GÉANT
Networks • Services • People

CONNECT

THE MAGAZINE FROM THE GÉANT COMMUNITY | ISSUE 19 2015

COMMUNITY COLLABORATION

A NEW MEANING FOR GÉANT

GÉANT AND TNE: HOW CAN GÉANT SUPPORT TRANS-NATIONAL EDUCATION?

FOCUS ON SECURITY: MEETING THE TEAM BEHIND GÉANT SECURITY

AFRICACONNECT2: EXPANDING CONNECTIVITY ACROSS AFRICA

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CONNECT is the quarterly magazine from the GÉANT community; highlighting the activities of Europe's leading collaboration on e-infrastructure and services for research and education. We give insights into the users who depend on the network, and the community that makes GÉANT what it is. We welcome feedback at **connect@geant.net**

CONNECT magazine has been shortlisted for the 2014 CorpComms award for best not-for-profit publication.

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Hyperlinks: CONNECT is produced as a digital magazine also made available in print. To view the digital edition and benefit from hyperlinks to further information, please see: **http://connect.geant.org**

WELCOME TO THIS LANDMARK ISSUE OF CONNECT

You will have noticed the new GÉANT logo on the cover of this issue. It was launched on 1 May 2015, marking the start of the **new unified GÉANT brand** (see page 2) and coinciding with the start of the new GÉANT Project (now GN4 Phase 1 – see page 5). Since that time the organisation that was formed last October from the restructuring of TERENA and DANTE is no longer known as GÉANT Association, but simply as GÉANT. And from now on, GÉANT no longer means a single project or organisation but stands for the entire community collaboration.

What better place to launch this new branding than at the largest and most prestigious European research networking conference, TNC15 (page 10). The GÉANT booth will feature both the organisation and the project activities, so if you are attending please drop by to catch up with event staff and to learn more about the new organisation and the unified branding.

Elsewhere in this issue we focus as always on several key areas of GÉANT: services relied on today (pages 20-29); network architecture and services for the future (pages 30-39); network security (page 18); and user communities, community news and networking stories from around the world. For instance, on page 9 you can read how GÉANT can support Trans-National Education; on page 53 how high-speed connectivity is set to expand across Africa with the new AfricaConnect2 project; and on page 50 about an exciting astronomy project in Latin America.

This diverse and dynamic community will ensure the new era for GÉANT is an exciting one, and we look forward to the journey together.

Editors
Paul Maurice & Tamsin Henderson

GÉANT MEANS COMMUNITY COLLABORATION

NEW BRANDING BRINGS PROJECT AND ASSOCIATION TOGETHER AS "GÉANT"

In October 2014, the European R&E networking community agreed to re-organise the two entities that represented and supported its collective work to provide network infrastructure and services for R&E. TERENA and DANTE joined forces under a unified governance structure to become known as the GÉANT Association. As a further step in this process, and with the GÉANT Project (now GN4 Phase 1 (GN4-1), which started 1 May 2015) continuing to form a large part of the organisation's work, the GÉANT Association is now known as simply 'GÉANT', with a new brand identity and a new meaning of community collaboration.

"This change is intended to simplify understanding of the organisation, its core activities and the community collaboration that drives it all, under a single name and a new logo," explains Interim CEO Bob Day. "GÉANT brings the activities, services, benefits and values of TERENA, DANTE and the GÉANT Project under one banner. This means our community is better positioned to achieve its collective strategic priorities in innovation, service provision, and stronger European and global relationships."

The new GÉANT website that was launched in October is evolving into its new look and feel, with the content encompassing information about the GÉANT Project as well as the other activities and services that the organisation offers. Other changes to GÉANT's online presences, email addresses, news and social media channels, as well as CONNECT magazine, are being made in a phased process that will take several months to fully complete.

GÉANT OFFERS 'NETWORKS · SERVICES · PEOPLE'

GÉANT is the leading collaboration on network and related infrastructure and services for the benefit of research and education, contributing to Europe's economic growth and competitiveness.

GÉANT:

- provides practical support for members, educators, researchers and other partners to collaborate, innovate, share knowledge and agree on policies and strategies;
- plans, procures, builds and operates large-scale, advanced international high-speed networks, including the 500 Gbps pan-European GÉANT network;
- organises events such as workshops, meetings, training and conferences, including TNC – Europe's largest networking conference for research and education;
- develops, operates and supports services relating to such areas as trust and identity, security and certification, mobility and access, and media and real-time communications;
- mobilises community expertise and provides staff expertise in procurement, project management, community engagement, network operations, and outreach including dissemination and training;
- liaises with other e-infrastructure organisations, user communities, industry and with the European Union.

MEMBERSHIP AND PARTICIPATION

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. Associates are also welcome and include commercial organisations and multi-national research infrastructures and projects.

In addition to working together through the GÉANT organisation on the GÉANT Project, the membership takes part in other activities offered by GÉANT. Many of these are also open to interested parties from the wider community: task forces and special interest groups provide opportunities for ideas to bubble up and inform GÉANT's more formal innovation programme; many events are open to non-members; and some small projects and other initiatives are relevant to industry, institutions and campus staff.

ONE NAME, TWO OFFICES

GÉANT has offices in Amsterdam, NL, and Cambridge, UK. Though these continue to be two legal entities with their own staff and financial arrangements, they are each trading as 'GÉANT' under the new unified brand.

This restructuring marks a new phase in almost thirty years of collaborative research and education networking in Europe.

HORIZON 2020

The decision to restructure came from the community of European NRENs. In October 2012, the community agreed it needed a strategy in order to achieve its part in the European Commission's vision for the future of research and innovation, 'Horizon 2020'. This agreement followed the presentation of a report by the Reykjavik Group, to prepare a response to recommendations published in the report 'Knowledge without Borders' produced in 2011, by the GÉANT Expert Group, set up by the European Commission.

Within the European Union's Horizon 2020 research and innovation programme, GÉANT is coordinating the GÉANT Project and AARC (Authentication and Authorisation for Research and Collaboration), and participating in MAGIC (Middleware for Collaborative Applications and Global Virtual Communities) and TANDEM (Trans-African Network Development).

FURTHER INFORMATION

http://ec.europa.eu/programmes/horizon2020/

www.geant.org

The managers and staff aim to keep all services, websites and mailing lists running smoothly while further web and branding changes are implemented, but ask for patience and help with reporting any issues that may occur. In case of any queries, please contact **info@geant.org.**

AARC PROJECT STARTS

TOWARDS AN INTEGRATED AAI FOR RESEARCH AND EDUCATION

The Authentication and Authorisation for Research and Collaboration project, AARC, started on 1 May. Led by the GÉANT Amsterdam office, the project got off to a flying start by gathering requirements from e-science and libraries communities at the EGI and GARR IDEM conferences, and holding a project kick-off meeting in early June for the 20 partners and other members of the wider community.

"I am very excited to lead AARC and work with NRENs, e-infrastructure providers and libraries," says Licia Florio. "With so many parties represented, this will enable us to progress on some very critical technical and policy areas and move towards a vision in which researchers use one set of existing credentials to access a wide range of services, regardless of which e-infrastructures and service providers are offering them."

AARC works closely with the GÉANT project, with the REFEDS (Research and Education Federations) and FIM4R (Federated Identity Management for Research communities) groups, with e-infrastructures such as EGI, PRACE, and EUDAT, and with user communities.

WHAT WILL AARC DO?

It is commonly recognised that national identity federations and the eduGAIN inter-federation service offer a secure and scalable infrastructure to enable shared access to online resources. However, there are still challenges that prevent their wider adoption by all e-infrastructures and collaborative projects.

AARC will help to avoid a future in which different e-infrastructures and research collaborations develop and operate independent AAIs. It builds on the results of previous projects to address the challenges of interoperability and the functional gaps among deployed AAIs by focusing its work on four main areas:

- developing an integrated, cross-discipline AAI framework, built on existing federated access services;
- developing an extensive training and outreach package;
- harmonising policies among e-infrastructures to make it easy for resource and service providers to offer their services on a cross-border and cross-organisational basis;
- piloting policy frameworks and components of the proposed integrated AAI in existing services.

FURTHER INFORMATION

AARC is a two-year project funded by the European Union's Horizon 2020 research and innovation programme. The partners are CERN, CESNET, CSC, DAASI, DFN, EGI, GARR, GÉANT, GRNET, JISC, Jülich, KIT, LIBER, MZK, FOM-Nikhef, PSNC, RENATER, STFC, SURFnet and SURFsara.

http://aarc-project.eu/

NEW PHASE IN GÉANT PROJECT

1 MAY MARKED THE START OF THE LATEST ITERATION OF THE GÉANT PROJECT, GN4 PHASE 1 (GN4-1)

GÉANT is Europe's leading collaboration on e-Infrastructure and services for research and education, with the GÉANT Project forming a major part of its work. Together with the NRENs, the Project has for nearly 15 years been a vital element of Europe's e-infrastructure strategy, providing the high speed connectivity needed to share, access and process massive volumes of data essential to the research and education communities.

The GÉANT Project has grown during its many iterations (GN2, GN3, GN3plus) to incorporate not just today's award-winning 500Gbps physical network, but a catalogue of advanced, user-focused services, and a successful programme of innovation that is pushing the boundaries of networking technology to deliver real impact to over 50 million users in 10,000 institutions across Europe, as well as thousands of schools.

GN4-1 is a 12-month project from 1 May 2015 to 30 April 2016, under the GÉANT2020 Framework Partnership Agreement (FPA) and has applied for funding from the European Union's Horizon 2020 Research and Innovation Framework Programme (No. 691567). It is a collaboration between 38 partners: 35 European NRENs, GEANT Limited (Project Coordinator), GÉANT Association and NORDUnet (representing the five Nordic countries).

This new iteration of the GÉANT Project is the first step of a new phase in providing a stable, yet highly innovative, environment for the growth of the GÉANT network and its services as the European Communications Commons

for the European Research Area, providing the best possible digital infrastructure to ensure Europe remains in the forefront of research and other knowledge endeavours.

The work of the project is divided into 15 activities within three areas of work: research; service development and delivery; outreach and coordination.

- **Networking Activities** (NAs) support all project activities with the full extent of internal and external communications, promotion and project management, foresight and best practice, international liaison and NREN development.
- **Development Service Activities** (SAs) develop GÉANT services and manage feature roadmaps to support the evolving needs of NRENs and the wider research and education community.
- **Production & Security Service Activities** (SAs) deliver and support the GÉANT service portfolio used by NRENs and the research and education community.
- **Joint Research Activities** (JRAs) are targeted at critical analyses of future network and application technologies with a view to future deployment of emerging technologies across the network and services.

FURTHER INFORMATION

Web: **www.geant.org**
Twitter: **www.twitter.com/GEANTnews**
Facebook: **www.facebook.com/GEANTcommunity**
YouTube: **www.youtube.com/GEANTtv**

Note: The website of GN3plus, the predecessor project (**www.geant.net**) is still available but will be archived after the formal closure of the project, early July 2015.

HAPPY 10TH ANNIVERSARY REFEDS!

REFEDS - the Research and Education Federations group - marked its 10th anniversary at a meeting at the annual networking conference, TNC15, in Porto on 14 June. With birthday cake for all participants, REFEDS celebrated this milestone and a brand new website: **https://refeds.org**.

Managed by GÉANT, which provides secretariat support for the group, REFEDS has grown from a talking shop of interested parties sharing ideas to a sponsored initiative delivering an annual plan of work to improve interoperability between identity federations.

REFEDS began as a small group of people who got together to discuss the issues associated with implementing SAML-based identity federations as they began to emerge. The group was proposed following a meeting held in the UK, attended by representatives from the UK (JISC), Australia (DEST), Finland (Finnish IT Centre for Science), Netherlands (SURF), Spain (RedIRIS), Switzerland (SWITCH), USA (Internet2) and representatives from CERN. The first meeting of REFEDS took place on 8th June 2005 in Poznan and involved just a few participants.

The 10th anniversary meeting of REFEDS at TNC15 attracted more than 70 delegates representing some of the 56 research and identity federations that now exist worldwide.

In its 10 years, REFEDS has delivered the following notable achievements:

- the REFEDS Discovery Guide to improve the user experience of federated access
- the introduction of entity categories to support the legal flow of user information to services
- federation monitoring tools such as MET (Metadata Explorer Tool)
- template documents and advice for emerging federations.

The work of REFEDS is made possible by the generosity of its sponsors. The REFEDS sponsorship model changed in January 2015; in line with the new model, sponsoring organisations sign a light-weight agreement with REFEDS. Eleven organisations from around the world are currently sponsors.

REFEDS has been coordinated by Licia Florio since its inception in 2005, with Nicole Harris joining her in 2010 as the group continued to grow in size and activity.

REFEDS meets twice a year, and manages its work via the REFEDS wiki, the REFEDS mailing list and via its working groups. **https://refeds.org**.

"REFEDS is the indispensable group for the global research and education identity community. SUNET and SWAMID have and will continue to engage with REFEDS to build a global identity ecosystem based on mutual trust and collaboration."

Leif Johansson,
CTO SUNET (Sweden)

Words and Picture
Nicole Harris, Project Development Officer, GÉANT

TRUSTED CERTIFICATE SERVICE GOES FROM STRENGTH TO STRENGTH

Words and Picture
Alessandra Scicchitano, Project Development Officer, GÉANT

GÉANT's Trusted Certificate Service (TCS – formerly known as the TERENA Certificate Service) helps to increase security in online transactions by facilitating the deployment of digital certificates. TCS takes advantage of a bulk purchasing arrangement whereby participating NRENs may issue close to unlimited numbers of certificates provided by a commercial Certification Authority (CA) at a significantly reduced price.

After around nine years issuing a variety of certificate types through a series of CA providers, the newest iteration of TCS geared up for action with a workshop at this year's networking conference, TNC15, in Porto on 16 June.

The workshop, 'TCS presents TCS', showed current and prospective service participants how to use the new online service portal developed by DigiCert, which is the new TCS service provider as from 1 July 2015.

DigiCert, a US-based company, is one of the largest worldwide Certification Authorities. Its new Web portal is expected to improve the user experience of ordering digital certificates because SAML-based federated access has been built in. The portal also allows for NRENs branding and will be available in different languages. Further training opportunities will be provided to current and new participants in the coming months.

The workshop also included discussion with a panel of technical experts from the TCS community, who had extensively tested the new portal before it went into production.

The new TCS is up-to-date with recent changes to the Secure Hash Algorithm (SHA), which plays an important role in signing digital certificates used to support secure websites. The DigiCert TCS will provide the more secure SHA-2 supported certificates that replace the original SHA-1 type.

Another change under the new TCS is the addition of a new type of certificate. The five main types of certificates available are:

- SSL certificates – for authenticating servers and establishing secure sessions with end clients.
- Grid certificates – for authenticating Grid hosts and services (IGTF compliant).
- Client certificates – for identifying individual users and securing email communications.
- Code signing certificates – for authenticating software distributed over the Internet.
- Document signing certificates – for authenticating documents from Adobe PDF, Microsoft Office, OpenOffice, and LibreOffice.

For more information about TCS, please visit **www.geant.org**

ABOUT THE AUTHOR

Alessandra Scicchitano is a Project Development Officer at the Amsterdam office of GÉANT. She joined the team in July 2014 after leaving SWITCH, the Swiss NREN, where she worked on AAI and eduPERT. She now supports the Information Security Management SIG (Special Interest Group) as well as TCS.

GÉANT ATTENDS CHEP2015 IN OKINAWA, JAPAN

In April, Enzo Capone, GÉANT Business Development Officer, attended CHEP2015 in Okinawa, Japan. It was the 21st International Conference on Computing in High Energy and Nuclear Physics.

This major event for physicists and computing professionals from the high energy and nuclear physics community, computer science and information technology sectors, provides a forum to exchange experiences and review recent, ongoing and future activities.

ONE-STOP SHOP: INTERNATIONAL USER SUPPORT FOR BIG SCIENCE COMMUNITIES

Enzo attended the conference to present: 'The GÉANT network: addressing current and future needs of the HEP community,' co-authored by Mian Usman, GÉANT IP Network Architect.

It was an opportunity to connect with Japanese and international physics communities, and explain how the GÉANT infrastructure serves Europe's research and education community. The presentation explains how GÉANT provides global access for end users and how its associated services provide support for educators, researchers and other partners to collaborate and agree on policies for big science communities.

Together with people from GARR and the INFN (Italy), Enzo had also a poster contribution to the conference, named: "A prototype infrastructure for cloud-based distributed services in high availability over WAN."

BETTER UNDERSTANDING THE NEEDS OF THE HEP COMMUNITY

With computing and software more important to High Energy Physics than ever before, the conference provides an opportunity to learn more about current networking trends, developments and related topics. In this way GÉANT has been able to deepen its understanding of community needs—as well as raise awareness of the benefits of European research and education networking and how it is accelerating science.

TECHNOLOGY AND TRANS-NATIONAL EDUCATION (TNE) - THE GÉANT PERSPECTIVE

HEGlobal

To be successful, TNE needs to think beyond student numbers and balance sheets. In a guest blog for HEGlobal reproduced here, John Chevers of GÉANT looks at the technology options available to facilitate successful international collaborations, and the best way to engage with local academic network providers around the world.

There is one characteristic of all TNE initiatives that can't be ignored: distance. Regardless of the strength of your partnership, the reliability of local staff and the air-conditioned comfort of your lecture theatres, the fact is that there will always be challenges associated with the physical separation of the sites involved. This is where technology, and network solutions like GÉANT, can help.

What technology is really necessary for TNE? Surely a good connection to a local Internet Service Provider (ISP) will suffice? Well perhaps. However:

- It is worth remembering that commercial network providers run their infrastructure rather differently from public-sector operators. Typically commercial ISPs will aim to fit the maximum amount of data on to any particular link, to maximise profit, thereby leading to the data equivalent of a traffic jam.
- Another issue can be geography - in many parts of the world the telecommunications infrastructure is much sparser than in Western Europe and the local markets are typically lacking competition. This means that the quality of service you can expect in the UK may not be available commercially in some countries and so the cost may be high.
- From a technical perspective, the issues which prevent good throughput of data on a network tend to be amplified proportionately to the distance covered. International and intercontinental collaborations therefore need specialist knowledge and high-quality infrastructure.

Network connections aside, it is important that remote campuses and partner institutions are able to provide the same digital services for both their TNE and UK based students if this is part of their TNE offer. On one level this is essential to promote inclusiveness and a high-quality student experience. On another it is in the institution's best interest to ensure secure access to resources and to ensure integrity of student and corporate data. eduroam, the service that allows single-sign-on to university WiFi networks, has been adopted around the world - and now is available in many public locations too. This means that travelling students and academics can just open their laptop and be online at a partner institution that uses eduroam. Similarly, digital identity is a key theme in academia and in wider society. eduGAIN is a technology which allows national identity federations to interact, meaning that the credentials for a student or academic in one country can be recognised and verified by a partner institution (or institutions) in another country.

Technologies will change with time. The most important ingredient for success is therefore not any particular platform, but to use services which understand the academic sector and the challenges of working internationally. Working together, Jisc, who provide the Janet network in the UK, and GÉANT can help institutions select and implement appropriate tools for TNE and help facilitate links with local national research and education networking (NREN) partners, be they in Asia, Africa or in any of the 100+ countries connected via GÉANT.

It won't always be easy to seamlessly connect partners halfway around the world, but working with the world's best-connected network is a very good way to start!

ABOUT HEGLOBAL AND TNE

HEGlobal brings together UK government, the higher education sector and other expertise to support and develop UK universities' transnational education (TNE) activity. TNE is education delivered in a country other than the country in which the awarding institution is based, for example students based in country Y studying for a degree from a university in country Z.
John Chevers also presented at the recent Jisc-supported HEGlobal seminar, "Technology: TNE's silent partner?"

For more information, see **http://heglobal.international.ac.uk** and for seminar presentations, visit **http://heglobal.international.ac.uk/events.aspx**

TNC15 SPECIAL

The TNC15 Networking Conference is the largest and most prestigious European research networking conference, with more than 650 participants attending this annual event. TNC brings together decision makers, managers, networking and collaboration specialists, and identity and access management experts from all major European networking and research organisations, universities, worldwide sister institutions, as well as industry representatives.

Through keynotes speeches by renowned specialists, varying parallel sessions, demonstrations and presentations, the conference presents participants with a unique overview of the latest developments in research networking, both in the technical field and in the area of application and management.

TNC15, its 31st edition, will be hosted by FCT | FCCN, Portugal's unit for the operation of the National Research and Education Network within the funding agency for science and research in Portugal, between 15-18 June 2015 in Porto.

Here we look at the involvement of the GÉANT Project in this event, and in the following pages speak to several of the associated speakers to get insight into their sessions. Then on page 16 we learn in more detail how the team from FCT | FCCN have been preparing for the show.

