GÉANT
Networks • Services • People

CONNECT

THE MAGAZINE FROM THE GÉANT COMMUNITY | ISSUE 22 2016

BUILDING THE INTERNET OF PEOPLE

TNC16: EUROPE'S R&E CONFERENCE COMES TO PRAGUE

GÉANT AND SDN: ENABLING FUTURE NETWORK SERVICES

CLOUD SERVICES: THE FUTURE VISION

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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**

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WELCOME FROM CATHRIN STÖVER

It is event season for the global research and education networking community. We were at the WACREN conference already in March and in May many of us met at the Internet2 Global Summit in Chicago and this issue of CONNECT magazine summarises some of its highlights. And now in June, we are meeting at TNC16 in Prague, where the European community will celebrate its 30th anniversary, together with the 20th anniversary of our local host CESNET. Many Happy Returns! But talking of events, I would also like to highlight some upcoming events around the world: There will be the TICAL conference in early September in Buenos Aires, followed by the APAN meeting in October in Hong Kong, the EaPConnect Conference in Tbilisi also in October, the UbuntuNet-Connect conference in early November in Kampala and the e-AGE conference in Beirut in early December 2016. Science and education is global today and in consequence, more and more countries around the world establish NRENs to provide the necessary data communications infrastructure. This year´s TNC in Prague is attended by many of our new colleagues; let´s ensure we fully include them in our celebrations, dialogues and discussions and let´s put the regional events around the world firmly into our calendars.

It is also award season and I am particularly pleased about writing this specific editorial, as it allows me to congratulate Jan Gruntorád to this year's "Vietsch Foundation" award as well as my friend, Iman Abuel Maaly, Member of the UbuntuNet Alliance Board, on receiving the "Distinguished Arab Woman Engineer" award.

TNC16 is here. Time again to get updates from the community, learn about the services, products and innovations, be part of the discussions, conversations and enjoy the mingling with colleagues and friends from around the world. I wish us all a very pleasant and successful conference!

Cathrin Stöver, GÉANT

TNC16: BUILDING THE INTERNET OF PEOPLE!

TNC is the largest and most prestigious European research and education networking conference, bringing together decision makers, managers, networking and collaboration specialists, and identity and access management experts from across Europe and beyond.

Keynote speeches, parallel sessions, demonstrations and presentations will give participants a unique overview of the latest developments in research networking, both in the technical field and in the area of application and management.

CELEBRATING ANNIVERSARIES!

his year TNC16 is hosted in Prague by CESNET, the Czech NREN, and helps to mark two important anniversaries. Karim Mostafi of GÉANT explains: "TNC16 is helping to celebrate 30 years of European NREN community collaboration, and our host NREN is also celebrating their 20 year anniversary! The wonderful city of Prague – the 'Mother of all cities' will provide just the right ambience to garnish the jam-packed programme of TNC16 in the evenings, with the daytime programme designed to appeal to all of our diverse audience. With over 650 participants expected, together we will put the conference theme 'Building the Internet of People' to practice: join our sessions, debates, panel discussions, workshops and side events and continue building (international) relationships!"

A PACKED SCHEDULE

With the European networking community celebrating its 30 year anniversary, the opening plenary session by Kees Neggers and Steve Cotter will reflect on this and take the audience on a guided tour through the past and towards the future. Other keynote sessions will also in various ways support the conference theme:

- 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
- Anna 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 (GN4-2) PROJECT

The GÉANT (GN4-2) 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. Additionally, Eli Dart of ESnet will provide consultancy time on ScienceDMZ at the GÉANT booth. Details of the project are available from the GÉANT booth.

JOIN US AT THE BOOTH AND ONLINE!

We will be happy to welcome you to the GÉANT booth where subject matter experts will be on hand to answer questions; on social media, you can find and join the discussion by using #TNC16. Also:

- Share your TNC16 photos at: https://www.flickr.com/groups/tnc16
- Contribute to contribute to the TNC16 blog at https://blog.geant.org/category/tnc16/. Send an email with your blog text (preferably with a decent picture) to karim.mostafi@geant.org, and – after checking the contents – we'll publish it.
- Share interesting sessions/views through your Twitter account, using #TNC16. You can also follow our Twitter channel @GÉANTnews.
- On Facebook you can find #TNC16 as well: https://www.facebook.com/GEANTcommunity.

STAY CURRENT

During the conference, you can stay up to date with programme changes and other information by visiting the TNC16 homepage. Under the header banner, you'll see an announcement bar with scrolling messages.

After TNC16, all live session video streams will be archived on our Youtube channel: http://www.youtube.com/user/GEANTtv.

MORE INFORMATION

You can find all travel, venue and conference information on the TNC16 website: https://tnc16.geant.org/

NEW GÉANT COMMUNITY BLOG

In April GÉANT introduced a new channel for the community – the GÉANT Community Blog. The objective is to help to grow the community – sharing experiences, opinions and thoughts on a wide range of subjects. There is already a growing number of categories if you wish to filter all blogs by, for example, TNC16. In recent weeks a number of blogs have been published, such as 'Putting the E in action for NRENs', 'Superman, cybersecurity and a spinning world' and 'The forty percent'.

Members of the GÉANT community are welcomed and encouraged to get involved – for further information see **https://blog.geant.org/** and start voicing your opinion!

GÉANT HONOURS 2016 RESEARCH AND EDUCATION NETWORKING COMMUNITY AWARD WINNERS

In recognition of their significant contributions to research and education networking over many years, GÉANT awarded the 2016 Community Awards to John Dyer, Scott Cantor and Stanislav Sima, during the opening plenary session of this year's networking conference, TNC16.

Stanislav Sima (CESNET) was posthumously honoured for sharing many important ideas with the European R&E networking community during his long affiliation with the Czech NREN, which he helped to establish around 20 years ago. With CESNET celebrating this anniversary on home soil during TNC16, it was timely to show this recognition during the Prague conference. Stanislav had designed the first optical network in Europe and had come up with the idea of customer-empowered fibre networks, among other achievements, and was seen by the panel of judges as a 'significant contributor' who had 'started a lot of things in Europe'. Stanislav passed away on 16th October 2015. His award was presented on behalf of the judges by Dorte Olesen, Chair of the GÉANT Programme Planning Committee to members of his family.

