Introduction to GÉANT
The Pan-European Collaboration with World Connectivity

Richard Hughes-Jones
DANTE Delivery of Advanced Network Technology to Europe
ESFRI & e-Infrastructure Collaborations, Barcelona , September 2009

European R&E Networking

- Each country operates it own independent R&E network.
- Depending on the country, this can connect universities, colleges, research laboratories, schools, libraries, museums, municipal offices, hospitals.
- These national research and education networks (NRENs) may use different technologies and offer different services.
- The NRENs are interconnected by a pan-European backbone called GÉANT.
- GÉANT provides extensive international connectivity to other world regions and is operated by DANTE.
- The key is close Collaboration & Co-operation.

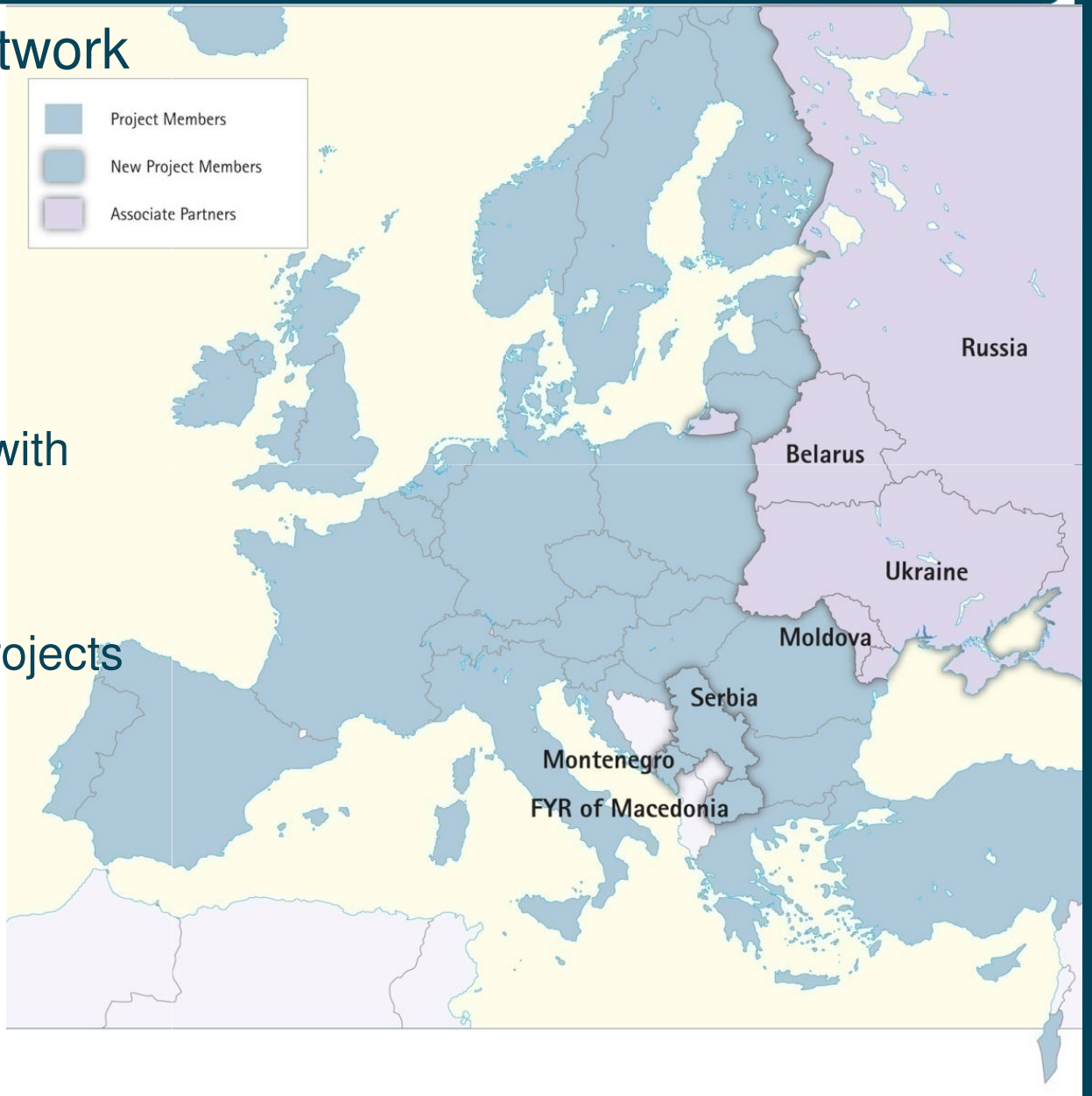
The GÉANT – NREN Evolution:

