



Annual Review 2014



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Foreword

We are GÉANT!

It's taken three years of analysis, preparation, discussions and a lot of hard work to get here. But we are proud to say that, at last, DANTE and TERENA, are now unified under the GÉANT brand. Despite many obstacles, not least building a consensus between our 41 countries, this is a superb achievement and testament to the collaborative effort of all involved.

By successfully merging three assemblies (the [TERENA General Assembly](#), the [NREN Policy Committee](#) and the DANTE shareholders assembly) and creating the GÉANT General Assembly, we are now ready to oversee all European research and education networking activities. In doing so, we have addressed recommendations from the [GÉANT Expert Group \(GEG\)](#) ('[Knowledge Without Borders](#)', October 2011), and built on [preparatory work](#) initiated by the Reykjavik Group.

Today, we are in the best place to develop a unified vision. There is still a long way to go, of course, so we must focus on the future. First, we need a governance that reflects the new reality. We need a CEO and appropriate committees; all while retaining an open dialogue with the NRENs, the users and the e-infrastructures.

We must respect the legacy of both [DANTE](#) and [TERENA](#), each of which brings fundamentally different skills, approaches and cultures to the table. We should strike the right balance, ensuring that one organisation does not absorb the other - preserving the values of each component, without dilution or loss of activities essential for our community.

Instead, our ambitious goal is to use a unified approach: one that allows for the provision of operational services on one hand and community building on the other, but always with a bottom-up approach in mind. By learning from each other, and by forming solid foundations, [GÉANT](#) will grow in the most efficient way possible.

I'd like to thank all the people who have been involved in this challenging process, i.e., the members of the Reykjavik group, the two boards and the two management teams. Your contribution has reinforced the major contribution made by Bob Day.

Pierre Bruyère



Note that in this publication, instead of referring to former-TERENA and former-DANTE activities, we will speak about one unified entity. Also, as this report is to be published at the same time that this organisation changes its name and branding from 'GÉANT Association' to simply 'GÉANT', that is the name that we will use.

A new identity, a new organisation, a new dynamic

Governance and strategy

Discussion of the restructuring of DANTE and TERENA during the 42nd GA meeting, Dublin, Ireland, 22 May 2014.



Successful joining of two partners

On 7 October 2014, in Berlin, the membership of TERENA and the shareholders of DANTE agreed to proceed with a restructuring process that had commenced late in 2013. TERENA members agreed to change the [Articles of Association](#) of TERENA, changing its name to the GÉANT Association, and the majority of DANTE shares were transferred to the GÉANT Association by the end of the year. It was agreed that adopting the GÉANT name was an effective way to reflect the pivotal role of this major project, and to recognise the community collaboration the name has come to stand for. This restructuring marks a new phase in almost thirty years of collaborative research and education networking in Europe. It will deliver simplified governance, more efficient management, more flexible use of resources and a more inclusive membership for the association.

Requested by Europe's national research and education networking organisations (NRENs), the restructuring of TERENA and DANTE also supports the European Commission's future vision for research and innovation, as set out in the '[Horizon 2020](#)' programme. In answer to this, GÉANT, in collaboration with other European e-infrastructures, has already submitted a number of proposals.

The mission of GÉANT translates into the following key objectives:

- Networks: planning, procuring, maintaining and operating high-speed research and education networks including the pan-European GÉANT and other regional networks;
- Services: developing innovative services for the research and education community;
- People: fostering collaboration in the wider research and education networking community.

One name, one brand, one vision

With the adoption of the GÉANT name by the NREN community as the new name for its association, and with the new Framework Partnership Agreement (FPA) relationship with the European Commission (EC) coming into effect, a branding transition has also been necessary. The DANTE,



7-8 October 2014, Berlin, 44th GA Meeting. The decision is made that TERENA becomes the GÉANT Association.

TERENA and GÉANT Project brands are to be replaced by one new visual identity that embraces all of those areas of work: GÉANT.

GÉANT is the world's leading collaboration on network and related infrastructure and services for the benefit of research and education. GÉANT unifies the strengths of DANTE and TERENA and consolidates their governance, representing a major change for the global research and education networking community. From better serving its members to strengthening relationships with partners and users, GÉANT is now in a much stronger strategic position to positively impact European research and education networking.

The GÉANT Board of Directors, from left to right, back to front: Erwin Bleumink, David Foster, Christian Grimm, Ivan Marić, Marko Bonač, Sabine Jaume-Rajaonia, Pierre Bruyère, Dorte Olesen, Alberto Pérez.



What does GÉANT stand for?

GÉANT is coming to have a wider meaning beyond that of a single project or organisation, to become the representative of the entire NREN collaboration.

Ownership

GÉANT is owned by its [core membership](#). This includes 36 National Members, which are European NRENs, and one Representative Member - [NORDUnet](#) - which participates on behalf of five Nordic NRENs. Associate Members are also welcome and include commercial organisations and multinational research infrastructures and projects.

New Board elected

The GÉANT General Assembly (GA) meeting on 11 December 2014, in Zagreb, Croatia marked an important step into the future of GÉANT by electing the new Board. [Pierre Bruyère](#) (Belnet) was elected as Chair of the Board for a two-year term, following three years as president of TERENA. He is joined for two years by Sabine Jaume-Rajaonia (RENATER) and Ivan Marić (CARNet). Erwin Bleumink (SURFnet), Marko Bonač (ARNES) and Alberto Pérez (RED.es/RedIRIS) were elected for one year, and Christian Grimm (DFN) for a three-year term.

Two Board positions, created for organisations other than national members of the association, were given to Dorte Olesen (Technical University of Denmark) and David Foster (CERN). Both have a long track record within research and education networking.

The interim CEO is Bob Day, the Executive Director of Jisc, the United Kingdom's NREN. Stepping down as chair of DANTE, his role covers the period of transition and integration. The new Board was set to meet for the first time on 15 January 2015.



The GÉANT Project

A large proportion of GÉANT's activities in 2014 were performed under the umbrella of the [GN3plus](#) project, known as 'the GÉANT Project'. The project was scheduled to run from 1 April 2013 until 30 March 2015 (an extension has been sought up to 30 April 2015), and is to continue as GN4 under the European Union's [Horizon 2020](#) research and innovation programme.

Co-funded by the EC and Europe's NRENs, the flagship GÉANT Project connects and empowers research and education communities within Europe and other world regions through the award-winning 500 Gbps GÉANT pan-European network and a portfolio of advanced services. GÉANT offers NRENs cost-effective inter-NREN networking and support for the development of vital services and plays a core role in the EU's e-infrastructure strategy, facilitating the free, unimpeded movement of scientific data and knowledge within and across the research and education community.

At the annual project review in June 2014, the Project was awarded the highest rating of "Excellent" for the third consecutive year.

Project strategy

An important task in 2014 was the production of two documents by the Strategy and Innovation Committee (SIC), which had been established to provide a long-term vision, strategy and innovation agenda for the GÉANT Project, with the blessing of the GN3plus Assembly. NREN representatives and GN3plus participants were consulted through hearings, surveys and debates sessions. The core aim was to establish the direction for the GÉANT community to provide an open, innovative and trusted information infrastructure for the European knowledge economy. The final documents "[GÉANT Strategy 2020 - Over the Horizon](#)" and "[GÉANT Strategy 2020 - Implementing the Strategy](#)" were to be published in early 2015.

"Make every European researcher digital"

As we move into 2015, there is a change in the project's administrative framework. As a trusted EC partner, we have entered into a special relationship, the GÉANT2020 'Framework Partnership Agreement', effective from 1 May 2015. The objective is to expand the current GÉANT infrastructure into the European Communications Commons, as envisioned in the GÉANT Expert Group (GEG)



The GÉANT Project is one of the core GÉANT activities.

Report. The European Communication Commons is to provide new opportunities for research, education and Citizen Science, through ubiquitous access to any resource for knowledge creation, innovation and learning. This will provide the means through which the research and education networking community can contribute to achieving the EC's goal - as stated in the Horizon 2020 Work Programme 2014-2015 - "e-infrastructures will make every European researcher *digital*, increasing the creativity and efficiency of research and bridging the divide between developed and less-developed regions."



GÉANT is contributing a significant part of its resources to the EC's Horizon 2020 programme.

