European Networking Activities

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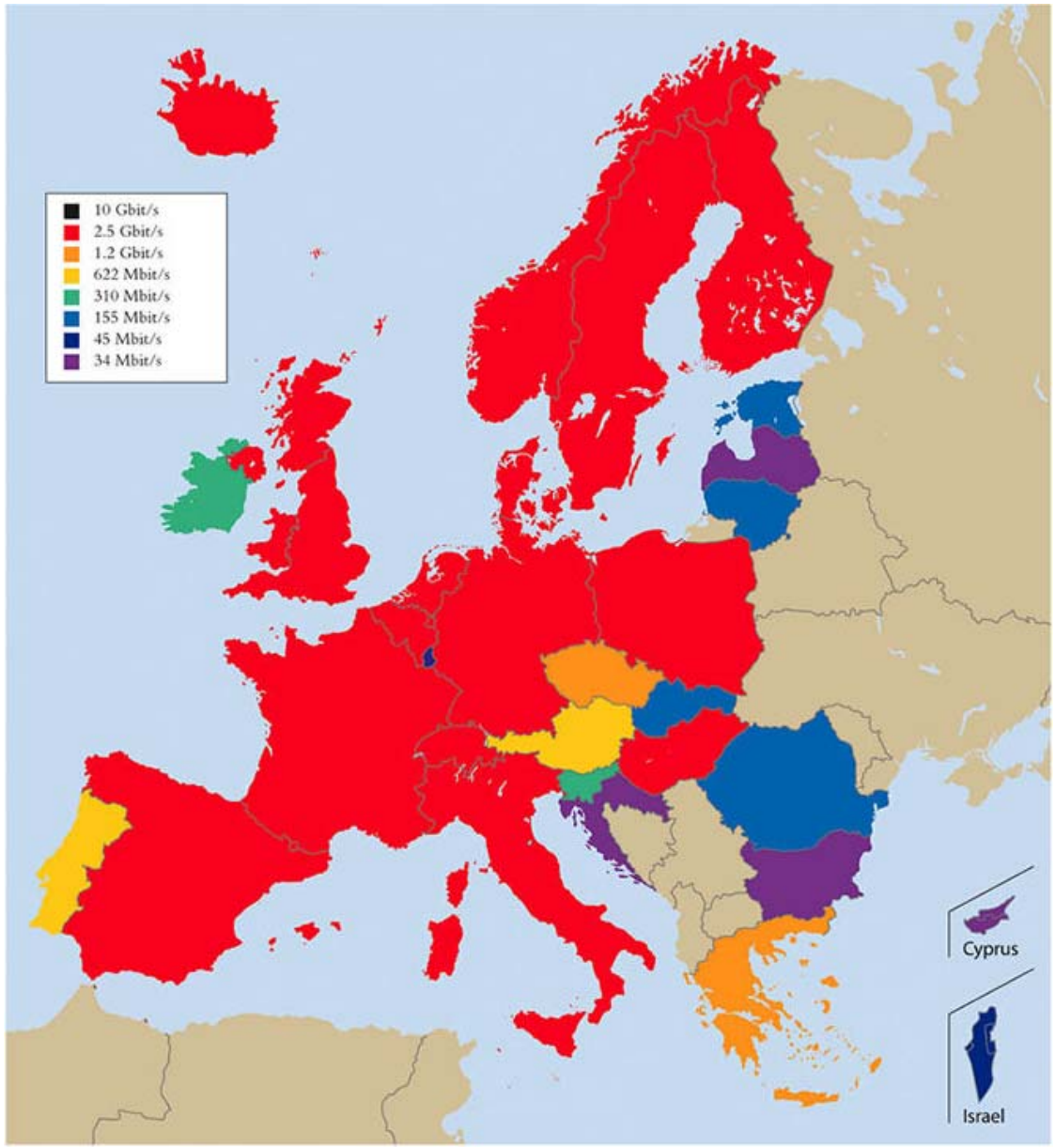
Introduction to GÉANT

- GÉANT means Grand European Academic NeTwork!
- 3-year project that started in October 2001 as successor to the QUANTUM/TEN-155 project.
- Main activity is provision of a 10 Gbps Pan-European network to support the development activities of the European National Research & Education Networks (NRENs)
- Connects 27 NRENs now. Plans to add Malta.
- 25% funded by the European Union Fifth Framework Programme, the rest by NRENs and national governments.
- Participation from EU/EEA countries, EU Accession States, Switzerland and Israel.
- 3,000+ research and education institutes in 31 countries.