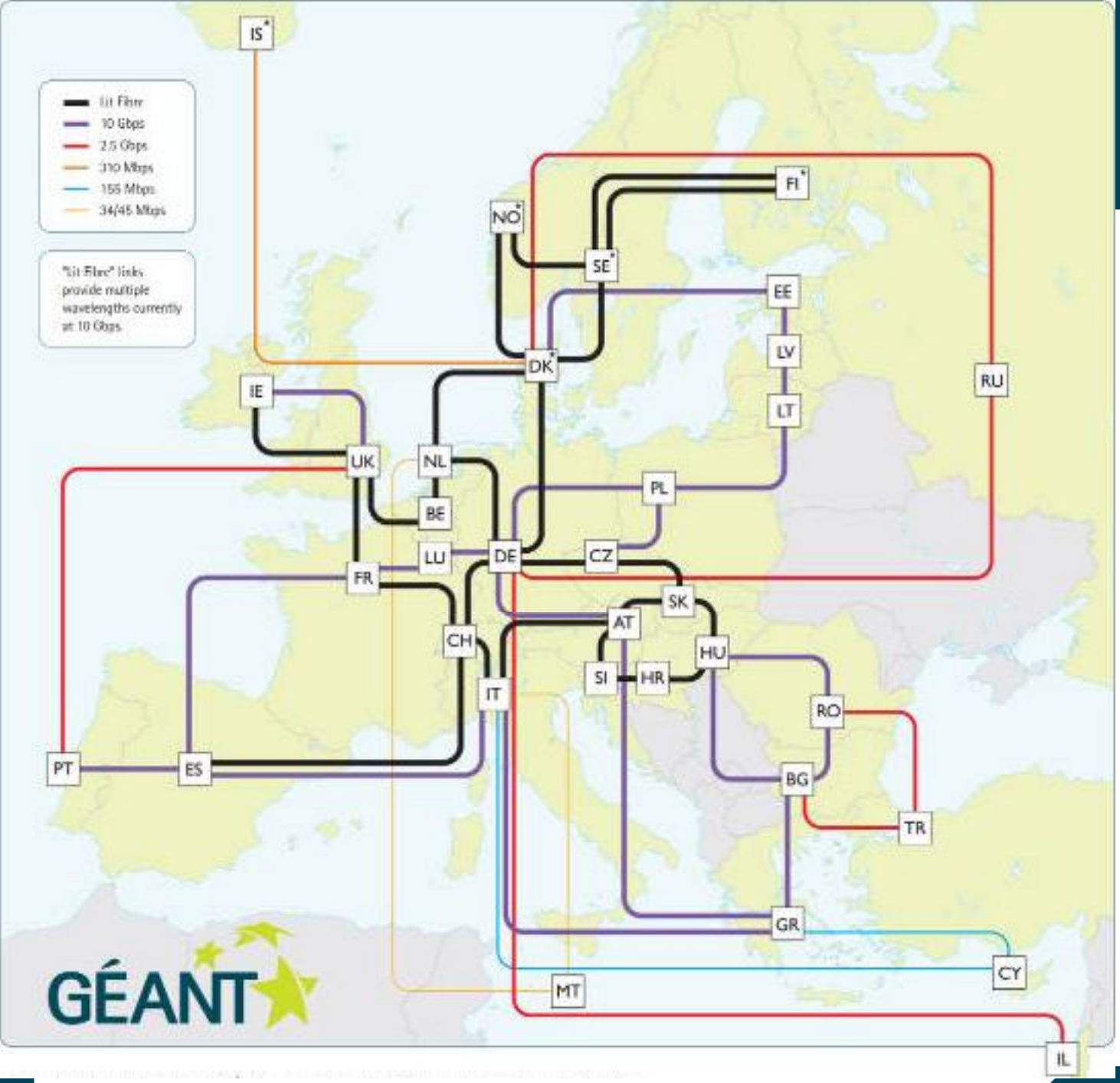
- 7th generation of pan-European research network ***federated*** infrastructure: A 20 year success story
  - EuropaNET → TEN34 → TEN155 → GÉANT (GN1 →GN2 → GN3)
- Connects 36 European countries through 32 NREN partners.
  - Serves over 3,500 research and education establishments across Europe
  - Over 30 million users
- Provides extensive international connectivity to other world regions.
- Funded jointly by NRENs and the EC.
- Mechanism is the GN3 ***Collaborative*** Project:
  - co-ordination by ***DANTE*** via the ***PMT*** (Project Management Team)
  - complemented by ***TERENA***
  - involves > ***400 NREN staff***
- **Collaboration & Co-operation.**

Vasilis Maglaris

GÉANT GN3 Objectives

- Provide a dependable Network
- Expand the reach
  - Complete the GÉANT European Footprint
  - New partners in South Eastern Europe
  - Associate and Cooperate with Eastern Europe partners
- Widen the user base
  - e-Infrastructure (ESFRI) projects including :
    - Earth Observation,
    - Climatology,
    - Space and Fusion,
    - Life Sciences,
    - Arts and Humanities



