GÉANT2

Connect. Communicate. Collaborate

# RESEARCH NETWORKS & THEIR ROLE IN e-INFRASTRUCTURES

**Vasilis Maglaris**
*maglaris@mail.ntua.gr*

Chairman, NREN Policy Committee - GÉANT Consortium
Professor, National Technical University of Athens - NTUA

GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***

# A European R&E Networking Model

Connect. Communicate. Collaborate

- Interconnects **34 National Research & Education Networks-NRENs** of the extended European Research Area (ERA)
- Connects more than **3500 Research & Education (R&E) Institutions**
- Serves millions of end-users + ***e-Science* Projects** (e.g. GRIDs) under *Accepted Usage Policy* (AUP) rules
- The model: **A 3-tier Federal Architecture**, partially subsidized by National and EU Research & Education funds:
  - The Campus Network (LAN/MAN)
  - The NREN (MAN/WAN)
  - The Pan-European Interconnection: **TEN34 → TEN155 → GÉANT** (GN1 in FP5) → **GÉANT2** (GN2 in FP6)**: Hybrid Optical Backbone (+ Cross Border Fibers)**

**GN2 EC Subsidy < 10% of total European R&E Networking Cost**

- **Governance:** NREN Policy Committee
- **Project Management:** GN2 Exec, DANTE

GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***

# The NREN PC

Connect. Communicate. Collaborate

Austria (ACOnet)
Belgium (BELNET)
Bulgaria (ISTF)
Croatia (CARNet)
Czech Republic (CESNET)
Cyprus (CYNET)
Germany (DFN)
Estonia (EENet)
France (RENATER)
Greece (GRNET)
Hungary (HUNGARNET)
Ireland (HEANet)
Israel (IUCC)
Italy (GARR)
Latvia (LATNET)
Lithuania (LITNET)
Luxembourg (RESTENA)
Malta (UoM)
Netherlands (SURFNET)

Nordic Countries – Denmark, Finland, Iceland, Norway, Sweden (NORDUNET )
Poland (PSNC)
Portugal (FCCN)
Romania (RoEduNet)
Russia (JSCC)
Slovakia (SANET)
Slovenia (ARNES)
Spain (RedIRIS)
Switzerland (SWITCH)
Turkey (ULAKBIM)
United Kingdom (UKERNA)

PLUS NON-VOTING MEMBERS:

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

Trans-European Research & Education Networking Association (TERENA)

PERMANENT OBSERVERS: CERN, AMREJ, MARNET

GÉANT2

*e-IRG Workshop, Linz, Austria*
*April 10, 2006*

# NRENs – GÉANT:
# A European Success Story

Connect. Communicate. Collaborate

## Some factors

- Century old Telecom (+ 40 years Internet) experience: Proven *"Network Externalities"* → Sharing tradition
- Industry needs for *Next Generation Network* proofs of concept, synergy with R&E community → the ARPAnet paradigm from the US of America to the *"US of Europe"*
- Foresight of National + EU funding authorities
- A decade (+) of success in serving R&E needs of the Continent → Easing *"digital divides"* & involving powerful education communities (educators, students, pupils?)
- Solidarity – human networking of NREN community
- Stable Governance: NRENs, PC, Exec, DANTE, TERENA

GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***

# e-IRG Recommendation on Hybrid Networking & GÉANT

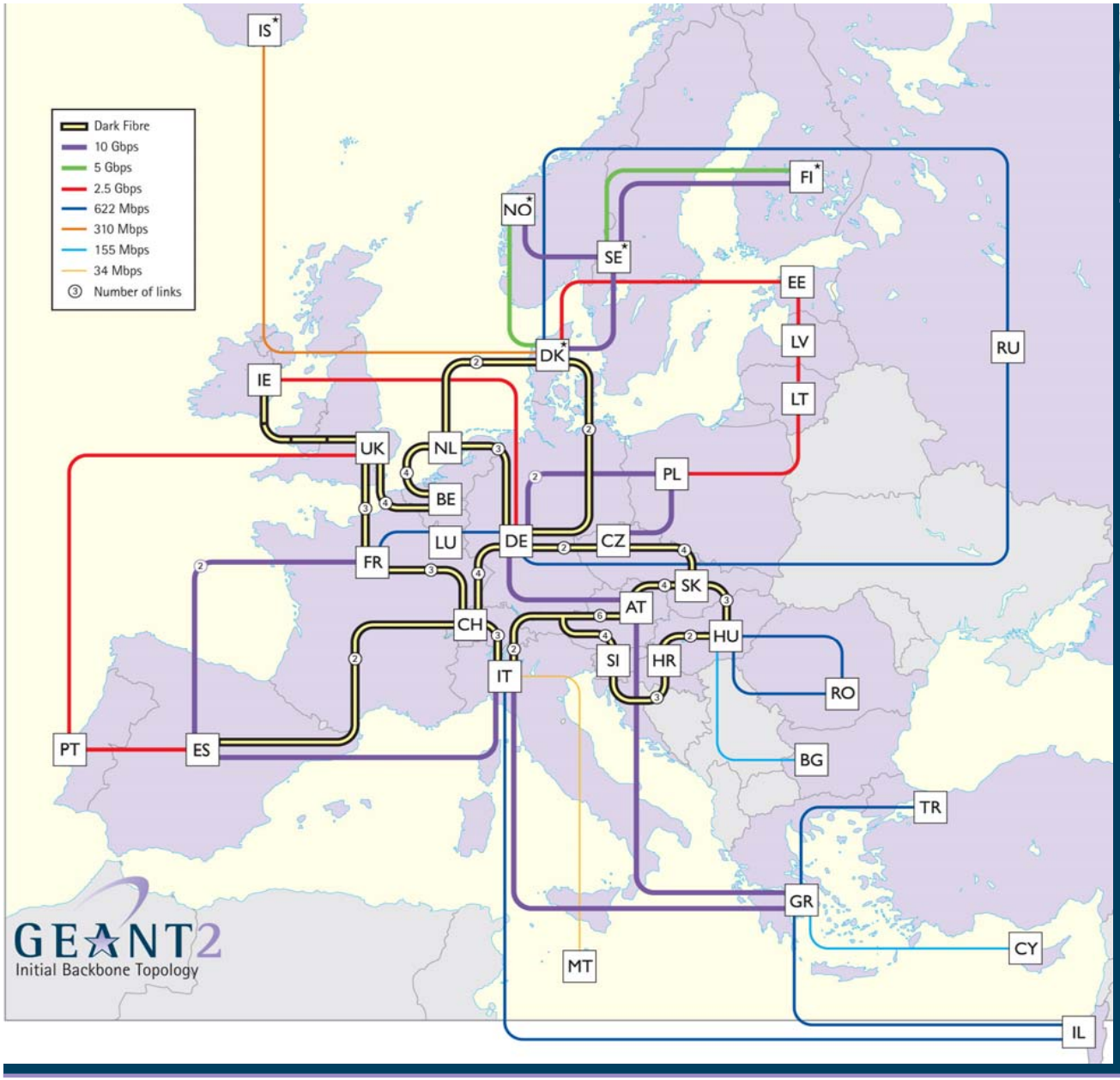
Connect. Communicate. Collaborate

*"The e-IRG stresses the importance of flexibly configurable, reliable end-to-end optical provision to European researchers and e-Science projects. This service should co-exist with routed IP connectivity and follow the three tier hierarchical European paradigm: Campus LAN, NREN and Pan-European GÉANT network"*

