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EVN-NREN Proof-of-Concept Project

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Outline

- European Research Networks
- eVLBI experience
- Proof of Concept Project
- UKLight proposal

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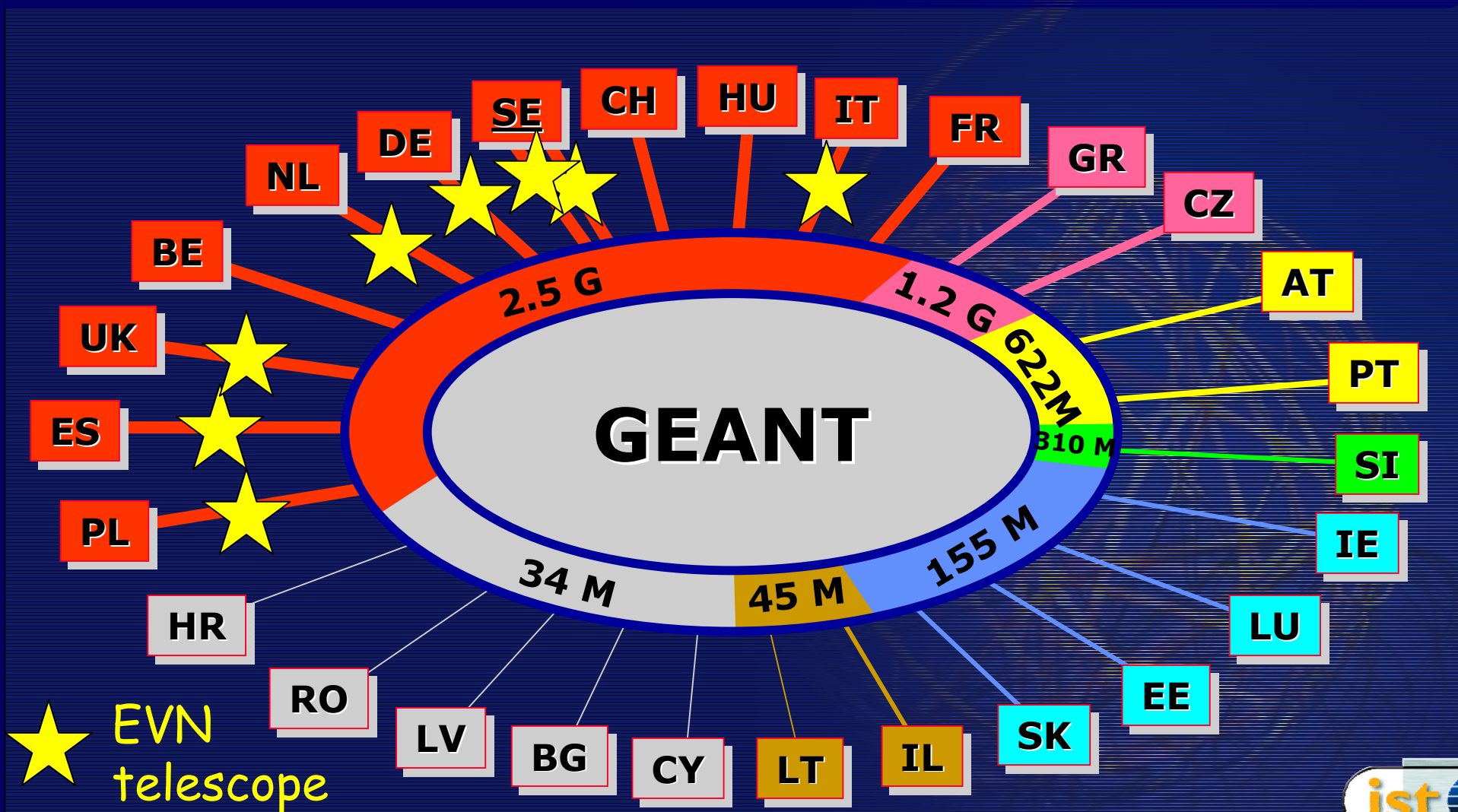
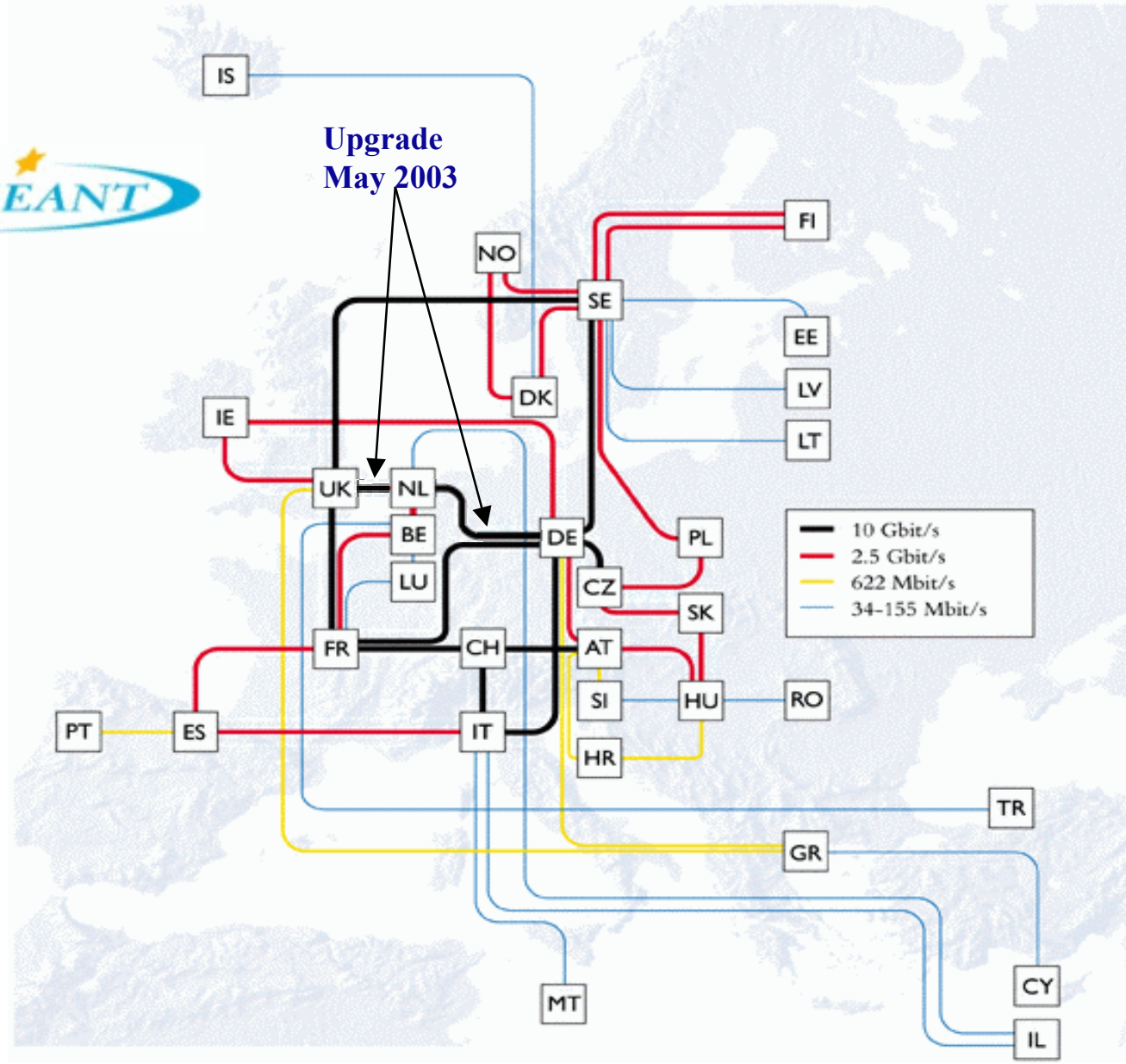
European Research Networks

