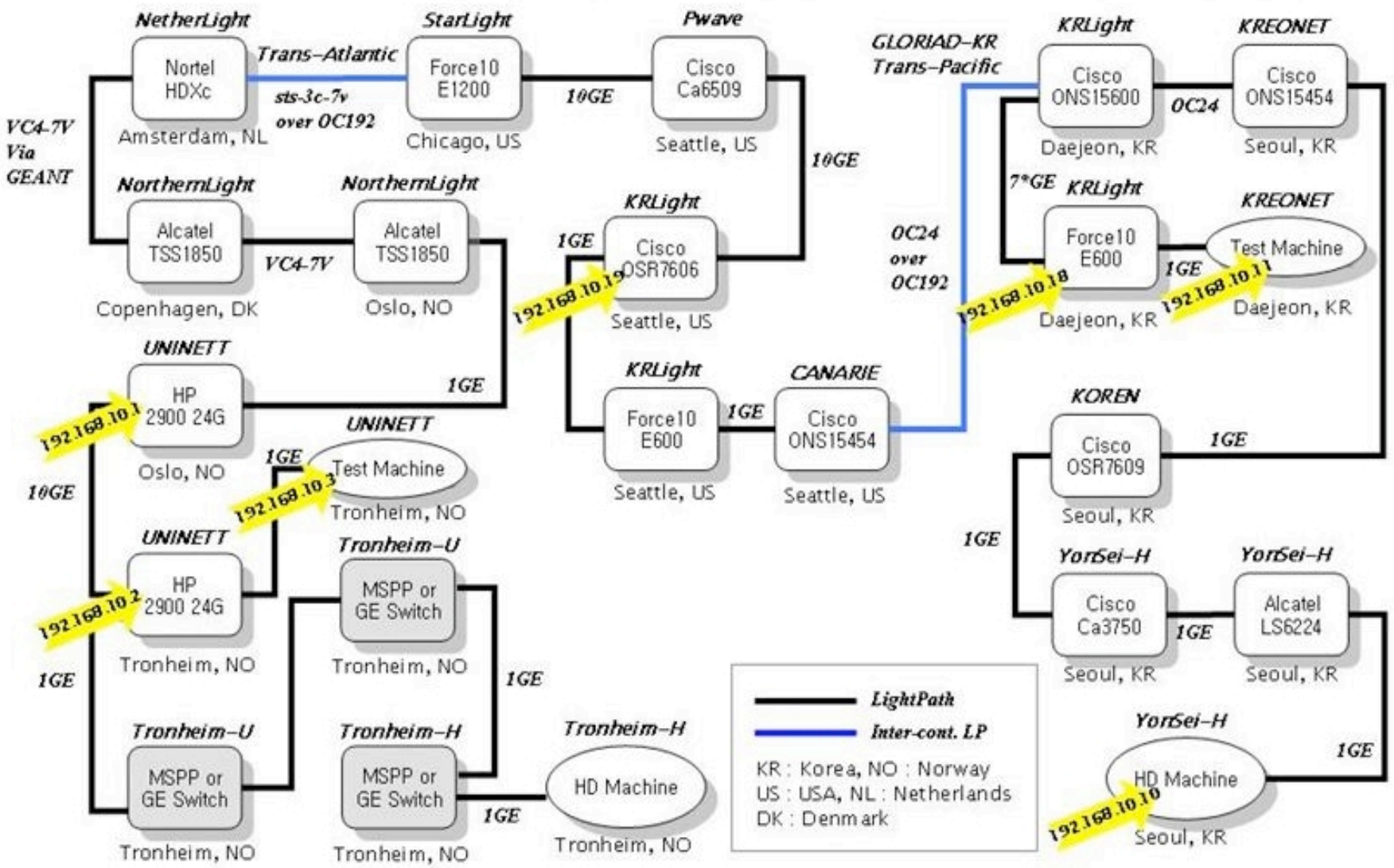
The Network



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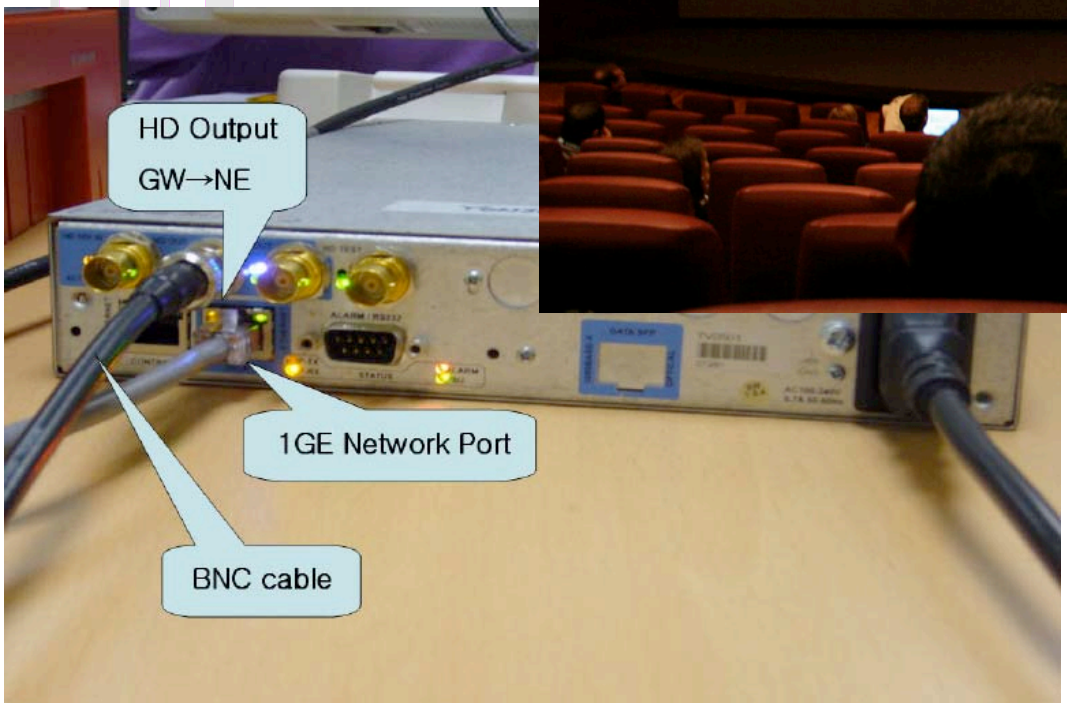
The Results