Scott Cantor (University of Ohio/InCommon) was commended for his long-term and special dedication to ensuring that the software behind federated identity management worked as well as possible. Scott had been part of a group that developed the idea of identity federation and developed the SAML protocol that made it a reality. When the realisation came that there needed to be a software implementation to back this up, Scott led and became almost synonymous with the Shibboleth project. Taking into account the major global impact of this work on mobility and access to online services that have become increasingly vital in recent years, the judges recognised that although many contributors have played a role in developing this area during many years, Scott's dedication and contribution has been outstanding.

John Dyer (GÉANT) was lauded for his long and influential career in R&E networking, which included 10 years with the UK NREN as well as 20 years with the European R&E networking association now known as GÉANT. In the former organisation he was first part of the team that set up, developed and ran the UK network, then he managed the development programme and the SuperJANET applications programme before undertaking a study into the future architecture of UK academic networking. In the latter organisation, then known as TERENA, John's focus on the business aspects of NRENs grew and he became instrumental to the Task Force on Management of Service Portfolios (TF-MSP), led the ASPIRE foresight study, and produced the 'Case for NRENs' document that is still being actively cited around the world 7 years after its publication. John retired on 31 March 2016 and the judges felt it was timely to thank John for all his contributions during the 2016 awards.

FURTHER INFORMATION

GÉANT honours people who have contributed significant ideas, time and expertise to the development of the research and education networking community's collaborative achievements and recognises that these contributions are often provided voluntarily and through the good will of employer organisations.

In addition to Dorte Olesen, this year's judges were:

- Christian Grimm (DFN), Chair of the GÉANT Board of Directors;
- Nordh (SUNET), Chair of the GÉANT Community Committee;
- Erik-Jan Bos (NORDUnet), Chair of the TNC16 Programme Committee;
- Helmut Sverenyak, representing the TNC16 host organisation, CESNET.

See details about all winners, past and present at **www.geant.org/People/Community_Awards/**

Pictures
Stanislav Sima (far left) and John Dyer

TEIN: CONNECTING ASIA AND EUROPE'S RESEARCH AND EDUCATION COMMUNITIES

The EU co-funded Trans-Eurasia Information Network (TEIN) provides a large-scale R&E network for the Asia-Pacific region. It connects Asian researchers to each other and their counterparts in Europe via direct links to the GÉANT network, providing the Asia-Pacific region with a gateway for global research collaborations. Operating at speeds of up to 10 Gbps, TEIN currently connects 20 partners across the region: Afghanistan, Australia, Bangladesh, Cambodia, China, Hong Kong, India, Indonesia, Laos, Japan, Korea, Malaysia, Nepal, New Zealand, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand and Vietnam.

DRIVING INNOVATIVE EU-ASIA APPLICATIONS

TEIN supports collaborative programmes with Europe in areas such as Earth observation, disaster warning, climate research, food security, delivery of e-health and e-learning; the network contributes towards the Sustainable Development Goals (SDGs) and previously towards the UN Millennium Development Goals (MDGs) by facilitating applications with high societal impact and by fostering regional cohesion and development.

Collaborative Future Internet research and big international science projects are also set to benefit from TEIN and its interconnection to GÉANT: LHCONE within the HEP community, climate/weather data sharing for disaster warning, participation in the worldwide e-VLBI radio-astronomy network to name but a few.

FOCUS ON CAPACITY BUILDING AND APPLICATIONS DEVELOPMENT

In addition to providing connectivity between partner countries, TEIN*CC proactively promotes R&E collaboration and NREN capacity building through dedicated application workshops and HRD training events. During 2015, 19 workshops were held, covering areas such as tele-medicine, large-scale science data transmission, e-learning and campus network design. In addition, TEMDEC in Kyushu University and Seoul National University at Bundang Hospital are providing expertise through telemedicine activities. The Australian partner AARNet is also providing invaluable expertise in rolling out eduroam to 7 developing countries in Asia.

A CONTINUING SUCCESS STORY

Launched at the Asia-Europe Summit (ASEM 3) in 2000 and now in its fourth phase, TEIN is jointly funded by the European Commission (Directorate-General for International Cooperation and Development - DG DEVCO) and Asian partners and has been managed by TEIN*CC (TEIN*Cooperation Center) based in Seoul, Korea since September 2012. Prior to that the TEIN project was operated by GÉANT (as DANTE) and it continues to provide advice and support. Plans are currently being developed in conjunction with the EC for a further five years of funding up to 2021.

FIND US AT TNC2016!

Find out more about TEIN and Asia at the GÉANT booth at TNC in Prague. This will provide an opportunity to get a better mutual understanding of the R&E communities in Europe and Asia so that we can jointly identify and facilitate further collaborations.

Find out more at **www.tein.asia**

Words
Sanggyun KIM (TEIN* Cooperation Center)

MAGIC, SCI-GAIA AND TANDEM TO SHOWCASE SUCCESS AT TNC16

At a joint TNC16 session titled 'Towards Sustainable e-Infrastructures around the World', the three complementary EC-funded projects will showcase their collective successes.

The session will start with brief introductions of MAGIC, Sci-GaIA and TANDEM which all aim to improve e-infrastructures for researchers in different world regions. Short presentations will show how the projects are fostering and empowering scientific collaboration around the world, followed by a joint session in which the three projects each showcase real examples of the benefits that they are already bringing to science and research communities. This will be followed by a 20-minute question and answer session designed to encourage the exchange of ideas on how to further improve the projects and their interactions.

ABOUT MAGIC

MAGIC aims to significantly improve the ability of researchers and academics around the world to collaborate together by expanding the reach of eduroam, Identity Federations and eduGAIN; and by supporting user communities with collaboration tools and information on funding opportunities.

ABOUT SCI-GAIA

Sci-GaIA (Energising Scientific Endeavour through Science Gateways and e-Infrastructures in Africa) aims to support National Research and Education Networks, Communities of Practice and Universities in Africa to develop Science Gateways and other e-Infrastructures services. Sci-GaIA also promotes Open Science in Africa.

