

# DFN-Services - what is the benefit for large scientific collaborations?

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- **Large scientific collaborations via networks**
- **Examples for large scientific collaborations**
- **Analysis: What is needed from NRENs?**
- **DFN Network Services**
- **DFN (generic) Application Service**

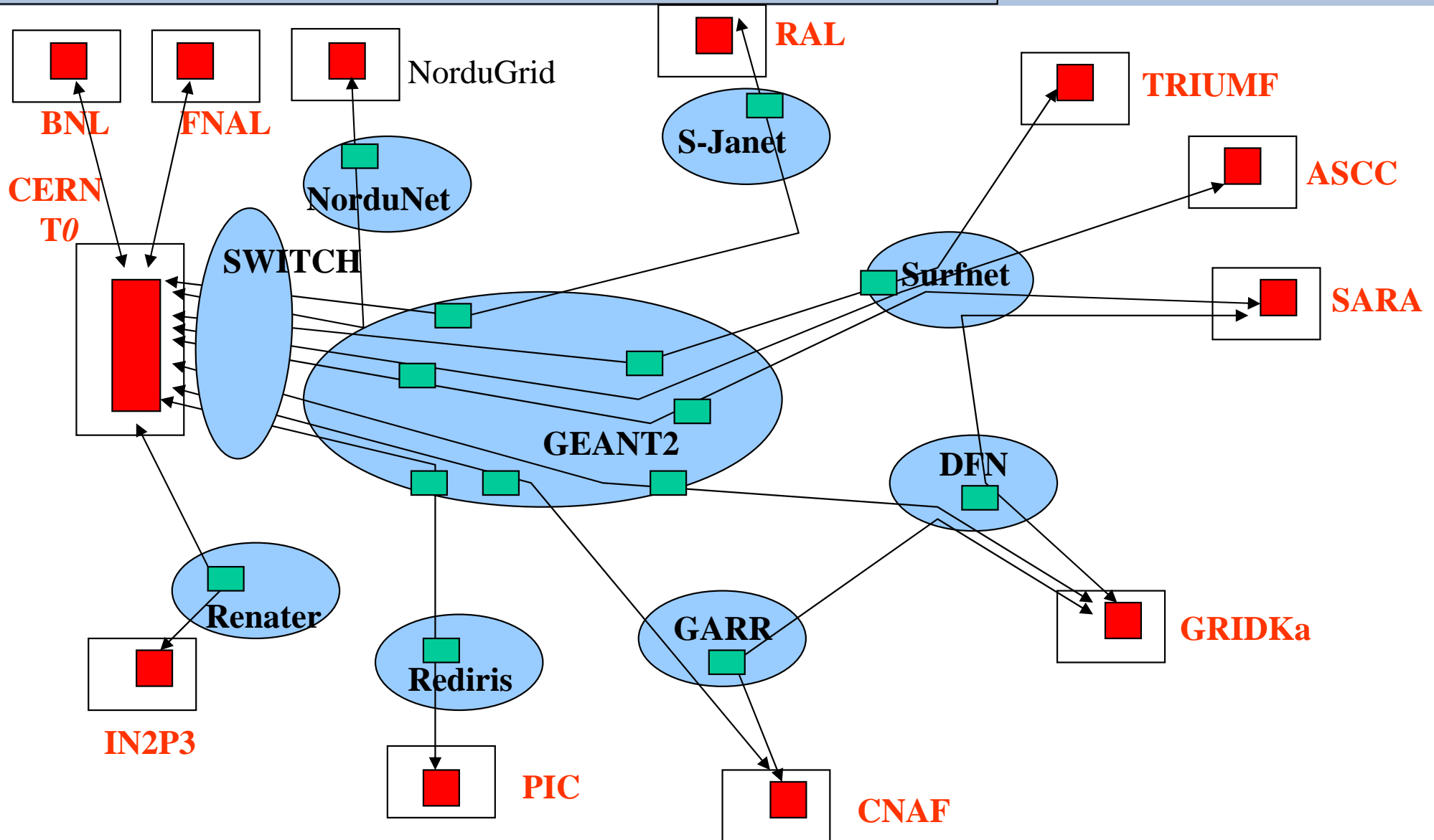
# Large scientific collaborations via networks

- A large scientific collaboration has in almost all cases an international dimension
- Their user groups
  - are often related to specific scientific instruments but distributed in different countries and organisations
  - need IT Services (compute and storage) accessible over networks
  - have very different levels of know-how in networking and other IT disciplines
  - need networking support to do their scientific work

- Criteria for large scientific collaboration:
- Specific scientific topic: **particle physics** grouped around the new LHC@CERN
- Need IT services: **summarized in a report on compute strategy**
- IT-Know-How: **well developed**
- Networking necessary?: **The whole process of LHC data evaluation is based on the availability of high-speed networks**

- Data are collected by four experiments at CERN (Tier 0) and immediately transferred to regional Tier 1 centers, which are used as IT competence centers and large storage and compute facilities
- The evaluation starts at Tier 2 /3 centers
- LHCOPN is THE network for the T0-T1 data transfer, designed by the T1 centers, NRENs and CERN