Membership map

as per 31 December 2014

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

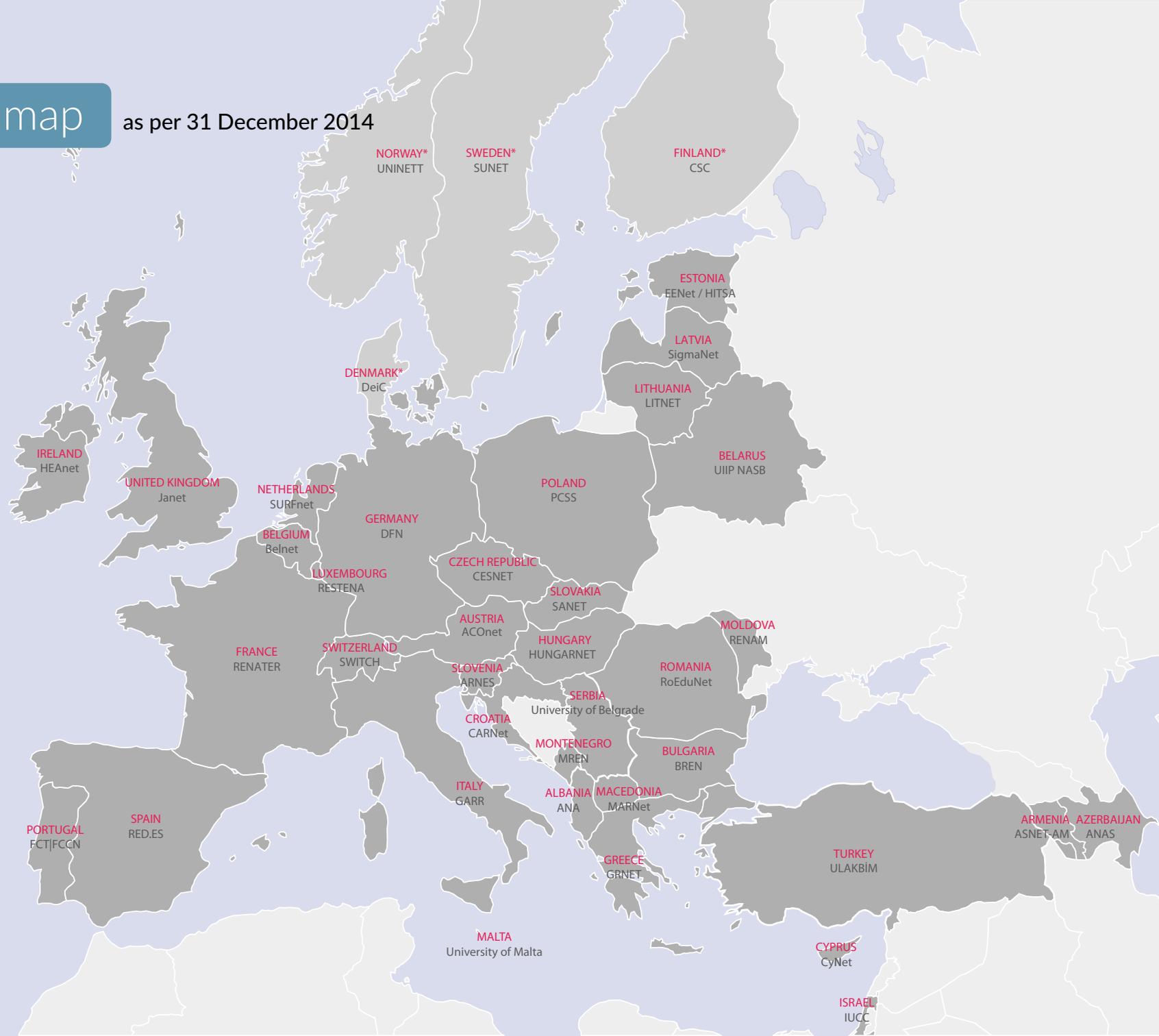
ownCloud

*RHnet (Iceland)

*SUNET (Sweden)

Tata Communications

*UNINETT (Norway)



Outreach and supporting community development



Spreading the word

[PeaR Community News](#) provides a dissemination service that is consistently used by more than thirty organisations. In 2014, almost 200 articles were published, 56 percent of which were news from NRENs around the globe, with the remainder being published by GÉANT and seven other non-NRENs, such as [RIPE NCC](#), [EUNIS](#) and [ISOC](#). The GÉANT [CONNECT magazine](#) highlighted news from NRENs and the wider community alongside news about the GÉANT Project. GÉANT also contributed to the publications of other organisations, including newsletters of [iSGTW](#), [EGI.eu](#), [CKLN](#) and [UbuntuNet](#).

One of GÉANT's core roles is to support the development of member organisations and promote collaboration amongst the wider research and education networking community. The continuous efforts in this area are reflected in the organisation's 2014 outreach activities: internal and external communications, extensive collaboration with international partners, liaising with large users and e-infrastructure partners, knowledge-sharing and events.

Community Awards

Since 2012, GÉANT has honoured people who have significantly contributed to the research and education networking community's collaborations. At the annual networking conference, TNC2014, three Community Awards were presented.

- Jan Meijer ([UNINETT](#)) - for sharing the idea of a file transport service for research and education. [FileSender](#) is now deployed by around 40 NRENs, institutions and other organisations around the world.
- Stefan Winter ([RESTENA](#)) - for contributions to eduroam service and technological developments, such as the [F-Ticks](#) tool for statistics collection and the [Configuration Assistant Tool \(CAT\)](#).
- Karel Vietsch, former Secretary General of TERENA (now GÉANT Association, Amsterdam) was posthumously awarded for his long-term dedication to the community. He had demonstrated his commitment by setting up the '[Vietsch Foundation](#)' to help stimulate the research and education networking community in the future.

NREN and user support

GÉANT's Business Development team works with external stakeholders to ensure that they get the best from the GÉANT network and services. The team provides account management for the GÉANT



Project's 37 NREN partners, handling service requests and feedback, network upgrades, funding applications and partner communications. Business development is also the GÉANT contact for large international users, such as [CERN's Large Hadron Collider](#), the [European Space Agency](#) and [Very Long Baseline astronomy](#). The team provides a single point of contact, which coordinates between international science, the NREN community, GÉANT and other e-infrastructures to give first class customer service to academic users.

Building relationships

GÉANT works hard to establish and build valuable relationships with its partners, for instance [ESA](#) and [CERN](#) (Associates), and e-infrastructures, such as [EGI.eu](#), [PRACE](#) and [EUDAT](#). For example, in September, EGI.eu and GÉANT organised a [two-day symposium](#) on federated cloud services as part of the EGI.eu conference in Amsterdam and supported CERN's 60th anniversary celebrations with sonification music for their video, and with media coverage.

Throughout the year, GÉANT staff members presented the updates in many events in different capacities. For example, as programme committee members at the [Internet2 Global Summit 2014](#), the [NORDUnet annual conference](#) and the [CLOSER2014 conference](#). Many staff members presented updates and achievements of the GÉANT organisation, its projects and activities across a wide variety of events. These included [FIM4R meetings](#), [APAN](#), [Tical 2014](#), [Linuxcon Europe](#), [e-AGE 2014](#) and many more.

EUMEDCONNECT3 meeting at e-AGE 2014 in Muscat, Oman, December 2014.



Over the years, TNC has become the event to look forward to in the research and education networking community. Building strong, international relationships has always been a key objective of the conference, and in recent years, the event has attracted more and more people from around the globe.

TNC2014 was attended by more than 650 people from 54 countries. The event was hosted by Ireland's national research and education network, HEAnet, from 19-22 May in Dublin. The majority of visitors came from Europe, but participants from twenty-five non-EU countries were also welcomed, and eighteen percent of all speakers came from outside Europe. Conference session live streams were followed online by almost 3,000 people worldwide, vastly expanding the audience of TNC.

The broadened, more global scope of TNC was also reflected in the conference theme 'Networking with the World', referring to the global community collaborations that are taking place on a day-to-day basis. This was illustrated by panel sessions, such as 'Going global on the cloud', 'Global collaboration makes us stronger' and 'The future of the Global University - a global CIO perspective'.

*TNC is the best place to connect
and to meet the community.*

Hot topics

Every year, TNC is packed with sessions on a wide variety of topics relevant to research and education (networking) around the world. Keynote speakers: [Jelmer Evers](#) (UniC, NL), [Tracy Futhy](#) (Duke University, USA) and [Lord David Puttnam](#) (UK) called on participants to engage with the challenges related to technology in global education and learning. [Barend Mons](#) (Netherlands Bioinformatics Centre, NL) asked for data stewardship to be included in future research projects and [Stephen Farrell](#) (Trinity College Dublin, IE) issued a call to arms against pervasive monitoring, and [Martyn Dade-Robertson](#) (Newcastle University, UK) illustrated how much more we could do with data available on the Internet. He also presented networking data as a modern art form and collaborated with [Domenico Vicinanza](#) (GÉANT) bring together a piece of audio-visual art. Other topics included 'the global university', cloud services and federated identity for research and education.



Aside from the daily programme of sessions, side meetings and informal 'birds of a feather' discussions, participants had the opportunity to see demonstrations, to meet sponsoring companies and the presenters of scientific posters, and to enjoy memorable social events and entertainment.



TERENA and DANTE staff getting together at TNC2014.

Supporting young talent

At TNC2014, talented students gave lightning talks and engaged in a poster competition, which was won by [Jessica Steinberger](#), (University of Applied Sciences Darmstadt, Germany and Twente University, the Netherlands) for her poster "[Real-time DDoS Defense: A collaborative Approach at Internet Scale](#)". The jury selected it from a set of excellent candidates, based on technical evaluations and the attendee vote.

TNC sponsors

Sponsorship of TNC2014 was provided by: [Coriant](#), [ECI Telecom](#), [Cisco](#), [Internet Society](#), [Ciena Corporation](#), [Juniper Networks](#), [Agile Networks](#), [GreenQloud](#), [Comodo](#), [RIPE NCC](#), [Vidyo Inc.](#), [Kaltura](#), [Adva Optical Networking](#), [ELCIRA](#), [XKL](#), [Box](#), [HEAnet](#), the [European Commission](#), the [GÉANT Project](#), and [University College Dublin](#).



The TF-CPR group meets with the Global PR network during TNC 2014.



Task forces - community collaboration

Collaboration across teams, geographical locations and disciplines is crucial to GÉANT. Providing a mechanism to facilitate and support the development of new ideas, products and services, the GÉANT task forces are forums for exchanging and promoting ideas, experience, knowledge and best practices as well as fostering collaborations among NRENs and academic and research institutions. In 2014, task forces were operational in the following areas: [European Middleware Coordination and Collaboration](#), [Middleware and Network Mobility](#), [Communications and Public Relations](#), [Management of Service Portfolios](#), [Computer Security Incident Response Teams](#), [Network Operation Centres](#), [Storage and Web Real-Time Communications](#).