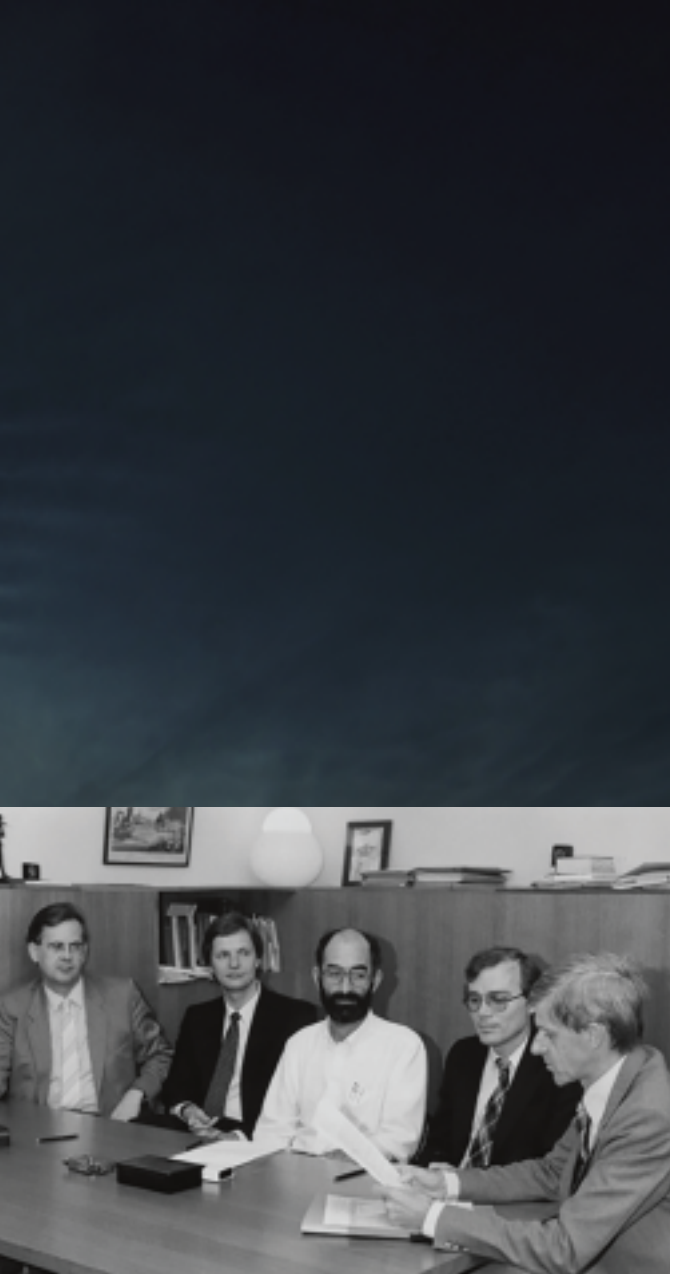
ABOUT TANDEM

TANDEM (Trans-African Network Development) is working to create favourable conditions for WACREN (West and Central African Research and Education Network), enabling it to draw maximum benefit from the AfricaConnect2 project and ensuring WACREN's integration into the global research and education networking community and its long-term sustainability.

Words
María José
López Pourailly

CONGRATULATIONS AND THANKS TO THE NREN COMMUNITY!

13 June 2016 marks the 30th year that the research and education networking community in Europe has been formally collaborating together through a membership association – now known as GÉANT. As this date coincides with day one of this year's networking conference, TNC16, what better than to highlight this milestone during the event and invite the community to suggest how our collaboration should develop in future.



Words
Laura Durnford, GÉANT

Picture
Peter Linington (JANET), Klaus Ullmann (DFN), Hans Rosenberg (Utrecht University) and Kees Neggers (SURF) meet the notary on 13 June 1986

Towards the end of May, some visitors arrived in the GÉANT Amsterdam office. Camille Paloque-Berges (Conservatoire national des arts et métiers, Paris) and Gerard Alberts (University of Amsterdam) are historians who hope to produce an academic study of the early days of computer networking in Europe. Exploring the storeroom archive boxes, they discovered a rich trove of documents dating back to the establishment of the European R&E networking association in 1986, when it was known as RARE (Réseaux Associés pour la Recherche Européenne).

Helping to identify the documents and recall key information was Kees Neggers, former Managing Director of the Dutch NREN SURFnet. Thirty years ago he was one of four R&E networking community members who signed RARE into existence. "Networks are built by people for people and it's essential they can meet, talk and cooperate together to produce anything on an international level: from the beginning that was a reason to start RARE".

When RARE was started, Europe was divided by the iron curtain and the association's statutes defined who could be a member, with fewer than 20 countries named. There was no internet, which made it difficult for organisations to communicate. Although the internet protocol existed, the networks that could support it did not. The protocol started to be used locally within the Netherlands, where the nucleus of the European backbone and various relevant organisations had been beginning to form. Once IP (Internet Protocol) became the dominant protocol, the RIPE (Réseaux IP Européens) Network Coordination Centre was created in 1992 and housed by RARE, later to be incorporated as RIPE NCC.

In the first few years of RARE, the main focus was the COSINE (Co-operation for Open Systems Interconnection Networking in Europe) project, which aimed to create an international OSI-based network infrastructure. In its specification phase, the project funding allowed RARE to bring the European community together really for the first time.

In parallel, the existing networks within Europe were able to share a common 'X25' infrastructure, managed by the project. A community task force was established to define an operational unit to run the international network services, which ultimately led to the formation of DANTE. In October 1994, RARE merged with EARN (European Academic and Research Network) and moved on as TERENA (Trans-European Research and Education Networking Association). In October 2014, TERENA and DANTE joined forces to become GÉANT.

Throughout all these changes, Kees Neggers played various leading roles. "As an engineer by background, and being on all the boards and meeting policy makers, funders etc., I could be a link between those two worlds to ensure that what was technically possible was the basis upon which to develop workable visions for the future. But of course I have never worked alone; always in collaboration with other people with shared visions and interests. And the most important aspect of RARE/TERENA/GÉANT is to maintain the community collaboration."

With this rich personal history in the story of European R&E networking, it is perhaps no surprise that Kees was invited to be half of a pair of keynote speakers in the TNC16 opening plenary session, alongside the GÉANT CEO, Steve Cotter.