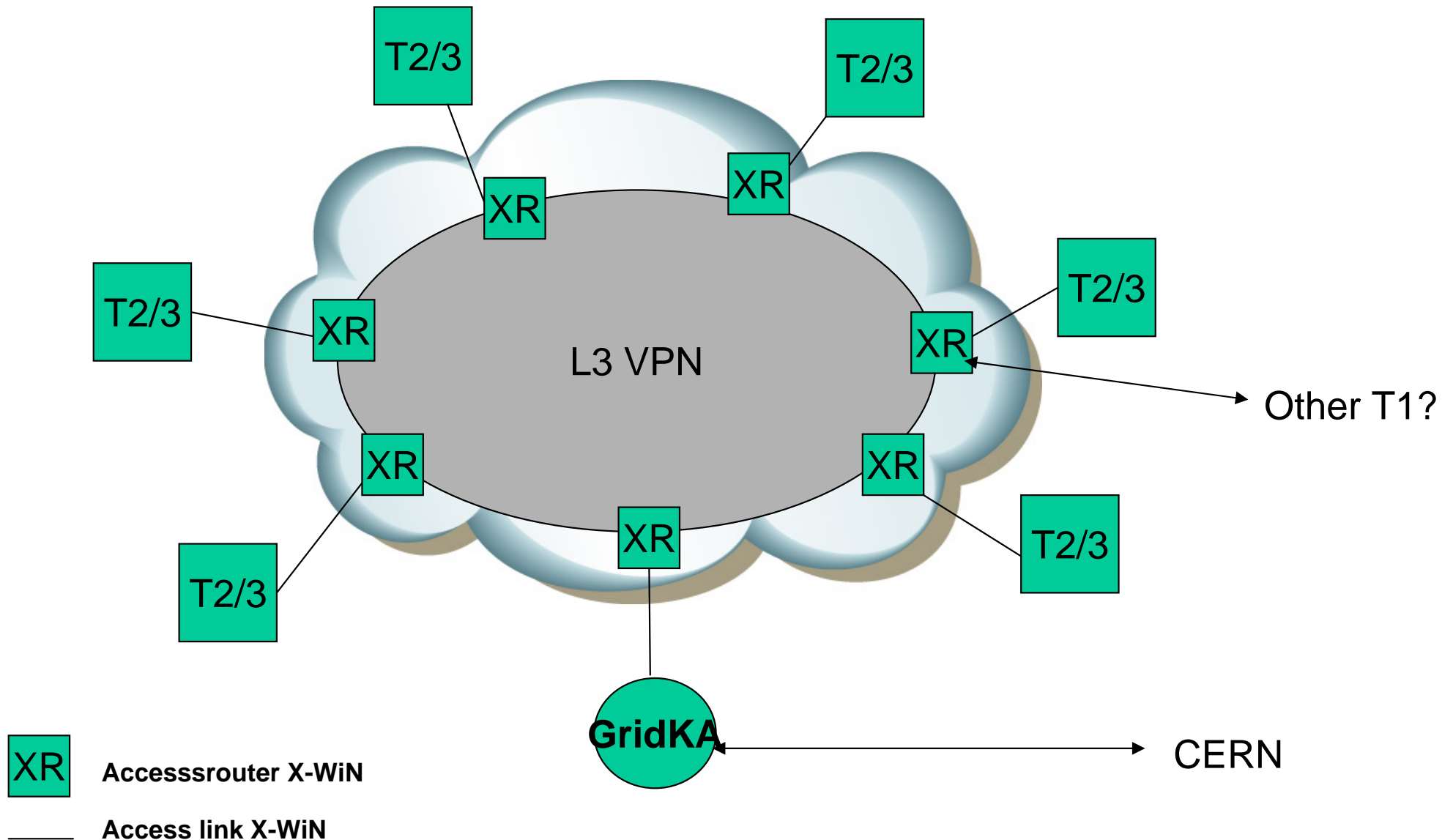
# LHC TIER0 – TIER1 OPN, scenario based on work by R. Sabatino (DANTE)



- **T1-T0 primary connection** through „Geant/NREN fibre cloud “
- **T0-T1 and T1-T1 secondary connection** based on path diverse fibre. Secondary connections provide resilience.
- **VPN approach**; permanent data flow with high data volume expected, Grid middleware driving this approach; „low“ prices for optical links due to liberalized situation per country
- LHCOPN is tested and already running under production conditions since roughly 12 months

- No full implementation yet but specification for „HEPPI“ covering T1-T2/T3 communication available
- In DE T2- and T3 sites are known – networking them is now on the agenda
- Design principles for this part of networking:
  - T2 sites need 1G access to T1 (which one?)
  - Build resilient ring of core-T2 sites (=cloud) in DE
  - T3 sites access data through DFNInternet service guaranteeing access to this cloud.
- 10 G Link DESY –GRIDKa as part of HEPPI is already working