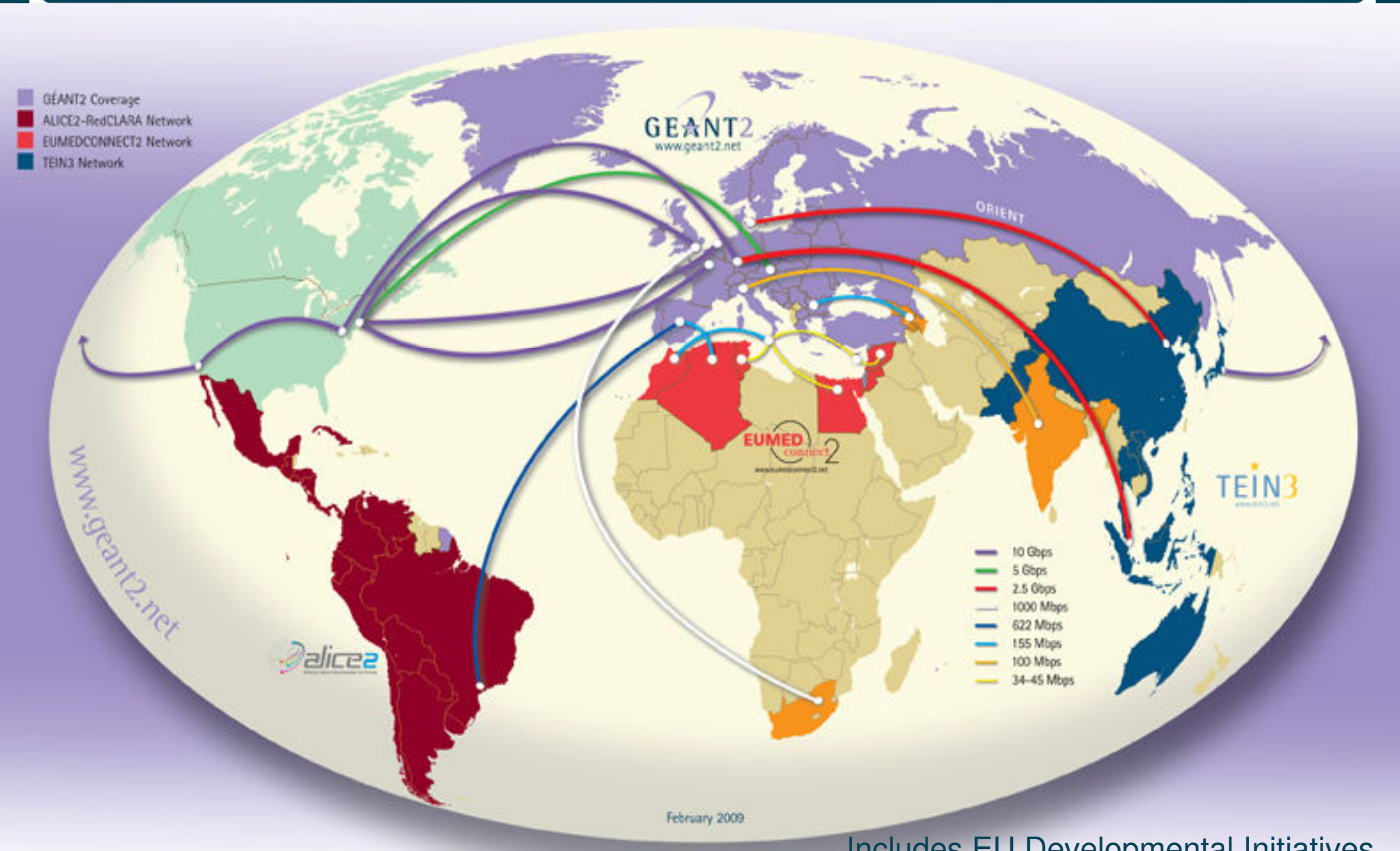


GÉANT

- 38 European Countries
- Dark Fibre
- Hybrid network:
  - IP Packet routed
  - Switched point-to-point Circuits
  - Dedicated wavelengths Lambdas