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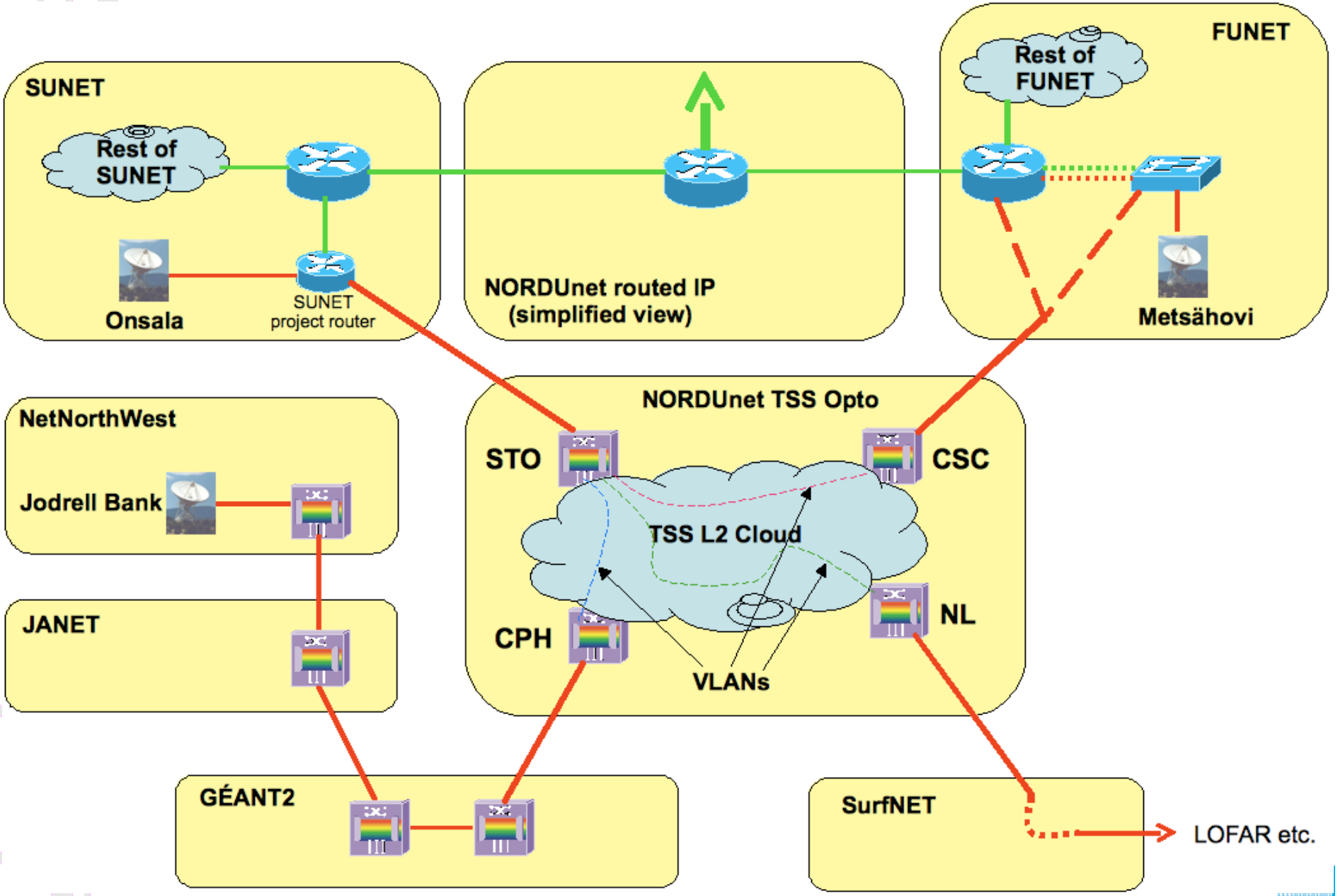
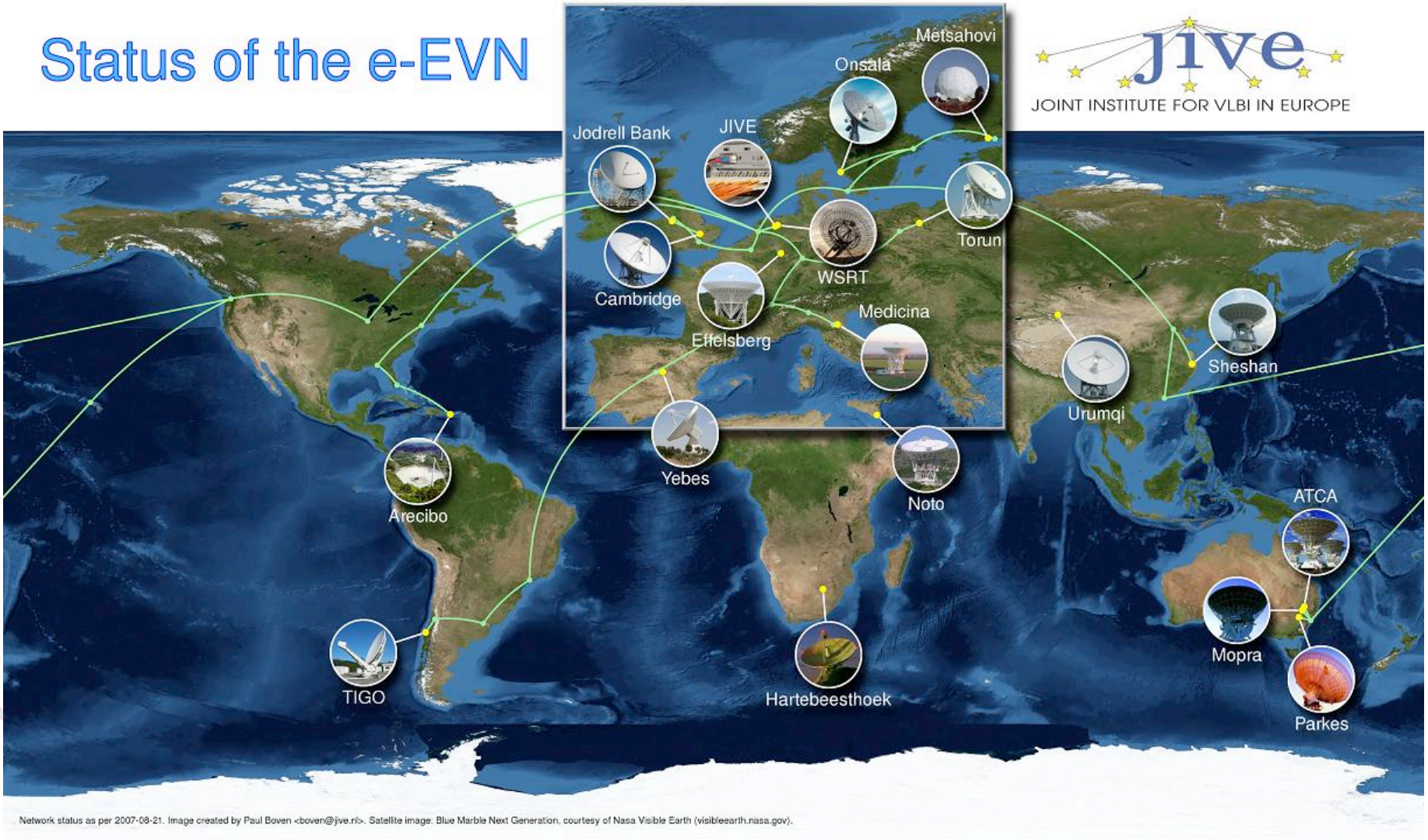
Example 2: Nordic Astronomy OPN



e-VLBI

Status of the e-EVN



jive
JOINT INSTITUTE FOR VLBI IN EUROPE

Example 3: Live 4k video Streaming

- Collaboration between KTH and Keio University, Japan
- Challenge
  - Stream the Kyoto price ceremony, live, from Kyoto to Stockholm, using 4k video (Nov. 2007)
  - Use Sony projector, NTT encoder / decoder
- 4k video – cinema quality
  - 4096 x 2160 pixels – 4x HDTV 1080p
  - Uncompressed 4k = 8.6 Gbps
- 10G circuit provisioned in two weeks
  - GLIF resources, GOLE-to-GOLE
  - Across Pacific, North America, Atlantic, N. Europe

