GÉANT General Overview

Advanced global network services to support research excellence

Rudolf VOHNOUT, Vincenzo CAPONE
Technical Business Development Officer

GRID 2018, Dubna, Russia, 13.9.2018

Public

www.geant.org

To support collaboration and development amongst researchers, the dissemination of information & knowledge, and provide access to a portfolio of services and infrastructure resources:

Runs a membership association for Europe's National Research & Education Networks (NRENs)
GÉANT Association

Coordinates and participates in EC-funded projects
Under Horizon 2020 the financial instrument for implementing the Innovation Union, a Europe 2020 flagship initiative aimed at securing Europe's global competitiveness

Operates a pan-European e-infrastructure
GÉANT network

Manages a portfolio of services for research & education
EduX

Organises and runs community events & working groups
TNC, task forces & special interest groups
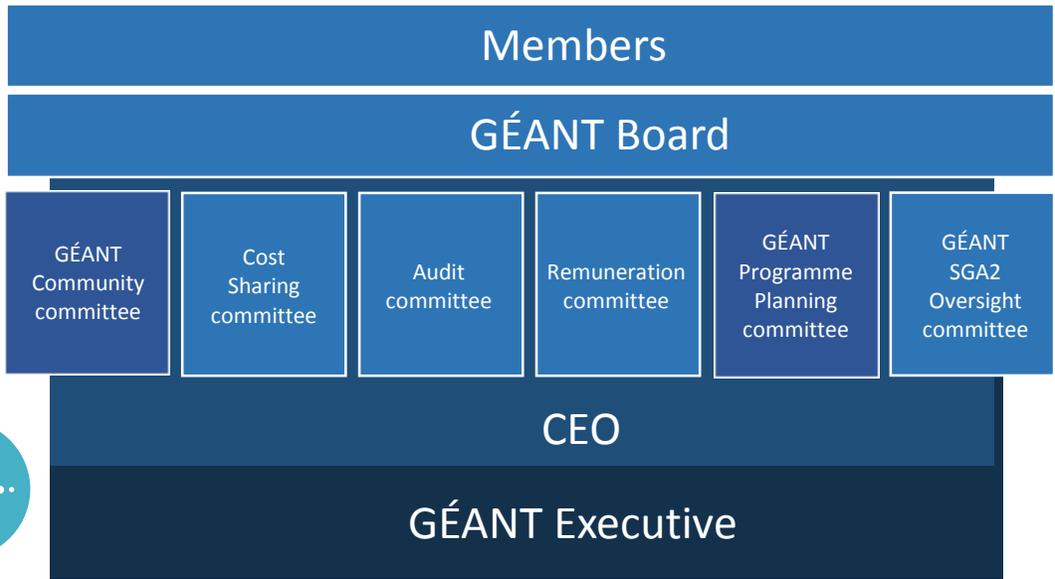
Membership Association

GÉANT Association supports and represents over 40 NRENs across Europe.

Together they support over 10,000 institutions and 50 million academic users.

Membership Association
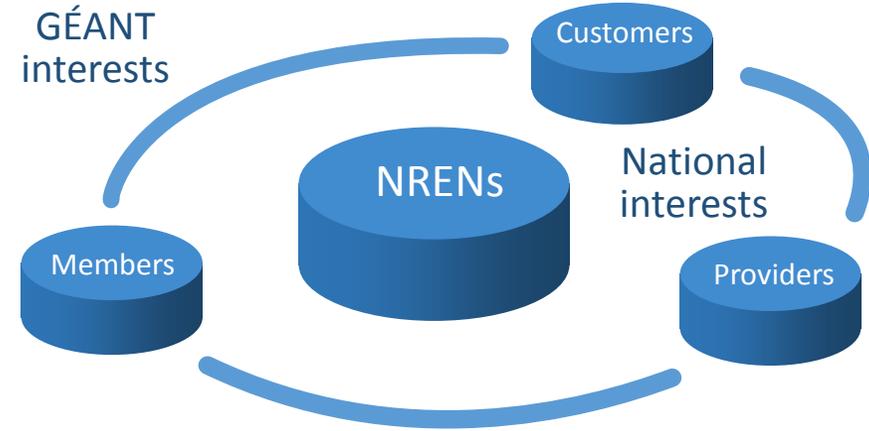
GÉANT Association supports and represents over 40 NRENs across Europe.

Together they support over 10,000 institutions and 50 million academic users.

Governance

GÉANT interests

Customers

NRENs

National interests

Members

Providers

Members	→ All European NRENs
GÉANT Board	→ Subset (9) of European NRENs
GÉANT Community committee · Cost Sharing committee · Audit committee · Remuneration committee · GÉANT Programme Planning committee · GÉANT SGA2 Oversight committee	→ Subset of board + CEO
CEO	
GÉANT Executive	→ GÉANT organisation management team

Projects

GÉANT is a trusted European Commission (EC) partner in many global collaboration projects and initiatives through our special relationship with the European Union.

European e-infrastructure projects

Trust & identity projects

Network projects

Collaborative projects

Network

The GÉANT network interconnects research, education and innovation communities worldwide, with secure, high-capacity networks.

We design, plan, build and operate the large-scale, high-performance GÉANT network that connects European NRENs to each other and the rest of the world for sharing, accessing and processing the high data volumes generated by research and education communities and for testing innovative technologies and concepts.

http://map.geant.org/

Interconnecting Europe's NREN over a 500Gb highly-resilient pan-European backbone.
NRENs serve 50 million users at 10,000 institutions across Europe.
Network services: IP, Point-to-Point Services, VPN, Testbeds, performance monitoring

GÉANT and partner networks enabling user collaboration across the globe

July 2016
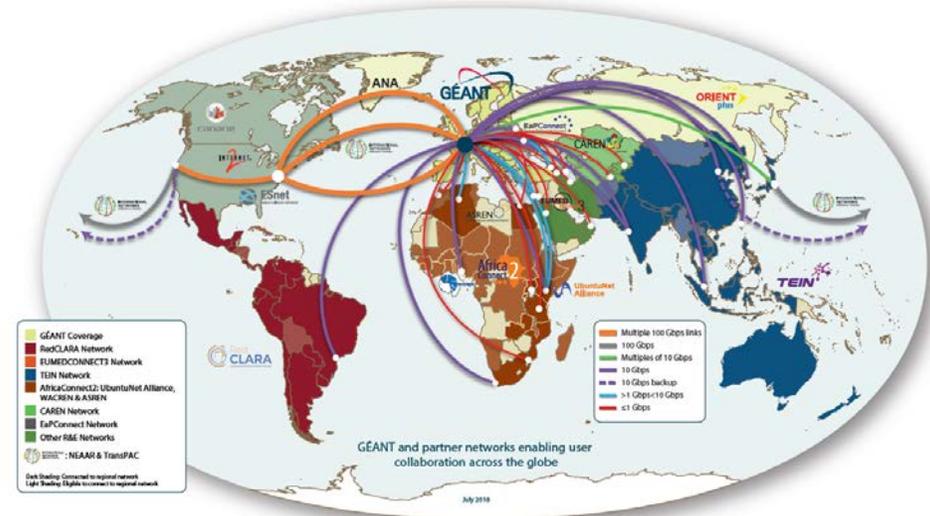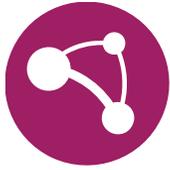
Network

A separate ultra-high-speed internet, only for research & education

Robustness
Over 1,000 terabytes of data are transferred every day via the GÉANT IP backbone.