GÉANT topology – April 2009

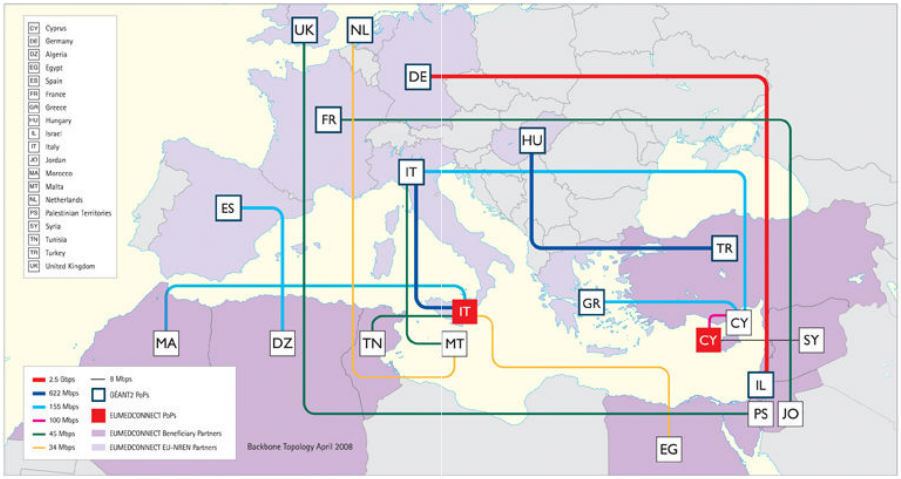
GÉANT global connectivity



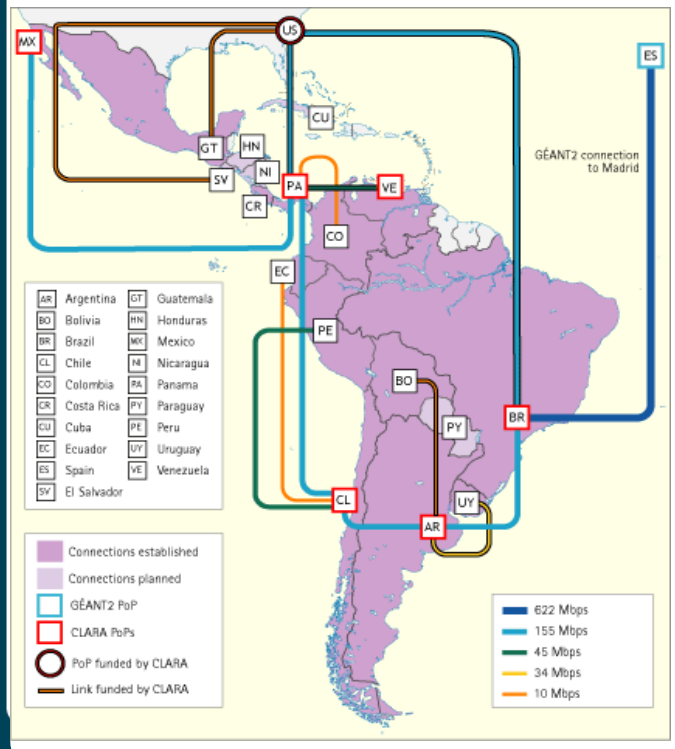
Includes EU Developmental Initiatives

Global Connectivity

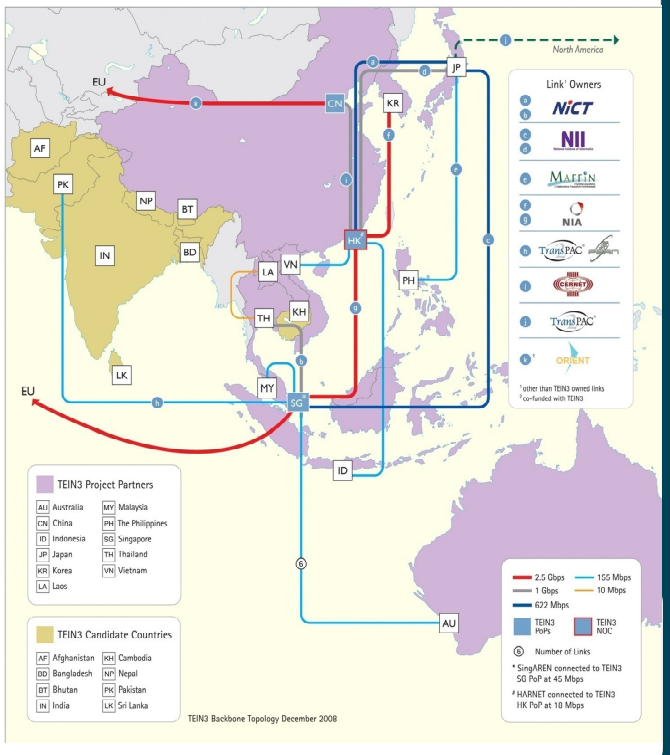
ALICE Project: RedCLARA Topology October 2007



TEIN3 Topology January 2009



EUMEDCONNECT Topology April 2008



Network Connectivity Services

- GÉANT & NRENs will offer connectivity.
  Hybrid networks built on dark fibre infrastructures lit with DWDM equipment.
- Basic IP access via a GÉANT2 router - GÉANT ip
  - High Bandwidth
  - Multicast
  - IPV6
  - QoS
  - MPLS / Traffic engineering
- Point-to-point Circuit Network - GÉANT plus
  - Dedicated Capacity – typically 1 Gigabit paths
  - Quickly configurable
  - More than 60 dedicated circuits by January 2009
- Wavelengths - GÉANT lambda
  - Full 10Gbps wavelengths across Europe – linking data centres

Key phrase is Multi-Domain

- Note that not all networks may be able to offer all these facilities.

