

# **GÉANT Developments**

**Networkshop 31,  
York,  
2 April 2003**

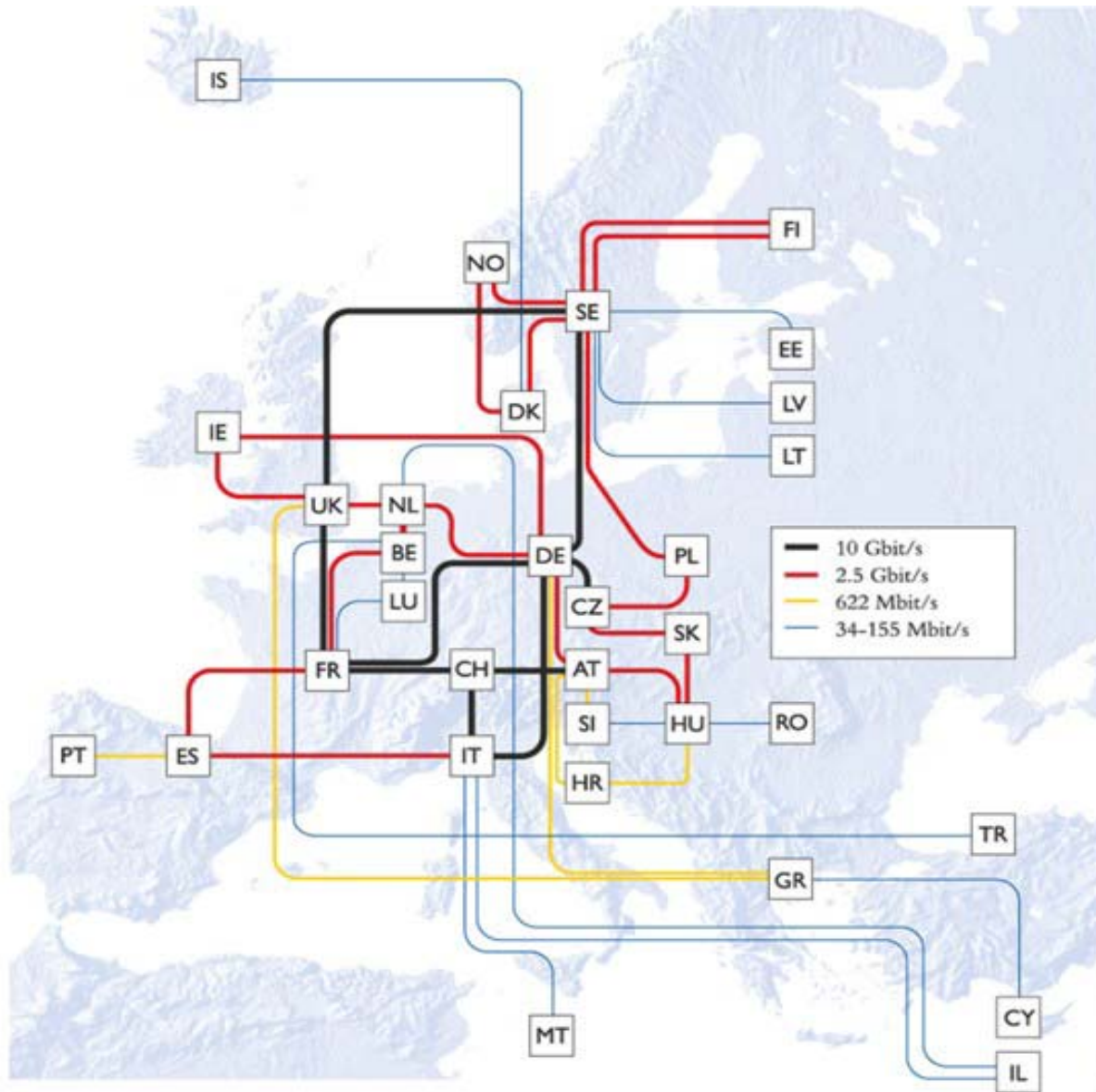
**Michael Enrico,  
Network Engineering & Planning  
DANTE**

## What is GÉANT ?

- **Pan-European Network connecting 28 NRENs from across Europe**
- **Based on 10Gbps capacity, using Juniper routers**
- **Global Research connectivity**
  - US, Canada, Japan
- **Platform for development and deployment of advanced services (QoS, IPv6, MPLS)**
- **Jointly funded by NRENs and EC**