# Example 1(6): HEPPI T2/T3 „cloud“



- **Open Issues:**

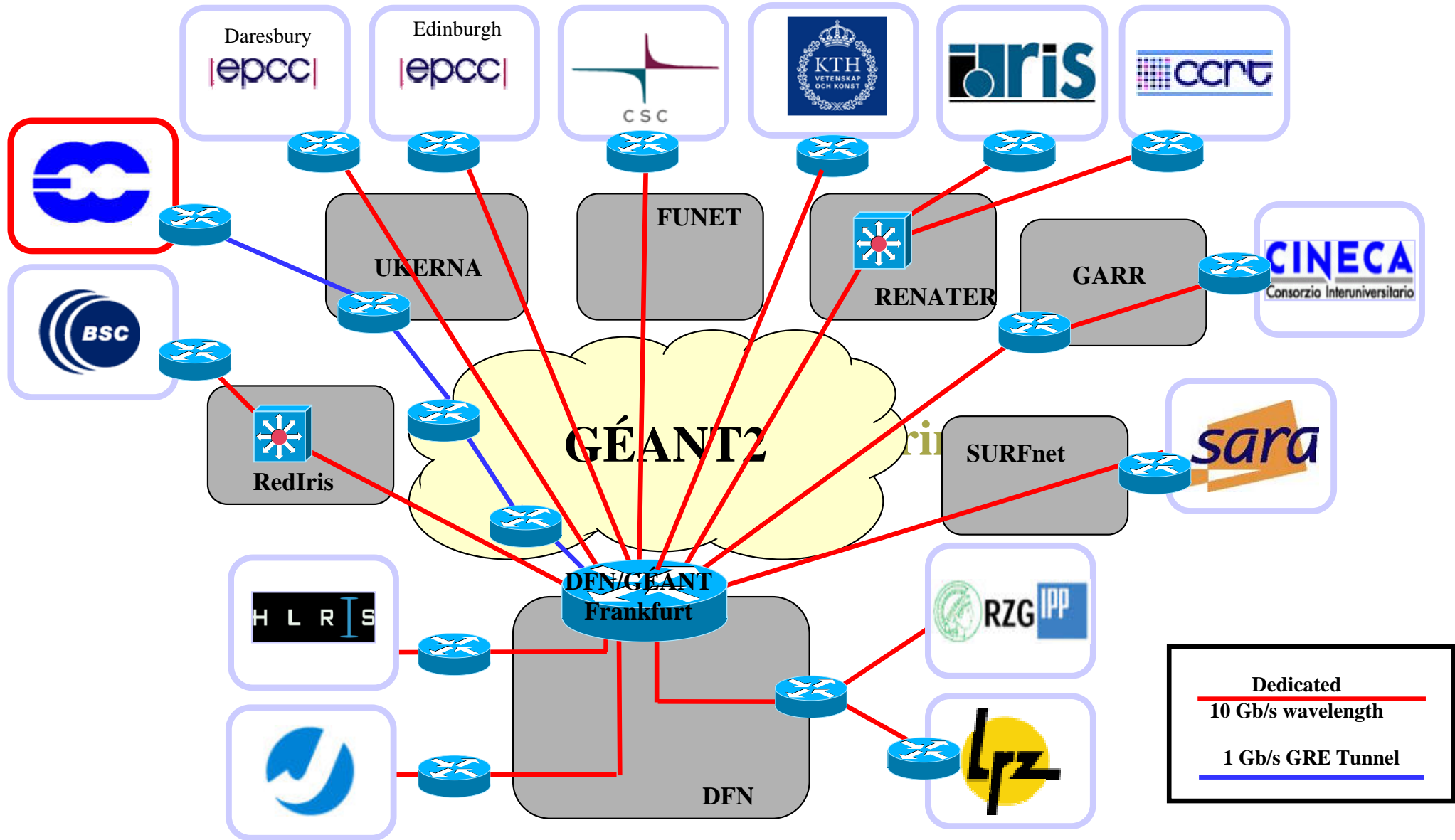
- Which pattern of T2-T1 data flows is expected?  
Only GridKa or other T1s in other world wide areas as well?
- Which pattern of T2-T3 data flows is expected?
- First overload effects can be observed on DFNInternet. In so far it's time to implement HEPP1 which offers scalable (up to 10G) capacity reserved for this large scientific collaboration.

# Example 2(1): DEISA

- Distributed European Infrastructure for Supercomputing Applications
- is based on a coupling of eleven national supercomputing centres from seven European countries
- using dedicated network interconnections of GÉANT2 and the NRENs.



# Example 2(2): DEISA Network overview



- Scientists from 12 countries participating
- Operating 2014
- Up to 10 GB/s per detector
- Total data volume (measurement data) ca. 10PB/a
- Remote access to data probably needed
- Data- / compute-model and hence traffic matrix not known yet, ongoing task to develop it including network infrastructure

# **Analysis: What is needed from NRENs?**

- No catch all approach possible
- Analysis for each large scientific collaboration needed
- Solution is dependant on compute- / data-model of the project
- Problem: As traffic matrix is not available yet, requirements are often unclear
- Conclusion: Use the time to estimate the upcoming network requirements of the ESFRI Projects as a collaboration between scientific collaborations, NRENs and Geant.
- Goal: Shape NREN portfolio of services according to (normally) high-end needs

Possible **generic services** may be (amongst others)

- IP Service (shared bandwidth)
  - in DFN DFNInternet
- L3 VPN Service (dedicated Bandwidth at L3)
  - in DFN specialised part of DFNInternet
- L2 VPN (dedicated Bandwidth at L2, wavelength)
  - in DFN DFNVPN
- PKI (Public Key Infrastructure)
  - in DFN DFNPKI
- Videoconference Service
  - in DFN DFNVC

# DFN Network Services

- (General) DFNInternet:
  - Scalable access (2 Mbps – 10 Gbps)
  - Redundant access line as standard
  - High availability (Target is 99,99%)
- L3 VPN Service (dedicated Bandwidth at L3):
  - scalable with requirements, very high availability through using DFNInternet platform, customized for specific user groups
  - Example: HEPPI is designed as a VPN with that characteristics
- L2 VPN (dedicated Bandwidth at L2, wavelength)
  - 1Gbps, 10 Gps available
  - Example: LHCOPN is designed as a L2 VPN