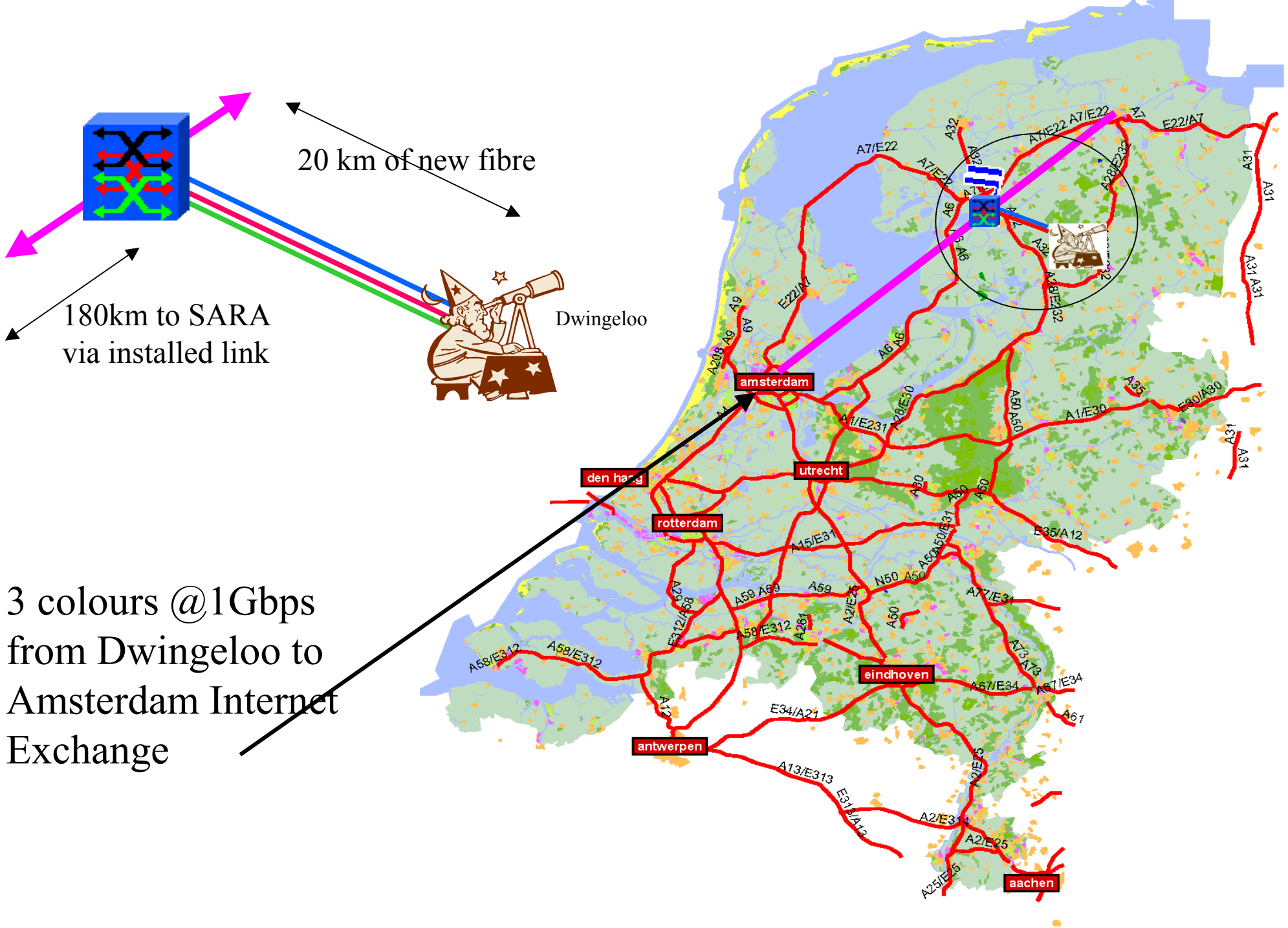
- National
  - NREN = National Research and Education Network
  - UKERNA, SURFnet, GARR, DFN, PSNC, NORDUnet .....
- International
  - GÉANT = Pan-European Research Network