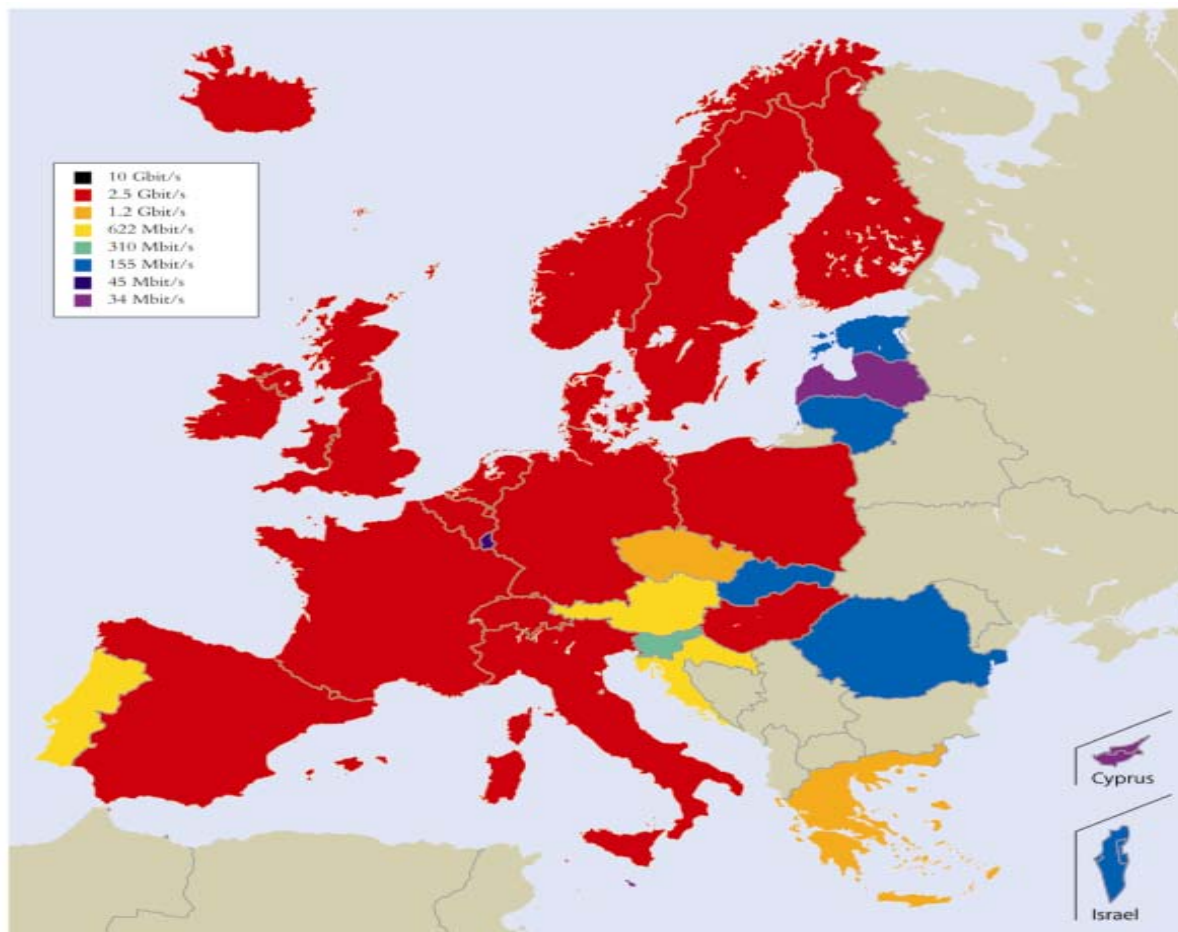
## Multi-Gigabit pan-European Research Network

### Backbone Topology December 2002



- Connecting 32 European Countries and 28 NRENs
- Backbone capacity in the range of:  
34Mb/s-10Gb/s