Set up as a two-way Q&A and with audience participation, the idea was to see what in our history applies to today and sketch a possible future for the community collaboration and GÉANT's role in it. "We want to stimulate ideas and make people enthusiastic, and willing to go and experiment. The world is still dynamic; by learning from the past we see that the only way forward is to collaborate, to talk and listen - to each other and especially to the user community we need to serve."

To help celebrate the community collaboration anniversary, GÉANT invited NRENs to use its exhibition booth to highlight their successes and activities. Visit the booth this week to meet them and GÉANT staff!

#GEANT30

GÉANT invites you to help celebrate this long and productive relationship by sharing your perspectives on the past and your ideas for the future R&E networking collaboration.

- Use the hashtag **#GEANT30** to post your stories and suggestions on
  - Twitter
  - Facebook
- Or blog about it on **https://blog.geant.org** (login at the bottom of page, add text and a 'featured image', save draft)
- Or email your message to **Marcomms@geant.org** and we will share it with the community for you.

Later in the year, all input will be passed on to the GÉANT General Assembly of member organisations for their consideration.

DIGITAL INFRASTRUCTURES FOR RESEARCH – SERVING THE USER BASE

Joining forces for the first time, Europe's leading e-infrastructures invite all researchers, developers, data practitioners and service providers to the Digital Infrastructures for Research (DI4R) event (28-30 September 2016, Krakow) to brainstorm and find practical solutions together to support and facilitate science and research across Europe.

WHO SHOULD ATTEND?

The event is designed with research communities in mind and aims to foster broader adoption of digital infrastructure services and promote user-driven innovation. As a researcher, the event is an opportunity to discuss and present your work to all leading e-infrastructures and projects. If you are a service provider, the conference is a chance to hear about what researchers need, brainstorm new services and align strategies with your peers.

"The DI4R 2016 event will bring together researchers and infrastructure providers to increase mutual understanding and ultimately ensure that researchers can really influence the services developed by the infrastructure providers," says Steve Cotter, GÉANT CEO.

"Krakow will be the home of the first joint event organised by the major European e-Infrastructure initiatives," says Tiziana Ferrari, technical director of the EGI Foundation. "We will join efforts to support the needs of European researchers and international collaborations and EGI is proud of having been one of the main promoters of this new series of events."

Registration for the event is now open. The call for participation is closed, but it is still possible to submit abstracts for posters and lightening talks until 20 July 2016.

WHAT IS ON THE AGENDA?

The main programme is structured around four main tracks that will serve as a backdrop for networking, collaboration and brainstorming, and complemented by training workshops, demonstrations and plenary sessions.

- **Challenges facing users and service providers**: emerging needs of research collaborations, the requirements of added value thematic services and the computing needs of data-driven science. (example topics: Working with the research community and industry, community engagement, computing platforms (cloud, HTC, HPC), thematic platforms (science gateways, Virtual Research Environments)
- **Services enabling research**: services and frameworks needed to enable researchers to securely collaborate and share resources in a federated environment combining geographically distributed services from multiple providers and further the opportunities of Open Science. Submissions for this track should highlight benefits and challenges as seen by researchers when using existing frameworks or present ideas to address the future challenges.
- **A changing environment, changing research**: The environment in which research is conducted, and digital infrastructures operate, is changing rapidly. Access and provisioning of services require clear governance, engagement rules, policies and funding models. Submissions should focus on the barriers, opportunities and changes in this environment in order to address the non-technical pressures, for example social, financial, legal and policy that influence the present and future opportunities.
- **Working with data**: requirements of data-driven science and the solutions for finding, accessing, integrating and reusing research data. Papers that highlight requirements and opportunities for a seamless usage of digital infrastructures for data management, storage and curation as well as for linking and publishing all forms of research objects like data, software, tools, pipelines and publications would be particularly topical.

CERN's David Foster, Chair of the Programme Committee, explains the motivation: "It is important that we try to bridge the gap between very outcome oriented user communities and often somewhat technology oriented service providers. This is why we have tried to introduce four themes that bring people together."

MORE INFORMATION

Organisers:
The DI4R 2016 conference is co-organised by EGI, EUDAT, GÉANT, OpenAIRE and RDA Europe, and is hosted by ACC Cyfronet AGH, Krakow's academic computing centre.

- EGI: International Grid & Cloud Infrastructure for Research **http://egi.eu**
- EUDAT: European Data Infrastructure **https://eudat.eu/**
- GÉANT: European Research and Education Networking Collaboration **http://www.geant.org/**
- OpenAIRE: Open Access Infrastructure for Research in Europe **https://www.openaire.eu/**
- RDA Europe: Research Data Sharing without Borders **https://europe.rd-alliance.org/**
- ACC Cyfronet AGH: Academic Computing Centre Kraków **http://www.cyfronet.krakow.pl/en/4421,main.html**

Event's website:
http://www.digitalinfrastructures.eu/

INTERNET2 GLOBAL SUMMIT SESSION SPOTLIGHTS INTERNATIONAL CONNECTIVITY

In May the 2016 Internet2 Global Summit took place in Chicago, attracting over 900 attendees from over 30 countries – truly reflecting the global nature of research and education. Europe was particularly well represented, with strong attendance from GÉANT and many NRENs including ARNES, CARNet, CESNET, DFN, GARR, GRNET, Jisc, NORDUnet, PSNC, RENATER, SUNET, SURFnet and SWITCH.

Several sessions reflected the global aspect of the event, and one in particular attracted great interest. The panel, 'International Interconnectivity R&E: Now & Beyond', part of Internet2´s 20 year anniversary session, included Steve Cotter and Cathrin Stöver of GÉANT, Christian Grimm of DFN, Steve Huter of the NSRC and Andrew Bjerring formerly of CANARIE. Panellists each spoke briefly about their past experiences and future hopes.

Cathrin Stöver explained how the Memorandums of Understanding (MoUs) Internet2 signed with global partners, and the international sessions they organised helped with GÉANT's regional work and had in turn changed the way science was conducted: "Scientists can think differently about how they work, having a profound impact on how we tackle society's challenges."