Total reliability
100% average monthly access availability.

> **"Today it would not be possible to work without the network that GÉANT and the NRENs have provided."**
> CMS experiment, Large Hadron Collider (LHC)

Efficient operations
The dedicated GÉANT Operations Centre ensures 99% of cases are reported within 15 minutes of any outage being detected, leading to rapid resolution.

Services
A wide range of services including IP and dedicated circuits, testbeds and virtualised resources, authentication and roaming, monitoring and troubleshooting, advisory and support services.

Specialist Services

GÉANT develops the specialist services members need to support researchers, educators and innovators – at national, European and international levels.

GÉANT's portfolio of advanced services covers:

Network centric services

Trust identity and security

Storage and clouds

Real-time communications

Professional services

Network Services

GÉANT operates an advanced, high-performance network supporting Europe's NRENs with cost-effective, highly available, high-capacity services customised for and dedicated to research and education

GÉANT network services

GÉANT IP – Ultra-high performance uncontended IP connectivity at up to 100Gbit/s or multiple 100Gbit/s connections

GÉANT VPN – Layer 3 VPN services for NRENs and institutions supporting private networking needs

GÉANT Point-to-Point – High performance dedicated connectivity up to 100Gbit/s for the most demanding applications

GÉANT Open – Allows NRENs and approved commercial organisations to exchange connectivity in a highly efficient and flexible manner

Created with mapchart.net ©
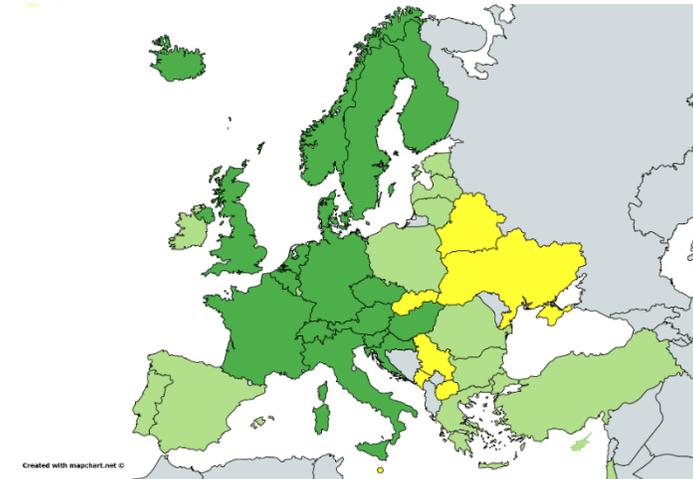
Availability Targets
99.999% - *27 seconds downtime/month*
99.99% - *4.5 minutes/month*
99.4%* - *4 hours/month*

GÉANT IP

Ultra-high performance uncontended IP connectivity at up to 100Gbit/s

GÉANT IP provides IP transit for NRENs and other approved research and education partners and providers. Its core function is to provide a private service for IP (internet protocol) traffic that is separated from general-purpose access to the internet. Working at speeds of up to 100Gbps, GÉANT IP provides core connectivity that supports inter-NREN connectivity.

Features

Peering
Provides NRENs with a high-performance, highly resilient peering facility, allowing access to a wide range of commercial network and cloud service providers.

GÉANT World Service (GWS)
Access to the wider, commercial internet. Ideal for NRENs that wish to take advantage of competitive costing, or those that are keen to diversify their existing commodity IP access.

GÉANT VPN Services

Increased privacy and control - helping to build effective virtual teams across borders.

VPNs are ideal for many-to-many (peer-to-peer) or one-to-many (central-site-to-satellite) environments, where each site can be allocated bandwidth according to its own requirements. Each site can support bandwidths from 155Mbps to 100Gbps (subject to availability). GÉANT and the national research and education networking (NREN) organisations have worked together to provide a range of uniquely flexible and powerful services.

Services:

MD-VPN

L3 VPN

GÉANT VPN Services

MD-VPN

The GÉANT Multi-Domain Virtual Private Network (MD-VPN) provides an end-to-end international network service that enables scientists all over Europe to collaborate via a common private network infrastructure.

MD-VPN can be used for connectivity between clusters, grids, clouds and HPC (high-performance computing) centres, allowing them to form virtual distributed resources for third-party research projects.

MD-VPN offers fast delivery of VPNs to end users and so can be used in a variety of ways, from a long-term infrastructure with a high demand for intensive network usage to quick point-to-point connections for a conference demonstration.

L3 VPN

The GÉANT L3-VPN service provides NRENs with the backbone infrastructure to enable custom VPN services for their users across the GÉANT backbone.
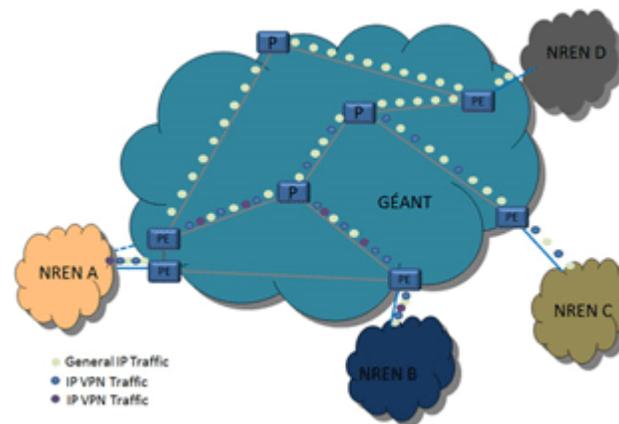
GÉANT Point-to-Point Services

High-performance interconnectivity for the most demanding networking requirements.

For when shared IP services can't provide the capacity or performance needed, GÉANT's point-to-point services provide the perfect solution.

Service Options

GÉANT Plus
GÉANT Plus allows national research and education networking (NREN) organisations to request point-to-point Ethernet circuits between end-points at GÉANT PoPs (p oints of presence). Circuits can be established to any European NREN.

GÉANT Lambda
GÉANT Lambda provides full wavelengths at up to 100Gbps to support NREN users with particularly demanding network requirements. The service provides transparent 10Gbps, or 100Gbps wavelengths between GÉANT PoPs.

GÉANT Open

Facilitating open collaboration across the globe

GÉANT Open allows national research and education networking (NREN) organisations and approved commercial organisations to exchange connectivity in a highly efficient and flexible manner.

As a first within the European research and education community, approved commercial organisations will be able to connect to GÉANT Open. This helps research and education users connect to commercial third parties as part of private-public research projects.