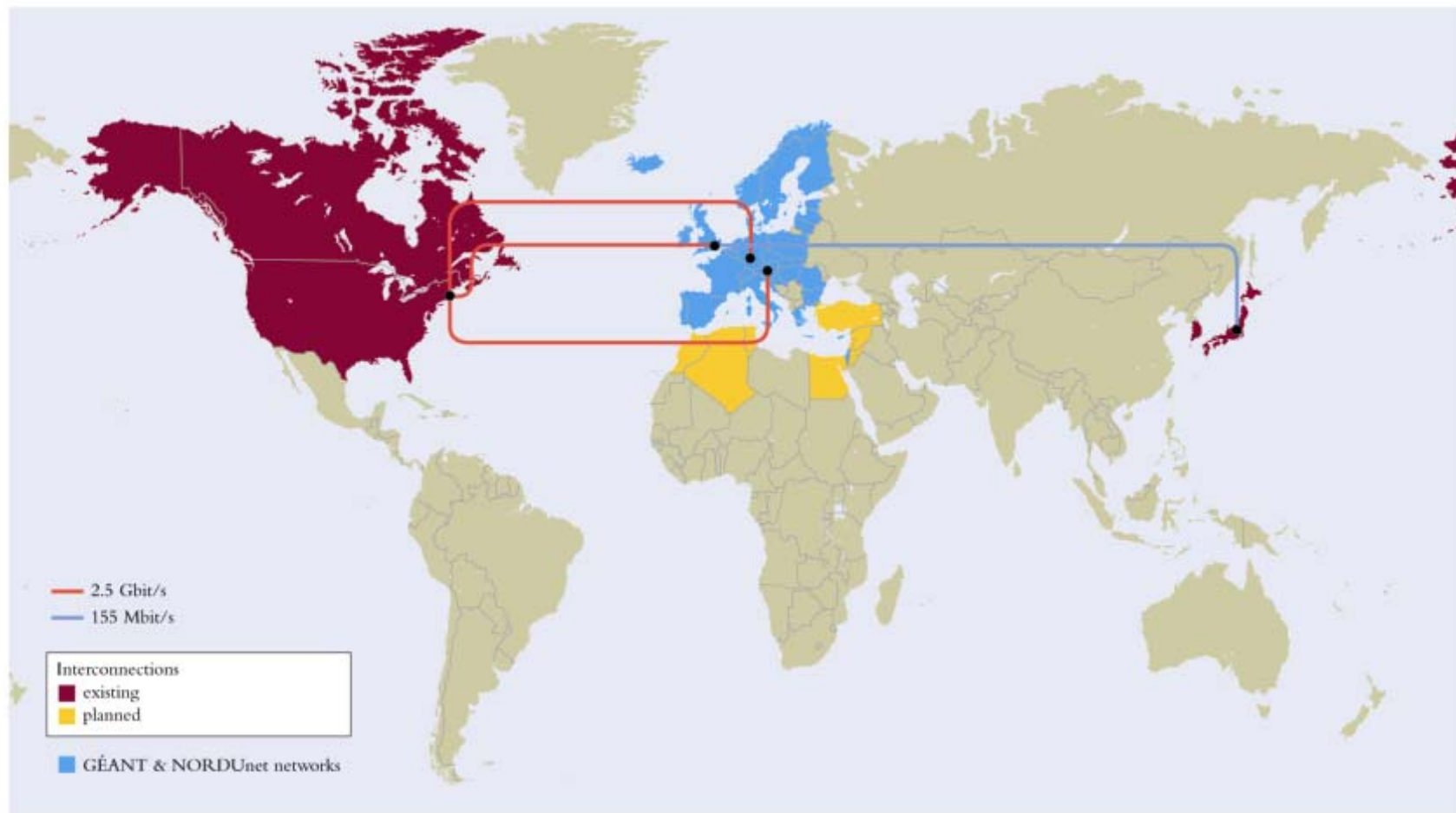
# Backbone Access Speeds - August 2002



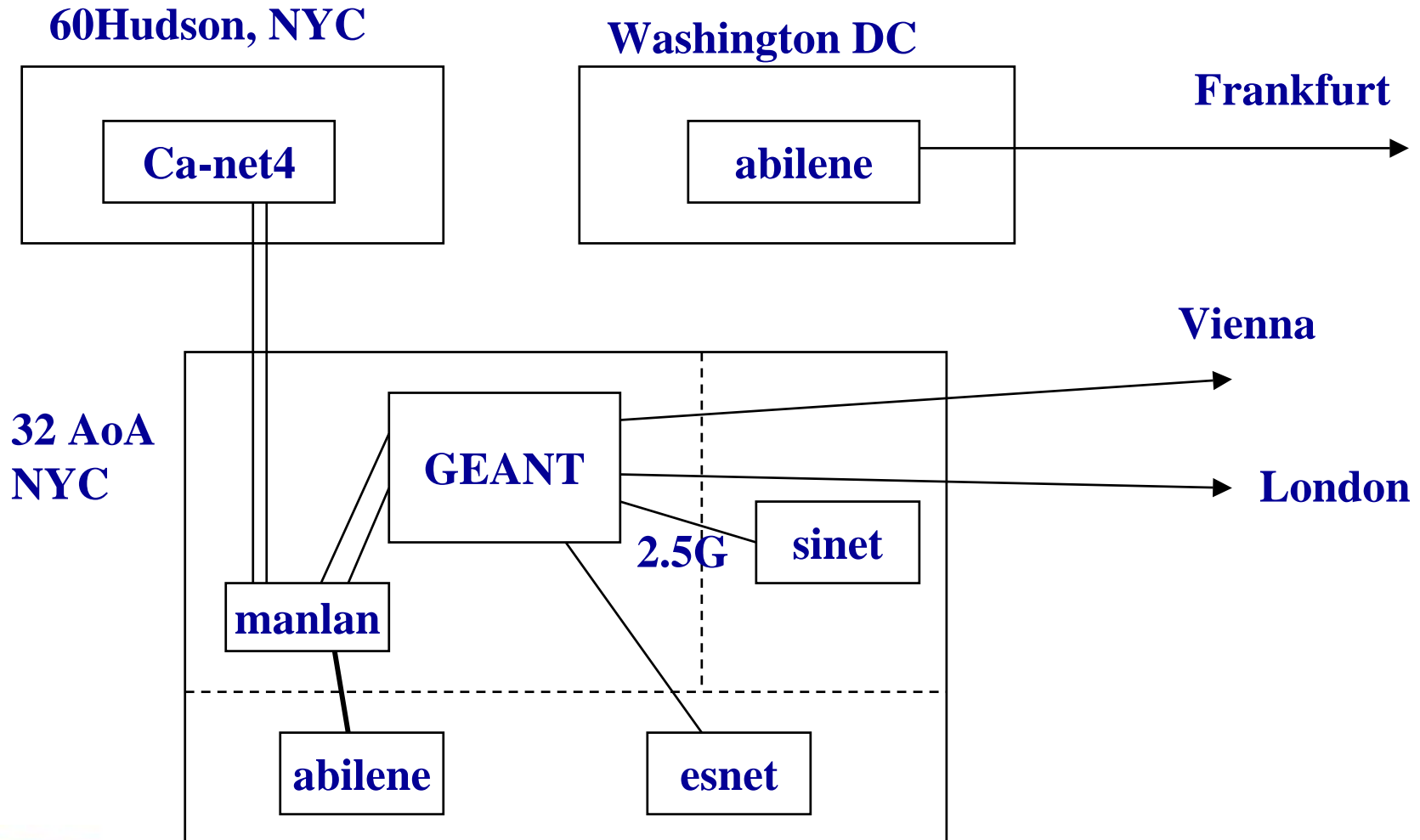
## Global Research Connectivity

- **3 x 2.5Gbps connectivity between Europe (AT, DE, UK) and US (NYC, DC)**
  - Interconnections with Abilene, CA\*net4, ESNET, SINET
- **NSF funded initiative to provide 2 x 2.5Gbps between Chicago and Amsterdam**
- **155Mbps connection London-Tokyo**

# Global Connectivity - August 2002



# North America - May 2003



## Other Regions

- **ALICE (South America)**
- **EUMEDCONNECT (Mediterranean)**

# The ALICE Project

## “America Latina Interconectada Con Europa”

The objective of ALICE is to create a regional Latin American research networking infrastructure and its interconnection to GEANT. The ALICE project is co-funded by the European Commission.

# Possible Latin American network topology



- Major connectivity between AR, BR, CL, MX (at least 45 Mbps)
- Other countries connect to major nodes (between 10 and 45 Mbps)
- Connectivity to Europe at least 155 Mbps
- Topology dependent on result of the ALICE tender
- IPv6, QoS, Multicast