GÉANT:
Access of NRENs to GÉANT

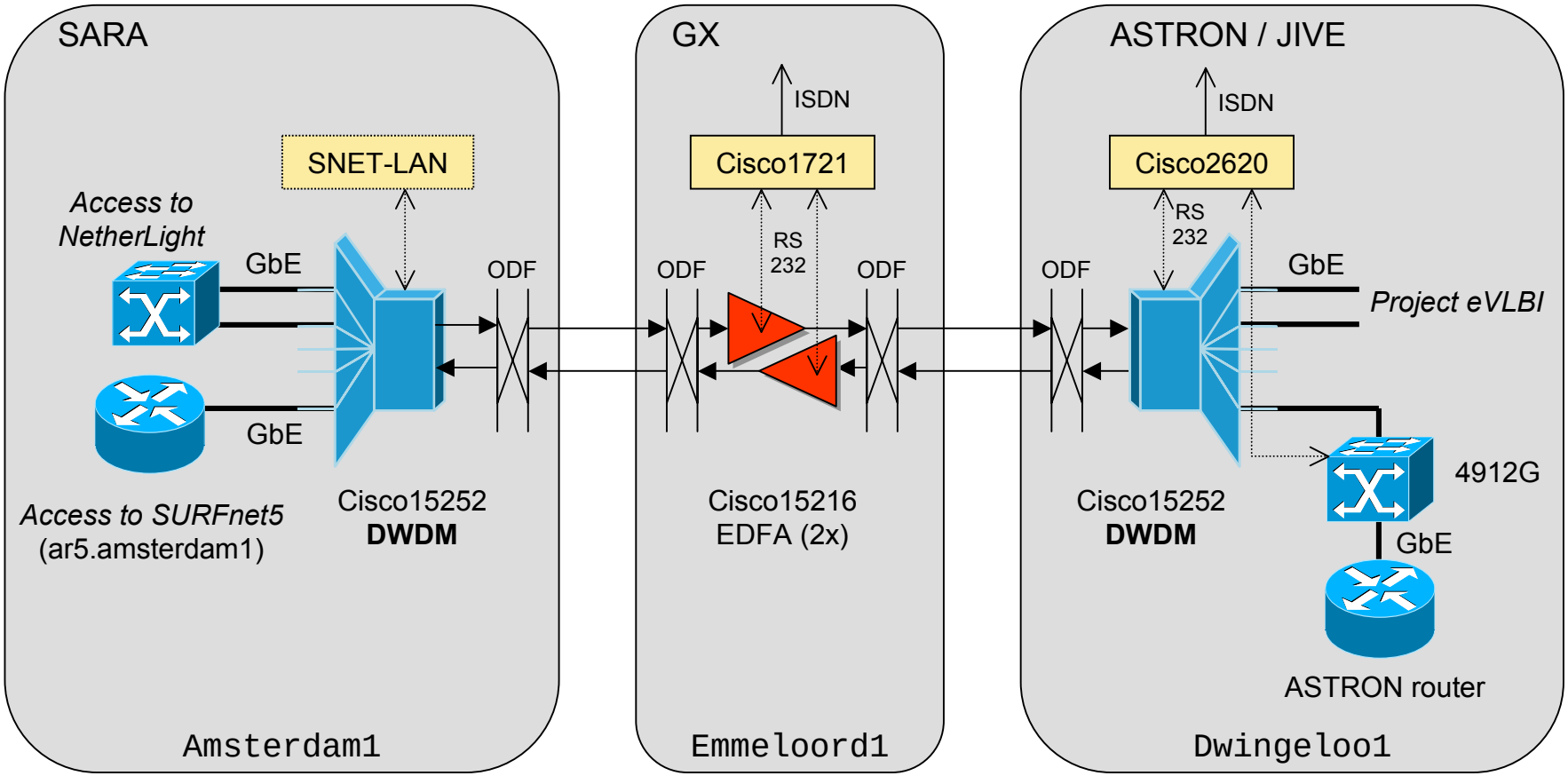




Backbone Topology March 2003


20 km of new fibre
180km to SARA
via installed link
Dwingeloo
3 colours @1Gbps
from Dwingeloo to
Amsterdam Internet
Exchange
amsterdam
den haag
rotterdam
utrecht
eindhoven
antwerpen
aachen

Network SARA - ASTRON / JIVE



iGrid 2002

The International Virtual Laboratory

www.startap.net/igrid2002
www.igrid2002.org (COMING SOON)

24-26 September 2002
Amsterdam Science and Technology Centre (WTCW)
The Netherlands

Call for Applications with Insatiable Bandwidth Appetites!

"We hereby challenge the international research community to demonstrate applications that benefit from huge amounts of bandwidth!"

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iGrid Lessons Learned

- 500Mbit/s VLBI data transfer on the production network using a simple UDP based protocol is feasible.
- Acceptable packet loss is achievable .
- End hosts must have sufficient power in both compute cycles and input/out capability.

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Proof of Concept Project (PoC)

- Target:
