

The GÉANT2 Hybrid Network

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A European Model

- 30 National Research & Education Networks-NRENs of the extended European Research Area (ERA)
 - More than 3000 Research & Education Institutions
 - Millions of end-users + eScience Projects (e.g. Grids) under *Accepted Usage Policy* (AUP) rules
 - A 3-tier Federal Architecture, 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)**
- NREN Policy Committee, DANTE, TERENA

GÉANT/GÉANT2:

The Pan-European Network *for Research & Research on* Next Generation Internet

The NREN PC



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**

GN2 project



- **Co-funded by the European Commission (EC) as an Integrated Infrastructure Initiative (6th Framework Program for RTD)**
 - Combining in a single contract, several activities essential to reinforce research infrastructures and to provide an integrated service at the European level
 - Networking activities
 - Provision of access to transnational users
 - Joint Research Activities
- **32 partners**
 - 30 NRENs + DANTE + TERENA
- **Total expected budget: 178.643.730 €**
- **EC contribution: 93.000.000 €**
- **Duration: 4 years**

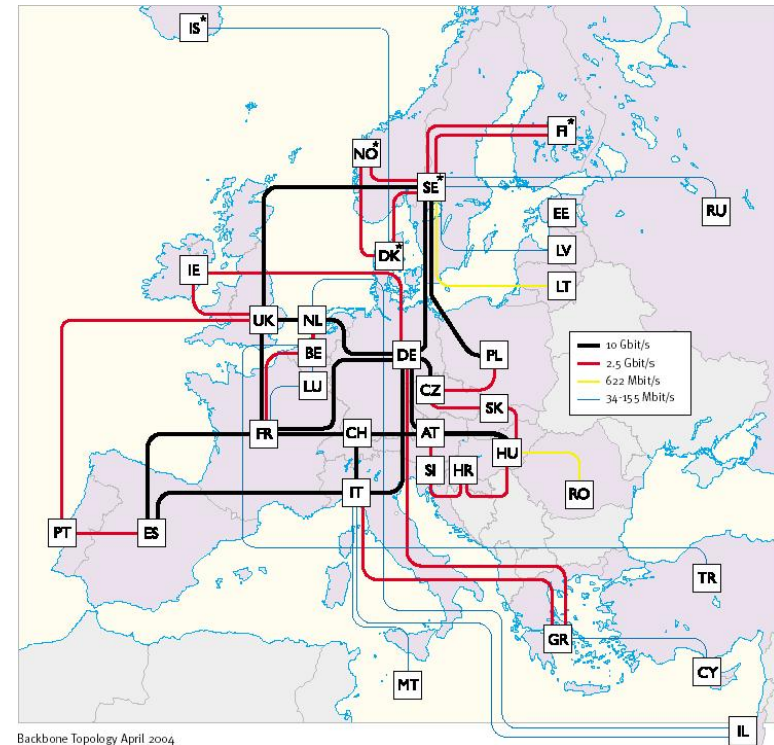
The EU (GN2) subsidy covers < 1% of the total Research & Education Networking European Infrastructure:

Campus LAN / MAN-WAN NREN / GÉANT-GÉANT2

(Assuming Cost factoring 100 / 10 / 1)

Scope

- Build on the GÉANT Pan-European **IP** R&E network – An international success story
- Deploy GÉANT2, a new generation **HYBRID** network backbone: IP(v6) + switched **end-to-end** provision across interconnected networks (over **DARK FIBER** among 15 countries & growing)
- Ubiquitous global services to users across NRENs & beyond via IPv6 and manageable e2e lower layer paths (e.g. WAN GigEthernet & Light-path switching)
- Gaining improved understanding of user needs – **Grids/eScience**
- End-user support, user access to e2e provisioning, AAA, collaborative services, roaming
- User basis: Universities, Research Centers, Schools (?), eScience Initiatives (Grids), Digital Libraries ...