GÉANT PROJECT ASSOCIATED SPEAKERS

Monday, 16 June

16:00 to 17:30
Location: Room B
Supporting user privacy, security and ease of use in eduroam
Tomasz Wolniewicz (Nicolaus Copernicus University)

Tuesday, 16 June

11:00 to 12:30
Location: Room D
GÉANT Open Calls – Generating Innovation with Impact
Michael Enrico (GÉANT, Cambridge)

14:00 to 15:30
Location: Plenary Room A
To the clouds and beyond - collaboration on service sharing and delivery
Andres Steijaert (SURFnet)

14:00 to 15:30
Location: Room D
GÉANT one-stop-shop: bringing scientific communities together
Vincenzo Capone and Maria Minaricova (GÉANT, Cambridge)

16:00 to 17:30
Location: Room B
VAMPIRE - Virtual organization Authorisation Management Practices in Research and Education
Mandeep Saini (GÉANT, Cambridge)

GÉANT BOOTH

This year, following the rebranding (see page 2) there is one booth for both GÉANT and the GÉANT Project. Come visit us to learn more!

GEANT PROJECT ASSOCIATED SPEAKERS

The TNC 2015 programme will this year feature fifteen speakers presenting on a wide range of subjects covering the GÉANT Project's technology, service developments and other initiatives.

16:00 to 17:30
Location: Room B
Federated Authorization
Andrea Bianchini (GARR)

16:00 to 17:30
Location: Plenary Room A
Creating Interactive Art with Prototype Boards and R&E Networks
Domenico Vicinanza (GÉANT, Cambridge)

16:00 to 17:30
Location: Room C
Multi-Domain Virtual Private Network service
Xavier Jeannin (RENATER)

16:00 to 17:30
Location: Room C
A solution for connection-oriented multi-domain SDN based on NSI
Alaitz Mendiola (University of the Basque Country,UPV/EHU)

Wednesday, 17 June

14:00 to 15:30
Location: Plenary Room A
Innovation and Evolution: the GÉANT Backbone network
Toby Rodwell, Guy Roberts, Mark Johnston and Mian Usman (GÉANT, Cambridge)

11:00 to 12:30
Location: Room D
Networking the Square Kilometer Array
Richard Hughes-Jones (GÉANT, Cambridge)

11:00 to 12:30
Location: Room B
Scholar European Electronic Identity Federation
Jordi Ortiz (Universidad de Murcia)

16:00 to 17:30
Location: Room D
Towards easy VC - technical background of eduCONF service
Bartlomiej Idzikowski (PSNC)

Thursday, 18 June

9:30 to 11:00
Location: Room C
Sharing Dark Fibre: Lessons from Amsterdam-Hamburg field trial
Guy Roberts (GÉANT, Cambridge)

9:30 to 11:00
Location: Room B
The new perfSONAR one year later
Domenico Vicinanza (GÉANT, Cambridge)

INNOVATION AND EVOLUTION: THE GÉANT BACKBONE NETWORK

WHEN: WEDNESDAY 17 JUNE 14:00-15:30
WHERE: PLENARY ROOM A

WHO IS CHAIRING THIS SESSION?

Toby Rodwell, Head of Service Assurance for GÉANT, and Roberto Sabatino, part of the Business Development team in GÉANT. The session will include several presentations, and Toby outlines the session below:

WHAT IS THIS SESSION ABOUT?

Our session is about innovation and evolution on the GÉANT Backbone network, with particular attention being given to describe recent and upcoming tests and demos we're conducting in collaboration with GÉANT's strategic partners, Juniper and Infinera.

WHAT DO YOU SEE AS THE KEY POINTS?

We will presenting the results of our Terabit per second (Tbps) trial, and describing our plans to trial a new packet switching module for our Infinera optical system. Mark will describe GNOVC, GÉANT's new Operational Verification Centre (where we will validate and prove new vendor software before deployment) and he will give a high level view of GÉANT's future plans including how we might better collaborate with NRENs to make use of their existing infrastructure. As such there will also be a presentation from Pieter Panis from BELnet, describing recent developments in BELnet's network.

WHAT FEEDBACK DO YOU HOPE FOR, AND HOW WILL THIS IMPACT YOUR WORK?

We hope to be able to gauge the audience's interest in, and support of, GÉANT progressing with these advanced features. If there is significant interest in GÉANT's GNOVC then we may devote effort to helping NRENs set up their own equivalent, or even host such a service for them.

COULD YOU INTRODUCE YOUR SESSION SPEAKERS?

Mark Johnston is presenting on Innovation on a Production Network. He became Chief Network Operations Officer for GÉANT Cambridge Office in 2013 and has responsibility for the delivery and operation of the GÉANT network and its services. He previously led the 500Gbps GÉANT Network Migration Project, having joined what was DANTE in 2012. Mark has over 20 years of telecommunications experience in managing operational teams to design, plan, build and operate network infrastructure and network-centric services; and in driving continual improvements of operational processes and workflows. He has an Electrical and Electronic engineering undergraduate degree and a Masters in Business Administration.

Pieter Panis (BELnet) is presenting on An Intelligent Optical Aggregation Layer: what, why and how. He has a broad experience in transmission. After obtaining his Masters degree in telecoms in 1995, he started working as transmission design engineer for one of the first European carriers. In 2000 Pieter joined a start-up dark fibre provider, first in operations and then as pre-sales helping the company to become a major telecom player in the Netherlands. Fascinated by DWDM, he joined Alcatel-Lucent in 2004, designing networks for several European NRENs and world-wide carriers, and became a product manager for their DWDM flagship. He joined Belnet in 2011 as network engineer and project managed Belnet's new optical network.

Guy Roberts is presenting on The GÉANT Photonic Layer. He received his BEng degree from RMIT University in Australia in 1991 and his PhD in photonics from the University of Cambridge in 2006. He joined DANTE (now GÉANT Cambridge Office) in 2006 and is now the Senior Transport Network Architect in the Office of the CTO. He is also research coordinator for the GÉANT Project and co-chair of the Network Service Interface working group in the Open Grid Forum.

Mian Usman is presenting on the GÉANT IP Layer. He received his BSc in Network Management and Design from University of Portsmouth in 2007. He joined DANTE (now GÉANT Cambridge Office) in 2008 as a NOC engineer, before joining the Operations team in 2010 and then becoming the IP Network Architect in the Office of CTO in 2012. Mian led the team responsible for designing and deploying GÉANT's new IP/MPLS platform and the migration of GÉANT Plus service from EoSDH to EoMPLS. Now focused on GÉANT network architecture and design as part of the GÉANT Project, he is also chair of the Technology and Topology working group in the Global Network Architecture (GNA) initiative.

SHARING DARK FIBRE: LESSONS FROM AMSTERDAM-HAMBURG FIELD TRIAL

(PART OF THE SESSION 'STRENGTHENING THE NETWORK')

WHEN: THURSDAY 18 JUNE 9:30 – 11:00
WHERE: ROOM C

WHO IS DELIVERING THIS PRESENTATION?

Guy Roberts, Senior Transport Network Architect (see intro on opposite page) is currently working with NRENs to try out new ideas in optical transmission infrastructure sharing. He is also JRA coordinator in GN3plus as well as co-chair of the Network Services Interface working group in OGF.

WHAT IS YOUR PRESENTATION ABOUT

I will be talking about network infrastructure sharing in the GÉANT community. This has become a hot topic lately since in recent years there has been a rapid expansion of R&E built and owned transmission infrastructure in Europe. This diversification risks diluting the utilization of the infrastructure and making it less economically viable. We are working to share the optical spectrum between multiple network providers. This is known as spectrum sharing or alien waves. This kind of infrastructure sharing between GÉANT and the NRENs promises to increase the utilization of the optical fibre infrastructure, resulting in reduced costs for all.

I will be describing the work we have been doing to trial alien waves. This is where a provider uses their DWDM equipment to carry light sourced from a third-party. The first trial was a collaboration between GÉANT and SURFnet where we have demonstrated the stable operation of GÉANT's Infinera wavelengths carried over SURFnet's Ciena equipped fibre running between Amsterdam and Hamburg.

This work is important as it heralds a new era of technical collaboration between GÉANT and the NRENs. It shows that with close technical collaboration it is possible to achieve novel engineering solutions that benefit the whole community.

WHAT SHOULD THE AUDIENCE TAKE AWAY?

I would like to get across the engineering concepts behind alien waves and raise awareness within the GÉANT community of the mutual benefits of alien waves for both the GÉANT Association and the NRENs.

GÉANT OPEN CALLS – GENERATING INNOVATION WITH IMPACT

(PART OF THE SESSION 'ENABLING RESEARCH USING THE NETWORK')

WHEN: TUESDAY 16 JUNE 11:00 – 12:30
WHERE: ROOM D

WHO IS DELIVERING THE PRESENTATION?

Annabel Grant is Open Call Coordinator for GÉANT, responsible for the successful delivery of GÉANT's first Open Call programme (October 2013 to April 2015).

Michael Enrico is Technical Coordinator for GÉANT, responsible for coordinating the work of the Joint Research Activities in GÉANT with innovative service development efforts within the project and with complementary related activities external to the project.

WHAT IS YOUR PRESENTATION ABOUT?

Michael: "It provides an overview of what we did within the Open Call programme – but primarily focuses on the innovation elements and impact of the projects."

WHAT ARE THE MAIN POINTS OF YOUR PRESENTATION?

Michael: "Demonstrating the significant mutual value (for GÉANT and the Open Call participants) of collaboration between the GÉANT community and expert researchers within industry, universities and research institutes across Europe."

WHAT DO YOU HOPE TO GET FROM THE AUDIENCE?

Annabel: "Feedback on areas where GÉANT should be innovating in the future."

HOW DOES OPEN CALL DRIVE INNOVATION?

Michael: "Innovation can be conducted in many ways – it need not solely be in the technology arena but can also be in the areas of service wrap, commercial models and policy. Looking at the Open Calls we have just run in the GN3plus project, we can confidently say that the most fruitful and highly rated projects are those that were the most keyed into extant service development effort in the project.

This is really just an exemplar of the "DevOps" approach to product development in which as close a link as possible is established between development and operations in order to avoid many common innovation problems. The result of this is that the act of innovation is seen to be fruitful by all stakeholders in the DevOps cycle including those who provide the innovation and those operational staff who have to work with the results of these innovations on a daily basis.

The methodology of the administrative process necessary to conduct an Open Call really does marshal the activities into the DevOps mould thereby promoting the virtuous circle of innovation leading to better services and happier users who are then happy to continue consuming services allowing for further innovation through successive Open Calls."

HOW WOULD YOU LIKE TO SEE OPEN CALL TYPE ACTIVITY DEVELOPING IN FUTURE?

Annabel and Michael: In the future, it will be very important to continue to work with industry as well as the research and education community to ensure that GÉANT remains a world-class provider of networking and services for our community. User requirements will continue to inform all of GÉANT's work – so that services remain cutting edge and fit for purpose for our community.

GÉANT ONE-STOP-SHOP

(PART OF THE SESSION 'EXTENDING THE BUSINESS')

WHEN: TUESDAY 16 JUNE 14:00 – 15:30
WHERE: ROOM D

WHO IS DELIVERING THE PRESENTATION?

Enzo Capone and Maria Minaricova are part of the Business Development team in GÉANT, looking after the international users communities.

WHAT IS YOUR PRESENTATION ABOUT?

Enzo: Our presentation is about the support to the science communities and users groups that spread over different countries or even different continents, with two case stories of how this has positively worked.

CAN YOU EXPLAIN THE CONCEPT OF THE ONE-STOP-SHOP?

Enzo: Today, all the big science projects need to have an international scale to be able to face the challenges that their scientific goals entail, since no single institution or, sometimes, country, has the means to pursue these results all alone.

Having a number of different actors in different countries poses new challenges, in terms of selection and deployment of network services to avail the computing activities for these experiments.

Given the structure of the R&E networking community, this also means that every site would have to contact the NREN which it connects to, at the same time losing that holistic view that would help the design of a collective solution for the community as a whole.

The one-stop-shop concept was created specifically to address these kind of issues: it provides a single point of contact for the community, helping them to understand the best possible solution in terms of network services, and also liaising with all the involved NRENs to actually deploy the solution.

WHAT ARE THE BENEFITS OF THIS CONCEPT FOR GÉANT'S USERS?

Enzo: This can greatly facilitate the time to deployment of a network service, as GÉANT is in a better position to contact all involved network partners; and also it helps to find the best solution in terms of service selection.

WHAT SHOULD THE AUDIENCE TAKE AWAY?

Enzo: The main point would be to encourage users to contact and make use of this GÉANT service, while for the NREN audience the point would be to show examples of how the one-stop-shop has been effective in delivering good solutions to the users.

WHAT DO YOU HOPE TO GET FROM THE AUDIENCE?

Enzo: Suggestions on better ways to liaise more efficiently with the partners, and possibly news about new science communities to be involved with. I also hope this presentation will give us more opportunities to facilitate the user's job.

BEHIND THE SCENES AT TNC

Q&A WITH RUI RIBEIRO, FCT | FCCN, PORTUGAL

CONNECT caught up with Rui Ribeiro from FCCN, to find out what it takes to play host to TNC, the largest and most prestigious European research networking conference, with more than 650 networking, identity and access specialists from all major European networking and research organisations, universities and worldwide sister institutions.

TELL US ABOUT YOUR INVOLVEMENT IN TNC TO DATE?

Our preparations for TNC15 started back in 2013. It's been over a year since our formal expression of interest and we've been excited to organise all logistical, budgetary and administrative matters and decisions; making our best effort to ensure the success of this year's conference.

HOW DID YOU COME TO PLAY HOST THIS YEAR?

We were very keen to host TNC. This year we're celebrating the 15th anniversary of the first TNC edition Portugal hosted, back in 2000, in Lisbon. We wanted the challenge a second time, a chance to invite TNC15 participants to visit Porto, one of the most charming cities in Europe. It is also quite accessible and offers excellent facilities.

Porto offers so much in terms of architecture, culture, gastronomy, trade, encounters and discoveries. It is one of the oldest European cities and was registered as a World Heritage Site by UNESCO in 1996 and Elected Best European Destination in 2014. We really enjoy the idea of bringing TNC participants to witness it for themselves.

WHAT DOES HOSTING TNC INVOLVE?

Hosting TNC involves a considerable amount of: planning, meetings, scheduling, work and of course overcoming a variety of challenges.

Ever since (and even before) the "Alea jacta est! feeling" at the signing of the MoU between FCT | FCCN and the GÉANT Amsterdam team we have been working together. We were grateful for the equipment lent to us by Cisco Portugal and for the support from the GÉANT Project Event Team. We would like to extend our thanks to them, for without their help and financial support the equipment needs would have been difficult.

As the 'field team', we're closer to the venue so it's up to us to make sure the conference runs smoothly and also to promote the event as much as we can, locally and internationally. This year, the location has also been an interesting challenge since we're based in Lisbon (around 300km away). Fortunately, the whole process also involves a lot of fun.

WHAT TECHNICAL CHALLENGES DID YOU HAVE AND HOW WERE THESE OVERCOME?

An event of such magnitude and technical complexity demands the correct handling of necessary infrastructures, as well as time to work on the details.

We needed some external help for some of the technical challenges. The Alfândega was very well equipped in terms of electrical infrastructure, however we had to make sure we could complement connectivity. The whole wireless network was set up, in different locations across a large building, bearing in mind up to 700 participants (and their multiple devices). We were grateful for the equipment lent to us by Cisco Portugal and for the support from the GÉANT Project Event Team. We would like to extend our thanks to them, for without their help and financial support the equipment needs would have been difficult.

We also had the support of the Porto Digital project, who offer a metropolitan high-speed network, interconnected with FCCN's network that passes through most parts of the city. This network has a fiber access point right at the Alfândega building.

Cabling and fibre distribution throughout the building was installed over Easter. Tests were completed whenever there were no events scheduled in the Congress Centre.

The availability and flexibility of the venue management was key to ensuring the network requirements could fulfil the innovative high-tech experience that TNC participants are accustomed to.

WHAT DO YOU SEE AS THE BENEFITS OF HOSTING TNC?

The Portuguese NREN, aligned with FCT's mission, aims to promote the advancement of knowledge in science and technology in Portugal, attain the highest international standards in quality and competitiveness, in all scientific and technological domains, and encourage its dissemination and active role in society and economic growth.

In bringing TNC to Portugal, we're providing a global stage to promote the best in "the business" in Europe and beyond. We consider this to be completely in sync with our mission, while offering the opportunity to build collaborative partnerships, drive innovation and spark creativity across Europe (and the rest of the world).

We want people to benefit from the great knowledge and innovation this event brings and to visit our beautiful city and surroundings.

TELL US ABOUT YOUR TEAM?

One part of the team takes care of the tech issues and the other is in charge of logistics and PR. Each member has his/her role and up to date tasks to complete with well-defined deadlines. The core Portuguese team has around 8 to 10 people. However, the whole NREN is committed to preparing this great event.

TELL US ABOUT THE VENUE?

The Alfândega Congress Centre was built in 1869 and used to be a Customs House. The project was designed by the French architect Jean Colson, who chose the right bank of the Douro River, on a former fisherman's beach for its construction. It was built according to different architecture characteristics in comparison to the nearby 15th century riverside buildings and is distinguished by its unique Riga Oak details in the plenary room.

WHAT ARE YOUR PERSONAL REFLECTIONS?

It will be an honour to be a point of support to this "connecting of communities". It is exciting to take part in this in a way much different than the regular participation we've had before. We're part of it. We're also making it happen. It's a special feeling and we hope all our efforts and hard work will be rewarded with great success.

For future reference, it is important to involve city services and government bodies from the early planning stages. It is very good to have support from the city and local organisations.

We are looking forward to greeting TNC's participants in Porto for a very successful TNC15. We really hope people will savour it and profit from all the rich exchanges and knowledge the largest and most prestigious European research networking conference can give.

Picture
Left to right: Ângelo Rodrigues, Ana Afonso, Nelson Dias, Pedro Simões, Cláudio Silva, Rui Ribeiro, Pedro Oliveira and Gonçalo Faria (Missing: Mónica Domingues and Alexandre Carreira)

FOCUS ON SECURITY

Security of networks and the information they carry is fundamental to enabling trusted collaboration. CONNECT spoke to Head of Information and Infrastructure Security, Wayne Routly, to learn more.

TELL US ABOUT YOUR ROLE?

As Head of Security within GÉANT, I have a broad remit, from ensuring the security of the GÉANT network at a PoP level to the security of information handled.

I also lead a very skilled team of multi domain security specialists who audit and review the code for security vulnerabilities of the systems that project participants and global researchers use every day.

We're also tasked with producing the next generation of security tools to defend the network against attacks. My other role as the security co-ordinator is to make users are aware of the benefits of secure systems and to showcase the world-leading services we deliver.

PLEASE EXPLAIN THE IMPORTANCE OF SECURITY FOR CONTEXT

We have to provide users with a secure network with which to facilitate research and education in free and open networks. Therefore, ensuring users can trust the network, to validate the integrity of the infrastructure and the confidentiality of the information that transits it, is critical.

CURRENT CHALLENGES?

Security is a challenge in itself. We must ensure networks remain open and trusted whilst simultaneously defending them against the thousands of events we see targeting the network and our customers across the network.

Potential new issues we see is the use of networks of scale to launch denial of service attacks either on the community or even entire countries. We have already started to implement a solution by which to block malicious traffic, but, at the same time enable legitimate traffic through to the end host. Ensuring we maintain access to services and systems is a key challenge.

We're also here to sell security. Everyone understands why you lock your front door and why you have an alarm. If we can transpose this mind-set to the networks and systems we rely on so much, half our work will be done.

HOW DO YOU PHYSICALLY MANAGE SECURITY FOR THE NETWORK? DESCRIBE A TYPICAL DAY.

Tasks are varied. The team monitor security dashboards that report on alerts and events that may require further investigation. Streams of security requests also flow in, from assistance in building firewall filters to security events that need reporting to system owners.

Then there are projects. We're constantly improving systems, enhancing existing processes and working with internal and external teams to understand their security requirements before they enter the network.

As the face of GÉANT security, we also provide advice on everything from access control to information rights management of documents. Promoting security within the company and the project is important and we are regularly invited to speak to groups, either on the technologies we are using or the strategies we deploy and lessons we've learnt.

TELL US ABOUT RECENT ACTIVITIES, UPGRADES, SCARES OR DEVELOPMENTS?

We've recently embarked on a major upgrade of our security tool set; to future proof the security needs in the next generation of the GÉANT project.

One of the underlying parts of detecting network security events is through the use of net flow, the "meta data" of network traffic conversations. Soon we will see a whole new type of traffic within the network due to changes in the configuration of the backbone.

As such we have implemented redundant net flow processing systems to firstly cater for the increased volume of traffic over the next few years, but also to cater for new types of traffic such as IPv6.

Hand in hand with the processing systems we have built into the fabric we have rolled out a new Anomaly Detection System to cater for new and emerging network based attack types. This upgrade will greatly enhance the added value of the NSHaRP process we deliver to NRENs.

Keeping tab of security updates on a network spanning Europe with hundreds of devices running multiple services and applications requires a very proactive approach. We have taken this challenge up by performing weekly vulnerability scans of the network to identify vulnerable machines and systems.