NORDUnet IPTV Trial

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NORDUnet IPTV Background

- Analogue and is discontinued on many places.
- Customers looking for alternatives, Sat & IPTV
- Utilize NORDIC Wide distribution network for TV / Content Distribution
  - Step one: IPTV
  - Step two: Content on demand
- Gain Experience with respect to technical & political issues relating to TV / Content distribution.
- Test NORDUnet Multicast Capabilities
- Project Start Q1 – 2008 Was intended for local NORDUnet experience gathering but significant Nordic Interest.

Lessons Learned

- Geographical Rights paradigm
- Vendor used to small Neighbor networks
- Many vendors have base in TV not in Networks.
- Limited vendor skill set on large Public IP based networks.
- Multiple Network paradigms
- HW versus SW Client
- Encryption

- JANET, Canarie & US in Front
  - http://www.inuknetworks.com/janet.html
  - http://www.freewire.co.uk

NORDUnet Friends do IT !

JANET / UKERNA

Inuk has a background of developing solutions around the student and academic market.

It is through this background that the power of UKERNA's JANET network became apparent. JANET is the network dedicated to the needs of education and research in the UK.

In July 2005 Inuk and UKERNA reached an agreement to launch an IPTV trial over the JANET backbone. A number of UK universities are now part of a live trial of the Inuk service over JANET, with a view to launching full services in September 2006.

- Over 16 million end users
- Fully multicast enabled
- Downstream speeds of 8Mbps+
- Student accommodation does not commonly provide for either analogue or digital TV
- Digital Switchover will mean indoor aerials become even poorer
- Around 500,000 University hall residents will be able to receive the IPTV feeds

Network Evolution Trends

Optical Networking Trends

- Federated networks built from NREN facilities:
  - Cross Border Fibers
  - Lightpath Exchanges
- Collapsed backbone topology
- Dynamic Circuit Networking
  - From static configurations to tunable lasers and filters
  - Wavelength Selector Switches for flexible routing of entire lambdas in the optical domain
  - Alien waves – for inter-domain lambdas
  - Dynamic configuration that allows control plane systems to alter lambda routes “on the fly”
- Transmission:
  - Multi-domain WSS 40G,
  - 100G trials
- Virtualization (logical routers, service oriented middleware, cloud computing ..)

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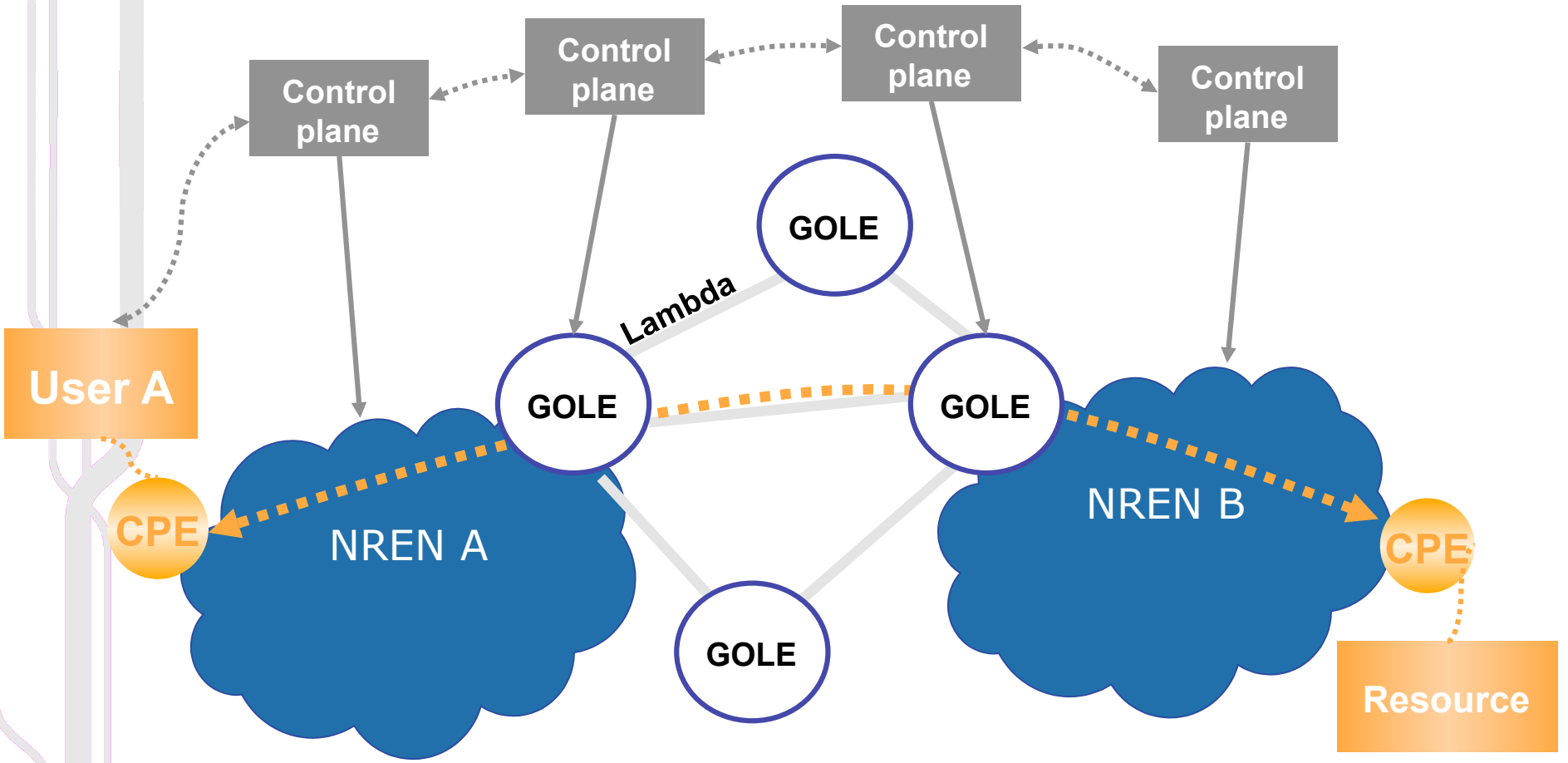
The Federated Challenge