Global Hybrid Networking

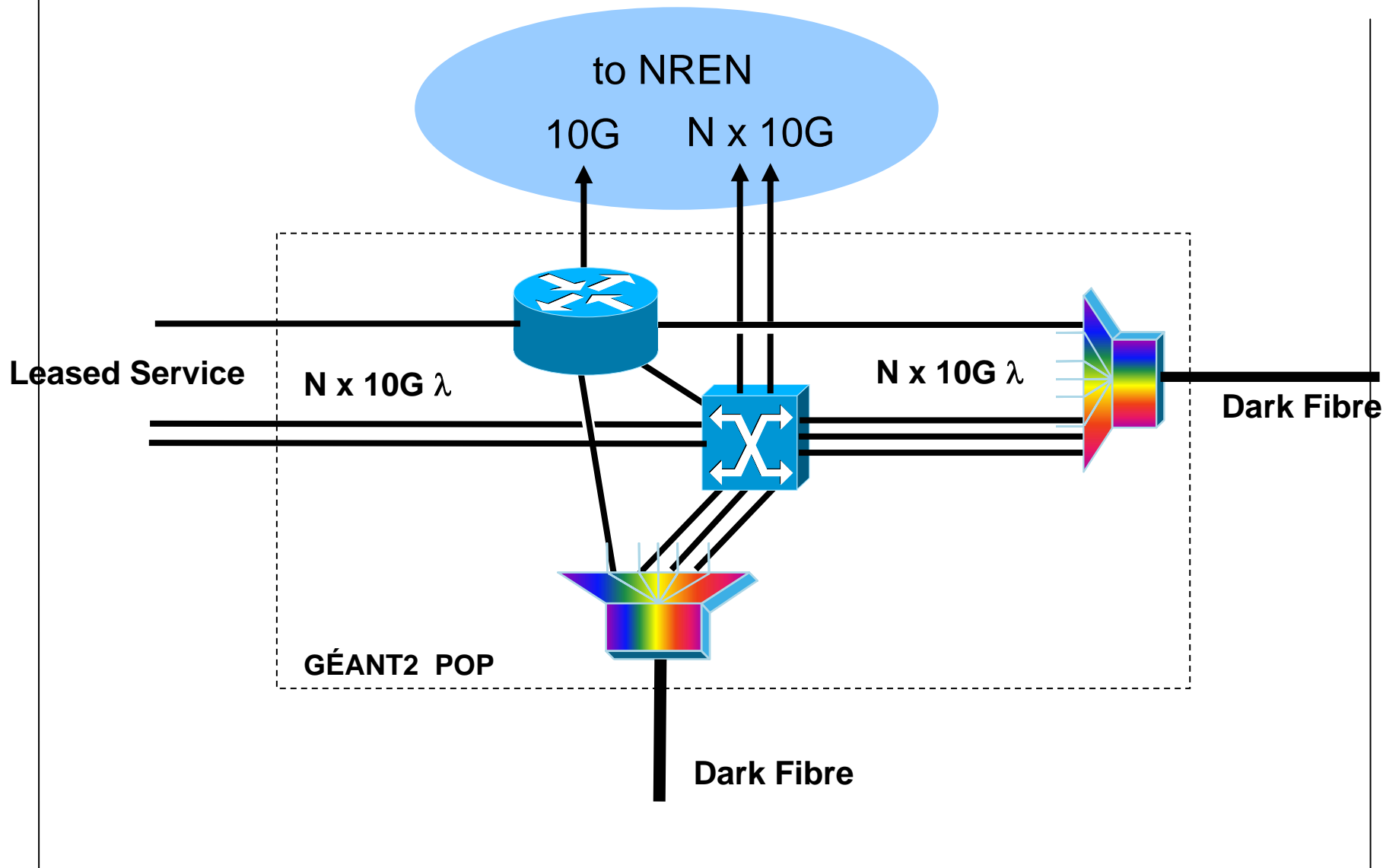


- The Internet enabled the ubiquitous global networking community based on IP services and the Web
- The Next Generation Hybrid Network will enable the global knowledge – based society by providing advanced collaborative platforms via hybrid IPv6 & Manageable Layer 1-2 (Ethernet & Light-path switching over Dark Fiber) Services
- GÉANT2 offers this new environment to European educators & researchers and paves the way for global, ubiquitous advanced networking services (cyber-services)
- The NREN - Grid /HPC communities test – develop - tailor and deploy network-based services & applications: Collaborative platforms, security, AAA, roaming...
- Key common issue: To integrate Hybrid Network control plane aspects within Grid Middle-ware (M/W)
- Grid (and HPCN) requirements motivated the design and deployment of GÉANT2 as a hybrid, dark-fiber network