  - Up to 5 radio telescope sites (not incl NL) connected in real-time to JIVE correlator
- Support:
  - Best effort IP service transiting NRENs and GÉANT
  - No significant upgrades to GÉANT (initially)
  - Support 512M and 1G real time modes of operation
  - Use existing NREN access ports
  - Limited resilience

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Success Criteria (for PoC)

- NREN/GÉANT point of view:
  - Connect at least three sites to JIVE
  - Observe significant usage (time and BW)
- EVN point of view:
  - Same-day imaging of 12hour, 1Gb/s observation
  - Real time network verification of transient phenomenon

Proof of Concept Participants

DANTE/GÉANT	Pan-European Network
GARR	Italian NREN
UKERNA	UK NREN
PSNC	Polish NREN
DFN	German NREN
SURFnet	Dutch NREN
KTHNOC/NORDUnet	Nordic NREN
Manchester University	Network application software
JIVE	EVN Correlator
Westerbork telescope	Netherlands
Onsala Space Observatory	Sweden
MRO	Finland
MPIfR	Germany
Jodrell Bank	UK
TCfA	Poland
CNR IRA	Italy

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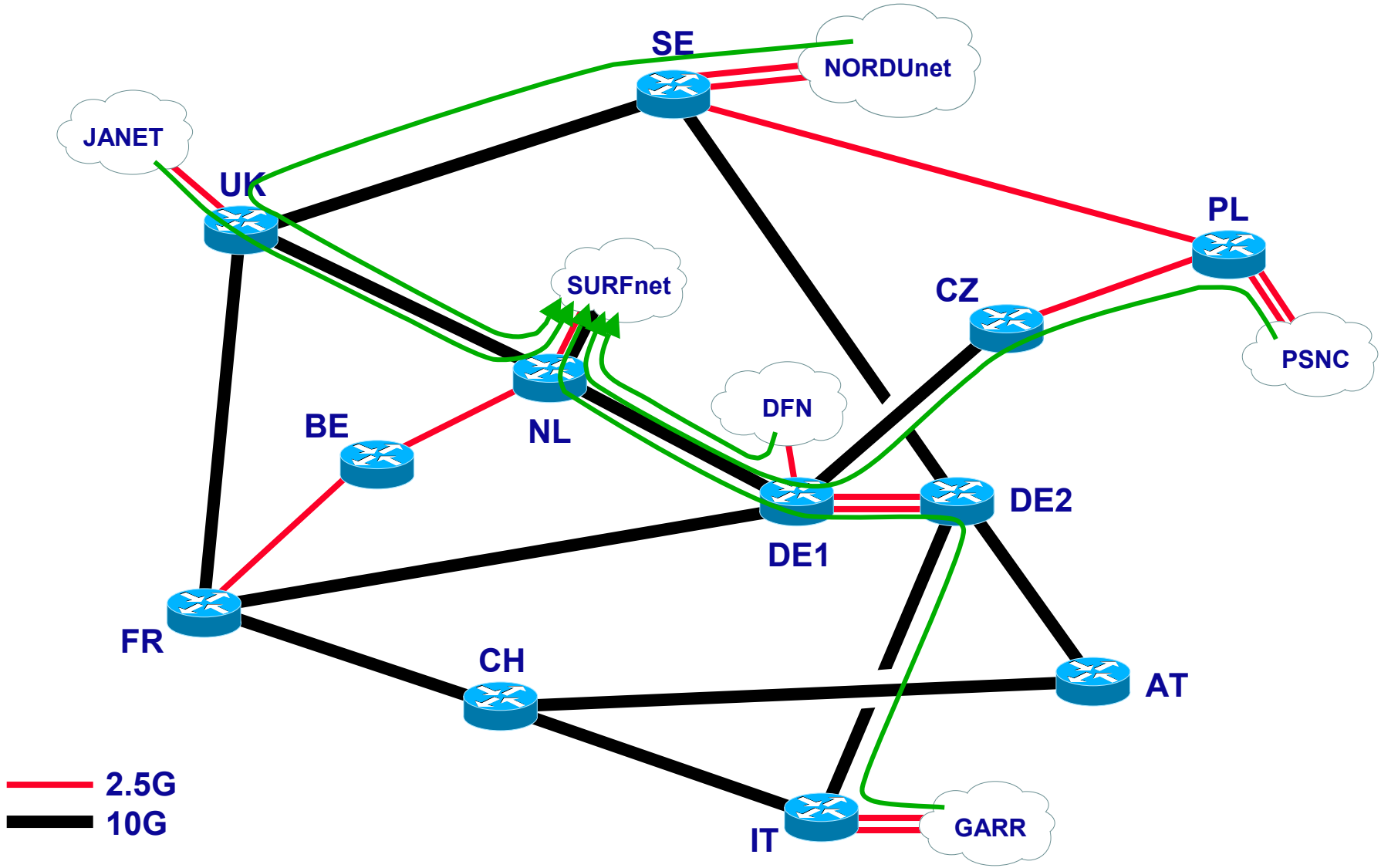
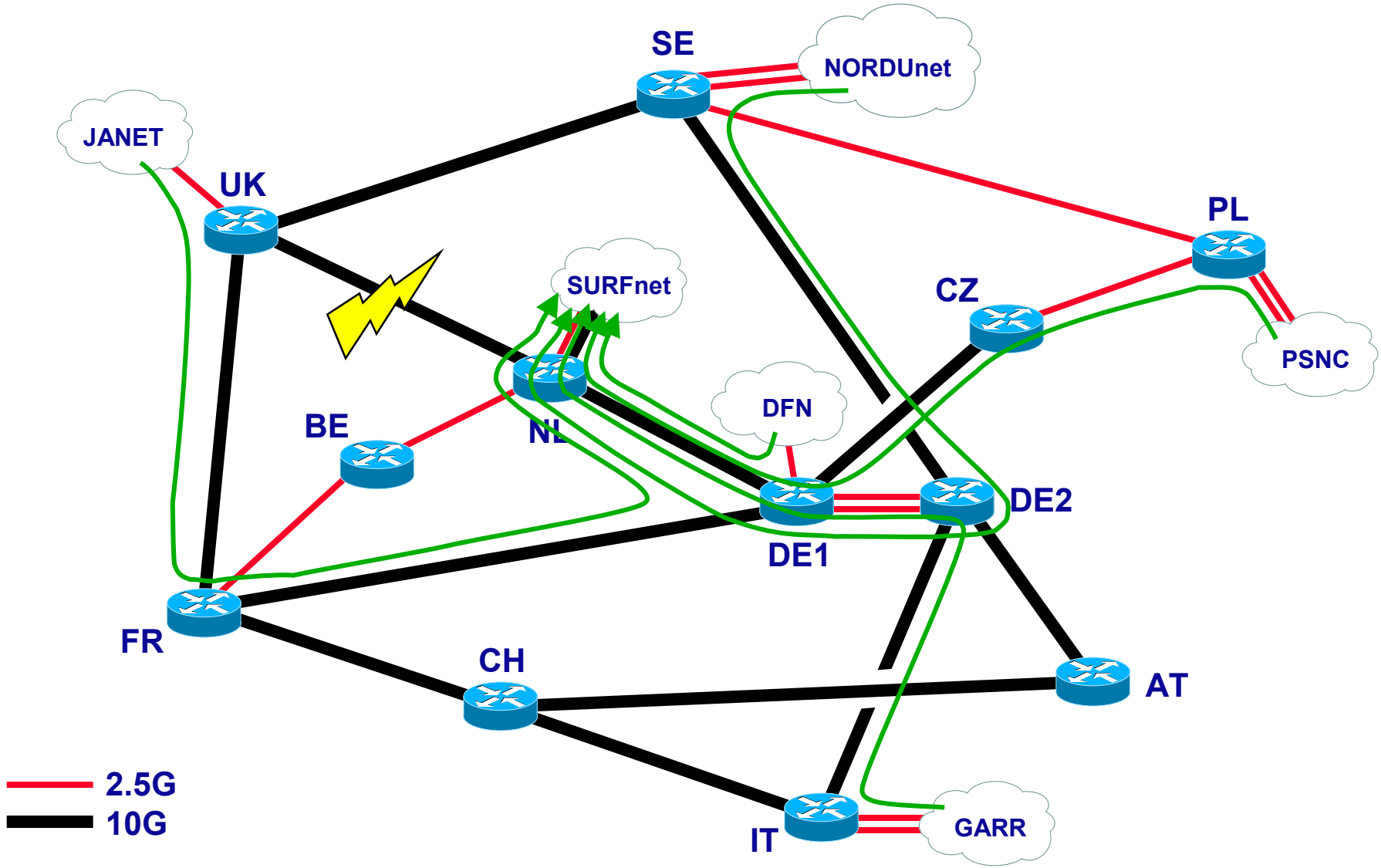
Traffic Engineering on GÉANT