- **More performance for services**

performance increase (same costs) by a factor of 4 since 01/06  
more performance available

- **More flexibility for services**

no volume charging (and no usage limitation)

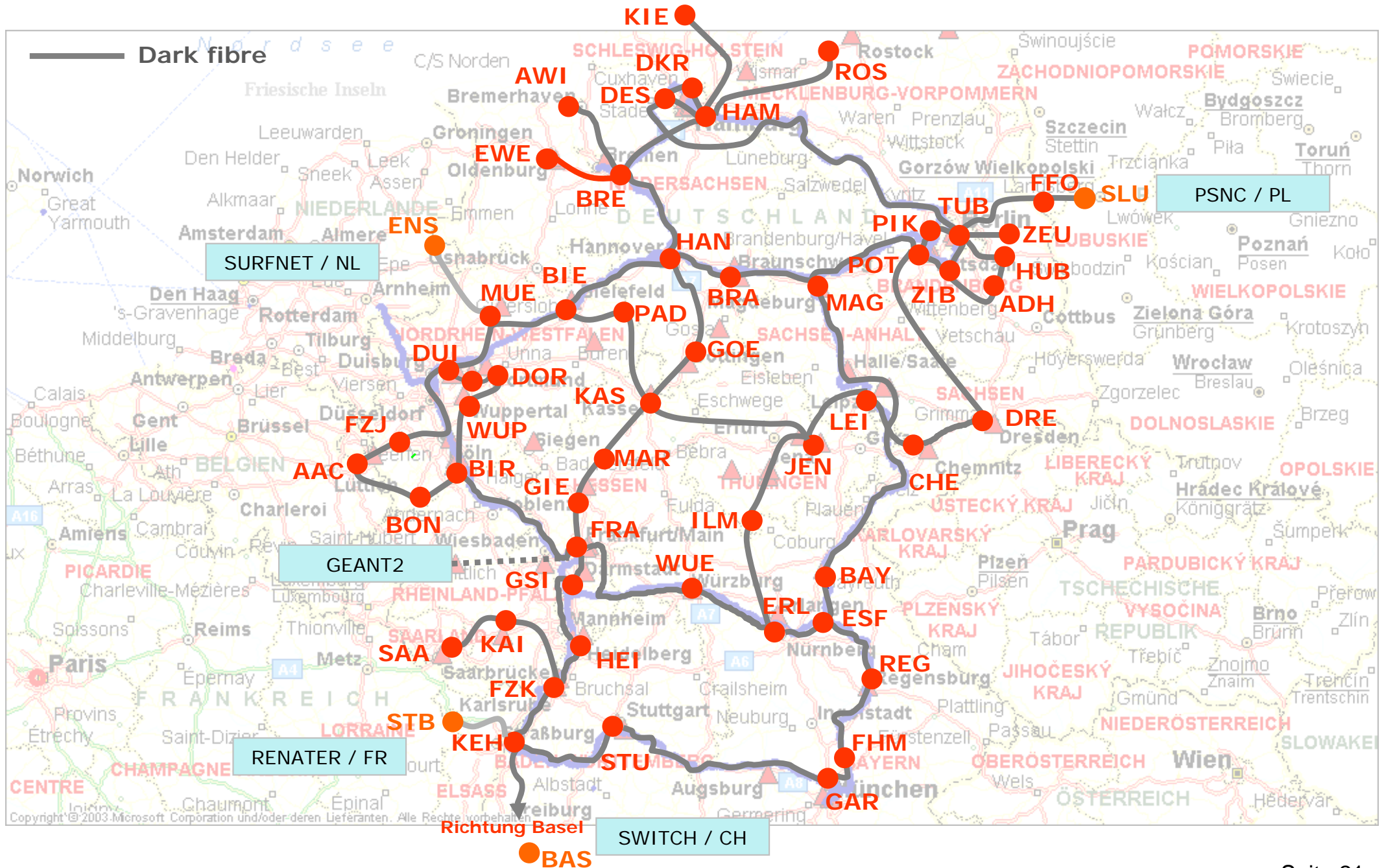
Ethernet as additional access technology

