CONNECT

THE MAGAZINE FROM THE GÉANT COMMUNITY | ISSUE 21 2016

SUPPORTING EARTH OBSERVATION WITH HIGH SPEED NETWORKS

GÉANT AND THE EUROPEAN OPEN SCIENCE CLOUD

FEDERATED IDENTITY TO SUPPORT RESEARCH AND EDUCATION COLLABORATION

SHARING DATA TO FIGHT DANGEROUS VIRUSES

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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 **paul.maurice@geant.org**

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**

Cover photo courtesy of ESA

WELCOME TO THIS ISSUE OF CONNECT!

March sees the annual gathering of GÉANT project participants at the symposium event – a great opportunity to reconnect with colleagues and collaborate on work programmes for the benefit of Europe's research and education community. Together with the upcoming TNC16 – Europe's largest and most prestigious research networking conference, these events serve to remind us that human networking is every bit as important as data networking when it comes to connecting, communicating and collaborating.

It is this combination of passionate people and tremendous technology that continues to attract vast earth observation projects such as Copernicus (see page 8), newly connected countries such as Lebanon (see page 31) and ensures this community is the partner of choice when it comes to helping to network the African continent (see page 27).

And with clear leadership in vital areas such as federated identity (see page 19) and cloud solutions (see page 20) the GÉANT community – together with its e-infrastructure partners – is set to remain at the very heart of global research networking, and to help push research and education ever further forward.

We hope you enjoy this issue, and look forward to seeing many of you in person at these exciting events!

Paul Maurice, Editor

JOIN US AT TNC16!

Europe's largest and most prestigious research networking conference TNC is back again this year. TNC16 will run 12-16 June in Prague, Czech Republic, with an expected 650 participants including decision makers, manages, networking and collaboration specialists, and identity and access management experts from all major European networking and research organisations, worldwide sister institutions, as well as industry representatives.

BUILDING THE INTERNET OF PEOPLE

Building strong, international relationships has always been a key objective of the conference and in recent years TNC has grown to be more inclusive and to attract more and more people from around the globe. TNC is the standout event for the research and education networking community, revolving not only around physical networks, but all the more about human networks, collaborating on a global scale. This focus on human networking is reflected in the TNC16 theme 'Building the internet of people', itself representative of the European research and education networking community this year celebrating 30 years of collaboration!

KEYNOTE SPEAKERS

TNC16 keynote sessions will in various ways play on the conference theme. The following keynote speakers are confirmed:

- Kees Neggers / Steve Cotter (Independent / GÉANT) will take participants on a guided tour through the past and towards the future
- Deborah Estrin (Cornell Tech) will address the shift from mobile health to immersive recommendations

- Olaf Kolkman (ISOC) will reflect on collaborative security and the open internet
- Dave Wilson (HEAnet) will talk about how the internet has changed peoples' lives
- Maria Farrell (ICC) will elaborate on winners and losers in the internet of things and what we can do about it
- Steven Tingay (ORA) will talk about big astrophysics and big networks
- Petr Holub (BBMRI ERIC) will address scalable storage and processing of privacy-sensitive data
- John Sexton (formerly NYU) will talk about the importance of global education for the research and education community

GÉANT (GN4) PROJECT

The GÉANT Project will again play an important role, contributing with topics such as virtual collaboration; AAI and eduGAIN; monitoring of alien wavelength service; dynamic circuits to support remote collaboration; and future transport network architectures.

SUBMIT IDEAS AND PARTICIPATE!

Online registration is open until 1 May, and you can still submit proposals for lightning talks and posters until 15 April. Lightning talks are five-minute presentations focusing on an idea, a successful project or an invitation to collaborate. Poster ideas may include future work that you expect to produce results in the first half of 2016.

You can also still submit demonstration or exhibition ideas, and BoF and side meeting proposals until 15 April. Send your proposals to: **tnc16@lists.geant.org**.

SPONSORSHIP

Companies that want to gain exposure in, and build relationships with the European research and education networking community can still become a sponsoring partner and exhibitor at TNC16 (contact: Gyöngyi Horváth at **gyongyi.horvath@geant.org**).

FURTHER INFORMATION

All registration, sponsorship and submissions information can be found on the TNC16 website: **http://tnc16.geant.org**.

On social media, you can find and join the discussion by using **#TNC16**.

We look forward to seeing you there!

GÉANT AGREES NEW BOARD, COMMUNITY PROGRAMME AND COST SHARING MODEL

Towards the end of 2015, representatives of the GÉANT membership elected a new Chair and members of the Board of Directors during the General Assembly (GA) meeting, hosted by RESTENA in Esch-sur-Alzette, Luxembourg. A new cost-sharing model and community programme were also adopted, and a new member organisation (the Ukranian NREN, URAN) was admitted.

BOARD OF DIRECTORS

Christian Grimm of DFN was appointed as the Chair of the Board and is joined on the Board by:

- Marko Bonac of ARNES
- Sabine Jaume-Rajaonia of Renater
- Valter Nordh of SUNET
- Raimundas Tuminauskas of Litnet
- Ivan Maric of SRCE
- Dorte Olesen of Technical University of Denmark
- Alberto Pérez of RedIRIS
- Erik Huizer of SURFnet

NEW COST SHARING MODEL

The General Assembly also agreed upon the proposed budget and membership fees for 2016, and adopted a new cost sharing model, which aims to monitor and maintain a fair apportionment of costs between national research and education networking organisations (NRENs) as their needs vary over time. The model is designed to allow the GÉANT network to be optimised for high performance research and education networking and at the same time to support NRENs in managing their internet traffic. The model promotes fair cost sharing among NRENs and encourages use of the GÉANT network.

COMMUNITY PROGRAMME AND VOTING SCHEME

Terms of Reference were adopted for a new framework for community collaboration, the GÉANT Community Programme (GCP), which evolved from the old TERENA Technical Programme. It will be overseen by a new GÉANT Community Committee, which will among other things, follow the work of the task forces and special interest groups. The GCP will be chaired by Valter Nordh.

GÉANT ANNUAL SYMPOSIUM

The GÉANT (GN4-1) Project's annual symposium event will be taking place in Vienna from 8-9 March. The event brings together the 600+ people from across Europe who work on the project, and provides a great opportunity not only to network and meet some of the researchers who rely on the network and services delivered by the project, but also to encourage and facilitate cross-collaboration across the many areas of work.

The event comprises opening and closing plenaries and around 20 individual sessions covering areas such as pan-European cloud and application services; supporting global science; trust and identity; and how to maximise innovation.

The opening plenary will be given by keynote speaker Bill Pulford on 'Trust and Identity – an implementation of Moonshot'. Bill is currently head of the Data Acquisition and Scientific Computing group at Diamond Light Source, the UK's national synchrotron science facility used by over 3,000 academic and industrial researchers across a wide range of disciplines including structural biology, energy, nanoscience and environmental sciences.

Ingrid Melve will give her keynote talk, 'Trustworthy enough for research data?' to bring the event to a close. Program director Ingrid leads the eCampus Norway program (2011-2016) taking on the challenges surrounding lecture recording, large-scale use of videoconferencing, digital assessment and cloud solutions. She was Chief Technology Officer with the Norwegian research network UNINETT 2006-2013. Working for UNINETT since 1994, she became Manager of Applications and Middleware in 1998 and has been involved in the field of Identity Management since 2000. Ingrid holds an MSc in Telecommunications from the Norwegian Institute of Technology, and has been a board member for DelC, Denmark, since 2012.

IN THE FIELD: A BLOG SHOWCASING THE GLOBAL IMPACT OF RESEARCH AND EDUCATION NETWORKS – OPEN FOR CONTRIBUTIONS FROM ALL NRENS AND RRENS IN THE WORLD

Research and education networking infrastructure traverses the globe, enabling access to content, tools and resources, connecting people, delivering new experiences, fostering collaboration and cultivating interdisciplinary communities striving to make a difference.

Words
Jane Gifford,
AARNet
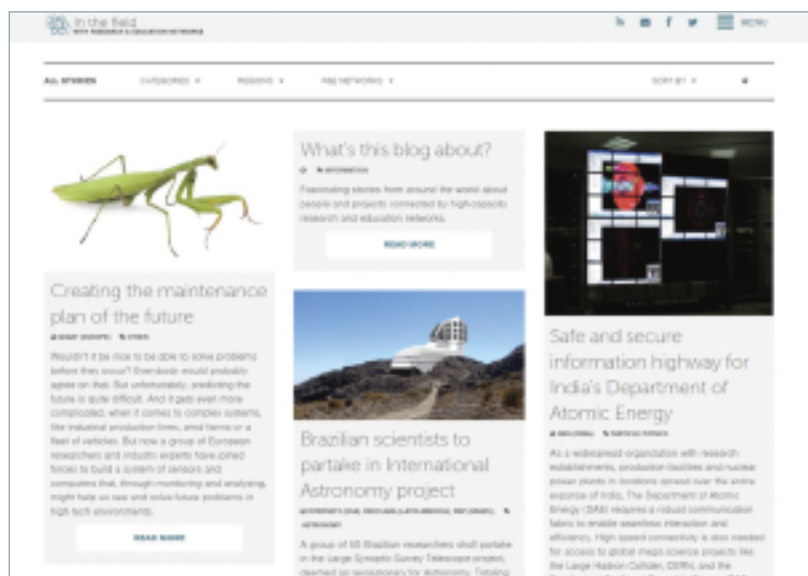
The In The Field blog (**http://www.inthefieldstories.net/**), developed by AARNet (the Australian NREN) and launched as a Global NREN PR Network initiative in October 2015, embodies that very spirit, bringing the R&E network community together in a global collaboration with users and beneficiaries to showcase and share inspiring stories and achievements.

More than 50 stories involving 40 NRENs and RRENs across six continents have been contributed and published since the blog was launched last year. These stories cover a diverse range of topics, including climate science, education, food security, disaster management, arts and culture, astronomy, health and more.

For example, you can read about people and projects involved in decoding the diversity of rice to improve yields for farmers in Asia, telemedicine changing the reality of health in Brazil, transitioning to digital exams in Norway and France, tracking Kyrgyzstan's melting glaciers, supercomputing for archaeology in Denmark, and connecting students to scientists in the jungles of Panama and remote robot museum tours in Australia.

You can also learn about making the Internet a bit safer, what happens inside our heads when we listen to music, how astronomers look back in time, new technologies bringing cultural heritage to life and sensor networks helping to predict natural disasters.

The blog is a truly global collaboration and welcomes contributions from all NRENs and RRENs in the world. We're seeking stories that illustrate how R&E networks around the world are utilised to solve problems and make a difference to the everyday lives of people. Stories can involve one or several networks. The focus of the stories needs to be on the impact rather than all about the infrastructure.

If you need help with developing ideas or writing a story, the blog editors: Jane Gifford (AARNet), Helga Spitaler (GEANT) and Arne Vollertsen (NORDUNET) are happy to assist.

For assistance, feedback and questions about the blog, please contact **jane.gifford@aarnet.edu.au**

Connect with In The Field

Facebook:
https://www.facebook.com/inthefieldstories

Twitter:
https://twitter.com/REfieldstories

RESOURCES FOR NRENS AROUND THE WORLD: THE CASE FOR NRENS PORTAL

NRENs are essential in providing advanced ICT services to the research and education communities. Whilst they are well established in Europe, countries in other parts of the world face difficult challenges persuading key stakeholders – funders, users and partners – of the inherent value in operating an NREN.

As part of the Global PR Network initiative and in collaboration with regional networking organisations, GÉANT has coordinated the development of a web portal with resources to help NRENs and RRENs argue their raison d'être, value and role and advocate R&E networking in general.

MAKING THE CASE

The idea for this 'Case for NRENs' portal originated in response to demand from a number of regional networks where NRENs are starting up in order to provide a community forum to share global experiences and best practice. It therefore also contains a toolkit with guidance material to support in particular new and emerging NRENs to help them progress towards sustainable organisations.

The Review group has collated existing material in an extensive document library and has developed additional tools designed to help NREN 'make the case' and achieve sustainability. These include templates for needs/stakeholder matrices, business/financial model templates and marketing exercises. Of particular interest is a benchmarking exercise to position an NREN in relation to user engagement and funding mechanism in an attempt to define a 'successful' NREN. A dedicated section includes examples of how successful NRENs present themselves, with an analysis of the reasons why a specific NREN got successfully established in its ecosystem and how it achieved sustainability.

A SHARING AND LEARNING COMMUNITY

This is only a starting point. We would like this portal to continue to evolve and develop over time with new material and content being added. For this portal to be a valuable resource we rely on NRENs to contribute. Please share with us and fellow NREN colleagues your own experiences of 'making the case' for your own organisation and R&E networking in general, your strategies and tactics, your success stories or challenges you face. There is no one-size-fits-all model for a successful NREN, however, the challenges one NREN faces are challenges many other NRENs also have to tackle and overcome. Thus, the spirit behind this portal initiative is that of a community: to share experiences, best practice and to learn from each other.

THE CASE FOR NRENS IN EUROPE

This initiative complements the activities within the Task Force on Management of Service Portfolios (TF-MSP) which are focussing on drawing together the evidence and arguments supporting NRENs in Europe.

Visit the portal at
www.casefornrens.org
Please send your contributions and feedback to the Review Group at
casefornrenswg@lists.geant.org

PSNC (Poznań)

URCA (Reims)

A*CRC
(Singapore)

INFINICORTEX PROJECT – BREAKING THE WALLS OF SUPERCOMPUTER CENTRES

InfiniBand (IB) is a computer networking communications standard featuring very high throughput and low latency. It is often used within high performance computing (HPC) data centres and supercomputer facilities, and until recently its use was restricted to the boundaries of those facilities. However at the recent SC15 event, a demonstration was successfully given of this technology being used across vast distances and in so doing showed an unprecedented way of connecting these facilities together.

Compared to the nature and limitations of the transmission control protocol (TCP), IB can reach higher throughput for long-distance flows and distribute heavy-parallel computational jobs over more facilities, thanks to the message passing interface (MPI) and remote direct memory access (RDMA) capabilities inherent in the IB protocol. Furthermore, it can be encapsulated in other protocols, as was the case for the InfiniCortex project which uses Ethernet as the carrier protocol to transport IB. However, despite being the world's most popular supercomputer interconnect, and largely known as a data centre fabric, to date IB it is virtually unknown in the internet community.

THE INFINICORTEX PROJECT

To harness the power of this protocol widespread industry collaboration is essential, leading to the creation of the InfiniCortex project. Over the past two years, InfiniCortex has clearly demonstrated that IB can perform over trans-continental distances, exploiting this technology to create a "Galaxy of Supercomputers" (a term coined by Marek Michalewicz and Yuefan Deng whose research focus is on mathematically optimal network topologies for supercomputers), a worldwide IB network spanning sites across Asia, Europe and North America.

Initiated and led by A*STAR CRC (Agency for Science, Technology and Research - Computational Resource Centre in Singapore), the project hit its first major breakthrough at SuperComputing14 (SC14), showcasing a first-time-ever 100G IB trans-continental connection from Singapore to the SC14 venue in New Orleans (USA). This was made possible primarily thanks to the support of TATA Telecommunications, which provided the 100G trans-pacific link from Singapore to the US, and Obisidian Strategics, the Canadian manufacturer of the IB long-range equipment, that made available a number of units to be deployed in the participating sites.