GÉANT CEO Steve Cotter described how international connectivity agreements had led to much better connectivity between countries and science infrastructures. In particular Internet2 led the formation of DICE (DANTE, Internet2, CANARIE [later CERN] and ESnet) to work together in supporting big science: "The fact that modern science assumes high-performance networks exist and will meet their needs is a testament to the hard work put in over the years by NRENs. Current initiatives such as ANA are looking at ways in which we can take that collaboration to a whole new level."

Christian Grimm talked about the CEO Forum, where new working groups are encouraging a new way of working together globally. For example the Knowledge Exchange Working Group plans to create a global Research and Education Networking knowledge exchange website, with the purpose of not only sharing information on subjects such as key international conferences, but also helping to facilitate community building and twinning activities. This working group will next meet at TNC16.

Several other sessions were of particular note:

- the Global REN Knowledge Exchange session where all world regions were represented, with a panel session examining critical success factors for NRENs, main barriers to achieving organisational and operating success, and tangible ways in which the global REN community can work together to ensure long-term sustainability for NREN organisations.
- A Trans-National Education (TNE) session examined the role of NRENs with an overview by Internet2 of the work they do in this area, illustrated by case studies of Duke and Georgetown universities, both of whom have a strong global presence. This was followed by an overview of how GÉANT coordinates TNE in Europe, with examples presented by Jisc and GARR.
- The Innovation Development and Management session stressed the 'Think Local, Act Global' approach featuring presentations by Florence Hudson (on Internet2's collaborative innovation programme) and Annabel Grant (Task Forces and the Open Call programme). This will also have a follow up session as part of TNC16.

For more information and to view archived streams, visit:
http://meetings.internet2.edu/2016-global-summit/

THE FUTURE DIRECTION FOR CLOUD SERVICES

GÉANT and the NRENs have been working together for three years to develop a clear and sustainable model for the use of cloud services across research and education. How will cloud services affect the NREN and R&E communities? Key experts share their vision…

HEANET AND CLOUD SERVICES

ROBERT HACKETT - PROJECT MANAGER, HEANET

Cloud has increasingly become a pervasive part of our personal and business lives with cloud services such as Dropbox, Gmail, Office365, Flickr, and many more changing the way we use IT. So what is the attraction? Cloud services are often seen as fast, easy, on-demand, free, or pay-as-you-go with no big upfront costs. Cloud services offer the ability to boost productivity, increase flexibility and save money.

So what does this mean for Universities or Research Institutes? Cloud services are likely to be an increasingly attractive option for the delivery of many mainstream services for the IT Department, Finance, HR & Admin, Teaching & Learning, Research, Libraries, Students, and Facilities etc.

The first wave of cloud adoption has been mostly Software as a Service (SaaS) and typically easy to adopt but there are challenges around data protection, compliance and governance issues. A major concern is the emergence of shadow IT where users are bypassing traditional IT services, policies and controls.

Many institutions are still grappling with this first wave of cloud adoption, but the second wave is already here – Infrastructure as a Service (IaaS), using public cloud services such as Amazon (AWS), Microsoft (Azure), Google (GCE) and others, as well as Private Cloud on the campus or Community Cloud provided by the NREN.

Cloud however is not the answer for everything and it is probable, for some business applications, that the right answer will remain traditional on-campus IT. It is also likely that there is no case of "one cloud fits all" but rather that institutions will use a hybrid cloud approach with multiple private, public and community clouds. It may make sense in many cases (particularly for the more complex IaaS offerings), to wait until infrastructure or applications are being upgraded or replaced, or the existing investments have been written off.

The adoption of cloud services brings many benefits such as agility and the flexibility to rapidly respond to business requirements. But also many challenges such as security, skills, and compliance. GÉANT with its IaaS procurement initiative and the NRENs are actively working to help institutions meet these challenges for a cloud future.

Pictures
This page:
Kristin Selvaag and Jan Meijer of UNINETT
Opposite page:
Robert Hackett of HEAnet

THE NORWEGIAN CLOUD INITIATIVE

KRISTIN SELVAAG AND JAN MEIJER FROM UNINETT EXPLAIN HOW CLOUD SERVICES ARE BEING IMPLEMENTED IN NORWAY

In Norway, UNINETT and the four major universities have been working together in a cloud initiative since 2013. For the next three years, the initiative enters a new phase, with increased activity, government funding and a strengthened, dedicated team. The work will be done in close collaboration with the Higher Education (HE) sector, and the ICT directors of the two largest universities in Norway are on the steering committee of the initiative.

The initiative concentrates on three main areas:

- Establishing a hybrid infrastructure platform for the Norwegian HE sector
- Establishing a cloud broker for the sector
- Establishing a portfolio of ready to use cloud services

There are still great differences in maturity and knowledge when it comes to the use of cloud services within research and education. The UNINETT clouds team will have to consider this when they aim to coordinate the implementation and adoption of such services. There's a lot of work to be done in establishing best practices and advising the institutions and users on security, data protection, legal matters, etc. Already, a team of experts from the Norwegian HE sector has created a best practice document for legal matters and security in the cloud.

While the initiative has to look at all aspects of clouds, the institutions are so far mostly interested in established services, such as Office 365. A main challenge will be to balance the long-term development of technologies, frameworks, delivery models and coherent solutions with the short-term need for ready-to-use services. The choices made today need to be valid also in the years to come.

HAPPY ONE BILLIONTH BIRTHDAY, EDUROAM!

It's not often you celebrate a billionth birthday so to be able to celebrate two at the same time must be pretty rare. However on 17 May 2016, eduroam clocked up two amazing milestones with both the one billionth authentication (either in-country or international) since the beginning of the year and the one billionth international authentication (when users are connecting from outside their home country) since the service was launched.

Since its launch on 1 September 2008 as a GÉANT service, the aim of eduroam has been to help the research and education community collaborate both nationally and internationally. From its early beginnings with a handful of European universities the service has grown to cover over 70 countries and tens of thousands of Wi-Fi hotspots on every continent around the globe. Now researchers can travel to each other's university and instantly and securely connect to eduroam without the need for guest identities, sharing of passwords or risking insecure webpage logins.