Communications (TF-CPR)

The [Task Force on Communications and Public Relations](#) (TF-CPR) shared marketing and communications best practices and ideas in three meetings and via email discussions held throughout the year. Marketing was also the focus of a joint meeting with TF-MSP (Task Force on Management of Service Portfolios) in February. A [joint meeting](#) with the Global PR Network explored lessons learned from recent [dengue fever workshops](#) as an example of community-building among users.

Updates about activities within NRENs are always popular: in 2014, these were delivered by ACOnet, Belnet, CKLN, DeIC, EENet, HEANet, RedCLARA, REUNA, SigmaNet, SWITCH and UbuntuNet Alliance. Other hot topics were social media, measuring success, internal communications, and the branding plans for the restructured GÉANT organisation.

Service portfolios (TF-MSP)

The [Task Force on Management of Service Portfolios](#) (TF-MSP) met quarterly, with the aim of uncovering new opportunities and developing new ways of working together, such as cooperating on digital research. TF-MSP focuses on end user needs, with cloud services of particular interest, as well as an area identified for joint activities. Research conducted by the task force showed that most NRENs are in a start-up phase in their cloud efforts, with just a small percentage dealing with clouds in a well-structured manner, with a clear and underlying strategy.

In February 2014, TF-MSP renewed its Terms of Reference.

EUMETSAT and GÉANT: ensuring the delivery of critical data

In 2014, GÉANT worked extensively with [EUMETSAT](#) (the European Organisation for the Exploitation of Meteorological Satellites). This global operational satellite agency is at the heart of Europe. Its purpose is to gather accurate and reliable satellite data on weather, climate and the environment 24 hours a day, 365 days a year. This data then needs to be delivered to the National Meteorological Services of EUMETSAT member and cooperating states in Europe, and to international partners and users worldwide.



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Weather forecasting has become ever more important, helping society to detect, prepare and deal with extreme weather. EUMETSAT data supports decision making at all levels of society, and is critical to governments, air travel safety, shipping and road traffic, as well as to areas, such as farming, construction and other industries.

Furthermore, satellite observations are highly relevant to climate monitoring and together with other organisations, such as [Copernicus](#) are helping to address this global challenge.

Due to the increasingly vital nature of this data transmission, EUMETSAT uses terrestrial Wide Area Network (WAN) links for data acquisition from EUMETSAT ground stations and for the exchange of data with worldwide distributed bilateral partners.

GÉANT and Europe's NRENs complement this connectivity, providing a flexible and scalable service that will facilitate a single point of contact interface for the network setup and monitoring, and will support connectivity, testing and validation activities across GÉANT and NREN networks. GÉANT worked hard with EUMETSAT towards the launch of the pilot production service early in 2015, starting with the initial capabilities in a core network, but offering a number of options to allow expansion of the current setup geographically, and providing additional monitoring capabilities.



Participants of the e-infrastructure workshop in Chisinau, Moldova, 11-13 September 2014.

Contributing to digital inclusion

GÉANT promotes and strengthens identity federations while contributing to digital inclusion, trying to bridge the Internet infrastructure and technology gap that still exists between many countries both inside and outside Europe.

GÉANT developed a series of [e-infrastructure workshops](#) intended specifically for Eastern European countries, to help their NRENs and members to raise their staff competencies.

A five-day workshop in Sofia in June consisted of a mixture of lectures and hands-on sessions conducted by leading specialists and experts from both within and outside the community and built around three core topics: security, services and federated identity. In September, a three-day workshop in Chisinau, Moldova focused on optical networking, network routing, monitoring and analysis, and federated identity training.

AAI across communities

In April, GÉANT organised an [AAI Workshop](#) (Authorisation and Authentication Infrastructures) in Brussels in collaboration with the [European Commission's Information Society and Media DG](#). Discussion focused on how e-infrastructures can meet the scientific community's increasing demand for federated access.

Representatives from AAI e-infrastructures and many user groups, including [ELIXIR](#), [ESA](#), [FIM4R](#), [DARIAH](#) and [CLARIN](#) shared their ideas and listened to presentations about [EGI.eu](#), [STORK](#), [eduGAIN](#) and [EUDAT](#). These highlighted increased interest from e-infrastructures in using federated access to support cross-sector collaboration. [OpenConext](#), the collaborative platform developed by [SURFnet](#) was also presented.

Campus Best Practice

[Campus Best Practice](#) shares the research and education networking community's best experiences in network infrastructure, network monitoring, wireless communications and security. As a knowledge base, it enables campuses to learn from their peers across Europe. An enhanced [Campus Best Practice website](#) has made it even easier to share information and skills.

Training

Throughout the year, GÉANT has managed the provision of successful courses in internally designed and delivered events, plus externally provided training.

These have included the internal [SecureCode Training](#) and [Summer School for Developers](#) in Poznań, [Moonshot Basics](#) in Utrecht, and [eduPERT](#) in Dublin. Each of these is continuing to be developed as part of an improvement in training delivery skills for project participants across the GÉANT Project with coaching and face-to-face training to support this.

Further continued employee development training has been completed in [ITIL Foundation](#), with 24 staff members attending courses held in Cambridge. [TM Forum](#) framework and [OpenDaylight](#) knowledge forums were attended through GÉANT assistance.

The [GÉANT Showcase](#) initiative proved to be a useful addition to the knowledge offerings from the GÉANT project, with webinars on products and services delivered on a regular basis by subject matter experts. Showcases covered topics such as Federation as a Service, GÉANT Testbed Service, Environmental Policies, and an Overview of the SecureCode Training course.



Attendees of the Summer School for Developers training event, Poznań, Poland, September 2014.

2014 Compendium shows positive trends

The 2014 Compendium of National Research and Education Networks in Europe was to be made [available online](#) early in 2015. It documents the work being done by NRENs, examines the contexts in which they operate and explains important trends in research and education networking.

Three interesting trends are described in the 2014 Compendium.

Trend 1: Increasing capacity

NRENs offer national backbones and international connectivity of exceptional quality. In most GÉANT partner countries, the typical core capacity in 2014 was 10 Gbps, though some NRENs had reached 100 Gbps. Some NRENs allowed several paths in their backbone, further increasing the capacity.

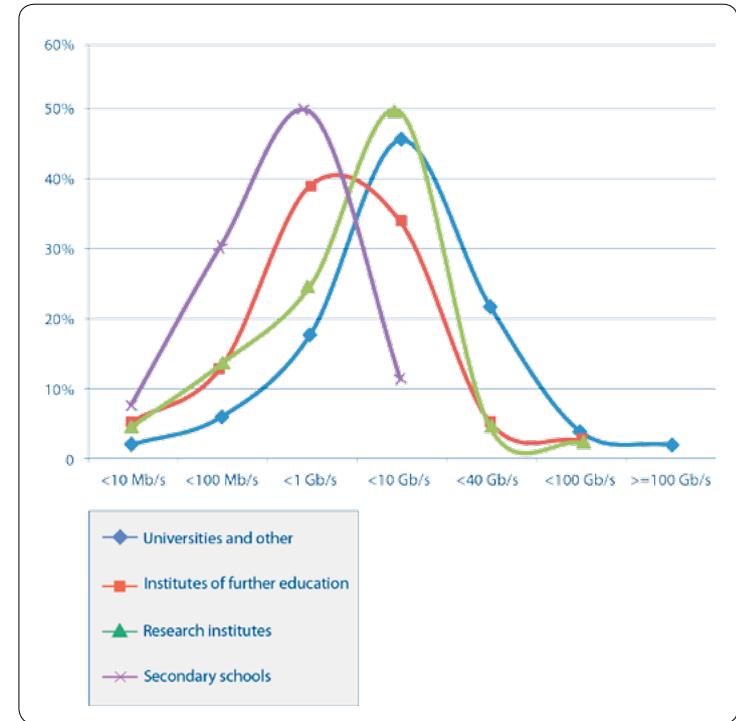
For the first time since the start of the Compendium, NRENs reported that users were experiencing no congestion at the backbone level.

For universities within the GÉANT region, the typical connection capacity in 2014 was above 1 Gbps, a tremendous increase compared with the situation a few years ago.

NRENs in the GÉANT region provided services to approximately 82 percent of all university-level students in the countries involved, or a total of 24 million students. Through the GÉANT network, more than 100 countries were now connected with high-speed links, dedicated to research and education.

Trend 2: Growing need for authentication, authorisation and security services

Authentication and Authorisation Infrastructures (AAIs) are key to giving users access to services, independent of the physical location of both the user and the service. In 2014, all but four European

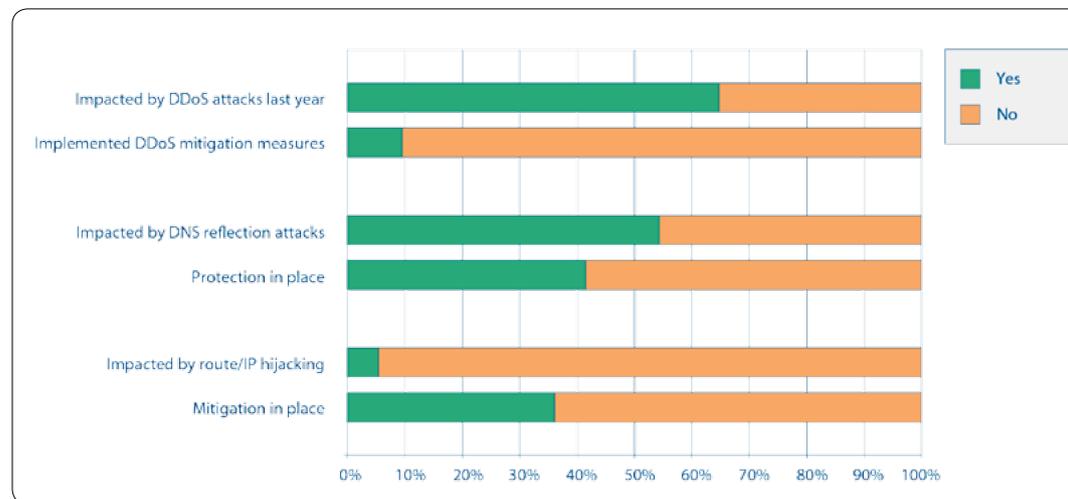


Graph showing typical bandwidth for GÉANT partner countries.