The release of Firewall on Demand as a new system in conjunction with the community black-holing we currently support has eliminated the already mentioned denial of service events we see. It has also provided us with a valuable system to scale firewall filtering and standardise our management of filtering for security events with an effective and valuable end solution, making Firewall on Demand the next generation of firewall filtering.

HOW DO YOU STAY ONE STEP AHEAD OF RAPID CHANGE?

By maintaining an accurate view of where the vulnerabilities lie in the network we are able to rapidly identify those systems affected. We maintain a visible presence at security conferences which provides us with awareness of new trends and approaches in security practices.

Part of the value of the security community is the ability to share information in a trusted environment. We are active members of these groups and they provide valuable insight into potential threats.

YOUR VISION FOR THE FUTURE OF GÉANT SECURITY?

Today's security requirements are different from yesterday's and as such will have a different meaning tomorrow. We see a convergence of networks, with R&E networks being used for transporting government department traffic or even traffic between EU institutions.

This will mean a bottom up review of security controls across the network. We are already seeing a concerted shift towards having standards as a basis for security controls within the domains.

From a controls perspective the tools will become more diverse as new potential areas of threats emerge, also greater focus will be placed on the concepts of risk and how to manage it.

MEET THE TEAM

JUAN QUINTANILLA, SECURITY OFFICER

Juan holds a CISMP, ITIL and the ISO 27001 LI Certifications. He joined the project in 2011 as a Security Engineer and has since been instrumental in the the roll out of NSHaRP, the Security service for GÉANT, and the Hardening Guides project in SA2T4—among many other tasks.

Juan has recently shifted focus towards information, overseeing security in the organisation and the project, defining and refining the ISMS Governance, improving processes and raising the security profile within the organisation.

EVANGELOS SPATHARAS, SECURITY ENGINEER

Evangelos, has an MSc in Information and Systems Security and has a passion for technology, with a never-ending eagerness to learn new concepts surrounding every aspect of security.

He delivered a vulnerability scanning solution which gave GÉANT visibility on particular threats to the corporate and backbone network; thus helping other departments to ensure risk was within acceptable levels.

Evangelos admits that one of the biggest challenges is the pace at which GÉANT evolves. Simultaneously making sure everything conforms to best security practices, and meeting the networks demanding requirements is a huge responsibility, given its diversity and magnitude.

EGI AND EDUGAIN – SUPPORTING THE "LONG TAIL" OF RESEARCH

Picture
Peter Solagna, Senior Operations Manager, EGI.eu

PETER, WHAT IS YOUR ROLE WITHIN EGI?

I am senior Operations manager at EGI.eu, which is the coordination body of the European grid infrastructure (EGI). Together with the Operations team at EGI.eu, I coordinate the operations activities of EGI, this includes the provisioning of the current portfolio of services - high throughput computing, cloud and storage resources and federation enabling tools - plus the rolling into production of the new services to support our stakeholders.

COULD YOU EXPLAIN WHAT YOUR PROJECT IS WORKING TO ACHIEVE?

EGI enables researchers to get access to distributed resources. The process of integrating a community in EGI works very well for the larger projects who have the experience and knowledge. However the process applied to individual researchers and small research teams sometimes is perceived as a big overhead, this added to some other technical barriers make some users struggle to access grid and cloud computing and storage resources from the network of NGIs to deploy 'big data applications'. EGI has recognised the need for simpler and more harmonised access for individual researchers and small research groups. So we're working to remove the barriers that discourage the new users of EGI, and to design and prototype a new platform to support this "long tail" of science.

WHAT DO YOU MEAN BY THE "LONG TAIL"?

Well most of the headline grabbing science is those huge projects like the high energy physics collaborations or the ESFRIS, and these projects are long-term, well organized research initiatives who already benefit from the services that EGI provides to enable large distributed collaborations. But a lot of research takes place in many very small teams across the world who have similar requirements but can't afford the dedicated IT resources that the major projects can command.

For us at EGI the long tail of science means users who do not need to join large distributed organization and who need to get access resources for a specific period in time to support a specific research project. There is a real need to provide support to these teams to help them in their research.

HOW WILL THESE SMALL RESEARCH PROJECTS BENEFIT?

The project will establish a set of services combining the most frequent grid and cloud computing systems that are suited to individual researchers and small research teams. This can lower the barrier of access to grid and cloud resources. The platform will serve users via a centrally operated 'user registration portal' and a set of science gateways that will be connected to resources in a dedicated catch-all Virtual Organisation. This will reduce to overhead for these small teams and allow them to focus on their research, no need to get a certificate if they don't have one, no need to set up a virtual organization or other collaboration infrastructures.

THIS SOUNDS EXCITING, HOW IS GÉANT AND EDUGAIN HELPING?

Of course the large data network capabilities of the NRENs and GÉANT make physical access to resources much easier but eduGAIN is the crucial aspect as it allows researchers to use their federated IDs to request and access distributed systems without the complexity of user account creation and management.

Users do not like to create a new credential for every service they access, and rightly so. IdPs federated in eduGAIN already provides high quality credentials to much of the research and education environment. When a user owns an eduGAIN credential we already know that he is involved in research and that the credential has a minimum level of security.

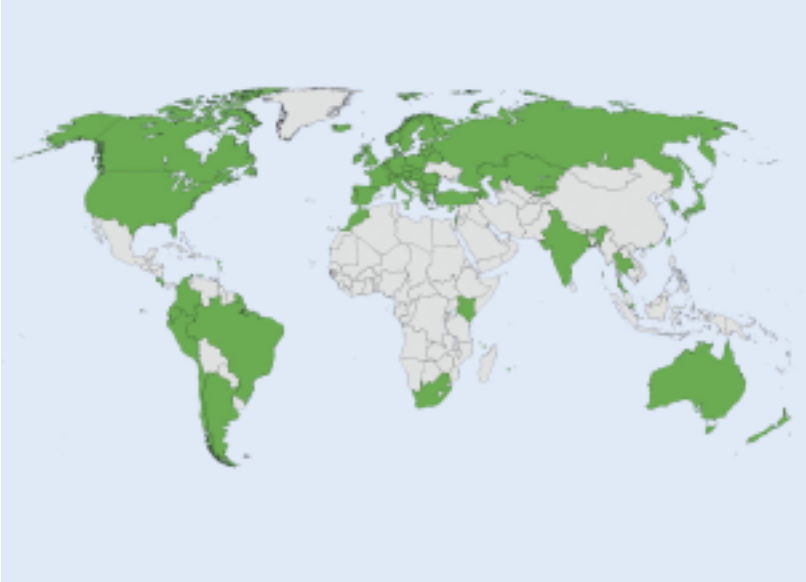
For users without eduGAIN or certificate credentials EGI will have to perform some vetting steps on the user request to access the platform, but we really count on eduGAIN to relieve most of this effort. eduGAIN dramatically reduces the cost of implementing the platform and greatly increases its scalability and usability.

WHERE CAN I FIND OUT MORE INFORMATION?

Information will be available online after the EGI Conference in Lisbon (18-22 of May) when we will present the pilot release of the service and can found at **www.egi.eu**.

EDUROAM NEWS

GLOBAL EDUROAM GOVERNANCE COMMITTEE STARTS ITS 3RD TERM WITH RENEWED MEMBERSHIP AND EXPANDED REPRESENTATION



Picture
Territories where eduroam is currently available

As the Global eduroam Governance Committee (GeGC) marks the beginning of its third term, it has recognised the increasingly global reach of eduroam by expanding its membership to include representatives from five world regions as compared to the original three.

The previous terms of reference listed members from only Europe, North America and Asia-Pacific but with more than seventy recognised roaming operators worldwide, GEANT called for nominees for committee membership from across the expanded eduroam family.

The accepted nominees are:

- **Africa**: Samia El Haddouti (CNRST/MARWAN, Morocco), Simeon Miteff (SANReN/TENET, South Africa)
- **Asia-Pacific**: Hideaki Goto (Tohoku University, Japan), Neil Witheridge (AARNet, Australia)
- **Europe**: Scott Armitage (Loughborough University, UK), Paul Dekkers (SURFnet, Netherlands), Miroslav Milinović (Srce, Croatia)
- **Latin America**: Leandro Marcos de Oliveira Guimarães (RNP, Brazil), Alejandro Lara (REUNA, Chile)
- **North America**: Philippe Hanset (Internet2, ANYROAM, LLC, USA), Chris Phillips (CANARIE, Canada)

The GeGC chose its new chair in May, ahead of its annual face-to-face meeting at TNC, to be held this year in Porto, Portugal. At this meeting, new Terms of Reference will be drawn up, in which the growth in world regions represented will be formally recognised.

In addition to the voting committee members, the GeGC also includes non-voting technical experts. As the Chair of TF-MNM (Mobility and Network Middleware) Klaas Wierenga (Cisco Systems) has been automatically included as a non-voting technical expert. In addition, Stefan Winter (RESTENA) was selected for his eduroam knowledge and development leadership, which saw him honoured with a Community Award at last year's networking conference, TNC2014.

"This new term is an ideal time to show how eduroam has grown dramatically and the new committee is ideally placed to help guide eduroam forward and to meet the opportunities of increase coverage and user numbers and to support global R&E collaboration."

Brook Schofield, GEANT

FURTHER INFORMATION

For more information about eduroam visit the **eduroam website**.

FEDERATION AS A SERVICE TRAINING COURSES A GREAT SUCCESS

GÉANT Federation as a Service - FaaS is an easy entry point for NRENs who are developing or are in early stage of operating an Identity federation. FaaS enables NRENs to roll out Identity federation services to their constituents in a way which accommodates current best practices for operating Identity federation and connecting to eduGAIN. FaaS offer includes toolbox for management of Identity federation metadata focusing on scalability, friendly user interface and high security achieved by using HSM signing. FaaS toolbox is built by using open source software and is provided as a hosted service where each FaaS customer gets its own FaaS instance that can be localized and branded as desired.

The FaaS team has organised two separate training courses for NRENs, with the latest course taking place in April 2015 in Vienna. These trainings focused on delivering the knowledge necessary for operating the Identity federation and teaching the trainees how to use the FaaS toolbox. In total 12 NRENs from across Europe took part and interest in FaaS has been shown by many other organisations.

The FaaS team contact address for any questions concerning FaaS is: **faas@geant.net**

Words
Marina Vermezovic, FaaS Task Leader

MULTI-DOMAIN VIRTUAL PRIVATE NETWORK SERVICE MOVES INTO PRODUCTION

MD-VPN team: Thomas Schmid (DFN), Magnus Bergroth (NORDUnet), Jani Myyry (Funet), Bojan Jakovljevic (AMRES), Miguel Angel Sotos (RedIRIS), Daniel Lete (HEAnet), Niall Donaghy (GÉANT) with the support of Brian Bach Mortensen (NORDUnet).

The GÉANT Multi-domain Virtual Private Network (MD-VPN) is providing an international network service, enabling scientists all over Europe to collaborate via a common private network infrastructure. VPN services are widely deployed across the public internet where VPNs are generally used to link together several distributed sites of a company, as if these different networks are physically in the same location, thus enabling the same level of security.

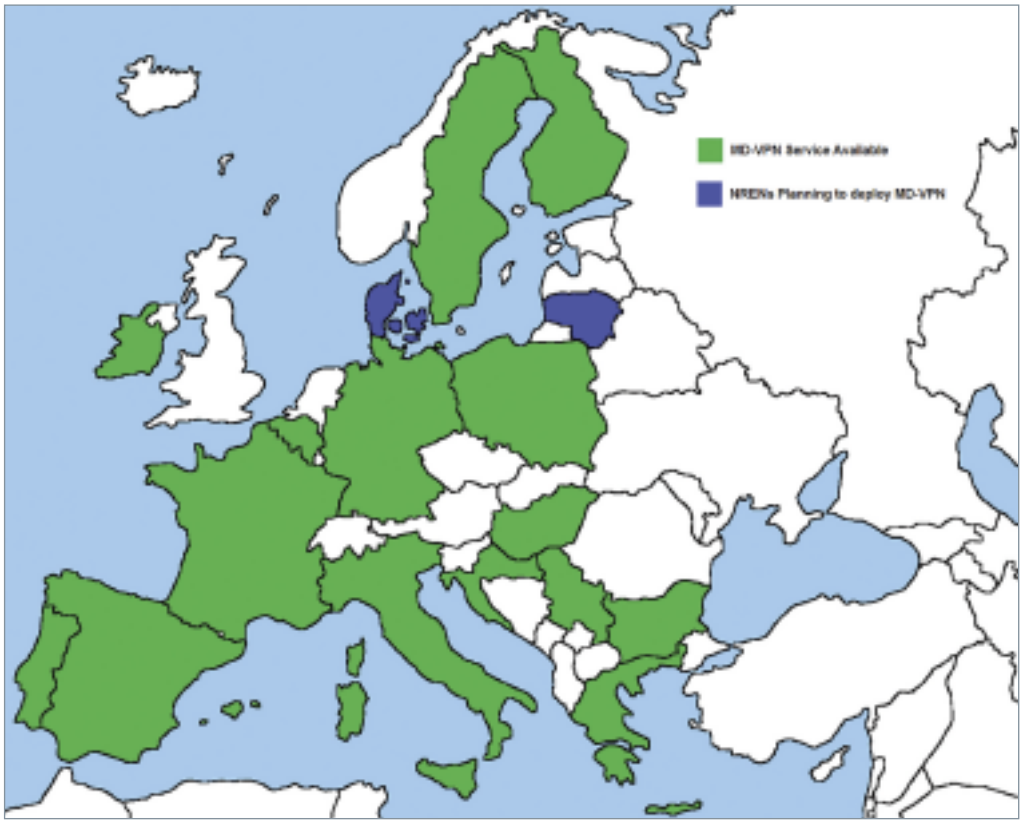
While this is also true for customers of the NREN community, the usage of international VPNs in the science and education world in general is quite different. Here VPNs are often used for international collaborations around a scientific or educational project. MD-VPN service is a new connectivity service and can be used for connectivity (Layer 2 or 3) between clusters, grids, clouds and HPC centers, 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 the long-term infrastructure with a high demand for intensive network usage to quick point-to-point connections for a conference demonstration.

GÉANT MD-VPN is a seamless multi-domain infrastructure that is able to deliver a wide range of end user facing services including: Layer 3 VPN (IPv4, IPv6), point-to-point Layer 2 VPN and multi-point Layer 2 VPN.

"MD-VPN is a unique and powerful networking tool for NRENs to add value to the services they offer the community."

Xavier Jeannin, MD-VPN Task Leader



Words
Xavier Jeannin (RENATER) and Tomasz Szewczyk (PSNC)

MD-VPN demonstrated its reliability during a pilot in 2014 and was launched as a production service in April 2015. MD-VPN is easy to deploy for a NREN, MD-VPN only requires each NREN to create BGP peering once and it uses only standardized protocols and can be implemented on existing hardware (No CAPEX). One of the benefits of MD-VPN is that the implementation of VPN between domains as easy and straightforward as in a single domain. In less than two years 15 NRENs, NORDUnet and GEANT have adopted MD-VPN showing the ease of implementation.

MD-VPN can also be extended to regional networks, allowing regional network to access to all Europe (400 PoPs in 15 NRENs already available) but also providing inter-regional network connectivity within the same country. MD-VPN proxy technology is used to connect non-MD-VPN capable NREN, non-European NREN or commercial sites. This ability increases the flexibility of MD-VPN to support innovative R&E projects allowing users to avoid using more expensive commercial offerings.

For more information on MD-VPN visit **www.geant.org/services**

GÉANT TESTBED SERVICE – A PLATFORM FOR ADVANCED NETWORK RESEARCH

One of the most significant developments over the next few years will be the research of new and innovative networking technologies and protocols and investigating the impact these new applications will have on networking and users.

The development of new concepts and technologies such as Software Defined Networking (SDN), OpenFlow, and advanced network virtualization rely upon research teams being able to test and prototype systems across environments that more closely match real-world systems. There is a need to test these technologies across geographically diverse high performance networks and to be able to measure and monitor behavior of these systems in the presence of real user traffic.

This type of research requires high capacity, high availability, flexible networking that would be impossible or unaffordable for individual research teams to build. This is why GÉANT has invested in the development of the GÉANT Testbeds Service (GTS). We asked Jerry Sobieski, Activity Leader of the GTS project about what this service offers…

JERRY, WHAT INITIATED TESTBED AS A SERVICE IN GÉANT?

We've been playing around with testbeds in GÉANT and certainly within the GÉANT community forever. With the start of the GN3plus project we were asked by the community to address this network research requirement in a more formal fashion.

We need something that can provide experimental access to wide area network facilities, a capability that allows researchers to deploy new ideas in the network core with real world conditions – not just in a simulation in a lab. In order to enhance European research competitiveness, this service has to reduce the ramp-up time and costs for network researchers, to enable them to get research results faster, with faster turnaround for innovations.

BASICALLY, YOU PROVIDED A TESTING GROUND FOR EXPERIMENTAL NETWORKS?

Yes, we're not trying to do our own research here, were trying to provide best infrastructure platform and let our users do the research. With testing in conventional production networks you often end up with "collateral damage" that you did not plan or expect. And I certainly have done that in testbeds in the past, (I'm sure that guys from SurfNET would love to share their stories with you.) And, of course, you don't want your production users to be affected by your experiments, as well as you do not want others crazy experiments affecting yours! So the GÉANT Testbeds Service is not itself a testbed, but it's a facility where we can serve many different research efforts each with their own network testbed – at scale across Europe.

WHAT ARE YOUR BIGGEST CHALLENGES?

It is important when we build Testbeds, particularly when you build it as a production service intended to meet the needs of a wide variety of possible research topics, that it will have some key features. For example, the underlying infrastructure for this network laboratory must be stable and reliable while at the same time we have to allow high risk experiments and secure them in such a way that, if they go wrong, they are isolated and the rest of the network is not affected... i.e. protect the innocent and no collateral damage. We need the service model to be extensible to be able to incorporate future technologies or other novel ideas. We do not want to build a tool that can only address one type of technology. This is highly challenging, as we don't know exactly what technologies are going to come along. So we have to build open placeholders for future and make it agile to be able to modify to new ideas.

Scalability is a great concern. Not just a high number of devices but making sure that we have geographic spread covered, the right authorisation models to interact with other environments outside our testbed, and to be able to define testbeds that can get huge. For example a testbed simulating a datacenter would require a large number of devices and we need to be able to accommodate that request if it comes our way.

HOW SIMPLE IS THE PROCESS OF SETTING UP?

We have protocols, software agents, and hardware facilities that allow us to translate a user's concept into a running network reaching across Europe in a matter of minutes. So, if the researcher has a brilliant idea and in the process he concludes he needs to set up a network that has a certain topology and technology, then all he needs to do is log into our GÉANT GUI (**gts.geant.net**). From there he uses a "domain specific language" (DSL) to describe the virtual machines, transport circuits, and switching/forwarding elements he needs and how they are to be arranged in the topology he wants. Then he gives this information to the GTS and GTS constructs it.

The testbed itself, once it is running, is under absolute control of the researcher. He can crash it and reset if necessary. We have mechanisms in place to keep the rest of the network unaffected. The ability to break a network safely is crucial to understanding how they work and help advance our understanding of these technologies.

WHAT SHOULD WE EXPECT IN THE FUTURE?

Soon we should be able to extend this research environment outside of GÉANT Network infrastructure into the NREN infrastructure. This multi-domain capability will provide researchers the ability to extend their experiments to more nodes across the R&E community. We will be scaling up the infrastructure to provide 100Gbps testbed transport circuits, a virtual machine (VM) pool that will have thousands of VMs available to users, and dedicated hardware servers – "bare metal servers" - that can be allocated to testbeds upon request. GTS already has hardware supported OpenFlow resources available for users, and we are hoping to integrate new species of testbed resources such as photonic resources or mobile (such as LTE) and wireless resources. And we are constantly upgrading the usability features such as a sophisticated point and click testbed monitoring and control GUI – the proverbial "glass cockpit", better integration with global partners, and the like. It's all about making it easier for researchers to get to the core of their research.

For more information on the GÉANT Testbed Service visit **services.geant.net/gts** or contact the GTS team via email at **gn3plus-sa2-operations@geant.net**

Words
Jerry Sobieski, Activity Leader – Testbed as a Service, is interviewed by Nino Cosic.

Q&A WITH MICHAEL WETS, GÉANT CLOUDS SERVICES

Words
Interviewed by
Karl Meyer

MICHEL, PLEASE INTRODUCE YOURSELF AND YOUR ROLE IN THE CLOUDS TEAM?

Sure, I'm Michel Wets and I work at SURFnet as Procurement Advisor. In the GÉANT project (GN4-1) I'm active in the SA7 Supply Chain activity in two roles: leading the procurement in Task 1 (Brokerage) and as Task Leader in the Support and Communication task, T4.

HOW DO YOU SEE THE USE OF CLOUD SERVICES DEVELOPING IN THE NEXT FEW YEARS?