GÉANT Open is available in Paris, Marseilles and London TeleCity enabling partners across Europe and the world to interconnect seamlessly.

Features

Protocol

VLAN connectivity

GÉANT network interconnectivity

International connectivity

Network Performance and Management

Supporting High Performance Networking

perfSONAR
- Network performance monitoring
- Joint venture with Internet2, ESnet and Indiana University
- Over 1650 measurement points deployed globally
- Helping measure and diagnose performance issues for the R&E community

eduPERT
- A world-wide Open Community for Performance Enhancement Response Teams,

- A virtual community covering performance issues for R&E networks

GÉANT CERT Pan-European Computer Security Incidence Response Team coordination and a suite of network security tools (Distributed Denial of Service (DDOS) attack mitigation tools etc.)

GÉANT Testbeds Service

Enabling the development of the next generation of networks and services

Advanced networks and services need to be tested in near real-world environments

Using live networks poses risks to other users

The GÉANT Testbeds Service provides user-defined and user-controlled virtual e-infrastructure environments containing transport circuits, switching/forwarding elements, computational elements and storage

These virtualised networked environments are dynamically created, scheduled, and can span Europe

Trust, Identity & Security

Supporting users and enabling secure access to services

eduroam - secure global roaming access service _**250+ million authentications per month**_ in 89 territories

eduGAIN - interconnects identity federations around the world, simplifying access to content, services and resources ~ 3500 identity providers accessing services

AARC project – collaborating with e-infrastructures, research collaborations, libraries & federations to share policies, architectures, training materials & pilots that avoid re-inventing the authentication & authorisation wheel

REFEDs – supporting identity federations worldwide

Trusted Introducer – services for security and incident response teams

Certificate Service – delivering cost-effective digital certificates.
In partnership with digicert

eduroam

**Linking students to the global community**

Free secure Wifi provided by NRENs between campuses.

A global network of users across 89 territories.
More than 2 billion international authentications and counting

A worldwide success story

From its early beginnings as a joint venture between a few European universities to today – with millions of users in more than 89 territories worldwide, eduroam has been an amazing success story and an example of research and education collaboration.
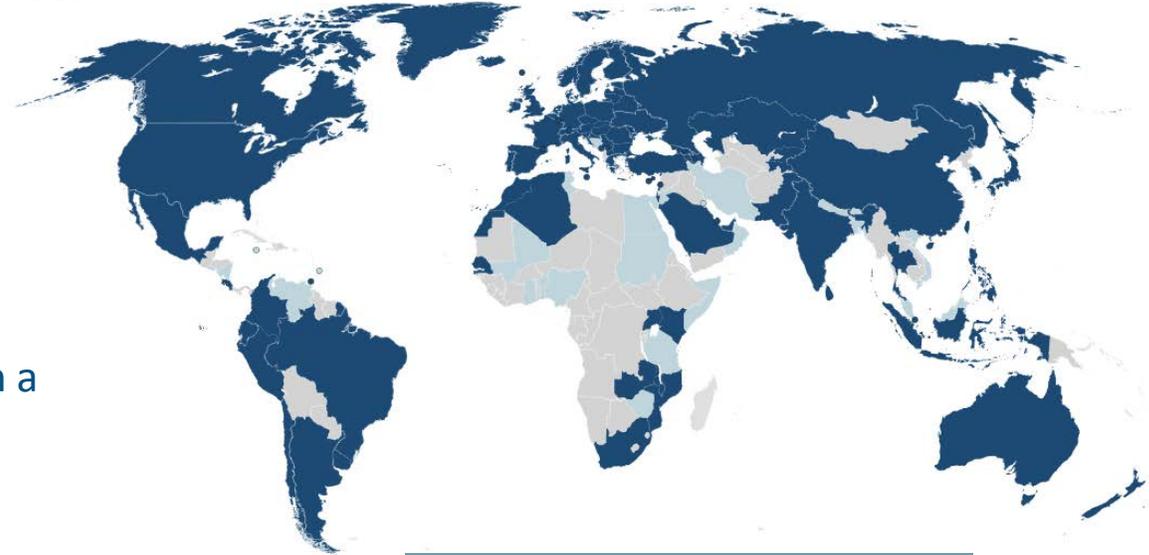
eduroam.org

@eduroam

NEW

eduroam Managed IdP service to simplify onboarding of smaller institutions

eduroam Managed IdP

Expanding access to eduroam for smaller institutions

For smaller institutions without the resources to implement and support eduroam, eduroam Managed IdP can get users on-line quickly and securely.

- A web-based user management interface where user accounts and access
- credentials can be created and revoked.
- A technical infrastructure ("CA") which issues and revokes credentials
- A technical infrastructure ("RADIUS") which verifies access credentials and subsequently grants access to eduroam

This leaves the institution only having to focus on the users and frees up valuable technical support resource.

eduGAIN

Enabling secure Single Sign On services to global research and educational resources

Federated identities enable users to access a wide range of services using a single account sign-on managed by their 'home' institution