Den Haag, 19/11/2004

GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***




Connect. Communicate. Collaborate

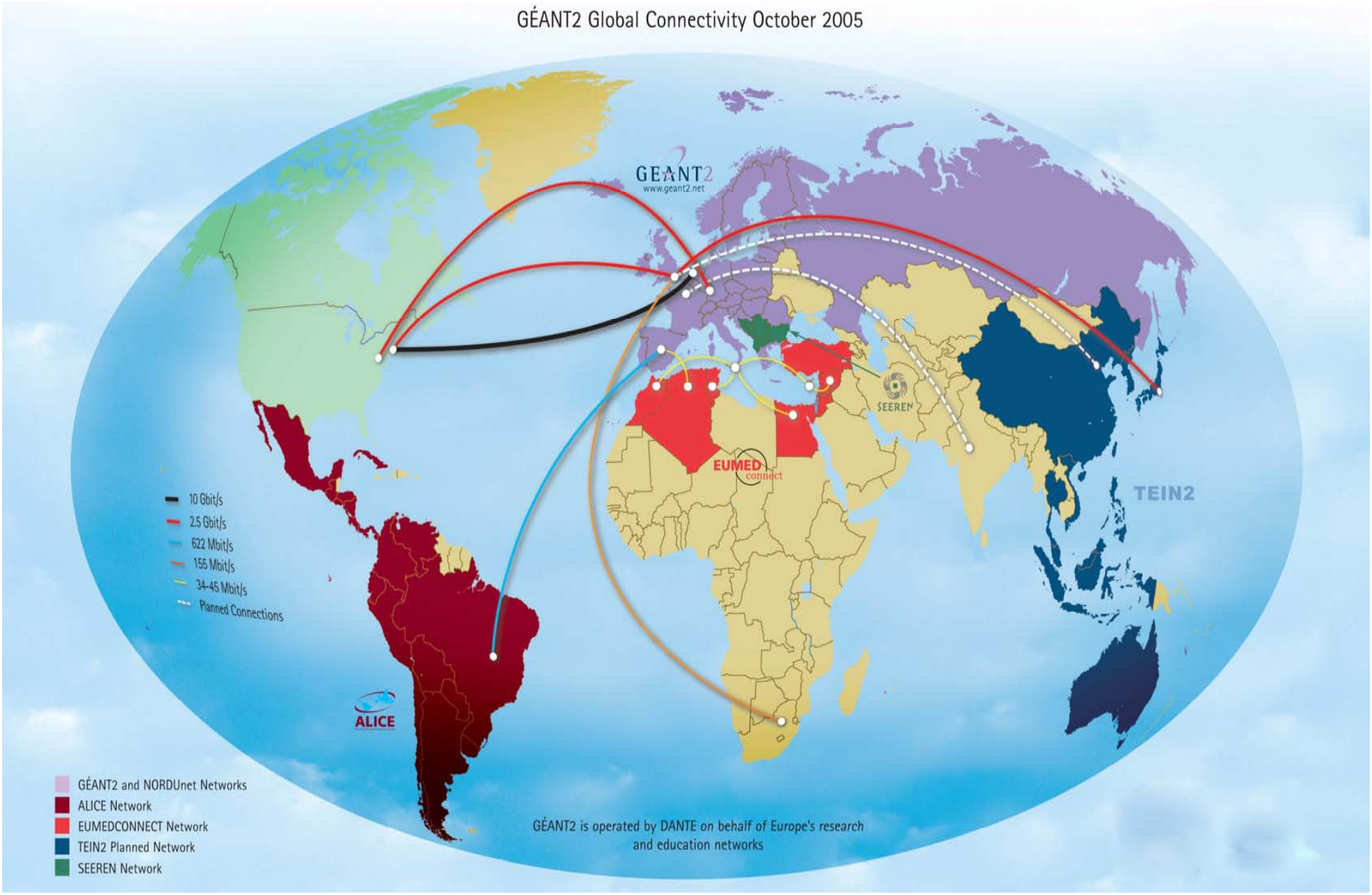
# GÉANT2 Topology

15+ NRENs interconnected within the Dark Fibre (DF) “cloud”

Rest, via leased “lambda” and SDH circuits

GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***




GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***

# Provision of end-to-end (e2e) Services to *e-Science* Initiatives

Connect. Communicate. Collaborate

- Up to now: IP (Layer 3) & MPLS Managed Bandwidth Services – VPNs
- From now on the hybrid NREN - GÉANT2 service model enables:
  - Layer 2 Switched e2e circuits (e.g.1 GigE) involving GÉANT2 facilities (local circuits provided by NRENs & Campuses)
  - 10 Gig Optical Private Networks (OPNs) configured for large *e-Science* projects using GÉANT2 DWDM & NREN - Campus *lightpaths*
- Pricing of additional e2e lightpaths: Incremental costing of GÉANT2 Dark Fibre, charged to projects via hosting NRENs, Global extensions (if possible) under similar terms
- Planning based on common understanding and "accurate" prediction of requirements (bandwidth, availability, delay, jitter …)
- Who, how and to what extend provisions, manages, monitors, charges, absorbs the costs, undertakes risks in a **multi-domain** network of HPC - GRID resources?