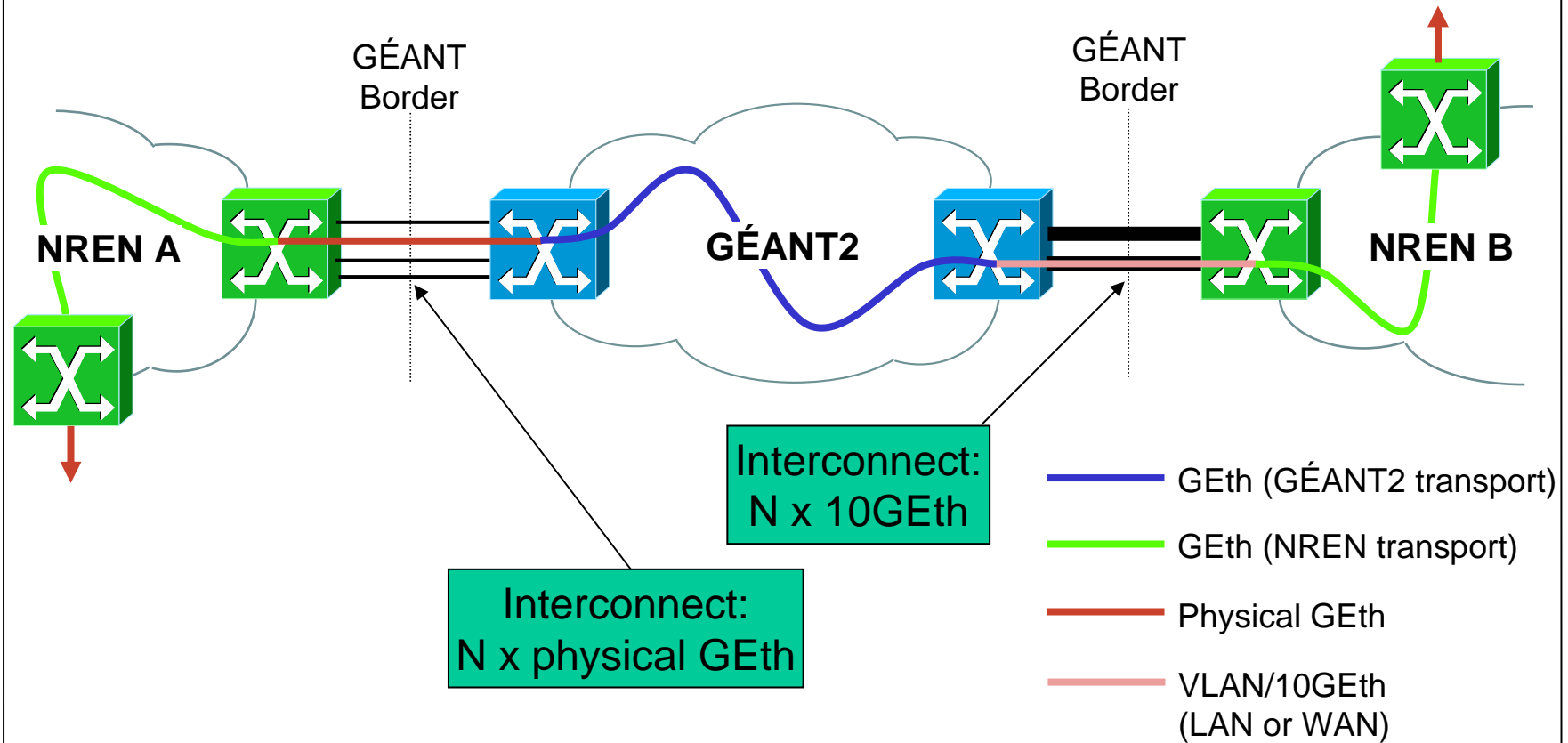
Some open policy issues:

- Investigate possible extension of the EDA (*European Distributed Access*) concept – a PoP with multiple 10 Gbps links is a potential global landing site - from the IP to the Hybrid world
- Overcoming of *Digital Divides*
- Inclusion of wider user communities – Acceptable Usage Policies / AUPs – *Regulatory Status*
- Funding – sustainability - ownership - control of infrastructures: New *Business Models*
- Management & Control planes of hybrid networks: *Open Standards, Multi-domain, User access*
- Role of Open Source for Hybrid Networks and Grids: Towards an *Open HPCN Architecture?*