- Improves access
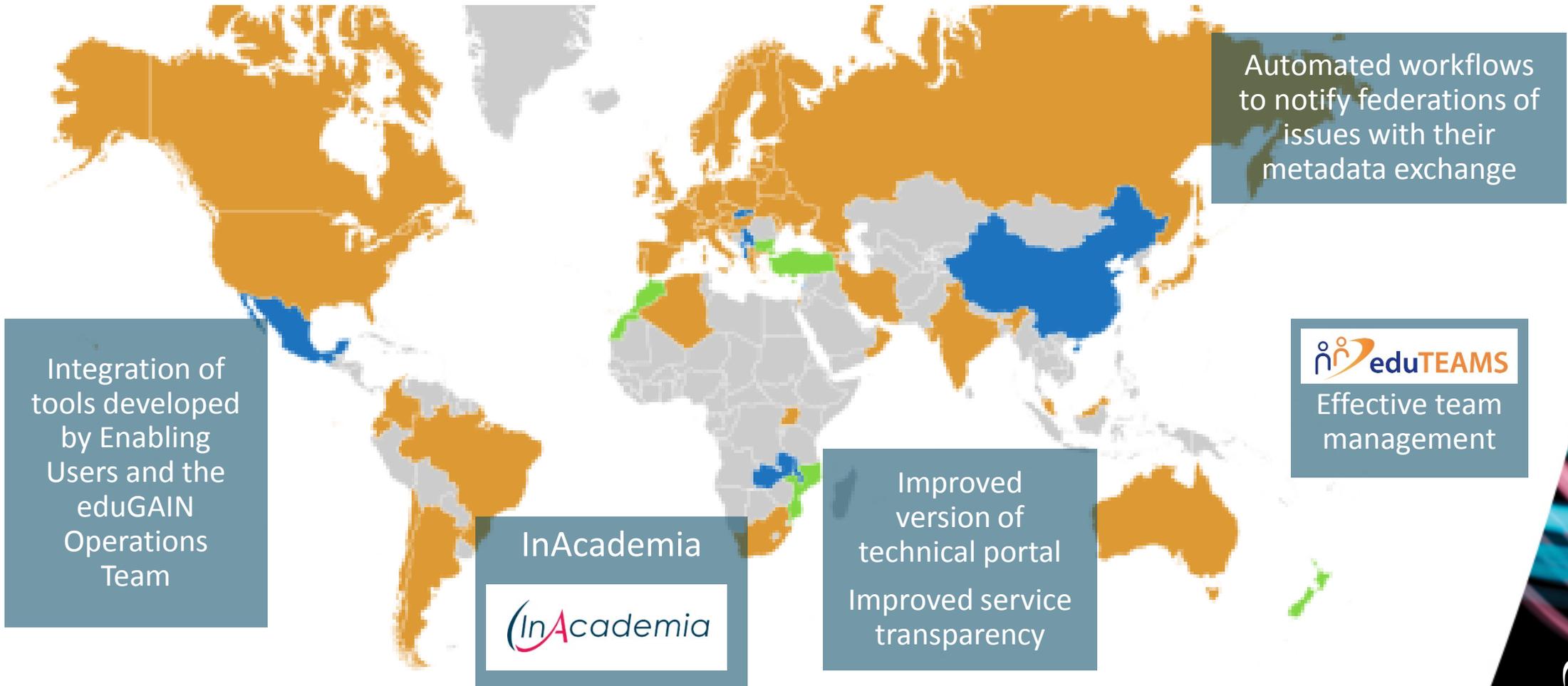- Improves security
- Reduces management overhead and costs.
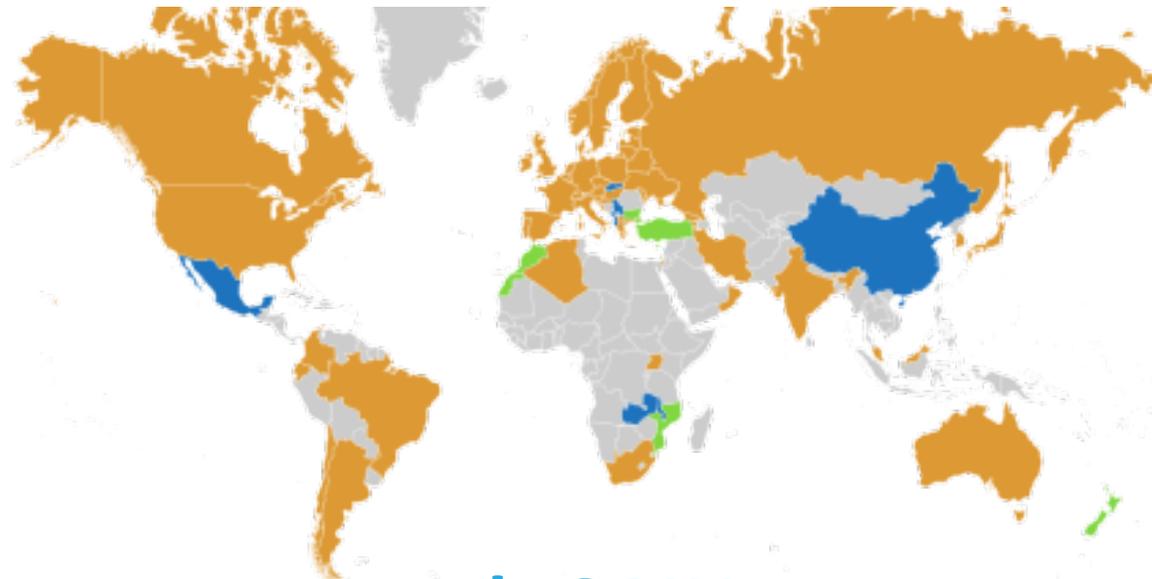
August 2018:

53 Federations active

6 Federations with voting rights in process of joining

4930 entities

eduGAIN.org

eduGAIN

Recent developments

eduGAIN

Automated workflows to notify federations of issues with their metadata exchange

Integration of tools developed by Enabling Users and the eduGAIN Operations Team

eduTEAMS
Effective team management

InAcademia

InAcademia

Improved version of technical portal

Improved service transparency

GÉANT

GÉANT Cloud Catalogue

A growing resource for the research and education community, with a structured listing of service providers and cloud services. It provides a quick and easy guide to clarify the capabilities of providers and helps in the procurement of cloud services
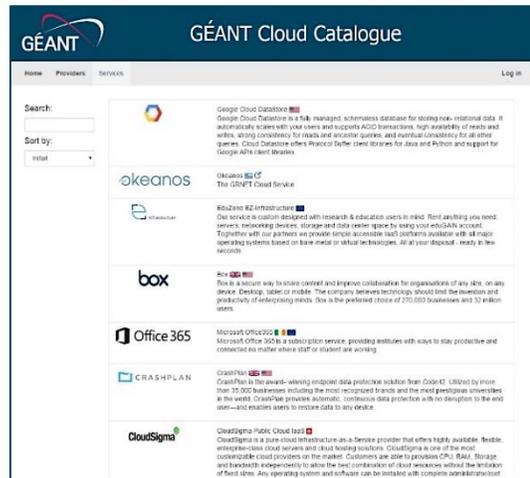
28 services from 16 providers

Real-Time Communications Services

Enabling communication and collaboration across the community.

Online communications are crucial to research and education. Students, researchers and institute staff rely on e-learning services and audio and video conferencing to learn and share. This is a rapidly developing area and GÉANT is working to support and foster innovation for the national research and education networking (NREN) organisations and their communities.

eduOER - Supporting access to multimedia content across multiple repositories.

NRENum.net - Interconnecting multiple dialling methods for real-time communications.

Professional Services

With over 40 partners across Europe and a €multi-million budget, GÉANT has met the challenge of managing complex international projects

Consultancy - GÉANT's valuable experience gained through the operation of the GÉANT Project and network has provided us the ability to assist a wide range of international research and education networking projects.

Secretariat services - GÉANT provides secretariat services to a wide range of task forces and special interest groups as well as supporting groups such as REFEDS, GLIF and NRENum.net.

Training – Supporting the needs of both the GÉANT organisation and offering specialist training to the wider community

Trust and Identity – User Consultancy & Support
Task 5: Enabling Users - CLARIN

Defining a long-term agreement/solution/process between CLARIN, ERIC and eduGAIN member federations to publish the CLARIN SP Federation metadata in eduGAIN

Using CLARIN's experience and existing concepts to create the eduGAIN Attribute Release Check tool

Notifyingthe identity federations with the highest numbers of users that have a requirement to use CLARIN services but are unable to do so

Evaluating concepts and solutions to better handle cases where a user with too few attributes attempts to access an eduGAIN service (ongoing)

CLARIN

GÉANT – supporting European NRENs

GÉANT Research Engagement (researchengagement@geant.org):

Dedicated single point-of-contact for NRENs

Dedicated single point-of-contact for large international collaborations and organisations

Providing a one-stop-shop include policy and technical consultancy

Welcome to the Case for NRENs portal

A pool of resources to assist national and regional R&E networks (NRENs and RRENs) 'make a case' towards their users, funders and partners.

