GN3

Next Generation Network in Europe

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SUNET TREFpunkt

15 October 2008

- There is no network – only a project proposal

- Handed in to the EC on 11 September 2008

- Project to start in February-March 2009

- No feedback yet – we don't really know

- GEANT2 network to live until we know more – and for first part of GN3 effort, too

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- 3-tier Federal Architecture
  - Campus Networks: > 3,500 Institutions, > 30 M Users
  - 34 NREN's
  - Pan-European Network: GEANT
- Funding
  - Partly subsidized by EU, national funds
  - 50% funding for GEANT - < EU <10% of total
- Organizations for collaboration
  - TERENA: loosely coupled collaborations, best practice, working groups, exploring ideas, annual conference
  - DANTE: operate network infrastructure, manage GN projects

European Network projects

- A history of European interconnect networks and related projects

  – TEN34, TEN155, GÉANT, GÉANT2, GÉANT3

  – EU funding from (5-year) *Framework Programs*. Each program can fund a project (that creates a network)

  – FP-5 funded GN1 (that created GÉANT), FP-6 funded GN2, FP-7 to fund GN3

- GN2 project is a consortium of NRENs

  – Governance: NREN Policy Committee

  – Management: DANTE, Executive committee

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GN2 Members

1. Austria (**ACOnet**)
2. Belgium (**BELNET**)
3. Bulgaria (**BREN**)
4. Croatia (**CARNet**)
5. Czech Republic (**CESNET**)
6. Cyprus (**CYNET**)
7. Germany (**DFN**)
8. Estonia (**EENet**)
9. France (**RENATER**)
10. Greece (**GRNET**)
11. Hungary (**HUNGARNET**)
12. Ireland (**HEANet**)
13. Israel (**IUCC**)
14. Italy (**GARR**)
15. Latvia (**LATNET**)
16. Lithuania (**SigmaNet**)
17. Luxembourg (**RESTENA**)
18. Malta (**UoM**)
19. Netherlands (**SURFNET**)
20. Nordic Countries – Denmark, Finland, Iceland, Norway, Sweden (**NORDUnet**)
21. Poland (**PSNC**)
22. Portugal (**FCCN**)
23. Romania (**RoEduNet**)
24. Russia (**JSCC**)
25. Slovakia (**SANET**)
26. Slovenia (**ARNES**)
27. Spain (**RedIRIS**)
28. Switzerland (**SWITCH**)
29. Turkey (**ULAKBIM**)
30. United Kingdom (**JANET**)

PLUS NON-VOTING MEMBERS:

Delivery of Advanced Network Technologies to Europe Ltd. (**DANTE**)

Trans-European Research & Education Networking Association (**TERENA**)

PERMANENT OBSERVERS: CERN, AMRES, MARNET

Why a European network?

- Enable European scale e-Science projects
- Bridge the digital divide, in Europe and globally
    - Ensure coverage for users in all of Europe
    - Enable collaboration throughout Europe
    - e-Infrastructures as equalizers
- Stimulate joint network research, promote European evaluation and deployment of novel concept evaluation
- Cost effective through collaboration
    - Ubiquitous IPv4 & IPv6
    - Global R&E connectivity
    - European e2e lightpath service

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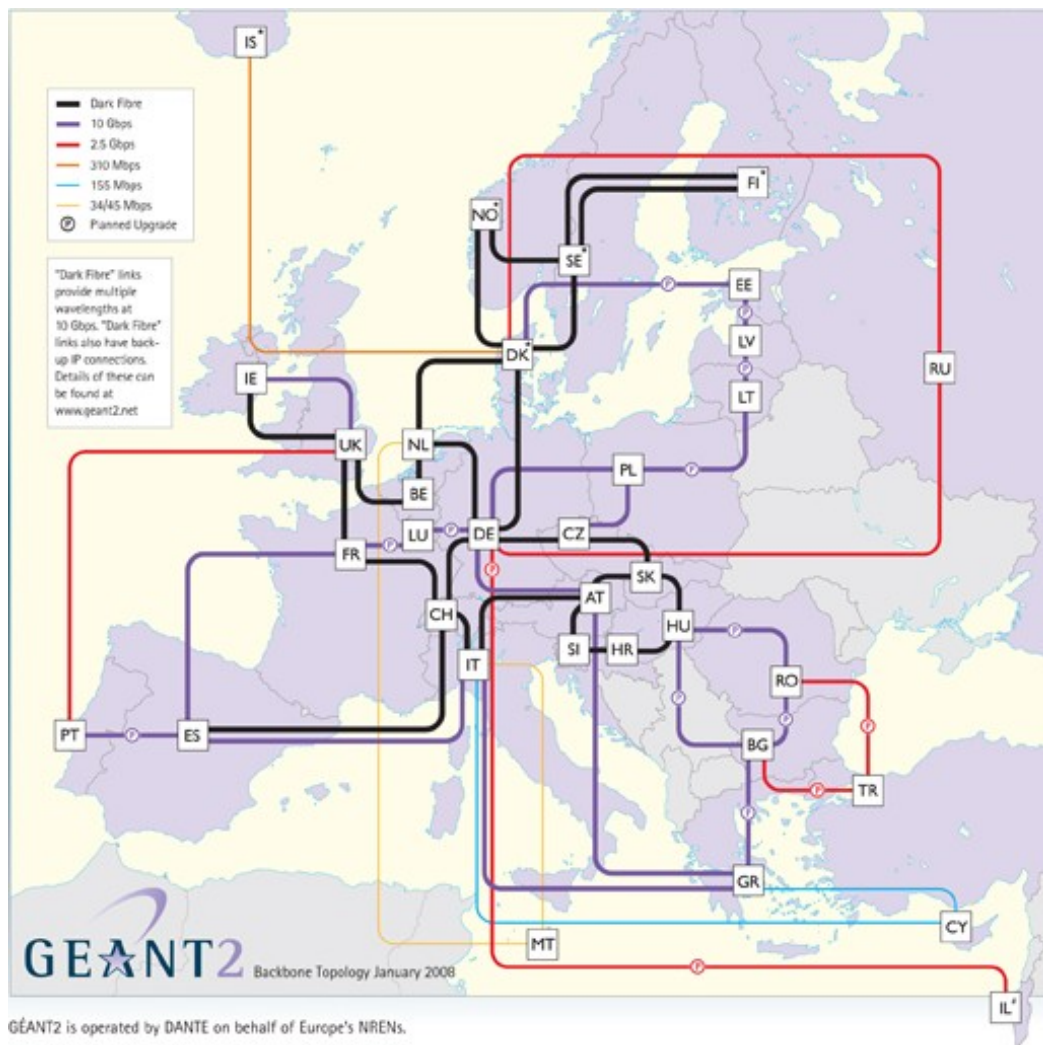
- 15+ NREN's interconnected with dark fibre + DWDM platform