NRENs that responded offer or plan to offer an AAI service. This has enabled the introduction of new services and the development of collaborative platforms that were previously impossible.

NRENs are aware of possible security risks: over the past year some of them were negatively impacted by various types of attacks. More can still be done to put mitigation or protection measures in place.

Most of the GÉANT partner NRENs (and a few non-GÉANT NRENs) joined or were planning to join the eduGAIN interederation service – a development that holds the promise of worldwide service access across federations.



Graph showing security risks, GÉANT NRENs.

Trend 3: Cost reductions

Comparing 2014 budget data with previous years shows that, overall, NREN budgets decreased with respect to 2013. The trend, as in the past few years, was that NRENs were able to deliver more bandwidth and more services for roughly the same amount of money as in the previous year.

The 2014 Compendium survey identified a number of services being provided by NRENs in the general category of 'brokerage'. This seems to be an area in which NRENs can achieve considerable savings for their customers and where there is potential for expansion.

Network architecture, operations and services

The pan-European GÉANT network

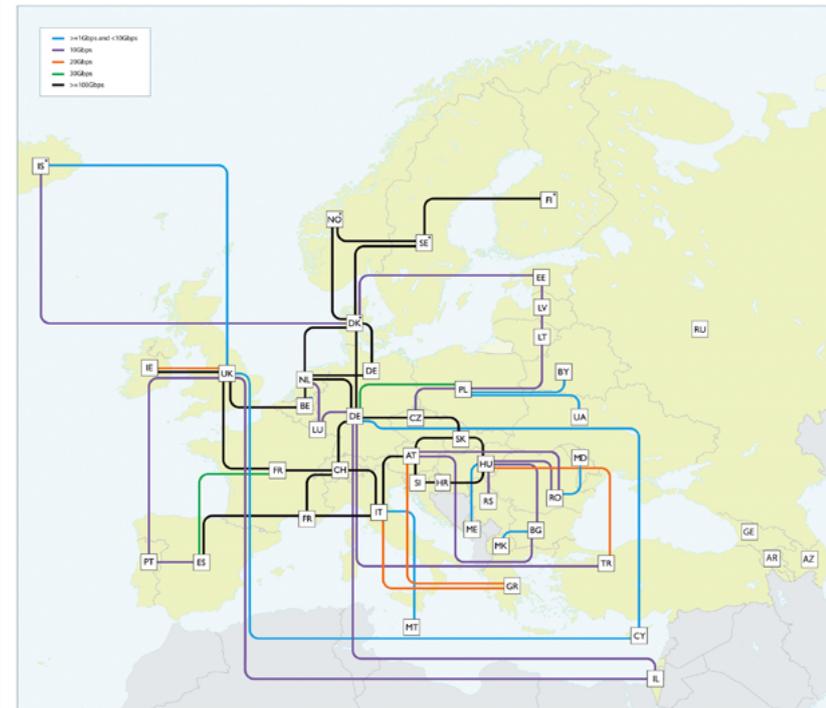
Considered the most advanced and well-connected research and education network in the world, the GÉANT backbone offers capacities of up to 2 Tbps and, together with Europe's NRENs, connects over 50 million users at 10,000 institutions across Europe, supporting research in areas, such as energy, the environment, space and medicine.

High performance network services

GÉANT's range of connectivity services, underpinned by the network, covers everything from robust, high-bandwidth IP, through Virtual Private Networks (L3VPN), point-to-point connectivity (Plus) to bespoke solutions for long term, highly data-intensive requirements (Lambda). As user needs change, the service portfolio has to scale and adapt, in order to ensure that GÉANT remains at the forefront of networking technology and service delivery.

2014 service portfolio highlights

- The [GÉANT Open Service](#) moved from pilot to production – enabling NRENs and approved commercial organisations to exchange connectivity.
- The GÉANT Multi-Domain Virtual Private Network ([MD-VPN](#)) successfully completed its pilot phase, and is ready for full production in 2015. The service offers enhanced end-to-end VPN
- The [Bandwidth on Demand Service](#), which dynamically establishes circuits in minutes for the duration needed, expanded to reach over 1000 global end-points, enabling international, on-demand service delivery. Over 500 circuits are now derived every month.



GÉANT connectivity at January 2014.

The flagship GÉANT network now reaches over 100 countries worldwide and continues to be the most advanced international network of its type, with the highest levels of availability, robust security, and a range of flexible networking services for NRENs to deliver to their constituents. During 2014, there have been many advances and improvements to these services.

- The [GÉANT Testbeds Service](#) (GTS), which is at the leading edge of advanced network services, successfully completed the first phase in its development. It offers network researchers a unique platform to undertake experimentation in Software Defined Networking (SDN) over a high performance, geographically distributed facility.
- GÉANT Plus point-to-point circuits for inter-NREN connections and major projects rose by 33%, to a total of 80 active services, and six GÉANT Lambda 100Gbps circuits were delivered, representing a 32% increase.

Availability of core services

A key measure of these GÉANT connectivity services is the baseline service availability. GÉANT delivers a carrier-grade service-level availability across the core product range.

Service	Target Availability	Delivered Availability
GÉANT IP	99.4% - 99.99%	100%
GÉANT Plus	99.4%- 99.99%	100%
GÉANT Lambda	99.5% -99.999%	100%
GÉANT L3 VPN	99.4%-99.99%	100%
GÉANT Open	99.4%	100%

Monitoring the network and improving user experience

Research and Education relies on a high performance network that can support the most demanding networking projects. GÉANT provides the community with services for monitoring network performance and improving the user experience.

[eduPERT](#) is a federated Performance Enhancement Response Team (PERT) that creates a centre of excellence to support the independent PERTs with services that will aid them in their network investigations. The monthly PERT calls and the eduPERT knowledge base offer NRENs and campuses an invaluable resource. Membership of eduPERT has continued to grow throughout 2014.

[perfSONAR](#) is the multi-domain monitoring service for the GÉANT service area. It enables NREN NOCs and PERTs to collaborate in providing seamless network performance for their users. 2014

saw the completion of a project to converge the two perfSONAR strands (PS and MDM) into a single perfSONAR system. This integrated system - the result of collaboration between GÉANT, Internet2, ESnet and Indiana University was released in October 2014 and is already installed in over 500 nodes worldwide. This success demonstrates the value of the collaborative efforts across the wider research and education networking community. The [perfSONAR website](#) has been rebranded to reflect the new, integrated service and allows the latest versions of the software to be downloaded.

Product Lifecycle Management and procurement

Over the past three years, GÉANT has developed its skills in Product Lifecycle Management to ensure all its services meet the needs of the users and are effectively managed, from inception through implementation and ultimately retirement. This, coupled with the procurement and contracting skills gained through the GÉANT Project, ensures the delivery of cost-effective services to the research and education networking community.

Operational improvements and efficiencies

In parallel with the expansion of the service offering and the delivery of outstanding availability, re-procurement contributed to a cut in network expenditure of €2.1 million. The GÉANT Service Desk was successfully migrated to a new provider, improving the level of experience and expertise available, whilst a new cloud-based ticketing system was also introduced.

At the heart of global research and education

The GÉANT network remains the best connected research and education network in the world, and is driven by extensive partnerships (see below), which continue to flourish.

In 2014, GÉANT continued to successfully manage regional network projects in other parts of the world: in the Mediterranean ([EUMEDCONNECT](#)); Sub-Saharan Africa ([AfricaConnect](#)); and Central Asia ([CAREN](#)). In addition, GÉANT coordinated the Europe-China collaboration ([ORIENTplus](#)) and continues to secure direct China-Europe connectivity via a long-term contract.

GÉANT also participated in the FP7-funded [ELCIRA](#) (Europe Latin America Collaborative e-Infrastructure for Research Activities), which was led by [RedCLARA](#) and ended in October 2014. Extensive involvement by GÉANT's international relations team helped ensure that ELCIRA



Valentino Cavalli, General Manager of the GÉANT Amsterdam office, and Dae Young Kim, Chairman of the APAN Board of Directors, sign an MoU between GÉANT and APAN on 22 January 2014.

successfully increased the coverage of eduroam in Latin America, established new Identity Federations in the region and made collaboration tools for end users available via a pilot portal. For more information, see page 34.

International collaboration

In 2014, GÉANT continued to cooperate closely with research and education networks across the world to ensure that the users' global connectivity and other service needs are being met. The focus of these global interactions covered North America, Latin America, the Caribbean, Sub-Saharan Africa, the Mediterranean, Central Asia and Asia-Pacific, and increased emphasis was placed on dialogue with partners in countries where European research and education interests are high: USA ([Internet2](#) and [ESnet](#)); Canada ([CANARIE](#)), Brazil ([RNP](#)), Chile ([REUNA](#)), South Africa ([TENET](#) and [SANReN](#)), India ([NKN](#)), China ([CERNET](#) and [CSTNET](#)) and Japan ([SINET](#) and [JGN-X](#)).