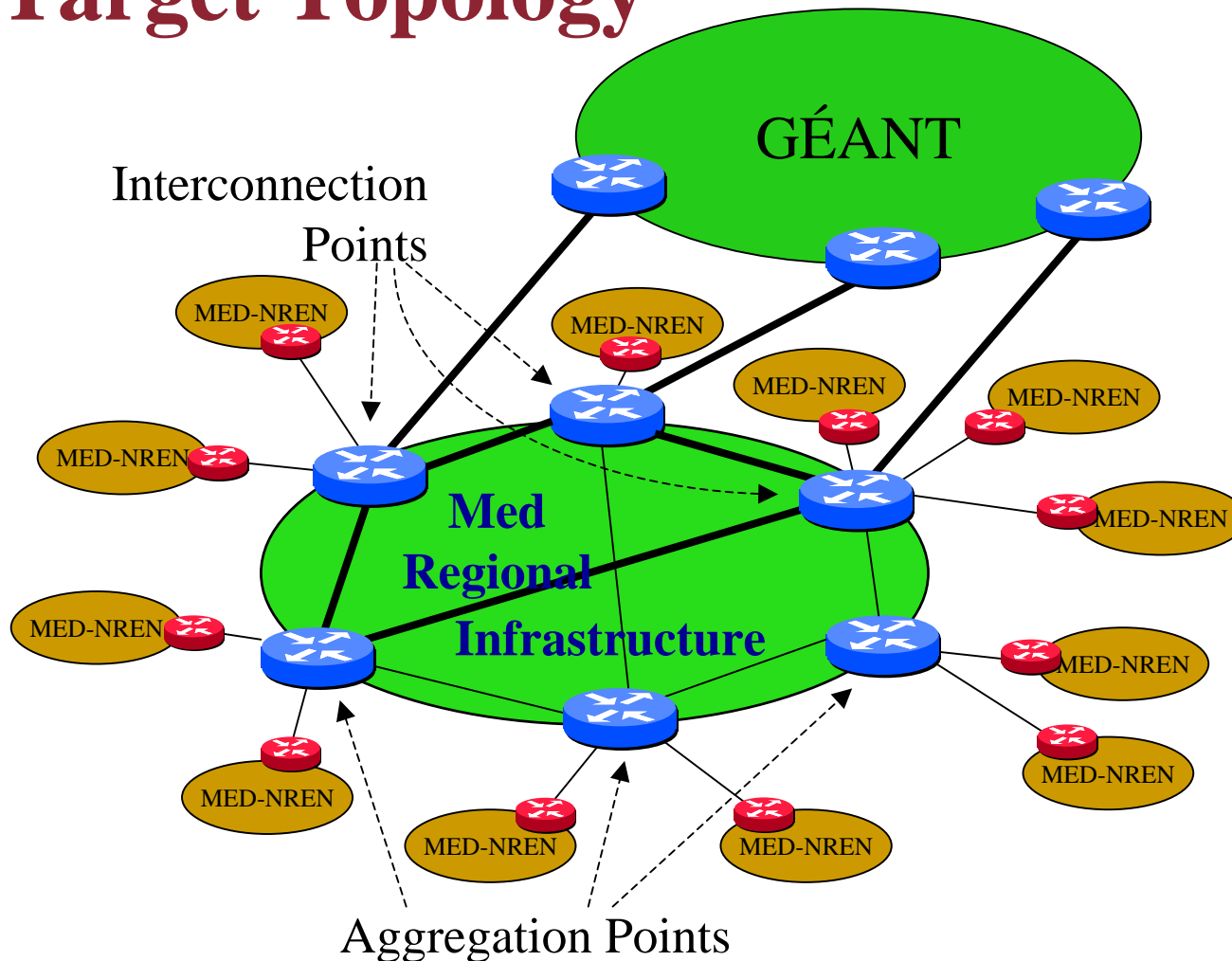
## **ALICE Timetable**

- **ALICE contract to be signed early April 2003**
- **Procurement Recommendation October 2003**
- **Main backbone ring (Mexico-Chile-Argentina-Brazil) and connectivity to GEANT end 2003**
- **Successive network roll-out to all other countries**
  - **EC funding will last until 31 March 2006**
- **Sustainability after 2006 to be ensured by CLARA (Cooperacion Latino Americana de Redes Avanzadas)**
- **More information: Please contact Cathrin Stover, [cathrin@dante.org.uk](mailto:cathrin@dante.org.uk)**

## **EUMEDCONNECT**

- **NREN's in Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, Palestinian Authority, Syria, Tunisia, Turkey**
- **Project Partners DANTE (UK), GARR (Italy), GRNET (Greece), RedIRIS (Spain), RENATER (France)**
- **Project supported by EC EUMEDIS programme**

# Target Topology



Most NRENs want  
34 Mbits + access

Connectivity and  
Equipment being  
Tendered

Net mgt by CS

## How do we get there?

- **Topology to be agreed during tender negotiations**
- **Initial topology could include:**
  - **Direct MED-NREN connections to GÉANT**
  - **Satellite links**
  - **“local hubs”**
- **Evolution to target topology as soon as achievable:**
- **Timescales: Tender currently underway**  
**Service from late 2003-2006**

## The Services

- **Best Efforts IP**
- **Premium IP**
- **LBE (scavenger)**
- **Multicast**
- **MPLS-based VPNs**
- **IPv6**
- **Interdomain Performance Monitoring**

## Premium IP

- **Separate IST project (SEQUIN) for the definition of Premium IP**
- **Validated, deployed on GEANT**
- **Based on diffserv-EF**