- Remaining NREN's connected to optical cloud using leased circuits and SDH.

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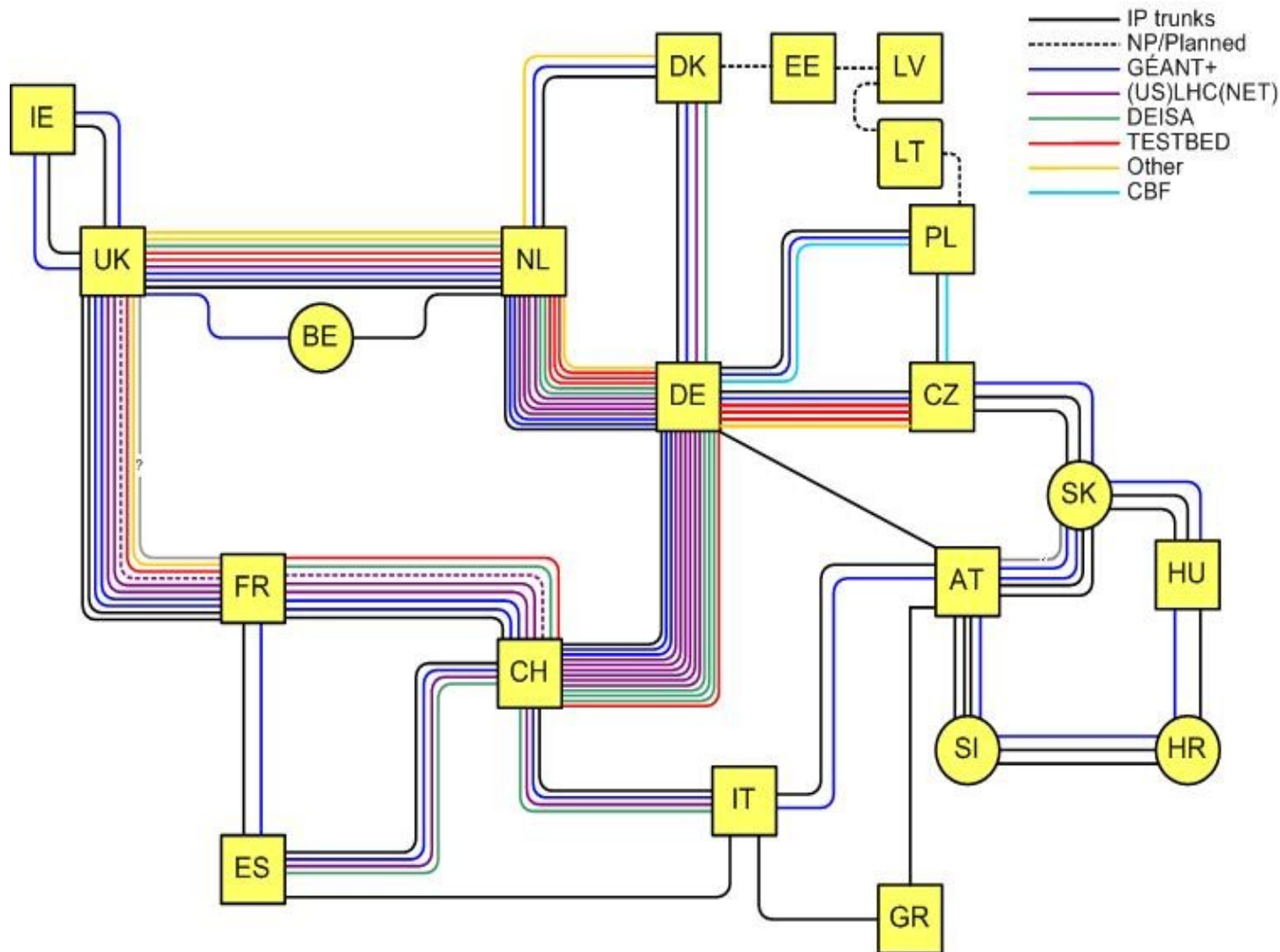Nordic infrastructure for Research & Education
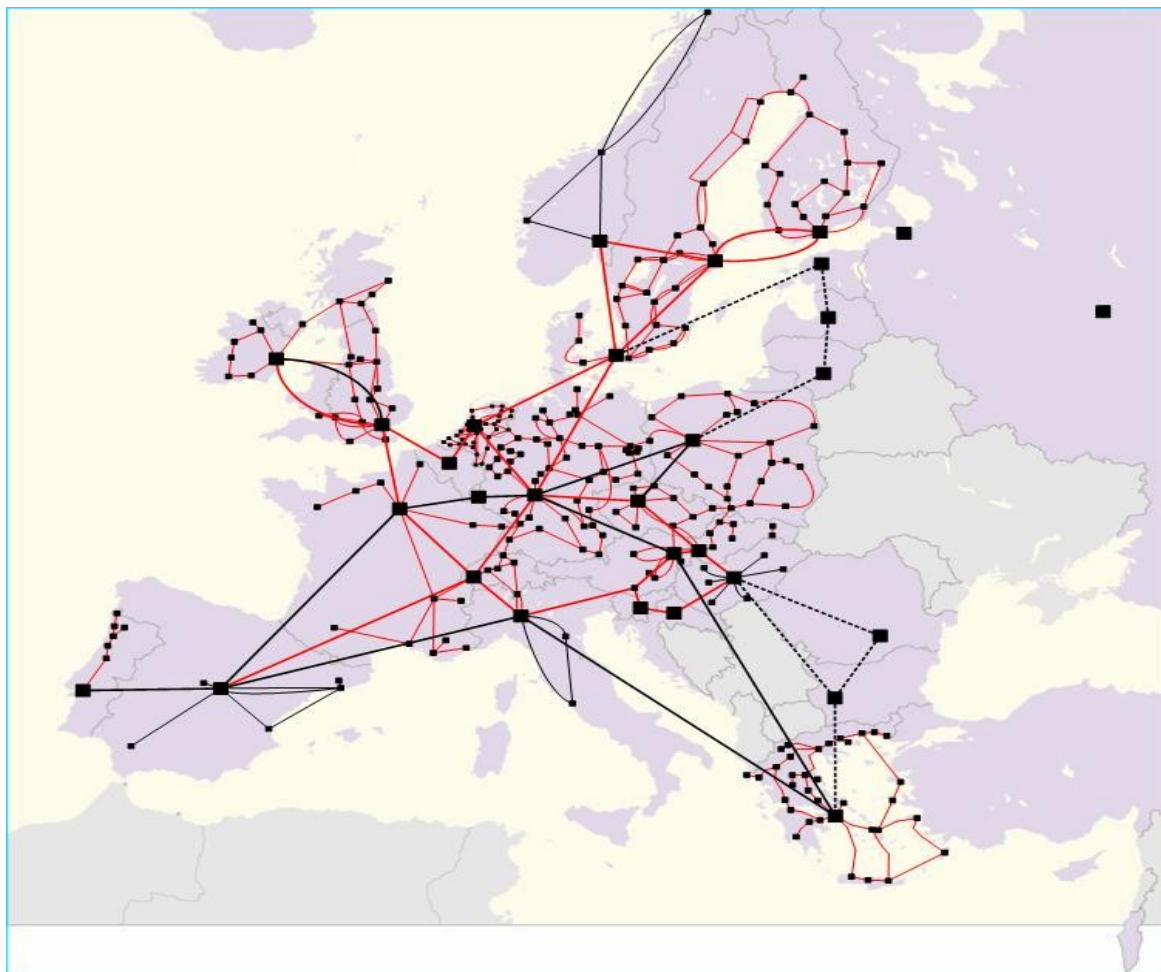
- 10G footprint of European R&E Networking community