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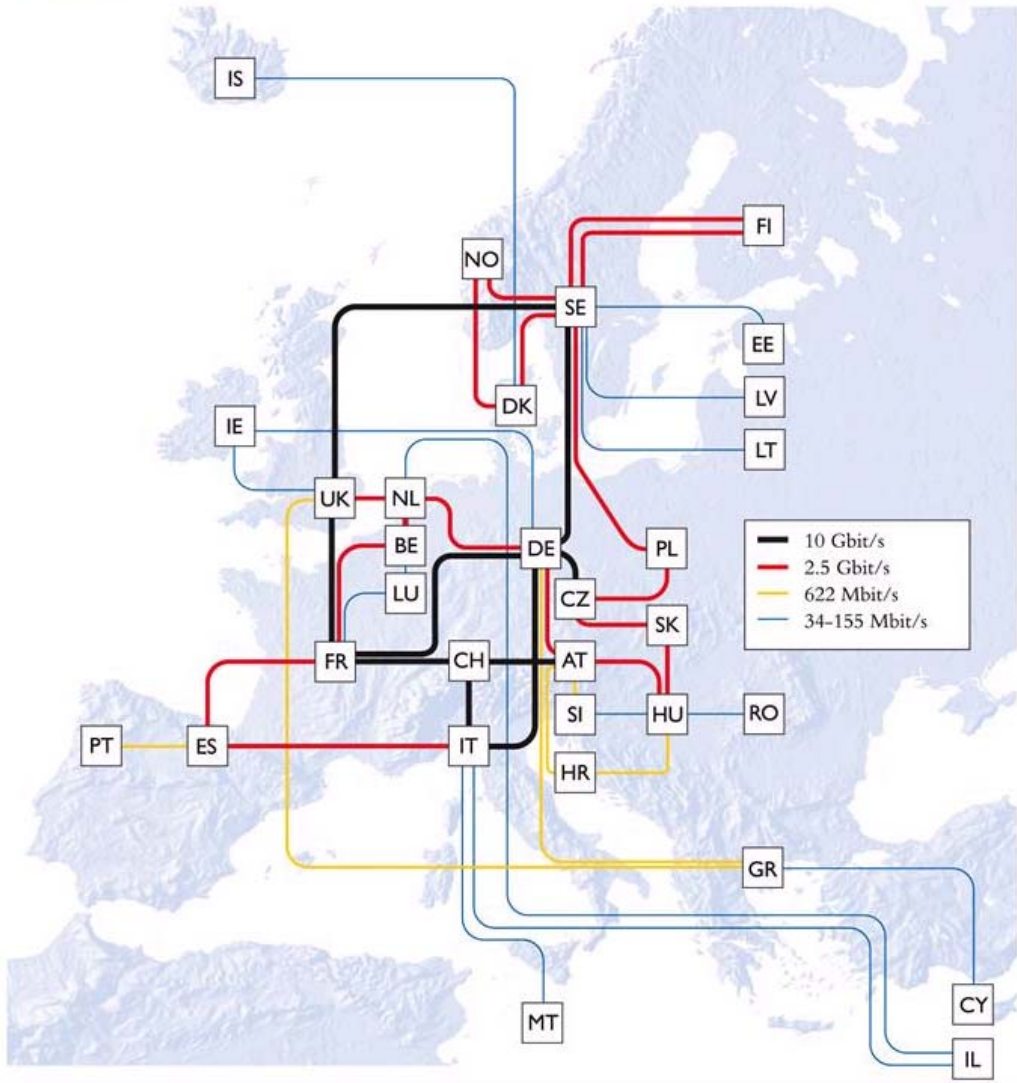
GÉANT Topology