A toolkit of guidance materials to support in particular new and emerging NRENs.

Find out how to use and contribute to this portal

Users we work with

Social Sciences, Arts and Humanities

Life Sciences

High-Energy Physics and Astronomy

Earth Sciences and Observations

Future Internet Projects

E-Infrastructures

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)

Future Internet projects (XiFi, Confine, SmartFire, etc.)

Life sciences
Genomics (Elixir, EBI, EMBL)
BioImaging

GÉANT

GÉANT – supporting NREN users

iMinds globally interconnected testbeds to drive future internet projects

251 L2VPNs to create a globally federated testbed infrastructure

User Liaison
- Feasibility analysis
- Single point of contact
- Liaison function between all involved parties
- Coordination of entire implementation process

Technical Service Support
- Tailor-made solutions per end site
- Troubleshooting to enable end-site connection
- End-to-end testing

Continuous Service Assurance
- 1st-line service monitoring
- Fully automated ticketing system for all connected testbeds
- Monthly, quarterly and annual service reporting
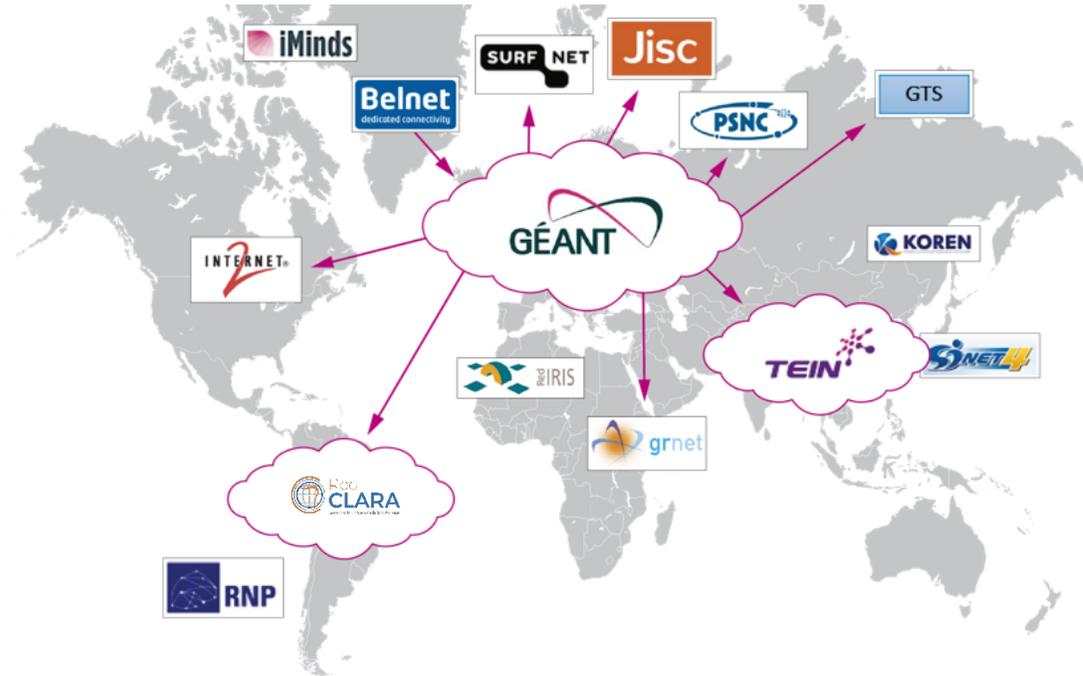
Special Interest Groups & Task Forces
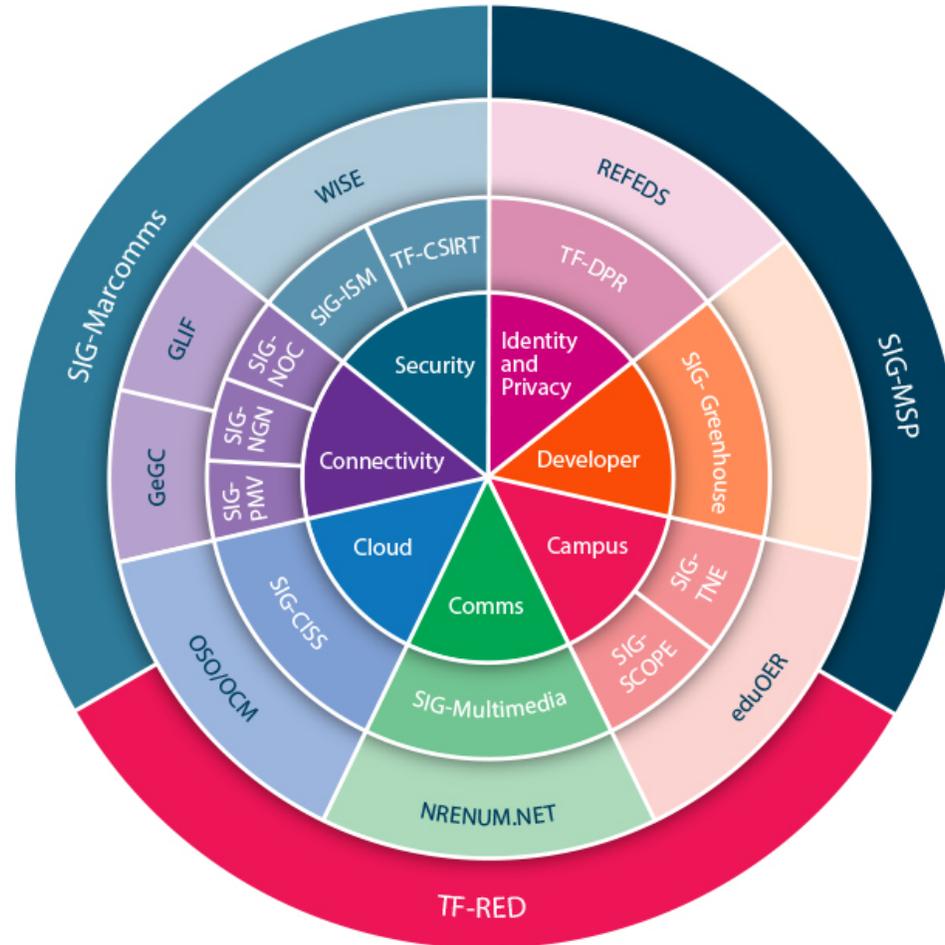
GÉANT International Projects

Title of Conference attended

Name, Affiliation, Date

www.geant.org

Africa – AfricaConnect2

Scope

Connecting the R&E communities across Africa and interconnecting them with GÉANT.