- Enables Hybrid Networking and end-to-end lambda networks for e-Science

From DANTE study, March 2008

March 2008 (Hans Döbbeling, DANTE)

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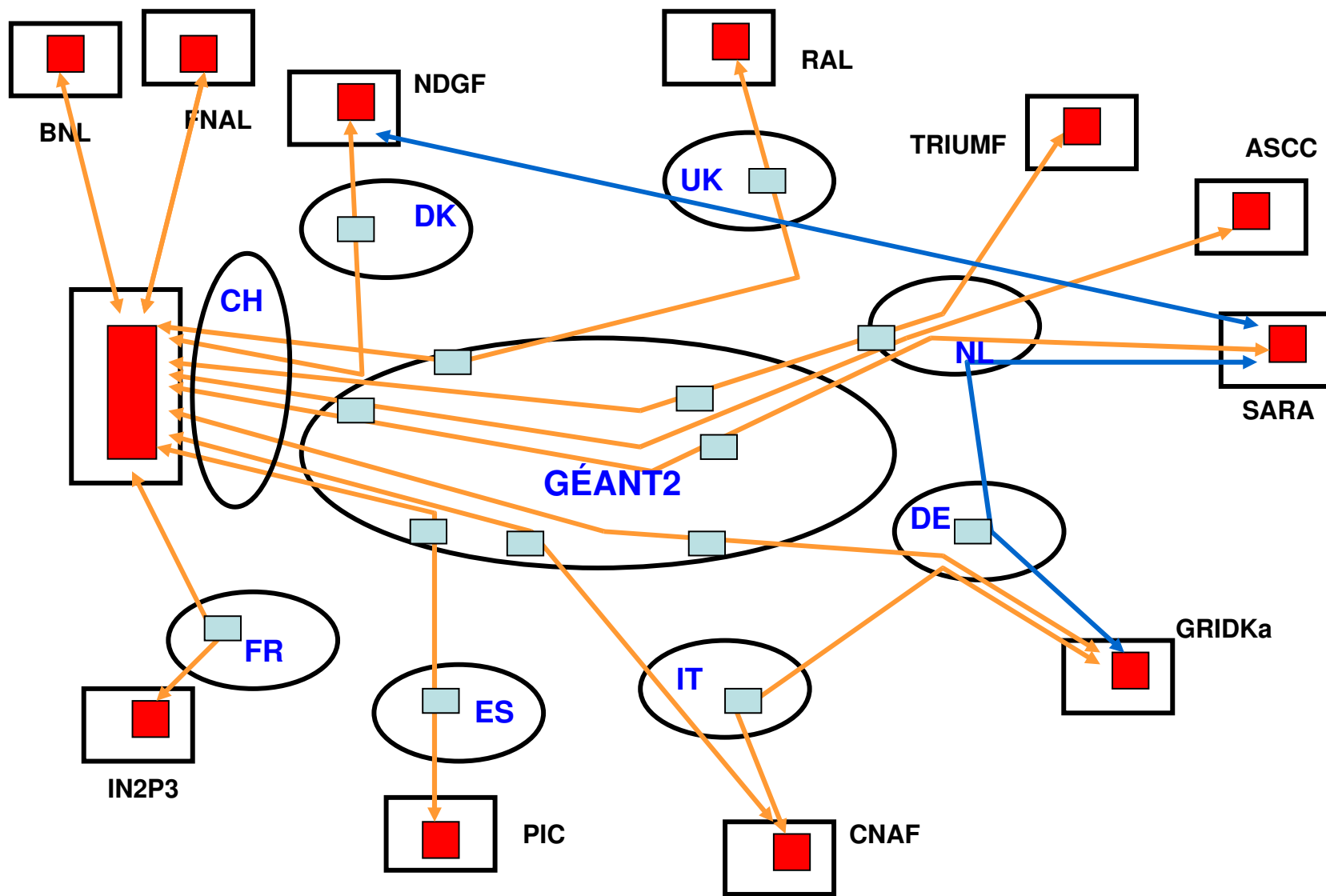
- Infrastructure
  - Dark fibre footprint in western Europe
  - Deployment of DWDM optical networking platform
  - Deployment of SDH/SONET partial wave and circuit switching platform
  - IP network on top of own L1 / L2 network
  - Baby steps towards cross-border fibre support
- Service introduction
  - European lambda service - full and partial wave
  - Manual setup, delivery time: weeks
- Key result for GN2, major improvement from GN1