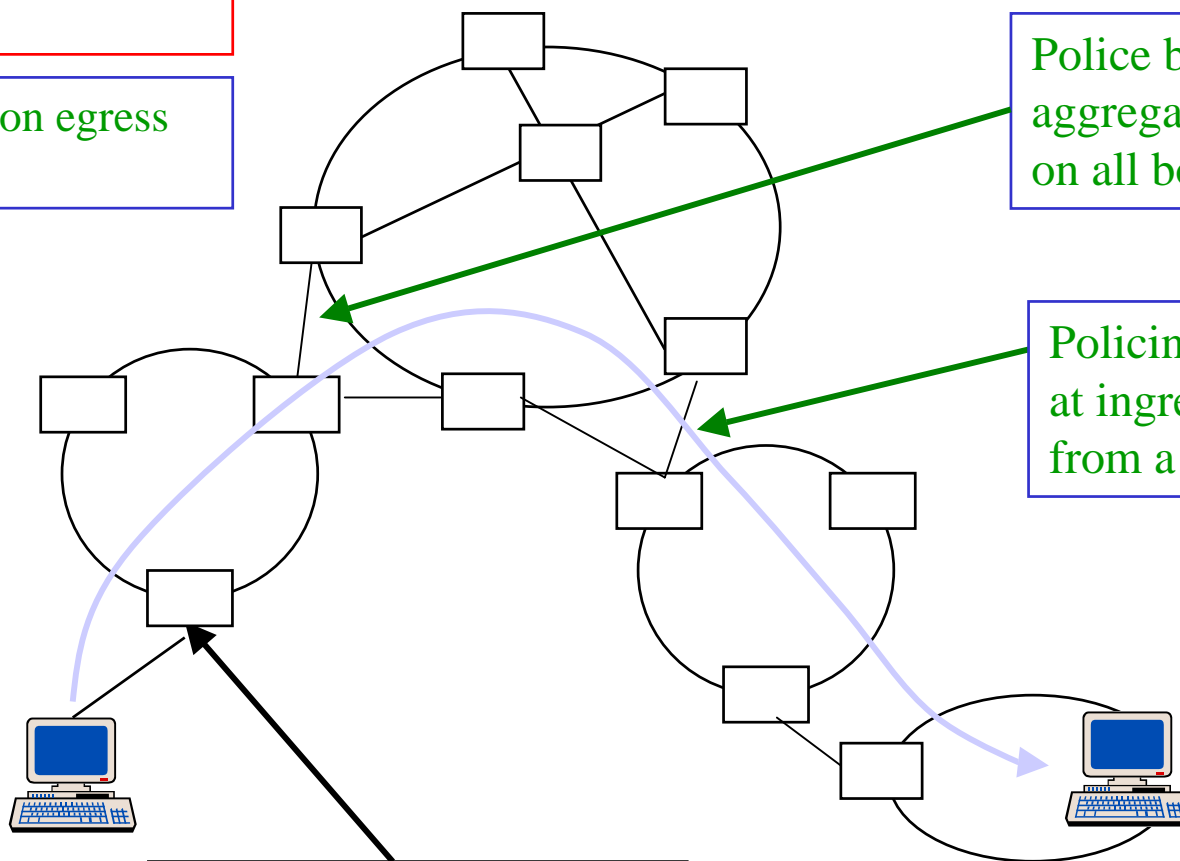
Classify (DSCP)  
High priority queuing  
on all nodes

Do not police on egress  
Do not shape

# Architecture

Police by (AS source,dest)  
aggregate capacity  
on all border nodes

Policing can be avoided  
at ingress when receiving  
from a trusted backbone



Classify (IP pair prefixes)  
Police - Strict, Capacity  
Mark

## Use of Premium IP

- **IST projects AQUILA, MOICANE, LONG**
- **Request for and configuration is not yet automated**
  - ongoing work
- **<http://www.dante.net/nep/geantqos/premiumip.html>**

## IPv6

- **GÉANT configured since February 2003 with dual stack operation**
- **First NREN connections next week!**
- **Abilene to follow in May 2003**
- **All other NRENs connected by October 2003**

## L2 VPN

- **Provision of emulated switched point to point connections, using Juniper MPLS/CCC**
- **6NET: STM-1 between Germany and Greece**
- **ATRIUM: STM-4 between Poland and France**
- **DATATAG: STM-4 between CERN and Italy**

## What next ?

- **GÉANT funding ends November 2004**
- **FP6 call for successor network May-September 2003**
- **Work for successor ( RfP, FP6 bid) starts *now***

## The Technical Requirements

- Support IP(v6) based services, perhaps at higher aggregate capacities (> 10Gbps)
- Switched point to point connections, from STM-4 to 10GE
  - middleware for *interdomain* resource allocation, AAA ?
- Support for GRIDs