SC15

National Supercomputing Centre Singapore

RENATER
CONNECTEUR DE SAVOIRS

Computational Resource Centre
A*STAR

PSNC

UAlberta (Edmonton)

SBU (New York)

GA TECH (Atlanta)

SC15 (Austin)

NCI (Canberra)

CREATING THE TESTBED

The testbed was realised creating a partial mesh of layer 2 point-to-point Ethernet circuits between the endpoints, then encapsulating InfiniBand (IB) over the Ethernet link. This was made possible thanks to the Obsidian Longbow E-100, an IB-Ethernet gateway equipped with 10G Ethernet ports. This box allows an 8Gbit IB connection, plus an in-band 2Gbit Ethernet connection.

Following SC14 the project expanded to include several National- and Regional Research and Education Networks (SingAREN, TEIN, GÉANT, PIONIER, RENATER, Internet2, ESnet) and end-sites (e.g. France's University of Reims Champagne-Ardenne and Poland's Poznan Supercomputing and Networking Centre [PSNC]). During the course of 2015 these project partners joined forces to demonstrate IB at various exhibitions, culminating in the complete topology being showcased at SC15 in Austin, involving around 10 different sites across four continents, connected with high-speed IB links (including 100G Singapore-Austin and 30G Poznan-Austin).

This successful demo relied on:

- the newly-deployed 10G direct link between Singapore and London to connect the European sites to the A*STAR Computational Resource Centre and other sites in Singapore. This circuit, jointly funded by NSCC (National SuperComputing Centre - Singapore) and the Asia-Pacific TEIN project, has increased the total capacity between the TEIN network and GÉANT, with the latter providing hosting for A*STAR network and IB equipment in the GÉANT PoP in London Slough;
- the GÉANT 100G circuit between Paris and New York to connect PSNC to the SC15 venue in Austin, with a 30G connection.
- 'sub-netting' the different world areas to build the testbed, effectively enabling IB routing.

For the first time ever, an IB fabric that circumnavigated the world was deployed, with the final important segment being the direct GÉANT-SingaGAREN link.

The InfiniCortex project has now achieved its final milestone, put in place by Vincenzo Capone, Business Development Officer for GÉANT, who coordinated the cooperation of more than a dozen partners, culminating in the IB around-the-world ring, demonstrated at SC15, traditionally the world's fastest-network showcase event.

SUCCESSFUL LARGE SCALE COLLABORATION

This huge effort was made possible thanks to the collaboration and the support of several institutions and actors. Obsidian has made available a number of units to be deployed in several sites. Internet2 has enabled the in-land capacity from New York to Austin for the PSNC-SC15 connection, not to mention the co-funding (together with NSCC) of ACA100, the 100G trans-pacific link from Singapore to the USA. ESnet has enabled the European partners to connect to A*STAR in Singapore with a temporary solution prior to the deployment of the new direct link from London, consisting of a connection reaching from the US East coast to their PoP in Amsterdam. RENATER, PIONIER and SingAREN have been instrumental in enabling their respective connecting sites to be part of this endeavour.

EUROPEAN SPACE AGENCY TO DISTRIBUTE COPERNICUS DATA OVER GÉANT AND DFN

GÉANT and the European Space Agency (ESA) have finalised an agreement to distribute data from Copernicus, the EU earth observation and monitoring programme, to research and education users worldwide.

Copernicus collects vast amounts of global data from satellites and other systems which it stores, analyses and distributes for a wide range of applications including environment protection, agriculture, health, transport, climate change, sustainable development and emergency response and crisis management in the case of natural disasters.

DFN, the German National Research and Education Network (NREN), will connect the Copernicus data centre gateway in Frankfurt via a 10Gbps (gigabits per second) link to the pan-European GÉANT network that together with Europe's NRENs and e-infrastructure partners connects over 50 million users and is helping to keep Europe at the heart of scientific excellence.

Mr. G. Buscemi, Network and Security Officer of the Copernicus Ground Segment explains, "Earth observation datasets are vast and their value to users cannot be underestimated. To ensure the continued distribution of these datasets, GÉANT and the NRENs are an essential partner, delivering the scalable, robust capacity required to meet the Copernicus programme's critical parameters, including bandwidth and latency, reliability and geographical scope. This important partnership will help citizens, researchers and policy makers improve their decision-making, which could have dramatic benefits for society."

GÉANT CEO Steve Cotter adds, "Earth observation is becoming ever more important and touches so many parts of our lives, so it follows that making earth observation data widely available is beneficial to all of us. The GÉANT community therefore is extremely proud to be enabling this large-scale collaboration, something that would not be possible without our close partner DFN."

Picture
Photos: ESA

ABOUT COPERNICUS

The Copernicus programme, led by the European Union, is one of the most ambitious Earth Observation systems to date and aims to manage the environment and respond to the challenges of global change.

The fast provision of accurate data is central to this innovative global monitoring initiative, which offers key information services for a wide range of practical applications to improve and secure everyday life and to help mitigate the effects of climate change.

EU's main partner in this endeavour is ESA which coordinates the space component. This component is made of satellites developed specifically to meet Copernicus needs, so called Sentinel families, and of missions from other space agencies, not designed originally for Copernicus, but contributing to the program.

As well as the challenging task of building and launching a satellite, the success of this Earth observation programme relies on being able to operate the satellite from the ground and ensure that the data gathered are of good quality and made readily available to users.

Copernicus will be affected by a growing volume of data and information. There is no definitive answer to the many challenges the deluge of available data will pose, but there are gradual solutions for Copernicus in view of the progressive expansion of the space infrastructure and the thematic services. To cope with this, a robust data dissemination infrastructure needs to be developed, including in particular the development of the Big Data paradigm in the Copernicus data dissemination architecture. This means that an underlying framework is required to support growing requirements (e.g. new products in the Copernicus services, platforms interoperability, hosted processing, cloud computing). Copernicus data must first be captured, and then organized and integrated. There are myriads of individual technologies and libraries which provide an overall analytics framework (e.g. Hadoop, MapReduce, parallel processing, distributed file systems) needed to process the required massive amounts of data in an efficient, cost-effective, and timely fashion.

The EC, jointly with ESA, are working on a step by step evolution of the current Copernicus Ground Segment and Data dissemination system in order to incorporate some of the above data management technologies.

ABOUT THE EUROPEAN SPACE AGENCY

The European Space Agency (ESA) provides Europe's gateway to space.

ESA is an intergovernmental organisation, created in 1975, with the mission to shape the development of Europe's space capability and ensure that investment in space delivers benefits to the citizens of Europe and the world.

ESA has 22 Member States: Austria, Belgium, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Switzerland and the United Kingdom, of whom 20 are Member States of the EU.

ESA has established formal cooperation with seven other Member States of the EU. Canada takes part in some ESA programmes under a Cooperation Agreement.

By coordinating the financial and intellectual resources of its members, ESA can undertake programmes and activities far beyond the scope of any single European country. It is working in particular with the EU on implementing the Galileo and Copernicus programmes.

ESA develops the launchers, spacecraft and ground facilities needed to keep Europe at the forefront of global space activities.

Today, it develops and launches satellites for Earth observation, navigation, telecommunications and astronomy, sends probes to the far reaches of the Solar System and cooperates in the human exploration of space.

ABOUT DFN

Deutsches Forschungsnetz e. V. (DFN) is the non-profit association that manages operation and development of Germany's National Research and Education Network. Founded in 1984 DFN today represents with more than 330 members the vast majority of German academia.

DFN's mission is to foster research and higher education by promoting innovation and development as well as operation and utilization of network resources. To achieve this, DFN is involved in a number of projects. Together with its members, DFN investigates in organizing and managing federated services. This extends the role of DFN from a network service organization to an enabler of e-Infrastructure processes for research and higher education communities.

More information about DFN is available at:
www.dfn.de/

GÉANT INTERNATIONAL USER ADVISORY COMMITTEE MEETS AT EUMETSAT

The 5th face-to-face meeting of the GÉANT International User Advisory Committee (IUAC) was held in Darmstadt, Germany, with activities taking place over two days on 15-16 December 2015. Instituted during GN3, the IUAC is formed of representatives of large international user groups in GÉANT's most demanding research areas. Chaired by Maryline Lengert (ESA), the IUAC meets twice-yearly to provide feedback on GÉANT's strategy and activities and articulate its requirements in different service and engagement areas.

The dense meeting agenda included project and organisational reports from GÉANT, an overview of GÉANT's global engagement activities, and updates from the user liaison team and the users themselves. GÉANT's recently appointed CEO, Steve Cotter, joined the meeting remotely and took the opportunity to introduce himself and welcome the IUAC members. As the host organisation's representative, Lothar Wolf (EUMETSAT) then opened the two-day session with a talk on the impact of big data and the resulting challenges for EUMETSAT services.

Several of the talks on the first day focused on GÉANT's global engagement and connectivity with other world regions beyond Europe, highlighting GÉANT's role in supporting the creation of a global infrastructure. Cathrin Stöver (GÉANT) gave a comprehensive overview of GÉANT's involvement in International connectivity and the integration of regional projects such as AfricaConnect with the GÉANT backbone. Presentations by other GÉANT speakers followed on the association's engagement with the United States, Asia and the Eastern Partnership countries.

The Committee expressed considerable interest in this area specifically in improving connectivity to Asia and Africa, which denotes an increased demand for research collaborations with these regions. GÉANT is considered to be well positioned to meet this global need in terms of its reach and its capacity to extend connectivity beyond individual users to cover entire countries and regions.

The session on the second day was opened by Christos Kanellopoulos (AARC) with an overview of the AAI landscape and of the AARC project, placing the different approaches to AAI in context and explaining their impact for the R&E community going forward. As AAI is of ongoing interest to the users, ensuing discussions addressed both the strategic high-level view and practical issues related to single researchers.

The remainder of the day's talks focused on user specific activities: Jakob Tendel (DFN) from the GN4-1 User team presented a recently implemented cross-border contract for the COPERNICUS Programme for which GÉANT acted as multi-party contract broker; Ernesto Doelling (ESA/ESOC) gave a description of ESA's network infrastructure and specified requirements for future work with GÉANT and the NRENs; finally Arpad Szomoru (JIVE) provided an introduction to ASTERICS, the Astronomy ESFRI and Research Infrastructure Cluster within H2020, highlighting future areas of support for GÉANT.

TRANSMITTING JUMBO FRAMES

The Ventspils International Radio Astronomy Centre is a recently re-furbished radio telescope facility located in Irbene, on the Baltic coast in Latvia. The Irbene facility needed to connect to other eVLBI facilities in Europe that are part of the JIVE (Joint Institute for VLBI) European research infrastructure consortium (ERIC), representing 10 national radio astronomy institutes, to transfer large amounts of data. A local commercial provider, keen to meet their needs, approached the facility's management with an offer. But the Latvian national GÉANT access team at the University of Latvia offered a trial high-bandwidth connection to JIVE to demonstrate the power of research and education networks and the flexibility to meet the dynamic needs of astronomy researchers. JIVE is located in the Netherlands and hosted by the Netherlands Institute for Radio Astronomy (ASTRON).

THE LATVIAN REQUEST

Looking ahead, the Irbene facility anticipated multiple-partner measurement events that would require up to 20Gb/s of data transmission capability in total. This meant a stable transmission of large data streams between up to 5 partners with estimated data flows of 4Gb/s per single stream from each radio telescope. Each data source needed to be capable of reliably transmitting large data packets without risking data loss. To allow packets beyond 1500 bytes to be transferred, Jumbo Frames were necessary. This is a relatively unusual application that requires non-standard network configurations.

R&E NETWORKS COLLABORATE TO STEP UP TO THE CHALLENGE

The Irbene facility, JIVE, the University of Latvia, SURFnet and GÉANT worked together to facilitate a pilot to demonstrate the advanced capabilities of R&E networks and that could serve as a baseline to compare R&E network performance against the local commercial IP.

A Layer 2 VPN was established across GÉANT between the University of Latvia and SURFnet. The local NRENs took care of the local connectivity to the user site.

To allow the reliable transmission of large data packets, Jumbo Frames were enabled end-to-end for the Ethernet link. Increasing the size of the Ethernet frames from the standard 1500 Bytes to the so-called "Jumbo" size (9000 Bytes) allows the transfer of more "real" data in every frame (the "payload"). This means less overhead in the bit flows and increased data throughput. This type of setup makes better use of the network connections, especially at speeds of 10G and beyond, to fully exploit the available capacity of the links.

The pilot was carried out over a week in December to allow a viable demonstration of the stability over a period of several days.

IMPRESSIVE RESULTS

First and foremost, the pilot delivered the capacity, reliability and speed required. Set-up was fast and with end to end support and coordination, the team was able to identify the most suitable solution quickly.

The network connection delivered greater than 4 Gbps, the highest bandwidth possible on the current hardware at the Dutch site, and the large packet size (Jumbo Frames) was successfully transmitted along the entire path. Beyond showcasing advanced GÉANT technologies, the pilot demonstrated stable end-to-end bandwidth they can be relied on in the future. Moreover, the service provided by GÉANT was at no additional cost. The data was delivered over a separate route via normal GÉANT IP network.

LOOKING AHEAD

Following the successful pilot, the Irbene facility continues to use the link and is very satisfied with the quality and capacity it provides to transit to JIVE. Both the Irbene facility and JIVE are eager to carry out further tests this year once additional VSRC equipment is in place. This will allow testing of even larger data flows and further stress-test the envisaged setup.

IDA HOLZ:
THE "MOTHER" OF THE INTERNET IN LATIN AMERICA

Ida Holz is a Uruguayan professor of engineering and computer science and researcher and a highly recognised pioneer in the field of networking and the Internet. For over 20 years, until 2011, she directed Central Computer Services at Uruguay's University of the Republic; it was under her direction that the university installed the first node of the Internet in Uruguay. Ida was instrumental in the actual formation of the local networking industry, helping to establish five of the region's cornerstone organisations – the Latin American Network Forum; LACNIC (the Latin American and Caribbean Internet Address Registry); LACTLD (Latin American and Caribbean Association of Country Code Top-Level Domains [ccTLDs]; RAU, the Uruguayan NREN, and the Latin American regional research and education network, RedCLARA, where she still serves on the Board of Directors.

In 2009 Ida was awarded a Lifetime Achievement Award by LACNIC. In 2013 she was the first Latin American to be inducted into the Internet Hall of Fame. Most recently she was recognised as an outstanding Uruguayan in 2015, and a stamp was issued by the Uruguayan postal service in her honour.

Thomas Fryer, GÉANT Senior International Relations Officer, had the pleasure of meeting with Ida on behalf of CONNECT to learn a bit more about the legend that is, Ida Holz.

THE WORK REFLECTED IN YOUR LONG LIST OF AWARDS HAS BEEN FOR THE BENEFIT OF URUGUAY AND LATIN AMERICA, BUT YOUR ROOTS ARE EUROPEAN. CAN YOU TELL US HOW IT IS THAT URUGUAY CAME TO BE YOUR HOME COUNTRY?

Although my family origins are European, I was born in Uruguay in 1935. My parents were Jewish immigrants from Poland. My mother was the youngest of eleven siblings and came from a very religious family. Her father and her eldest brother were rabbis. My mother's entire extended family, brothers and sisters, their wives and husbands, nephews and nieces and grandchildren, were murdered in the Holocaust.