Cloud services are rapidly maturing and can increasingly serve as excellent alternatives for in-house services. The adoption of them within the Research and Education sector has been slow, as many of these services were not consumable in a way which fit the R&E abilities (Purchase Order based and post-paid), conditions of use were not clear (SLA, Privacy, Security, data location) and lastly TCO (total cost of ownership) was often difficult to predict due to data egress charges. We believe that the cloud requirements, created in SA7 during GN3plus will allow NRENs and institutions to easily see in the GÉANT Cloud Catalogue if a service (community or commercial) can adhere to the required conditions (on e.g. data location). The Clouds Team is now centrally procuring the first set of cloud services (IaaS) so NRENs are able to offer these services to their institutions (either in a brokerage or reseller role) in a transparent way without institutions having to worry about procurement legislation. We believe that this will greatly increase the adoption of these services.

MUCH OF THE CLOUDS ACTIVITY SEEMS TO BE FOCUSING ON BRINGING IN THIRD PARTY SUPPLIERS – WHY AREN'T NRENS BUILDING THEIR OWN CLOUD SERVICES?

They are, many NRENs are building File share, Video Conferencing or even IaaS services, and they should. There is not going to be a single solution which fits all the needs for all of the R&E sector. Institutions should be able to have access to a wide range of cloud services (both community and commercial ones) and be able to get a clear understanding of the differences between them in order to be able to use the one which fits their need.

WON'T THESE VENDORS BE WORKING WITH NRENS ALREADY? WHAT DO YOU SEE AS THE VALUE THE CLOUDS TEAM IS BRINGING?

The two main issues will be the legal contract conditions and communicating these services to the Institutions. We have to create contract conditions which are unambiguous but acceptable by

cloud vendors in order to allow NRENs to promote them to the Institutions. But the biggest challenge is to communicate about the availability of the services to the Institutions. Many NRENs are still primarily network centred and have limited communication and marketing capacity. They may also have difficulty in identifying the right people within the Institutions to communicate to about these services. The Clouds Team will help NRENs by organizing workshops and creating marketing elements for them to reuse in their organisation.

FINALLY, TELL US SOMETHING ABOUT YOURSELF THAT NOT MANY PEOPLE KNOW!

Hmm, okay, I have an old-timer car (a 1966 Ford Mustang convertible, bought over the internet in the US and shipped to The Netherlands myself) which I like working on (nice to use your hands instead of your head) and we have two foster children.

To find out more about the GÉANT Clouds Team visit **clouds.geant.net**. The cloud service catalogue is available at **catalogue.clouds.geant.net**.

OpenCloudMesh

JOIN THE OpenCloudMesh INITIATIVE!

GÉANT announced an ambitious project that for the first time links together researchers and universities in Europe, the Americas and Asia via a series of interconnected, secure private clouds. OpenCloudMesh, a joint international initiative coordinated by ownCloud Inc. as an Associate Member of GÉANT, is built on ownCloud's open server-to-server sharing application programming interface (API). It delivers universal file access through a globally interconnected mesh of research clouds, without sacrificing any of the advantages in privacy, control and security an on-premises cloud provides. Leading research organisations from all over the world have joined the initiative and more participants are welcome.

The ownCloud software provides a common file access layer across an organisation and across globally interconnected organisations, whether the data resides on internal servers, on object storage, in applications like SharePoint or Jive, other ownClouds, or even external cloud systems such as Dropbox and Google. OpenCloudMesh syncs data to desktops or mobile apps, making everything available offline, regardless of the source that is being used.

"We are at an important juncture in cloud-based services," said Peter Szegedi, Project Development Officer at GÉANT's Amsterdam office. "There is no longer a need to choose between strict privacy and security or open collaboration and ease of use. I believe OpenCloudMesh will redefine the way people use the cloud to share their important files in a standardised and trusted manner across all platforms."

ORGANISATIONS JOIN

OwnCloud's open API ensures secure yet transparent connections between remote on-premises cloud installations. The first version of the API has been developed by ownCloud and is already deployed in multi-server installations (between more than 20 universities) in North Rhine-Westphalia in Germany. The OpenCloudMesh initiative is to make this development fully open to the community and come up with a version 2.0 API based on the recommendations of the community. So it will work between different countries where the NREN has deployed ownCloud.
To date, several organisations have signed up to participate, including CERN, SWITCH, SURF, GARR, University of Vienna, Aarnet, the Max Planck Institute, Sciebo (NRW), University of Florida, DESY Research, ETH Zürich, the University of Saskatchewan and Texas A&M."

OWNCLOUD

The collaboration in OpenCloudMesh is not the first that GÉANT has had with ownCloud. At the end of 2013, GÉANT's Amsterdam office (at that time TERENA) secured a discounted price on ownCloud software licenses for its members. These licenses enable institutions to host their own file sync-and-share, giving IT complete control of their data whether using on-premises or cloud storage. It has more than a million users worldwide.

Now that there's a distributed ownCloud environment in the NREN space, the next step is to introduce and further develop OpenCloudMesh.

MORE INFORMATION

For more information please visit the OpenCloudMesh information page, where you can fill in a form to find out more about how to join in this initiative:
https://owncloud.com/lp/opencloudmesh/

A DATA SECURITY DISCUSSION WITH CODE42

ANDY HARDY, MANAGING DIRECTOR FOR EMEA, CODE42 SERVICES

CODE42

WHY IS DATA SECURITY IMPORTANT TO R&E?

Hardly a day goes by without a media report about a data breach that exposes the personally identifiable information of individuals. While much of the news regarding data breaches focuses on the harm to affected individuals, data breaches also harm the organisation experiencing the breach. Potential direct financial costs of a data breach include legal representation, fines (depending on the nature of the breach), and the expense of notifying affected individuals. Organisations also face losses in reputation and consumer confidence. Particularly important for higher education institutions are reputational consequences, which could result in a loss of alumni donations and even a reduction in the number of students choosing to apply to or attend the institution.

IN TERMS OF SECURING USER DATA, IS THE R&E SECTOR DIFFERENT FROM OTHERS?

Securing data on bring-your-own devices in a university setting is different than in a corporate environment. Faculty and staff are highly mobile—spending much of their time off campus, away from a secured network connection. Yet the information that exists on those user devices is sensitive data, such as student grades and accounts, and academic research—all with a significant need to be safeguarded from hackers and viruses. As more devices and mobile apps are embraced by users, IT must find new ways to ensure endpoint data security while allowing business to go on as usual.

WHAT IS CODE42'S EXPERIENCE IN THE HIGHER EDUCATION MARKET?

Code42 has deep roots in the higher education market with a client roster of leading educational institutions all over the world, including MIT, Harvard, and Columbia Business School. In the UK, we help protect endpoint data for Imperial College London, the University of Sheffield and Birkbeck College.

Our enterprise file sync and share capabilities have met all four of the criteria for security and compliance laid out by Jisc, the body that delivers digital solutions such as the Janet network to educational institutions throughout the UK. In the US, Code42 is the only endpoint protection and security solution selected for the widely used Internet2 NET+ service.

HOW DOES CODE42 PROTECT USER DATA FOR R&E?

Code42 delivers endpoint data protection and file sync/share capabilities that give teachers, researchers and students the security and freedom to focus on their work. We silently, continuously protect files created and stored on desktops and laptops—wherever they go. And we give IT full visibility of all protected devices and data in a single dashboard, enabling IT to balance data security and control with end-user productivity. IT departments get a comprehensive solution for protecting and managing user data, and students and staff know their data will always be there when they need it. Once user data is protected, IT has control of it and can determine who had which data and when. This is important in the event of a data breach and helps IT departments know when to disclose data loss.

Crucially our offerings give staff and students self-service capabilities. For such vast and often disparate organisations, this is essential in ensuring data is protected continuously. We take away the millstone of relying on an over-burdened IT department and make file backup, restore and sync/share an effortless process.

Code42 is the endpoint data protection and security company that provides integrated file sharing and backup for the enterprise. The company's award-winning products are the gold standard, trusted by more than 35,000 businesses, including the most recognized brands and universities in the world. For more information, visit **www.code42.com** or contact sales at **https://www.code42.com/contact/**.

NAAS, SDN AND NFV ECOSYSTEM: WHAT VIRTUALISATION IS DOING FOR FUTURE GÉANT NETWORK SERVICES

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Abstract—The vision of telecommunications networking requires agile programmability and efficient introduction of new network services, with systems that provide greater programmability and flexibility while reducing overall operational costs. This reflects an overall technological and economic transformation trend deeply impacting Telecom and IT industries. A shift is taking place towards software driven networks, which includes the efforts in Software-Defined Networking (SDN), Network Function Virtualization (NFV) and Network as a Service (NaaS).

Index Terms—NaaS, SDN, NFV, Network services.

I. NAAS, SDN AND NFV ECOSYSTEM: ONE STEP BEYOND

SDN [1], NaaS [2] and NFV [3] greatly increase automation, optimization and flexibility for the telecom sector and constitute a key enabler for networks carrying both innovative end-user facing and resource-facing services in several ways:

- Decoupling of network functions from the hardware vendor allows third-party developers to enter the hardware-controlled segment, adding fresh competition from new sources.
- Telecom operators are expected to have greater choice and operational control of network functions to integrate into their equipment, without being locked to a hardware vendor.
- Hardware constraints slow implementation and testing, from hardware vendor and to complex integration at the telecom operator. NFV improves time to market of innovative deployments.
- The NaaS service model tailors network services to customers. It leans on virtualization technologies and integrates SDN technology and NFV developments to deliver, manage and fit out a wider service portfolio, to a wider range of users, than was possible before.

SDN is a flexible intermediate layer between the high-level NFV-based services offered by NaaS and the low-level infrastructure components. Together, these technologies (and their results, such as Management as a Service) will drive novel business opportunities and provide NRENs and their clients with novel services.

II. GROWTH AND VALUE AROUND GÉANT SERVICES AND SHOWCASES

The value of these approaches is shown in GÉANT, where national research networks (NRENs) deploy services that must interact with other networks elsewhere. Doing so quickly is a challenge, because the existing architecture at each site is typically built only with regular IP connectivity in mind.

The value in using these technologies to virtualize the customer connection comes from the wider range of services that can be deployed; the edge comes under the control of the NREN and can take advantage of multi-domain services from around GÉANT.

This leads, then, to the growth hypothesis for virtualized networks: that once services are more easily available, “network effects” take over and they will gain users at an accelerating rate.

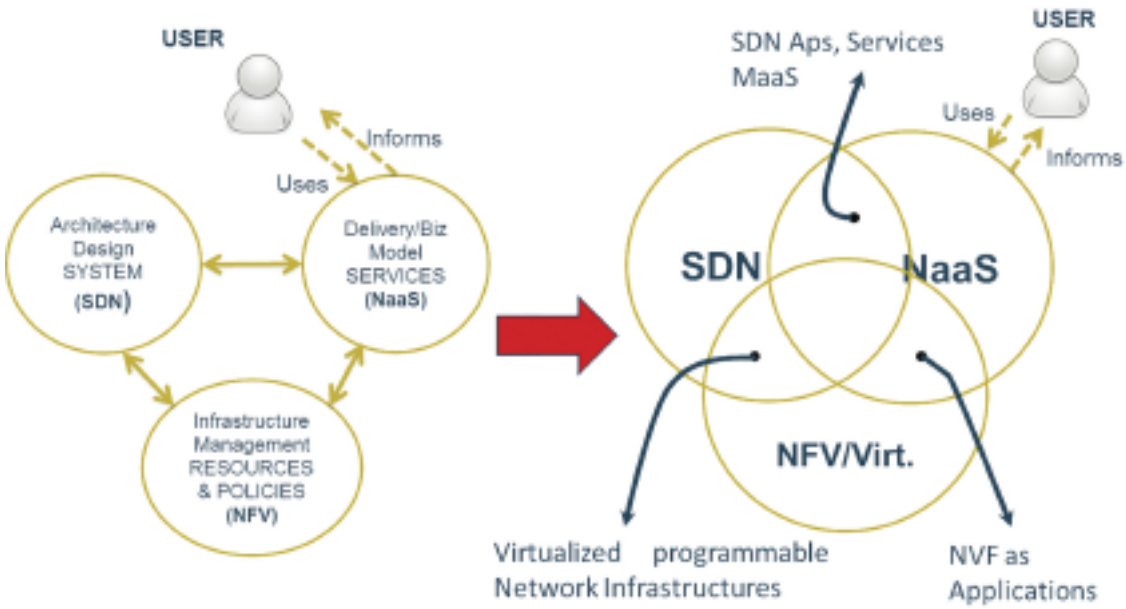

Figure 1. NaaS-SDN-VFN current ecosystem and foreseen one step beyond

III. IMMEDIATE CHALLENGES AND CONCLUSIONS

From a technical perspective there are key specific missing pieces. NFV/SDN based services development is cumbersome and not yet easy to operationalise with high speed. Much of the process is still a manual and hence slow, and unreliable. And without proper deployment and operational support tools, the adoption of virtualised services will be slow.

On the operational side, telecoms must be able to rapidly adapt and shift. Software-driven networks introduce a need to deal with a rapidly changing environment. Likewise, a similar approach in the network industry can leverage NFV and hardware independence.

On the user side, it is fundamental to create Real Value proposition: Make an assumption about what will make NaaS, NFV and SDN useful to users, validate it, and report on the limitations/needs/specific requirements in NRENs' facilities. While the user might be interested in the technology, they will certainly be interested in the end result.

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VITAE

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Dr. Eduard Escalona is Director of the Distributed Applications and Networks Area at the i2CAT Foundation. His main research interests are related to SDN and control and management of future internet infrastructures.

Dave Wilson studied Computer Science at University College Dublin and now works for HEAnet, where he is responsible for the IP network. He is co-chair of the RIPE IPv6 working group, and active in GÉANT.

Victor Reijs manages the Network Development department in HEAnet and is actively involved in international activities including GN3plus, XIFI, Network as a Service (NaaS/SDN), as well as (optical) networking, point-to-point links, virtualisation and monitoring in general.

SURVEY: NETWORK AND CLOUD COMPUTING

A QUALITATIVE ANALYSIS

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Abstract—This article summarizes results of cloud survey carried out by GN3plus and JRA2 T1 team.

I. INTRODUCTION

Increasing popularity of cloud services as well as new emerging network technologies may impose new requirements to the Research and Education Networks (RENs). To investigate how cloud service provisioning may influence networks a survey focusing on network requirements as to Cloud Computing was constructed and sent to GÉANT (N)RENs; thus the questionnaire asked primarily on 'what can the network do for clouds'. In detail the survey was focused more technically on SDN/NFV[1][2], the network set-up, statically or dynamically configured and their virtualization and processes, respective used technologies. On cloud computing we followed the conventions of NIST[3].

II. RESULTS OF THE SURVEY

The survey feedback is about 20 responses from the (N)REN community. The highlights of the feedback are presented. Signee's affiliations could be divided into three categories:

- National Research and Education network
- Research organizations and Universities
- Others (e.g. private research labs)

Today building cloud services were mostly focused on the RENs' requirements based on national roadmaps with academic ICTs and/or their research community as target audience. The feedback showed that 57% of all responses provided offerings or consumed cloud services as IaaS and PaaS. Only 10% described offerings/services on SaaS and 13% listed providing/consuming other services. Other services were mostly a mix, e.g. VMs with Linux or Windows OSes, firewalling, separate subnets for research projects, big data services or providing/consuming individual services locally or on specific HPCaaS.

Answering the question of the maturity level on Cloud computing we could summarize it as Building Cloud Competencies (BCCs), instantiated by national/international projects, initiatives, trials and prototyping, standardization work, and own deployments on institution's level.
As for the specific network requirements when asked about the access to clouds, NRENs' user relied on dedicated connections, whereas users outside the campus network indicated to use the commodity Internet or VPNs. 20% of the respondents noted to have limited bandwidth.

Answering the questions about network configuration, (static vs dynamic), 80% of respondents indicated that they use statically configured networks; 20% use both. For dynamic configurations mostly classic approaches such as VLANs and VPNs were mentioned, but some answers also listed more advanced technologies such as GÉANT BoD[4], OpenStack Neutron[5], that includes a set of APIs, plug-ins reflecting SDN to the network. The evaluation of the network configuration answers showed also that today 75% of the NRENs mostly still rely on VLAN for traffic isolation between tenants; VXLAN (15%) and GRE tunnels (15%) were also listed. Further, some NRENs described technologies like MAC address space separation, proxy ARP or MPLS configurations.

Looking for expertise in SDN/NFV implementation at the (N)RENs, 66% of signees declared familiarity of the terms and implementation forms of SDN and NFV, mostly on research and engineering level; but the survey showed too that 30% of respondents are waiting for hardware based SDN implementation and are willing to take this into account when considering upgrades of network devices. Up to 60% indicated that they are currently developing or planning deployment on SDN apps. However today none of the respondents does allow end-users, students, researchers and staff into the NRENs community to deploy their own apps.

Answers to the questions as to inter-cloud computing, e.g establishing of federations, confirmed that approximately 60% of respondents actually had experience with inter-cloud computing. On the wish-list NRENs replied that they would prefer hybrid clouds in which private and public cloud services are interconnected but with unified mechanisms and automation in place for operating both.

The question about existing cloud service portfolios and future plans of new services showed various trends, the most important ones are:

- TaaS for research/experiments, e.g. video streaming and in-network caching experiments.
- Cloud services on demand, e.g. VMs and GUIs. This implies orchestration, aggregation and distribution of resources is in a wider scope, OpenStack as an orchestrator is in focus.
- Providing Cloud Storage to the GÉANT community, e.g. on Synnefo Pythos.
- Having a concept of a Cloud FEDERATION, IaaS cloud and Satellite image processing.

III. CONCLUSION

To support cloud computing network requirements identified in the survey both stable and high quality IP network, as well as providing advanced (network) services and testbed services for when it comes to SDN availability should be assured. Central cloud services brokerage is a good approach and open the door to cloud federations. Such services may leverage efforts to host cloud services within different NRENs' networks or may integrate national cloud initiatives under a collaborative umbrella. For federations of cloud services, mechanisms for resource planning, federation of credentials and common service portfolios should be investigated.

ACKNOWLEDGEMENT

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[5] OpenStack Neutron, http://searchsdn.techtarget.com/definition/OpenStack-Neutron

OPEN CLOUD EXCHANGE (OCX)

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Abstract—This paper presents the concept of Open Cloud eXchange (OCX) that has been proposed by the GN3plus JRA1 task2 activity to bridge the gap between two major components of the cloud services provisioning infrastructure: Cloud Service Provider (CSP) infrastructure; and cloud services delivery infrastructure which in many cases requires dedicated local infrastructure and quality of services that cannot be delivered by the public Internet infrastructure. This documents also describes the features and benefits of GÉANT's Open Cloud eXchange (gOCX) as a proposed architecture solution to run data intensive real-time cloud applications on top of GÉANT to address the growing demand for cloud services within the R&E environment.

Index Terms—Intercloud Architecture Framework (ICAF); Open Cloud eXchange (OCX), GÉANT Open Cloud eXchange service (gOCX), Intercloud Federations Framework, Dynamic Trust Establishment.

I. INTRODUCTION

The continued rise in the use of cloud computing [1, 2] means that there is also a growing demand for these services in the research and education (R&E) environment. This creates new challenges for National Research and Education Networks (NRENs) as additional strain is placed on their networks. A reliable high-performance networking infrastructure is therefore necessary to facilitate the delivery of cloud computing services to end-users in the R&E community [3].

In many cases large Cloud Service Providers (CSP) establish a Point of Presence (POP) for large customers. On the other hand, customers with distributed campuses are willing to extend their network to one of the CSP's POP.

The Open Cloud eXchange (OCX) has been proposed by the GN3plus JRA1 activity as a new concept and a new functional component of the general inter-cloud infrastructure. OCX intends to bridge the gap between the two major components of the cloud services infrastructure: (1) Cloud Service Provider (CSP) infrastructure that typically has a global footprint and is intended to serve the global customer community; and (2) cloud services delivery infrastructure which in many cases requires dedicated local infrastructure and quality of services that cannot be delivered by the public Internet infrastructure.