- Telia, Deutsche Telekom and Colt are providers.
- 19 PoPs across Europe, with 2 being added in Croatia and Israel.
  - 15 x Juniper M160s
  - 4 x Juniper M40s (from TEN-155)
- Trunk connections:
  - 9 x STM-64 in Western Europe
  - 11 x STM-16 in Eastern Europe
  - 3 x STM-4 to Southern Europe
- Access to GÉANT:
  - 12 x STM-16
  - 10 x STM-1
- NOC based in Paris.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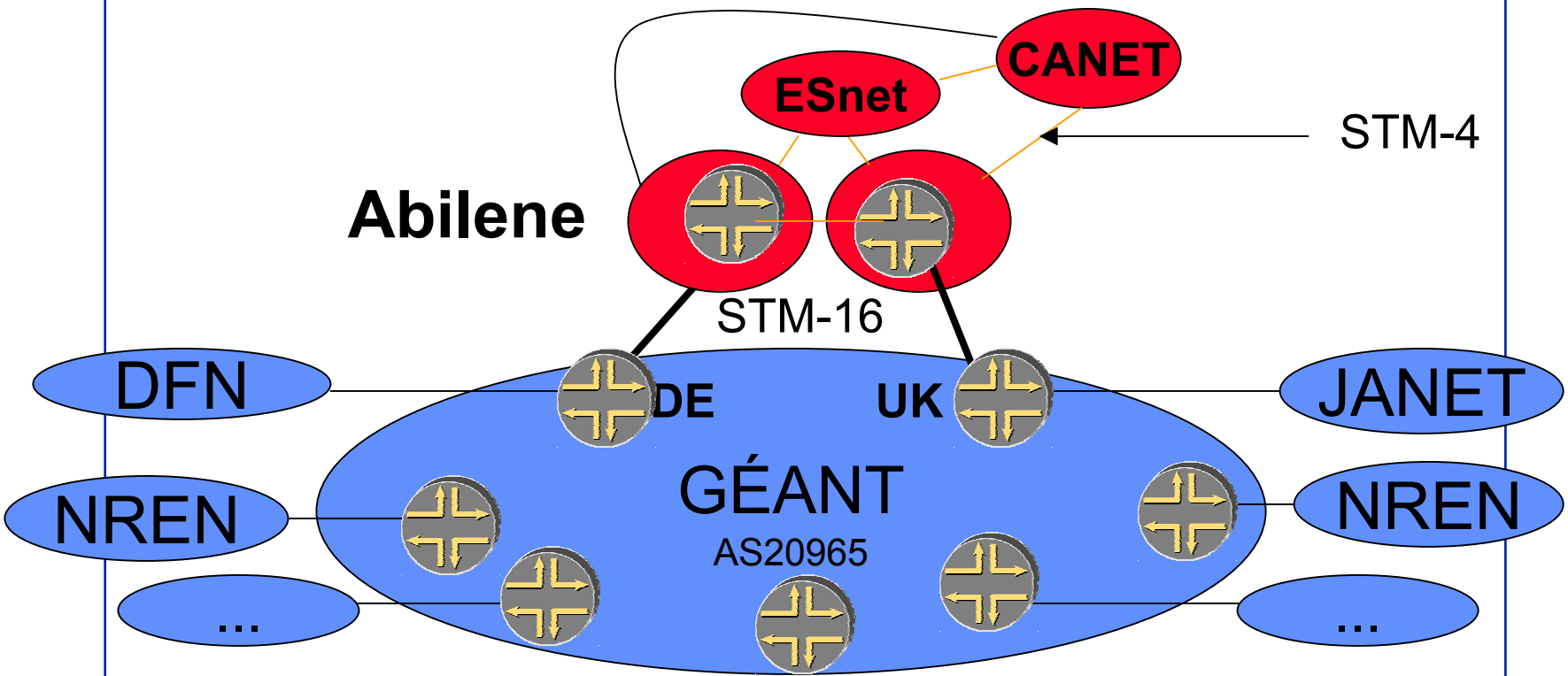
10 Gbit/s
2.5 Gbit/s
622 Mbit/s
34-155 Mbit/s

GÉANT Interconnections



GTRN is the **G**lobal **T**erabit **R**esearch & **E**ducation **N**etwork initiative of Internet2 and GÉANT (and APAN?)

GÉANT Interconnections

- Commercial peerings (8 locations)
  - Infonet (being phased out)
  - KPNQwest(?)
  - Global Crossing
  - Level3
  - Deutsche Telekom
- Trans-Eurasia Information Network (TEIN)
  - Co-funded by RENATER (France) and KISDI (Korea).
  - 10 Mbps, with upgrade to 34 Mbps planned.
  - Not formerly a GÉANT interconnection, but may be used by GÉANT partners.
  - Used for specific research projects including IPv6, Authentication & Security, Digital Heritage Exchange.

NREN Interconnections

Country	NREN	Speed	Location
Belgium	Belnet	155 Mbps	NYC
CERN	CERN	622 Mbps	StarTap
Ireland	HEAnet	310 Mbps	NYC/StarTap
Netherlands	SURFnet	1.2 Gbps+	StarLight
Scandinavia	NORDUnet	622 Mbps	NYC/StarLight
UK	JANET	2.5 Gbps	NYC

Planned Connectivity

- EUMEDConnect Project (36 months)
  - Part of the **Eu**ro-**Med**iterranean **I**nformation **S**ociety (EUMEDIS) Initiative.
  - EUR 120 million. 80% EU-funded
  - Aimed at North African and Eastern Mediterranean states:
    - Algeria, Egypt, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia & Turkey.
  - Provide both GÉANT and intra-regional connectivity (at 200-300 Mbps).
  - Gradual evolution from point-to-point to fully-redundant network.
- CAESAR Project
  - Similar initiative for South America.
  - Feasibility study being conducted (NRENs and operators).
  - Inter-regional connection(s) rather than 'per-country'.