Hybrid PoPs enable VPNs

- **More service availability**

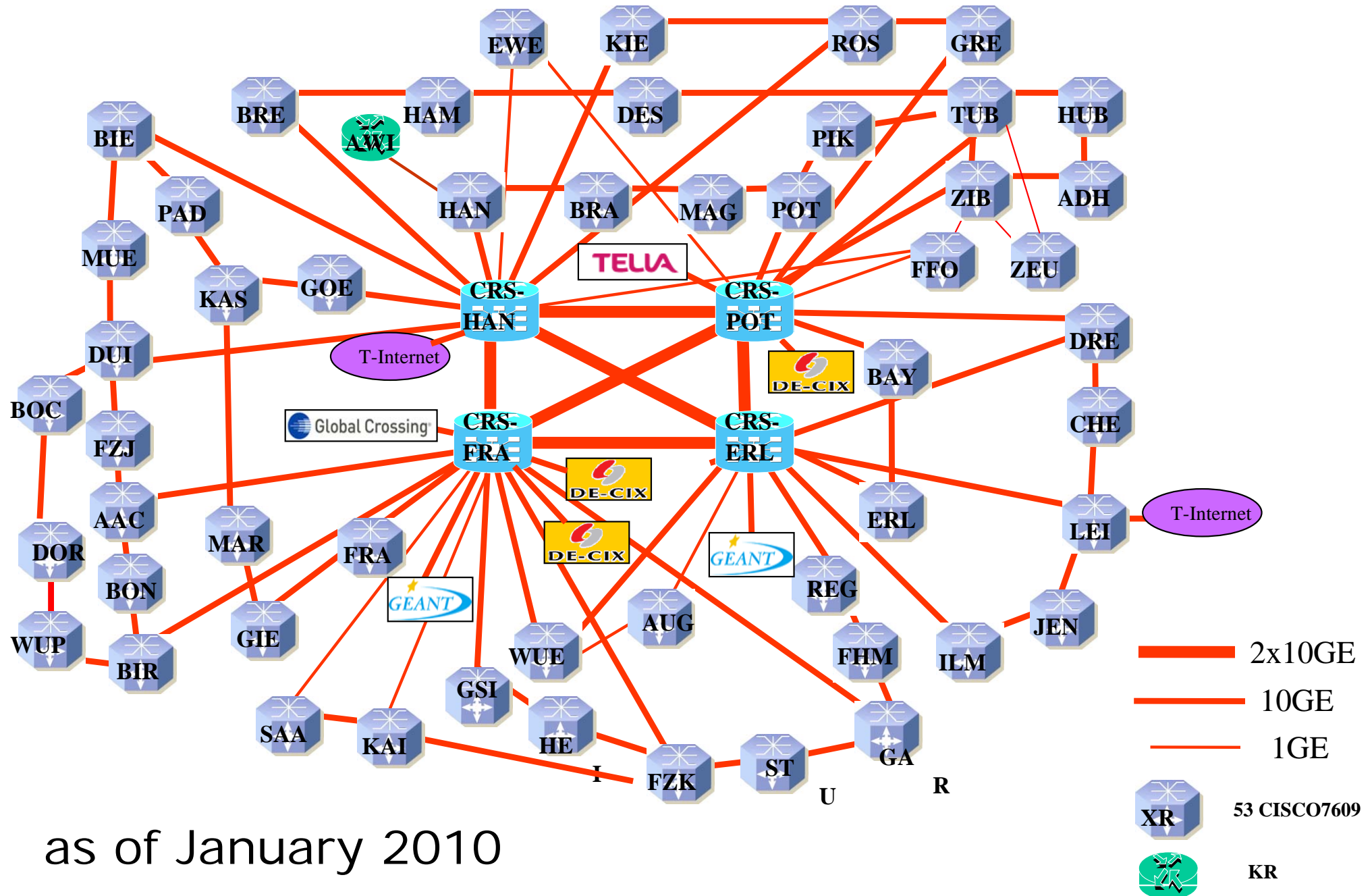
during design for both optical and Internet backbone implicitly taken into account