GEANT 2

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Nordic Efforts in GN2

- Introduction of hybrid networking
  - NORDUnet, national networks
- Nordic contributions to
  - PerfSONAR - UNINETT
  - Eduroam – SUNET, Forskningsnet
  - EduGAIN – SUNET, UNINETT, CSC
    UNINETT award for simpleSAMLphp
  - Participation by NRENs, coordination through NORDUnet
- 8,5 Mann Year Equivalent
- Funded by NRENS and EU (APPROX 45%)

GN2 - It's political

- 30+ countries collaborating
- The centralists vs. the collaborators:
  - Different priorities,
  - Different ambitions,
  - Different economies,
  - Different strategies,
  - Different tradition,
- Resulting in constant conflict and compromises
- Substantial funding from the EC:
  - To entice collaboration and bridge to the digital divide
  - But for how long ?

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NREN Changes during GN2

- NREN Paradigm shift
  - European NREN's Switched form Leased capacity to NREN owned dark fibre in many European countries
  - NREN owned cross-border fibre
  - NREN owned international connections
- GN2 is now a parallel infrastructure in many regions.

GEANT 3

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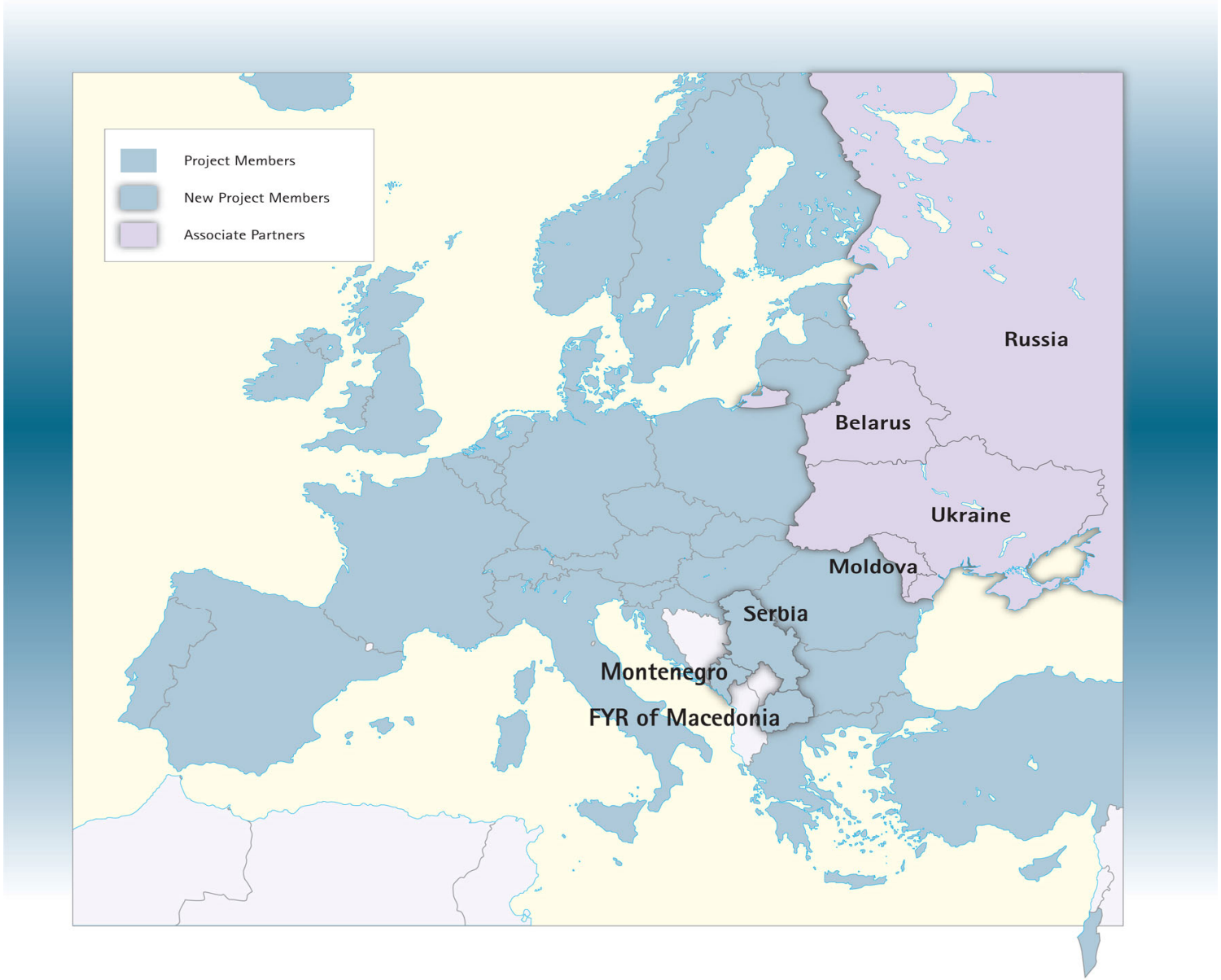
GN3 Consortium