My father moved with his mother and his sisters to Uruguay in the 1930s. He died when I was only three years old and I believe that had a lot to do with my poor, challenging and difficult childhood.

I received a traditional Jewish upbringing but eventually became more involved in the problems of my native country, particularly at university and when I met the man who was to become my husband. During the dictatorship, we spent eleven years in exile in Mexico. That helped me to better understand Latin America and Uruguay in the context of the history and culture of the region.

HOW HAVE YOU SEEN URUGUAYAN SOCIETY CHANGE AS A RESULT OF THE GROWTH OF THE INTERNET?

The changes are very varied and depend on things like education, age and openness to change.

It is important to remember that the development of the Internet enabled progress towards the mobile telephone. Both factors have without a doubt brought about profound changes.

In 2009 the government launched a public education initiative called Ceibal ("a laptop for every child"). An inherent feature of the programme was that laptops were given to the schoolchildren as their own, meaning that they were encouraged to bring them home so that their whole family could use them. This programme has accelerated the spread of Internet usage because it enabled equal access for all levels of society.

WHAT ROLE DO YOU FEEL NRENS PLAY IN THE DEVELOPMENT OF EXCELLENT SCIENCE AND RESEARCH IN LATIN AMERICA?

I think that collaboration among countries and their researchers is fundamental for the development of science in general, and for each of its constituent parts in particular. Organisations like ours, which promote and enable collaboration across advanced networks are an extremely important factor for both science and society. I have often said that in our region, unity, which unfortunately is not being achieved on a political level, is being achieved through scientific collaboration. This is, and always has been, the fundamental purpose of my activities.

HOW DO YOU SEE THE ROLE OF WOMEN IN LATIN AMERICA TODAY, BOTH IN THE WORLD OF TECHNOLOGY AND MORE WIDELY?

Slowly women in our region are making progress. Today there are as many women as men, or more, studying at university. Yet social integration is a slow process because as long we do not have equal participation of men and women in family and home life, it will be hard to say that women are truly equal on all fronts. I think that this is a subject which concerns both genders. Women will not be able to achieve the level of freedom they deserve as long as men continue to the think that they do not need or aspire to this freedom. I am happy to see that in the younger generation this is changing dramatically.

THOUGH ONE MIGHT SAY YOU ARE RETIRED, WE SEE THAT YOU ARE STILL QUITE BUSY AND CONTINUE TO WORK AT REDCLARA. CAN YOU TELL US WHAT YOUR DREAMS ARE FOR THE FUTURE?

I don't think that I am capable of not working. I really do not want to live without contributing and I am grateful I still have a clear mind and still dream of a better future. Even though I know that the distant future is not something I will be a part of.

What do I dream of? Well, it's hard to put into words. I guess you could call it a utopian vision. I dream of a fairer, more participative and inclusive society. I dream of the happiness of my children and their descendants. What more can we ask for?

WOMEN IN TECHNOLOGY

The online community NREN Women in Technology (NREN-WIT) launched at TNC15. Active email list discussions and sharing has begun, and web resources are planned for sharing of best practice and ideas to reduce the gender gap in the NREN community. CONNECT readers are invited to participate in the NREN-WIT community by sending a blank email to: **nren-wit-subscribe-request@listserv.heanet.ie**

GÉANT ENVIRONMENTAL POLICY AND "BREAKING GREEN"

Ensuring the healthy future of our planet is all of our concern. Every responsible organisation is expected to 'do their bit' to make more efficient use of energy and help slowdown global warming. GÉANT is hoping to do just that by launching "Breaking Green", a project to follow the guidelines set forth in the new GÉANT corporate environmental policy.
The GÉANT Environmental Policy document is a result of the organisation's participation and work in the GN4-1 Project 'Green Team' task.

The 'Green Team' was established in 2008 to assist NRENs with various tools, best practices and policies to help them be as energy-efficient and ecologically sound as possible. One of the first steps to do this, is to adopt an Environmental Policy by the NREN or R&E organisation.

GÉANT BREAKING GREEN

Stimulated into action by the Green Team initiatives, GÉANT adopted a company-wide environmental policy, approved in January 2016, and its roll-out has been dubbed "Breaking Green".

"We are currently evaluating where we stand now, in terms of how environmentally friendly our current practices are and what can we do to improve," says Trupti Kulkarni, senior software engineer at GÉANT who is leading the work on this project and has always been, in her own words, somewhat of an "environmental activist". Breaking Green is about putting into

action the guidelines adopted in the GÉANT Environmental Policy. The year-long project was launched in January and is divided into 3 phases.

- Phase 1 is primarily an audit of various forms of energy and resource usage, such as utility bills, and even staff commuting and travel patterns, to ascertain what is being used and how much it costs the organisation and environment. One of the tools that will be used is the SURF Green ICT Maturity Model, developed by SURFNet, a tool for self-evaluation in Green ICT.

- Phase 2 will develop recommendations and best practice ideas, based on the data gathered in Phase 1, to reduce our carbon footprint.

- Phase 3, which will start in July, is about Breaking Green - putting into action the recommendations from Phase 2 and staff will be expected to take an active role, bringing their ideas and contributions to webinars and workshops.

"It's all about corporate social responsibility and doing your bit," says John Dyer, Business and technology Strategist, GÉANT. "Our aim is to increase our engagement on such an important global issue. GÉANT and its projects, past and present, have been pioneering in building and providing R&E networks to advance technology and knowledge. So now we need to be just as pioneering when it comes to vital issues like effecting change in environmental awareness."

Trupti is hopeful of success: "It is not about doing this just for the duration of the project, but also adopting it as a lifestyle choice. On paper, Breaking Green runs until December 2016, but I have faith that we will all come together to continue to make positive contributions and keep the environment in our thoughts as we go about our daily activities."

For more information on the Breaking Green project and to find out how to help visit:
http://www.geant.org/about/ BreakingGreen

GÉANT AND THE EUROPEAN OPEN SCIENCE CLOUD

How GÉANT Can Help Achieve the EC's Vision for Open Science in Europe

OPEN SCIENCE

The large amount of data produced by the use of ICT in research has been identified by the EC as having further value which should be unlocked. The EC's vision is that the exponential growth of data will drive societal challenges, scientific advances and productivity gains across the European economy. This vision is about achieving Open Science.

OPEN SCIENCE

Open Science is about transforming research through ICT tools, networks and media. By changing how research is carried out, disseminated, deployed and transformed, research can become more open, global, collaborative, creative and closer to society:

- Research knowledge will become more easily accessible
- Use of scientific data will be increased, with participation from industry and commerce including SMEs, from citizen scientists and from the public sector.

EUROPEAN OPEN SCIENCE CLOUD

The European Open Science Cloud (EOSC) is essentially the vehicle by which the European Commission proposes to achieve Open Science. It is proposed that the EOSC will federate existing and emerging data infrastructures, bridging the fragmentation and ad-hoc solutions which populate the e-Infrastructures landscape today, so as to remove obstacles to wide access to publicly funded research publications and underlying data. It will enable sharing and re-use of research data across disciplines and borders, taking into account relevant legal, security and privacy aspects.

EUROPEAN OPEN SCIENCE CLOUD

The EOSC is perceived as a trusted, open environment for storing, sharing and re-using scientific data and results and supporting Open Science practices. It will seamlessly integrate existing networks, data and high-performance computing systems and e-Infrastructure services across scientific fields, within a framework of shared policies, standards and investments.

GÉANT AND THE EC

GÉANT and its predecessor European networks have received the support of the European Commission in the form of co-fund grants for nearly twenty years. The EC's vision in supporting pan-European research & education networking has helped make it the international success it is today. GÉANT and its European NREN partners provide a world-leading foundation so the European research and education community can communicate and collaborate, across Europe and around the world, keeping Europe at the forefront of global research.

The collaboration of the NREN partners is paramount to the continued success of the GÉANT Project. The unique and enduring GÉANT partnership balances European and national interests through the EC co-funding and the cost-sharing model. The GÉANT cost-sharing model helps overcome the digital divide caused by differences in levels of competition in the telecoms markets across Europe. This helps ensure the participation in GÉANT of NRENs from across Europe and its Associate countries, reducing fragmentation and supporting cooperation between the partners.

GÉANT procures and operates inter-NREN capacity on behalf of the NRENs, aggregating demand at European level. Together, GÉANT and the NRENs innovate to develop and operate scalable, multi-domain, pan-European services.

The successful and enduring partnership between GÉANT and the European Commission has been recognised in the form of the GÉANT Framework Partnership Agreement (FPA), which identifies the parties' common long-term vision for GÉANT's continued contribution to the success of European research and education.

GÉANT AND THE EUROPEAN OPEN SCIENCE CLOUD

The European Open Science Cloud is still in the process of being defined but as the fundamental layer underpinning other e-Infrastructures, GÉANT will undoubtedly play a role.

The EC's data infrastructure model combines processing data (HPC infrastructure), storing data (data infrastructure) and moving data (network infrastructure). GÉANT fulfils the "moving data" part of this model, although there is much more involved than simply moving data: GÉANT and the NRENS provide the secure, performant European and global connectivity and federated access services essential for realising the potential of data storage and processing; these services are key for realising the EC's vision for HPC and Big Data in Europe, and for achieving the objectives of Open Science.

GÉANT's potential role in the EOSC extends beyond this however.

GÉANT is collaborating with other European e-Infrastructures to develop a common approach towards the EOSC, and is a signatory to the joint e-Infrastructures statement on the European Open Science Cloud (reproduced in full overleaf), which details eight elements for the success of the EOSC: that it be open, publicly funded and governed, research-centric, comprehensive, diverse and distributed, interoperable, service-oriented and social.

GÉANT can contribute to this vision in several ways. GÉANT can essentially serve as the access provider for the EOSC, contributing, together with the NRENs, secure seamless high-speed multi-domain networking and wide peering together with federated identity services delivering appropriate access to cloud services, data, research infrastructures and the many other components and resources of the EOSC. In addition, GÉANT has a role in a coordinated data management framework where the network, compute and storage are all working together to serve the needs of researchers. Furthermore, we can contribute to end-to-end performance optimisation and user support services including data planning consultancy, troubleshooting, training and service marketing. The aim is to overcome the challenges of the EOSC such as fragmentation of solutions, lack of trust, lack of interoperability and the skills gap between users and e-Infrastructures.

On the road to a trusted, seamless, integrated environment for research, not only the fundamental role of the network but also the organisational strength, services and expertise of GÉANT and its NREN partners all have a key contribution to make towards the successful realisation of the European Open Science Cloud.

CONNECTIVITY:

The GÉANT and NREN networks underpin the work of a wide range of e-infrastructure and scientific research projects by providing a high performance, reliable and cost-effective communications platform across the research and education (R&E) community. Service options cover IP, dedicated private connections, virtual private networks and roaming options.

eduroam provides 50 million students and researchers with access to thousands of wi-fi access points in over 70 countries using a single, secure login facility - making international collaboration much easier. Over 5 million international logins a day are enabled by eduroam. GÉANT also provides an advanced testbeds service to support innovative research into the next generation of networking.

TRUST, IDENTITY & SECURITY:

GÉANT and its NREN partners provide technologies that build trust, promote security and support the use of online identities. This is an essential component of many infrastructure projects by bringing together services and users in a scalable, manageable and secure manner. eduGAIN enables single-sign-on access for students and researchers from 1,500 institutions worldwide to over 1,000 academic services.

CLOUDS AND OTHER SERVICES:

Cloud services offer higher education and research organisations the opportunity to become more agile and provide their users with a wider range of IT services at a lower cost. GÉANT provides the platform for users to access cloud services and, through its cloud service catalogue, works with other e-infrastructure projects and commercial cloud service providers to help deliver innovative services to research and education institutions and their users.

POSITION PAPER: EUROPEAN OPEN SCIENCE CLOUD FOR RESEARCH

SUMMARY

As part of the Digital Single Market strategy, 1 the Open Science Cloud will raise research to the next level. It promotes not only scientific excellence and data reuse but also job growth and increased competitiveness in Europe, and drives Europe-wide cost efficiencies in scientific infrastructure through the promotion of interoperability on an unprecedented scale. The Open Science Cloud offers researchers from all disciplines seamless, open access to the advanced digital capabilities, resources and expertise they need to collaborate and to carry out data- and computing-intensive science. Secure and trustworthy, the Open Science Cloud engages researchers in governing, managing and preserving resources for everyone's benefit. The Open Science Cloud is an open, service-driven endeavour, inclusive of all stakeholders. Governed as a commons, it leverages two decades of public and private investment in e-infrastructures for the benefit of scientific research and innovation.

BACKGROUND

Science is changing, both in the way it is performed and the way it is communicated. Driven by remarkable advances in information and communication technologies, today's scientific infrastructures offer researchers unprecedented access to data sources, data-intensive sensors, and increasingly comprehensive analysis and simulation facilities that have revolutionized scientific methods in a remarkably short space of time. Research services, processes and outputs are becoming accessible to all levels of society. Enormous amounts of data are being generated, bringing extraordinary new opportunities for their innovative reuse in novel scientific, commercial, and citizen-science contexts. This is Open Science.

Open Science is a key driver, not only of scientific progress, but also of economic and societal innovation. To harness its full value and reap the fruits of public and private investment, Europe needs to foster an open, collaborative platform for the management, analysis, sharing, reuse and preservation of research data on which innovative services can be developed and delivered. For this, Europe can build on decades of public investment in scientific infrastructures—experimental facilities, networking, high-performance and high-throughput computing, cloud services, scientific software and institutional and community data repositories—by connecting national and international infrastructures and services. The Open Science Cloud is the vehicle to achieve this vision. Below we articulate the eight essential elements it needs to succeed.

Many of the resources and services needed for the Open Science Cloud already exist; while technical challenges remain, most of the barriers are ones of policy and concern funding, lack of interoperability, access policies and coordinated provisioning. The Open Science Cloud will address these issues and enrich and further advance the portfolio of resources and services to make the entire scientific lifecycle more open and transparent. To this end, governance of the Open Science Cloud will be modelled after the governance of the Internet, conducted by a decentralized, international group of stakeholders drawn from across research and civic society, from both public and private sectors. The Open Science Cloud's governance will hold custody of the shared services, policies and standards that maintain its persistency, its global interoperability and its adherence to the Open Science vision. By involving all the relevant stakeholders who support today's research—funding agencies, policy makers, research infrastructures, e-Infrastructures, libraries, data providers and service providers—the Open Science Cloud will significantly impact the way research is done in Europe and will put European research at the forefront of Open Science globally.

¹ http://ec.europa.eu/digital-agenda/en/news/open-science-competitiveness-council-28-29-may-2015

THE OPEN SCIENCE CLOUD: EIGHT ELEMENTS FOR SUCCESS

I. Open: This is the driving principle of the Open Science Cloud: openness in design, in participation and in use. The Open Science Cloud will be based on open access and promote the development and adoption of open standards, enabling collaborative environments with no artificial barriers to participation or resource-sharing by any stakeholder. It will enable accessibility, transparency, and reproducibility in all stages of the research life-cycle. Having a flexible open design, the Open Science Cloud will foster public-private partnerships, turning all investment into economic growth.