# Technology (2): X-WiN Fibre Topology

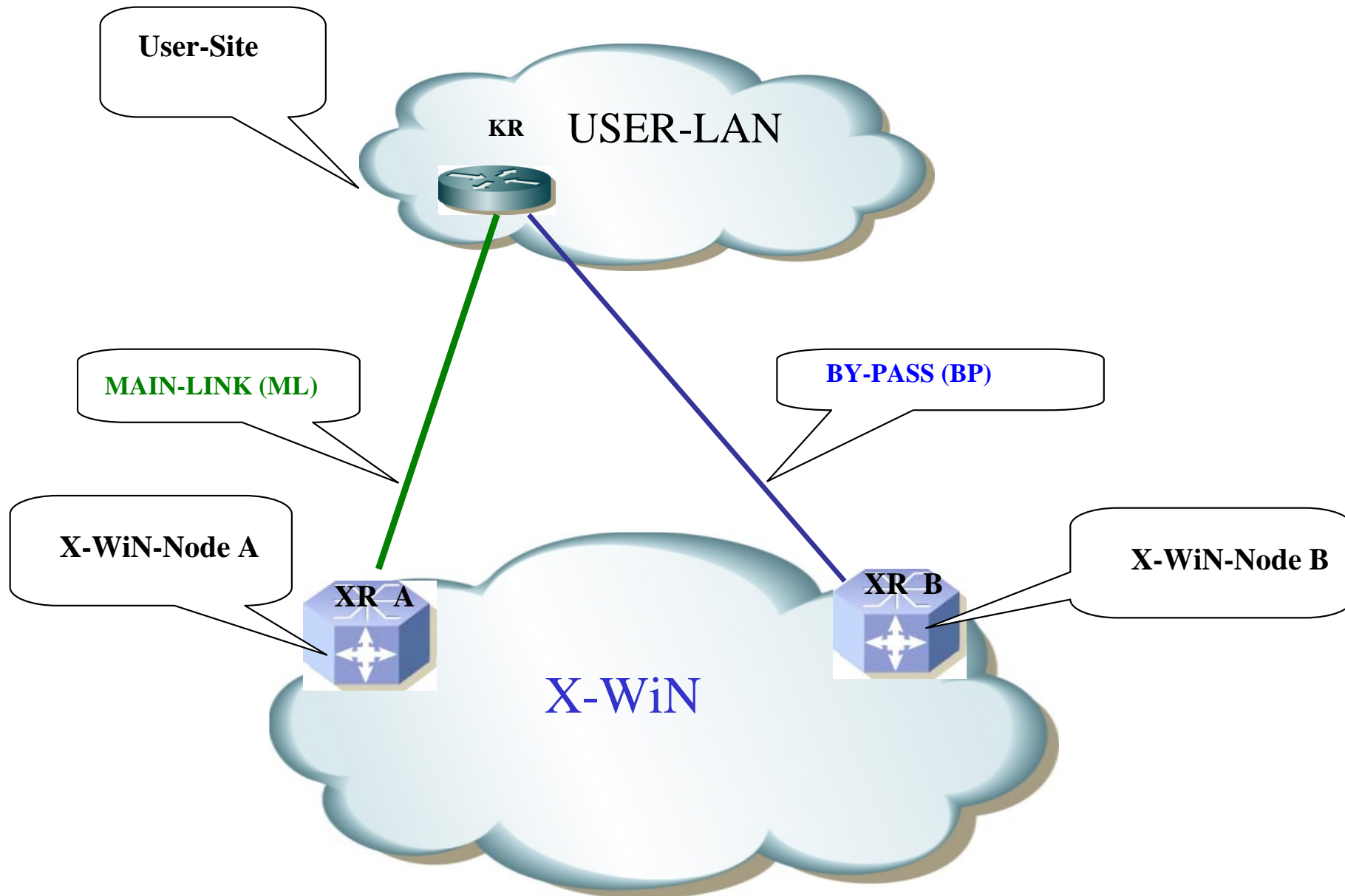


- Platform available for national VPNs, for the national part of international VPNs and for the DFNInternet Backbone
- Optical technology delivers ample bandwidth, i.e. **160\*10G per link**
- Costs per 10G link are relatively low (as in Geant2) - in the order of 89 K€/a for long distance (>400 fibre-km) links

