# GÉANT

## Advanced Network Services Delivery for HPC in Science

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# Current members

## GÉANT Association Membership

**NATIONAL MEMBERS**
*1 per country*

**REPRESENTATIVE MEMBER**
*NORDUnet**

**ASSOCIATES**

ADVA Optical Networking

Alcatel-Lucent

Ciena Corporation

Cisco Systems

Coriant GmbH

*CSC (Finland)

CERN

*DeIC (Denmark)

ECI Telecom GmbH

EMBL

ESA

Google UK Ltd

Huawei Technologies

Level 3 Communications

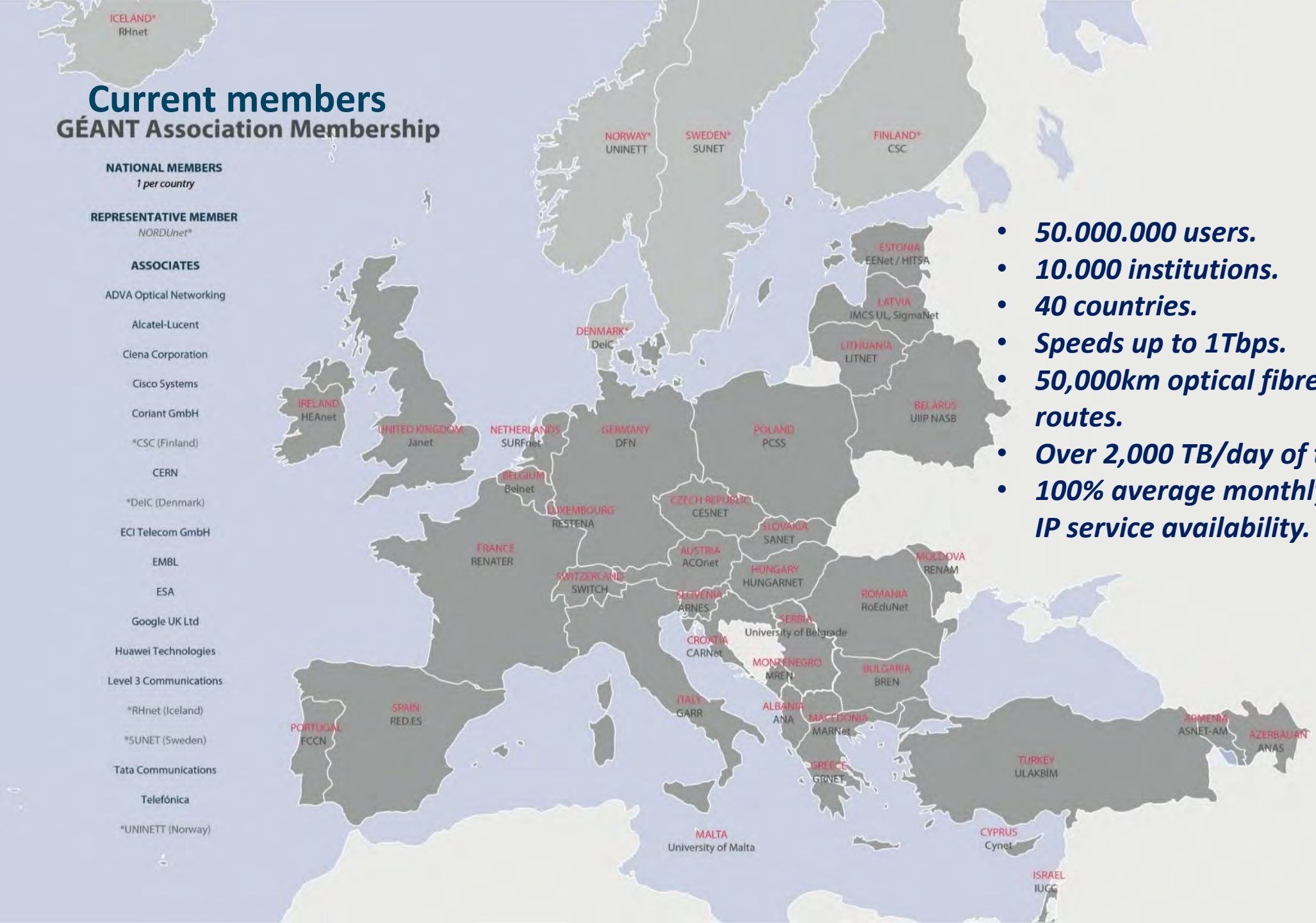
*RHnet (Iceland)

*SUNET (Sweden)

Tata Communications

Telefónica

*UNINETT (Norway)