€20M EU funding for 3.5 years (from June 2015)

Partners

- **UbuntuNet Alliance**: Eastern & Southern Africa – Cluster 1
- **WACREN**: West & Central Africa – Cluster 2
- **ASREN**: North Africa – Cluster 3
- **GÉANT**: Administrative (Clusters 2, 3) + Coordination
- EU NRENs (**CY, ES, FR, GR, IT, PT**) also supporting
- Beneficiaries: **30 African NRENs**

Project update

- Accra-Lagos-London link now operational
- Morocco connected via ASREN link at 1 Gbps
- Somalia connected to UbuntuNet backbone at 155 Mbps
- Regional partners working with AfriGEOSS to support Earth observation programmes across Africa
- Regional partners participating in NSF-funded NEAAR project to improve connectivity with North America
- Planning underway for project continuation beyond November 2018

R & E Network Links in Africa and to GÉANT (1 October 2017)
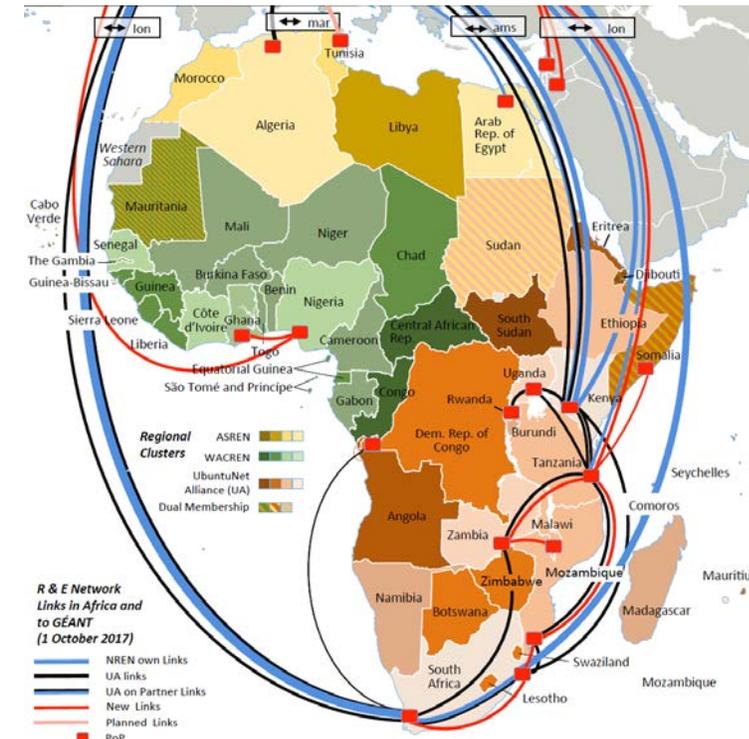
Eastern Mediterranean - EUMEDCONNECT

Scope

Regional network for the Mediterranean since 2004 – now in its third phase
Phase 3: 2011-2014, extended until end 2019

Partners

- Managed by **GÉANT**
- Regional partner **ASREN**
  (The Arab States Research and Education Network)
- 5 EU NRENs (**CY, ES, FR, GR, IT**)
- Beneficiaries: **Jordan**, **Lebanon** and **Palestine**

Project update

- Lebanon upgraded to 1.4Gbps, NREN formed (TechCARE)
- Jordan link upgraded by ASREN to 1Gbps, re-connects JUNet
  and connects SESAME to CERN
- Palestine interested in re-connection
- DG NEAR increased EC funding to 60%

Backbone Topology June 2018
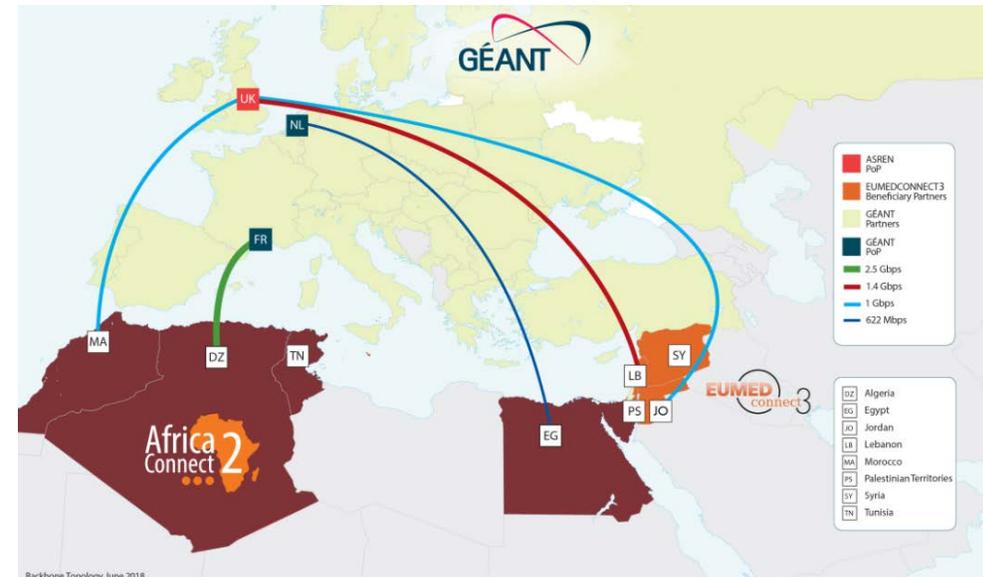
Central Asia - CAREN

Scope

Regional network for Central Asia since 2010
2 previous phases 2010 - 2015
3rd phase (CAREN3) resumed in June 2016 up to 2019
€10M EU funding up to 2019

Partners
- Managed by **GÉANT**
- Initial beneficiaries: **Kyrgyzstan** and **Tajikistan**
- Kazakhstan, Turkmenistan and Uzbekistan also eligible, subject to financial agreements between their governments and the EC

Project update
- Ring of 1Gbps circuits within the region connecting Kyrgyzstan and Tajikistan with GÉANT operational since April 2017
- CAREN Cooperation Center (CAREN CC) established
- 3rd CAREN Regional Conference (CRNC2018) to be held in Dushanbe in Oct 2017

Asia Pacific – Asi@Connect

Scope

TEIN (Trans-Eurasia Information Network): R&E connectivity across Asia-Pacific and to Europe

3 EU-funded phases (TEIN2-4) from 2005 to 2016

New project phase: Asi@Connect (2016-2021; €20M EU-funding)

Partners

- GÉANT set up and ran until 2012 when handed over to **TEIN* Cooperation Centre (TEIN*CC)** based in Korea
- TEIN*CC supported by GÉANT (ongoing consultancy agreement)
- Beneficiaries: TEIN connects over 55 million users in **21 countries and economies**

Project update

- Major emphasis on applications support, community building and public internet deployment in remote area

- Mechanism of Call for Proposals (CFPs) – 2 held so far with a total of 29 project awarded with over €5m investment