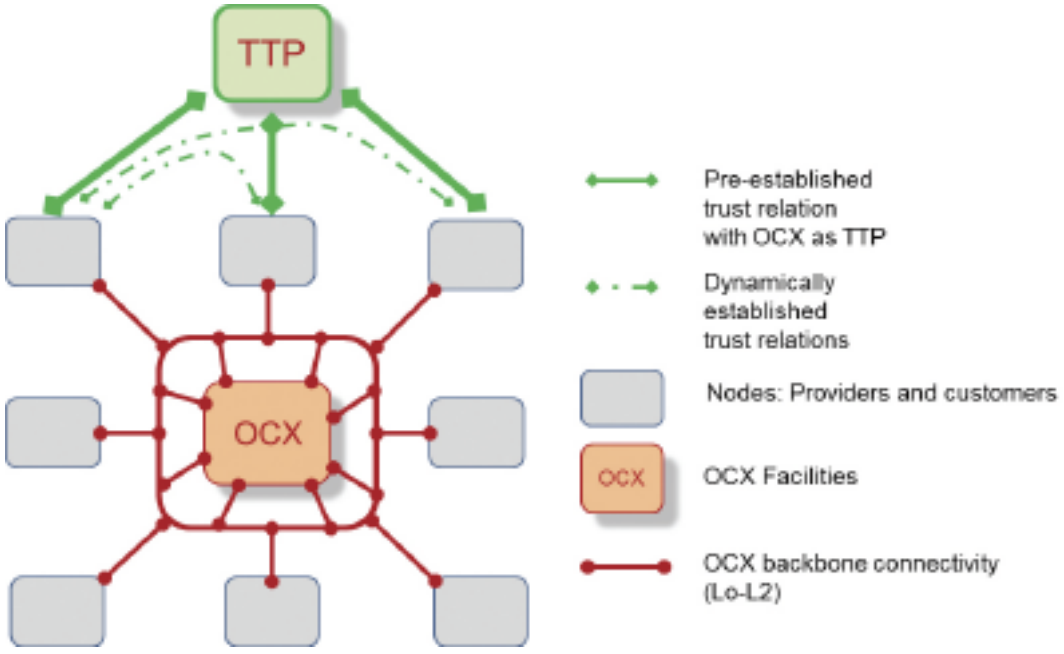

Figure 1. OCX interconnection capability and TTP role in establishing dynamic trust relations between OCX members

II. CLOUD USE CASES FOR UNIVERSITIES INSTITUTIONS AND NREN'S

Typical cloud use by universities and research community motivates the need for dedicated delivery infrastructure for cloud services in order to support advanced research and collaboration [4, 5]. In this context the GÉANT/NREN network [6] clearly has great potential to undertake the role of cloud service delivery network both within the R&E community (for academic CSPs), and outside it (offering high-performing service delivery for public CSPs). In any case, the increase in use of cloud computing in the R&E environment means that the need for the GÉANT network to take on this role will be inevitable in the near future. A major goal of the Task was therefore to review the status of the network architectures for cloud services delivery and lay down the steps for the future evolution of the GÉANT and the NRENs as a composite cloud service delivery network that will offer high dedicated bandwidth and QoS to their demanding cloud end users.

With this goal in mind, a fruitful communication was initiated with a number of CSPs, which in the case of Amazon Web Services (AWS), for example, resulted in the awarding of the Amazon Educational Grant [7] which has been an important step in the promotion of cloud computing and cloud-ready networks in the GÉANT/NREN R&E community.

Much positive feedback has also been received from Microsoft Azure, CloudSigma, Kentis and Equinix. All of these contacts have established the ground for further strengthening collaborations, especially with the CSPs that have also supported the idea of gOCX and participated in the demo scenarios.

III. OPEN CLOUD EXCHANGE (OCX) ARCHITECTURE

The OCX architecture is a response to the demand from the R&E community for federation-based cloud services with high-performance connectivity from campus/labs to cloud resources and scientific data sources; referring to the generic Cloud Services Model (CSM) [8]. Designed with power cloud users in mind, the main goal of the OCX architecture is to provide dedicated infrastructure that will bring together the CSPs and users in an efficient, fast, reliable and cost effective manner, facilitating intercloud computing federations. Please note that, in the rest of the text, the term user (or end-user) is used to represent a power cloud user coming from an R&E organization (e.g. group of big data scientists from a research institute) that would like to use one or more integrated cloud services.

gOCX is defined as (shown in Figure 1):

- Physical Point of Presence (PoP) for providers and customers
- L0-L2 network interconnection facility (optionally also connectivity with dedicated optical links)
- Marketplace that offers:
  - a service directory, in which CSPs publish their services and users can discover and subscribe to services,
  - "connectivity as a service" via automatic link provisioning: users can set up connectivity on-demand (which in turn provides short "time-to-market"),
  - an SLA Repository and Clearing house;
- Trusted Third Party (TTP) that can act as:
- Certificate directory that facilitates dynamic federation service agreements,
- Trusted introducer for dynamic trust establishment.

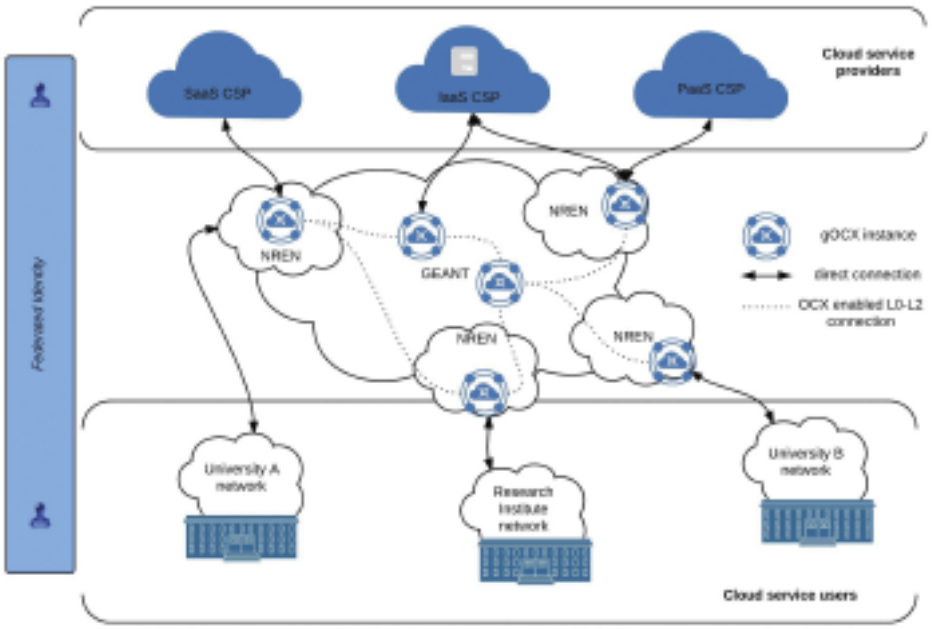

Figure 2. OCX instances deployed in NRENs and GÉANT connected to main stakeholders

When deployed on top of the GÉANT/NREN network (see Figure 2), the gOCX, as defined above, involves a hierarchical distributed system with OCX instances in multiple NRENs, and one or several OCX instances at the level of the GÉANT network, which are used not only for connecting CSPs, but also for orchestration and performance purposes. GÉANT Open Exchanges [9] can easily add the role of OCX instance. The physical placement of the OCX instances is mainly determined by the geographical closeness to cloud users and providers in relation to the number of willing parties (CSPs or users) to connect in that area. This means that any NREN close to the physical location(s) of one or more CSPs could host an OCX instance to which a given CSPs could connect using a direct L0-L2 connection. Once a CSP is connected to at least one OCX, the services it offers can be used by the whole GÉANT/NREN community via the same OCX instance (for local users) or a different one (for remote users), depending on availability of necessary resources (ports and bandwidth). Actual network usage is subject to policy restrictions defined by GÉANT as applicable at the time.

The proposed OCX architecture and service model is built upon successful services like Internet Exchange (IX) [10] for general Internet traffic exchange and GOLE (GLIF Open Lightpath Exchange) [11] that provides lightpath interconnection service.

IV. OCX DESIGN VALIDATION

In order to test the implementation of the gOCX design for power user use cases the Task started with the organisation and deployment of the demo scenarios. These demo scenarios also helped to obtain increased understanding of the necessary steps that need to be defined and further automated within gOCX, as well as of any possible difficulties and side issues that might have been overlooked. The main aim of developing the demo scenarios was to start early-stage negotiations with different CSPs so as to obtain valuable feedback which would enable the Task to assess their interest in collaborating on the gOCX proposal.

A. Demo scenario I: Terena Network Conference2014

In order to create a proof of concept demo that will highlight the benefits of using gOCX, a simple test scenario was defined and presented in real time at the TERENA Networking Conference, in 2014 [12]. The aim of the proof of concept is to present how the gOCX solution can provide a reusable network infrastructure that will deliver guaranteed QoS compared to the public Internet best effort connection alternative.

The demo scenario was defined as follows: two institutions (A and B) would like to combine and edit several, locally available, HD video streams. Two separately provided video streams are to be combined into a single HD video stream using a cloud IaaS and storage provider [Okeanos]. The single combined stream is edited using image manipulation software available from a different CSP [CloudSigma]. The video data located at the University of Amsterdam (UvA) is transferred to and from the computing resources demanded from Okeanos [13] and CloudSigma via the direct connections established using the OCX instances. The resulting video is then sent to both participating institutions (clients).

B. Demo scenario II: Supercomputing Conference 2014 and Helix-nebula 2014 assembly

The second demo scenario is an extension of the proof of concept intended to introduce more participants in the demonstration. The extended demo scenario involves multiple cloud service users from academic institutions that are connected to GÉANT via different NRENs. Most of the users have opted for gOCX to benefit from a joint service from multiple CSPs, while one uses the traditional approach (commodity Internet instead of the direct L0-L2 connections provided by the OCX infrastructure) so as to enable a qualitative and quantitative comparison of both approaches to be carried out. The demo scenario and its results were presented live at the Super Computing conference SC2014 in the USA.

The task to be completed in this demo scenario was ultraHD Video Editing and Streaming. Several institutions (University of Amsterdam (UvA), the Croatian NREN (CARNet) and the NREN from Israel (IUCC) collaborate on efficient transcoding and streaming of 4K movies stored at UvA. In the extended version the resource pool is enlarged with a number of new CSPs. To transcode the vast amount of data, a number of VMs are spawned at Okeanos via GRNET OCX, at Cloud Sigma via SWITCH OCX, and at Kentis via NetherLight-SURFnet.

As shown in Figure 3, UvA and CARNet are connected to their local OCX instances, which enable them to easily gain direct access to the necessary cloud resources via high-performance dedicated network links. On the other hand, the IUCC demonstrates the traditional approach by connecting via the standard Internet at the closest GÉANT PoP, while accessing cloud services via GRE tunnelling.

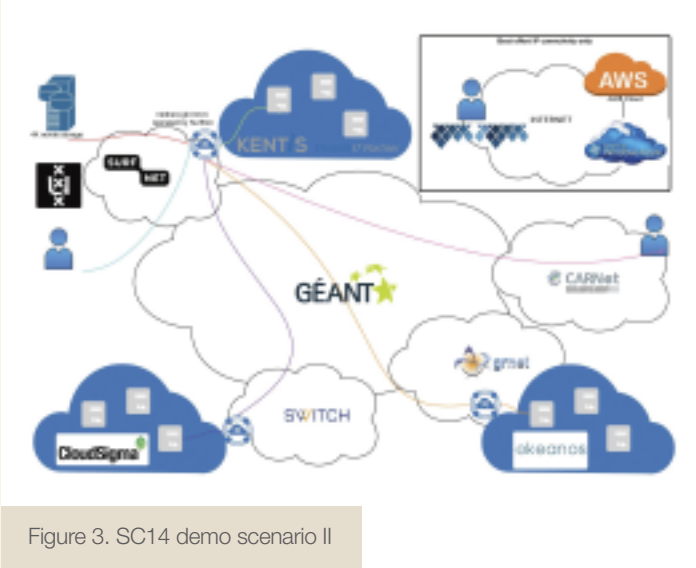

Figure 3. SC14 demo scenario II

Additionally, on-demand networking using an OGF NSI (Network Service Interface) connection service has been implemented by the CSP Kentis. The service enables on-demand connectivity between Kentis and other NSI-enabled users and CSPs. In the demo, UvA uses the API provided by Kentis to set up dedicated paths via NetherLight's OCX that connect VMs spawned at Kentis to the UvA network, creating a network extension.

V. CONCLUSION

The expansion of cloud computing services demands that the NRENs and GÉANT adapt their networks and services offer portfolios to include cloud-ready networks that offer high-level cloud services to their end users. To further this goal, the JRA1 task 2 team proposes that a gOCX architecture be adopted as to provide a cloud-based collaborative infrastructure to support new emerging data-intensive research domains and applications. The hierarchical structure of OCX points will enable direct, on-demand connectivity between users and CSPs, providing dedicated bandwidth and the needed QoS and solving the last mile issues.

The gOCX architecture presented here can be extended [14, 15] to bring more benefits in the future, such as: offloading traffic which could lead to lowering costs of Internet traffic, the provision of TTP services through eduGAIN, and a broker service/marketplace which will allow the R&E community to choose from a broad range of cloud services that guarantee network service levels while maintaining logical separation from the Internet.

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FUTURE NETWORK ARCHITECTURES

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Abstract—This study identifies key requirements for NRENs towards future network architectures that become apparent as users become more mobile and have increased expectations in terms of availability of data. In addition, cost saving requirements call for federated use of, in particular, the optical spectral resources.

Index Terms—Cloud services, federations, network architecture, alien waves, time synchronisation, Open exchanges.

I. INTRODUCTION

In the future, the NRENs face a number of requirements from user, technology and cost perspectives. The work in GN3plus JRA1 Task 1 has focused on these requirements and has focused on integrating the key findings from all other tasks including Open Calls in JRA1 in the quest for a viable solution. The users today are everywhere and they expect 24/7 access to their data with an acceptable quality. This boosts the demands for fixed and mobile cloud services, which again places severe requirements on the way the future network is equipped and managed. In addition, the NRENs are typically faced with cost reduction demands, and such different requirements call for a new network architecture which in particular takes federated use of resources into consideration. This work investigates requirements to the future network architecture and provides a set of guidelines useful for NREN operator. The framework of the work is shown in Fig. 1.

II. REQUIREMENTS TO FUTURE NETWORK ARCHITECTURES

The collection of requirements towards future architectures is based on general literature, work in related GN3plus JRA1 tasks [GN3p-JRA1-T3, GN3p-JRA1-T2] and key results European projects CONTENT [CONTENT], BonFire [BONFIRE], and GEYSERS [TZA-2014]. The requirement analysis reveals that the current network technologies and architecture cannot offer the fully dynamic and flexible transport services needed for the future service orchestration; a service orchestration which should include both IT and network infrastructure resources. In addition, new technologies emerge for very high bandwidth, and the ability to understand and manage these technologies should be supported. From the cloud perspective, it is needed to provide the infrastructure to support GEANT Open Cloud Exchanges (gOCX) and further for cost reduction purposes implementing Open Exchange Points.

III. TECHNOLOGIES TOWARDS FEDERATED USE

The GN3plus JRA1 Task has collaborated closely with the two Open Call projects REACTION [REACTION] and MOMoT [MOMOT] which deal with the optical spectrum from bandwidth improvement and alien wave aspects, respectively. The joint work has resulted in an improved understanding of the spectral impact of different modulation schemes and Alien Waves, which is highly needed for utilising the spectrum for ultra-high bandwidth and federated use of spectral resources. Also, the work provides a survey on the common techniques for increasing bit rates including sophisticated modulation schemes and super channels. Possible models for the set of technologies typically available at an NREN are shown in Common technology mapping. And the models are compared to vendor roadmaps. This provides an overview of the basic handles and tools available for NRENs; understanding these handles is the key to identify possibilities for cost saving federations.

When the traditional TDM technologies in the WAN are replaced with Ethernet, the intrinsic timing reference is no longer available. This calls for alternative technologies to ensure the time synchronisation between

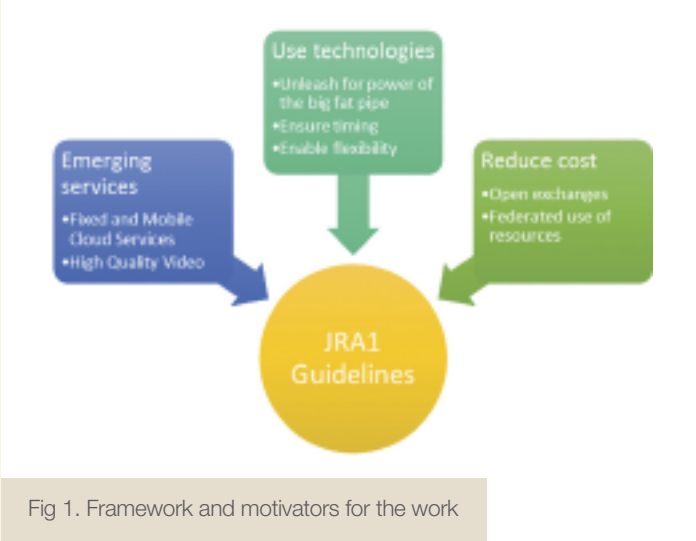

Fig 1. Framework and motivators for the work

services in the NREN environment. In the work, technologies have been evaluated for providing synchronisation in the sub ps and ns scales. Specifically, experimental evaluation of PTP for providing synchronisation between Nuremberg and Munich over a packet switched network has been conducted with successful results for normal network conditions. Also timing stability necessary for comparison of atomic clocks has been achieved relying on regular alien waves within two DWDM systems [VOJ-2014].

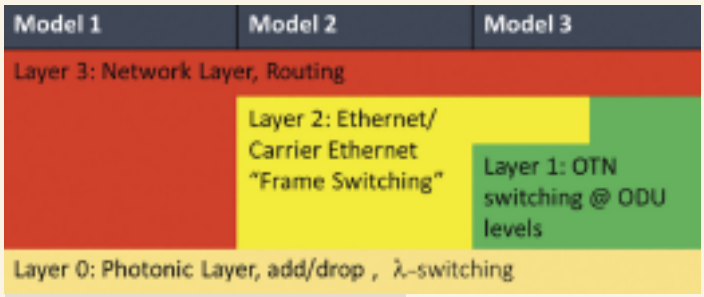

Fig 2. Common technology mapping

IV. SUGGESTED ARCHITECTURE

Knowing the emerging technologies and the tools available at the NREN it is possible to sketch a network architecture supporting the future need for cloud computing, mobile access and seamless provisioning of network resources and Zero Touch Connectivity. The suggested network architecture is shown in : Suggested Network Architecture

The Physical Infrastructure Layer is multi domain, and comprises very heterogeneous technologies. The basic elements that can be manipulated are among others fibres, lambdas, spectrum, ODUs, Ethernet, exchanges points, computational and storage resources. The set of technologies depends on the given NREN and a key recommendation is to identify which of these resources are suitable for federated use.

The Physical Infrastructure Management is responsible for providing management of physical resources and enabling capabilities such as sharing resources. A key challenge is a unified description of the physical resources needed for scaled integrated provisioning.

The Control and Service Orchestration layers are responsible for the service provisioning and orchestration of IT and network resources.
A number of relevant technical solutions have been investigated and proposed for a variety of scenarios spanning from multi-layer architectures up to procedures, protocols and interfaces allowing integrated workflows to support delivery and operation of joint cloud and network services. It is recommended to implement unified management in the network and integrate existing solutions with available Open Source management platforms.

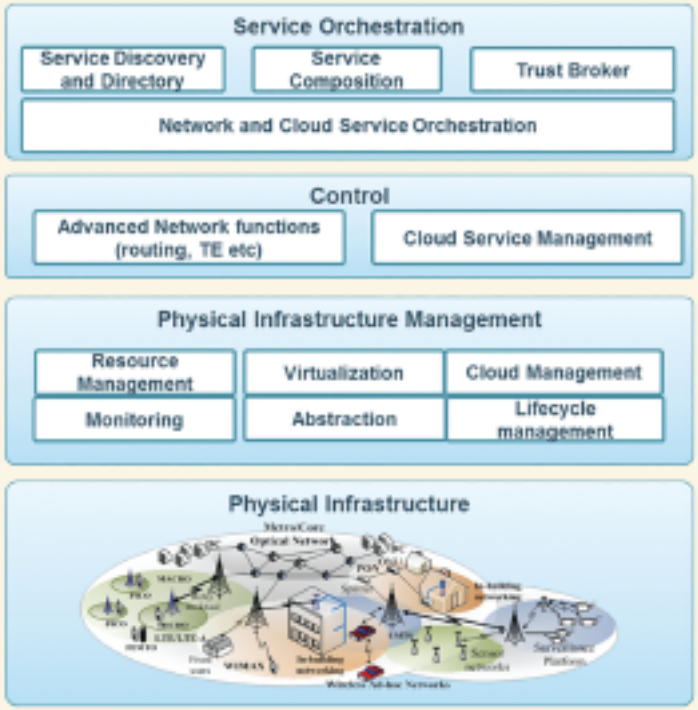

Fig 3. Suggested Network Architecture

V. CONCLUSIONS

The mobility of NREN users and the requirement to always access data in the cloud identified new requirements towards network infrastructures. This work has addressed these new challenges by investigating the requirements to come up with guidelines for the NRENs for their future network architectures. The technology enablers for realising this, e.g, bringing the networks beyond 100G have been addressed, and a new modular network architecture has been derived.

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NRENS IN THE WIRE-FREE WORLD

"NETWORK ARCHITECTURES FOR AGGREGATING HIGH-SPEED WIRELESS/MOBILE NETWORKING"

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Abstract—The community demands seamless access proposal integrated across technologies and thus extending the confines of university premises. The task has identified network technology enablers to achieve this in the R&E environment. The paper outlines three main directions of technology research and prototyping future wire-free world.