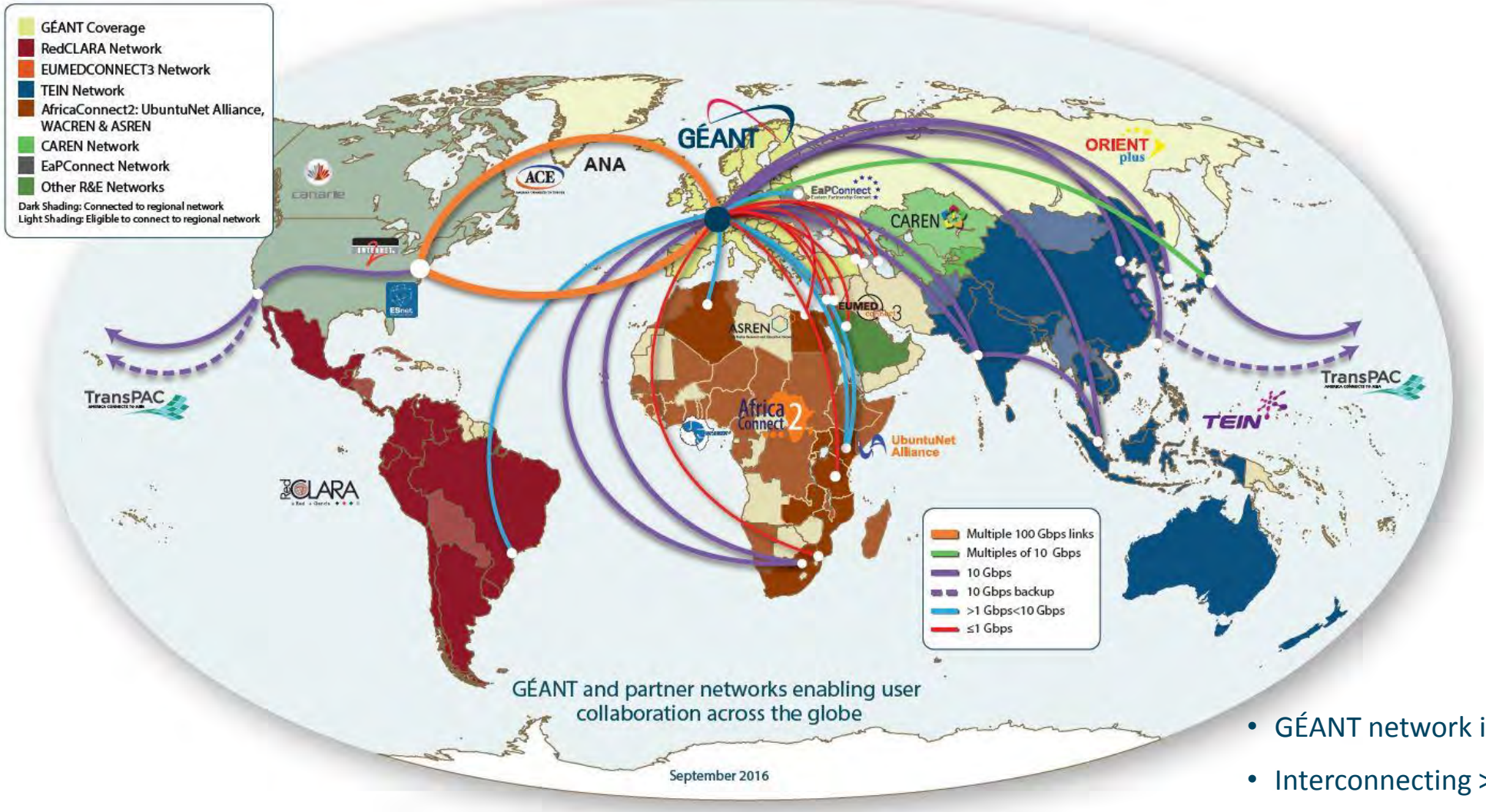



- ***50.000.000 users.***
- ***10.000 institutions.***
- ***40 countries.***
- ***Speeds up to 1Tbps.***
- ***50,000km optical fibres on 44 routes.***
- ***Over 2,000 TB/day of transfer.***
- ***100% average monthly IP service availability.***

# GÉANT - Networks

- Manages research & education networking projects
- Procures, builds and operates large-scale, advanced international high-speed networks
  - GÉANT (Europe)
    - National RENs participates directly and indirectly on GÉANT development.
  - EUMEDCONNECT (Mediterranean)
  - AfricaConnect (Africa)
  - CAREN (Central Asia)
  - EAPConnect (Eastern Partnership Countries)
  - GLIF (Global)
- Supports and assists other regional projects
  - ORIENTplus (Europe-China collaboration)
  - TEIN*CC (Asia-Pacific)
  - RedCLARA (Latin America)
  - CKLN (Caribbean)

# Global connectivity




- GÉANT network is connected to all continents
- Interconnecting >100 countries globally

# User support: what do users see?

Imagine two collaborators in two different countries:

- Different connecting NREN
- Different services, with different T&Cs
- Which services are available to them end to end?
- What are the business models along the delivery chain?