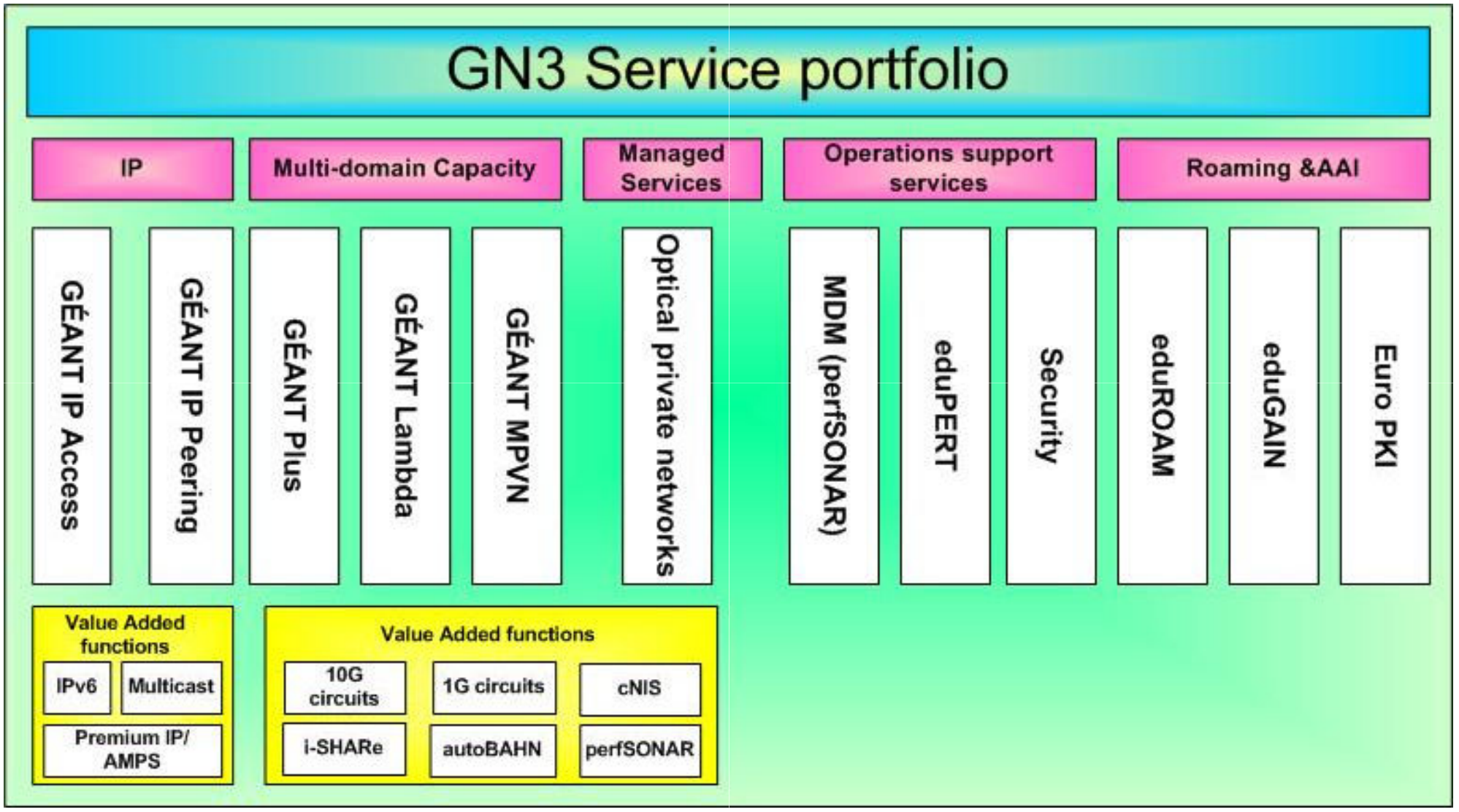
Network Services

- GÉANT & NRENs will offer network services.

- Network Monitoring
  - perfSONAR - based on OGF Standards
  - e2eMON
  - (Troubleshooting tool EGEE)
  - eduPERT
- Network Provisioning “on demand”: Circuits / VPNs / MPLS / QoS
  - autoBAHN tool from GN2
  - World wide interoperation – OGF Standard being developed
  - Quick configuration tool as a minimum
- Security & mobility
  - PKI coordination
  - Roaming Access Service eduROAM
  - eduGAIN Service introduction
- Note that not all networks may be able to offer all these service facilities.

Key phrase is still Multi-Domain

GN3 Service Portfolio

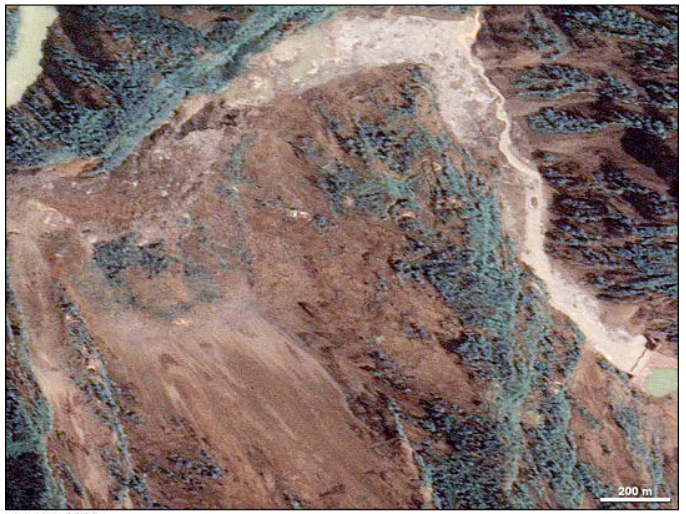


PROJECTS USING GÉANT

Sichuan Earthquake Recovery Efforts

- Sichuan Earthquake on 12th May 2008
- Satellite images of disaster region transferred over the ORIENT link from JRC (Italy) to RSGS (China) with routed IP.
- Tuned TCP throughput
- Added a second GE link from CSTnet in China.