## Network Architecture options

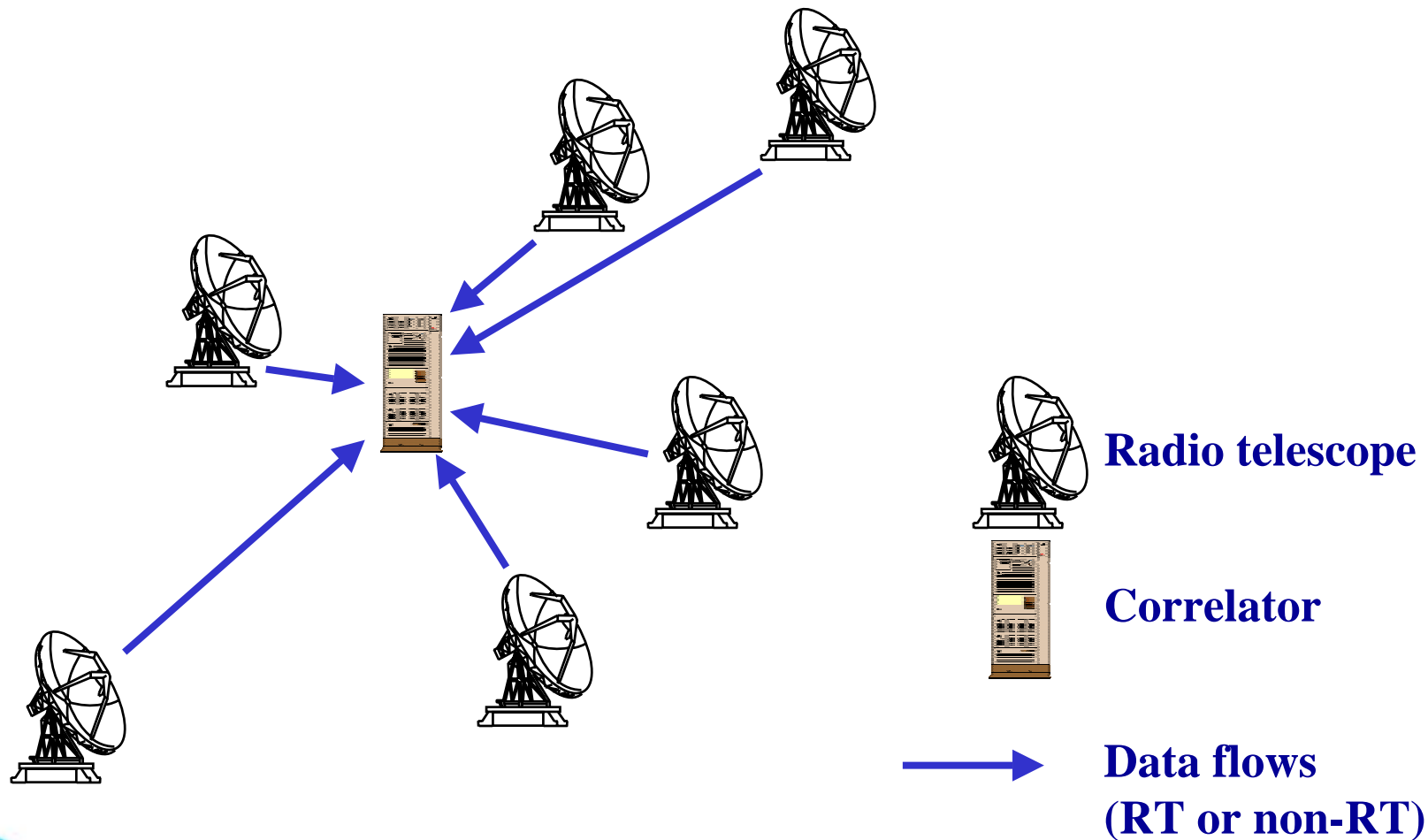
- **Routed (IP only)**
- **Mix of switched + routed**
  - SDH or GE or both ?
- **Connectivity (depends on costs and locations)**
  - managed wavelength/SDH
  - DIY (see CH, CZ, PL, NL)
  - mix of both

*Thank You*

# Largest GRID Application on GÉANT yet

- **VLBI - Very Long Baseline Interferometry**
  - e-VLBI - Real-time VLBI done using network interconnectivity
- **EVN - European VLBI Network**
  - 14 radio telescopes in Europe
  - plus others further afield
- **JIVE - Joint Institute for VLBI in Europe**
  - hosts Mk IV correlator (dedicated supercomputer)
  - JIVE hosted by ASTRON at Dwingeloo in The Netherlands
- See <http://www.evlbi.org>