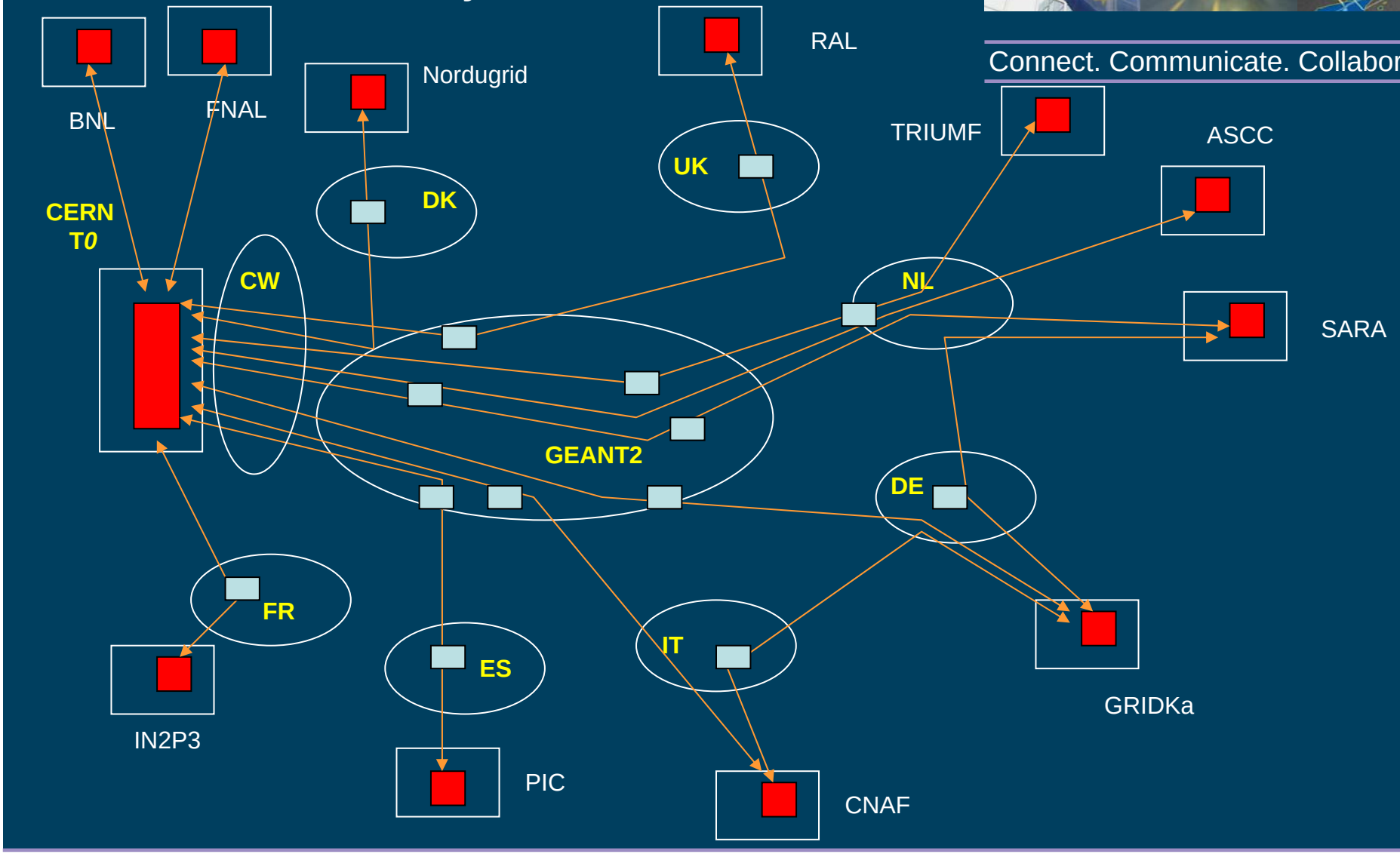
**{LHC T0 – T1, EGEE, DEISA, eVLBI} + {NRENs, GÉANT2, DANTE}**
**pave the way & uncover hidden issues (technical & managerial)**

GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***

# LHC TIER*0* – TIER*1* Optical Private Network - OPN, scenario based on work by *Roberto Sabatino* DANTE

Connect. Communicate. Collaborate

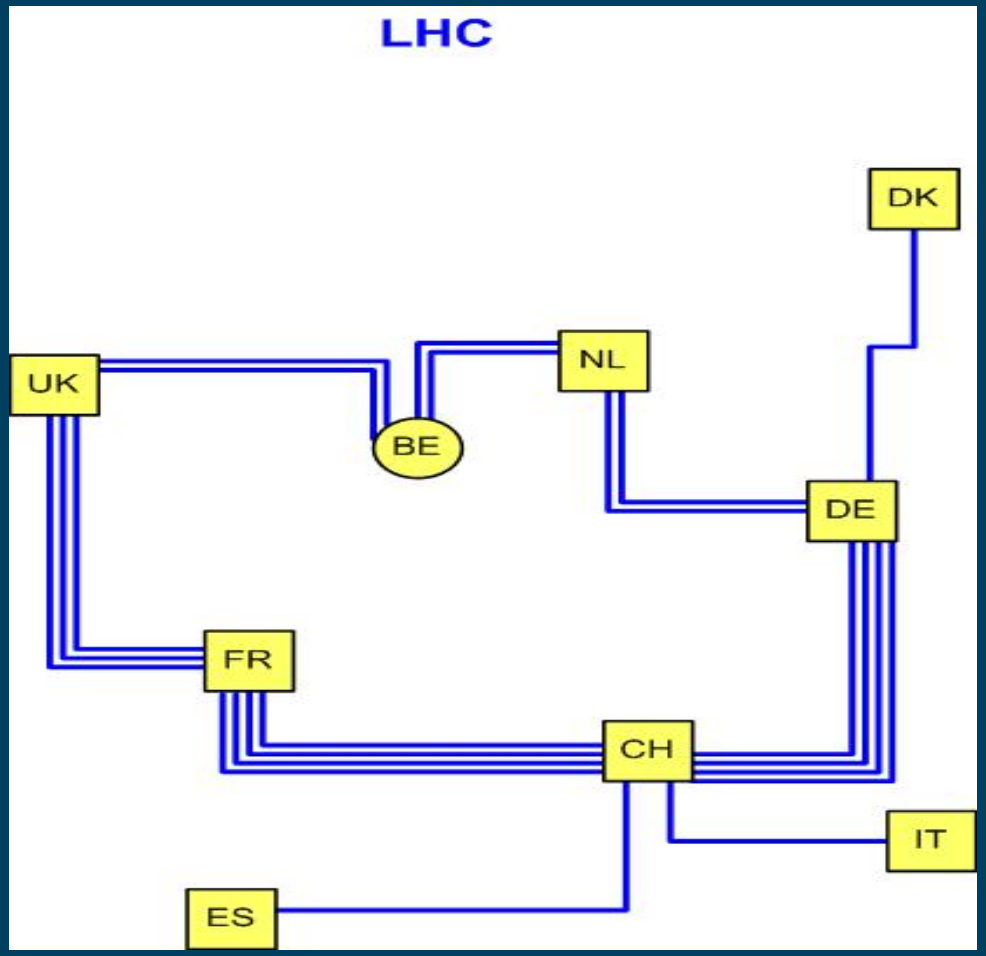



*e-IRG Workshop, Linz, Austria*
*April 10, 2006*

# LHC Light - Wave Assignment on GÉANT2 Backbone

***Hans Döbbeling,*** **DANTE**

Connect. Communicate. Collaborate



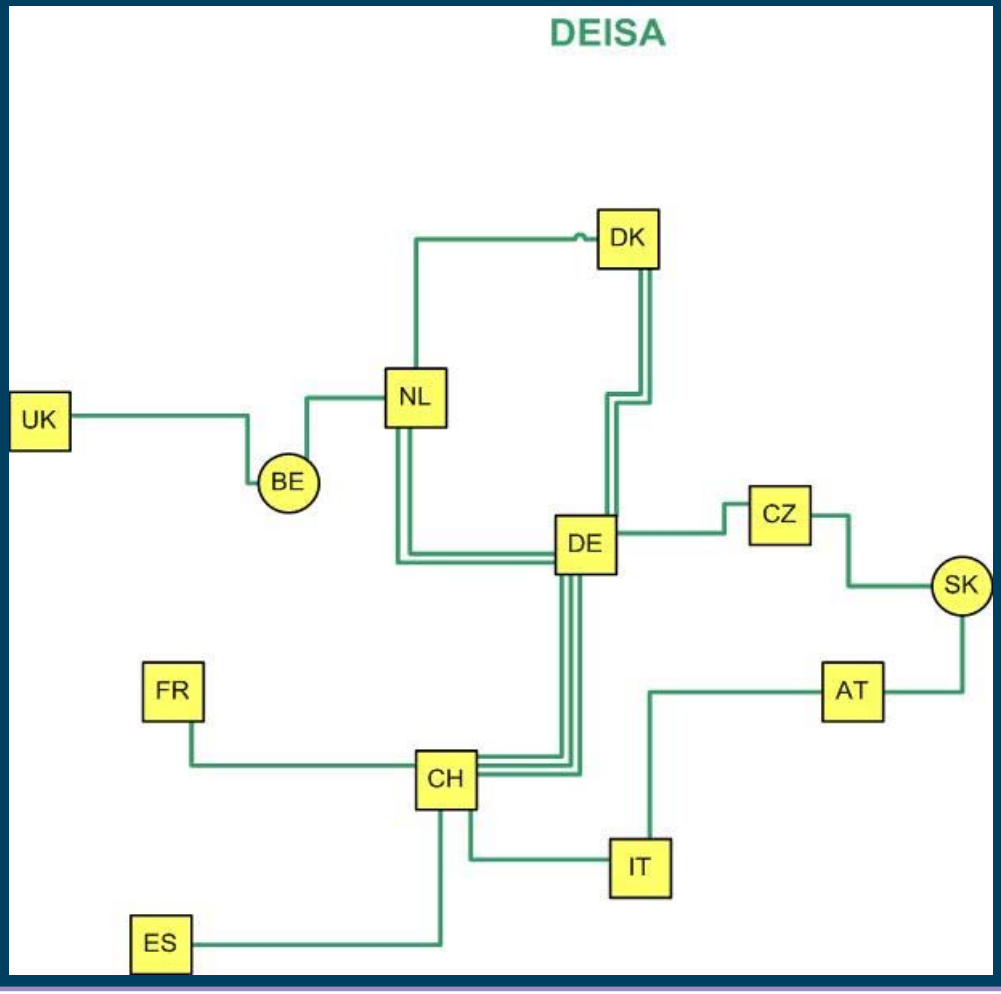

GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***

# DEISA Light - Wave Assignment on GÉANT2 Backbone

*Hans Döbbeling,* DANTE

Connect. Communicate. Collaborate



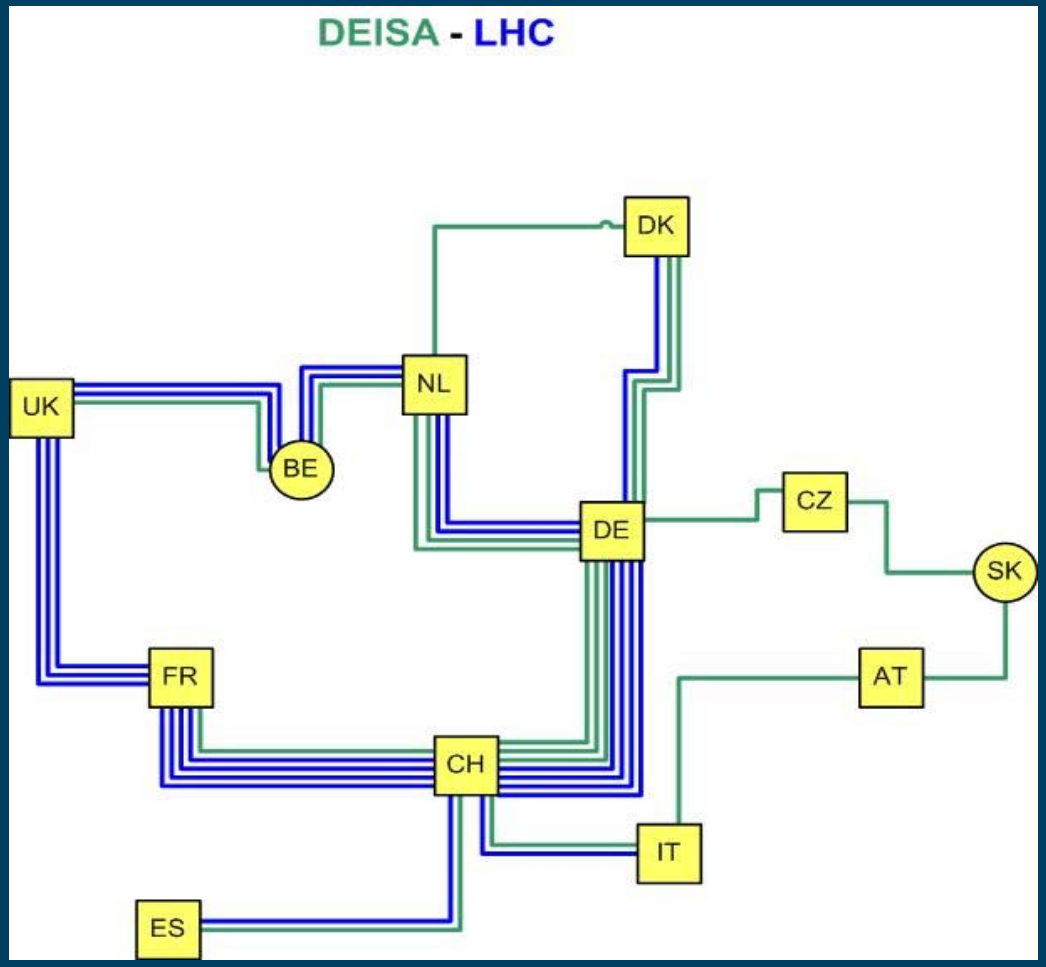

GÉANT2

*e-IRG Workshop, Linz, Austria*
*April 10, 2006*

# LHC + DEISA Light - Wave Assignment on GÉANT2 Backbone

***Hans Döbbeling,*** **DANTE**

Connect. Communicate. Collaborate