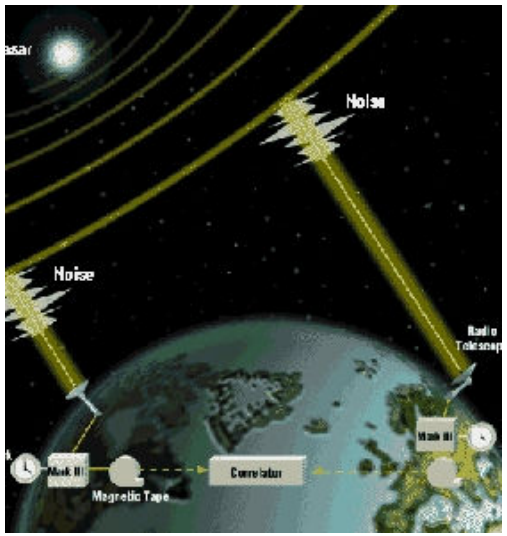
May 14, 2006



May 14, 2008

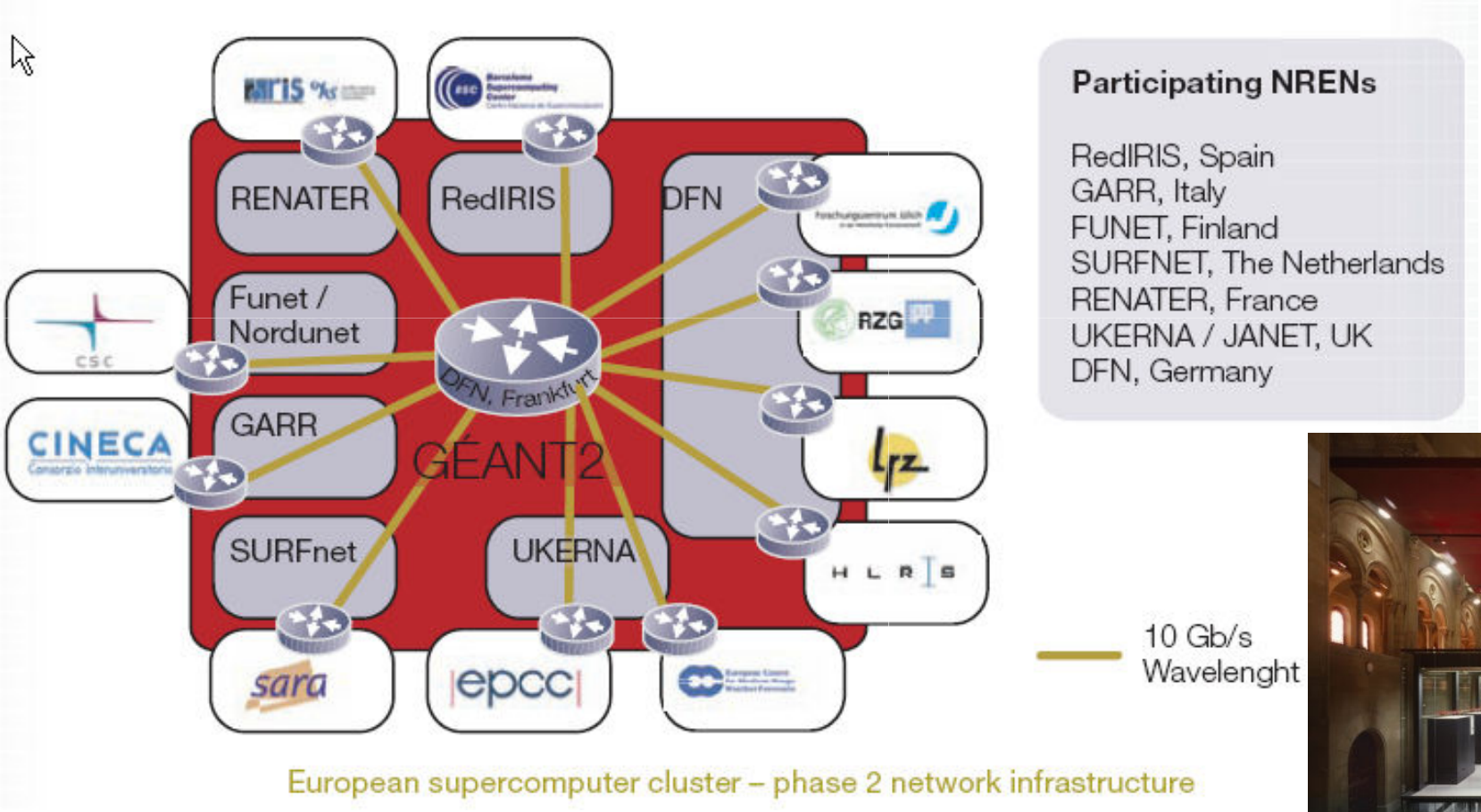
VLBI 1GE Circuits & IP connections in 2008

- 1 Gigabit Ethernet point to point circuits to the telescopes in Europe.
- Supplied by NRENs & GÉANT
- Also use Routed IP to other world regions
- Timeliness important
- Data rates:
  64Mbit/s
  512 Mbit/s
  1 Gbit

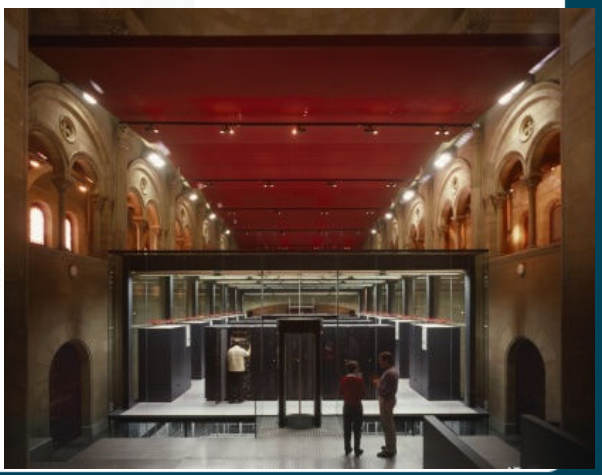


GÉANT lambdas form the DEISA Network 2008

All the Super Computers use 10 G Ethernet links connect to a 10 GE switch in DFN Frankfurt.