At the start of the year, GÉANT signed [Memoranda of Understanding](#) with [TEIN*CC](#) (Trans-Eurasia Information Network * Cooperation Center) and with [APAN](#) (Asia-Pacific Advanced Network), to promote cooperation and collaboration between the organisations on various levels.

International highlights

- GÉANT installed [ESnet's](#) (the US Department of Energy's Energy Sciences Network) first European network node at CERN in mid-September, as part of a new agreement to procure a high-speed network ring across Europe.
- GÉANT completed the [AfricaConnect](#) project and secured a second phase as a pan-African umbrella project, structured in three geographic clusters.
- GÉANT completed the [ORIENTplus](#) project and secured a long term connectivity, jointly funded by Europe and China.
- GÉANT assisted with [WACREN](#) and [ASREN](#) regarding connectivity requirements towards GÉANT.
- GÉANT acted as a consultant for two consecutive years in support of [TEIN*CC](#).
- GÉANT co-developed a workshop model for the medical community to battle dengue fever and other infectious diseases and helped roll it out to different world regions.
- GÉANT negotiated an extension of the [CAREN](#) and [EUMEDCONNECT3](#) projects with the EC and its partners.
- GÉANT participated in the successful project submission of MAGIC, TANDEM and the E@PConnect, due to start in 2015.



Participants in the Dengue fever workshop at APAN37 in Bandung, Indonesia, January 2014.

Supporting advanced network research

As a leader in networking technology, GÉANT's networks support the development of new technologies and uses - for industry players as well as within the research and education community.

- In September, an active segment of GÉANT's production network between Budapest, Hungary and Bratislava, Slovak Republic was successfully used by [Infibera](#) to [demonstrate](#) a single card terabit super-channel.
- For disruptive testing, the GÉANT Testbeds Service (GTS) provides network innovators with a high-performance, geographically-distributed 'laboratory on demand', where the network research community can develop and test new concepts. Testbeds are an important resource for the GÉANT Innovation Programme.

GÉANT Innovation Programme

The GÉANT Innovation Programme is an umbrella programme to provide a way for the wider community to pool resources and collaborate on the researching and developing of innovative technologies that address the future needs of the community and its users. The programme consists of the research and development work carried out within the GÉANT project by participants in the [Joint Research Activities](#) (JRAs), Task Forces and Special Interest Groups, which include experts from outside the project, and the [GÉANT Open Call projects](#).

Knowledge forums

GÉANT provides a forum for network architects to collaborate and share expertise, and supports the ongoing exchange of experience between the [GÉANT Operations Centre](#) (GOC) personnel. In addition to contributing to the technical work of the [Global Lambda Integrated Facility](#) (GLIF), GÉANT provides secretariat support to GLIF, and in 2014, secured a new two-year contract. The group convened twice in 2014. Thirty-three participants from North America, South America, Europe and the Asia-Pacific region attended the [GLIF Technical Working Group](#) in March, in conjunction with the [19th GENI Engineering Conference](#). The [14th Annual Global LambdaGrid Workshop](#) in September played host to the first 100Gbps Trans-Pacific connection.

Technological leadership

In order to support the advance of networking services, the GÉANT CTO participates to help drive the development of new standards and new technologies. Over 2014, the team:

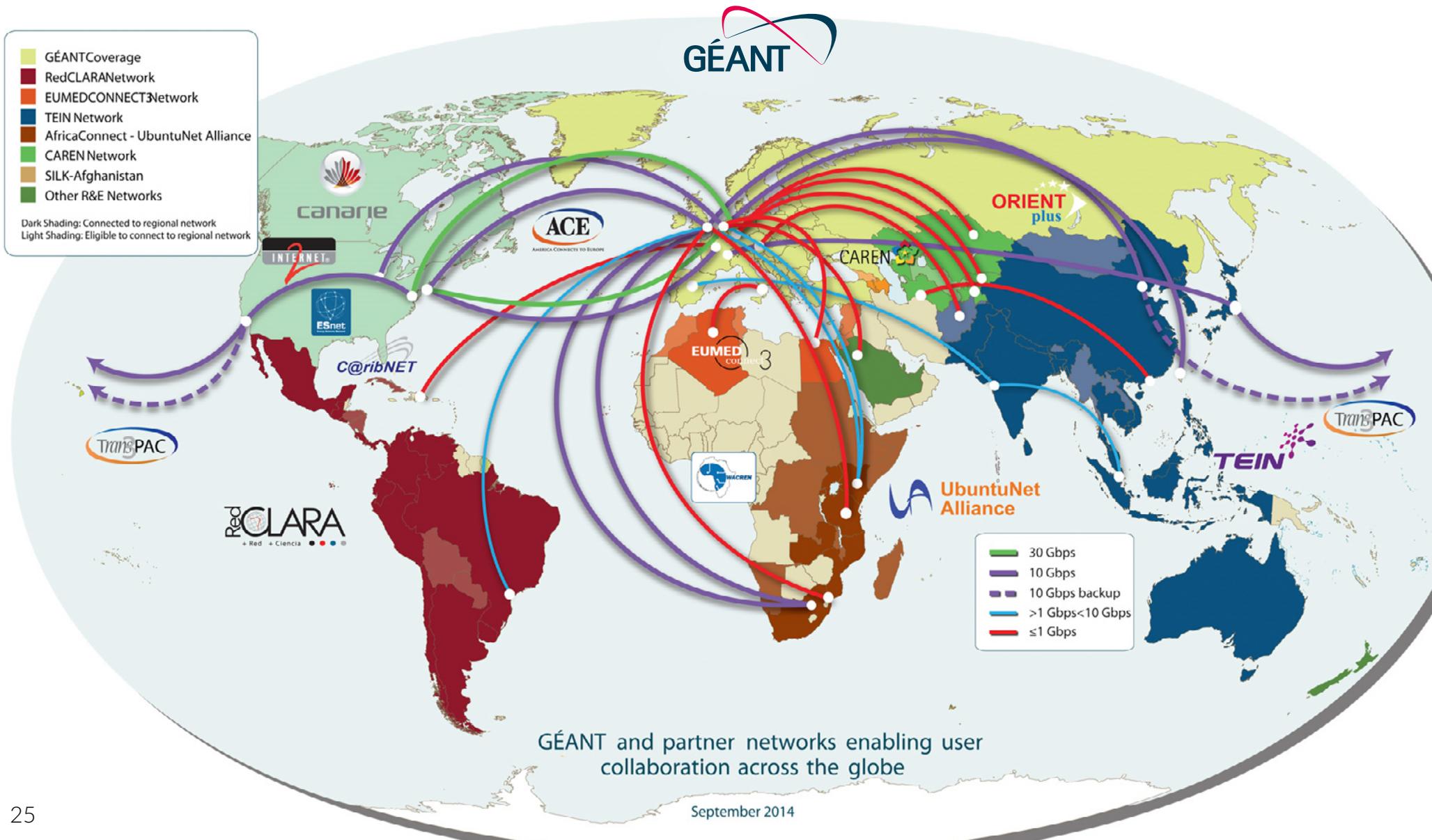
- chaired the [NSI working group](#) in the [Open Grid Forum](#) which has developed a suite of Internet standards defining a web service protocol known as the Network Service Interface. This protocol allows the dynamic circuit services of GÉANT's global research partners to interoperate to form a global dynamic circuit service;
- led the GÉANT Network Planning and Design team to conceive a technical vision for the evolution of the GÉANT network as well as plan the medium term network evolution;
- coordinated a successful field trial of an “alien wave” setup on the transmission network of SURFnet, in which a 500G “superchannel” sourced from GÉANT transmission equipment in Amsterdam and Hamburg is carried over an extant optical transmission line belonging to SURFnet and NORDUnet;
- continued to lead efforts for closer engagement with the European “Future Internet” community. This is in the context of the supply of connectivity services to various [FI projects](#) (as an example, the [FI-PPP XIFI project](#) – which supports the [FIWARE Lab](#) – was a key trial user of the new MDVPN service) and direct participation in projects (for example, GÉANT has been the partner in the [Fed4FIRE project](#) that provides the operational help desk / FLS function);
- participated in work to develop the networking centric aspects of SKA technical design and operation;
- led GÉANT's engagement in the technical aspects of the [Global Network Architecture Technical Group's](#) efforts to develop a global network architecture model that supports intercontinental research and education networking.

GÉANT network global map



■ GÉANT Coverage
■ RedCLARANetwork
■ EUMEDCONNECT3Network
■ TEIN Network
■ AfricaConnect - UbuntuNet Alliance
■ CAREN Network
■ SILK-Afghanistan
■ Other R&E Networks

Dark Shading: Connected to regional network
 Light Shading: Eligible to connect to regional network



GÉANT and partner networks enabling user collaboration across the globe

September 2014

GÉANT Open Call projects – an oversubscribed success

The €3.3 million of GÉANT project funding allocated for [Open Calls](#) brought in fresh ideas to the joint research activities and new use cases for the GÉANT testbed facilities.

Having been launched in April 2013 as part of the GÉANT Innovation Programme, the two-year Open Call initiative was highly oversubscribed with 70 project proposals across eighteen topic areas. Following a rigorous evaluation by an independent panel, twenty-one independent projects were funded and thirty new partners joined the consortium. More than twenty papers are expected to be published in peer-reviewed journals.

GÉANT funding supported these projects in their cutting edge research into advanced networking technologies, paving the way to the next generation of services, applications and uses for networking - thereby supporting [Horizon 2020](#) and the challenges of the data deluge.