**Now imagine 30 users in 30 countries…**

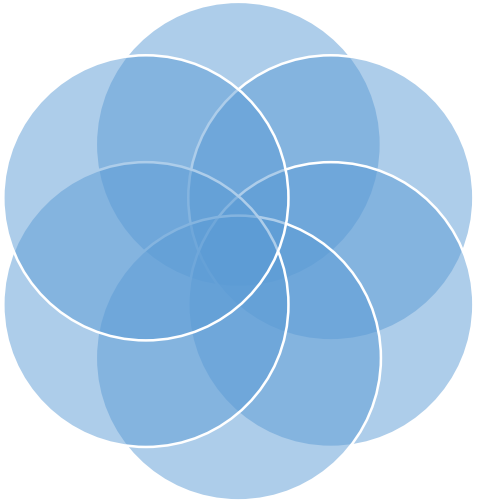
# Users we work with

Social Sciences, Arts and Humanities

High-Energy Physics and Astronomy

Earth Sciences and Observations

Life Sciences



Future Internet Projects

E-Infrastructures

# Some scientific user groups we liaise with

- Physics sciences
  - High-energy physics (LHC, BELLE II, CERN, etc.)
  - Neutrino observation (KM3NET)
- Astronomy and Earth observation
  - Earth observation (EUMETSAT, COPERNICUS)
  - Radio-astronomy (eVLBI, SKA, etc.)
  - Satellite operations (ESOC)
- E-Infrastructures (EGI, EUDAT, PRACE, HelixNebula)
- Life sciences
  - Genomics (Elixir, EBI, EMBL)
  - BioImaging
- Future Internet projects (XiFi, Confine, SmartFire, etc.)

# Services

- **Connectivity & network management**
  - Standard IP, up to multiple 100Gbps
  - MD-VPNs (L2 and L3)
  - Point-to-point circuits
  - Wavelengths 10 -100Gbps
  - GÉANT Testbed Service (GTS)
  - International and Commercial Peerings
  - Firewall on-demand
  - …
- **End to end Performance**
  - perfSONAR – *Real-time, multi-domain performance monitoring*
  - eduPERT – *Performance troubleshooting*
  - …
- **Trust, Identity and Security**
  - eduGAIN – *Secure access, single sign-on*
  - Eduroam – *Seamless Wi-Fi access for research and education around the world*
  - …
- **One Stop Shop**
  - Consultancy
  - International co-ordination
  - Bespoke solutions

- **Cloud**
  - Filesender
  - OwnCloud
  - NREN Support and https://clouds.geant.org/

perfSONAR
PART OF THE GÉANT SERVICES PORTFOLIO

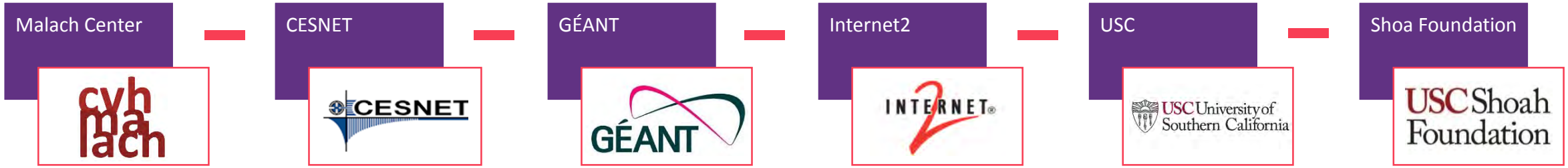
Summer 2016:
Cloud services – GÉANT as community broker

# Connectivity Services: IP connectivity
## *Shoah Foundation Institute*

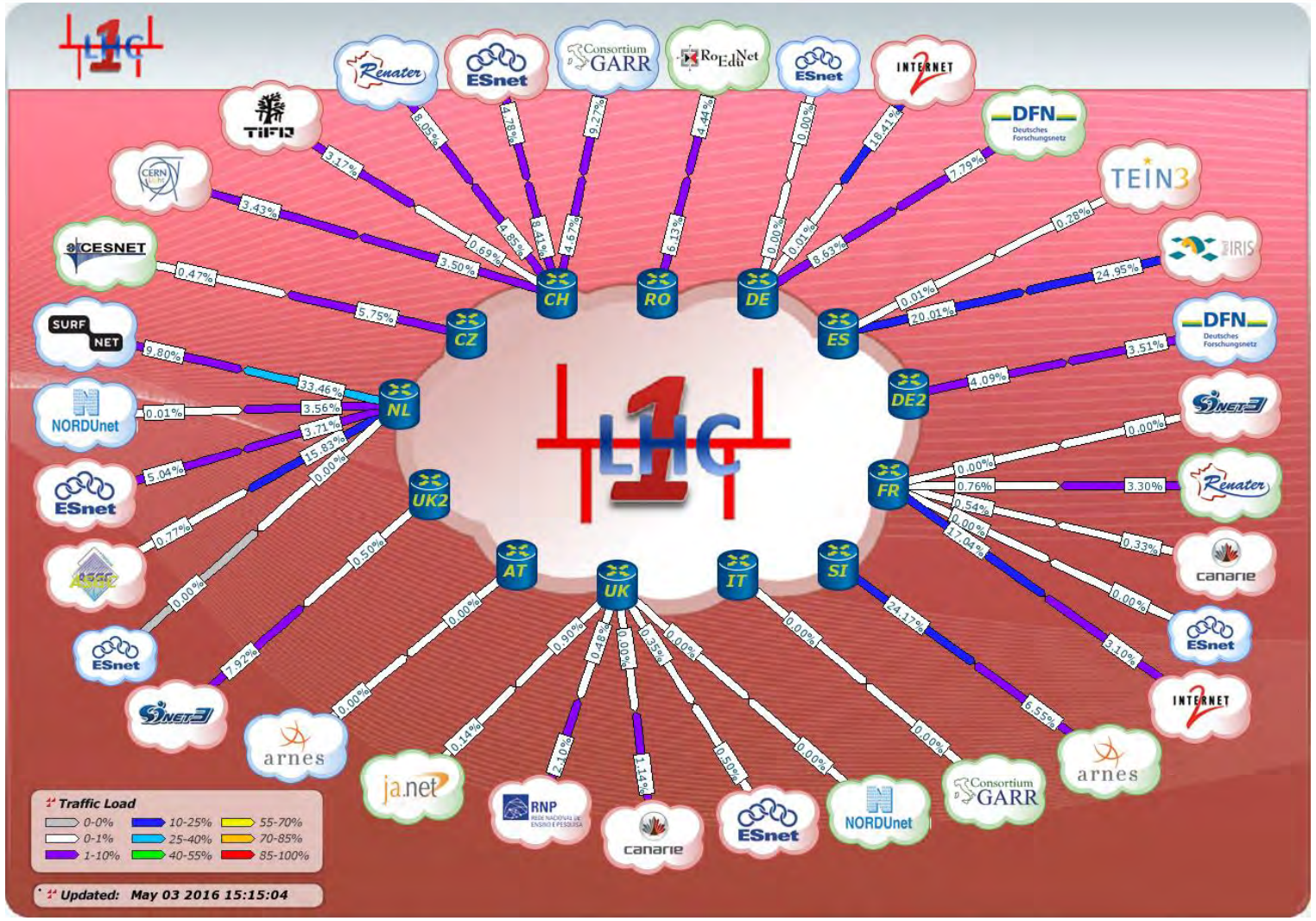
- Secure memory of Holocaust and genocide survivors
- One of the largest video digital libraries in the world (~ 42 PB of data)
- Long-term objective of USC: Build global digital preservation and access grid for digital humanities
- Need reliable and scalable data mirroring between US and Europe
- 1st Data Node: Malach Center at University of Prague
- data transmission and performance monitoring starting Q316