# What is VLBI?



## Picture of (part of) MkIV Correlator...

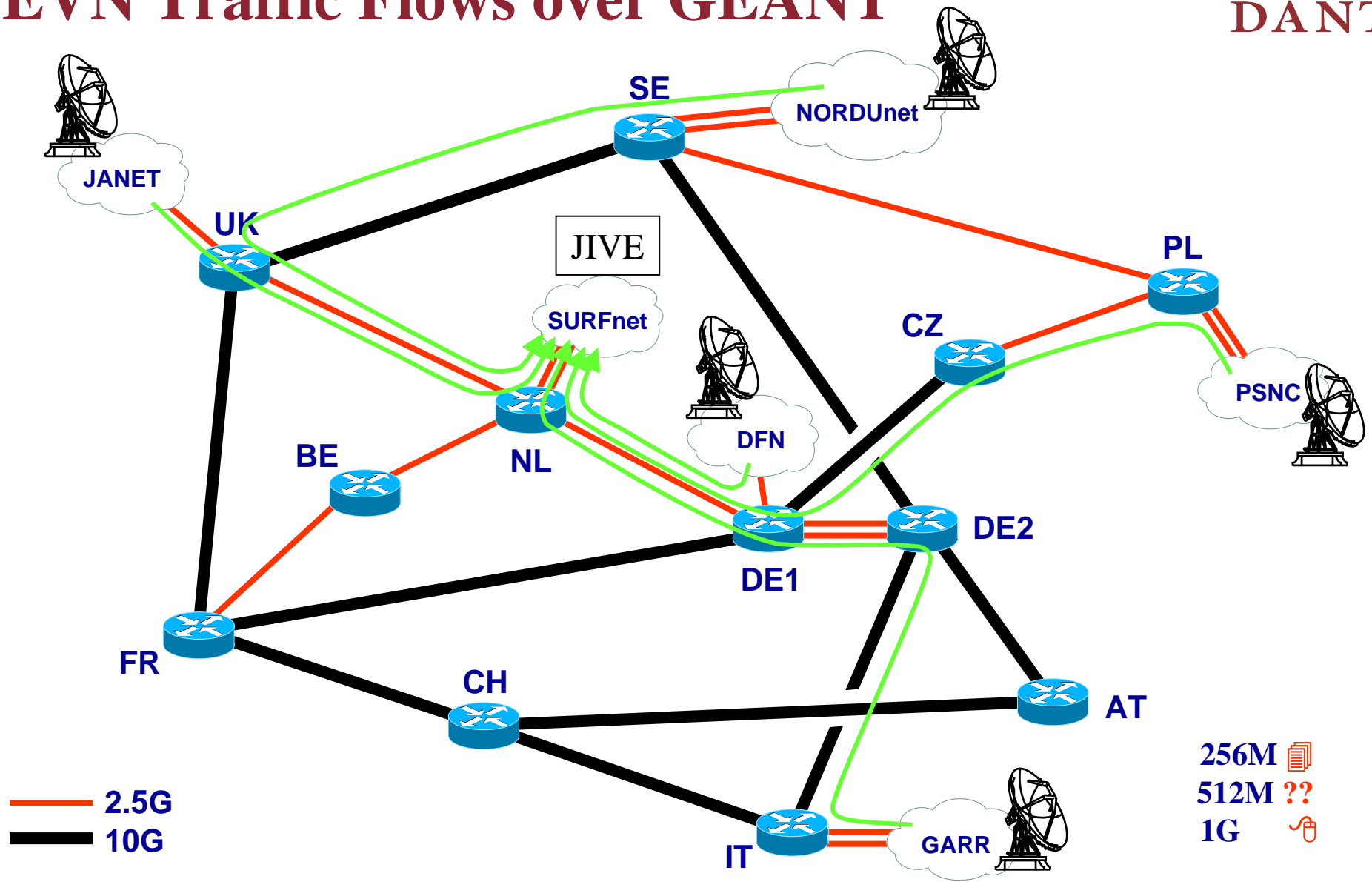


## Current arrangement uses tapes...

- **Tape technology nearing EOL**
  - One supplier left
  - \$1200 per tape
  - Drives no longer available
- **Expensive logistics**
- **Effectively limits bit rates**
  - Hence limits resolution
- **Slow turn around time**
  - Real-time measurement not possible
  - Inflexible duty cycles



# EVN Traffic Flows over GÉANT



# Who is supporting the PoC?

- **Radio astronomy community (EVN)**
  - **JIVE**
  - **Radio telescope sites:**
    - Westerbork (NL)
    - Effelsberg (DE)
    - Onsala Space Observatory (SE)
    - Medicina (IT)
    - Jodrell Bank (UK)
    - Torun (PL)
- **NRENs**
  - **GARR, UKERNA, DFN, NORDUnet (SUNET), PSNC**
  - **SURFnet (all roads lead to Dwingeloo!)**
- **DANTE**