What is most amazing about eduroam is its seamless and virtually invisible operation – truly the mark of a successful service. Put simply, it just works!

eduroam stands as an example of the success of international collaboration. Experts from around the world have all contributed time, effort and expertise to ensure that research and education can benefit from advanced technology.

To all those people who have worked (and continue to work) on making eduroam the success it is we thank you.

Indeed, particular credit is due to Licia Florio and Karel Vietsch (1952-2014) who were the driving forces behind the TF-Mobility and The Global eduroam Governance Committee and who helped guide the development of eduroam into the global success it now is.

To celebrate these milestones, the eduroam website has been completely revamped and is now fully responsive to support desktop, tablet and smartphone devices.

You can read some of the stories from the originators and developers who have made eduroam what it is and find out more at **www.eduroam.org**

WHAT IS EDUROAM?

eduroam (education roaming) is the secure, world-wide roaming access service developed for the international research and education community. It allows students, researchers and staff from participating institutions to obtain Internet connectivity across campus and when visiting other participating institutions by simply opening their laptop.

eduroam was pioneered by the GÉANT research and education networking community in Europe. The GÉANT task force on mobility and network middleware - TF-MNM - and the GÉANT (GN4-2) Project work together and with relevant industry and standardisation groups to find and share solutions related to eduroam technology and security. The GÉANT organisation coordinates and supports the Global eduroam Governance Committee (GeGC), which sets technical and organisational standards for the service and authorises compliant ROs to provide eduroam around the world.

PERFSONAR ON LOW-COST HARDWARE – NEW USES AND OPPORTUNITIES

INTRODUCTION

Performance focussed **S**ervice **O**riented **N**etwork monitoring **AR**chitecture, or perfSONAR, is a well-known network monitoring and troubleshooting infrastructure used in the research and education networking world, and beyond. It helps pinpoint the problems within the network and enables effective utilisation of network resources. There are over 1500 deployments of perfSONAR worldwide, a number that increases with every new release of the software.

It is recommended to deploy perfSONAR on dedicated physical hardware, in order to achieve accurate measurement results. Often, dedicated physical hardware is expensive to maintain and support. This is beneficial where organisations require accurate network monitoring and measurement available at critical points in their network. However, there are other times such as an organisation with limited budget, or with small network, or simply a requirement for a "mobile" solution where perfSONAR Measurement Points (MPs) are to be easily relocated between different sites in the network, where alternative and lower cost platforms may be useful. For example, the ability to have a compact, low-cost perfSONAR device may help to troubleshoot solutions or to support building temporary networks for events and conferences, etc.

Based on this requirement, the global perfSONAR group began investigating various Mini PCs that were easy to install and configure, cost less than €160, and would have a capability to test throughput of up to 1Gbps, while at the same time accepting some platform limitations. The aim is to extend perfSONAR footprint to support as many use cases, while keeping deployment and support costs low.

BRINGING THE 'PERFSONAR ON LOW-COST HARDWARE' PROJECT TO EUROPEAN R&E COMMUNITY

Spurred on by the success of this work, a similar initiative is being started within GÉANT to bring the benefits of using perfSONAR on these devices to the European R&E network community. A project, called 'perfSONAR on Low-Cost Hardware' will be launched at TNC16 on June 13 by the GÉANT perfSONAR team. The aim of this project is to introduce the work of perfSONAR project on this topic and bring more users into the fold, and will run until October 2016. At the launch at TNC16 BoF session, a number of nodes by Gigabyte, will be demonstrated. The nodes will be configured in a measurement mesh along with some GÉANT perfSONAR deployments. A central configuration server will host the perfSONAR central configuration tool, a central measurement archive (MA) and a dashboard to display the measurement results.

Attendees will also be able to take some of the pre-configured nodes with them, so that they can take part in the project by plugging them into own network, join the project's measurement mesh and use them to carry out measurements and tests. This way, all participants can reap the benefits of using low-cost hardware installed with perfSONAR to carry out monitoring in their network. This will help users share feedback on how the small nodes have been useful in monitoring their network and how quickly become part of the global measurement infrastructure. Follow-up events can also be arranged based on need and interest from attendees.

To find out more about perfSONAR on Low-Cost Hardware, take part in the BoF at TNC16 or visit **www.perfsonar.net**