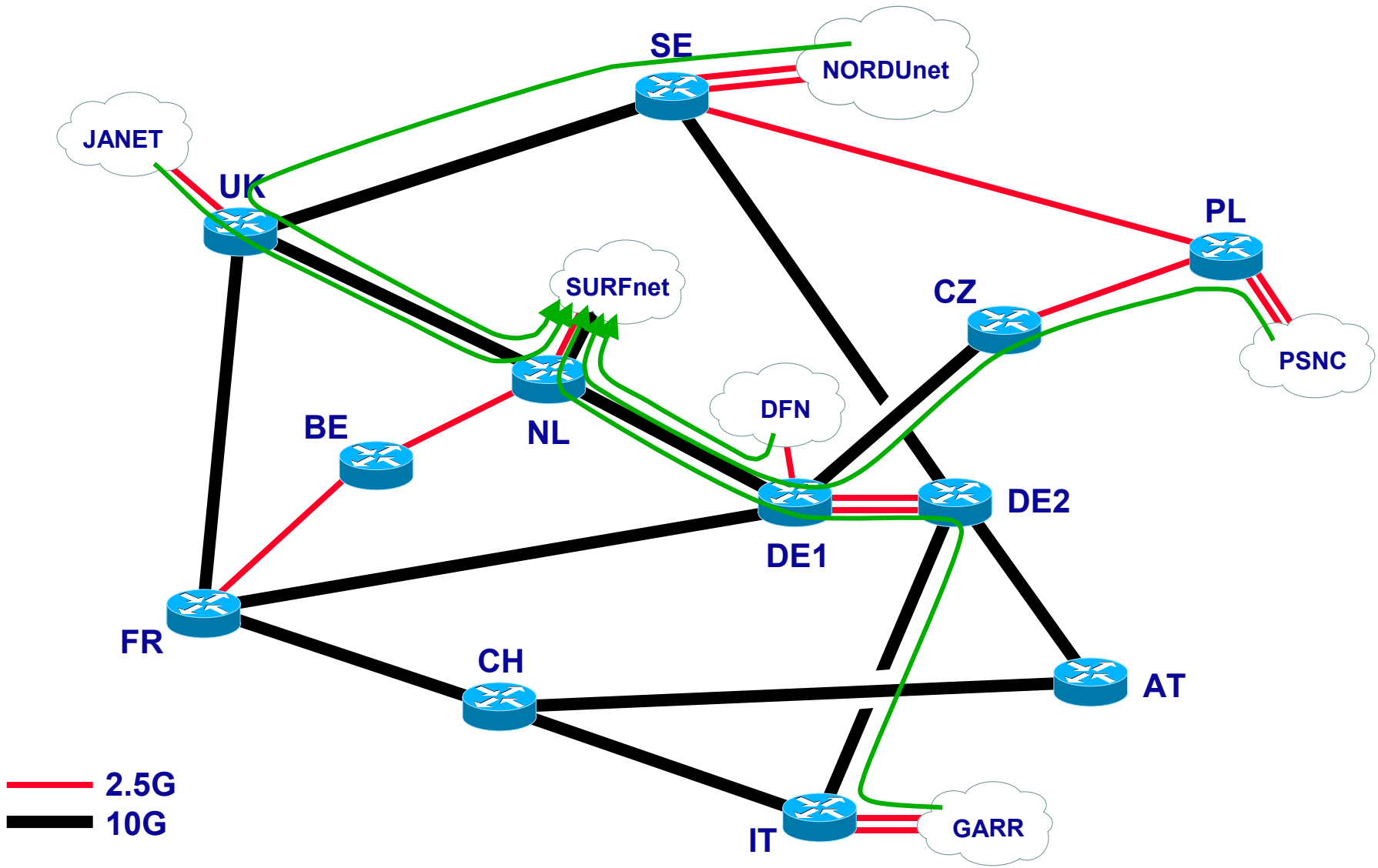
GÉANT: Upgraded Links to NL



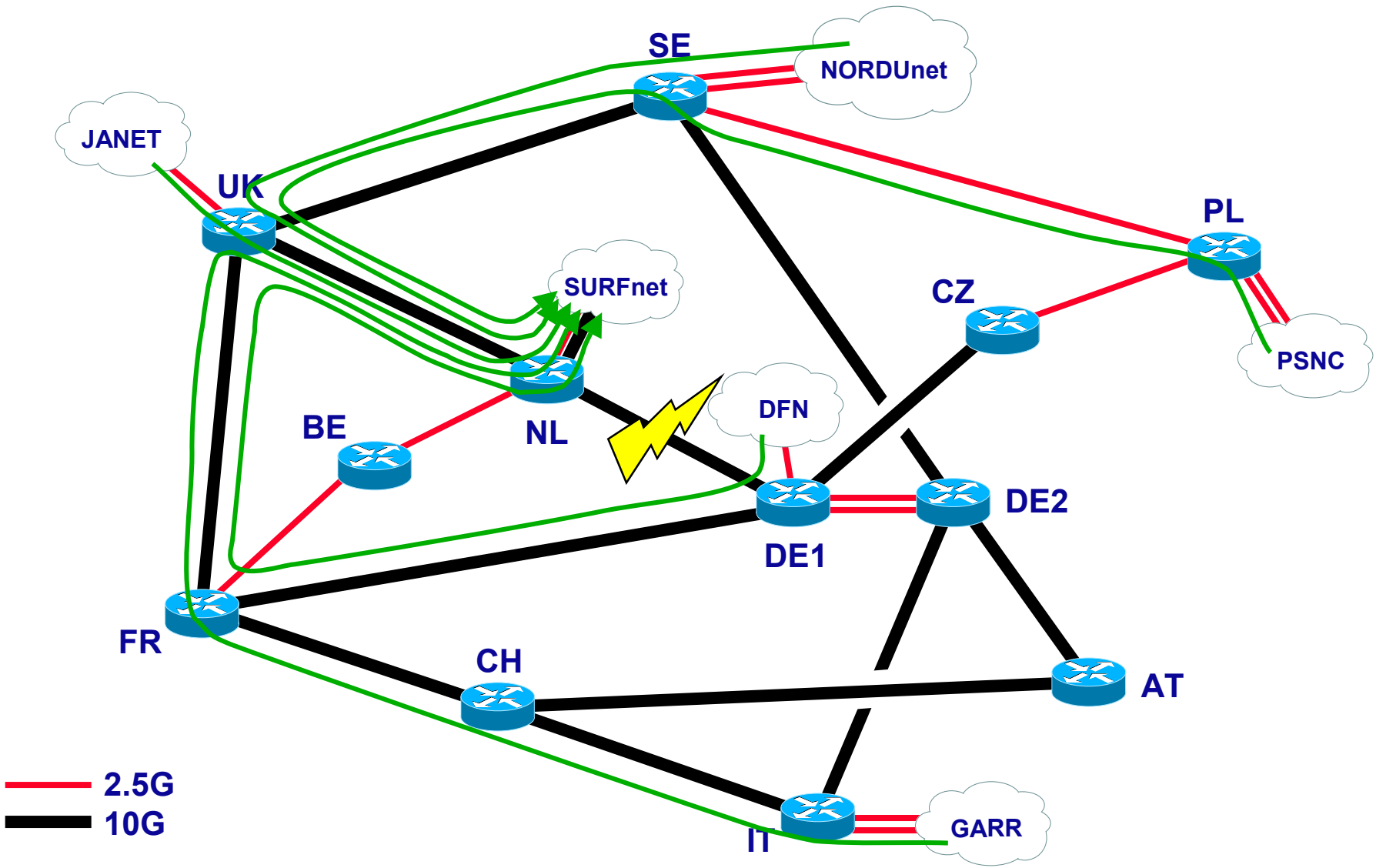
Failure Scenarios



Failure Scenarios



Failure Scenarios



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Traffic Routing/Delays

- Paths are "least cost" routes calculated by IS-IS internal gateway protocol.
- IS-IS metrics can be “tweaked” to optimise routing and minimise delays.
- Adjust BGP attributes or use MPLS techniques to force paths.
- One-way path delays in GÉANT :
  - SE-UK-NL 22ms
  - DE-NL 3.7ms
  - UK-NL 4.6ms
  - IT-DE-NL 8.3ms
  - PL-CZ-DE-NL 17.7ms