- A number of JRA's, of uneven quality
  - Collaboration of many NRENs
  - Joint NREN – EU funding
- Highlights
  - End-to-end lambda provisioning: AutoBAHN. Platform developed, demonstrations. Inter Domain Communication trials with Internet2.
  - Measurement & Monitoring: PerfSONAR. Network capability measurement, topology visualisation, etc. Joint project with Internet2.
  - AAI: eduroam (support for roaming users), eduGAIN (identity management)
  - PERT – performance issue response

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- Introduction of hybrid networking
  - NORDUnet, national networks
- Strong Nordic contributions to
  - PerfSONAR - UNINETT
  - Eduroam – SUNET, Forskningsnet
  - EduGAIN – SUNET, UNINETT, CSC UNINETT award for simpleSAMLphp
  - Participation by NRENs, coordination through NORDUnet

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- **Initiated September 2007 with two task forces**

- GN3 Membership Committee

  - Artur Binczewski (*PSNC.PL*), Thomas Brunner (*SWITCH.CH*), Dai Davies (*DANTE*), Jan Gruntorad (*CESNET.CZ, Chair*), SabineJaume-Rajaonia (*RENATER.FR*), Karel Vietsch (*TERENA*)

- **GN3 High Level Technical Strategy**

  - Erik-Jan Bos (*SURFNet.NL*), Mauro Campanella (*GARR.IT*), Hans Döbbeling (*DANTE*), Lars Fischer (*NORDUNet*), David Foster (*CERN*), Vasilis Maglaris (*NREN PC, Chair*), Dorte Olesen (*TERENA*), Roberto Sabatino (*DANTE*), Afrodite Sevasti (*GRNET.GR*)

Preparation Documents

- Rules of membership, categories (December 2007)

- Green Paper (March 2008)

  - Consultation with NRENs for requirements and wishes for GN3

- White Paper (July 2008)

  - GN3 vision and strategic objectives

  - Based on Green paper, TERENA EARNEST study of next-generation technology, input from NRENs and international partners, discussion of the Technical Strategy Committee

  - http://www.geant2.net/upload/pdf/GN3-08-034-GN3-White-Paper_20080808173508.pdf

- 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 coupled) administrative domains: Campuses, NRENs, and International interconnections.

- Multi-domain requirements of e-Science: international circuit stitching, automated provisioning, distributed monitoring infrastructure

- 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, interconnecting wireless and sensor networks

- Strong NREN involvement: lead by NRENs, executed by NRENs

- Bridging the digital divide, advanced and affordable services for all of Europe

GN3 Consortium

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Project Members
New Project Members
Associate Partners

Russia
Belarus
Ukraine
Moldova
Serbia
Montenegro
FYR of Macedonia

- GN3 Proposal Review Board established by the NREN PC to
  - integrate work of the 2 committees in accordance with NREN viewpoints
  - create a joint, coherent proposal
  - create a workable project structure
  - agree on activity leaders for main activities
- Proposal to be
  - evaluated and approved by all members of the GN3 consortium
 - submitted by 11 September 2008