II. Publicly funded & governed: A publicly funded and publicly governed Open Science Cloud will guarantee persistence and sustainability, and ensure that outcomes are driven by scientific excellence and societal needs rather than profit. This "commons" approach, welcoming partnership with private-sector actors while driven by the public good, will encourage the development of innovative services that are conducive to the future of Open Science, while guaranteeing the long-term, persistent care of resources.

III. Research-centric: Following the true spirit of agile co-design and participation, researchers and research communities—including those from the private sector—will be fully engaged in the design of the Open Science Cloud, to ensure the development of services responsive to their needs.

IV. Comprehensive: The Open Science Cloud will be universal, specific to no single scientific discipline or research field. It will promote inter- and multi-disciplinary science and encourage innovation and integrated knowledge creation among all research communities, also capturing the long tail of science and citizen science.

V. Diverse & distributed: The Open Science Cloud will leverage the richness of Europe's distributed e-infrastructures, encompassing a resilient network of actors, resources and services organized nationally and at the European level. Embracing diversity through openness, the Open Science Cloud will drive a more efficient use of ICT investments across infrastructures and communities, addressing the digital divide and lowering the barriers to adoption for institutions and researchers.

VI. Interoperable: Through the promotion and adoption of common standards and protocols for all resources and digital services, the Open Science Cloud will connect networks, data, computing systems, software, tools and services for research as seamlessly as the Web connects information.

VII. Service-oriented: The Open Science Cloud will be protocol-centric and service-oriented. It will provide services that address the full research lifecycle, including data gathering, management, analysis, sharing and discovery. The Open Science Cloud will be the framework and testing environment for new, innovative methodologies and services that further advance research in the Open Science context.

VIII. Social: The Open Science Cloud will be a socio-technical endeavour that connects diverse communities and promotes the development of human networks. By adopting community-based rules and procedures with incentives for sharing and responsible use, it will enable the sharing of knowledge and facilitate the embedding of Open Science practices into researchers' everyday workflows. This will require a strong social dimension of consultation, outreach, advocacy, training and support, in an ecosystem of local, national and international programmes.

Dr. Kimmo Koski, Project Coordinator, EUDAT
Kristiina Hormia-Poutanen, President, LIBER
Prof. Mike Chatzopoulos, Project Coordinator, OpenAIRE
Yannick Legré, Director, EGI
Dr. Bob Day MBE (Interim CEO of GÉANT until Nov 2015)

FEDERATED IDENTITY – SUPPORTING RESEARCH AND EDUCATION COLLABORATION

THE NEED FOR FEDERATED IDENTITY

With the rapid growth in distributed services across research and education (R&E) there are increasing numbers of service providers offering access to their systems.

Most R&E institutions will have provided some form of single-sign-on (SSO) identity within their facilities, giving students, staff and researchers the ability to use one username and password across the campus environment. Federated identity allows the same SSO identity to be used across multiple services provided by many different organisations. Interfederation – the interconnection of multiple identity federations – allows this SSO identity to be used even more widely, giving users much easier access to a greater range of services from a larger pool of providers internationally.

For interfederation to succeed, all participating organisations need to operate to the same standards and 'rules of engagement', to ensure that identity providers share the correct level of information to trusted parties in a secure way and that service providers use that information in a consistent and secure manner. This requires cooperation between all the parties and use of a common standard set of protocols.

- Service providers benefit by gaining access to more users without increased demand for passwords and user support.
- Identity providers can offer more to their users without any extra administrative burden.
- Users benefit by getting access to a wider range of resources without the need to manage multiple identities and credentials.

Federated identities and Web SSO do not replace all elements of identity management, but allow providers to use existing identities in a secure and scalable manner. They allow service providers to manage access to systems on a per-user, per-organisation level or even (particularly for free services) to all identities.

EDUGAIN – SUPPORTING RESEARCH AND EDUCATION

eduGAIN is an important feature in this landscape. This fast-growing initiative interconnects research and education identity federations around the world. It enables the trustworthy exchange of information between service providers and research and education institutions or other identity providers. This means simpler access to a wider range of online content, services and other resources that benefit collaboration in the research and education community. eduGAIN:

- provides access to all the online services that students, researchers and educators need while minimising the number of accounts users and service providers have to manage - reducing costs, complexity and security risks;
- gives service providers access to a larger pool of users internationally, and allows users to access resources of peer institutions or commercial or cloud services using their one trusted identity.

With eduGAIN participants from more than 1,500 identity providers accessing services from 1,000 service providers, eduGAIN has fast become the primary interfederation mechanism for research and education collaboration around the world.

FEDERATION "AS A SERVICE" – GÉANT SUPPORTING NEW IDENTITY FEDERATIONS

Using identity federation and participating in eduGAIN provides huge benefits for the R&E community, but the development of an identity federation is not always simple and not all institutions have the infrastructure or expertise to create an identity federation from scratch.

In order to reduce the workload for a new federation and to simplify the processes, GÉANT has developed Federation as a Service (FaaS). This is a toolbox for managing identity federation metadata and exchanging metadata with other federations through eduGAIN. FaaS focuses on scalability, a user friendly interface and high security.

The FaaS toolbox is built using open-source software and is provided as a hosted single tenant service, where each FaaS customer gets its own FaaS instance that can be localised and branded as desired.

By using FaaS, new identity federations can quickly implement services without the steep learning curve usually required in a green field implementation. In addition, the use of a standardised toolbox of elements helps ensure compliance with standards and minimises the need for customised solutions.

Federation as a Service and eduGAIN together help support access to research and education around the world.

For more information on eduGAIN and FaaS visit **eduGAIN.org**

HOW THE CLOUD BENEFITS RESEARCH AND EDUCATION

Cloud computing offers new opportunities and challenges as both a technology and operations model, but what impact does it have on the Research and Education (R&E) sector? The traditional answers have been cost reduction and flexibility. However the cloud offers a wide range of additional benefits, including global collaboration, accelerated innovation, and enhanced user experience and satisfaction — as well as risk mitigation and the ability to smooth users' demands and allow NRENs to support new and emerging requirements cost effectively.

WHAT IS "THE CLOUD"?

Just as there are hundreds of cloud services, there are hundreds of different definitions of what "The Cloud" really means. This has resulted in many organisations rebranding their services as "Cloud Services" in order to jump on the bandwagon of this new technology.

In simple terms, cloud services are software, applications or facilities that are hosted in data centres connected to the internet, remote from the users. They are based on infrastructure owned by a third party with access rented by multiple users. They are called "Cloud Services" simply because in diagrams the internet is usually represented by drawing a cloud and these facilities are inside this cloud!

Cloud services offer NRENs new ways to deliver existing services and to enable services that could not otherwise be delivered. They offer a flexible "pay-as-you-go" model enabling researchers and students the ability to start small and grow as needed.

In many cases, the needs of the Research and Education community go beyond the basic commodity offerings of many cloud service providers. In addition, areas such as data integrity, privacy and security mean that GÉANT and the NRENs have a key role to play in ensuring that services are fit for purpose and are contracted in ways that meet the needs of the R&E community.

NEW USAGE MODELS

The rise of BYOD (Bring Your Own Device) within the education sector is being matched by the increase in BYOC (Bring Your Own Cloud). Users are increasingly technologically savvy and so less willing to accept what IT departments give them. If a researcher or a student needs a service now then they will try and obtain it, rather than wait for a potentially lengthy or inflexible provisioning via their IT department.

GLOBAL COLLABORATION

The world is becoming more interconnected and this is most apparent within the R&E sector. The ability to work together and manage "knowledge-intensive" collaboration in today's interconnected world relies on the cloud. The cloud offers these international collaborations the ability to acquire immensely powerful systems without lengthy development projects and without the need to bring in dedicated support systems and teams.

AGILITY AND ACCELERATED INNOVATION

More and more research and education activities are becoming reliant on connected IT services. Whilst the extremely large projects have the in-house resources to manage complex IT solutions, it is arguably within smaller projects that cloud services can benefit R&E more.

Projects from across the spectrum of education can use the flexible, on-demand, "pay and play" offerings to manage their needs and enable them to focus on their research rather than have to spend time and resources on making the IT work. Media and the Performing arts are an example of groups that can focus on being IT consumers rather than IT developers.

ENHANCED USER EXPERIENCES

With the rise in high performance networks and Federated Identity, computing resources can be located virtually anywhere with users being able to reach and manage them from any location. As IT becomes less "something that needs to be done" and more "something that can be used" it makes research much more agile and innovative. Cloud Services become a basic commodity to be turned on and off on demand which allows the skills of the teams to be directed towards generating new and innovative activities.

HOW GÉANT AND THE NRENS CAN HELP THE R&E COMMUNITY

Within the R&E community the opportunities for the use of cloud computing are clear; increased flexibility, demand smoothing, expansion of services to wider audiences. But there are significant challenges.

Cloud Customisation

Most Cloud Service Providers offer a range of basic services targeted at either individuals or businesses. The needs of the R&E community frequently go beyond this – particularly in areas such as data integrity and transferability. GÉANT and the NRENs can work with CSPs to help ensure that these services are suitable for our community.

Purchase Models and Cost Predictability

The purchase models offered by cloud providers often do not match the financial structures in the R&E community/environment. For instance, those purchasing the services on behalf of an institution will have limited access to company credit cards. So cloud services will have to be acquired through the institutions' purchasing structures, meeting procurement and tender regulations. In addition, the payment structures offered by cloud providers are too unpredictable, as they contain large variable cost components. To prevent the (fear of a) bill shock, predictable cost models and purchase-order-based systems are needed.

Connectivity

Users expect services to be highly available and offer seamless performance as if the services were local. The NREN networks and GÉANT have significant roles to play in ensuring the user experience of cloud services match expectation. Developments such as SDN and other advanced networking technologies will be driven by this need for high performance networking. Also, the variable costs of services can be reduced by limiting network traffic charges (data ingress and egress), through peering arrangements and connecting cloud providers to the GÉANT and NRENs networks.

Access and User Identity

Access and Security of cloud services is another challenge for the future development of cloud services (particularly hybrid solutions). The cost and complexity of managing user access to services can be considerable and users don't want to manage multiple logins and identities.

The Interfederation approach developed by eduGAIN can provide an open, flexible and extensible solution to the need for users to be able to access resources from multiple suppliers in a seamless and secure manner. eduGAIN, and federated identity solutions via NRENs, also provide opportunities for CSPs to enhance their offerings to the R&E community and help gain acceptance.

By combining these three fields – Cloud Services, High Performance Networking and Interfederated Identity, GÉANT and the NRENs can leverage the skills and abilities of their own resources with those of cloud providers to offer their users enhanced facilities.

For more information on how GÉANT is supporting the NRENs and the wider Research and Education Community visit
http://clouds.geant.net

INFRASTRUCTURE AS A SERVICE - DELIVERY AND ADOPTION THROUGH GÉANT

European NRENs are working through GÉANT to stimulate the adoption of cloud services in research and education, by representing their member institutions and establishing framework agreements with suppliers of Infrastructure as a Service (IaaS) solutions. This framework will be the result of a European tender, which will be launched in April 2016, resulting in a portfolio of services for the community. The frameworks will provide standardised contract terms for use by the NRENs to bring to their client institutions, without the need to run a tender themselves.

For more information on the tender process visit **http://services.geant.net/clouds/Activities/Pages/IaaS-delivery-and-adoption.aspx**

NRENs wishing to take advantage of this procurement process are invited to contact the clouds team via **clouds@geant.net**

CLOUDS ACADEMY

To help NRENs and users understand the opportunities and challenges of cloud services, GÉANT has created a Clouds Academy which provides video showcases, presentations, white papers and a series of workshops that will help NRENs support the clouds environment.
clouds.geant.net/clouds/academy

CLOUDS CATALOGUE

With over 15 service providers and 25 different cloud services the GÉANT Clouds Catalogue provides NRENs with a quick and easy guide to a range of services for the R&E community. The catalogue, with its structured listing of cloud providers' answers to the cloud requirements, offers to the research and education community clarity about providers' capabilities, which helps when procuring cloud services
https://catalogue.clouds.geant.net

EDUOER – NEW EUROPEAN SEARCH HUB GIVES ACCESS TO AGGREGATED MULTIMEDIA CONTENT

eduOER
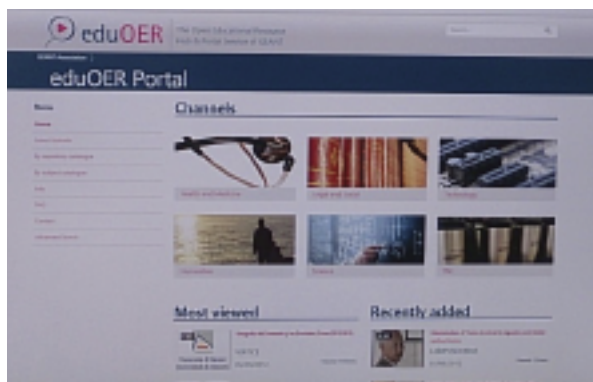
Traditional web-based search facilities often have difficulties with searching and categorising multimedia data and, with the growth in the use of video and audio material, there is an increasing need across the R&E community to be able to share and reuse this type of content.

eduOER is an Open Educational Resource (OER) service with the aim of facilitating access to digital multimedia content such as lecture recordings, webinars, audio-visual learning objects, animations. It operates across Europe as a search hub and portal by aggregating content metadata and allowing researchers and students to search multiple repositories and services. Initiated in the GÉANT task force TF-Media, eduOER helps educators and researchers find and re-use a wide range of multimedia resources across multiple research and educational content repositories, languages and disciplines.

eduOER supports owners of data repositories wishing to provide access to their content, and gives researchers and educators access to a wider range of resources.

Peter Szegedi of GÉANT explains, "The European NREN community is in an excellent position to facilitate how

Open Education Resources can be findable and accessible, more effective in helping students, serving minority populations, improving the teaching and learning process and potentially lowering the cost of higher and adult education."

SUPPORTING DATA PROVIDERS

The metadata aggregation service of eduOER supports national, institutional or thematic content repositories of any size, in order to facilitate their technical developments and let them contribute to the open educational movements of Europe and world-wide. Connected repositories can make sure that their metadata has good quality, openly searchable, findable and harvestable. Using eduOER will help maximise the re-use of content and increases its value to the community. For more information on adding a repository to eduOER visit: **https://oer.geant.org/services-for-content-providers/**

SUPPORTING RESEARCH

The end-user web portal service of eduOER targets all learners and educators; students, professors, and also system integrators. The portal shows information (metadata) about the multimedia educational resources harvested from various content

repositories across Europe in an openly searchable, findable and reusable fashion. To search eduOER visit: **https://portal.oer.geant.org/**

The service will be launched at GÉANT's annual symposium, this year held at Vienna in March.

TNC ARCHIVE

TNC archive session recordings back to 2001 are now indexed in eduOER and can be linked to any related content available in connected NREN or university repositories. And eduOER will soon be able to offer recordings from the NORDUnet Conferences as well as the RDA events.

PRACE TRAINING RESOURCES

eduOER is connected to the PRACE repository containing more than 160 multimedia training materials in the field of advanced computing. These materials can be shared and reused through eduOER and linked to related content. Training materials produced by other e-infrastructures including CERN will soon be available in eduOER.