NRENUM.NET
THE GLOBAL ENUM SERVICE FOR ACADEMIA

NRENum.net

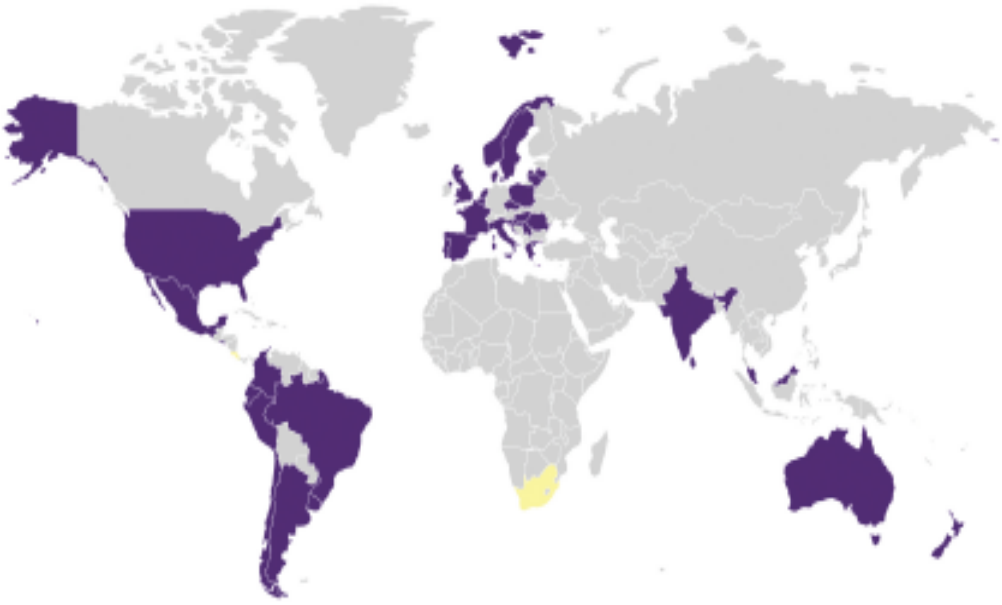
IT'S GREAT TO COMMUNICATE – 10 YEARS OF SUPPORTING COMMUNITY COLLABORATION

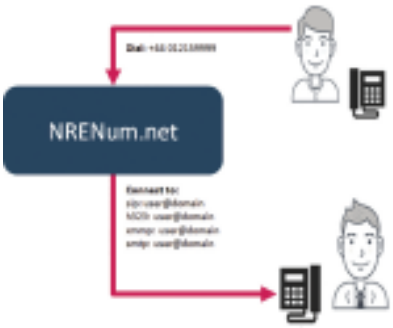
Today, Unified Communication (UC) is replacing traditional telephone systems at academic and research institutions around the globe. Various products and service are available at very favourable conditions to the research and education community, complemented with cloud delivery models that lower deployment costs significantly. Different national communities are at different points in this transition, tackling with the integration complexity of legacy video conferencing and the emerging new WebRTC solutions.

THE SERVICE – SIMPLE, SECURE AND RELIABLE

NRENum.net is a global service, initiated by the GÉANT community, to facilitate unified dialling of voice and video conferencing services operated by the National Research and Education Networks (NRENs) and their connected academic and research institutions around the world. It is based on the standard E.164 Number Mapping (ENUM) protocol and the secure and reliable Domain Name Server (DNS) infrastructure of NRENs.

The service maps the Public Switched Telephone Network (PSTN) numbers to resource identifiers on the Internet (such as SIP URIs or GDS numbers) thus, it enables the end-to-end delivery of Internet calls over the research and education networks without dropping to commercial providers and increasing egress traffic and/or long distance PSTN call charges.





Beyond the potential cost savings, users can benefit from simply dialling on numeric keypads while the NRENum.net lookup and discovery function takes care of the proper addressing. It helps reduce the call setup failure rates and improving the overall user satisfaction. With the recent sunset of RIPE NCC's public Golden ENUM Tree (e.164.arpa) service, NRENum.net became the only global alternative for Unified Communications providers in the research and education sector.

The potential development directions of NRENum.net includes the investigation of a unified presence engine for both dedicated and contextual communication across organisational boundaries and the support of a federated directory sharing service for the global community.

THE COMMUNITY – SIZE IS IMPORTANT

NRENum.net is a truly community service; the more the ENUM records that the individual participants register in the service, the larger the benefits that community can jointly realize.

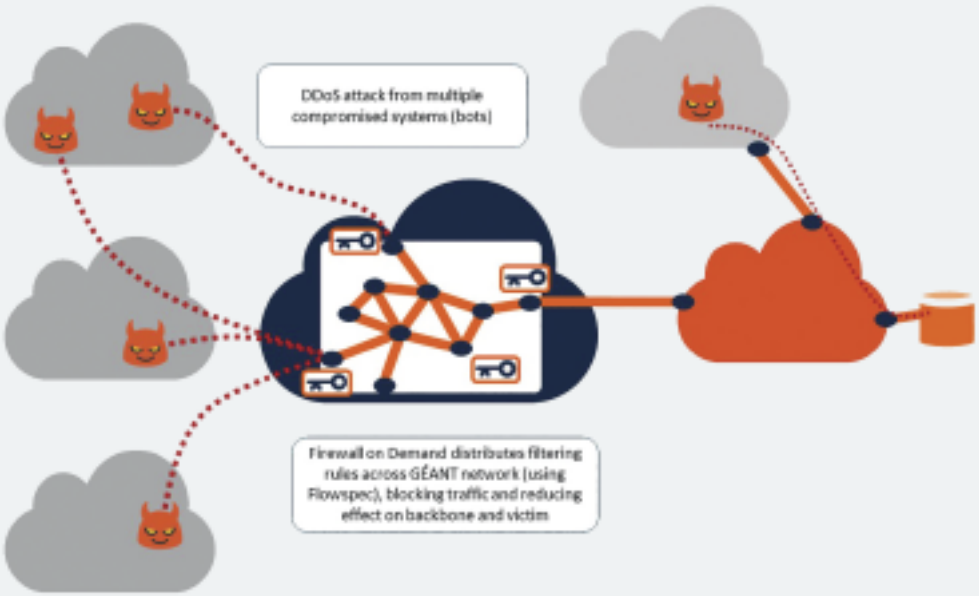
Globally there are 44 country codes delegated to the service with more than 250,000 end-user ENUM numbers registered and routable across the top 25 countries. **https://nrenum.net/members/**

FIND OUT MORE

The NRENum.net service is operated and governed by the NREN community. The top level secure and reliable Domain Name Servers are hosted by NIIF, SUNET and CARNet in Europe, Intranet2 in the USA, and AARNet in Australia.

The service community encourages the state-of-the-art configuration and use of DNS and the implementation of DNSSec as much as possible.

To find out more about how your country, organisation or community can take part and benefit from NRENum.net visit **www.nrenum.net**



NSHARP AND FIREWALL ON DEMAND

HELPING NRENS DEFEND THEIR NETWORK INFRASTRUCTURE

All networks are seeing a rise in malicious attacks with malicious users from around the world seeking to disrupt business services or penetrate into valuable business resources. Of these attacks, amongst various risks faced by NRENs, Distributed Denial of Service (DDoS) attacks can be some of the most visible and hardest to counter..

GÉANT has implemented a range of services to help support NRENs in identifying, tracking and mitigating against their risks with particular interest on DDoS and DoS attacks. The NSHaRP process provides a mechanism to quickly and effectively inform affected users and to manage the mitigation process of DoS and DDoS attacks.

NSHaRP allows CERTs to tailor how and for what type of incidents they want their notifications to be triggered for. The system serves as an extension to the network security defence services of national research and education networking (NREN) organisations CERTs, since some of the NRENs might not have either the available human or the technical resources to monitor for security incidents affecting their end-users. NSHaRP extends the NRENs' detection and mitigation capability across the GÉANT network and to its borders with other networks, therefore enabling the attack to be mitigated before it transits the GÉANT network. This is a highly automated, innovative and unique security service in that it caters for different requirements from each NREN, by enabling the customisation of their NREN specific alerts in their hands.