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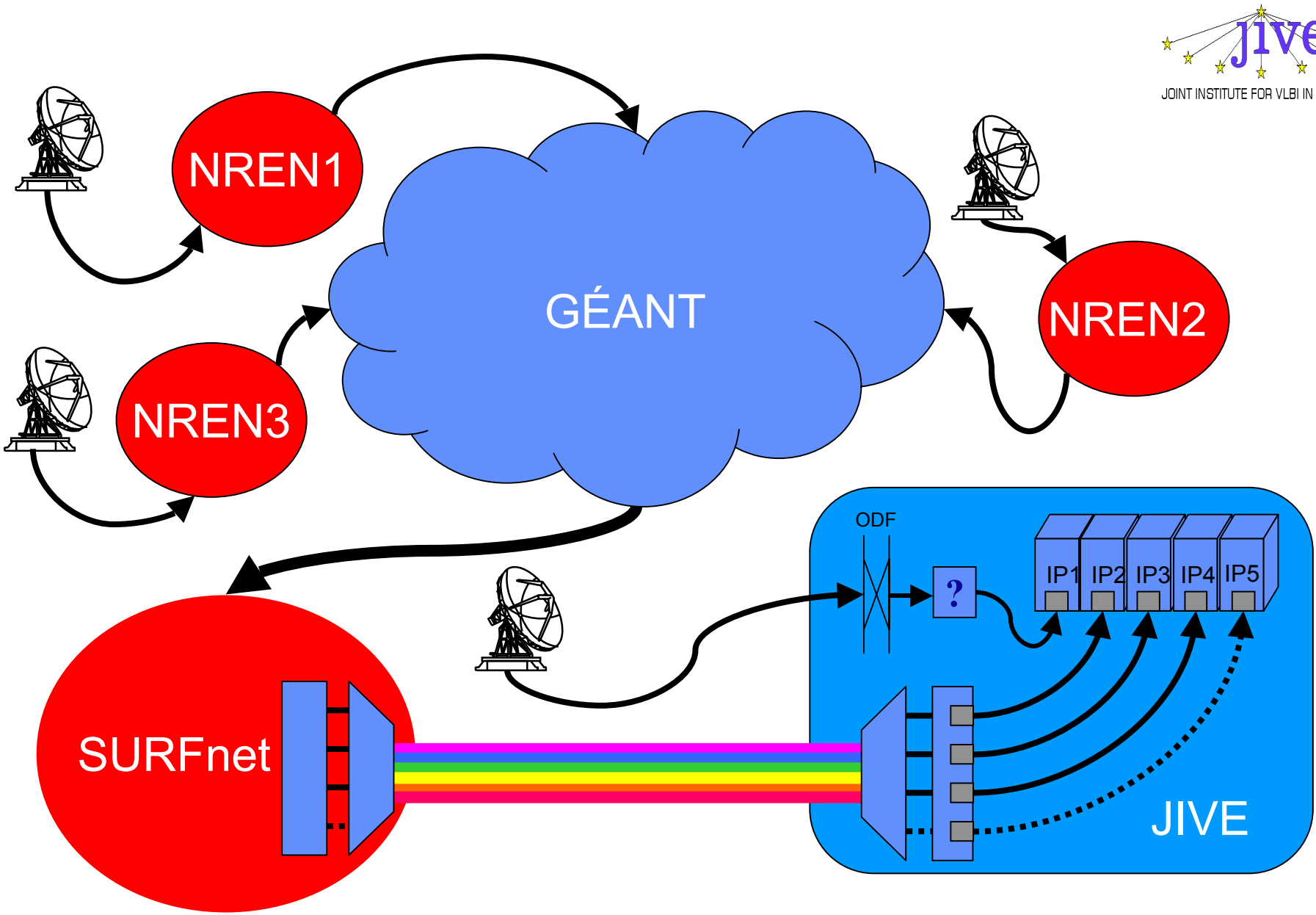
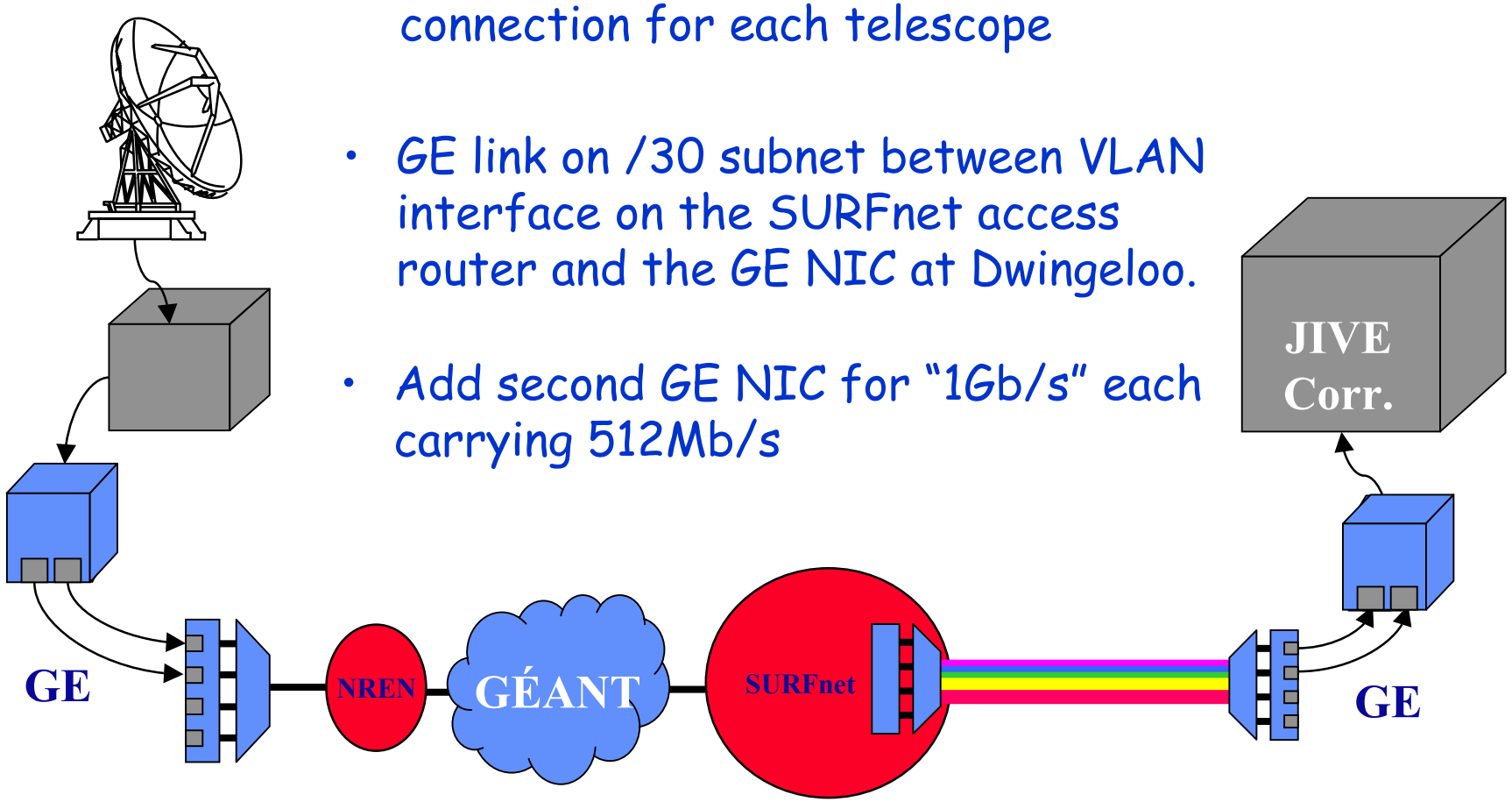
Congestion Control

- Mark VLBI traffic as less-than-best-effort (LBE)
  - Other traffic takes priority when congestion occurs
  - VLBI flows severely degraded
- Drop whole flows?


NREN1
GÉANT
NREN2
NREN3
ODF
?
IP1
IP2
IP3
IP4
IP5
SURFnet
JIVE

PoC Design

- Separate, GE point-to-point connection for each telescope
- GE link on /30 subnet between VLAN interface on the SURFnet access router and the GE NIC at Dwingeloo.
- Add second GE NIC for "1Gb/s" each carrying 512Mb/s



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Local Loops

VLBI Station			NREN	Nearest PoP		Local loop Status					Expected data rate
Name	Country	Location		Location	Additional fibre needed	Costs			Funded?	ETA	
						Installation	Recurring	Basis			
Westerbork	Netherlands	Dwingeloo 30km	SURFnet	Dwingeloo	0km (May'03)				Yes	Work in progress	
Onsala	Sweden	Göteborg 40km	SUNET	Göteborg	10km	€95k	€4.7k/quarter	Ordered	Yes	6-10 months	1Gb/s
Torun	Poland	Torun City 15km	PSNC	Torun	0km	€2.5k		Preliminary offer		June-03	2Gb/s
Medicina	Italy	Bologna 35km	GARR	Bologna	35km	€25k		Quotation	Yes	Dec-03	1Gb/s
Noto	Italy		GARR						Yes		
Effelsberg	Germany	Bonn 50km	DFN	Bonn	10km	€1.5 - 2M		Estimate	No		
Jodrell Bank	UK	Manchester 30km	UKERNA	Manchester	1km or 30km	€50k or €500k		Estimate	Yes No	6-12 months	2.5Gb/s
Metsähovi	Finland	Otaniemi 35km	FUNET	HUT campus	500m	Incuded in monthly	€10k/month	Quotation	No		1Gb/s
Yebes	Spain	Madrid 70km	RedIRIS	Madrid	70km				No		

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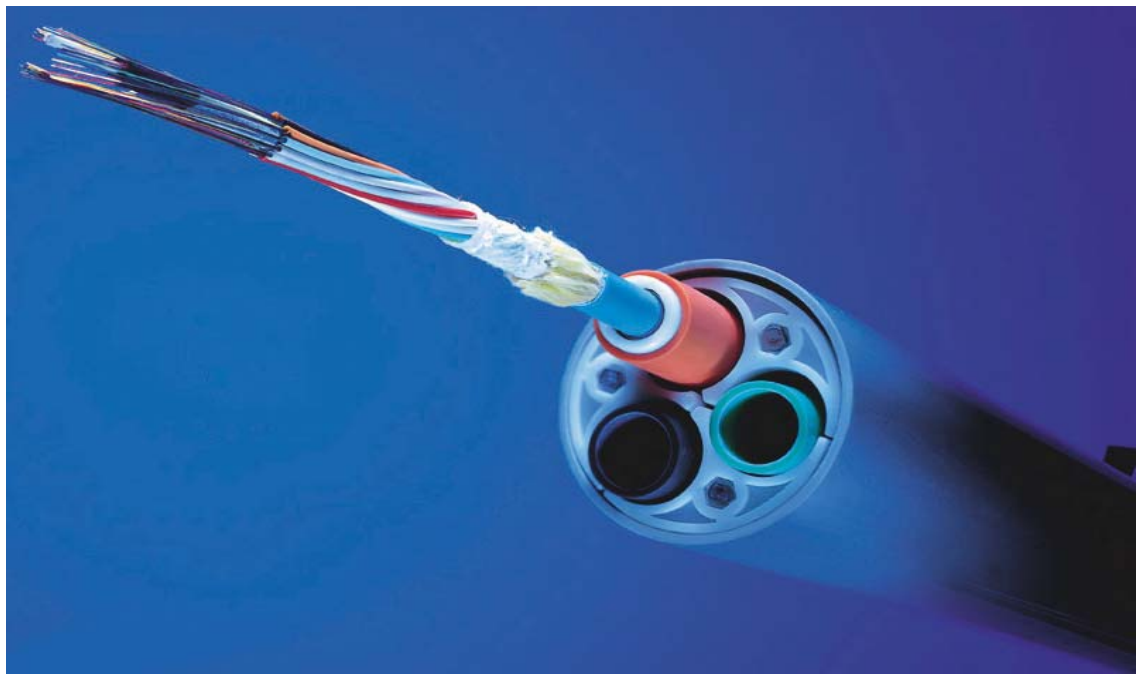
Dwingeloo - Westerbork