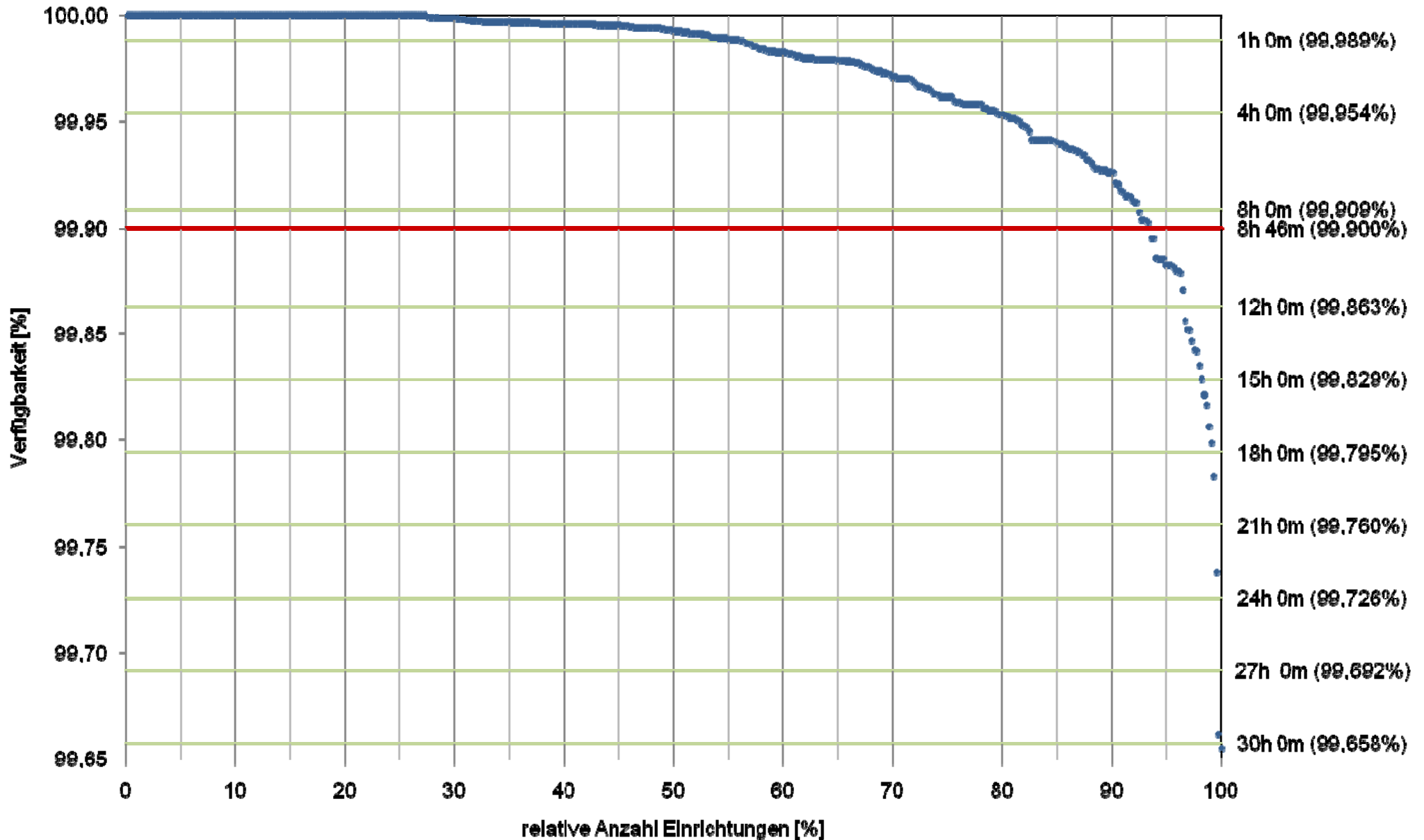
# Technology (4): IP-Plattform



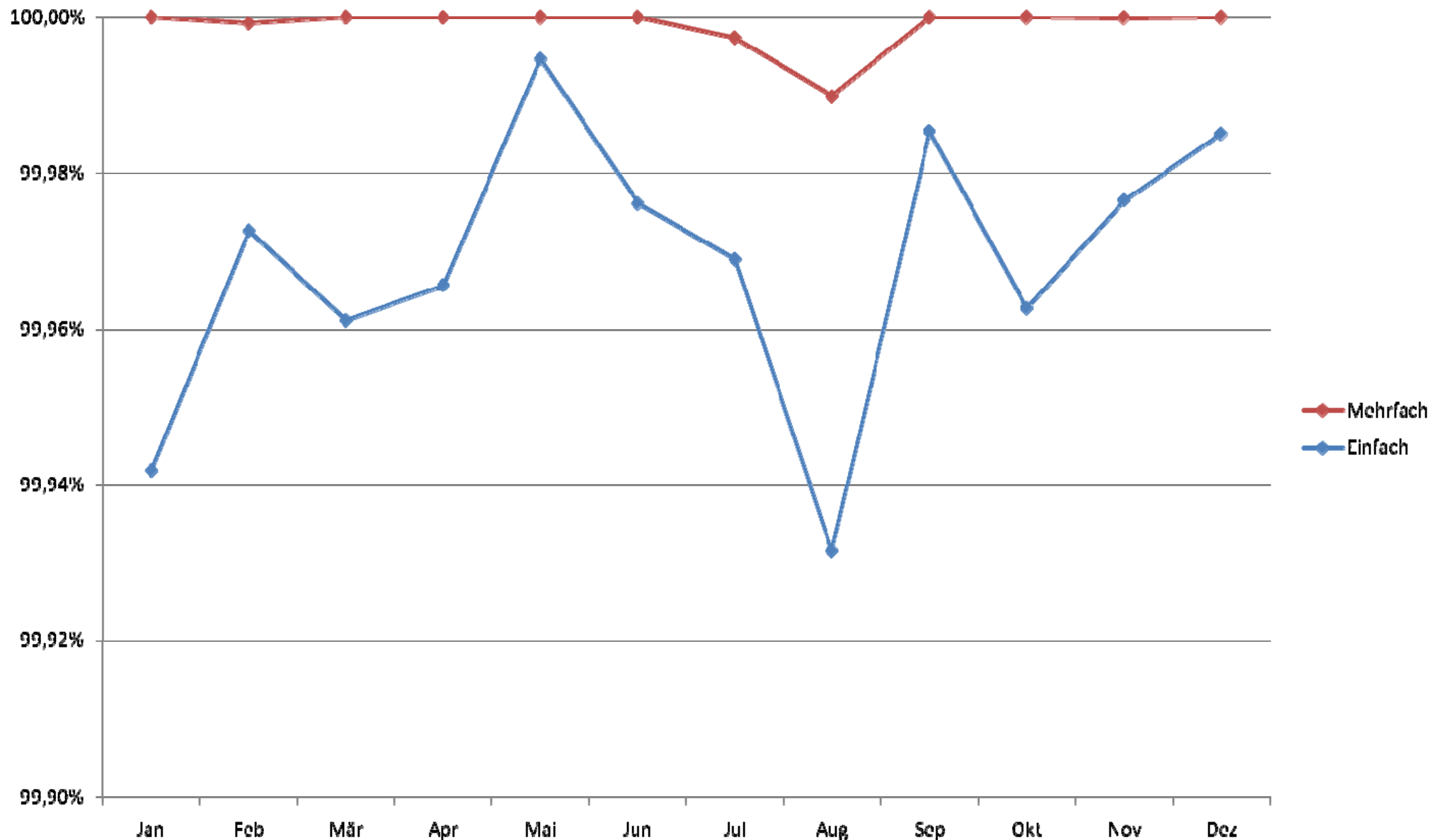
# Technology (5): Redundant Access



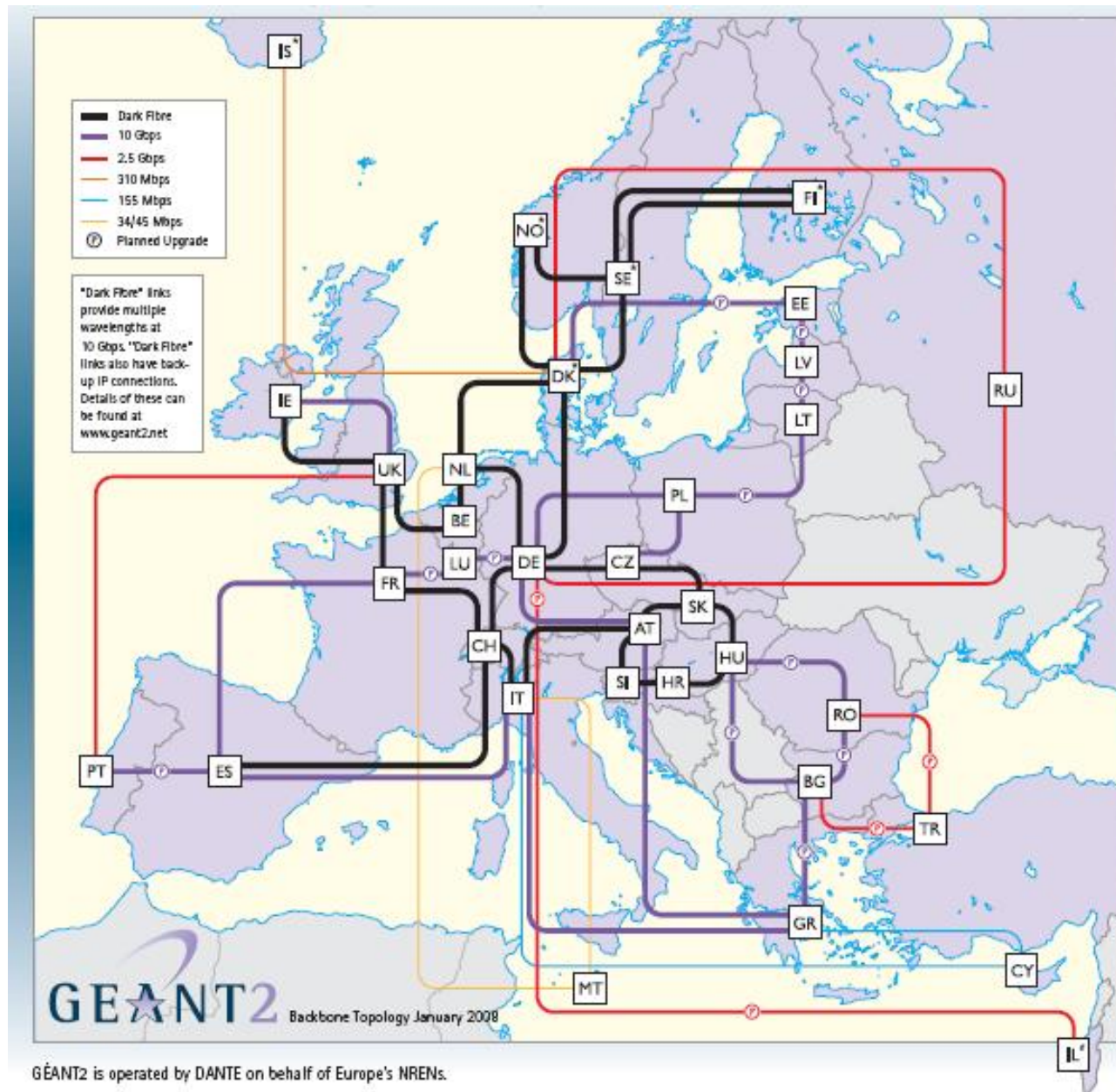
## Availability DFNInternet in 2009 (total)



## Monthly Availability (average) DFNInternet 2009



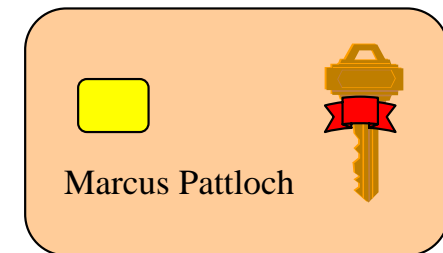
# Technology (8): GÉANT2 footprint



# Generic DFN Application Services

- A PKI is an infrastructure „generating“ certificates and consisting of the following main components.
  - Registration Authorities (RA)
  - Certification Authorities (CA)
  - Policies
  - Directory Service for certificates
  - (PKI-aware applications)

- Certificate = digital identity card for use on the internet
- Once I have a certificate and use it in electronic communication, everyone can proven that I am who I claim to be
- E.g. on a „chipcard“  
(but: not every chipcard contains a certificate)



- Confidentiality
  - encryption of documents and e-mails
- Signature
  - signing .pdf documents
  - signing e-mails
  - creating time stamps on documents
- Authentication (not authorization!!)
  - server identification (SSL, https)
  - ID for access to protected websites
  - ID for access to databases etc. (ssh, IPsec)

- DFN offers different kinds of certificates
  - regular, grid, SLCS
  - share of regular certificates is around 98%
  - for the time being grid users need at least two certificates