GÉANT Services

- Standard IP service
  - Carries IP traffic between NRENs
  - Carries IP traffic between (some) NRENs and other regional research networks. Some NRENS have their own separate connections.
  - Connects (some) NRENs to commercial peerings.
- Multicast service
  - Connects 24 NRENs via primary access or tunnels.
  - Also a transit domain for multicast traffic.
  - Intention is to make it a fully-supported service.
  - Supports PIM-SM v2 only.
  - Peering with MBGP, MSDP, PIM-SM v2.

GÉANT Services (cont..)

- IP Premium Service
  - Currently being piloted as replacement for ATM-based Managed Bandwidth Service.
  - Aims to provide international virtual leased lines based on DiffServ EF.
  - Premium IP service is end-to-end (university-to-university) and crosses multiple administrative domains.
  - Packets entering the GÉANT domain are tagged with DSCP code = 46.
  - Rate limitation is applied on an NREN's access, based on the total demanded bandwidth to destination.
  - Access control is currently manual.
  - Several projects currently using service (e.g. AQUILA, MOICANE).

GÉANT Test Programme

- Undertaken by TF-NGN - joint activity between TERENA and DANTE.
- Works on voluntary basis. NRENs + commercial vendors.
- Determines suitability of new technologies for future networks (also applicable to NRENs).
- Test programme includes:
  - Multicasting
  - Premium IP and LBE
  - QoS Monitoring
  - Optical networking.
  - IPv6 (although most activity now taken over by 6NET)
  - Defining and implementing security polices