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

GN3 Proposal Structure
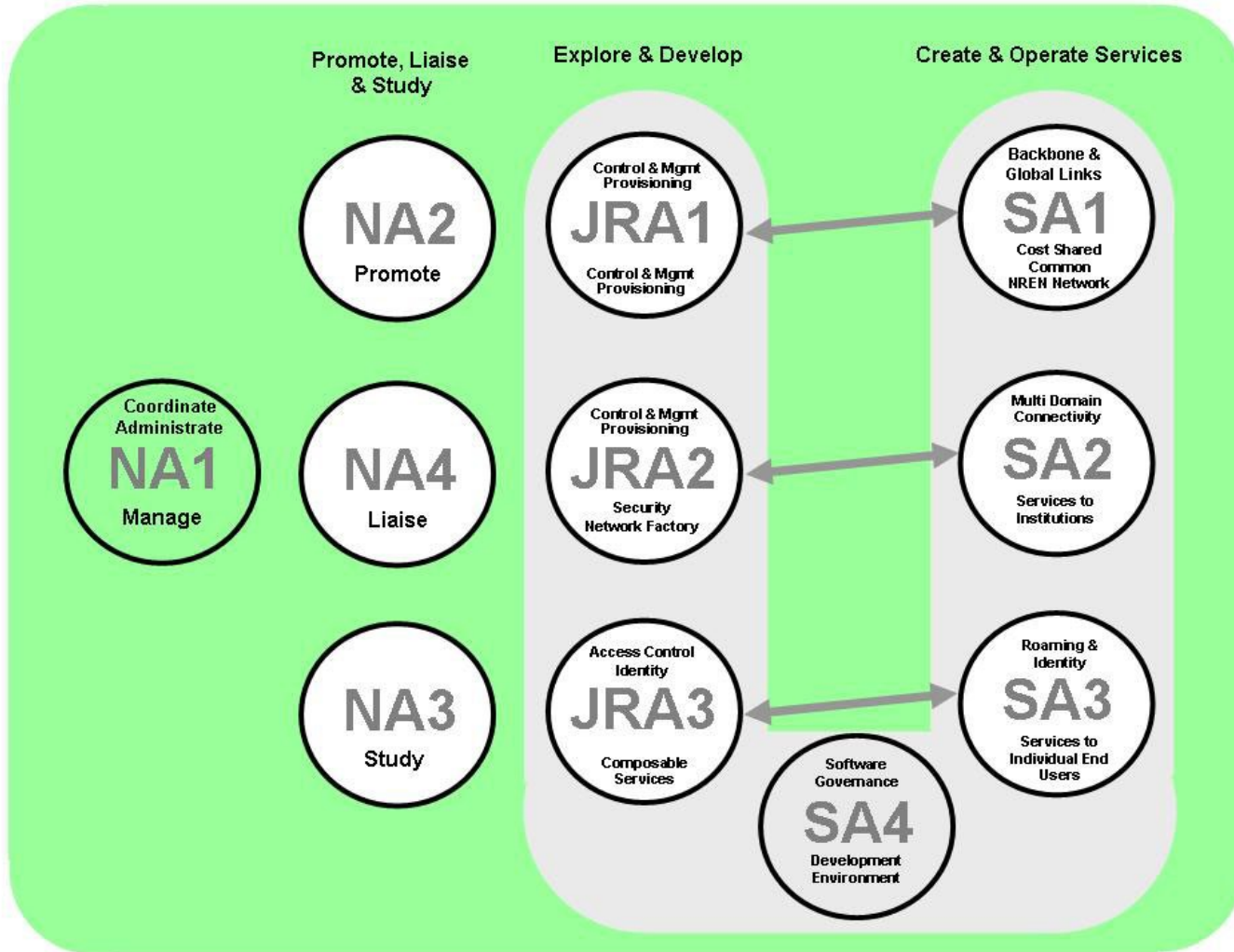
NA's: Networking Activities

SA's: Service Activities

JRA's: Joint Research Activities

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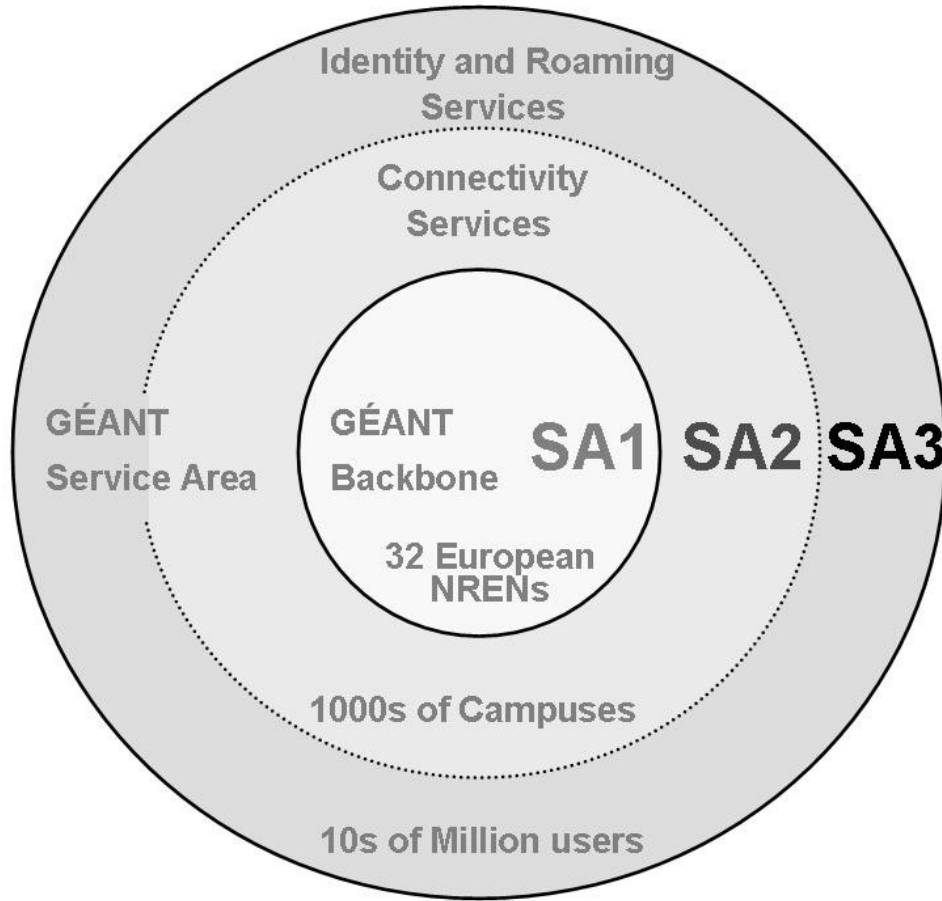
- The GN3 proposal does not detail a new network architecture

- 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

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- Extending the service portfolio to production quality multi-domain hybrid networking

  – Campus, NRENs, GÉANT3, global …

  – Innovate to resolve the current conflicting multi-domain technologies and protocol proposals

- Integrating Control Plane Functionality within distributed computing (GRID, SOA) middleware

- Develop and implement standard inter-domain communication protocols for services and topology. Translate between per-domain representations Work with peers, standards bodies (IETF, OGF, ...)