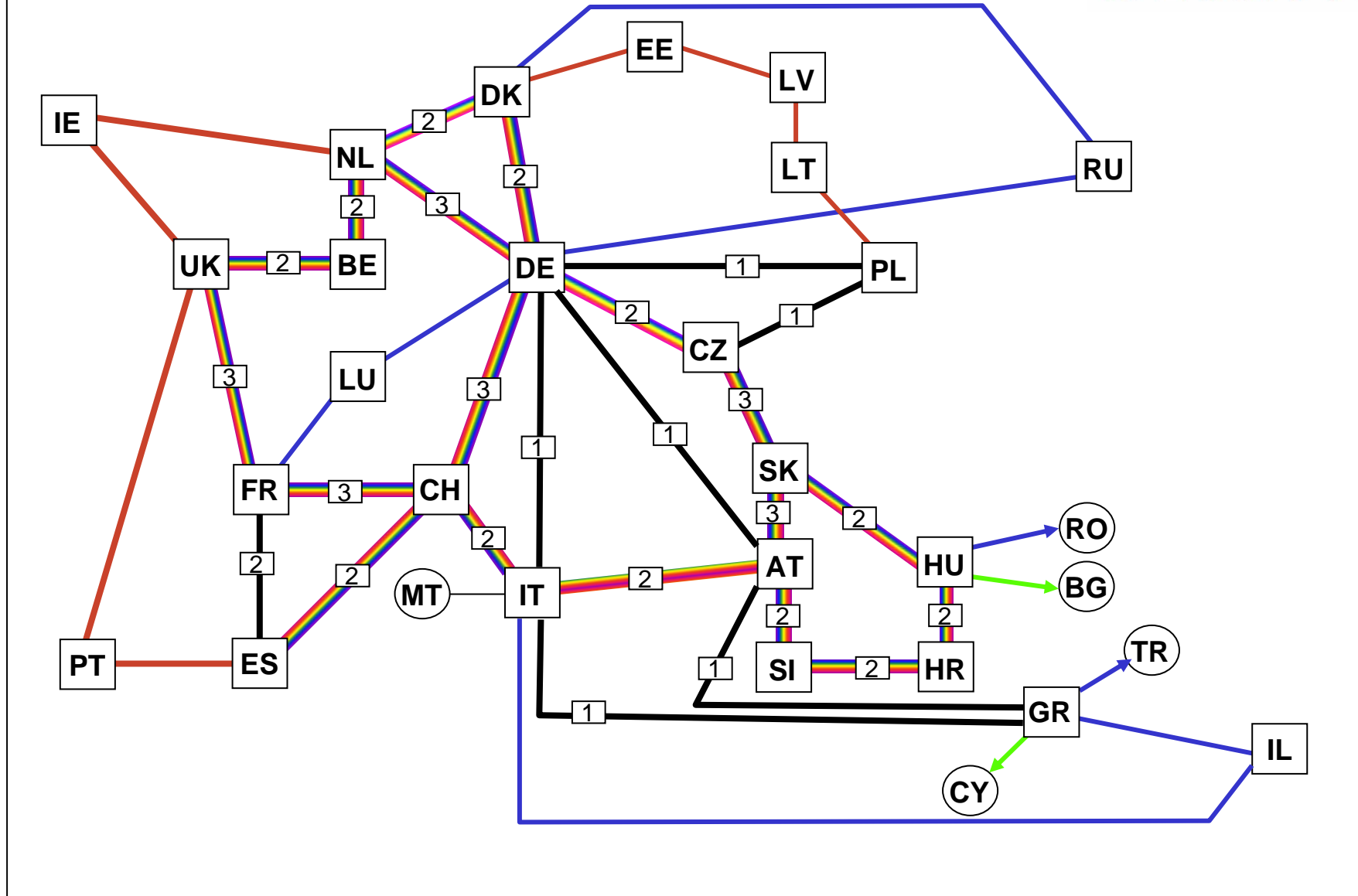
GÉANT2 Hybrid POP



GB Ethernet p2p Service



The (approximate) GÉANT2 Footprint



GÉANT2 Cost Sharing & Economy



- **Equitable & fair**
- **Level differences in Europe**
- **Annual subscriptions by NRENs**