GN3 Vision

- To create an innovative multi-domain hybrid networking environment, using advanced transmission & switching technologies
- To enable R&E users through their Organizations with flexible and scalable production quality services via their constituent NRENs
- To be an enabler for Global R&E networking supporting international e-Science initiatives, creating a Global Virtual Village to house researchers & educators around the world
- To contribute to standards as a key participant in European & Global efforts towards the Network of the Future

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White paper highlights

- Innovative multi-domain hybrid networking infrastructure
- Coordinated user services: seamless access to services, computing, storage across multiple domains, identity management, mobility.
- Multi-domain nature: services must be established across confederate (loosely couple) domains: Campuses, NRENs, and International.
- Collaboration and Federation: use of NREN resources, work closely with GLIF, open exchange points international peers
- Networks of the future: facilitate development and experimentation, testbeds, testing transmission and switching technology, novel multi-domain services and protocols.
- Strong NREN involvement: lead by NRENs, executed by NRENs
- Bridging the digital divide, advanced and affordable services for all of Europe

See the entire document at wiki.nordu.net

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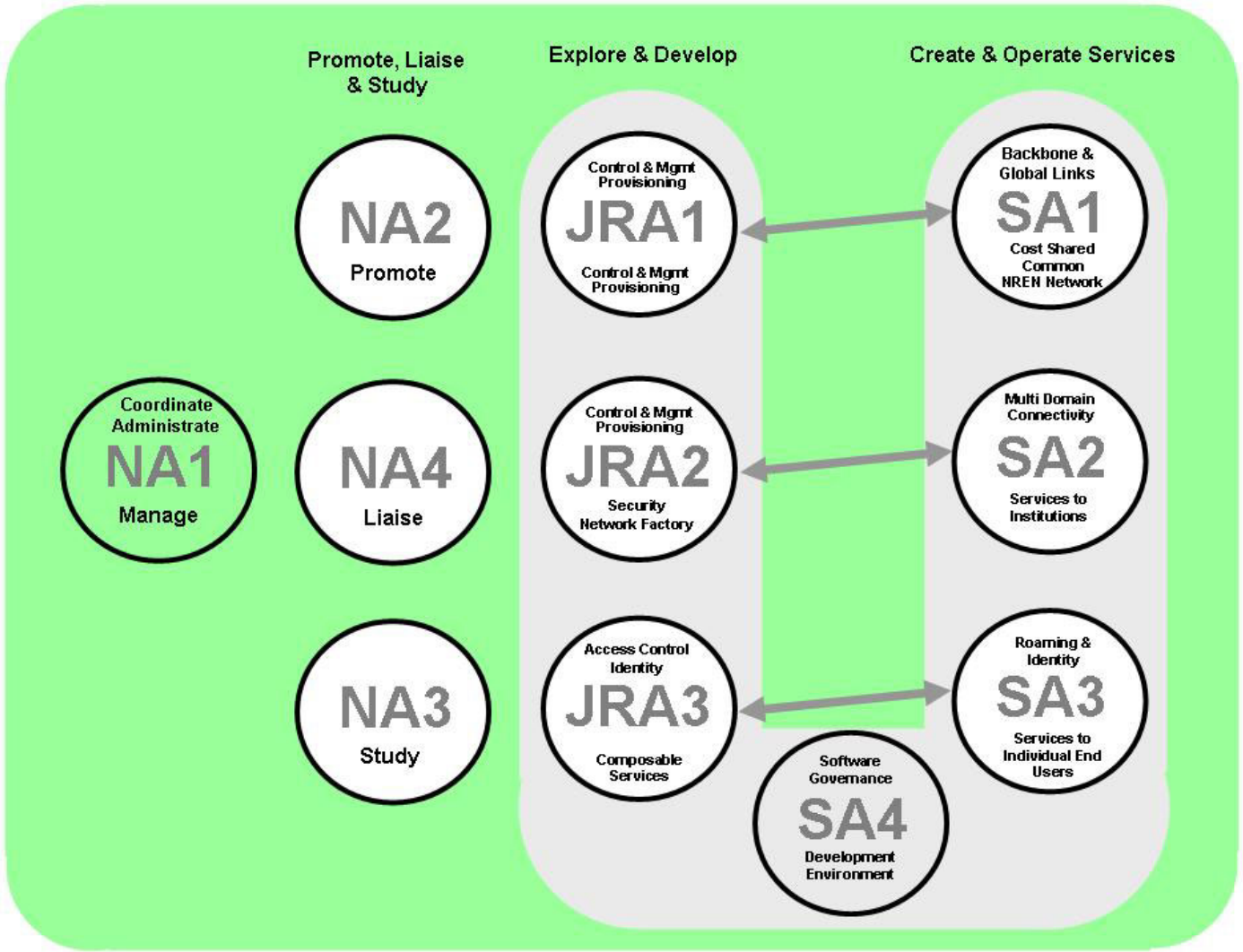
GN3 Proposal Structure



NA's: Networking Activities

SA's: Service Activities

JRA's: Joint Research Activities

GN3 Network Architecture

- GN3 will initially use GEANT2 while developing a new network architecture
- GN3 network architecture workgroup to be formed in late October 2008, and deliver first report in February 2008.
- Work to take into account experience from GN2, international experiences, recent technology developments
- Architecture to stress cost efficiency, use of NREN resources, collaboration, federation

Nordic contributions

- Stronger role than for GN2
  - NRENs and NORDUnet
- Contributions to:
  - Optical networking, technology trials
  - Hybrid networking, development and deployment of provisioning platform, inter-domain facilities
  - Roaming, Identity management
  - Network monitoring & measurement
  - Campus best practice initiative
  - Environmental Impact initiative
- A total of 46 man-years over 4 years
  - One of the largest partner contributions

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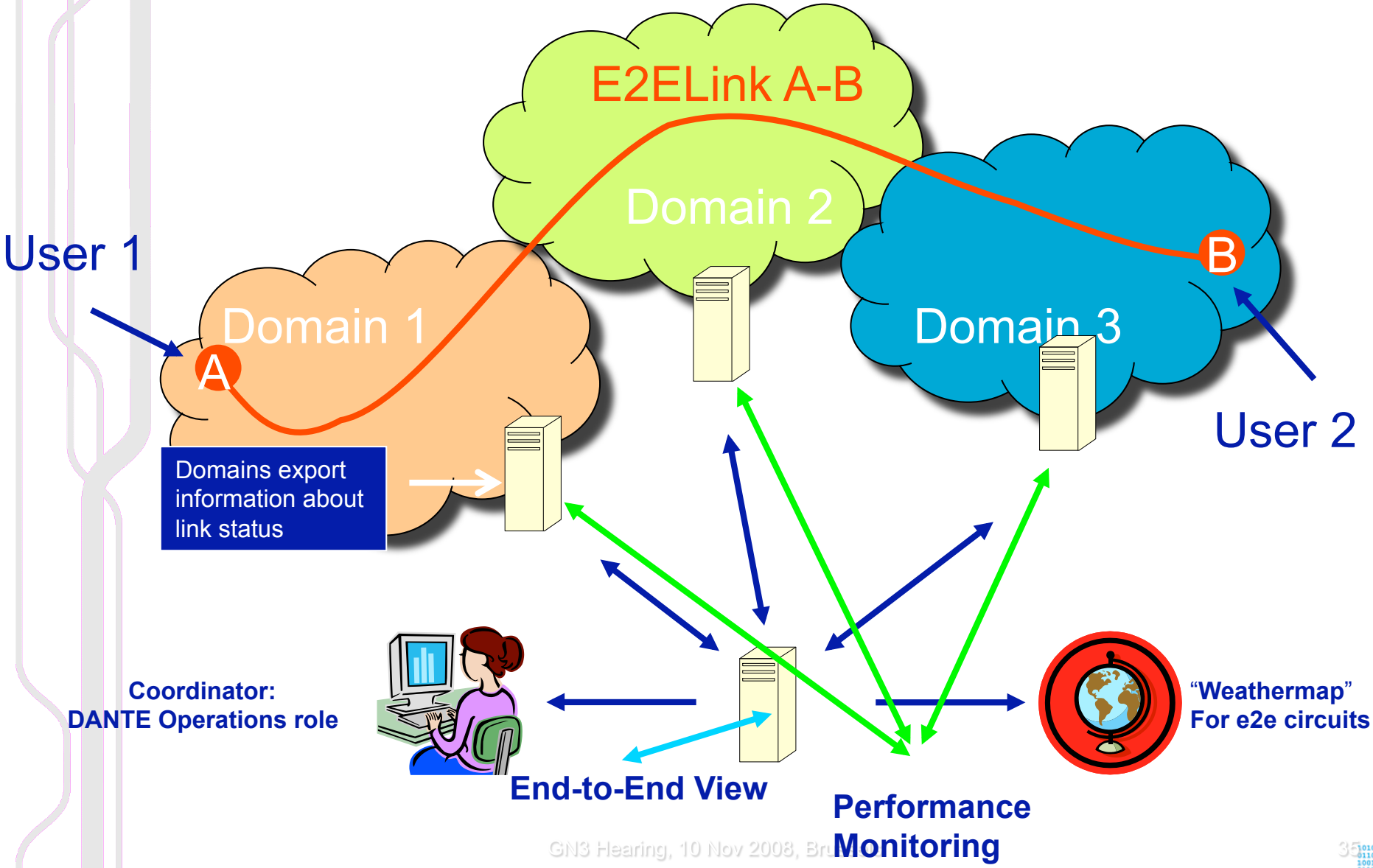
GN3 Multi-Domain Challenges