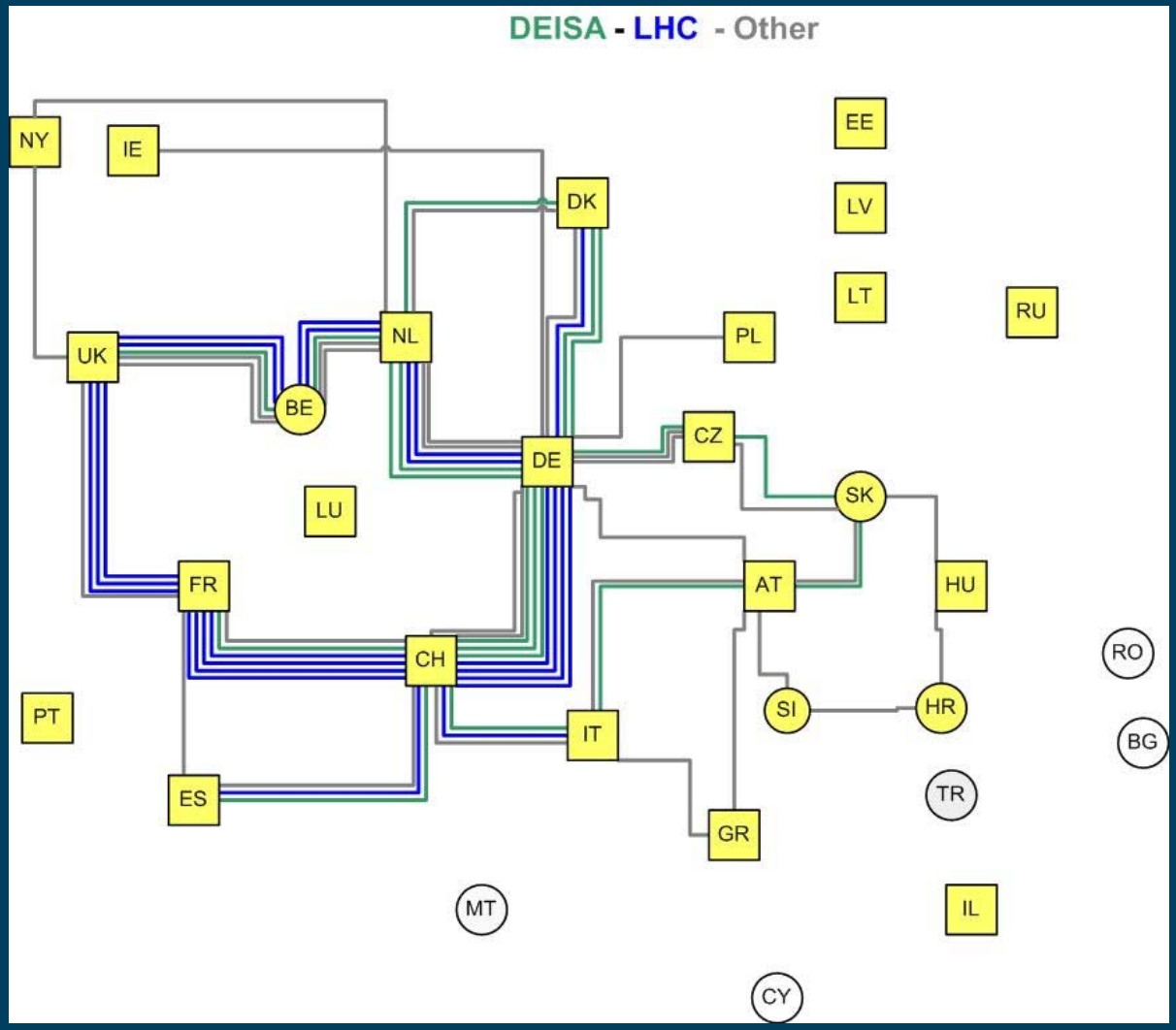



GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***

# A view of the future: OPNs on GÉANT2 Backbone, *Hans Döbbeling,* DANTE

Connect. Communicate. Collaborate




GÉANT2

*e-IRG Workshop, Linz, Austria*
*April 10, 2006*

# Why *e-Science* projects should use GÉANT2 ?

Connect. Communicate. Collaborate

- NRENs - GÉANT2 provide cost effective e2e switched & lightpath connectivity within the Dark Fibre Cloud (DWDM footprint)
  + Global IP coverage (and progressing towards Global Hybrid networking)
  + Network management, resiliency & support

- *e-Science* (GRID) Virtual Organisations obtain customized, production quality hybrid networking services, beyond leasing individual circuits, wave-lengths or dark fibres