The Open Call projects were tightly aligned to the GÉANT joint research activities, as an integral part of their research resources, and covered topics areas such as:

- Applications and Tools: advanced research activities and projects;
- Authentication: developing secure end-to-end authentication of systems and people;
- Network Architecture and Optical Projects – studying future networking systems;
- SDN – exploring the potential of Software Defined Networking to meet new networking demands;

A high proportion of project participants will continue to work with GÉANT and the results of the work will form an important part of the Joint Research work and Service Activity work into GN4 and beyond.

Overview of GÉANT Open Call projects in 2014.

Applications and Tools	Authentication	Software Defined Networking	Network Architecture & Optical Projects
ARES CEOVDS eMusic NSI CONTEST	CLASSe TrustBroker HEXAA MEAL SENSE WoT4LoA	AUTOFLOW CoCo DREAMER DyNPac MINERVA MOTE	COFFEE ICOF IRINA MOMoT REACTION



Knowledge sharing for better networking

For users, such as research organisations and universities, the 'GÉANT network' often means the pan-European core infrastructure and all the NRENs connected together. Sharing knowledge on network architectural designs, concepts, future developments and operational aspects is, therefore, more important than ever.

Three activities underpin the knowledge sharing process in this area: [Network Architects Workshops](#), the [Task Force on Network Operation Centres](#) (TF-NOC), and the Services and Technology Forum.

Network Architects Workshop

Hosted by NORDUnet, the 2014 [Network Architects Workshop](#) provided an opportunity to establish cross-silo discussions among the various technical tasks in the GÉANT Project ([GN3plus](#)) and other initiatives, such as [GLIF](#). Serving as a forum to bring industry partners, users and researcher communities closer to the NRENs, several developments were discussed by participants in the workshop, such as the growing demand for zero-touch networking among customers (mainly universities), 3G / 4G mobile and WiFi convergence and benefits of sharing the photonic spectrum and fibre networks.

Network Operation Centres (TF-NOC)

The [Task Force on Network Operation Centres](#) (TF-NOC) brings together NOC managers, engineers, developers, operators, controllers and project managers to share experiences and create common best practices. Discussions during the two [meetings](#) held in 2014 covered how to achieve efficient information exchange between NOC and CSIRT teams. NOC dashboards, NOC tiers and the boundaries between first, second and third level support were the other main topics for discussion. Preparations took place for a new [Special Interest Group for Chief Information Security Officers](#) and other related community members.

Other discussions focused on NOC Dashboards, NOC Tiers and the boundaries between first-, second- and third-level support.

The Network Architects Workshops serve as a platform for cross-silo discussions. Here participants of the November 2014 workshop are engaged in group discussions.

Services and Technology Forum

The Cambridge office coordinates a meeting for GÉANT network access port managers and organises the Service and Technology Forum (STF) in which these managers are provided with relevant GÉANT service and network information for dissemination within their respective NRENs. In 2014, three STFs were held, hosted by [NIIF](#), [SWITCH](#) and [SURFnet](#). Areas covered in the new GÉANT Operations Centre include the future of GÉANT services, GÉANT network upgrade plans, customer satisfaction surveys, and the introduction of new services (MD-VPN, EUMETSAT).



Security



NRENs need to strengthen their position as world leaders in privacy and security in order to stay ahead in an uncertain Internet environment. In 2014, GÉANT invested heavily in services and activities to support this position.

Network security

Highly available and secure international networks are now an essential component for research teams and projects, and maintaining their security and integrity is a core requirement. The provision of expert- and vendor-neutral security advice and services is a key differentiator between GÉANT and commercial service providers. This year's annual security audit on the GÉANT network resulted in a number of enhancements to network security.

Upgrade of the netflow infrastructure

Netflow forms the basis of anomaly-detection capabilities of security teams. The upgrade resulted in two load-balanced FlowMon devices being incorporated into the network, which now provides resilient netflow visibility for the network. The second major upgrade was a new anomaly-detection system for the [NSHaRP](#) process. FlowMon Anomaly Detection System (ADS) has been incorporated in the existing netflow system to make it more robust and enable it to support increased netflow traffic and new threats to the network. ADS was also incorporated into the new GÉANT ticketing system.

Patch compliancy and rogue device detection

The security team has embarked on a proactive approach to highlighting security issues within the GÉANT network and its management components. The security team have installed SPLUNK, a log aggregation tool, and have implemented regular scanning of the network. These determine if there are rogue devices on the network and ensure that any new devices have been checked for patch compliancy.

Firewall on Demand

The security team has built a new generation firewall-filtering mechanism into the network – "Firewall on Demand" – which has the ability to deploy standardised firewall filters across the entire GÉANT network within the space of a few seconds. This new tool will be made available to GÉANT NRENs as an enhancement to their security protection, monitoring and reporting package. Through NSHaRP, they will receive real-time and daily incident information, enabling them to deploy firewall filters directly on the network to protect against denial of service events.

New Security Officer

A new dedicated security officer has been employed to ensure that GÉANT's security policies are up-to-date and that the risk register is available to all relevant parties to gauge the level of security risks new threats pose.

Expansion of Trusted Introducer

The Trusted Introducer service offers an accreditation and certification scheme for CSIRTs in Europe, the Middle East and Mediterranean Africa. In August 2014, after an extensive re-procurement exercise, [PRESECURE](#) was re-appointed as the TI service provider for three years. Various improvements were made, including a review of accreditation processes, management of TI data and tools for participants.

In 2014, 31 new teams were listed, thirteen teams were accredited and four new certifications were made. TF-CSIRT continues to refine the TI charter and manage the service in a changing world. A complete review is planned for 2015.

Busy year for security task force (TF-CSIRT)

The [Task Force on Computer Security Incident Response Teams](#) (TF-CSIRT) provides a forum where the CSIRT community can exchange knowledge. It maintains a system for registering and accrediting CSIRTs, as well as certifying service standards. It also develops services for CSIRTs, promotes the use of common standards and coordinates joint initiatives. Additionally, the task force oversees [TRANSITS](#) security training, and the [Trusted Introducer](#) (TI) service.

Interest from the security community continued to grow throughout the year. A [TF-CSIRT/FIRST meeting](#) in February in Zurich saw 170 attendees - the highest-ever turn out.

TRANSITS

To stay on top of the game in the fast-paced security area, GÉANT delivered a new [TRANSITS I](#) Technical Introduction module in 2014. Co-authored by [SWITCH](#) and [Secuenzo](#), it includes more support material for tutors, ensuring events maintain a high level of quality. The MoU with [FIRST](#) led to a growth in externally organised courses - a record number of thirteen worldwide.



Group shot of participants in the TRANSITS I course, 12-13 November 2014.

What to get from TRANSITS I

TRANSITS I courses are intended for people from Computer Security Incident Response Teams (CSIRTs) who wish to gain a thorough grounding in the main aspects of working in an incident handling and response team. They cover basic incident handling and response techniques and operational practices, as well as organisational and legal issues. Trainees also get a unique opportunity to mix with their peers and discuss security issues in a secure and trusted environment, while being tutored by leading members of the CSIRT community.

The year of severe security breaches

When the [Heartbleed security bug](#) was discovered in April 2014, the need for collaboration between security experts became stronger than ever. At that time, some seventeen percent (around half a million) of the Internet's secure web servers, which were certified by [trusted authorities](#) were vulnerable to theft of [private keys](#), session cookies and passwords. This severe security breach underlined the importance of up-to-date security certificates.

TCS evolves

GÉANT has been providing discounted security certificates to its members since 2005 under [TCS](#) (Trusted Certificate Service). This service provides server certificates, personal certificates, e-science certificates and code signing certificates. In 2014, twenty-seven European NRENs took advantage of the TCS. In the middle of the Heartbleed turmoil, a re-procurement of the service led to the two-year appointment of [DigiCert](#) as the new [Certificate Authority](#).

SHA-1 to SHA-2 migration support

TCS played a key role in 2014, providing its members with the latest security updates.

In September, when Google and Microsoft announced deprecation of the [SHA-1](#) security algorithm

in favour of the stronger, more secure [SHA-2](#), GÉANT and certificate provider [Comodo](#) took steps to support the community in migrating to SHA-2.

Digital certificates

To maximise safety measures internally, GÉANT continued to use the eduPKI service. This supports other GÉANT services in defining their security requirements and providing digital certificates, which are verified using a [chain of trust](#). The [trust anchor](#) for these digital certificates is the Root Certificate Authority (CA). Other services in this area are [eduPKI PMA](#) (the Policy Management Authority) and [eduPKI CA](#), a dedicated Certification Authority supporting GÉANT services users who cannot obtain service-specific certificates from national CAs - and the service is also used for test purposes.

GÉANT supported its community's security needs further by maintaining its trusted repository for verified root-CA certificates, [TACAR](#).

NREN Security Strategy Workshop

GÉANT organised an [NREN Security Strategy Workshop](#) in September, together with the Dutch NREN, SURFnet. More than thirty participants attended from sixteen organisations across fifteen countries. The aim was to reach a shared view on international NREN collaboration on security, privacy and trust, and to agree on follow-up actions, including the creation of a [Special Interest Group on Information Security Management](#) (SIG-ISM).

Group discussions took place on topics, such as security, privacy and trust strategy, knowledge sharing, and the work of Chief Information Security Officers. The overwhelming take-home message from the event was a harmonisation of strategies is needed, that checklists could serve as the simplest security framework, and that 'sharing with care' remains an important maxim.