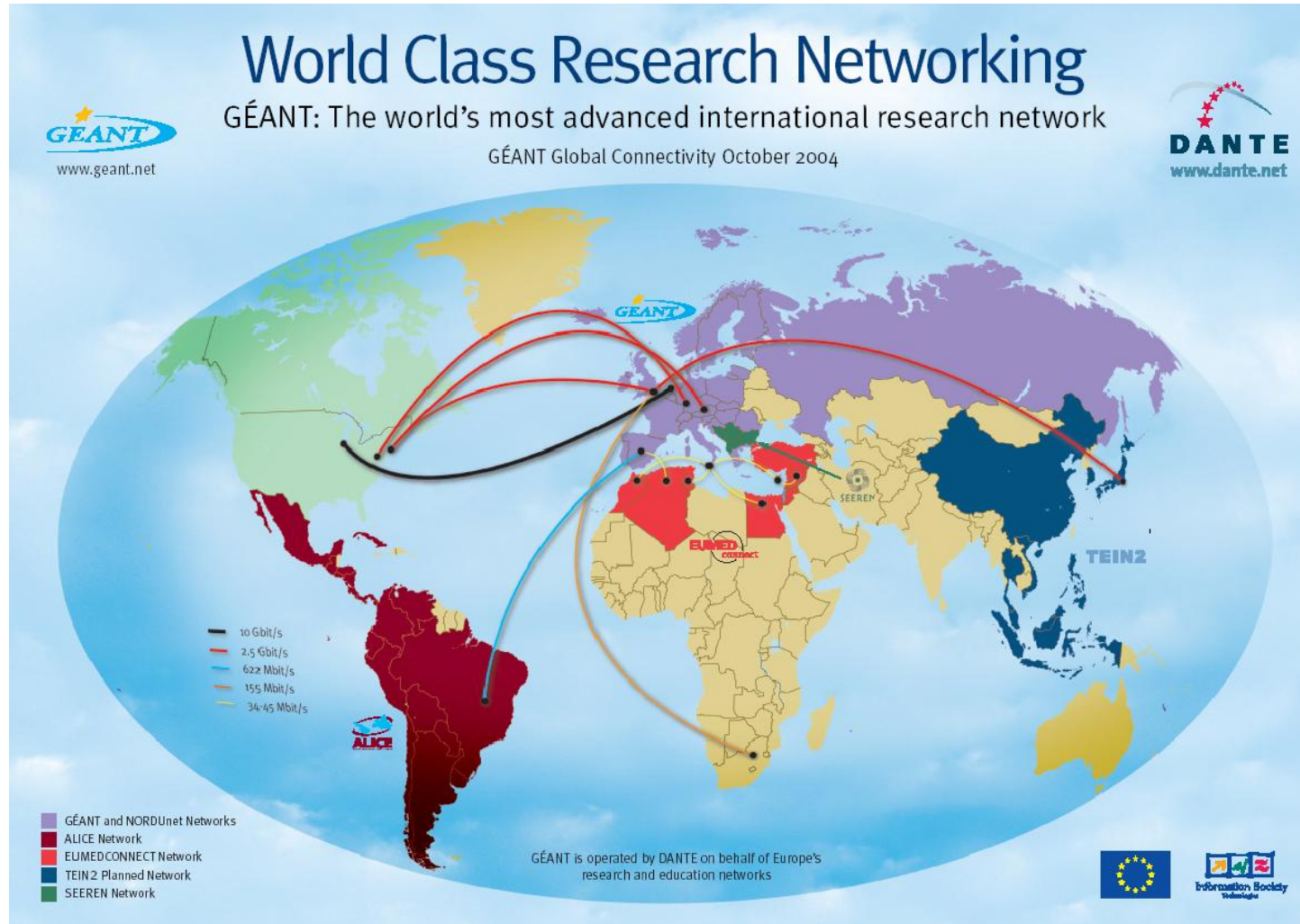
- **Dark Fibre footprint is paid for by the subscriptions**
- **Small incremental cost for extra wavelengths**

Support for Projects & Research Organisations

- **eVLBI**
- **CERN LHC (11 Tier1 sites, 7 in Europe)**
- **DEISA**
- **EGEE**
- **ESA**
- **....**