TF-MSP PROGRESSES THINKING ON POLICIES FOR CLOUD AND COMMERCIAL PARTNERS

The GÉANT Task Force on the Management of Service Portfolios (TF-MSP) is taking the lead in helping national research and education networking organisations (NRENs) and GÉANT to be 'cloud friendly' in order to support the use of cloud services in the research and education community. With the rapid growth of cloud services, the situation increasingly arises that users within one NREN are accessing cloud service providers that are connected by another NREN - frequently via the GÉANT network. This can pose challenges regarding service performance and for ensuring that the services comply with the connection policies (CPs) and acceptable use policies (AUPs) of the partner networks.

In order that NRENs and users can be confident that the use of cloud services complies with differing policies, it would be advantageous for the community to have a consistent policy for connecting cloud service providers and commercial collaborators. So agreed participants at a January workshop of TF-MSP, where several NRENs presented their CPs and AUPs. Though similar in intent, these are diverse in their details and formulation; the AUP of an NREN may be affected by the legal structure within the country and also the way in which the network is provisioned and funded.

JANUARY'S TF-MSP BERLIN WORKSHOP

Andres Steijaert (SURFnet), who leads the GÉANT (GN4-1) Project's clouds activity, gave a presentation on cloud network peerings, joint tenders and the place of NRENs in the delivery of such services, exposing many of the issues.

Participants agreed that settlement-free peering agreements or connection at open exchange points are practical ways to provide the necessary network connections. The imperative is to ensure the continued integrity of the NREN and GÉANT technical and business models. Cases where one NREN has a direct connection to a commercial cloud service provider and other NREN users wish to gain access could raise issues of transit traffic between entities. Other more complex situations would need to be addressed in detail. Participants noted that the economic and policy issues raised in this respect must be picked up in some appropriate high-level but focused community forum.

An explicit and concise GÉANT AUP is expected to provide much needed clarity. A draft is expected to be presented to the GÉANT General Assembly during 2016..

Picture
Martin Bech and John Dyer – the chair and secretary of TF-MSP – with Andres Steijaert at the Berlin workshop, which was hosted by DFN on 11-12 January 2016.

Presentations from this workshop are available from:
http://bit.do/geant-msp-2016-01

To learn more about GÉANT Task Forces see the Community Development section on
www.geant.org

MULTI-DOMAIN MULTICAST – THE NEXT GENERATION OF BROADCAST TECHNOLOGIES

Everyone is now familiar with live streaming video and audio services across the internet. From listening to your favourite national radio station while on the beach to watching live rocket launches through NASA TV, the ability to access content when you want it is no longer "magic". But these services are usually delivered either by unicast solutions or via expensive, dedicated Content Delivery Networks (CDNs).

Within the R&E community, the "traditional" unicast solutions do not scale well and are only suited for low bandwidth services or very low user numbers. If large amounts of data needs to be streamed, the unicast method can quickly swamp even high capacity R&E network links.

To solve this problem GÉANT and the NREN networks have worked together to enable multi-domain multicast - able to deliver streams of up to 200Mbps to users worldwide. This development allows the R&E community to distribute high capacity live data streams in a uniquely scalable manner. This opens up opportunities many different fields of research from live high definition video broadcast to weather data.

SUPPORTING NRENS WITHOUT MULTICAST

For users connected to multicast NRENs, the data can be accessed simply (with the permission of the sender) but for those NRENs currently without multicast capability GÉANT has implemented an innovative system that allows users to "tunnel" across their network to the GÉANT backbone and access the multicast. This combines the power and scalability of multicast and the GÉANT backbone with the ubiquity of "unicast" technology to provide a system that can reach out to research and education users across the world.

Organisations and projects are already starting to use multicast services to distribute streaming data across GÉANT. The flexibility of enabling multi-domain access and the tunnelling ability to reach non-multicast networks provides the essential platform for innovative collaboration across the community.

To find out more about GÉANT's multicast capabilities and how your project could benefit from them visit
http://www.geant.org/services

GÉANT EXTENDS THE REACH OF 100GPS SERVICES TO SUPPORT CLOUD SERVICES AND HIGH CAPACITY DATA FACILITIES

GÉANT has recently deployed the Infinera Cloud Xpress to extend 100 gigabit Ethernet (GbE) network connectivity into data centers. Initial connectivity is being provided to Jisc and CERN. The addition of the Cloud Xpress allows GÉANT to extend 100GbE services seamlessly into more European data centers.

With Cloud Xpress, GÉANT leverages Infinera's unique photonic integrated circuit (PIC) technology to support up to one terabit per second (Tbps) of input and output capacity in just two rack units. With its small form factor and low power consumption, Cloud Xpress delivers a full 500 gigabit per second (Gbps) super-channel of wavelength division multiplexing (WDM) bandwidth over 150km without any need for additional multiplexers or amplifiers and up to 600km with an amplified line system.

Cloud Xpress also enables efficient scaling with simple provisioning and open interfaces to plug into existing cloud provisioning systems using open software defined networking (SDN) systems. Instant Bandwidth™ allows the activation of WDM bandwidth in 100Gbps increments via a few clicks of a mouse enabling GÉANT to meet customer demands.

Mark Johnston, chief network operations officer at GÉANT:

"We wanted something that integrated with our existing Infinera XTC footprint across Europe to provide a scalable, cost effective way to extend 100 GbE connectivity into more locations across Europe to meet the growing demands of our users while minimizing the need for space and power. Rapid and easy provision of new services was also a critical factor for us."

For more information on this exciting development visit **http://www.geant.org/News_and_Events/Pages/GEANT-deploys-Infinera-Cloud-Xpress.aspx**
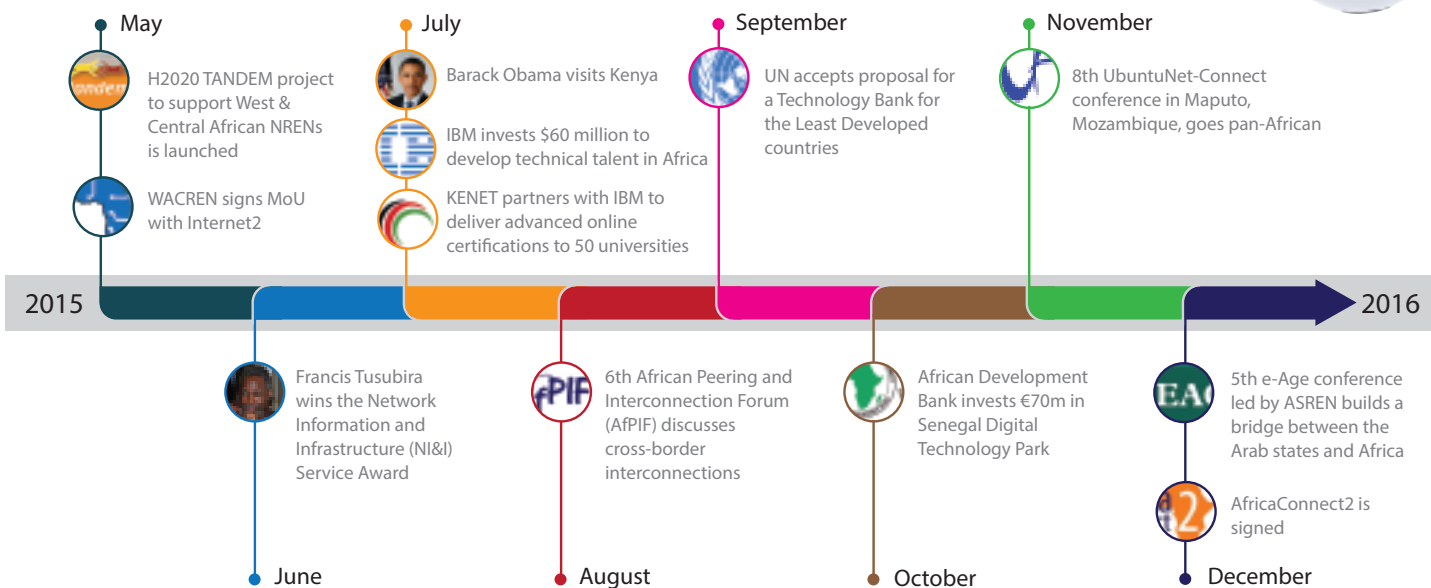
ALL EYES ON AFRICA

With just over 330 million users, the internet penetration in Africa is of 28%* (as of Nov. 2015), compared to an average of 50% for the rest of the world. This number, which includes both the commercial and non-commercial internet, has nearly doubled in less than a year. No wonder Google, Facebook, IBM and others are in for their piece of cake. Access to information is transforming African societies and economies at a fast pace.

AfricaConnect, co-led by GÉANT and the UbuntuNet Alliance allowed to connect over 3 million users across 6 countries only in Eastern and Southern Africa. With AfricaConnect2, we expect to connect more users to the UbuntuNet network and reach out to another 5 million potential users in West and Central Africa and North Africa together. Connecting this small percentage of the African population will have a huge impact not only in Africa but also in other regions of the world through educational and research collaborations and advances.

2015 IN A FEW DATES

May
- H2020 TANDEM project to support West & Central African NRENs is launched
- WACREN signs MoU with Internet2

July
- Barack Obama visits Kenya
- IBM invests $60 million to develop technical talent in Africa
- KENET partners with IBM to deliver advanced online certifications to 50 universities

September
- UN accepts proposal for a Technology Bank for the Least Developed countries

November
- 8th UbuntuNet-Connect conference in Maputo, Mozambique, goes pan-African

2015 — **2016**

June
- Francis Tusubira wins the Network Information and Infrastructure (NI&I) Service Award

August
- 6th African Peering and Interconnection Forum (AfPIF) discusses cross-border interconnections

October
- African Development Bank invests €70m in Senegal Digital Technology Park

December
- 5th e-Age conference led by ASREN builds a bridge between the Arab states and Africa
- AfricaConnect2 is signed

2016 continues to see green signals as the Internet society pledges support to the African research and education networks. Major transformations are under way with the implementation of

AfricaConnect2: in the North, Algeria has already upgraded capacity from 622Mbps to 2.5Gbps. More is to come in West and central Africa as WACREN organises its 2nd annual conference

later this year in Senegal. Further East the UbuntuNet Alliance is connecting new members. All pursuing a shared vision of a connected pan-African research and education community.

AFRICACONNECT2 IS A DEAL!

Africa and Europe gathered at the end of 2015 to seal a deal that is already transforming Africa and global research and education: the €26.6m EU-funded AfricaConnect2 has been signed by all partners and the project is on its way to provide dedicated high-speed internet all over Africa thus laying the foundations for a pan-African network for research and education.

AfricaConnect2 is a pan-African connectivity project involving three African regions:

- Eastern and Southern Africa, managed by the UbuntuNet Alliance;
- West and Central Africa co-managed by WACREN, the regional research and education network, and GÉANT;
- North Africa also co-managed by ASREN, the Arab states network for research and education, and GÉANT.

The project's mission is to establish regional networks in all African regions, interconnect and link them to other world regions via the GÉANT network.

AfricaConnect2 is expected to open a wealth of opportunities for African researchers and students as well as the global community as the networks and upgrades implemented by each partner provide support to critical research in climate change, food security and infectious diseases. Students from around the world will be able to collaborate and take their work to the next level thanks to e-learning services and further advanced communication tools.

WE WERE THERE

UBUNTUNET-CONNECT OPENS THE ROAD TO NREN MATURITY

UbuntuNet 2015
CONNECT

The 8th edition of the UbuntuNet-Connect conference took place in Maputo on 19-20 November 2015 attracting over 150 participants from all over Africa and beyond with representatives of local research and education networks as well as West & Central African and North African regional networks, the World Bank, the European Union, global collaboration projects such as MAGIC, and the pan-European GÉANT network.

The theme of the conference was ''Beyond connectivity: the road to maturity'' and featured presentations about tech hubs accelerating local growth in Africa, global services such as Sci-GaIA science grid, eduroam and multiple strategies to add value to local networks from building fibre to creating local telecoms synergies.

Cathrin Stöver, Chief International Relations and Communications Officer at GÉANT, presented the AfricaConnect2 project to the assembly, stressing the need for engagement from universities and research institutions to NRENs and policy makers across the whole African continent.

AfricaConnect2 aims to repeat the success story of the UbuntuNet network in the rest of Africa. The UbuntuNet network will also make the most of AfricaConnect2 by upgrading its services and welcoming more countries, an ambition which was showcased by the signature of a membership agreement with the Somali NREN (SomaliREN) during the conference, made possible thanks to the further contribution of the World Bank.

Find all the UbuntuNet-Connect 2015 expert presentations at: **https://www.ubuntunet.net/uc2015_programme**

WEST & CENTRAL AFRICA: LE NOUVEL ÉLÉMENT

West & Central African regional organisation WACREN held its first AfricaConnect2 project meeting at IRD research institute in Montpellier on 7th of December 2015, prior to JRES, the main research and education networking event in France.

Following their involvement in the H2020-funded TANDEM project to support the development of national NRENs locally, West and Central Africa appears all set to roll out connectivity in a mainly French-speaking region, making the most of partnerships with RENATER and French research institutes such as IRD.

Through TANDEM, WACREN has also launched a survey that will allow

them to cater for the specific needs of the research and education community in the region with tailored services and applications.

AfricaConnect2 will assist WACREN to reach out to nearly 3 million users in the region.

2016 is already full of planned rendez-vous, not least the 2nd annual WACREN conference in Dakar, Senegal on March 17-18th sure to become the main R&E networking event in the region.

Find out more about the WACREN conference at **www.wacren.net**

E-AGE 2015: INTERNATIONAL COLLABORATION IS KEY, INTERNATIONAL CONNECTIVITY IS A MUST!

ASREN
Arab States Research and Education Network

The 5th "International Platform on Integrating Arab e-Infrastructure in a Global Environment" (e-AGE 2015 conference) took place 7-8 December 2015 in Casablanca under the patronage of HM King Mohammed VI of Morocco, attracting 120 high-profile participants from over 30 countries spanning all world regions.

FOCUS ON R&E COLLABORATIONS

Ministers and senior EC officials emphasised the strategic value of e-infrastructure for the development of research and education across the Arab region and the role of ASREN in providing Arab scientists, students and academics with a gateway to participation in world-class activities. Rupert Joy, EU Ambassador to Morocco, explicitly mentioned the role of GÉANT and other regional networking initiatives, such as AfricaConnect2 and EUMEDCONNECT3, in contributing to a global knowledge society by facilitating R&E collaborations across borders.

Themed "Revealing and Harvesting Knowledge", this year's conference put

the focus on scientific and academic applications supported by R&E connectivity, with contributions from researchers across a wide array of fields, ranging from medical diagnostics, high-energy physics, climate change studies to remote sensing for disaster warning. Esther Wilkinson, Jisc's Head of International, made the case for supporting the 'E' in NREN by providing an overview of Jisc's Transnational Education activities with focus on the Arab region. The message of all presentations was: international collaboration is key, international connectivity is a must!

The development of eduroam and eduGAIN throughout the Arab region was another recurring theme during the two days, with various countries having already implemented these services, or are in the process of doing so. .

GROWING COMMITMENT

At previous e-AGE conferences ASREN had announced ambitious plans to construct a regional R&E network and secure long-term sustainability of e-Infrastructures in the region. Following ASREN's first link to the ASREN PoP in London in November 2015, a year on, another connection was announced: Lebanon is joining the international R&E networking community with an ASREN link from the American University in Beirut (AUB). Further peering contracts

are currently being negotiated with several other Arab partners.