Managed Dark Fiber

(By Courtesy of Erik.Radius@surfnet.nl)



Geographical route of the cable

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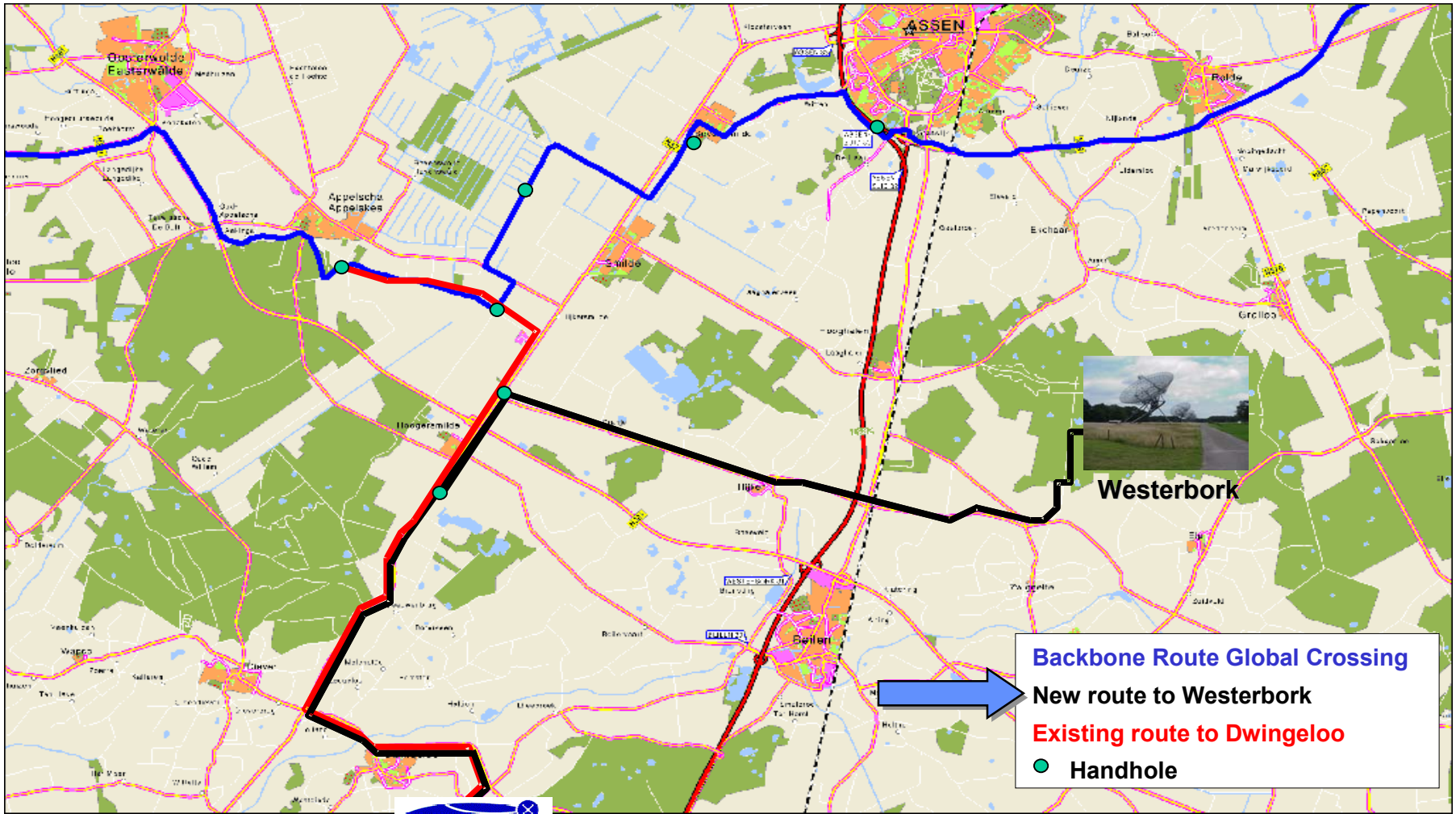

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Technical info

- Fiberoptic cable, 48 fibers (24 fiber pairs)
- Fiber type: G.652 (single mode)
- Cable length: 27.6 km
  - Typical attenuation:
    - max. 7dB @ 1550nm
    - max. 12dB @ 1310nm
- Terminated on Optical Distribution Frame (ODF)
  - ODF at both ends (Dwingeloo, Westerbork)
  - Connectorized (type: SC/PC)

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Operational info

- Cable maintenance by Global Crossing, via SURFnet
  - Installation complete: June 2003
  - Fiber cable faults: report to SURFnet NOC
- ASTRON/JIVE can choose any type of transmission on this fiber plant
  - Only requirement: optical equipment has **singlemode** interface, compatible with fibertype and distance