**The challenge is to build networks out of P2P
services across multiple domains**

GÉANT2 Global Connectivity

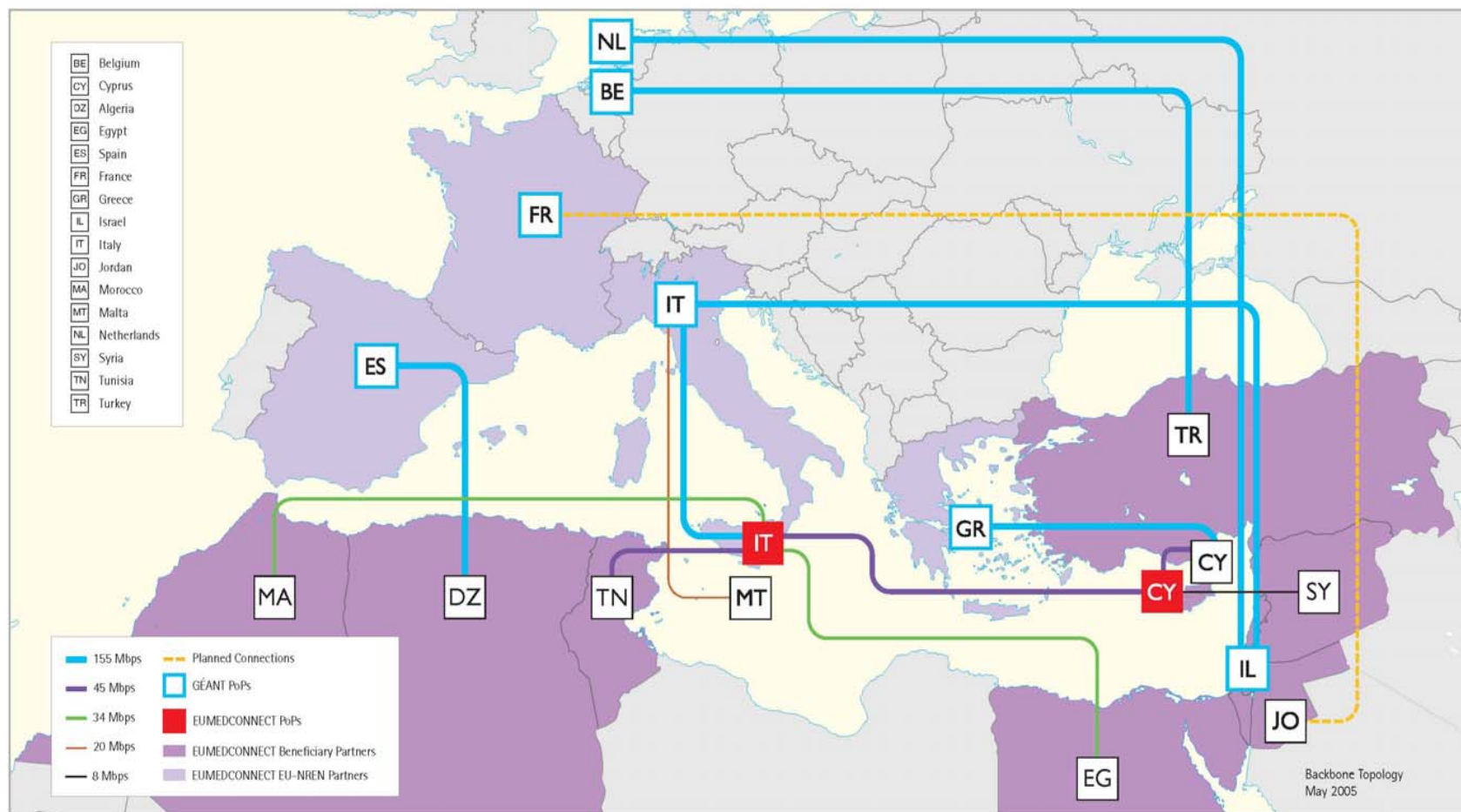


Global Connectivity

- **2 10G links to North America in 3Q2005**
 - Internet2, ESnet, Canarie (+ Sinet)
- **Tender for China/Europe Link**
- **Peering with South Africa, ...**

- **Alice**
- **Eumedconnect**
- **TEIN2**

EUMEDCONNECT 5/2005



GN2 – NREN



hot potatoes

- Assess NREN – GÉANT requirements & technology trends over the next 10 years (*foresight*)
- Test & deploy “bleeding edge” technologies (e.g. nx40 Gbps over DF) and adopt novel business models (e.g. DF ownership & *cross-border fiber provisioning* by neighboring NRENs)
- Coordinate between Next Generation Networking & High Performance Computing towards a *Global HPCN*
- Test & deploy GÉANT - wide *Security & Monitoring* (prerequisite for eScience / Grids, eSchools, Digital Libraries, eGovernment, eHealth ...)
- Establish *virtual collaborative environments* (e.g. VRVS, Access Grid)
- Enhance *global connectivity* (USA, Canada, China, Japan, Korea, South Africa, Latin America, SEEREN, EUMED, *India* ...)
- Help to overcome *digital divides*
- Promote NRENs – GÉANT – GÉANT2 as a *European success story*
- Stress NREN views to National and EU Decision Makers (lobby)

while at the same time

- *Keep-up the good work* and meet new challenges in the GTREN – eScience world (deploy optical technologies, provide e2e L1/L2 connectivity, update cost sharing models, test new business models ...)

Not a mission impossible!



See you in June 14 – 15 in Luxembourg

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