I. INTRODUCTION

The industry proposal for Horizon 2020 network architecture [1] considers the possibility that one trillion devices will be connected in Europe alone. The uptake of WiFi and introduction of 4G has increased the interest in the mobile learning concept [2]. The network architectures for the aggregation of high-speed mobile and wireless networking are becoming an important enabler of contemporary R&E activities.

Deployment of eduroam forms a firm ground for further involvement into the mobile/WiFi architectures. Novel architectures are aimed to improve the experience to match the demand. The task has identified two key elements to improve:

1. seamless roaming in the extended heterogeneous radio access environments, and
2. expansion of the footprint of eduroam access.

II. ROAMING AND HRAN

Integrating different wireless access technologies to provide users with data services will result in the creation of a heterogeneous radio access network (HRAN), e.g. Wi-Fi and cellular networks operated by the same entity to provide data services to its users. Moving from one wireless network to another can cause traffic to restart on a new interface on the UE. Current industrial solutions [3] address the UE handover within a network operated by a single entity (operator). Owning a mobile network code is an important prerequisite to become Mobile Virtual Network Operator. Obtaining one, however, requires offering a public ICT service. Since many NRENs offer service to a closed community, a mobile network code cannot be obtained and hence NRENs are forced to look for alternatives to integrate Wi-Fi and cellular networks.

However, the reality of the R&E community is more complex than that presented by the homogeneous operation of a single-provider network. The close geographical proximity of different wireless technology domains operated by different entities is the common situation.

The proposed solution for vertical handover aims at making the handover process transparent and fast so that the UE does not have to perform any complex algorithm or application restart. The proposed methodology utilizes the SDN approach to implement Proxy Mobile IPv6 [4] protocol extensions for cooperation between the WLAN domain and the Evolved Packet Core (EPC) in the cellular domain.

The data path characteristics may be optimized by establishing physical connections between LMAs of adjacent providers.

The idea promoted to solve the multi-domain handover problem requires new areas to be evaluated and developed, so the modeling and simulation work is preferred at this stage. A model for the signaling path has been built in OPNET Modeler to evaluate the complexity of the protocol.

III. EXPANSION OF EDUROAM FOOTPRINT

A. eduroam in the public areas

eduroam has already established its success, with a constantly growing number of connected sites and a large number of researchers and students using eduroam for their specific research needs as well as simply to gain Internet access. eduroam is available in most R&E institutions in the EU and many outside the EU. eduroam is usually available in the areas covered by the Wi-Fi networks of the participating institutions – mainly university campuses. The idea for expanding the eduroam coverage beyond campuses is to use WiFi infrastructures belonging to other providers as access networks for eduroam. It is expected that WiFi providers who provide their services for free (like municipalities, conference centres, transportation hubs, etc.) should not be opposed to introducing the eduroam SSID in their infrastructures, while providers of commercial services will require more advanced business cases.

There are some working examples of eduroam in non-campus infrastructures, including city centres, airports and R&E community events that support the idea of expanding eduroam outside campuses.

B. WaaS

As a consequence of the popularity and growth of Wi-Fi, the operational overhead to maintain and manage a Wi-Fi environment has become considerable for institutions. Furthermore, the Wi-Fi network needs upgrades rather frequently as a result of demand for flexibility, functionality and capacity. At one hand institutions rely on a good proper functioning Wi-Fi network whereas at the other hand they increasing focus on their core business. Combining the two trends, institutions may soon lack the resources and knowledge to purchase and/or install and maintain a Wi-Fi service. As the NREN is the institute's collaboration organisation which has proven itself by delivering a reliable internet connectivity, their service can be extended by offering deliver Wi-Fi as a service (WaaS).

WaaS architecture used in pilot implementation

WaaS builds upon current existing models as cloud-controlled and cloud-managed Wi-Fi networks. The Wi-Fi components at the various institutions must be managed from a central location. All sites will have common radio planning and installation methodology and operate on the same hardware. The basis of the WaaS-architecture is that the Wi-Fi access points can be easily connected to the NREN's infrastructure via the Local Area Network of each institution.

IV. CONCLUSIONS

The performed simulation of PMIPv6 [4] extensions has shown that:

- It is possible to achieve seamless handover between different operators.
- The data path in this case mandates sufficient network connectivity between operators to support data flow to the home MA.
- SDNs have evaluated as a signaling technology. SDN and OpenFlow technology framework is not yet mature enough to support required functionality of interworking between administrative domains (operators).

eduroam service take-up in Poznan indicate that the ultimate feasibility of such service. It can be provided by NRENs but there are cases of local universities extending their eduroam coverage into the public areas.

Number of eduroam user authentications in the Poznan municipal network

The PoC implementation of WaaS show that such service is feasible for R&E institutions. The implementation phase revealed important steps like quality of access that have to be taken into the account while planning and implementing it.

The results of the study show that the community formed of the NRENs and GÉANT possesses the capabilities and is in the position to provide a fundamental contribution to the expansion of the connectivity.

The WiFi and mobile service offering of GÉANT and the NRENs directly to individual R&E community members diffuses the established organizational boundaries of R&E networking. NRENs are relying on campus networks to provide the underlying infrastructure needed to offer WaaS, or offload public area traffic at the aggregation level. The federated use of network resources should be adopted by the community to facilitate operation of both local and centralized services on the same physical infrastructure. Wi-Fi and mobile (2G/3G/4G) services complement one another.

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Q&A

WITH GUY ROBERTS AND RICHARD HUGH-JONES: STANDARDS IN GÉANT

What's the importance of standards?

Guy: Standards are the cornerstone of technology development. Standards allow the community to get together to agree a common approach to solving technical challenges. The Internet is built around standards developed in ITU, IEEE, and IETF among others. These standards remove risk for equipment vendors and network providers – an IETF Standards-Track RFC provides a commonly agreed method (such as a protocol) that allows vendors' equipment to interoperate.

The importance of standards is highlighted when they go wrong. For example when the market place is split by competing standards (Betamax vs. VHS) or standards are over-engineered ATM (Asynchronous Transfer Mode). But when we get standards right they are technology enablers, and as a community GÉANT needs to be actively engaged in the standards development to enable the innovative new services for our community.

How are standards making a difference in the R&E community?

Guy: One of the greatest achievements in European R&E networking has been the invention of the World Wide Web. One of the lessons to be learnt from the www is that a great idea needs to be standardized if it is to endure and develop. It you get this right, there is almost no limit to the reach a protocol can achieve. The new services we are developing in GÉANT must be part of a community effort to thrive. This means the community must agree a common approach which is formalized, either in standards or via de-facto standards such as open-source code developments.

Can you give an example of successful GÉANT engagement in standards development?

Richard: GÉANT operates the Wi-Fi roaming consortium eduroam in Europe. Eduroam has tens of thousands of hotspots and millions of end users and is making use of the "Wi-Fi Certified" label as criterion for its equipment. GÉANT has been active in the Wi-Fi Alliance to influence Hotspot 2.0 to ensure that it is eduroam compatible.

Can standards drive new GÉANT services?

Guy: Yes, the Network Services Interface (NSI) standard that has been developed in the Open Grid Forum www.ogf.org is a good example of how the NREN community can drive new technologies through standardization. Across the world there are many local dynamic circuit services, however these have been built around proprietary or regional protocols. NSI has brought together many NRENs from the US, Europe and East Asia to build a consensus standard. NSI is a web service based protocol that allows global dynamic circuits to be negotiated.

Picture
Guy Roberts, Senior Transport Network Architect, GÉANT

How does GÉANT's innovation programme impact standards?

Richard: Three IETF Internet drafts have come out of the GÉANT Open Call program as well as one OGF draft. These contributions have helped support GÉANT's service portfolio. For example the SENSE project has defined an Extensible Authentication Protocol (EAP) configuration file format that enables your mobile device to set up authentication parameters in an automated way on multiple platforms.

OVER 100 GBPS TO BRIDGE ITALY'S DIGITAL DIVIDE: THE GARR FIBER OPTIC NETWORK

In just two years, the GARR-X Progress project has built an infrastructure to extend and enhance GARR's research and education network. The project is supported by the Ministry of Education, University and Research, and aims not only to reduce the digital divide, but also to convert some Italian regions into real innovation laboratories. Funded with EUR 46.5 million with 5.5 million dedicated to connecting schools, GARR-X Progress targeted Italy's Regions of Convergence, where the European indicators on competitiveness and technological innovation are below the EU average, considering that the regular use of the Internet is around 40% while the objectives of the European Digital Agenda are set at 75%. Thanks to the project, currently Southern Italy has a digital infrastructure more advanced than the rest of the country, with a backbone of about 4000 km with a transmission capacity at 100 Gbps and up to several Terabits, highly distributed across 4000 km and 24 Points of Presence (PoP) (restructured and strengthened to host the new network equipment provided by the project) and a new distributed computing and storage environment of 8,448 virtual CPUs with capacity of 10PB.

Picture
Claudia Battista, Project Coordinator, GARR

There are hundreds of locations involved, including universities, schools, research centers, academies, conservatories, biomedical research institutes and cultural institutions (including museums, archives and libraries) that will benefit from a network access up to 10 Gbps, bringing aggregate capacity to over 400 Gbps, which is more than four times the current value, and serving about 500000 users among researchers, teachers and students. Finally, the project also provides training courses on the use, enhancement and development of digital infrastructures for different users.

We spoke to Claudia Battista, project coordinator.

GARR-X Progress is a very ambitious project realized in a very short time ...

Exactly. GARR-X Progress has achieved something really concrete for Southern Italy with GARR fully involved to deliver important results. We set ourselves some ambitious goals, making the most of all the experience we gained in the deployment of the first fiber optic network, GARR-X, setting up a highly efficient organizational machine and building an infrastructure similar to GARR-X in terms of size and complexity in half the time compared to the original effort. We started with the planning of the infrastructure, proceeding then with the adaptation and setup of Points of Presence, the delivery of fibers, the activation of the transmission and IP / MPLS network equipment, and the installation of hardware and software for the computing and storage infrastructure.

What technologies did you use?

For the equipment of the transmission network, the public tender was won by the innovative Infinera "Intelligent Transport Network" technology, which can support multi-terabit optical transmissions. The technological solution we chose is also adopted by the GÉANT network and is characterized by the use of so-called super channels capable of carrying on a single pair of long distance optical fibers a capacity of 500 Gbps (up to an aggregate of 8 Tbps) and deliver services from 40 to 100 Gbps.

We purchased routers in technological continuity with of the GARR-X ones: Juniper MX960 and MX480 updated with network interfaces at 40/100 Gbps, which allow the creation of a ring at 100 Gbps between the 4 core points of presence of Naples, Bari, Catania and Palermo, and the creation of links from 10 to 40 Gbps for the other aggregation PoPs.

A distributed computing and storage infrastructure has been implemented on five sites, which we plan to interconnect at 40 Gbps to create a single distributed data center available to the whole community.

What does a project like this mean for Italy?

It means first of all that we bridge the digital divide between different regions of the country. The regions of Southern Italy will be well positioned for participation in national and European research programs and in view of Horizon2020, bringing an advantage to the entire nation. The availability of a collaborative environment made up of symmetrical links and a simple and secure access to ICT resources to handle large amounts of data, will support the active participation within the European Research Area; we believe this can give a strong impetus to attract talent, knowledge and skills also in the South.

In accordance with the objectives of the Italian and European digital agendas, GARR-X Progress aims to become the enabler of existing collaborations and news ones; at the same time, it will allow users to experiment in a real environment innovative models of digital infrastructures that can be extended to the whole country.

A collaborative environment that will include school students, thanks to the connection to the GARR-X Progress network...

Yes, because one new aspect of the project is the high-bandwidth access for the schools. GARR-X Progress is expected to connect 130 schools in the four Regions of Convergence by the end of June, even in areas far from the largest towns, where the digital divide is stronger. These schools will join the other 130 already connected to GARR-X. The connected institutes are experiencing completely new learning processes, from distance learning to the creation of innovative training spaces, to the opportunity to participate in online university orientation courses. Our goal is to foster an innovative and experimental teaching environment by strengthening the link between schools, universities and research and by creating an integrated learning system of excellence at national level. The feedback we are receiving today from the schools is certainly very positive and I would like to let them speak directly!

Picture
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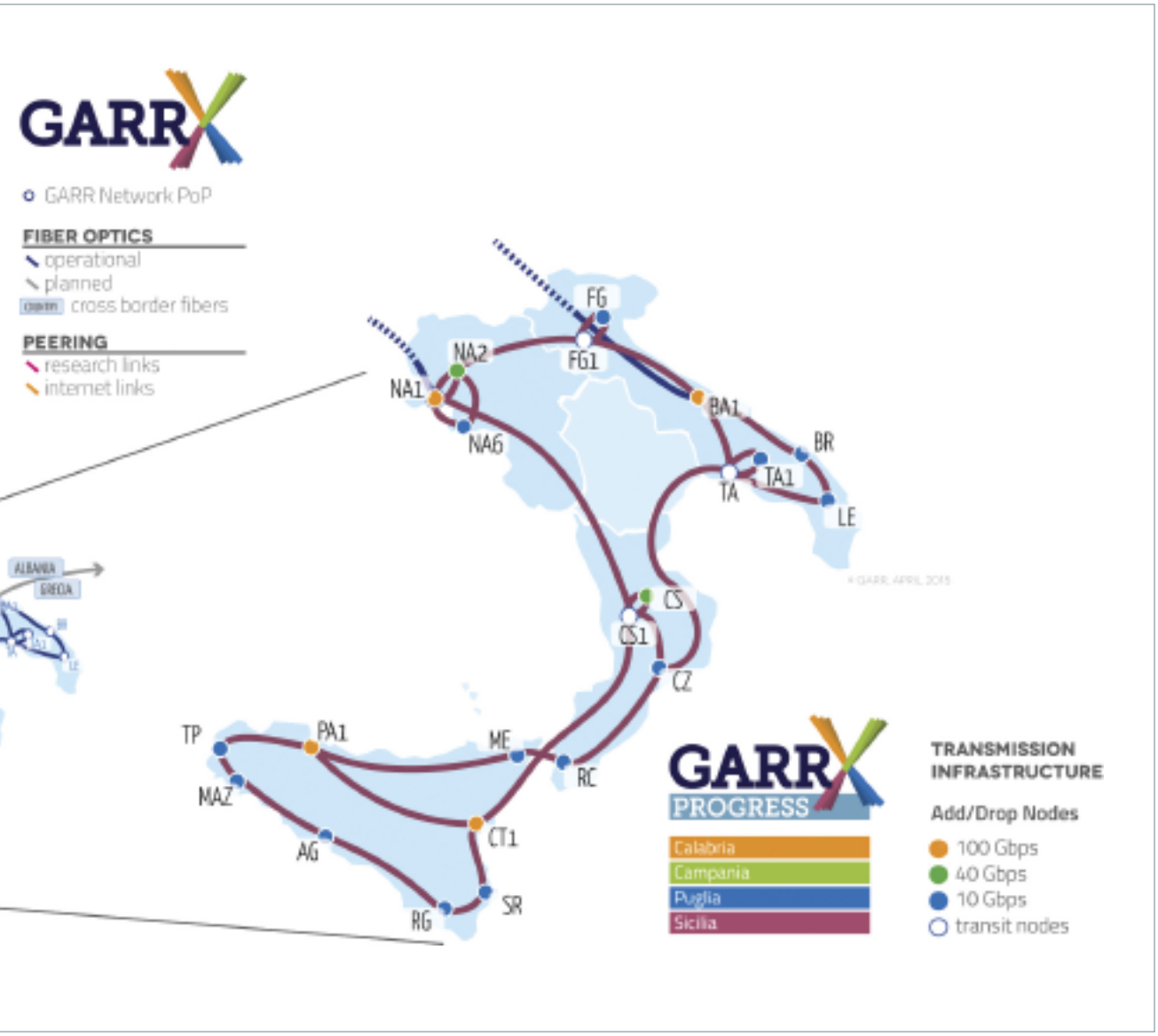


The schools speak:

Salvatore Giuliano – Headmaster of the Majorana Institute of Higher Education, Brindisi

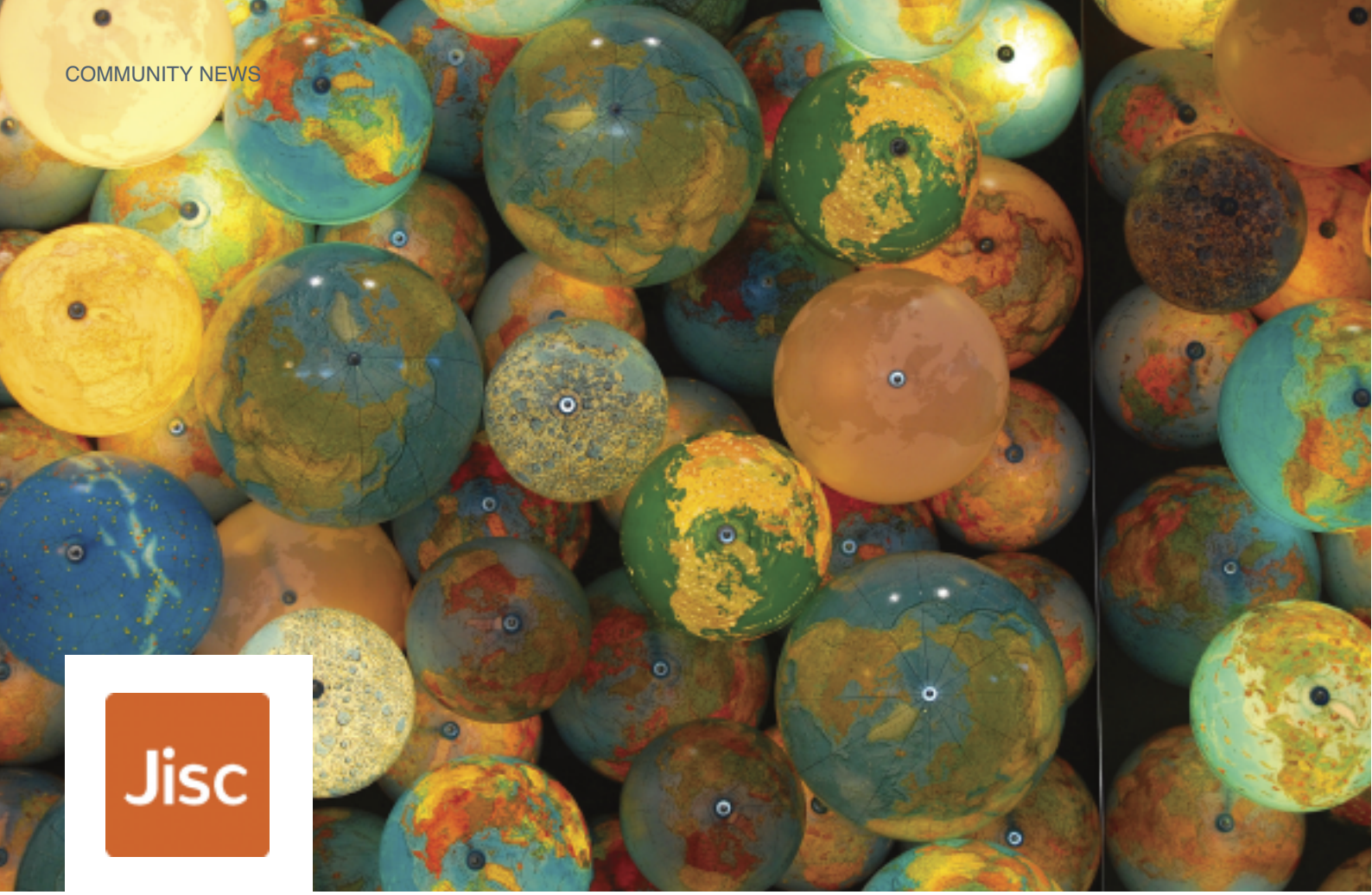
When we learned about the GARR network we quickly understood its potential. Thanks to the GARR-X Progress project, we are now connected with optical fiber and the advantage is evident. We are already a 2.0 school, but in addition now everyone can enter large amounts of data over the network in a short period of time. We have over 1,000 student devices and 500 computers: even the simple simultaneous viewing of a video for educational purposes would have been a problem without the high bandwidth network.

Antonio Guida – Headmaster of the Marco Polo Institute of Higher Education, Bari

We have been using electronic records, interactive whiteboards and tablets for three years, but only now we can make the most of them. As soon as we were connected to GARR we noticed an increase in capacity from 4 to 98 Mbps! The world has definitely changed. Without the broadband connection we could not start the Living School project to rethink the design of our learning spaces and conduct lessons even outside the classrooms.

Gabriella Chisari – Headmaster of the Galilei "Liceo Scientifico", Catania

We welcomed with enthusiasm the GARR proposal because we believe in educational innovation and in the opportunity to connect students with universities and private companies. We are doing our best to provide better learning opportunities for our students!



LOOK TO IT FOR NEW OPPORTUNITIES IN TNE

Technology is such a crucial part in delivering successful transnational education (TNE) programmes, so you would expect institutions' IT departments to play a big role in the planning and provision.