### Assessment of Performance Needs

- Utilisation of general IP
- Monitor traffic behaviour over 6 months to assess if specialised solution is required
- Ongoing performance tests to see how updates and synchronisations of the archive will affect the utilisation of the lines



# Connectivity Services: L3VPN Service
## *LHCONE*




Serving the LHC experiments:

- ATLAS
- CMS
- ALICE
- LHCb

But also:

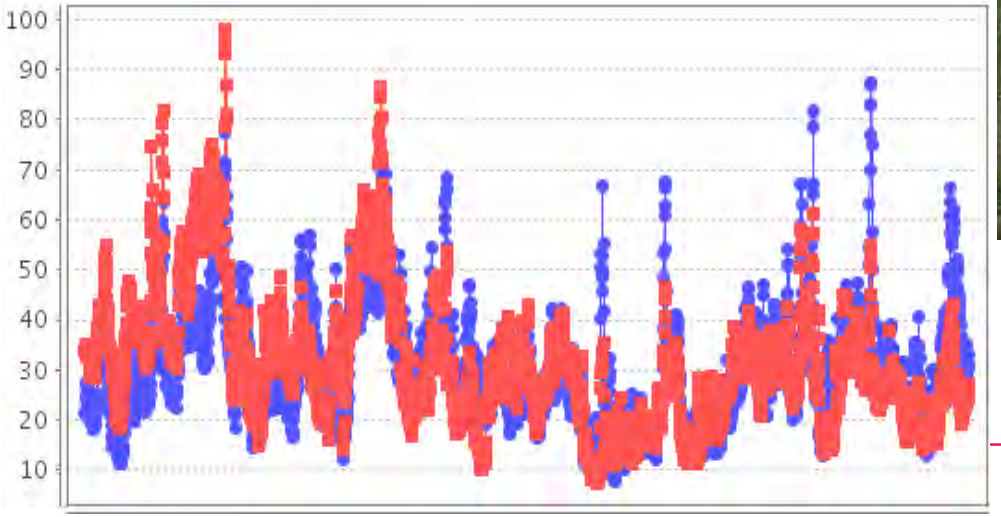
- BELLE 2
- Pierre Auger Observatory
- NOVA
- *XENON1T (in discussion)*