- Inter-domain control planes is hard: SS7 and BGP only known success stories

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- Distributed ticketing workflows, performance monitoring (*PERT+*)

- Security (incident reporting, anomaly detection)

- Federated Roaming (*Eduroam*), AAI & ID management (*eduGAIN*)

- Multi-protocol monitoring at 10 -100 Gig speeds (*perfSONAR+*)

- End-to-end Provisioning (*E2ECU, Ishare*)

- Automated multi-domain provisioning (*AutoBAHN*)

- All services to reach production quality

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- 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
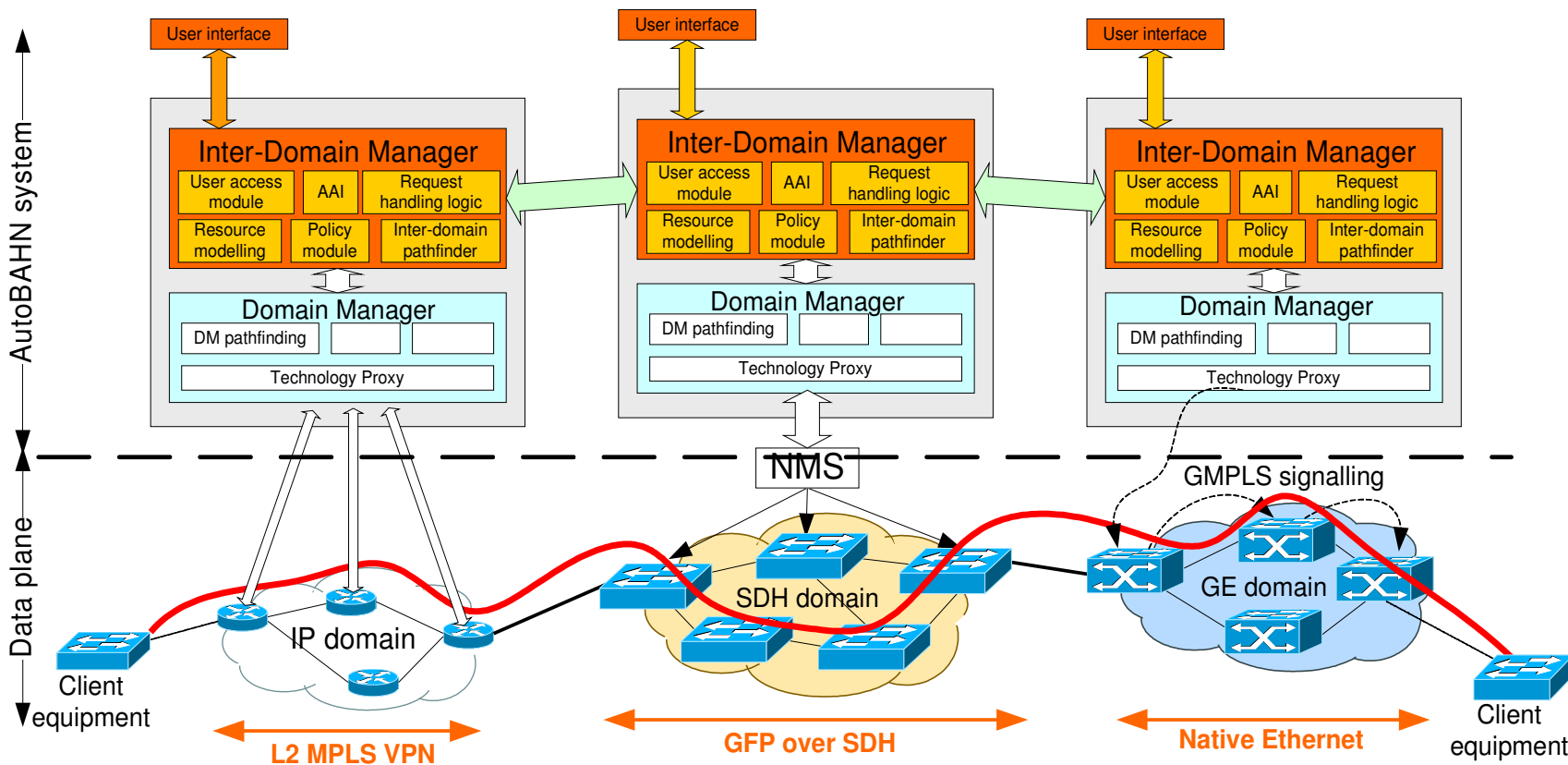
From Afrodite Sevasti (GRNET)

- 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 managemet
  - 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

- Federated E-infrastructures Dedicated to European Researchers Innovating in Computing network Architectures

- FP7 Project

  – NRENs, GEANT2, universities, vendors

  – Coordinator: GARR (Italian NREN)

- Goals:

  – Create 1 Gbps testbed

  – Install open source routers, programmable routers and open API switches

  – Develop tool-bench for managing virtual e2e facilities

  – Provide virtualized facilities to end-users: Research groups on the network of the future, requiring disruptive experiments
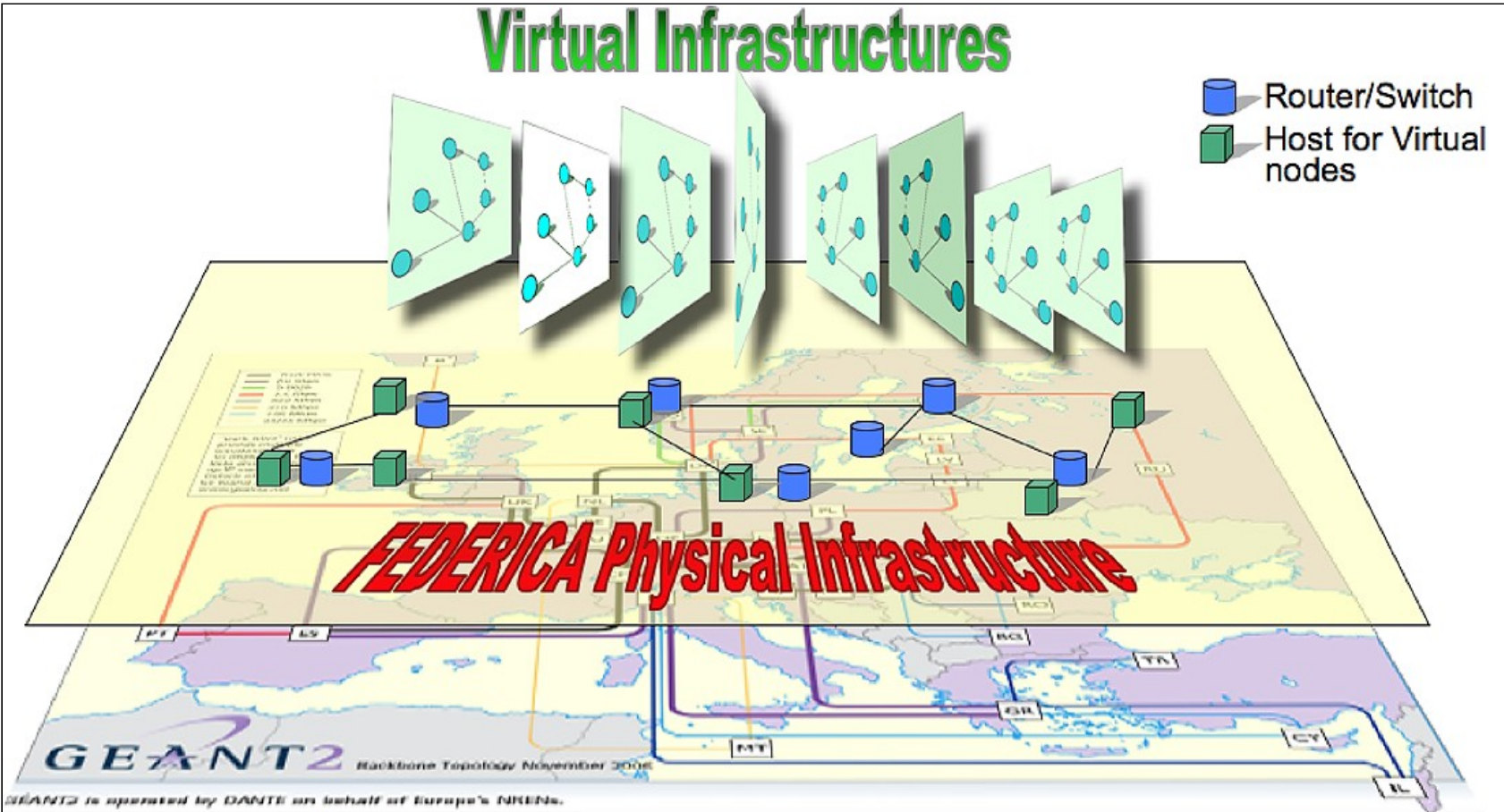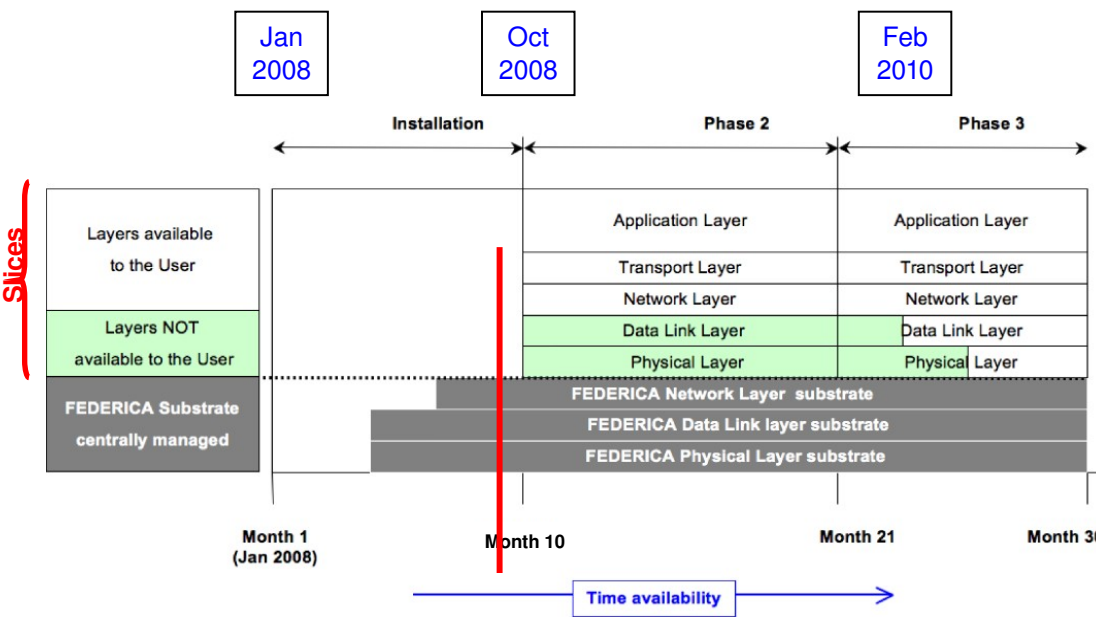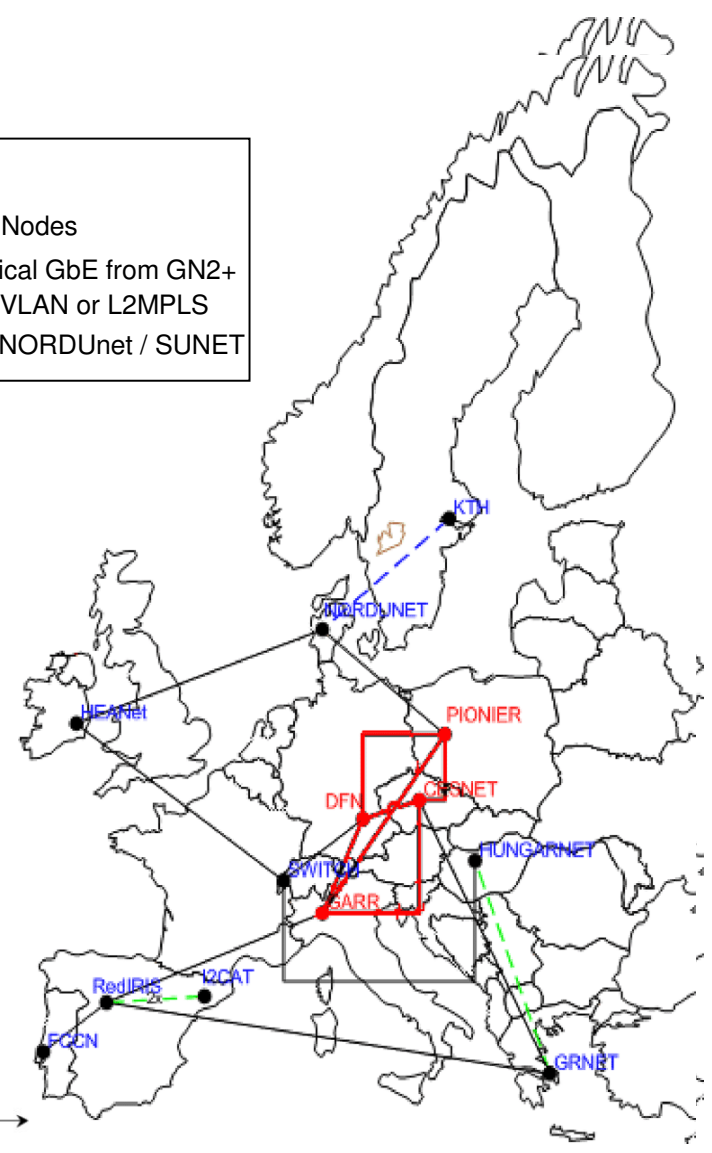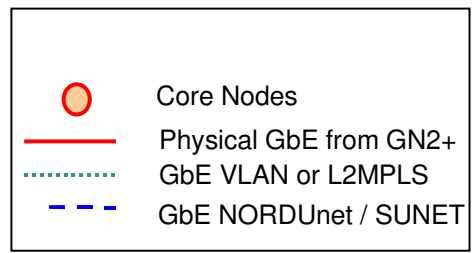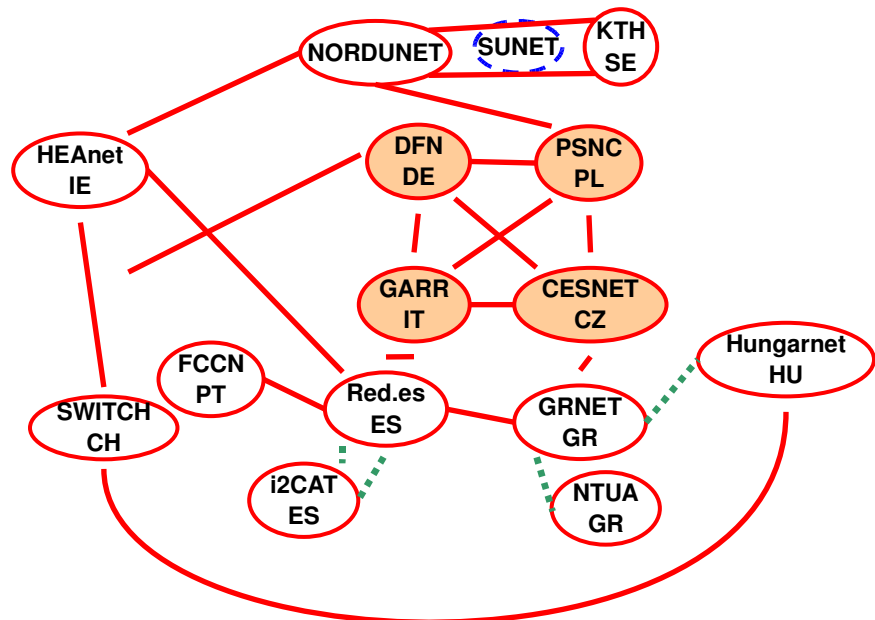
- Terabit hybrid optical networking

- Collapsed backbone topology trends (Carrier Ethernet…)

- Layer 1-2 connectivity to power end-users

- Federated networks built from NREN facilities (Cross Border Fibers, Lightpath Exchanges…)

- Virtualization (logical routers, service oriented middleware, cloud computing…)

- Global role & commitments

  - Service development, standardization
  - Digital divide
  - Connectivity

GE★NT2 At the Heart of Global Research Networking

GÉANT2 Coverage
ALICE-RedCLARA Network
EUMEDCONNECT Network
TEIN2 Network
SEEREN2 Network

GE★NT2
www.geant2.net

TEIN2/ORIENT

SEEREN2

EUMED
connect
www.eumedconnect.net

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TEIN2
www.tein2.net

10 Gbps
2.5 Gbps
622 Mbps
155 Mbps
8-45 Mbps
3 Number of Links

ALICE
America Latina Interconectada Con Europa
www.dante.net/alice

GÉANT2 Global Connectivity November 2006

GÉANT2 is operated by DANTE on behalf of Europe's
research and education networks

DANTE
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★Connect ★Communicate ★Collaborate

European Commission
Information Society and Media

Questions?

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