- Developing closer links with the APAN community
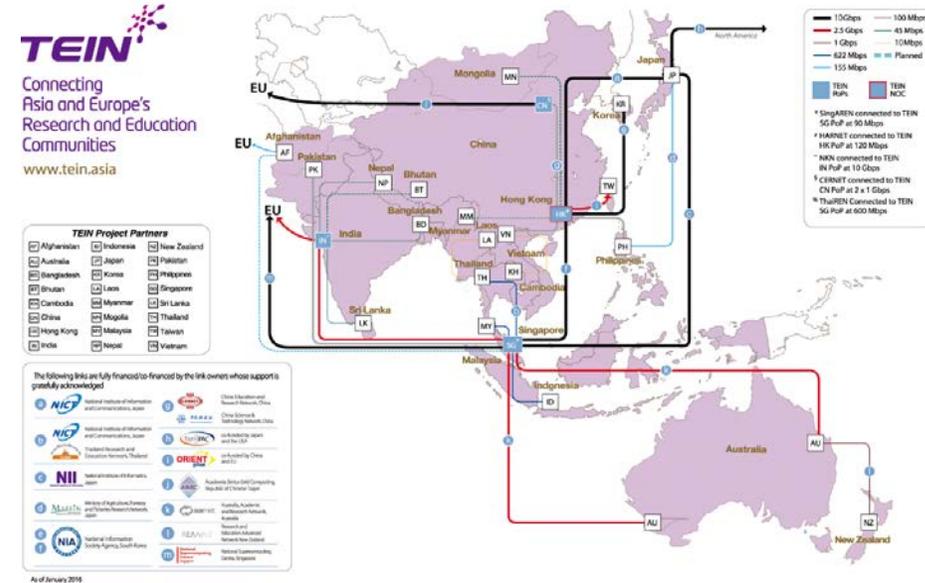
Asia Pacific

GÉANT has also developed strong bilateral relations with the region's major NRENs

CERNET and CSTNET

- 10Gbps direct EU-China connectivity jointly provided by GÉANT (GN4) and CERNET, seamlessly continuing ORIENTplus

- Additional 10Gbps circuit currently tendered in conjunction with CSTNET

- Working with CERNET and CSTNET to promote EU-China collaborations (e.g radio-astronomy, meteorology, genomics TNE etc)

- ORIENTplus website launched www.orientplus.eu

NKN

- 10Gbps peering in Amsterdam

- Seeking to strengthen EU-India user collaborations

- First EYR India2Europe programme launched in January 2018, 2 projects awarded

Asia Pacific

NII/SINET

- 20Gbps peering in London, GÉANT providing equipment housing

- Active technical and marketing collaborations and user support (e.g. ITER and BELLE II)

- Further connectivity upgrades planned

NICT

- New MOU signed 2016, extending technical co-operation (e.g. SDN, federated identity technologies etc)

SingAREN

- Co-funding a 10Gbps TEIN link to GÉANT

- GÉANT providing London equipment housing for Singaporean HPC community

- User collaborations (e.g. supercomputing)

KREONET

- 10Gbps peering in Amsterdam

Latin America

Connects 12 Latin American NRENs

10Gbps interconnection with GÉANT

Funded via NREN membership.

- Previously co-funded by DG-DEVCO ALICE and ALICE2 projects (2003-2013)

Efforts underway to procure & deploy:

- Long-term high-capacity transatlantic connectivity Europe and Latin America

- 100Gbps RedCLARA backbone

Advanced North Atlantic Collaboration

ANA is a collaborative effort of GÉANT, Internet2, CANARIE, Indiana University, NORDUnet and SURFnet to provide multiple, diverse links to support North America-European research.

Provides 400Gbps on diverse paths:

- 100Gbps between New York and Paris, funded by GÉANT

- 100Gbps between Amsterdam and Montreal, funded by NORDUnet and SURFnet

- 100Gbs between Washington and London, funded by Internet2 and CANARIE

- 100Gbps between London and New York, funded by the US NSF NEAAR project led by Indiana University

ESnet funds 340Gbps of capacity between Europe and North America (Boston-Amsterdam; New York-London; Washington DC-Geneva. The links provides back-up for ANA collaboration connectivity.

Eastern Partnership - EaPConnect

Scope

€13M (95%) EU funding from DG NEAR,
July 2015 to 2020

- Connectivity & equipment procurements
- Service portfolio & competency growth
- Knowledge transfer & outreach events

Partners

- Beneficiaries: IIAP NA RA (Armenia), IIT of ANAS (Azerbaijan), UIIP NASB (Belarus), GRENA (Georgia), RENAM (Moldova) & URAN (Ukraine)
- Associates: AARNet, AMRES, BREN, CyNet, DFN, EENet of HITSA, ESnet, GARR, LITNET, PSNC, RoEduNet, REANNZ, SURFnet

Conference

- 3rd Eastern Partnership E-infrastructures Conference (EaPEC 2018) in Chisinau, Moldova, 17-18 October 2018
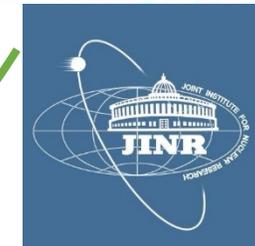- 3rd regional Enlighten Your Research call in progress – record response with 35+ entries
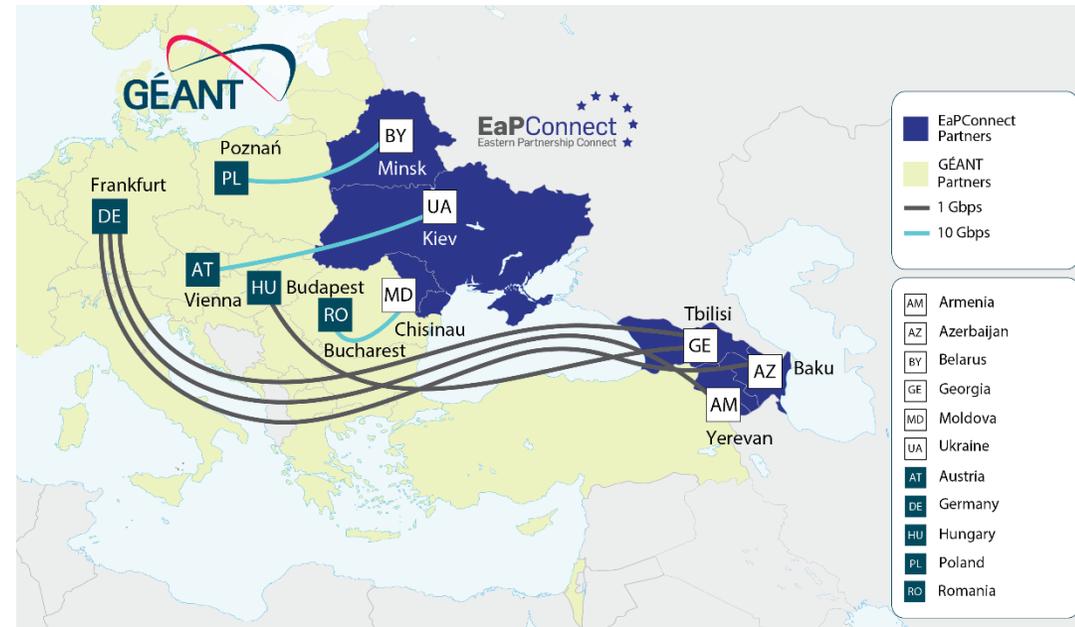
Russian connections to GÉANT