Currently spanning three continents

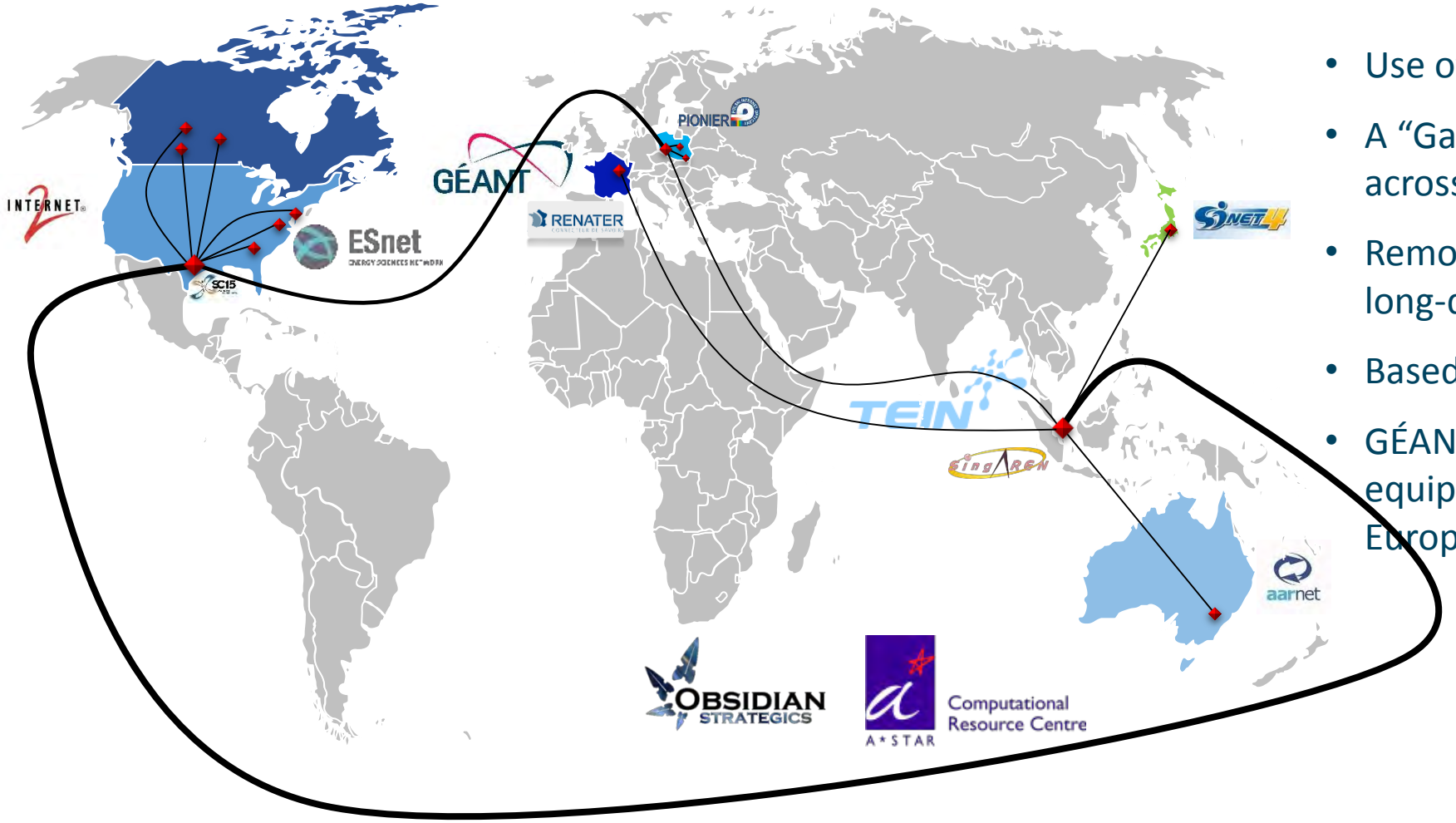
- Europe
- North and South America
- Asia

# Connectivity Services: lambda service
## *CERN*

- Connection to the remote data centre in Budapest
- First ever 100G user service in R&E community
- In operation since 11/2012
- Provided by GÉANT (GVA-BUD) + NIIFI/HungarNet (local loop in Budapest)
- GÉANT NOC operating as SPOC