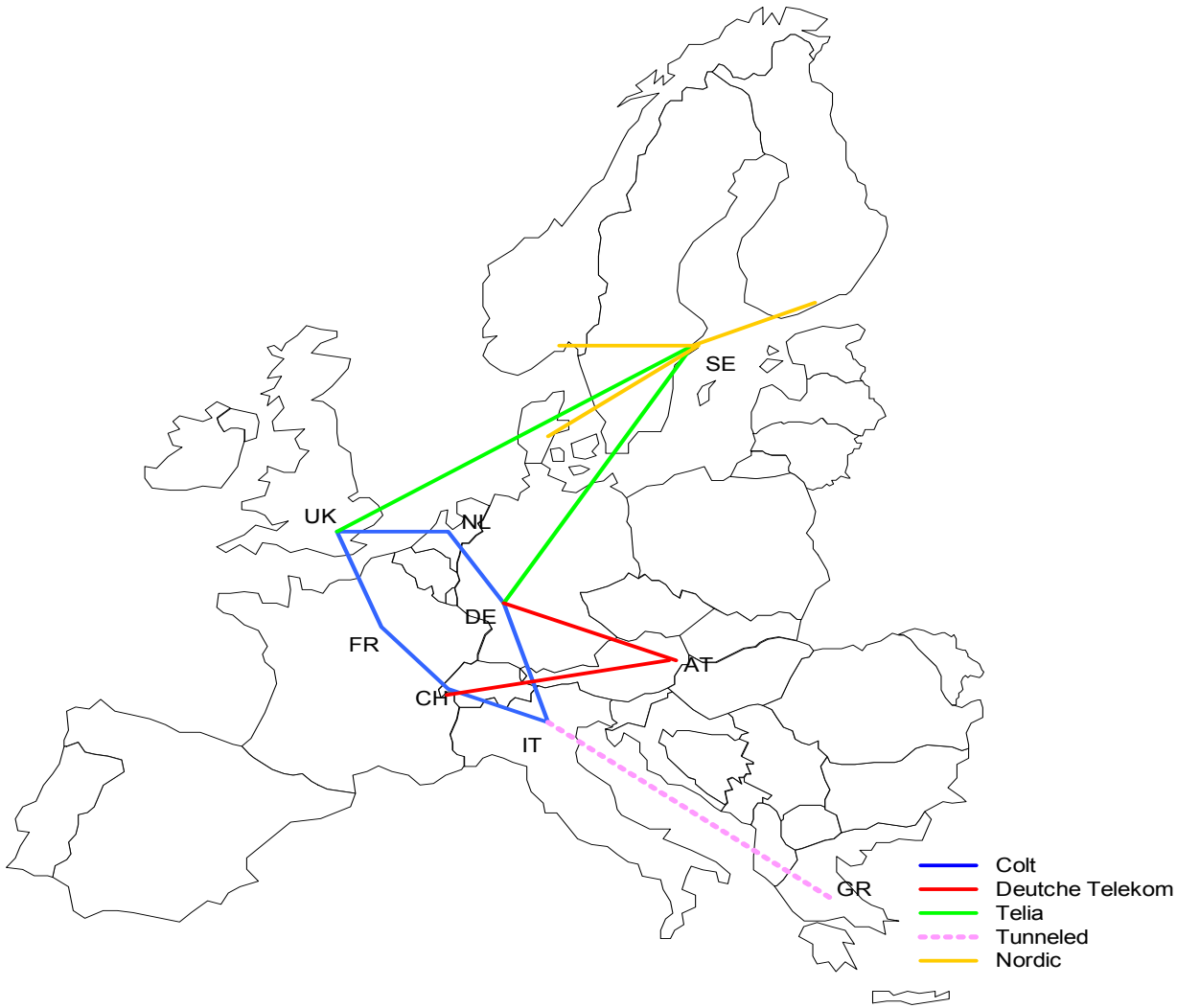
6NET Project

- 6NET: A Large-Scale International IPv6 Pilot Network
- 3-year project that started in January 2002.
- 34 partners:
  - 14 NRENs + TERENA & DANTE
  - 14 Universities & Research Institutes (including ETRI)
  - 4 Commercial Companies (Cisco, IBM, NTT Japan & Sony)
- Total investment = EUR 26.5 million. 35% from EU, 65% from participants.
- Aims to ‘demonstrate that continued growth of the Internet can be met using IPv6 technology”.

6NET Goals

- Install and operate an international pilot IPv6 network
  - Mostly native links (initially running at 155 Mbps and increasing to 2.5 Gbps in 2nd year).
  - Interconnect national IPv6 testbeds.
  - Interconnect with other IPv6 networks (e.g. Euro6IX)
  - Test the migration strategies for integrating IPv6 networks with existing IPv4 infrastructure.
- Introduce and test new IPv6 services and applications, as well as legacy services and applications on IPv6 infrastructure.
- Evaluate address allocation, routing and DNS operation for IPv6 networks.
- Collaborate with other IPv6 activities.
- Promote IPv6 technology through workshops, seminars, conferences and demos.

6NET Topology



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6NET Interconnectivity

- European research institutions must connect via their NREN.
- Interconnections deliberately limited until network is stable.
- GTPv6 Network (and onward to ETRI)
  - Telebit router in London
  - Juniper M5 in Paris
- Euro6IX (planned Sep 2002)
  - Sister project to 6NET
  - Provision of IPv6 Internet Exchanges
  - Peering with other IPv6 networks (including commercial).
- 6Bone (planned Q4, peering via Paris and London)
- 6TAP (planned Q4, peering via Amsterdam)
- NII (planned, peering via London)

6NET Activities

- Build and Operate Network (DANTE)
  - Defined and implement the network infrastructure, the addressing and naming scheme, the initial routing architecture, and the peering policies.
  - Responsible for daily operations, interoperability tests and facilitating interconnection with other networks.
- IPv4-IPv6 Coexistence, Interworking and Migration (UoS)
  - Investigate how to transition IPv4-based networks to IPv6 at backbone, regional and campus levels.
- Basic Network Services (ACOnet)
  - Design, implement and test IPv6-enabled network services such as routing (both inter-domain and intra-domain), DNS, DHCP, QoS and multicasting.
  - Investigate registry procedures.
  - Focus on interoperability between IPv6 and IPv4 services.

6NET Activities

- Application and Service Support (Uni. Lancaster)
  - Identify and implement applications and services that support network mobility (e.g. MIPv6)
  - This includes autoconfiguration, handoff, multihoming, renumbering, virtual private networks (VPNs) and quality-of-service (QoS).
- IPv6 Middleware and User Application Trials (IBM)
  - Trial IPv6-enabled middleware and user applications.
  - This includes real-time videoconference and media streaming applications, online gaming, relational databases, transaction processing systems, and portal services.
- Network Management Architecture and Tools (RENATER)
  - Considering configuration, performance, fault, security and availability management issues.
  - Develop and test appropriate management tools (e.g. NeTraMet, NetFlow, RIPE TTM).

References

TERENA	http://www.terena.nl/
GÉANT	http://www.dante.net/geant/
TF-NGN (GTP)	http://www.dante.net/tf-ngn/
SEQUIN (PIP)	http://www.dante.net/sequin/
CAESAR	http://www.dante.net/caesar/
6NET	http://www.6net.org/