http://map.geant.org/
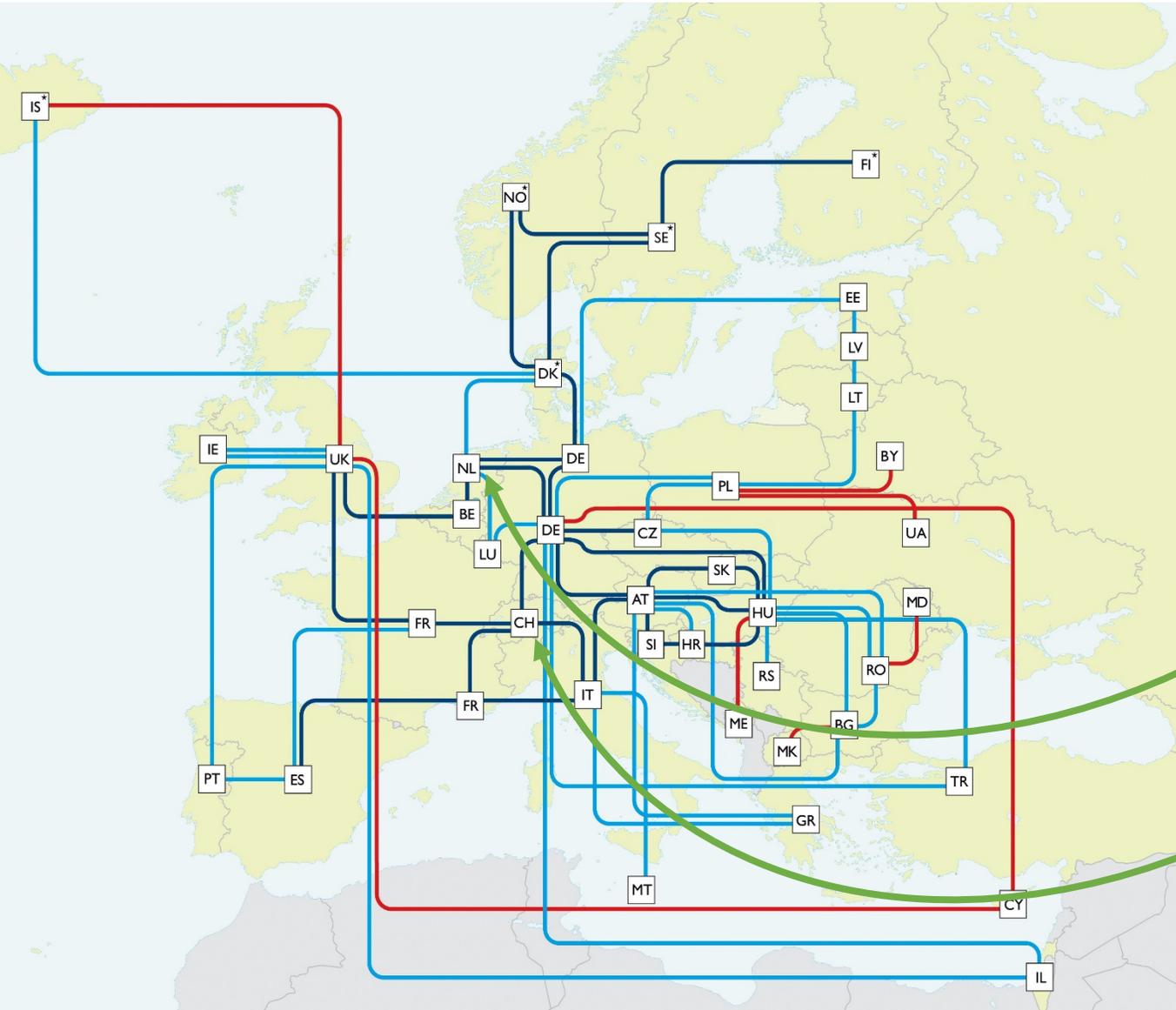
Thank you
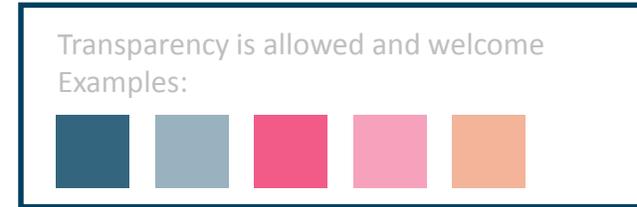
Any questions?

www.geant.org

Colour Palette

Primary Colours

GÉANT Red

CMYK | 0 100 55 0
RGB | 237 21 86
Hex | #ed1556

GÉANT Blue

CMYK | 100 11 0 74
RGB | 0 63 95
Hex | #003f5f

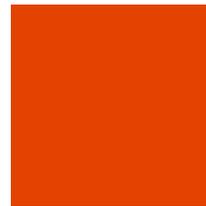Transparency is allowed and welcome
Examples:

Secondary Colours
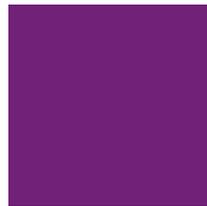
GÉANT Purple

CMYK | 67 100 19 6
RGB | 113 33 119
Hex | #6D2077

GÉANT Orange

CMYK | 6 87 100 1
RGB | 226 67 1
Hex | #e24301

GÉANT Pink

CMYK | 19 100 14 0
RGB | 204 0 123
Hex | #cc007b

GÉANT Grey

CMYK | 36 22 26 0
RGB | 167 179 180
Hex | #a7b3b4

The GÉANT primary colours are as much a part of the visual identity as the logo mark so it is essential that they are used and reproduced well to ensure brand recognition. The secondary colours and tints work to support our primary colours and to ensure clarity of hierarchy and information on any piece of communication. However they should never dominate a page.

www.geant.org

Icon set 1 (use them as much you can)

Users: Arts and Education

Users: Earth Observation

Users: Energy

Users: Health and Medicine

Users: Space

Users: Physics

User Groups

Efficiency

Cloud Services

Strategy and Vision

Schedule

TFs and SIGs

Storage

Real-Time Communications

Professional Services

Connectivity and Network

GÉANT Logo

GÉANT People

GÉANT Services

GÉANT Network

GÉANT Community

EU Logo

Research Programmes

www.geant.org

GÉANT

Icon set 2 (use them as much you can)

Latin America region

CAREN region

Asia Pacific region

AC2 region

EUMED region

EaPConnect region

North America

Europe

Location

Glue

Vision

Strategy & Vision

Campus

Service cogs 1

Service cogs 2

Finance

Pilot

Production

Developer

Journal/Library

Legal

NREN

Events

Compass

www.geant.org

GÉANT