A survey we released at the start of the year with the Observatory on Borderless Higher Education (OBHE) about TNE in UK higher education (HE) showed this not to be the case.

Despite connectivity being integral to universities offering teaching to students in other countries, almost half (45%) of IT workers were in the dark about their own institution's TNE programmes. The number of IT staff included in the decision making drops even further, falling to 27% who were involved in TNE development planning, and only 1% in the initial decision making.

This lack of awareness runs through to service management, with just over half (52%) answering 'don't know' when asked about whether their institution had run into data-related problems through their TNE activities, while 57% were unaware if their institutional risk assessments included IT infrastructure.

Not only is this approach rather short-sighted in not considering future technology and network needs, it also opens up risks relating to cyber security and data protection.

For many organisations the fast-evolving Transnational Education (TNE) market has meant they haven't always had the time to fully consider the 'how', but connectivity is clearly a hugely important issue in providing a high quality, borderless education. If we want to ensure that the UK retains its position as a leader, universities and colleges' international departments need to be made aware of the vital role IT staff can play in the planning and delivery of TNE, and encouraged to engage with their colleagues.

It's hugely important that institutions understand and are given the support they need to deliver world-class TNE. We believe that this begins with communication. One of the outputs of the report is that we have embarked on a far-reaching engagement campaign with IT and international staff in both UK higher and further education. Our aim is to fill this knowledge gap, increase IT staff involvement in TNE development and delivery, and better share best practice.

To stay up-to-date, and view the report, visit **www.jisc.ac.uk**.

Words and Picture
Esther Wilkinson, business development lead for transnational education, Jisc

SHIBBOLETH UPDATE PROVIDES IMPROVED ACCESS AND IDENTITY MANAGEMENT

The research and education community is set to benefit from an upgrade to a free open source software system that will deliver better access and identity management services.

Version 3 of the Shibboleth identity provider offers significant functional and security enhancements to single web sign-on, including user consent and on-demand metadata lookup. It also supports the Central Authentication Service (CAS), the internationally-recognised protocol used by many universities and research organisations.

The software has been released by the Shibboleth Consortium - a collaboration of international research and education organisations. The two principal members are Internet2 in the US and Jisc in the UK. Jisc also acts as consortium operator, managing the day-to-day running of the group.

"This new release comes with many new features requested by the broad international community that uses Shibboleth to make informed access decisions and protect their online resources," said Shelton Waggener, senior vice president at Internet2 and chair of the consortium board.

Josh Howlett, head of trust and identity at Jisc, said: "Seamless and secure access to systems and services is paramount to the continued health of the education and research sector, which makes Shibboleth a vital tool in delivering effective access and identity management services.

"The latest release has been developed for the community, by the community, listening to their feedback to ensure the software truly meets their needs, both now and in the future. We will continue to work with the consortium to ensure this remains to be the case."

For more information visit **www.shibboleth.net**

Words
Josh Howlett, head of trust and identity at Jisc

UK RESEARCHERS SET TO BENEFIT FROM EASIER ACCESS TO DIGITAL SERVICES

A new service enabling researchers to access their digital resources and applications through a single, federated sign-on has been launched, thanks to Jisc, the charity that provides digital solutions for education and research.

A world-first, Assent, provided by Jisc, enables simplified, seamless and secure access to the broad range of web and non-web services that researchers commonly need – from cloud, email and file storage services, through to desktop login, high performance computing (HPC) facilities and secure data communications.

Assent uses the same open standards and open source software that underpin the two leading federated access services in global education and research: eduroam, the world-wide single sign-on roaming service, and the UK Access Management Federation, which provides web-only single sign on. It works by combining these technologies to provide a powerful and flexible access management solution appropriate to the needs of research.

There are significant benefits in adopting Jisc Assent for both institutions and their researchers.

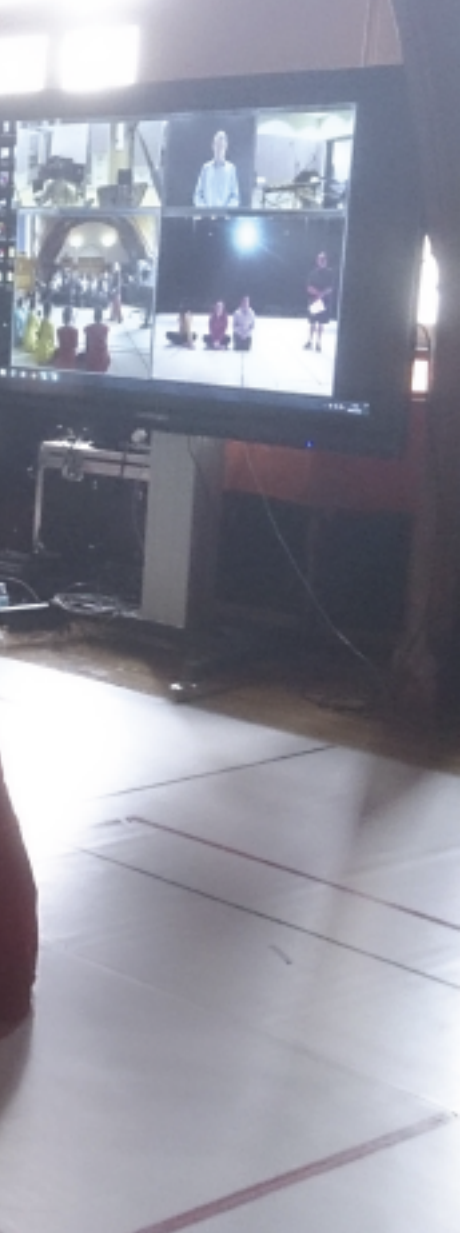
Institutions benefit by reducing the number of credentials issued to each user, greatly reducing the administrative burden and cost. User identities are managed by their home institutions, reducing the need to issue credentials from partner organisations.

For researchers, using Assent means they are able to seamlessly access the digital resources and applications they need to do their jobs, wherever it has been made available by a participating organisation.

If you are interested in adopting Jisc Assent, please contact **assent@jisc.ac.uk**.

NETWORK PERFORMING ARTS PRODUCTION WORKSHOP

GÉANT is a partner in the series of Network Performing Arts Production (NPAP) workshops, of which the last one was held between 4-6 May 2015 in London, UK. The use of the latest networking technology in combination with performing arts was demonstrated and explained, and an evening performance by students at the Royal College of Music was included for workshop participants.



Pictures
Left: Live multi-site dance performance with musicians in Edinburgh, dancers in Florida & London, featured by students from Liverpool John Moores University using Visimeet.

Top: Ann Doyle, Internet2, chairs panel discussion after the evening multimedia symphony by Mike Ladouceur and his creative team at Royal College of Music.

Bottom: String quartet playing live music between Trieste and London using the LOLA system.

It has been the most attended Network Performing Arts Production Workshop including the ten previous editions in the US and the four previous events in Europe. On average, over fifty people joined. After Trieste, Paris, Barcelona and Vienna, the workshop was hosted by the Royal College of Music and JISC/Janet in London, UK. Aside from the high number of participants, also a record number of technologies, performances, use cases, artists and networkers were achieved in the three day event.

The workshop programme included sessions where the latest networking technology was shown and explained in combination with live performances, one of which was a multi-site dance performance given by local dancers from Liverpool, remote dancers from Miami, Florida, US and musicians from Edinburgh, all using the Visimeet video conferencing technology. In addition to live demonstrations, the workshop participants joined in hands-on sessions with the largest collection of specialist arts and music streaming technologies ever assembled, such as 4K Gateway technology of CESNET, which was used to create a 10G connection between London and Prague.

On top of all this, round-table discussions with experts of various fields took place.
The workshop built upon the basic knowledge and skills of people who had already participated in one or more of the previous workshops in the series, but also people who had acquired knowledge by using the free online learning materials could partipate.

Multimedia evening symphony

On 5 May, Royal College of Music students, dancers from London and Barcelona as well as musicians from Copenhagen and Helsinki were brought together in a sold-out multimedia symphony titled 'The Infinite Bridge', using some of the technologies presented during the workshop. This innovative and cross-disciplinary event used music, theatre, dance, computer-generated graphics and three live connections to tell the story of a girl trapped in a mundane existence, who in her dreams escapes into an alternate cyber-world.

The 400 attendees witnessed the first time in history that Polycom and LOLA technologies were being used in a multimedia symphony.

More information

This event was the eighth in the series of workshops that has been held in Europe and the United States annually since 2009, and the fifth European event. The workshop was hosted by the Royal College of Music, with local technical support provided by Jisc, which provides Janet, the UK national research and education network, and coordinated by Internet2 and the GÉANT Association Amsterdam office, with additional technical expertise provided by the Programme Committee members.

For an overview of the whole workshop series and online learning materials, visit the Networking Performing Arts Production Workshops page: **https://www.terena.org/activities/network-arts/**.

NEW SPECIAL INTEREST GROUPS ESTABLISHED

During its 12th meeting, on 8-9 April 2015, the Task Force on Network Operating Centres (TF-NOC) discussed and agreed its new objectives as a Special Interest Group (SIG). The task force's terms of reference had expired towards the end of March and its new charter in its new SIG format was approved by participants. Formal approval by GÉANT was pending at the time of writing. Unlike traditional 'task forces', which have a fixed-term mandate, a SIG is a long-term working partnership around a topic of common interest.

The first SIG-NOC meeting was held ad interim, in Stuttgart, Germany, hosted by BelWü, the German state network of Baden-Württemberg. About 26 people attended and some joined via video conferencing. The new direction and name change from TF-NOC to SIG-NOC was reflected upon during this meeting, and participants agreed about the main direction and objectives that the SIG should have for its first annual reporting period:

- Discuss, design and develop recommendations for a NOC Personnel's Training (basic) and potential Certification Programme in order to bring/keep NOC staff up to the "standard" level.
- Onvite NOC tool developers and organise half-day technical tutorial sessions on various products/topics.
- Extend the reach of the community to regional, metropolitan and campus NOCs.

The new SIG format was appreciated by the attendees and the following voluntary Steering Committee members were accepted: Brian Nisbet (HEAnet), Jonny Lundin (NORDUnet), Pieter Hanssens (Belnet), and Maria Isabel Gandía Carriedo (CSUC).

You can find the topics and speakers of this first SIG-NOC meeting on the workshop page: **https://www.terena.org/activitie/tf-noc/meeting12/**.

New SIG-ISM group meet for the first time

In March, GÉANT established another SIG: SIG-ISM, the Special Interest Group on Information Security Management. The main aim of this group is to create a community of security management professionals from among national research and education networking (NREN) organisations, who can develop, maintain and promote trust frameworks between NRENs, based on international standards.

T he group held its first workshop on 12-13 May, at Imperial College in London. The workshop was mainly aimed at Chief Information Security Officers, but also other people interested in ISM issues were welcomed.

Pictures
Left: Gyorgy Balazs, CERN presenting in front of the TF-NOC audience in Stuttgart, Germany.

Right: Attendees setting up for last TERENA TF-NOC meeting that was the first GÉANT SIG-NOC meeting, after re-chartering.

MORE INFORMATION

For more information about this new group, please visit the SIG-ISM web pages: **https://www.terena.org/activities/ism/**

OPEN EDUCATION RESOURCE HUB AND PORTAL REACHES IMPORTANT MILESTONE

GÉANT's Open Education Resource (OER) service development pilot has reached an important milestone. The pilot resulted in a working prototype metadata-aggregation hub and web portal that can provide aggregated multimedia e-learning content to the higher education and academic research communities. Now the preliminary results and deliverables are being picked up in the GÉANT Project (GN4-1), as part of the service activity on 'Real-time Applications and Multimedia Management', which started on 1 May 2015. One of the aims of this activity is to further develop the OER prototype and bring it to the next level as a service.

In November 2014, the OER pilot project participants published a position paper 'GÉANT Association NRENs and Open Education' that summarises the motives for the OER service development and its future directions. In the paper, GÉANT also offered its knowledge and expertise to progress the objectives of the EC's open education policy. The pan-European level GÉANT OER hub should bridge the gap between smaller institutional and national repositories and the large, global collectors, and contribute to flagship initiatives such as the EC's Open Education Europa portal.

OER architecture

The OER service architecture has two major components. The metadata harvester and aggregation engine uses standard protocols such as RSS (Rich Site Summary) and OAI-PMH (Open Archives Initiative Protocol for Metadata Harvesting) to collect information about multimedia recordings and learning objects that are stored in connected national and institutional content repositories. The aggregated, translated and filtered, good-quality metadata are made available on a web portal front-end for testing and demonstration purposes.

By being able to harvest iTunes U RSS feeds, and soon also various YouTube channels, the GÉANT OER portal creates a one-stop-shop brokering hub, potentially both for end users and for repository owners who wish to re-use the aggregated metadata set.

Picture
The OER pilot project participants discussing service architecture details in Amsterdam.

MORE INFORMATION

- The OER pilot project deliverables and all other technical documents are on the OER web pages: **https://www.terena.org/activities/oer/**.
- The OER web portal front-end (BETA) is available for testing and demonstration purposes only: **http://terenatv.media.uvigo.es/**.
- Position paper 'GÉANT Association NRENs and Open Education': **https://www.terena.org/activities/oer/GEANT_Association_NRENs_And_Open_Education-final.pdf**

NETWORKING OF GALACTIC PROPORTIONS TO UNCOVER THE MYSTERIES OF THE UNIVERSE

The skies of Latin America have captivated stargazers for centuries. The ancient Maya were keen astronomers, known for detailed recording and interpretation of every aspect of the skies. They believed that the will and actions of the gods could be read in the stars. Benjamin Apthorp Gould set boundaries for southern hemisphere constellations that were permanently fixed by the International Astronomical Union based on his work in Latin America in the late 19th century.

It is no wonder that the region is considered the astronomy capital of the world, with exceptionally clear and dry skies for more than 300 days a year. Today Latin America's is home to the world's most important regional and national observatories, providing forefront access to the heavens and beyond.

THE ICT AND NETWORKING BEHIND ASTRONOMY RESEARCH

Astronomy research is driven by collaboration and high bandwidth network technologies. Distributed research groups, viewing the skies from different sites and vantage points across the globe, need to transfer and process enormous data sets and visualisations. This requires network connectivity with the reach, capacity and reliability that only Research & Education (R&E) networks can provide.

In addition, Latin American observatories and research sites are often in remote locations, far from well-developed infrastructure hubs. Deploying the necessary connectivity infrastructure for this research brings advanced connectivity to remote areas.

This small selection of astronomy research projects illustrates how NRENs throughout Latin America, connected via GÉANT, enable ground-breaking research and help bridge the digital divide.

LARGE SYNOPTIC SURVEY TELESCOPE (LSST), CHILE

The AURA Observatory and REUNA are implementing connectivity for the Large Synoptic Survey Telescope (LSST), which will be the most advanced connectivity infrastructure in Chile. The photonic "superhighway" will deliver capacity of 100 Gbps from the summit of Cerro Pachon to international data centres. "High-speed connectivity is crucial to achieve the successful operation of the LSST and fulfil its commitment to deliver notifications in real time," says Dr. Christopher Smith, AURA Director. "We asked for the help of REUNA for its expertise in developing the network of research and advanced education in Chile, seeking a connectivity solution in the country and in particular from La Serena to Santiago." It is planned that scientists, students and the general public will have access to the digital universe created by the LSST, expected to be completed by 2019.

PIERRE AUGER OBSERVATORY, ARGENTINA

The Pierre Auger Collaboration includes more than 490 scientists from all over the world. The Observatory's 27 telescopes look for ultraviolet light resulting from cosmic rays. Data is transferred from the Auger Observatory to a collaborating computing centre in Lyon and mirrored at the FNAL laboratory in Chicago. About 5GB to 15GB of data is generated daily, as well as simulations produced via the EGEE/LCG computer grid, and transferred using HPSS. Each simulation series can include between 5TB to 20TB per simulation campaign. Thanks to an abundance of data collected, researchers are closer to understanding the composition of cosmic rays and where they come from.

THE ATACAMA LARGE MILLIMETRE/SUBMIL LIMETRE ARRAY (ALMA), CHILE

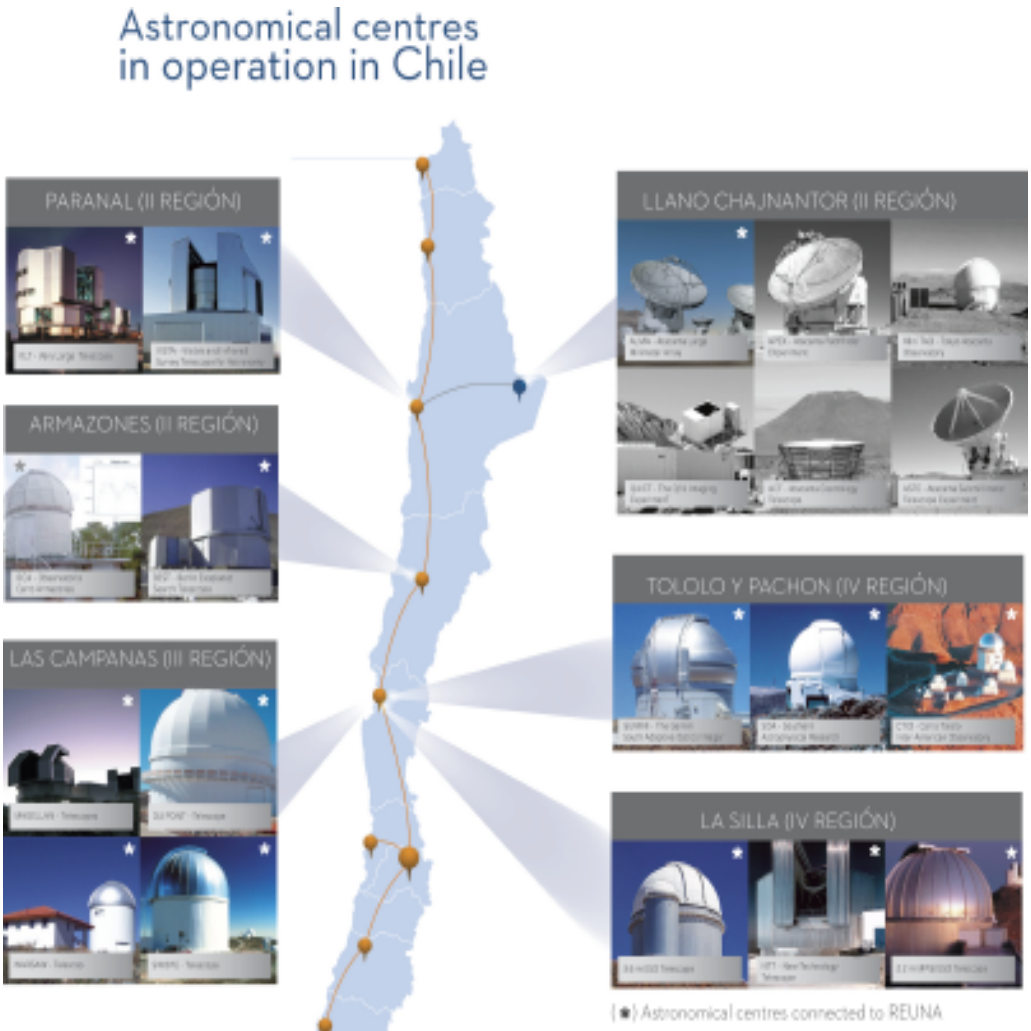
ALMA is an international partnership of the European Organisation for Astronomical Research in the Southern Hemisphere (ESO), the U.S. National Science Foundation (NSF) and the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Chile and the largest astronomical project in existence. ALMA is a single telescope of revolutionary design, composed initially of 66 high precision antennas located on the Chajnantor plateau, at 5,000 meters altitude.

ALMA's remote location presents unique challenges. The installed 150 kilometres of fibre optic cable links the ALMA Operations Site (AOS) to Calama in northern Chile and the REUNA network. This network provides 25 times faster access than before. "This infrastructure not only allows transmitting the enormous amount of data generated by ALMA. It also improves the level of communication between the people operating the observatory at a remote site in the middle of the Atacama Desert and those who process that data in the central offices in Santiago," says Giorgio Filippi, Project Leader, European Southern Observatory (ESO).

FOCUS ON THE FUTURE

Latin America continues to be the prime location for many of the world's most ambitious astronomy research projects. The E-ELT Extremely Large Telescopes ("the World's Biggest Eye on the Sky") is one of the highest priorities in ground-based astronomy. Located in Chile, the E-ELT, will be the largest optical/near-infrared telescope in the world and will gather 13 times more light than the largest optical telescopes existing today. The J-PAS (Javalambre Physics of the Accelerating Universe Astrophysical Survey) in Chile and Spain will map the observable universe in 59 colours. The J-PAS newly inaugurated data centre consists of a core network of 4 virtual chassis with 40GbE uplinks. The processing system consists of 17 nodes each with 24 cores, 192GB RAM and 4 TB internal storage.

These and others to come require enormous computing capacity and networking resources, supported and facilitated by the region's NRENs.