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Prepare for the future

- Extend the NREN & GÉANT service model to provisioning of e-Infratructure for R&E:
  - Multi-domain hybrid networking services
  - Virtualization of computing and network resources
  - Storage & computing services
- Converging e-Infrastructures
  - Relationship with Grid, HPC, Cloud computing
  - We may have different technologies and multiple organizations, but users are expecting a single, coherent, European infrastructure
  - Provide foundations: connectivity, network management, network provisioning, mobile access, identity management

Other EU PRojects

EU Funded Projects

- **TEIN2**

  The TEIN2 project began in spring 2004, with the objective of improving research and education IP connectivity between Europe and the Asia-Pacific regions, and within Asia-Pacific for the benefit of developing ASEM countries. Demand for the initiative was clearly established by the high use of the original Trans-Eurasia Information Network link between Korea and France (known as TEIN1), which was upgraded to 34Mbps and then to 155 Mbps to meet demand.

  TEIN2 is largely funded by the European Commission, and supported by a number of Asian and European partners. After planning studies and a major procurement programme, the first links came into service in December 2005. The network was fully deployed during the first half of 2006.

- **ORIENT**

  ORIENT is a collaborative Sino-European project to connect the research and education networks of China and Europe.

  Jointly funded from China and Europe, the project has procured and currently operates a high capacity data-communication link between the pan-European GÉANT2 backbone network and Chinese research and education networks.

- **EUMEDCONNECT:**

  The EUMEDCONNECT project is a pioneering IP research network within the Mediterranean region, linking Mediterranean and North African countries to each other, and to the pan-European GÉANT2 network.The infrastructure provides an international backbone dedicated to research and other non-commercial purposes.

  It is linking national research centres and institutions in the region with over 3,500 research and education establishments in Europe, and other regional research communities worldwide.The Mediterranean partners in the EUMEDCONNECT project are Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, the Palestinian Authority, Syria, Tunisia and Turkey. The European partners are France, Greece, Italy and Spain.

NORDUnet Outreach

NORDUnet Outreach

- International Research Initiatives
  - GENI – http://www.geni.net/
  - CINEGRID – http://www.cinegrid.org/
  - DCN (Internet2)
  - Fenrir (Mainly NSF Funded)
  - TAJ (Mainly NSF Funded)
  - 40 Gbit Long Distance trials
- Workshops:
  - DCN – For Management
  - DCN – For Techies
  - Autobahn

International Research Initiatives

International Research Initiatives is focusing on:

- Being the main driving force in expanding the International Research Collaboration between the Nordic Countries and global key Research Initiatives and evangelizing the achievements of the Nordic NREN Community and the benefit of working with NORDIC Scientists.
- Knowledge Transfer
- Working with global partners facilitating potential projects, contacts and research initiatives to the Nordic NREN community within:
  - eInfrastucture
  - Global Network integration and Network Provisioning Research
  - GRID
  - AAI
  - eScience
  - Astronomy
  - High Energy Physics
  - Environmental Research

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