With this new momentum in the Eastern Mediterranean countries, negotiations are underway with the EC to extend the EUMEDCONNECT3 project (which with the migration of the North African partners to AfricaConnect2 now comprises Jordan, Lebanon and Palestine) beyond 2016.

Furthermore, following promising network readiness studies, the North African partners in AfricaConnect2 (previously EUMEDCONNECT3 beneficiaries) have shown renewed interest in international R&E connectivity. Algeria has recently upgraded its connection from 622Mbps to 2.5Gbps, driven by increased user demand, while Tunisia and Egypt are also expected to re-connect this year.
For more information, please visit
http://asrenorg.net/eage2015/

WHO WE MET

PATRICK OKUI, A NETWORK ENGINEER AND A TRAINER

NSRC
Network Startup Resource Center

Prior to UbuntuNet-Connect a four-day advanced routing workshop was organised by NSRC to teach engineers across Africa how to run a network and build new connections. The workshop was attended by 21 participants from across the UbuntuNet region, including 4 women engineers. We met Patrick Okui, a consultant at NSRC who after training on his own and graduating from Makarere University in Uganda volunteered as a teaching assistant with AfNOG, the African Network Operators Group, in 2001 and a trainer of engineers.

NSRC, the Network Start-up Resource Centre, is a not-for-profit organisation, part of the University of Oregon, funded by US National Science Foundation, Google and several other private and public bodies. NSRC has been instrumental in building network engineering capacities by providing training and they continue to develop a community that projects such as AfricaConnect2 is serving.

Patrick accepted to share his in-the-field insight as an engineer himself and a trainer.

WHY ARE NETWORK ENGINEERING WORKSHOPS NEEDED?

Every network relies on a network of people. To run it properly you need to develop skills and share best practice. These workshops work on both aspects since we teach technical hands-on matters but also bring people together to fix possible problems. In the field the same process applies between connected networks: an engineer from Uganda may ask his colleague in Kenya for help and support and work together on joint issues.

WHAT IS THE IMPLICATION IN TERMS OF COSTS?

Working together as a network of people is definitely the way towards sustainability since we can share human resources and much more. Here at NSRC we have supporters such as CISCO which have lent us materials at time. We have a good relationship with Ubiquity and are developing our relationship with Juniper. These people are part of our network and they also contribute to this success story. When engineers are connected they can address shared matters such as maintenance and other aspects of the network and share resources.

HOW DO YOU MEASURE THE IMPACT OF SUCH WORKSHOPS?

The workshops that we organise at regional conferences have a huge impact on our audience, not only because we train new engineers each year but also because we can monitor those we have trained and end up coaching them as trainers themselves in a ''Train the trainers'' perspective. The best possible positive outcome is that NRENs go back and run their own workshops in their countries. Since UbuntuNet-Connect14 ZAMREN has run 4 of our workshops on their own and KENET has organised many more training on campuses around Kenya. We provide material but the NRENs use their own trained staff to deliver it. Some NRENs like Benin even translated some of our material in French, and used them in their workshop to further support their bidding for being part of AfricaConnect2 with WACREN.

WHAT OTHER AREAS OF TRAINING DOES NSRC OFFER?

In addition to routing, we also offer training in network monitoring, campus design network, services such as cloud and eduroam and we have started to work on wireless in places hard to reach with cable, such as in Senegal lately between two universities which where 50 kms apart.

HOW CAN ENGINEERS ADD VALUE TO THEIR NETWORKS, BESIDES RUNNING THEM AND FIXING BUGS?

By sharing info and analysing the data their networks provide to find insights on how to address the needs of their users better. Basically network monitoring can help engineers see patterns in their traffic, where it comes from, where it goes to, why and this can help make better decisions. Sharing this info between networks could surely empower the whole backbone regional network and support a common vision at a wider scale. It's all about analysing this mine of information and sharing it.

LEBANON JOINS GLOBAL R&E NETWORKING COMMUNITY

Lebanon has recently joined the global R&E networking community with a link from the American University of Beirut (AUB) to the ASREN PoP in London, bringing the number of non-EU countries reached by GÉANT to 65. We spoke to AUB's CIO Yousif Asfour on what this connection means to AUB, Lebanon and the global R&E community.

LET'S START WITH SOME BACKGROUND…

Lebanon's network infrastructure has many limitations which have slowed down the development of an NREN and prevented us from connecting with the rest of the global R&E community. Rather than waiting for an infrastructure upgrade, we decided at AUB to use our existing connectivity to set up a VPN tunnel to the ASREN PoP in London, which is our gateway to GÉANT. This has also paved the way for establishing LERN (Lebanese Education and Research Network) in our country.

WHAT WAS THE MAIN DRIVING FORCE BEHIND THIS CONNECTION?

At AUB we believe that IT should be a partner with academic and administrative staff to help transform teaching, research, student life and patient care. This means turning IT from being a pure service provider into a service broker that identifies services from different institutions and integrates them seamlessly into the AUB fabric. This allows us to give our faculty access to a large service portfolio and facilitate collaboration between them and researchers across the world. We see AUB as both a user and provider of services to the R&E community at large, and the NRENs as the conduit for sharing such services.

WHAT IS ASREN'S ROLE IN THIS?

ASREN has been both the catalyst and conduit for getting this done. It was at the ASREN meeting in Jordan last autumn that I connected with David West from GÉANT, and jointly with ASREN's leadership team we figured out the best way to move forward in setting up an NREN in Lebanon and in providing international R&E connecting to AUB.

AS CIO OF AUB WHAT ARE YOUR MAIN ARGUMENTS FOR LERN?

As the founding CIO at New York University Abu Dhabi, I got to work very closely with various NRENs and networking organisations, including Ankabut, Internet2, ASREN and GÉANT. This gave me the opportunity to help establish the Arabian Global Education Open Exchange (AGE-OX) in Fujairah connecting the UAE with other regional networks. My experience at NYU Abu Dhabi gave me insight into the type of services that education and research institutions need. It also made me realise that NRENs are much more than just a "cost-effective high-bandwidth network" and that they are about developing and providing services that transform teaching, research and collaboration across the world.

When I joined AUB, it became very clear to me that it was essential for Lebanon to join the R&E networking community to regain its leadership role in research and education in the world.

WHAT ARE THE MAIN CHALLENGES FOR LERN?

Connectivity in Lebanon is very expensive; building a cost-effective, high-bandwidth NREN in Lebanon and connecting it to the rest of the NREN community is cost-prohibitive and politically challenging. This explains why AUB's connection to ASREN is currently limited to only 10Mbps. But there is also an awareness issue. Most people – not just in Lebanon - think of NRENs as "cheap, high-bandwidth internet providers" without realising that they also build communities and provide services on top of connectivity. Getting institutions to understand the added value of NRENs is therefore critical.

WHAT WAS YOUR APPROACH?

Well, how do you go about convincing R&E institutions in Lebanon to invest time and resources in establishing an NREN, especially when the infrastructure, tariffs and political climate are all but favourable? The answer is simple – just flip the typical NREN argument around: change the NREN discussion from "how can we build
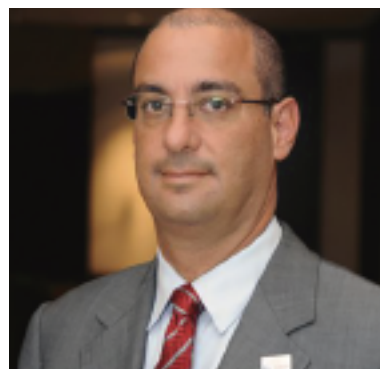
a fast and cheap network" to "let's focus on shared services to build a community of R&E institutions and then use this community as leverage to build the high bandwidth".

So we first focused on the services that an NREN can provide without a high-bandwidth network. We started by implementing eduroam at AUB - a simple but very effective collaboration service. We then showed this service to a few other universities in Lebanon, who quickly adopted it and started promoting it to yet other institutions. Once we had a critical mass, we kicked off discussions about other potential services, and how as a community of R&E institutions we can work together to change the landscape. LERN took off from there. In other words, we have taken a "community and services first, connectivity second" approach to the NREN, untangling it from politics – and it seems to be working! As a matter of fact, we were able to accomplish within a few months what had been stuck in discussions for over 5 years.

WHAT FUTURE STEPS ARE ENVISAGED TO GET LERN OFF THE GROUND?

We have started discussions with 10 universities and research centres across Lebanon to formally establish LERN. The institutions have already agreed on the objectives and draft by-laws, and are currently reviewing them internally for final approval. It is my hope that the GÉANT-ASREN-AUB connection will quickly show the value of an NREN and help us accelerate the process of formalising LERN. Once LERN becomes operational, our plan is to open the current connection to all LERN members, use it to market GEANT's services to the LERN community, and encourage LERN members to provide services to the R&E community in order to encourage collaboration among Lebanese institutions and between Lebanon, Europe and the rest of the Arab World.

WHAT IMPACT DO YOU EXPECT WILL LERN HAVE ON LEBANON?

Partnering with EUMEDCONNECT3, GÉANT, ASREN and other NRENs will help Lebanon regain its leadership role in R&E, regionally and globally. Such partnerships are already beginning to bear fruit. We already see a significant uptake of eduroam which encourages faculty and students to move between universities locally, regionally and globally. Lebanon in general, and AUB in particular, in partnership with the EU is also playing leadership roles in multiple regional programmes such as ProGreen, a multi-disciplinary online program.

Over the next 5 years, I expect AUB and LERN to help Lebanon become a significant player on the global R&E scene as well as a major contributor to NREN services within the region and beyond.

GÉANT AND NICT STRENGTHEN TIES THROUGH NEW MOU

During the TEIN and APAN41 meetings in Manila, GÉANT and NICT (National Institute of Information and Communications Technology in Japan) reaffirmed their commitment to strengthen network research cooperation between Europe and Japan by signing a new Memorandum of Understanding (MoU).

At the signing ceremony on 26 January Dr. Makoto Imase, Vice President of NICT said: "NICT's goal is to develop a reliable and energy-conscious global network infrastructure utilising innovative technologies. Such a goal is widely shared by many organisations across the world, including our partners in Europe. In the framework of Horizon2020, NICT has built a sound partnership with European players through participation in various EU-Japanese network research projects. We therefore welcome extending the MoU to continue our collaboration with GÉANT and to jointly support our many researchers across Europe and Japan".

NICT is Japan's principal ICT research organisation and, through the JGN-X (JGN eXtreme) network, provides advanced, new-generation research testbed facilities for the development of cutting-edge internet technologies and applications at national and international levels.

For its part, the GÉANT Testbed Service (GTS) delivers integrated virtual environments to test novel networking and telecommunications concepts, at scale, and across a geographically dispersed footprint.

The primary areas of cooperation agreed upon in the memorandum include testbed interconnection and interoperability and research in the field of Software Defined Networking (SDN). Further areas of mutual interest are expected to be identified during the term of the MoU.

Steve Cotter, CEO GÉANT, welcomed the new cooperation opportunities: "The relationship between the GÉANT community and Japan is longstanding. NICT has been a major partner in the TEIN programme from its outset in 2004 and this has helped foster the good relations between us. We look forward to joining forces with NICT to continue shaping Future Internet research and are happy to be the bridge between NICT and the European NRENs and their users for better collaborations and improved research outcomes in the future".

DENGUE FEVER WORKSHOP AT APAN41

Over 30 clinicians, researchers from within the multi-disciplinary dengue fever community, public health officials and NREN representatives from across the Asia-Pacific gathered in January during APAN41 in Manila to share experiences and best practices and to exchange ideas around how to manage, prevent and fight this infectious tropical disease.

Now in its third edition, the joint TEIN/APAN Dengue Fever and Public Health Workshop saw lively interaction and enthusiasm within the medical community to join forces with NRENs and thus to make a difference. "We share the virus and mosquitos, let's share also our data": this statement of Dr Raul Destura from the National Institute of Health-University of the Philippines in Manila – a passionate champion of this cooperation - encapsulates the very essence of the workshop.

The driving force behind this initiative, Prof. Francis Lee Bu Sung, President of SingAREN and Chair of Governors of TEIN*CC, commented: "We have come a long way since we set out back in 2014. There is now a much better understanding among the dengue fever research community as to what our networks can bring to the table. Not just in terms on supporting videoconferencing for clinical case discussions and capacity building, but there are now plans to develop a digital platform for data exchange and to work towards a regional outbreak prediction model. This is computationally intensive stuff, which requires good connectivity and therefore our networks!"

Workshop co-chair Helga Spitaler from GÉANT added: "With global travel and climate change the infection corridor across the world map is widening. Dengue fever and other viruses are no longer confined to endemic regions. We see an increased need to also engage with the infectious diseases research community here in Europe. The Zika outbreak has certainly hammered it home."

Picture
Participants at the 3rd Dengue Fever and Public Health Workshop on 24 January in Manila

To view the workshop agenda and presentations visit
https://master.apan.net/meetings/Manila2016/Sessions/session.php?id=72

ARMENIA AND GEORGIA CONNECT TO GÉANT

Georgia and Armenia have started to implement links to the GÉANT network, as part of EU-funded EaPConnect project.

EaPConnect aims to create a modern digital environment for innovations and collaborations in the Eastern Partnership region –Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine – by providing advanced e-infrastructure and services to students and researchers and integrating them in the European research area.

GRENA and ASNET-AM are established networks which have been connecting the main research and education institutions in Georgia and Armenia for two decades already. Two 1Gbps links to GÉANT will now enable over 50 universities and research institutes locally to join the European research and education community and collaborate with their peers across borders. Researchers in Georgia and Armenia already work with global partners such as CERN in high-energy physics, meteorology, climate change, and seismology.

Next to join in is Azerbaijan, which has started contract negotiations to connect their national network, AzScienceNet, to GÉANT. There is also a tender under way to link the Belarus network, UIIP NASB, to the pan-European network.

We expect the Eastern Partnership countries to be fully connected to GÉANT by the end of 2016. For the European research and education community, this enlargement will provide a welcome addition of expertise in the fields of physics, climate change, disaster prevention or life sciences.

Pictures
Left: Tbilisi Bridge of Peace, Georgia

Right: Mount Ararat, Armenia

GÉANT PARTNERS UP WITH UNION FOR THE MEDITERRANEAN (UFM) TO SUPPORT THE DIGITAL ECONOMY IN THE MEDITERRANEAN

Union for the Mediterranean
Union pour la Méditerranée
الإتحاد من أجل المتوسط

GÉANT has recently been given official recognition by the Union for the Mediterranean (UfM) of its role in R&E networking and invited to use its expertise to help UfM implement its digital economy agenda in the Southern Mediterranean.

GÉANT's role was confirmed in Barcelona last December at the first meeting of UfM's new Digital Economy Working Group (DEWoG) set up to implement recommendations of the 2014 UfM Summit of Digital Economy Ministers to accelerate the development of the digital economy for Euro-Mediterranean citizens, consumers and businesses. As well as regulatory and

commercial initiatives, the importance of high-speed connectivity for all Southern Mediterranean countries with GÉANT was expressly recognised and this is to be built upon through DEWoG's activities.