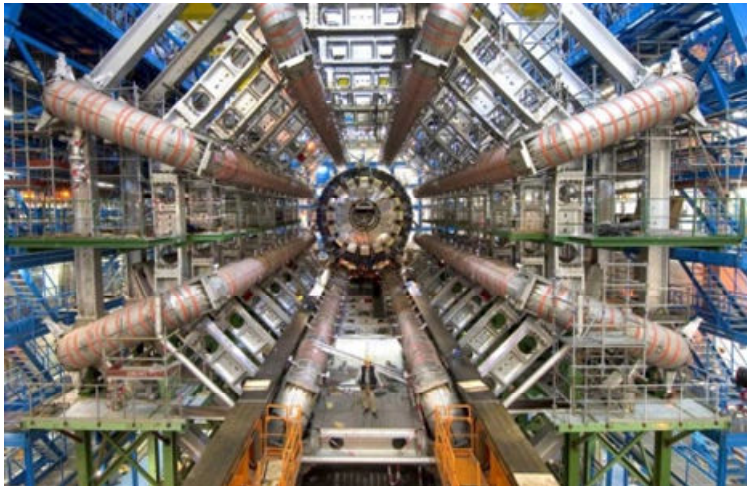
European supercomputer cluster – phase 2 network infrastructure

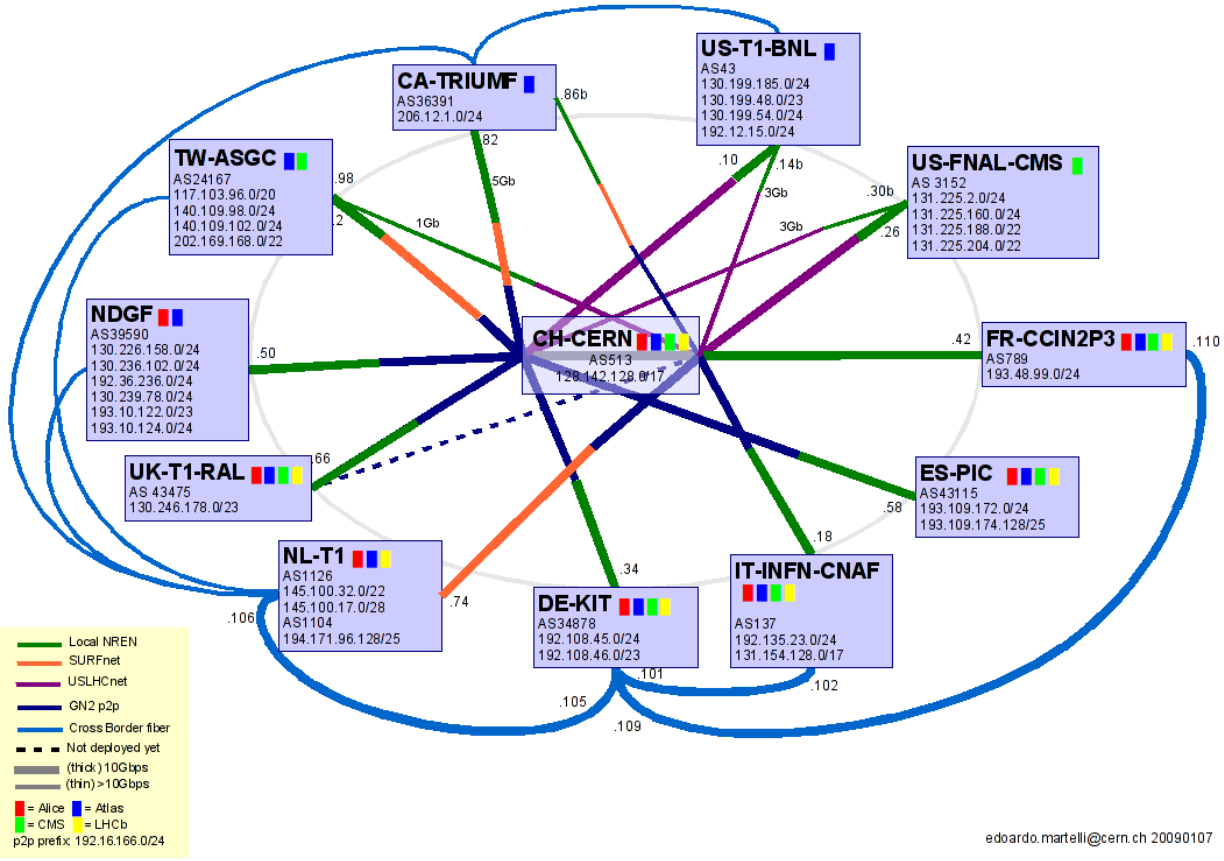


Also use the routed IP service.