- Obtaining a certificate is quite easy and about 300 sites use DFN-PKI
- More information
  - [www.pki.dfn.de](http://www.pki.dfn.de)
  - [pki@dfn.de](mailto:pki@dfn.de)

- Technology is standard based (ITU H.323)
- Integrated in world wide VC infrastructure of addressing capability **g**lobal **d**ialing **s**ystem (GDS)
- Access from all kinds of H.323 compatible end-systems via Internet access or ISDN
- High availability by overprovisioning technical resources
- High redundancy of DFNVC resources by placing them into two different locations

- Access to service via portal
- Can be used in „ad-hoc-mode“ i.e. spontaneously (no reservation necessary)
- Optional: streaming
- Optional: password protection

- Contract wise DFNVC is part of DFNInternet i.e. nearly all institutions in DE have access to the service
- Ca. 4.000 MCU hours aggregated usage per month
- In addition to that ca. 1.000 point-to-point VCs (without MCU but gatekeeper usage) per month

- **Adobe Acrobat Connect**
- Stable operation
- Positive feedback from users
- Collaboration with H.323 available
- More information: <https://www.vc.dfn.de/>

- Major NRENs have a similar service portfolio
- NRENs and Geant offer a bundle of generic network and application services for large scale scientific collaboration
- NRENs and Geant look for cooperation with high-end users (i.e. large scale scientific collaborations) to further develop and enhance these generic services