Trust, identity and mobility

Growth of identity federation activities

REFEDS (Research and Education Federations) is of vital importance for expanding the deployment of middleware and federated identity technology and standards globally. With secretariat support and coordination by GÉANT staff, REFEDS focuses on highlighting existing standards, engaging with user groups and improving policies and processes to mature identity federations.

In 2014, REFEDS grew more than ever before, with more people on the FOG (closed [Federation Operator Group](#)) mailing list and with more federations listed. The REFEDS coordinators maintained relations with [Kantara](#), [Internet2](#), [Aperio](#) and [NSTIC](#), and [TIER](#) work was tracked throughout the year.

In April, REFEDS announced that its first Entity Category had been formally approved by the REFEDS [Steering Committee](#) and was available for use by research and education identity federations. The [Research and Scholarship Entity Category](#) helps identity providers to securely release a set of attributes, including personal data, to a service provider that has proved it needs the information in order to provide an effective service to users.

To strengthen its position for 2015, REFEDS prepared a revised sponsorship process introducing formal levels of sponsorship with clearer benefits. In addition, GÉANT signed one year contracts to support REFEDS work.

Research on identity and trust technologies

GÉANT led the research activity in the GÉANT Project on identity and trust technologies. This research investigated new identity and trust protocols to facilitate research collaboration and support for virtual organisations when sharing resources. It also improves security and validates existing implementations of technologies used by the identity providers against current standards.



REFEDS presentation about federated identity technology during the GÉANT e-infrastructure Summer Workshops, June 2014, Sofia, Bulgaria.

Being able to work together across institutional and geographical borders is a fundamental need in the research and education community. Providing support for such collaboration is an important objective for GÉANT, which continues to be a significant innovator in this area. In 2014, work was done to ensure that federated access will be more widely used on a global scale.

In 2014 the team achieved important results in several areas.

- Federated authorisation – manages users' authorisation (based on the groups to which the users belong) in a cross-organisational context. [GARR](#) (task leader) tested three different applications: [MediaWiki](#), [Moodle](#) and [GARRBox](#) (a sort of Dropbox for GARR users).
- [InAcademia](#) - a task led by [SURFnet](#) and [SUNET](#), delivers a light-weight service to validate whether a user is a student. The information returned (a binary value) is then used by a resource provider for authorisation purposes.
- [FedLab](#) – [SUNET](#) led the task to update this suite of tools for federation operators, including tools to monitor identity providers, to assess the correctness of metadata and to support the [SAML2int](#) profile.

An overview of all achievements can be viewed on the [REFEDS blog](#).

Revitalised Schema for Academia

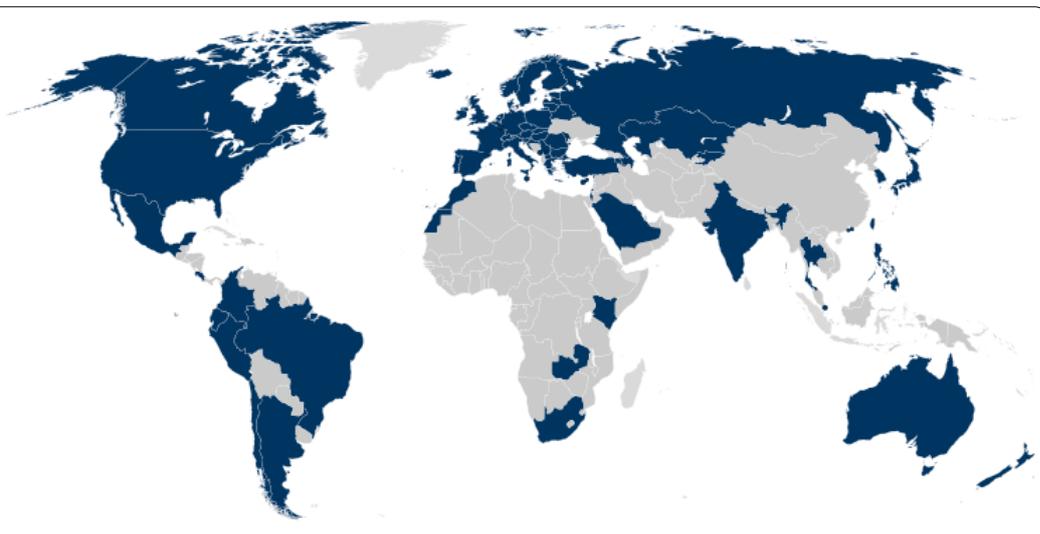
GÉANT revitalised the [Schema for Academia](#) (SCHAC) during the summer of 2014, responding to community demand for a well-structured and maintained attribute schema. SCHAC is a collection of common schemas that facilitate inter-institutional data exchange.

Updating SCHAC was a critical step to ensure efficient federation and inter-federation interoperability.

In 2014, all SCHAC-related online documentation and tools were harmonised into one single specification, and an editorial board was appointed. The outcome, delivered in December, was a coherent SCHAC schema, available via the [REFEDS wiki](#), and the decision that, as of 2015, SCHAC will be managed via REFEDS to ensure more global coordination with other relevant schemas and global activities.

ELCIRA: collaboration in Latin America

On the global platform, GÉANT also participated in the successful Europe Latin America Collaborative e-infrastructure for Research Activities (ELCIRA) project (1 June 2012 - 31 October 2014), led by RedCLARA. ELCIRA increased the coverage of eduoam in Latin America, established new Identity Federations in the region and made collaboration tools for end users available via a pilot portal.



■ Territories that are participating in the eduroam service in 2014.

ELCIRA coordinated a series of collaboration tools and services developed in Europe and Latin America. The goal was to create an interoperability framework that facilitates the work of European-Latin American research teams and to foster collaboration in joint research projects. ELCIRA delivered a shared collaboration platform, an [interactive map](#) of research groups from Europe and Latin America and a database of projects and institutions.

The [eduroam](#) service played an important role in connecting research and education institutions across the continent. In September, Porto Alegre became the first city in Latin America to offer eduroam access in public places.

eduroam - the global standard for roaming

Launched in 2003 as a product of the [Task Force on Mobility](#) (now TF-MNM, task force on Mobility and Network Middleware), eduroam has grown to become the global standard for roaming access across research and education networks. The task force continues to work on eduroam technical developments, which also take place through the GN3plus project. In 2014, the project also provided an Operational Team, which coordinates the European confederation, and project partners participated in the European eduroam service Steering Group. The European confederation is represented alongside other world regions in the [Global eduroam Governance Committee](#) (GeGC), which receives secretariat support from GÉANT staff.

eduroam is available in all GÉANT member countries and a growing number of territories worldwide. In 2014, Zambia, Saudi Arabia and The Philippines joined.

Global governance

The GeGC met at [TNC2014](#) in May to acknowledge the 69th roaming operator and the establishment of an eduroam confederation in Latin America. Work began over the summer to define confederation operations, and to determine how the addition of a roaming operator will ensure infrastructure interoperability. Follow-up meetings were held in October and November.

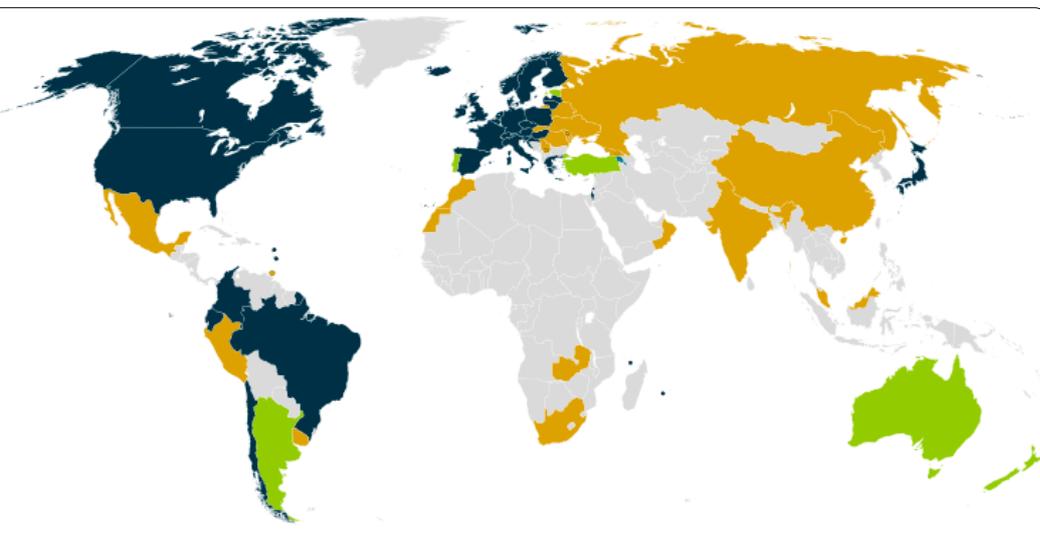
eduroam governance

The GeGC was constituted in November 2010, and in 2014 comprised eleven roaming operators in Africa, Asia-Pacific, Latin America, North America and Europe. Secretariat support is provided by Brook Schofield (GÉANT), who finalised the summary charter for global eduroam governance after extensive consultation with eduroam leaders.

Mobility task force (TF-MNM)

Mobile technologies and the use of network middleware to support interoperable roaming services are becoming key activities among NRENs and academic research institutions. GÉANT plays a significant role in this area through its [Task Force on Mobility and Network Middleware](#) (TF-MNM).

In 2013, TF-MNM had agreed a change in focus, as eduroam had become a stable, globally successful service, and more opportunities for commercial collaboration had arisen. The task force rechartering brought its work closer to that of the [eduroam GeGC](#) and the core GÉANT Project work throughout 2014, and this convergence will continue in 2015.