Along with officials of the 43 UfM member states and of the European Commission, DEWoG also comprises 'promoters', i.e. experts to act as champions for aspects of the digital economy implementation. GÉANT has now been formally granted the status for R&E promotion activities; this clearly reflects GÉANT's active support of the development of R&E networks in the Southern Mediterranean since 2004 through the EUMEDCONNECT project and now also through AfricaConnect2, as well as the confidence that the organisation's expertise and relationships in the region will prove beneficial to achieve the overall DEWoG goals.

David West, GÉANT's project manager for this activity welcomed UfM's recognition: "This is a great endorsement of GÉANT's work in the region. The agreed priorities for our involvement in DEWoG's work plan are to connect all Southern Mediterranean countries to GÉANT, secure additional EU funding for Eastern Mediterranean countries beyond 2016 and to promote the use of GÉANT connectivity to the user communities in the region. These efforts are very complementary to GÉANT's core activities and it is hoped that UfM's endorsement will bring additional political support to achieving them."

The UfM is an intergovernmental institution bringing together the 28 EU member states, the European Commission and 15 Southern Mediterranean countries to promote cooperation in the Euro-Mediterranean region.

BOOST FOR ASIA-EU CAPACITY

The last year has witnessed a step-up of connectivity between Europe and Asia. First, there was the launch of the previously reported 10Gbps link between GÉANT and China which continues from the successful ORIENTplus collaboration for a further 10 years. More recently, a number of further major capacity injections are in the pipeline, with existing links either being upgraded or additional links becoming operational. Taking together, they represent a major increase of direct connectivity between GÉANT and its sister networks in Asia, underpinning transcontinental R&E collaborations.

SINGAPORE
GÉANT, TEIN*CC and SingAREN have worked together to deploy a new

10Gbps link from Singapore to London which has recently gone into service; jointly funded by the TEIN project and the Singaporean government, it provides additional connectivity between the GÉANT and TEIN communities in Europe and Asia opening up, in particular, direct channels for supercomputing tie-ups between the regions. An early beneficiary is the InfiniCortex project, with genomics and climate science being other candidates.

INDIA
To stay ahead of increasing traffic demand between Europe and Asia, in particular from the HEP community, the TEIN project is upgrading its connectivity to GÉANT from 2.5 to 10Gbps from Singapore to Madrid via Mumbai. Imminent also is further international

connectivity from India to GÉANT by the National Knowledge Network (NKN) which provides India's network backbone. This is providing a further 10Gbps of capacity over two diverse cable systems, giving a strong base for increasing EU-India collaboration projects.

JAPAN
Connections between GÉANT and Japan are also being ramped up. Up to now, connections between GÉANT and SINET (the Japanese network operated by NII) have been achieved by interconnection in North America. Now, SINET is bringing 20 Gbps directly to GÉANT and this will give faster and higher capacities as well as lower latency to support R&E collaborations.

1ST EUROPEAN LARYNGOLOGICAL LIVE SURGERY BROADCAST FROM POZNAN

The 1st European Live Surgery Broadcast (**http://els.livesurgery.net/**), an interactive videoconferencing session presenting otolaryngological surgery, took place on December 2nd 2015. The event was organised by the European Laryngological Society (ELS), the Department of Otolaryngology, Head and Neck Surgery of Poznan University of Medical Sciences (PUMS) and Poznan Supercomputing and Networking Center (PSNC). The aim of the session was to demonstrate the newest surgical methods utilised by specialists from leading European laryngology clinics. Hospitals from Barcelona, Marseille, Genoa, Leiden, Essen, Luxembourg and Poznan took part in the event.

The team of doctors from PUMS and the staff from PSNC, who had cooperated in numerous telemedical undertakings, prepared this all-day educative session under the auspices of ELS. The central point of the broadcast, both from the medical as well as the technical point of view, was located in the PlatonTV (**http://tv.pionier.net.pl/**) TV studio at PSNC. Professor Frederik Dikkers (University of Groningen), Professor Manuel Bernal Sprekelsen (University of Barcelona), Professor Jens Klussmann (University of Giessen) and Professor Witold Szyfter (Poznań University of Medical Science) were moderating the session from the studio.

The extraordinary element of the session was that surgeons from participating hospitals performed multiple otolaryngological interventions in parallel, allowing the moderators to dynamically switch between the operating theatres. This permitted to show the highlights of each procedure and maintain high educational value throughout the whole 6 hours of the broadcast. The surgeons from the clinics stayed in contact throughout the whole session and were able to exchange remarks and pass on their knowledge. At the end of the broadcast, a discussion was conducted between all surgeons and moderators concerning surgical methods and difficult cases.

In order to augment the educational effect, the whole session was also streamed live through the Internet in HD quality using PlatonTV, the Interactive Scientific TV Platform operated by PSNC. Over 1000 participants from all around the world have watched the broadcast. Over 226 GB of video data was streamed. The recording of the session is available at **http://tv.pionier.net.pl/play?id=5629**.

The hospitals and the studio at PSNC were interconnected through medVC (**http://medvc.eu**), a remote medical collaboration platform providing the possibility to perform multipoint audio-video communication in realtime. medVC allows to carry out multistream high definition (HD) video transmissions using video from surgical cameras, microscopes, endoscopes, surgical robots and other medical imaging devices. During this broadcast, video from medical equipment of such manufacturers as Storz, Olympus, Medrobotics, Trumpf Medical and ConMed was used.

The Multi-Point Control Unit (MCU) enabling multi-point connectivity was deployed at PSNC's data center in Poznań. medVC's MCU is a packet reflector providing all participants of the videoconferencing session with video streams in the same quality as they are being transmitted from their sources, with no need for recoding. This ensures maximum quality of the image, which is very important for medical education, however requires more bandwidth. During the session 9 sites (10 medVC terminals, as two have been used in the studio in Poznań) have been connected sending a HD video stream of 5 Mbps each. The MCU was receiving 50 Mbps of incoming traffic and sending out 450 Mbps of video streams.

About PSNC:
PSNC is the operator of the PIONIER network (Polish Optical Internet), a nationwide broadband optical network for e-science and is the Polish NREN. PIONIER connects all Polish scientific institutions, including all clinical hospitals, with its over 7000 km wide network built on own fibres. PIONIER is directly connected to the GÉANT network, which made it possible to seamlessly perform the live surgery session.

About medVC:
medVC is a cutting edge remote medical collaboration platform enabling realtime communication between operating rooms, conference rooms and doctors' offices. Apart from multistream HD video transmissions, medVC offers numerous tools facilitating remote collaboration of doctors, like pausing the video stream, marking areas of the picture, saving snapshots of the image to a medical repository, and remote control of computers running medical software (e.g. DICOM browsers). medVC is compatible with stereoscopic video streams coming from surgical robots or 3D endoscopes that are just entering the market.

Words
Piotr Pawałowski, PSNC

Pictures
Left: Operating room equipped with the medVC system at the Department of Otolaryngology - Head and Neck Surgery of Poznan University of Medical Sciences

Right: Moderators in the PlatonTV studio at PSNC (left to right): Professor Manuel Bernal Sprekelsen (University of Barcelona), Professor Jens Klussmann (University of Giessen), Professor Witold Szyfter (Poznań University of Medical Sciences), Professor Frederik Dikkers (University of Groningen)

KEEPING EDUCATION CONNECTED

John Boland, Chief Executive, explains how HEAnet - Ireland's National Education and Research Network keeps education institutions at the cutting edge of technology.

Established in 1983 by Ireland's Universities, with the support of the Higher Education Authority, HEAnet provides essential e-infrastructure services across all levels of the Irish education system. The 100 Gbit-capable, high-bandwidth, resilient network connects all Irish Universities, Institutes of Technology (IoTs) and other higher education institutions as well as research organisations. In addition, all primary and post-primary schools across Ireland greatly benefit from using HEAnet for their internet services.

"Students, staff and researchers here in Ireland have all the advantages which the largest EU countries have access to", said John Boland. "We are at the leading edge of research networking, ensuring our end-users have access to the same services as their counterparts across Europe. We offer our one million users connectivity that is typically 1000 times faster than what small businesses or home users have access to."

Advanced Network

Thanks to HEAnet, Ireland's education and research community now has a very high-speed bandwidth network that connects institutions across the length and breadth of the country. The network is being constantly improved, with the next phase of development entitled RMAN (Replacement of Metropolitan Area Networks), facilitating increased collaboration across institutions, and ensuring a reduced carbon footprint.

Words
Fi Coyle, HEAnet

Pictures
Left: HEAnet network map

Right: Lord David Puttnam, Ireland's Digital Champion speaking at the HEAnet National Conference

One of the most tangible benefits of this network is that every school in Ireland now also has high-speed access to the internet. "Our network provides world-class internet connectivity to 800 post-primary schools and every single one of them has a 100Mb dedicated connection," said John Boland. "This gives teachers the opportunity to confidently use their electronic white boards and use activities on the internet for teaching. It is one thing for the teacher to describe from a book the ceiling of the Sistine Chapel but it is another to navigate right around it on the white board."

Market Leader in Services

An area where HEAnet and Ireland have lead the way is the delivery of the Edugate system. Edugate is a single sign-on authentication service for students and academic researchers that allows them to access and collaborate on lots of different web resources, including online databases, e-books and exam systems as well as uploading assignments, without having to remember multiple usernames and passwords every time.

"In this instance, Ireland is a leader, not a follower, with more and more institutions signing up to Edugate each year. We have also developed a federation management tool called JAGGER. Federation management can be complex, but JAGGER has made this task much simpler and is now being

adopted around the world", Boland said.

Edugate membership comes with an opt-in mechanism to participate in the wider eduGAIN confederation; providing Edugate members with an extended range of academic services and allowing Edugate services to authorise access to international academic users.

Management Information Systems (MIS) are also important in Ireland's education sector. HEAnet now has a subsidiary EduCampus Services Ltd providing centrally managed MIS services covering library, finance and student systems to all of Ireland's Institutes of Technology.

"This is another example of our mission to provide cost-effective shared services," explains Boland. "It gives our clients the most effective way of obtaining complex systems, without having to individually and expensively procure their own solutions and recruit staff to maintain the systems."

All of this underlines how HEAnet has moved towards offering a diverse portfolio of shared services. Evolving beyond being simply the supplier of the network connection, HEAnet now represents a responsive network focused on clients' needs as well as real collaboration.

For more information on HEAnet and its services, visit:
www.heanet.ie

HEAnet Awarded Green Campus Certification

HEAnet has been collaborating with An Taisce's Green Campus FEE (Foundation for Environmental Education) programme for several years now.

This programme encourages a partnership approach to environmental education, management and action in third level institutions. Primarily aimed at campus communities it ensures that students and staff can engage in a meaningful way to enhance sustainability on campus.

As HEAnet and An Taisce share a common client base across the University and Higher Education sector, they have combined their efforts to promote sustainability and dissemination through the use of ICT technologies.

To fully establish this collaboration, HEAnet successfully undertook Green Campus Certification in their own right, in order to fully experience the program being pursued by an increasing number of their clients. HEAnet are the first company to be awarded Green Campus Certification in this category.

HEAnet also lead GÉANTs Green Team activities, part of the GÉANT Project (GN4-1) and are in discussions with other NRENs about their participation in FEE activities in their own countries.

Picture
John Boland, HEAnet Chief Executive and Andrew Mackarel, HEAnet Project Manager accepting the Green Campus Certification award from Anthony Purcell, Development Manager, Environmental Education Unit, An Taisce, at HEAnet's National Conference, 13 November 2015.

More information:

For HEAnet's involvement with An Taisce Green Campus, please contact **noc@heanet.ie**

To learn more about An Taisce Green Campus, see **http://www.greencampusireland.org/**

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INNOVATING COLOSSEO: ART AND SCIENCE COME TOGETHER OVER THE NETWORK

Archaeology and fiber-optics, theatre and networking; ultra-high definition for actors and musicians participating from distant locations; past, present and future come together in a digital environment. Thus the inauguration of the fiber-optic connection to the GARR network of all the sites of the Superintendency for the Rome Archaeological Area becomes a unique event with the performance of "La Nave Argo" by director Giorgio Barberio Corsetti in the Aula Ottagona of the Baths of Diocletian.

"A leap into the future" commented Superintendent Francesco Prosperetti, "which shows us how the network is not only a tool for researchers but also a key enabler of the creative spirit".

The event was an opportunity for the cultural heritage community to come together and discover how the potential of ultra-broadband comes alive through the vision of an internationally acclaimed artist. Says Corsetti, "I was curious to explore the possibilities of a poetic approach to concepts of presence and absence in different places, and how this would reflect on perceptions of time and space."

A space which, like the network, has no borders, bringing together four remote locations (Baths of Diocletian, Colosseum, Crypta Balbi and the INFN National Laboratories in Frascati) onto a single stage. "The theatrical spectacle lives off its components which are a temporal duration and a space;" explains Corsetti, "we have challenged both these notions."

This relation between archaeological locations and experimental research underscores the added value of a multi-disciplinary network such as that provided by GARR, which is first and foremost a network of people. GARR director Federico Ruggieri describes a challenging and greatly satisfying experience. "As is often the case, when everything works the public does not notice the significant technical work that goes into it, but this is the value of a network that is 'transparent' for its users".

The performance required an ultra-high definition video stream with extremely low latency, setting up two locations with the LoLa (Low Latency) software developed by GARR in collaboration with the Tartini Music School in Trieste. Preparations took about a month and saw the collaboration of multimedia experts from the GARR Netcast community.

The collaboration between GARR and the Superintendency is deeply rooted. "Ours is truly a Special Superintendency," says Prosperetti, "we have many sites in our organization, and sharing data and applications is part of our daily life. As an example, the National Roman Museum is distributed over four sites, so having them joined with ultra-broadband connections is essential to our research".

There are already several highly innovative projects, such as the SITAR system, which relies on GARR for connectivity, storage and digital identity management. It is a multi-dimensional digital archaeological survey, based on an open source platform for the benefit of the entire community.

In other areas there is still work to do, for instance, in establishing collaborations with other institutions: "The technology is ready but not the mindset," observes the Superintendent. "In the United States it is normal for researchers and academics to access their museums' databases not just for research but also for teaching purposes. I would like to extend access to our enormous wealth of resources, they are extraordinary and unique items that should be shared through collaborations with universities and schools".

Prosperetti also speaks of digital infrastructures to enhance tourism: "We must provide high quality content to promote thoughtful tourism. We prefer that tourists arrive with some prior knowledge of our monuments, so they come not merely to be amazed but also to gain a deeper knowledge. In this way the network is not just a physical tool but also an indicator of our civility, as we collaborate with a growing number of institutions to maximize the sharing of knowledge".

Research, conservation and enhancement of artifacts are thus keywords for the future of cultural heritage, but there is also great interest in the performing arts. According to Federico Ruggieri, "with the great potential of fiber-optics the only limits are those of the imagination. Today we opened an avenue and we will continue to support people from the performing arts community who wish to explore these techniques for their performances".

Corsetti offers a thought from the artistic perspective as well as that of creating new languages: "traditional culture is sometimes the domain of a restricted elite. The experience with "La Nave Argo" raises a number of questions and opens up new possibilities that speak to a new audience".

Words
Maddalena Vario, GARR

Pictures
Left Credit: Edoardo Angelucci, GARR

Right Credit: Stefano Cavese

COMBINING STRENGTH AND SPEED

With Europe excelling through PRACE in the supply and use of computational infrastructure and services, it is important that this developing and improving use of High Performance Computing in industry and academia be coupled with a reliable, adaptable, secure and high speed network which will allows for European-level pooling and sharing of resources.