**LAST BUT NOT LEAST**

- Affinity of Networking & HPC/GRID communities, sharing the same mission: Provision of leading-edge *e-Infrastructures* for Research and advancement of HPCN technologies as European added value

GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***

# Personal Thoughts on Governance for European GRID Initiatives for Research

Connect. Communicate. Collaborate

- Is the NREN - GÉANT2 paradigm applicable to GRIDs ?

- Commonalities:
  - Aggregated e-Infrastrucures for Research
  - Instruments for National – EC Public Funding
  - Serve a rather cohesive research community (University & Research Centre end-users)

- Probable equivalence of roles:
  - NRENs → National GRID Initiatives – NGIs?
  - GÉANT2 → EGEE, DEISA …?
  - NREN PC → NGI Representatives?
  - DANTE → European GRID Organisation - EGO?

GÉANT2

***e-IRG Workshop, Linz, Austria***
***April 10, 2006***

# Personal Thoughts on Governance for European GRID Initiatives for Research (cont.)

Connect. Communicate. Collaborate

- Some questions on the GRID nature:
  - Are "network externalities" strong enough to enforce a global sharing mentality, as in the networking sector?
  - Are conditions (politically and technologically) ripe throughout Europe for the formation of single, shared, production quality research GRIDs, Nationally and Continent-wide?
  - Does cost & depreciation rate of GRID resources favor long-term investments and sustainable institutions?

- The NREN community can share its experience with the GRID community and the e-IRG

GÉANT2