Project Timeline

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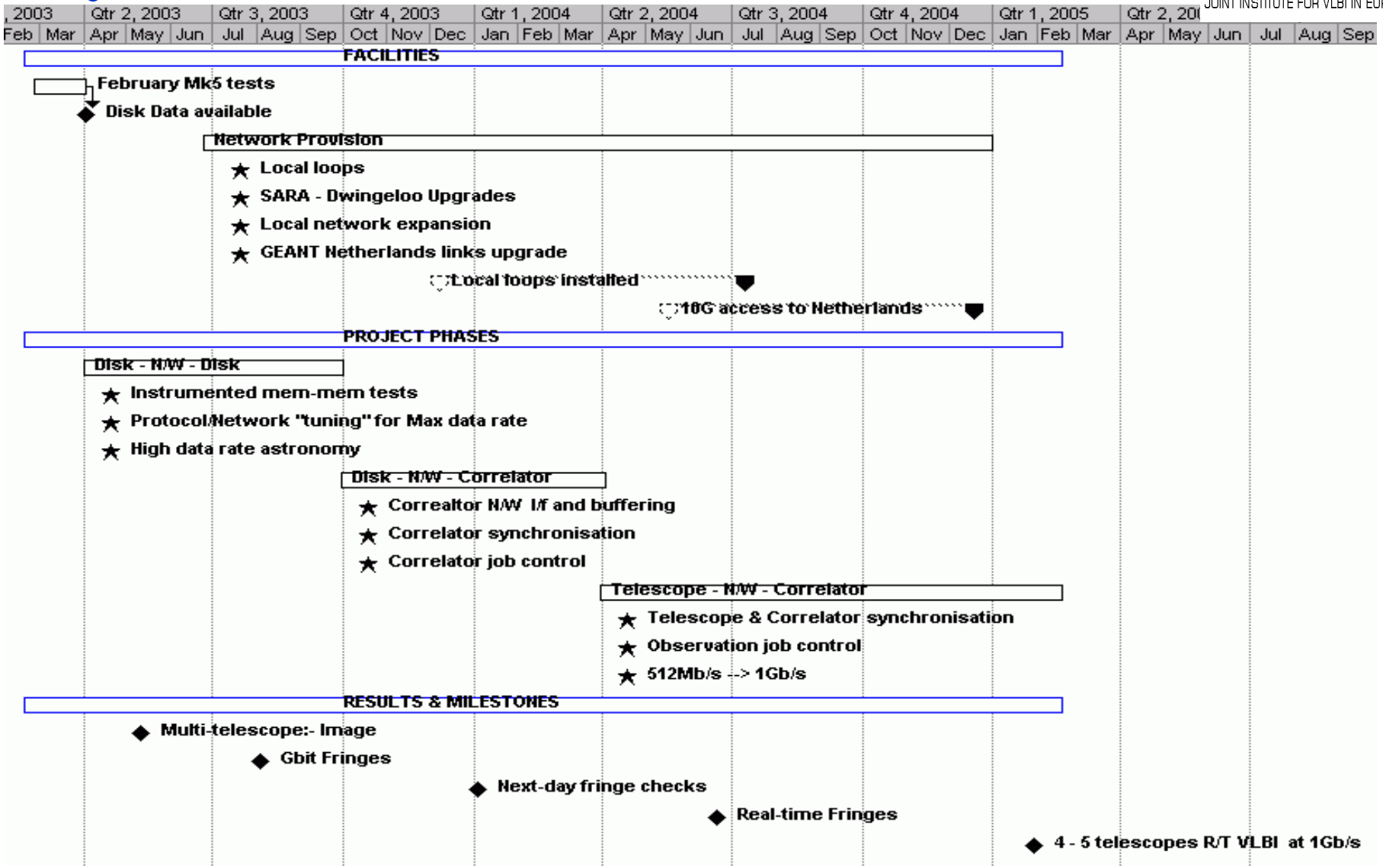

Progress

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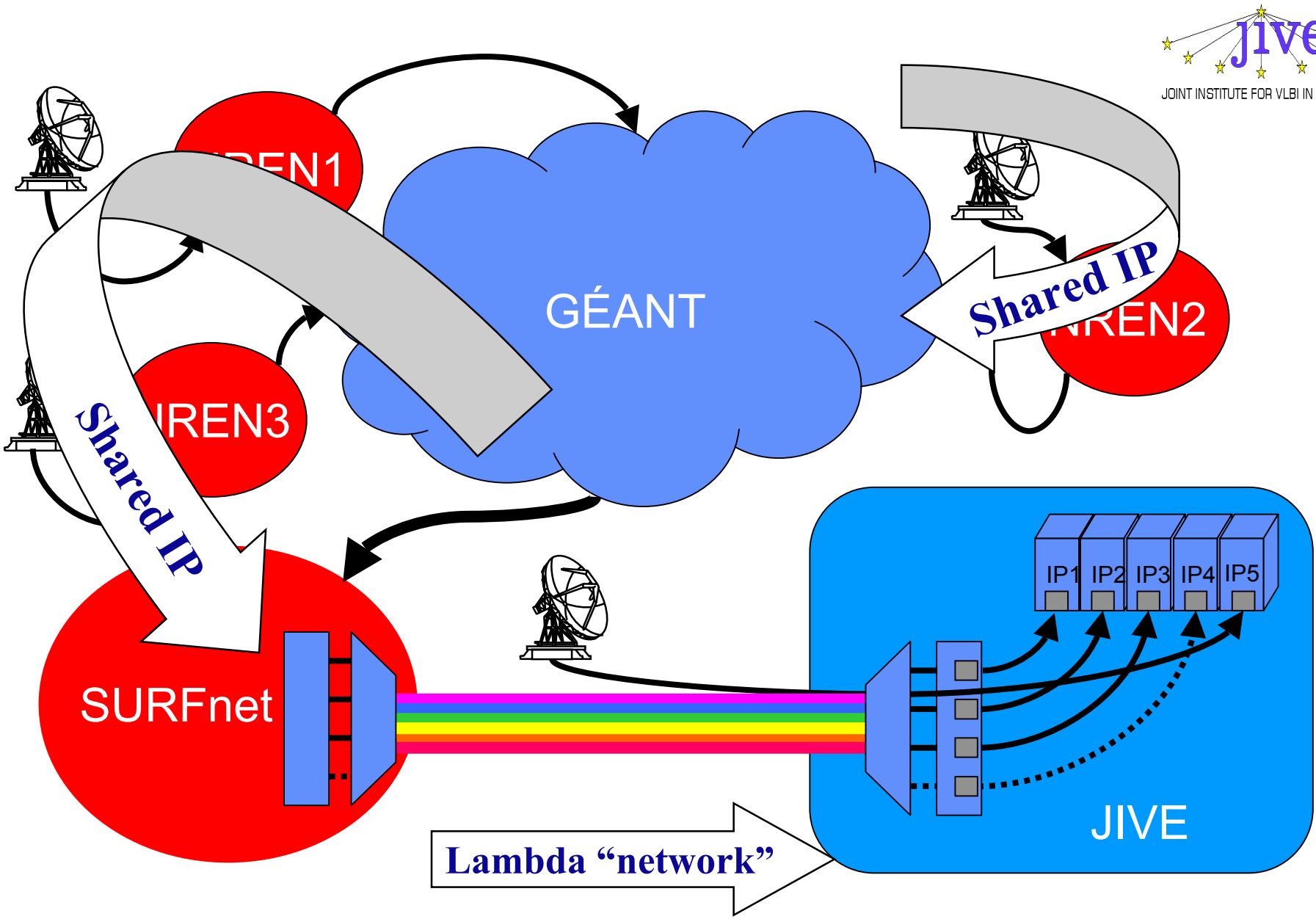
- February Session:
  - VLBI data recorded to disk at Medicina and Westerbork
  - Medicina data transferred to JIVE by FTP and correlated
- Mid-April:
  - Fringe test feasibility: JB, On, Ef, Mc, Nt, Hb, Tr, Mh
  - Test and practice simultaneous FTP of 2Gbyte file (=1min VLBI data) from each station to Mk5 unit at JIVE
  - Data received at JIVE via 1GE line.
- Next week:
  - First EVN FTP fringe test: Jb, Ef, Wb, Mc, Nt
  - Jodrell Bank uses PCEVN – Made possible by Mh – Jb 1Gb/s tests.
  - Collect disk data for ongoing eVLBI tests.


JIVE
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GÉANT
Shared IP
Shared IP
IREN3
SURFnet
IP1
IP2
IP3
IP4
IP5
JIVE
Lambda "network"

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UKLight Proposal

- Initiative to attract funding to create:
  - UK point-of-access (PoA) to the international test-bed
  - Intra UK optical test-bed
- Draft projects:
  - Development of a common optical control plane
  - Secure Optical Community Services
  - A project to use a dark fibre infrastructure
  - An applications demonstration based upon very long baseline interferometry (VLBI) for Radio Astronomy

Dedicated Lambda VLBI Network

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