Interconnecting Europe's national research and education networks, the GÉANT high speed connectivity network allows for massive volumes of data generated by computational scientists to be shared, accessed and processed by PRACE Tier-0 users.

GÉANT offers the network that European industry and academia requires, and it is currently creating a long term partnership with PRACE and other e-infrastructures and the European Commission, to guarantee operational sustainability of services to HPC users.

An example of this partnership is the iTesla project (**http://www.itesla-**
project.eu) led by RTE (France) which encompasses 20 partners and which received 10 million hours on Curie, the French supercomputer hosted by GENCI at CEA, through PRACE access. For the iTesla project's partners, it involved generating the widest possible range of representative situations for a pan-European power network – the cables and generators that bring electricity to our homes and businesses - such as a series of particularly cold winter scenarios, or the growing contribution of less predictable and intermittent renewable energy sources (wind energy, solar power), and then

Words
Marjolein Oorsprong, PRACE

simulating how the system behaves for a large number of potential problems, for instance the loss of a network lines following a short-circuit.

After a year of simulations, the results will develop the next generation tools that will be needed to operate the European power grid and allow for the creation of security rules. These rules will form the framework for any corrective action to be taken in case problems with the grid or the supply. They will outline how the availability of electricity can be guaranteed for Europe's citizens and entrepreneurs.
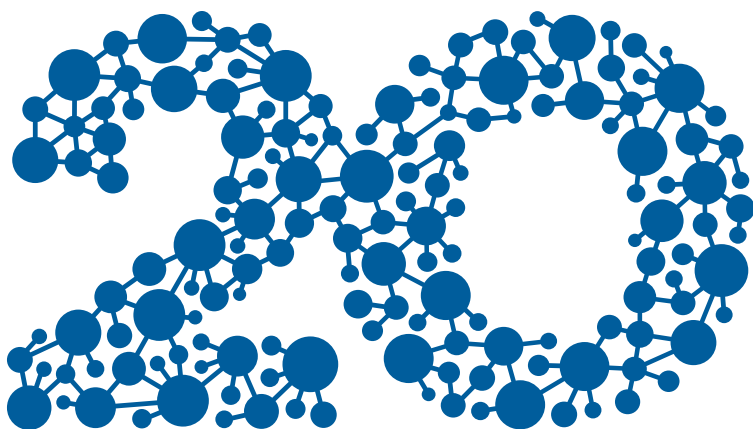
1996–2016
CESNET

CESNET CELEBRATES ITS 20TH ANNIVERSARY THIS YEAR

The CESNET association, managing the Czech national e-infrastructure for science, research and education will celebrate the 20th anniversary of its foundation this year. Academic networks in the Czech Republic originated in 1991, when the Czech Technical University in Prague installed a mainframe computer connected to the EARN academic network. The official Internet connection of the Czech Republic dates back to 13 February 1992 and was fathered by the current CESNET managing director Jan Gruntorád. There was a significant interest of the academic community in the Internet connectivity and it led to the FESNET project with the aim to connect universities and the Czech Academy of Science to the Internet.

After the split of Czechoslovakia, the project was changed to CESNET. The CESNET network started operation in early 1993. The team responsible for the network operation was part of the computation centre of the Czech Technical University in Prague, however, the universities and the Czech Academy of Science soon agreed on establishment of an independent entity, the CESNET association, founded in 1996. The involvement in the TEN-34 European project building the European backbone academic infrastructure immediately followed.

A fundamental reconstruction of the national research network to the e-infrastructure was performed by the CESNET Large Infrastructure project (2011–2015), one of the large priority infrastructure projects approved for governmental funding. The project was closely linked to eIGeR (2011–2013), providing an initial investment in the development of the CESNET regional e-infrastructure.

The current CESNET e-infrastructure represents a complex of modern ICT services for research and development, used by 94% of the scientific and research community, including all 54 institutes of the Academy of Sciences, 28 universities, private colleges, research centres, libraries, hospitals – in total close to 300 user institutions and 450 thousands of individual users.

CESNET also performs significant in-house research on advanced communication technologies, including support for specialised low-latency sound and image transmissions (4K Gateway, UltraGrid), accurate transmissions of time and frequency via optical networks or development of a specialised hardware-accelerated network card for traffic processing and filtering at the rate of 400 Gb/s. CESNET holds several European and U.S. patents. The results of the in-house research are applied in licensing of developed technologies and contributing to the establishment of spin-off companies (INVEA-TECH, Comprimato Systems).

In 2014, the national e-infrastructure was subject to a detailed ministerial evaluation. CESNET received the highest rating level, which is a key prerequisite for public financing of the e-infrastructure in 2016–2022. It has confirmed the key role of the CESNET e-infrastructure for research, development and education in the Czech Republic.

Words
Gabriela Krcmarova, CESNET

NOMINATE A COLLEAGUE FOR THE 2016 COMMUNITY AWARD!

2016
GÉANT
COMMUNITY
AWARDS

Time is tight, but it is still possible to nominate a candidate or two for this year's research and education networking Community Awards. Information about nominees can be submitted online until midnight on 31 March 2016.

GÉANT honours community members who have made outstanding contributions to collaborative work and the development of services and technologies by sharing their ideas, expertise and time with the community.

Past community award winners have included individuals whose ideas led to the development of a world-wide service, or who volunteered considerable effort to ensure the smooth running of a community service, or who were influential across a broad range of collaborative activities over a number of years.

The online nomination form has been shortened since last year and it is now possible to submit more than one nomination. A maximum of two submissions per person will be accepted; if more candidates are submitted, only the first two complete forms will be taken into account. Nominations for people who were suggested but not selected in previous years will also be accepted. Please nominate candidates via: **https://www.surveymonkey.com/r/2016communityaward**.

The winner will be selected by a panel of judges from the GÉANT community and will be presented with a token gift during the closing plenary session of the 2016 networking conference, TNC16, in Prague, Czech Republic on 15 June 2016.

FURTHER INFORMATION

Information about past winners and full details of the criteria for nominees and for people submitting nominations for this year's award are available via the GÉANT website under **www.geant.org/People/Community_Awards/**

Since 2012, TNC has been the place where public recognition has been given to members of the research and education networking community for their contributions to the development of relevant technologies and services or to collaborative community activities. Information about TNC16: **https://tnc16.geant.org**

If you have any queries, please contact **marcomms@geant.org**.

GÉANT GREEN-LIGHTS SOFTWARE 'GREENHOUSE'

In today's digital environment there is a tension between grass-roots development and the convenience of off-the-shelf procurement. The proliferation of cloud services and simplified apps means the market for commodity software tools is large. On the other hand, we are encouraged to embrace coding and produce rather than just consume to meet requirements. The research and education environment is a natural home for innovation creations to meet community needs, with open-source code also being second nature. But what happens when the tool you developed for your small department suddenly becomes an in-demand application?

National research and education networking organisations (NRENs) have a strong history of producing successful open-source software from within their communities. As these projects grow into well-used products, initial developer teams need a range of support to meet the needs of expanding groups of users. An excellent coder might not necessarily have the skills to manage multiple code contributions from other parties, or know how to provide effective support to the growing community of users. Most importantly, the funding may not be in place to ensure the product's stability for organisations that are growing dependent upon it.

A new GÉANT special interest group, SIG-Greenhouse, has been set up to support open-source software development and sustainability and address such challenges. It will provide a framework for managing donations to open-source software projects as well as advice and guidance on licensing,

legal agreements and good practice for code management and software quality. The SIG will provide advice to projects at different points in their lifecycle – from issues to consider when first making code publicly available, to process for managing user requests and support, through to providing a framework for accepting donations and managing teams.

The SIG was launched towards the end of 2015 and a steering committee and the wider community immediately began setting its scope and direction. A list of open-source software developed in or by the GÉANT community and in use in real service scenarios was compiled: if you would like to suggest suitable projects to be included, contact **Nicole.Harris@geant.org**. The SIG will now focus on two specific issues: piloting funding models with mature projects and defining good practice within the community for software quality.

> **"The Nordic NRENs and NORDUnet fully support the creation of a software greenhouse function hosted by GÉANT"**
>
> NORDUnet

> **"There is a sense of urgency for this to be put in place and we would like to see that this activity will be given priority so that pilots can start from the beginning of 2016"**
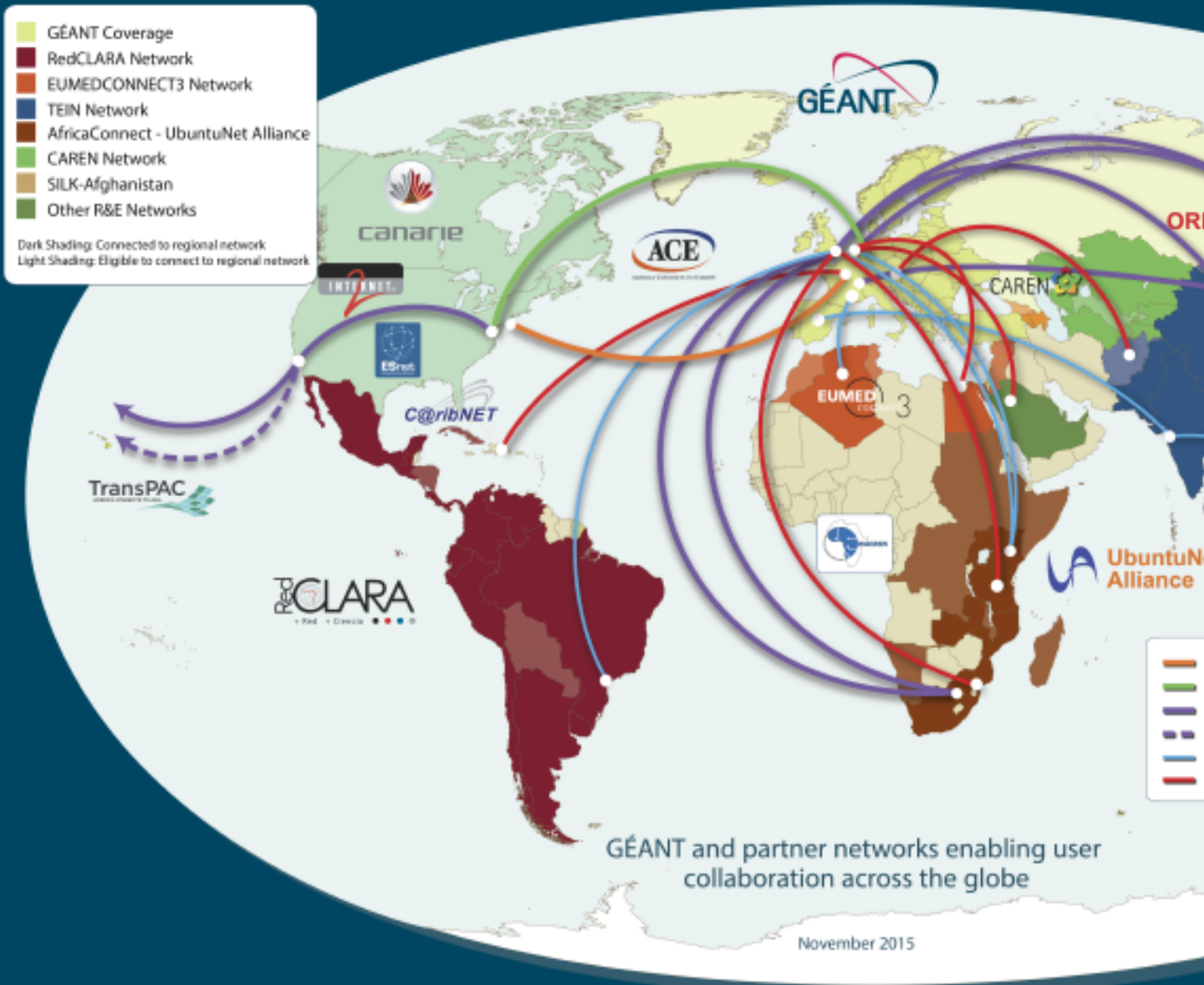>
> SURFnet

Current materials involving the Greenhouse idea can be found on the **Greenhouse Wiki home page**.

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 has 41 member countries and is owned by its core NREN membership, and also has Associate members including commercial organisations and multi-national research infrastructures and projects.

Legend:
- GÉANT Coverage
- RedCLARA Network
- EUMEDCONNECT3 Network
- TEIN Network
- AfricaConnect - UbuntuNet Alliance
- CAREN Network
- SILK-Afghanistan
- Other R&E Networks

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

GÉANT and partner networks enabling user collaboration across the globe

November 2015

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.

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.

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.

Learn more at
www.geant.org

100 Gbps
30 Gbps
10 Gbps
10 Gbps backup
>1 Gbps<10 Gbps
≤1 Gbps

TransPAC

TEIN
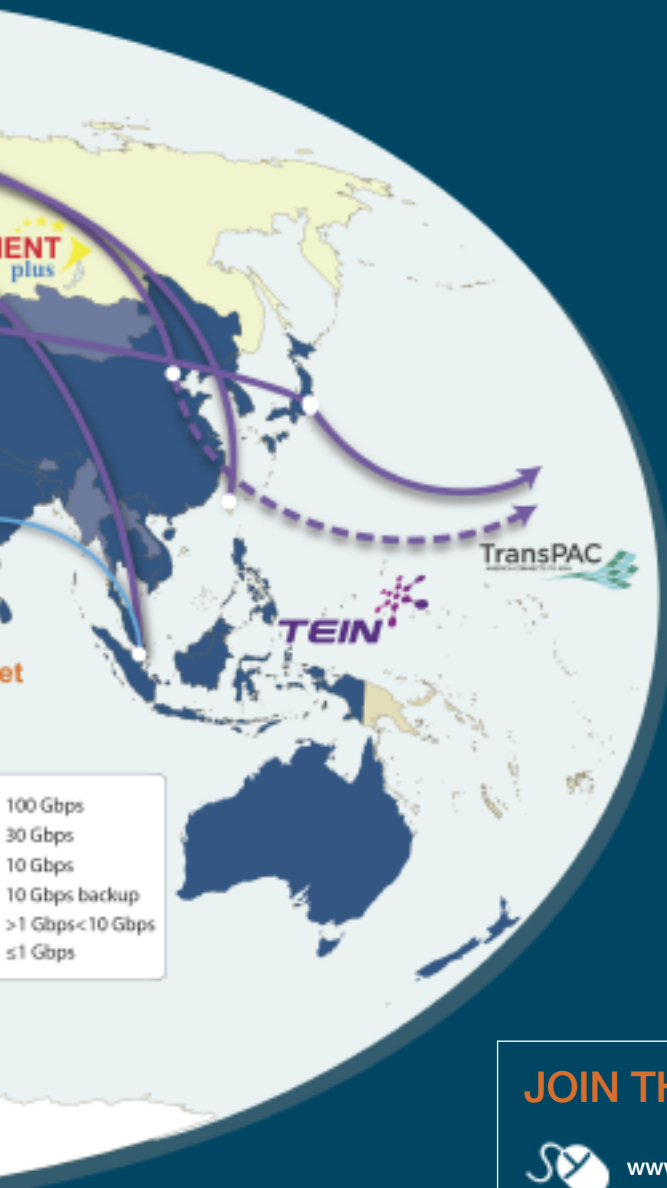
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