# Connectivity Services: p2p circuits
## *InfiniCortex project*



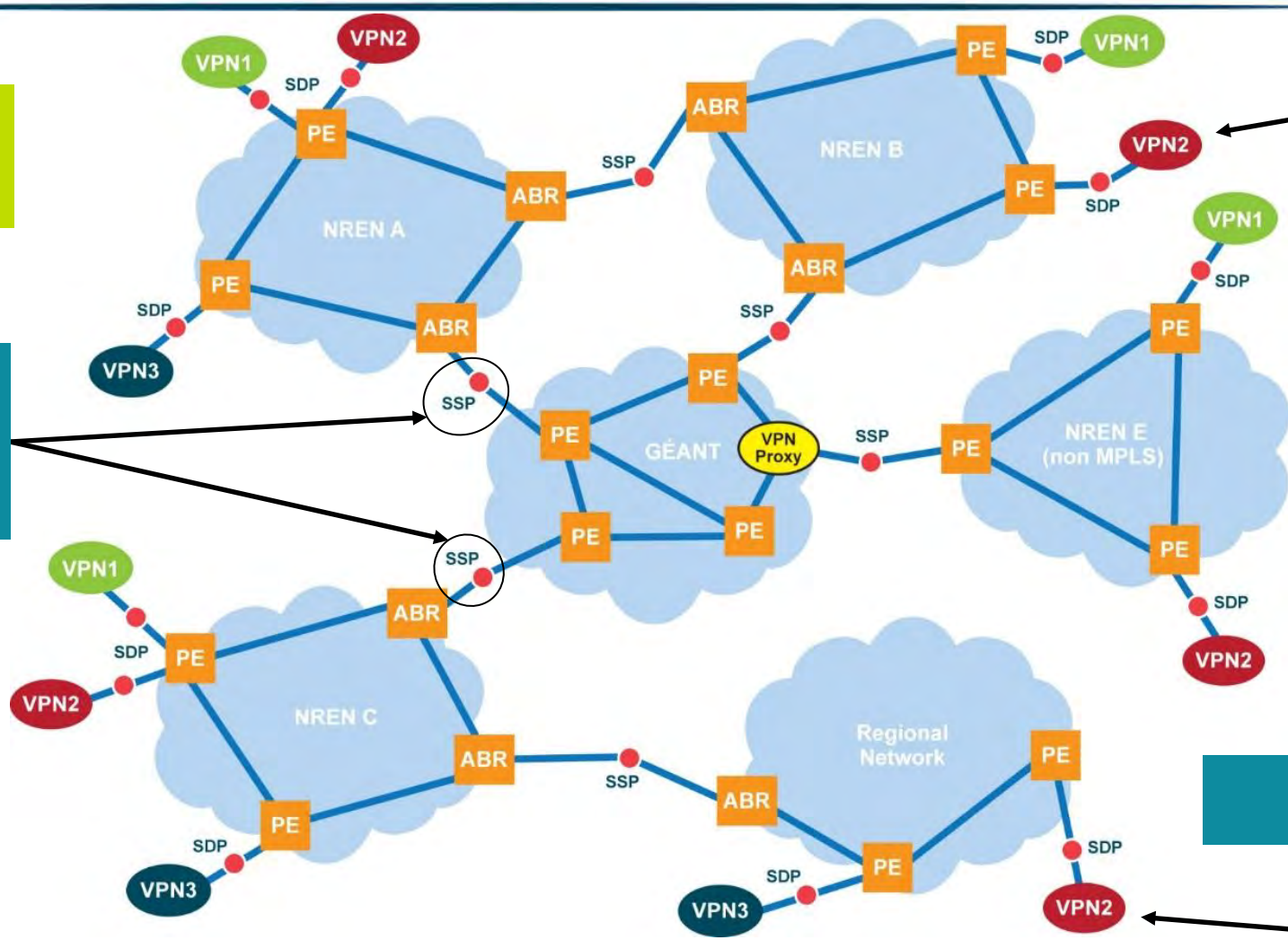

- Use of InfiniBand on the WAN
- A “Galaxy of Supercomputers” scattered across the world
- Remote Direct Memory Access over long-distance connection
- Based on Obsidian Longbow.
- GÉANT will host some InfiniBand equipment in the London PoP for a European InfiniCortex infrastructure

# Connectivity Services: Multi-domain VPN

Lead-time reduced

Easy to deploy
No Capex
VPN multiplexed

High scalability




Configure only at the edge

VPN Provisioning as easy as in a single-domain

An end-to-end extensible and flexible service

NREN OPEX Reduced

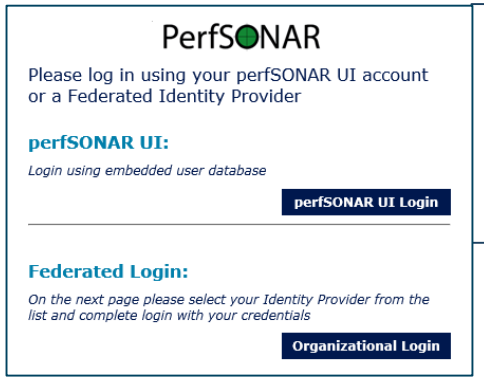
Configure only at the edge

# Network Performance Monitoring: *perfSONAR*

perfSONAR

- Tool to monitor network performance
  - Bandwidth / Latency / Jitter / Trace route

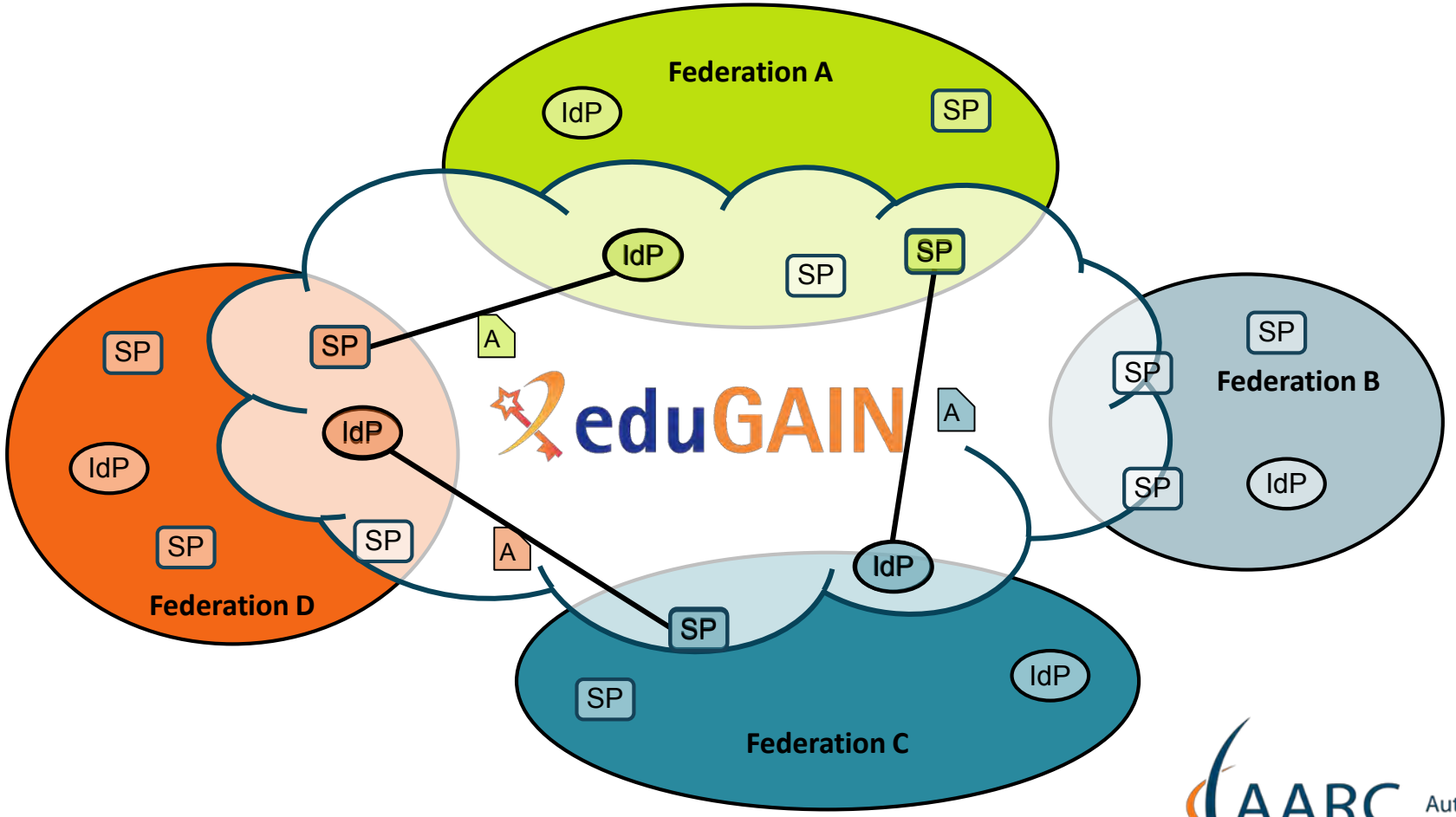
- Previously two versions: perfSONAR MDM and perfSONAR PS
- Now just one version for use globally by R&E Networks and Institutions!
- Single website: http://www.perfsonar.net/