GÉANT lambdas form the LHC Optical Private Network

- 10 Gigabit Lambdas form a dual star on 2 routers at CERN.
- Connects National data centres to CERN
- DANTE advised on architecture & resiliency.
- Have backup links.
- LHC operate the OPN
- Use Routed IP for other international traffic



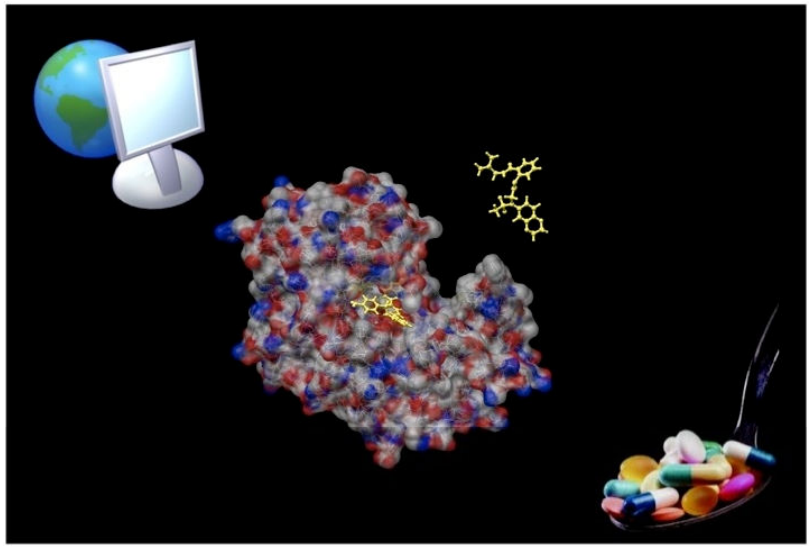


Edoardo Martelli

ATLAS @ LHC

Collaborative projects with high societal impact: eHealth & eLearning

WISDOM:



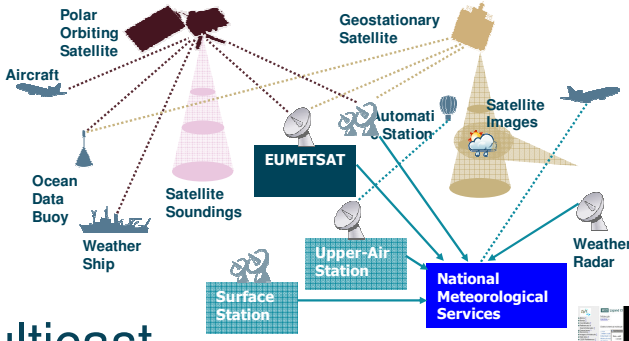
- Massive biomedical data challenge
- Involves parallel use 5000 computers in 27 countries
  (~ 420 years' computing for a single PC)
- e-Infrastructure accelerate screening of drugs against malaria, avian flu and other emerging diseases

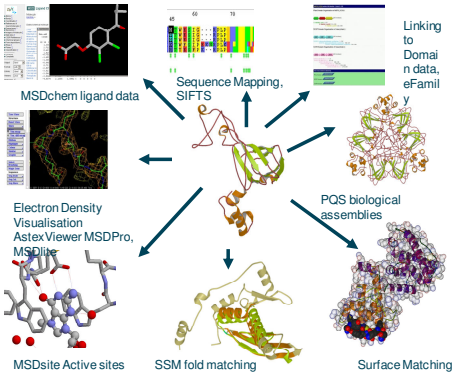
ICT-LEAP (EC-TEMPUS project)

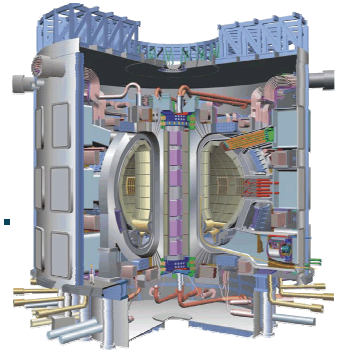
- Links universities from Polar Area to Middle East
- Facilitates e-learning centres in Middle East
- Broadens access to education
- Virtual enrolment in remote lectures
- Virtual capacity building in e-learning of teaching staff

Working with Emerging Users

- GEO / GEOSS
  - Accepted as a participating Organisation.
  - Areas: BW for disasters, linking data centres, Africa FEAST,GEONET
- EUMETSAT
  - Discussed requirements.
  - working with them on options for using the academic network.
  - Collaborative tests on high BW multicast.
- Bio-Informatics
  - Examine current connectivity.
  - Interest in creating a Bio-NREN forum.
- ITER
  - Require high bandwidth data transfers.
  - Discussing multi-gigabit transfers to Japan.







Summary: The GN3 Mission

- To create a **reliable**, innovative, responsive **multi-domain hybrid networking** environment, using advanced transmission & switching technologies.
- In collaboration with the NRENs to provide R&E users and projects with **flexible and scalable production quality network services.**
- 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.**
- **To be a dependable component of the European e-Infrastructure.**

Working with the ESFRI projects

- Projects will have very different needs for Network services.
- More detailed discussions on a project by project basis to understand their compute models and network requirements.
  - The talks yesterday were a good starting point.
  - Work towards mapping requirements onto services.
- GN3 project is developing a collaborative approach for working with multi-national projects.
- In collaboration with the NRENs to provide connectivity analysis and budgetary quotes.
- Co-ordination of requests to the NRENs for links & services.
- Help with multi-domain performance issues.
- Collaborative Technical tests or Proof of Concept demonstrations.

ANY QUESTIONS ?