"The alliance with AURA for the connectivity of the LSST is a great satisfaction for the Chilean academic network. It reflects the confidence in the work done by the Corporation and is an initiative aligned with the strategic objectives of REUNA – to consolidate a digital platform of excellence and that is opened to the entire community of science and education."

Dr José Palacios, President of REUNA Board of Directors

HORIZON 2020 FUNDING TO ASSIST GREATER INTERNATIONAL COOPERATION

MAGIC

Following the success of the ELCIRA project, RedCLARA is leading a global collaboration project called MAGIC (Middleware for collaborative Applications and Global vIrtual Communities) which aims over the next two years to significantly improve the ability of researchers and academics around the world to collaborate together. With partners from Latin America, the Caribbean, West and Central Africa, Eastern and Southern Africa, North Africa and the Middle East, Central Asia and Asia-Pacific, emphasis will be given to expanding the global reach of eduroam and identity infrastructures for the academic world. MAGIC will also seek to establish middleware which will enable NRENs around the world to share services and real-time applications for international and inter-continental research groups via a common marketplace. At the heart of MAGIC are Global Science Communities which the MAGIC partners will engage in, not only to support them in the use of the collaboration applications implemented by MAGIC, but also to raise their awareness of funding opportunities and encourage their engagement with their peers around the world. MAGIC promises to share the successful experiences of ELCIRA globally, and by doing so, is perhaps the most global single collaboration project involving R&E networks around the world. Find out more on the MAGIC website: **www.magic-project.eu**.

TANDEM

TANDEM (TransAfrican Network Development) will create favourable conditions for WACREN (West and Central African Research and Education Network), enabling it to draw maximum benefit from the forthcoming AfricaConnect2 project and ensuring WACREN's integration into the global Research and Education networking community and its long-term sustainability. TANDEM's long-term goal is to make it possible for researchers and academics to contribute with their peers around the world to the socio-economic development of the West and Central African Region. The project will run for 24 months and is coordinated by the Institute de Recherche pour le Développement (France). Other partners are WACREN (Ghana), GÉANT (UK), RENATER (France), CIRAD (France), Sigma Orionis (France), Brunel University (UK), UbuntuNet Alliance (Malawi) and RedCLARA (Uruguay). More information will be available soon on the project website: **www.tandem-wacren.eu**.

SCI-GAIA

Sci-GaIA (Energising Scientific Endeavour through Science Gateways and e-Infrastructures in Africa) aims to support National Research and Education Networks, Communities of Practice and Universities in Africa to develop Science Gateways and other e-Infrastructures services. Sci-GaIA will work with new and emerging Communities of Practice to develop these exciting technologies, strengthen e-Infrastructure service provision, especially in terms of open access linked data, and deliver training and dissemination workshops. This will establish a sustainable foundation on which African e-Infrastructures can be developed and linked to science networks across Africa. Significantly, the results of the project will be usable by Communities of Practice in Europe and the rest of the world. The project will run for 24 months and is coordinated by Brunel University (UK). The partnership is composed of: DIT (Tanzania), University of Catania (Italy), Karolinska Intitutet (Sweden), KTH (Sweden), Sigma Orionis (France), UbuntuNet Alliance (Malawi), WACREN (Ghana) and CSIR (South Africa). The Sci-GaIA website will be available soon at **www.sci-gaia.eu** with more information.

AFRICACONNECT2 TO EXPAND CONNECTIVITY ACROSS AFRICA

Following the successful completion of AfricaConnect, the finishing touches are currently being added to the Grant Agreement for its successor project. Conceived as a pan-African umbrella connectivity project, AfricaConnect2 will adopt a modular approach adjusted to the geographical, cultural and organisational context of the African regions and their different stages of NREN development, as well as their sources of funding. Consequently, AfricaConnect2 will comprise 3 geographical clusters and involve their respective regional networking organisations:

- Cluster 1: Southern and Eastern Africa (contracted between the EC and the UbuntuNet Alliance)
- Cluster 2: Western and Central Africa (coordinated by GÉANT in conjunction with WACREN)
- Cluster 3: North Africa (coordinated by GÉANT in conjunction with ASREN).

The project budget for AfricaConnect2 will amount to €26.6m of which €20m will be co-funded by the European Commission's Directorate-General International Cooperation and Development (DG DEVCO).

BUILDING ON THE ACHIEVEMENTS OF AFRICACONNECT

The UbuntuNet network – the first of its kind in Africa – is the regional research and education Internet network in Eastern and Southern Africa. Through the procurement and deployment of high speed Internet connections across the region, between 2011 and 2014 AfricaConnect has significantly contributed to the UbuntuNet network. Thanks to its interconnection with GÉANT, it helped create a regional gateway for global research collaboration.

Implementing the UbuntuNet network meant establishing points of presence in major cities in the region and interconnecting them with broadband cross-border links. Historically, all intra-regional traffic had to travel via routers in London and Amsterdam - incurring delays and additional costs. Scientists, researchers and students in Sub-Saharan Africa are now connected directly, able to share data quickly and collaborate more efficiently. But AfricaConnect and the backbone it implemented mean much more than just improved connectivity and reduced bandwidth costs – looking beyond the routers, switches and fibre cables, the secret to a successful network and project is people. The UbuntuNet Alliance has created a close-knit community, with a pool of well-trained engineers who efficiently manage their networks and support their users across the region.

AfricaConnect2 sets out to extend this success story to the whole continent, thus accelerating the development of the Information Society in Africa. Whilst the connectivity boost will improve the lives of millions of Africans through accelerated research and education, it will equally benefit collaborative scientific research the world over, in areas such as climate change, biodiversity, crop research, malaria and other infectious diseases.

AfricaConnect2 is expected to commence in June 2015 and will have a duration of 3.5 years.

TEIN AND MEDICAL COMMUNITY STEP UP COLLABORATION AGAINST DENGUE

Following the successful first joint APAN-TEIN dengue fever workshop held at the 37th Asia Pacific Advanced Networking (APAN) meeting in January 2014 in Bandung, Indonesia, a second dedicated event took place at the recent 38th APAN meeting in Fukuoka, Japan.

Part of the programme for the established APAN Medical Working Group, the workshop was held on 1st March 2015, attracting over 20 attendees, including clinicians and researchers from within the multi-disciplinary dengue fever community, public health officials as well as National Research and Education Network (NREN) representatives from across the Asia-Pacific region, Europe and Africa.

The workshop provided a forum to take stock of developments since the Bandung meeting, to share experiences and discuss best practices, mobilising a community dedicated to helping combat the spread of this devastating disease. The recent dengue fever outbreak in Japan— after 70 years since the last outbreak—made the workshop and its location particularly relevant for local clinicians and public heath personnel. In the run-up to the workshop they had opportunities to join colleagues and network professionals in a series of videoconferences to share relevant expertise.

In addition to the discussion of dengue fever management specifically for Japan, the presentations covered a wide range of topics, from global fatality trends, dengue case classification to case management and climate impact studies.

Joining the discussion remotely via videoconference, Annelies Wilder-Smith, Professor of Infectious Diseases and Global Health at the Lee Kong Chian School of Medicine in Singapore and Scientific Coordinator of the EU-

funded DengueTools project, focused her presentation on the impact of climate change and global travel as main drivers for the spread of dengue from endemic to previously uninfected regions.

Dr Olaf Horstick, Director of Teaching Unit at the Institute of Public Health, University Hospital Heidelberg, Germany provided an overview of the WHO dengue case classification and evidence of its application whilst Dr Raul Destura, Director of the Institute of Molecular Biology and Biotechnology at the UP National Institute of Health, Philippines, presented on the molecular characterisation of the dengue virus in the Philippines and the impact of the introduction of different genotypes.

Prof. Leo Yee Sin from the Tan Tock Seng Hospital in Singapore outlined dengue management in Singapore and Dr Saleem Rana from Contech International School of Public Health in Lahore, Pakistan highlighted the importance of demographic factors, such as age-sex specific mortality analysis, for informed and effective health policy decisions.

When it comes to stopping dengue, social media posts and tweeting may be just what the doctor ordered. This was a key message in the presentation by Prof. May O. Lwin who explained how the social-media based Mo-Buzz system, developed by researchers at Nanyang Technological University, can boost the authorities' efforts to keep a constant eye on the spread of dengue in Sri Lanka.

One of the highlights of the workshop was the remote participation of Dr Misaki Wayengera, Uganda's principal investigator of the Ebola rapid diagnostic kit, who presented on the situation and prevention of Ebola in his country. Although Ebola has so far not hit Asia, participants recognised that, similarly to dengue, global mobility might facilitate its spread to other regions.

Participants enthusiastically agreed to build on the positive experience of the workshop and NREN-supported videoconferencing by following up with virtual meetings around specific topics and areas of research interest.

Other suggestions that generated substantial interest included enabling three or more sites to join regular clinician case reviews using the videoconferencing system supported by R&E networks, organising online training courses for public heath personnel focusing on dengue, and creating FAQs for dissemination via online community portals to help address concerns around dengue and at the same time dispel myths.

The driving force behind the workshop and the idea of the NREN and medical communities joining forces, Prof. Francis Lee, President of SingAREN and Chair of Governors of TEIN*CC, commented: "Building communities is not a one-time effort. Within 6 months after the Bandung meeting a second workshop was held in the Caribbean where organisers sought to develop new approaches to leverage R&E networks in the region to combat dengue and Chikungunya. The workshop idea was subsequently also embraced by colleagues in Africa, adapting it to the challenge of sharing expertise to treat and stop the spread of Ebola. This just shows the scalable nature of our efforts to build communities – and building communities is the best way to affect real change!"

The presentations can be downloaded from **https://www-lk.apan.net/meetings/Fukuoka2015/Sessions/session.php?id=37**

If you wish to find out more about this Dengue Fever initiative or want to join the next virtual workshop, please contact Prof. Francis Lee at **ebslee@ntu.edu.sg**

TEIN COMMUNITY WELCOMES NEW ZEALAND

New Zealand is the latest country to connect to the TEIN network in the Asia-Pacific region, bringing the number of partners benefiting from the high-speed regional backbone up to 20. Last month REANNZ (Research and Education Advanced Network New Zealand) made live a brand new connection between New Zealand and Singapore, opening up new opportunities for collaboration between local researchers and their Asian and European counterparts.

The new 100Mbps connection runs from Auckland over the AARNet route (Sydney ➙ Perth) to Singapore, where it joins the TEIN network, creating a much more direct route from New Zealand to Asia and by extension to the GÉANT R&E community. Previously, traffic to Asia had to pass through the United States before bouncing back across the Pacific to Singapore.

"The TEIN connection will make interactive collaboration quicker and more efficient from New Zealand to Asia, creating new opportunities for researchers, educators and innovators on the REANNZ network," said REANNZ CEO Steve Cotter. **"The connection further confirms our commitment to connecting our researchers with the wider research and education community."**

The formal go-ahead for the connection was given at the APAN39 meeting in Fukuoka, Japan in March, where the TEIN*CC Governors unanimously approved REANNZ's application to join the TEIN community.

"We welcome New Zealand as our partner and look forward to working with REANNZ to develop research networking in the region," said TEIN*CC Executive Officer ByungKyu Kim. **"We expect REANNZ's connection to the TEIN network to act as a bridge between Asia and the Pacific, opening up exciting collaboration opportunities for the entire TEIN community."**

Picture
Steve Cotter, REANNZ CEO

QATAR NREN INTERCONNECTS WITH GÉANT

GÉANT has recently signed an agreement with Qatar Research and Education Network (QNREN) to interconnect with the GÉANT network in Amsterdam. The peering, initially at 1 Gbps, will extend GÉANT international connectivity and allow researchers in Qatar to collaborate with peers in Europe and in other world regions in fields such as genomics and environmental studies and to potentially participate in Horizon 2020 programmes.

QNREN has been established with government endorsement by Qatar University, which is Qatar's main public university. QNREN is in the process of rolling out a national network and has deployed an International Layer2 connection of 10 Gbps to the Netherlight Exchange in Amsterdam for European and worldwide R&E access. The interconnection agreement will have an initial term of one year which could then be extended by mutual agreement.

CONNECTING THE R&E COMMUNITIES IN THE EUROPEAN UNION'S EASTERN NEIGHBOURHOOD

June is expected to see the kick-off of the Eastern Partnership Connect (EaPConnect) project which sets out to create a regional R&E network in Eastern Europe and the Southern Caucasus. This will interconnect the NRENs in six Eastern Partnership (EaP) countries and integrate them into the pan-European GÉANT network. The partner countries are Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine.

Launched as the Eastern dimension of the European Neighbourhood Policy in 2009, with the Eastern Partnership the EU offers its partners concrete, far-reaching support for democratic reform, sustainable development and overall stability. It recognises the importance of e-Infrastructures in:

- promoting digital inclusion
- enabling participation of EaP countries in Horizon2020 projects
- deploying eduroam and stimulating integration towards GÉANT services
- stopping brain drain
- procuring and federating access to high-quality scientific content

The European Commission's Directorate-General for Neighbourhood and Enlargements Negotiations (DG NEAR) is contributing 95% (€13m) towards the project costs. EaPConnect will be managed by networking organisation GÉANT in collaboration with the NRENs in the six partner countries.

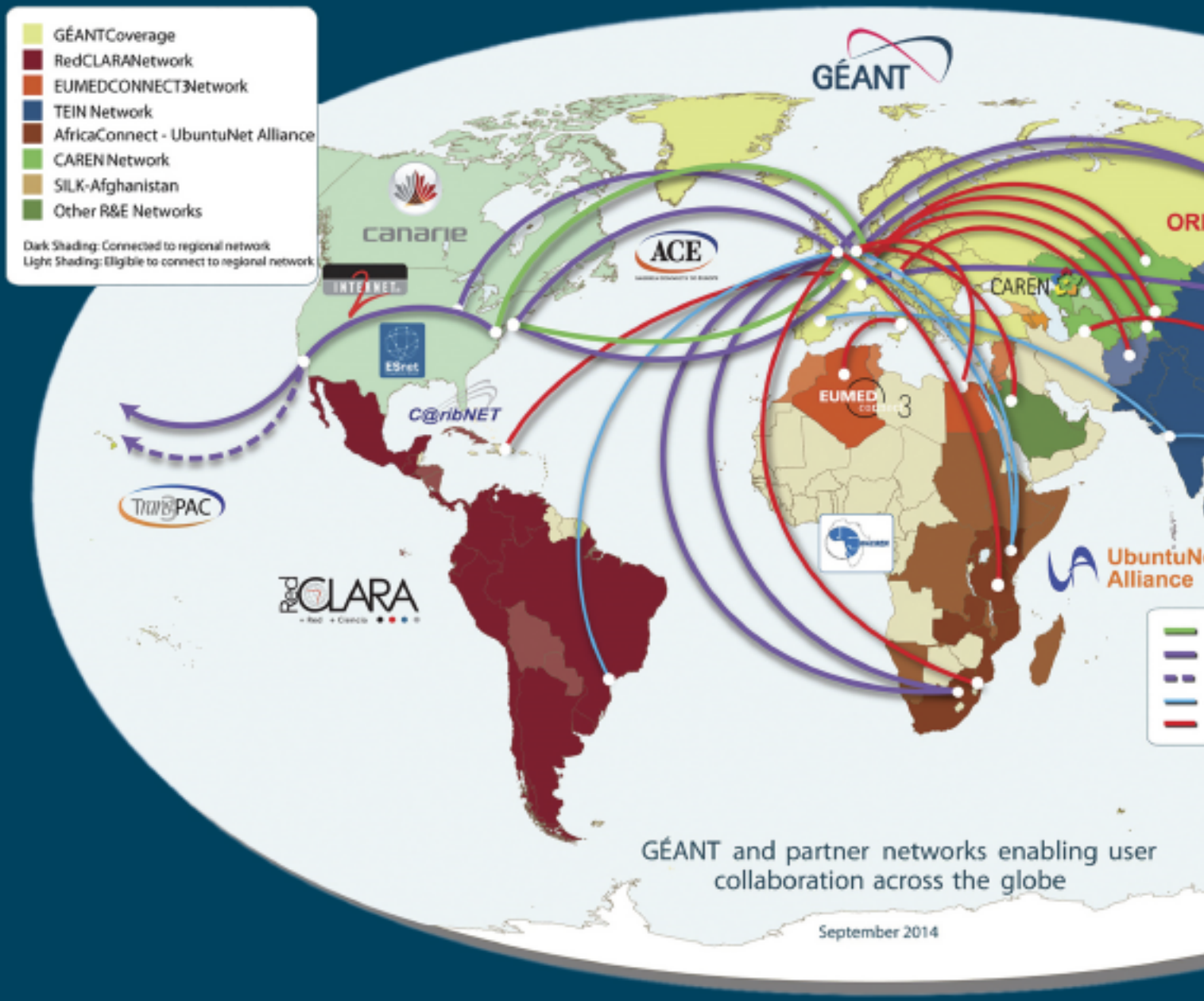
Picture
Maria Minaricova, EaPConnect Project Manager, GÉANT

THIS PROJECT IS FUNDED BY THE EUROPEAN UNION

GÉANT AT A GLANCE

GÉANT is the leading collaboration on network and related infrastructure and services for the benefit of research and education, contributing to Europe's economic growth and competitiveness.

GÉANT is owned by its core membership. This includes 36 National Members, which are European national research and education network (NREN) organisations, and one Representative Member - NORDUnet - which participates on behalf of five Nordic NRENs. Associates are also welcome and include commercial organisations and multi-national research infrastructures and projects.



PAN-EUROPEAN NETWORK

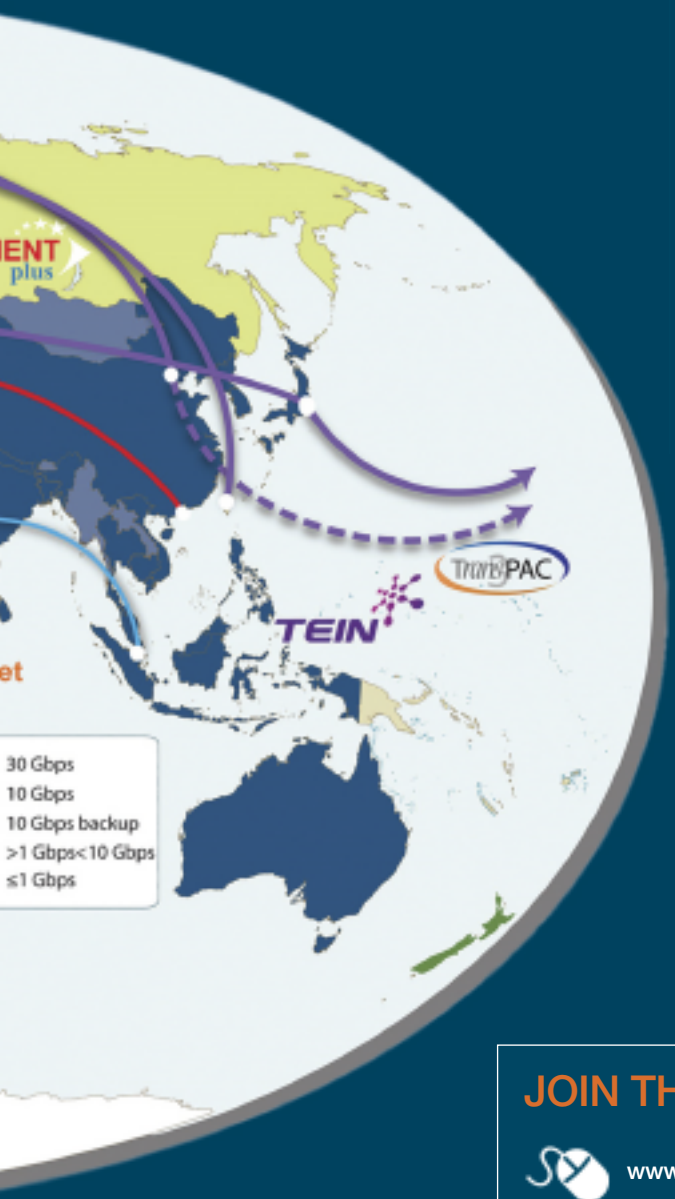
The GÉANT backbone offers capacities of up to 2 Tbps and, together with Europe's NRENs, connects over 50 million users at 10,000 institutions across Europe, supporting research in areas, such as energy, the environment, space and medicine.

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. GÉANT advanced services in monitoring, trust and identity, security and certification, mobility and access, and media and real-time communications, all serve to enhance the user experience.

INTERNATIONAL COLLABORATION

GÉANT continues 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 covers North America, Latin America, the Caribbean, Sub-Saharan Africa, the Mediterranean, Central Asia and Asia-Pacific, and increased emphasis is being 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). Furthermore, GÉANT has 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.



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 which continue to flourish. GÉANT successfully manages regional network projects in other parts of the world: in the Mediterranean (EUMEDCONNECT); Sub-Saharan Africa (AfricaConnect); and Central Asia (CAREN). In addition, GÉANT coordinates the Europe-China collaboration (ORIENTplus) and continues to secure direct China-Europe connectivity via a long-term contract.

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