- Web User interface http://psui.geant.net/
- In eduGAIN


- Over 1100 BWCTL and OWAMP MPs deployed globally

# Trust and Identity:
## *eduGAIN and AARC*




The GÉANT eduTEAM service was developed to provide a platform as a service Authentication and Authorization infrastructure for Collaborative Organizations (VOPaaS)

By adopting a collaborative and user-requirements driven approach, AARC works to deliver a framework that builds on eduGAIN but it is interoperability with existing AAIs.

AARC Authentication and Authorisation for Research and Collaboration

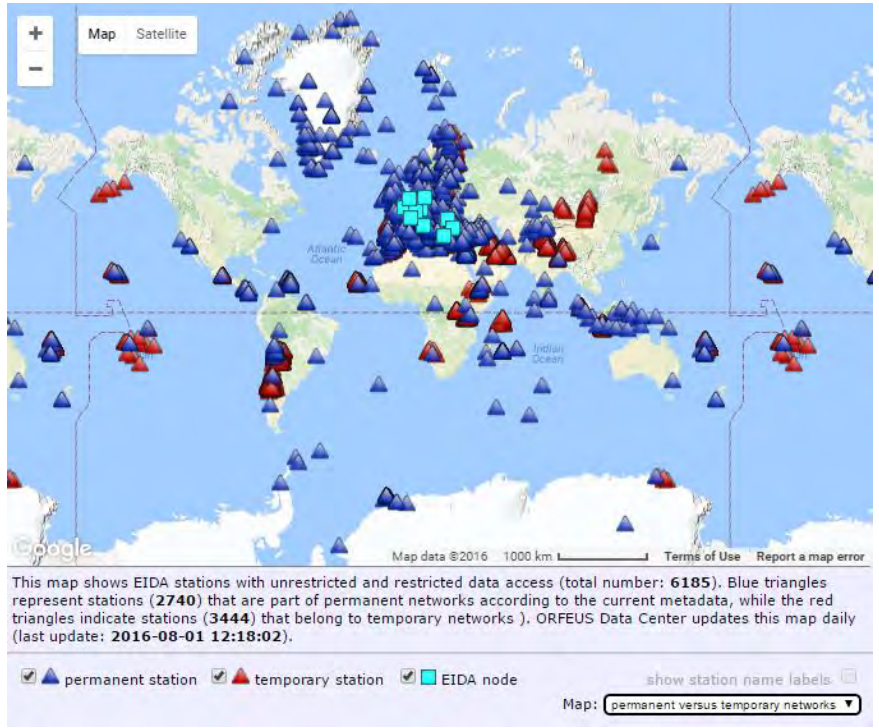
# Example: Group on Earth Observations (GEO)

- Formal role in GEO Work programme (start Jan 2016)
- To secure wider and sustainable global access to Earth Observation data
- Objectives:
  - Explore new technologies and cooperation to improve existing infrastructure (gaps/future demands)
  - Support AfriGEOSS to improve data dissemination to and from Africa
- First successful steps made:
  - Potential services for further assessment identified (SSO, Multicast, Clouds)
  - Relations between AfriGEOSS and African R&E networks established

**GEO Task Team:**
GÉANT NA3 (Lead), WMO, Météo France, DWD, EUMETSAT, GEO Secretariat

# Example: European Integrated Data Archive (EIDA) for seismological data

- EIDA is the largest and most advanced user community within the Earth Plate Observation System (EPOS)
- Need for a scalable AAI system that works via desktop and web client
- Federated archive: 11 European seismological data centres storing globally collected data
- ~ 1.3TB data downloaded/day, global user community
- Joint effort of GFZ (German EIDA node), GÉANT, SWITCH & DFN (via NA4 and SA5 User Support Teams)