Overview of eduGAIN participation in 2014.

- Members that are participating in the service
- Members of eduGAIN that are working at being participants
- A federation exists

In 2014, developing WiFi-as-a-service and finding ways to create more partnerships with commercial ventures (to be able to expand more quickly) became priorities. Security incidents were also a new focus for the task force, which led a global community effort to understand the impact of the Heartbleed bug, and to secure the eduroam RADIUS infrastructure from such attacks.

eduGAIN - interconnecting identity federations

eduGAIN is another highly successful service developed within the [GÉANT Project](#). Interconnecting identity federations around the world, eduGAIN simplifies access to

content, services and resources for the global research and education community.

It enables the trustworthy exchange of information related to identity, authentication and authorisation (AAI) by coordinating elements of the federations' technical infrastructure and providing a policy framework that controls this information exchange.

eduGAIN held a steering group meeting at the end of July with a focus on the metadata improvement programme and the transition from SHA-1 to SHA-2, which has a more visible impact on the client

facing certificate space - but is also relevant in securing the signing of SAML metadata and SAML messages between endpoints. A vote by the steering group, concluded at the end of September, admitted three new federations from Latin America. Work over the summer focused on encouraging existing eduGAIN members (identity providers and service providers) to actively contribute metadata to the service.

Enabling users - bringing the benefits of eduGAIN to the community

An increasing number of federations are becoming members of eduGAIN and its overall coverage is growing. In 2014, the GÉANT 'Enabling Users' team worked with various research communities, including including [ESA](#), [CERN](#), [DARIAH-EU](#), [Elixir](#) and [Umbrella](#), to help them get the most out of eduGAIN.

The main objectives were:

- to act as an expert partner for research communities wishing to use eduGAIN;
- to build a knowledge database focused particularly on supporting the needs of user communities;
- to promote the increased use of federated login via eduGAIN.

Closure for middleware task force (TF-EMC2)

The [task force on European Middleware Coordination and Collaboration](#) (TF-EMC2) came to a close in September 2014. It had been set up in 2004 to promote the development of open and interoperable middleware infrastructures among national and regional research and education networking organisations, and academic and research institutions. Over its ten years, TF-EMC2 had spawned [SCHAC](#), [REFEDS](#), [TACAR](#) and more. Secretariat support for this task force was provided by GÉANT staff, with funding in 2014 coming from the GN3plus project.

Real-time communications, media, e-learning & culture

In recent years, GÉANT has witnessed an increasing interest in the research and education networking community in serving users in the areas of arts, humanities, cultural heritage, real-time communications and e-learning. Several activities address these areas and provide relevant services, training and support.

A whole new world to discover: WebRTC

Video conferencing is a key collaboration technology that enables distributed research teams to work together more effectively. By reducing the need for face-to-face meetings and travel, video conferencing plays a key role in the greening of ICT. However, communicating across the Internet, for instance, through proprietary videoconferencing systems, can often have technical issues.

Web real-time communications (WebRTC) keeps it simple, and strives to offer high quality audio and video communication capabilities to anyone with a web browser. GÉANT wants to be at the forefront of developments in this area, so in October 2014 a new task force, [TF-WebRTC](#), was established. The task force will organise the community and will be the public face for discussing the directions for the development of integrated web-based, real-time communication services and applications.

The [first TF-WebRTC meeting](#) was held in Paris in December, hosted by [RENATER](#), with Mihály Mészáros from [NIIF/HUNGARNET](#) as chair. Thirty-five participants representing thirteen NRENs and twelve other organisations discussed the latest developments and agreed the scope for the new task force. It was agreed that this GN4 activity will result in a WebRTC demonstrator and a clear roadmap.

eduCONF

The uptake of video conferencing in general is hampered by the lack of visibility of VC facilities available to potential users, and also by the choice of different service options. To address this, the GÉANT [eduCONF](#) team developed an easy-to-use service directory in 2014 that allows users to register and search for compatible video conferencing facilities across Europe. This directory is to help increase service uptake and improve the return on investment for video conferencing equipment and rooms.

eduCONF training in Porto, 12-13 March 2014.



NRENUM.net

To further contribute to easier global communication between researchers, GÉANT runs the [NRENum.net](#) service, the worldwide telephone number mapping system (ENUM) for academia. In 2014, the NRENum.net website was upgraded to make it easier to find information for the growing number of (prospective) users. In addition, a new [federated Wiki page](#) was launched, which contains past meeting minutes and other support documents (restricted to members only).

The NRENum.net service has been growing, and in 2014, four countries joined - [MyREN](#) (Malaysia), [RAAP](#) (Peru), [SingaREN](#) (Singapore) and [RENATA](#) (Columbia), bringing the total to thirty territories participating by the end of the year, and covering large parts of North and Latin America, Europe, and Asia Pacific.

Roadmap to preserving digital cultural heritage

In other cultural areas GÉANT has been actively contributing to the community. In the [Digital Cultural Heritage-Roadmap for Preservation](#) (DCH-RP) project, GÉANT staff contributed a set of recommendations on the adoption of federated access as part of the 'Roadmap for Preservation' that the project delivered. The roadmap could become instrumental when approaching policy makers and national authorities in the creation of an e-infrastructure able to meet the requirements of the cultural heritage community.

Live performing artists, some of which remotely, during the Miami NPAP workshop in April 2014.

Workshop merges arts and technology

GÉANT seeks to reach out beyond its core community to stretch the limits of technology. The Network Performing Arts Production (NPAP) workshop series is a joint effort between GÉANT, [Internet2](#), [GARR](#), hosting NRENs and performing arts schools and professionals. Here, arts and technology meet, merge and push the boundaries of what is technically possible.

The 2014 NPAP workshop was held in [Miami](#), USA from 26 to 28 April. The workshop focused heavily on the implementation of networking technology in live performances. Prominent institutions, such as the [New World Symphony](#) and



the [Royal Danish Academy of Music](#), together with experts from many universities and technology development labs showed how technology is changing the experience for the performers as well as for the audience. Live performances were mixed with technical discussion sessions and hands-on workshops.

Open Education Resource gets the green light

In December 2013, the Task Force on Applied Media in Teaching and Learning, TF-Media, had come to an end, leaving a legacy of activities that continued to develop. Its main offspring, the [Open Education Resource hub and portal](#) (OER), underwent some development in 2014. The idea behind OER is that the GÉANT community provides a central hub for metadata aggregation, collecting information about online learning content made available by NRENs, the broader community and institutional repositories, so this content can be shared, re-used and commented upon.

With community involvement, a service development [pilot](#) project was started in 2014, based on prototypes that had been made available the previous year. By December, preliminary [results and deliverables](#) were published, and GÉANT sent a [positioning paper](#) to the European Commission, showing the important role of GÉANT NRENs in the open education space. Further development will occur in the GN4 project, which will handle real-time communications and media management services from 1 May 2015.

Storage and clouds

GÉANT is working to help deliver leading cloud services across Europe, by identifying strategic cloud suppliers and building a framework to support effective commercial brokerage of cloud services throughout the community. This activity enables the sharing of best practices across Europe and ensures NRENs and campuses are able to take best advantage of available cloud services.

GÉANT is leveraging the capabilities of both the GÉANT network and [eduGAIN](#) to provide high performance, secure access to cloud facilities for the benefit of the research and education networking community. To support the delivery of in-house and NREN collaborative cloud services, GÉANT is pursuing parallel activities.

Task forces co-locate

The task forces [TF-Storage](#) and [TF-EMC2](#) co-located their meetings in February and organised a joint session to exchange information about AAI state-of-the-art storage solutions and cloud use-cases. A new task panel was created to find and deploy cost effective storage infrastructures among NRENs.

During the September meeting, which was organised in conjunction with the [NORDUnet Conference](#), hosted by [SUNET](#), the aforementioned task panel concluded that a TCO (Total Cost of Ownership) calculator tool was needed. This tool should take into account all the important cost components and the recent experiences of NRENs with various vendor products. Development started on the TCO tool, with the introduction of the first official version scheduled during TNC15.

OpenCloudMesh initiative

[ownCloud Inc.](#), an industry partner and associate member of GÉANT as well as a regular participant in TF-Storage, proposed an open initiative to interconnect the already existing ownCloud software-



TF-Storage meeting in Zurich, Switzerland, February 2014.

As cloud services are increasingly used by the wider research and education networking community, the provisioning and support of cloud facilities will become a key differentiator for the NRENs and GÉANT in an increasingly competitive industry.

based sync-and-share service domains of the community. The idea was that [OpenCloudMesh](#) would eventually deliver universal file access through a globally interconnected mesh of research clouds without sacrificing any advantages in privacy, control and security that are provided by an on-premises cloud.

At the end of 2014, several members and associates of GÉANT expressed interest in joining the initiative, to help define and develop a standardised interface (open API). The OpenCloudMesh project kick-off was anticipated to happen in early 2015.

Joint cloud procurement

The GÉANT procurement team worked alongside a number of key task forces, particularly [TF-MSP](#), [TF-NOC](#) and [TF-Storage](#), to support the procurement of software and services for community-developed services as well as external cloud service providers, taking advantage of the combined purchasing power of the community.

The GÉANT Project prepared to launch its Clouds Catalogue, which will offer NRENs and institutions clarity about providers' capabilities to the research and education community and help with the procurement of cloud services. During 2014, twelve services from eight providers were identified and assessed, in readiness for inclusion in the catalogue as recommended suppliers. The activity was supported by staff from the entire GÉANT organisation including Product Management, Business Development, Procurement and Marketing Communications.