1. Integration of all 11 nodes into eduGAIN
2. Set up an EIDA IdP hosted at GFZ, integrate into eduGAIN
3. Development of Service Provider Pilot “EIDA Authentication Service (EAS)”
4. Support move from SP prototype into production

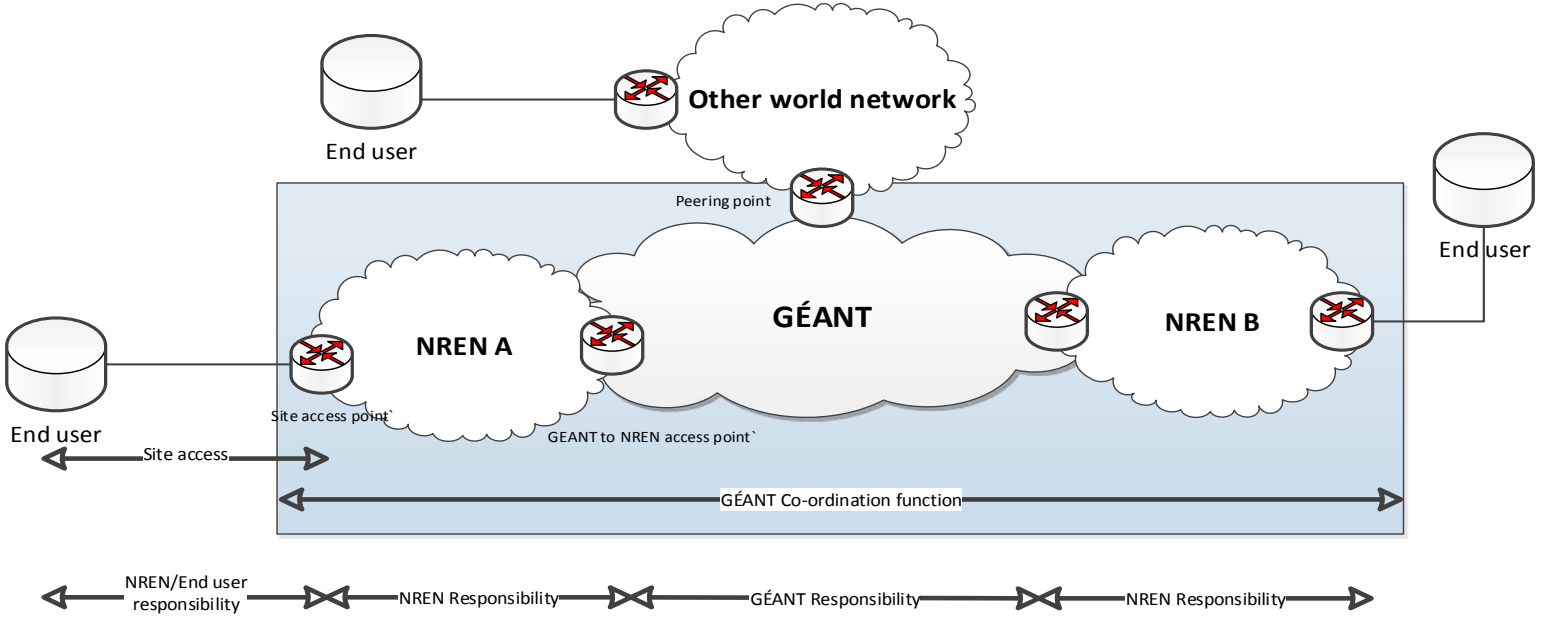
# Example: Cloud and HPC – CZ *National Case*

- Rather development of own facility GÉANT supports NRENs to deliver Cloud/Grid/HPC services to their communities.
- GÉANT collaborates either with EGI or PRACE-RI to deliver end-user communities national HPC resources:
  - NGI – Metacentrum (http://www.metacentrum.cz/en), CESNET, Czech Republic. Member of EGI.
  - NSC – IT4Innovations - IT4I – (http://www.it4i.cz/?lang=en; http://prace.it4i.cz). Joint Project by VŠB – TU Ostrava, University of Ostrava, Brno University of Technology. Member of PRACE.
- Collaboration with other e-infrastructures/research projects is crucial for such activities.
  - Usually number of users used to be the key indicator for big research infrastructure project evaluation.

# The One-stop-shop concept

- Work closely with Users, NRENs, other e-Infrastructures and GÉANT subject experts.
- Discuss and understand user requirements.
- Develop a consolidated and consistent solution for all involved sites:

  *technical/administrative/financial/contractual*
- Ensure seamless service implementation and operation through full project lifecycle management.
- Respect for the NRENs administrative boundaries→ GÉANT connects networks, not end-sites.



# Support for International Users

- **Dedicated User Support Team**
- **Single point-of-contact for international collaborations and organisations**
- **Providing a one-stop-shop**
- **Policy and technical consultancy**
- **User's voice within GÉANT**
  - International User Advisor Committee
  - NREN feedback, Surveys
  - Conferences, Focus Groups….

Thank you

Questions?

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GÉANT

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