FIREWALL ON DEMAND

DEFENDING AGAINST DDOS AND OTHER MALICIOUS ATTACKS

Firewall on Demand (FoD) is a powerful system which allows authorised users, via a web portal, to quickly create and disseminate firewall filters based on traffic flows to or from their designated address space. This system allows NRENs to filter and block malicious traffic flows from within the GÉANT backbone giving NRENs unprecedented power and control.

FoD's key features are:

- **Precision** – specific malicious flows can be targeted
- **Speed** - Time to disseminate/withdraw firewall filters is sub 10 seconds
- **Convenience** - NREN users can use web portal themselves, or make request by phone or e-mail.
- **Simplicity** - The web portal uses intuitive, non-vendor specific GUI-based wizard to configure router firewall filters.

FoD is powered by standards-based flowspec technology as specified in RFC 5575.

For more information on NSHaRP and Firewall on Demand, visit **http://www.geant.org/Networks/Network_Operations/Pages/NSHaRP.aspx**

TF-CSIRT – SUPPORTING THE COMMUNITY AND ENHANCING RESPONSE TO SECURITY THREATS

Threats to computer security and integrity have been around ever since the first computer systems were designed and started talking to each other, but the rising dependence on computers, smart phones and tablets in our everyday lives has meant that impact of attacks has a far wider impact than we would have seen 15 years ago. The "attack surface" - the number of possible vulnerable points for unauthorised users – is constantly growing and as systems become more complex, they are more prone to vulnerabilities that can increase the risk of malicious exploitation.

As well as supporting their own systems and users, it is essential that organisations share in the responsibility of coordinating their response efforts with other similar institutions. Gathering intelligence information from all sources is a critical part of information infrastructure protection. Networking in a trusted environment and sharing incident information and detection and response techniques can play an important role in identifying and correcting weaknesses. Achieving effective information sharing, however, is critically dependent on a strong trust infrastructure and good relationships between the sharing organisations.

It is to support these efforts that TF-CSIRT was formed in 2000. TF-CSIRT serves to raise awareness among its customers of computer security issues, provides information for secure protection of critical computing infrastructure and equipment against potential organised computer attacks and most importantly provides a framework to help build trust between organisations.

TF-CSIRT – NOT JUST A TASK FORCE

TF-CSIRT has always been more than "just another Task Force". It provides a range services to the community to help CSIRT teams work together, learn and mutually support each other.

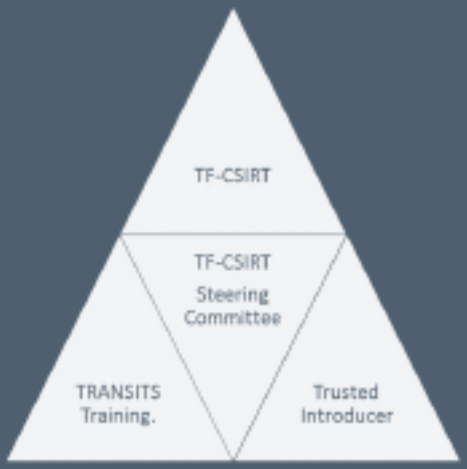
Alongside 3 Task Force meeting per year, each with over 100 attendees, TF-CSIRT supports the operation of the Trusted Introducer service – which lists, accredits and certifies CSIRT teams and provides TRANSITS training courses to increase community knowledge and help share best practice.

TRANSITS TRAINING

High-quality training for computer security teams.

TRANSITS provides affordable, high-quality training to both new and experienced computer security incident response team (CSIRT) personnel, as well as individuals with a bona-fide interest in establishing a CSIRT.

TRANSITS has directly trained more than 500 individuals in the European region, and many more have benefited from third-party courses. A number of participants have gone on to become TRANSITS trainers themselves, passing on their knowledge within their own regions and countries.



http://www.geant.org/Services/Trust_identity_and_security/Pages/TRANSITS_Training.aspx

Together these activities help ensure that NRENs and the wider R&E IT community have the best possible support to help them identify, mitigate and counter security threats. Through the face-to-face meetings, TF-CSIRT is able to help build relationships between CSIRT teams and team members. The Trusted Introducer infrastructure then supports this initial trust base by supplying a well-vetted database of contacts and extra assurances about team capabilities via the "accreditation" and "certification" schemes.

TF-CSIRT is a community security initiative and works alongside the core GÉANT security team, including GÉANT CERT and the GÉANT NOC. GÉANT CERT is itself a certified team within Trusted Introducer: **https://www.trusted-introducer.org/directory/teams/geant-cert.html**. It is part of a wider portfolio of security services and initiatives within GÉANT, that includes SIG-ISM, WISE, the GÉANT DDoS Workshops, TCS, and the Firewall on Demand service. **http://www.geant.org/Services/Trust_identity_and_security/Pages/Home.aspx**

TF-CSIRT – GOING FROM STRENGTH TO STRENGTH

Uniquely TF-CSIRT is not purely for NRENs and supports a range of Commercial, Governmental and National CERTs as well. This wide mix of participants helps share knowledge and skills and strengthens all members in their responses to IT security incidents.

CONNECTIVITY BOOST ACCELERATES EU-JAPANESE SCIENCE COLLABORATIONS

SINET5 OFFICIALLY LAUNCHED IN TOKYO

Over 50 million researchers, academics and students across Europe and Japan are set to benefit from a direct 20Gbps connectivity injection into the pan-European GÉANT network, celebrated on 25 May at the launch event of the upgraded Japanese Science Information Network (SINET5) in Tokyo.

The capacity boost comes in response to the increasing data transfer requirements of collaborative research between Europe and Japan on projects such as the ITER energy fusion reactor, the Large Hadron Collider (LHC) experiments and the worldwide e-VLBI radio-astronomy network.

During his keynote speech at the launch Steve Cotter, CEO GÉANT, said: "Up to now, connections between GÉANT and SINET have been achieved by peering in North America. Now, SINET is bringing 20Gbps directly to GÉANT; this means that we can jointly support European and Japanese researchers in their cutting-edge

scientific endeavours with faster and higher capacities as well as lower latency. We expect to see a major ramp-up of traffic exchanged over our networks as further EU-Japan user projects come to fruition in the next 2-3 years."

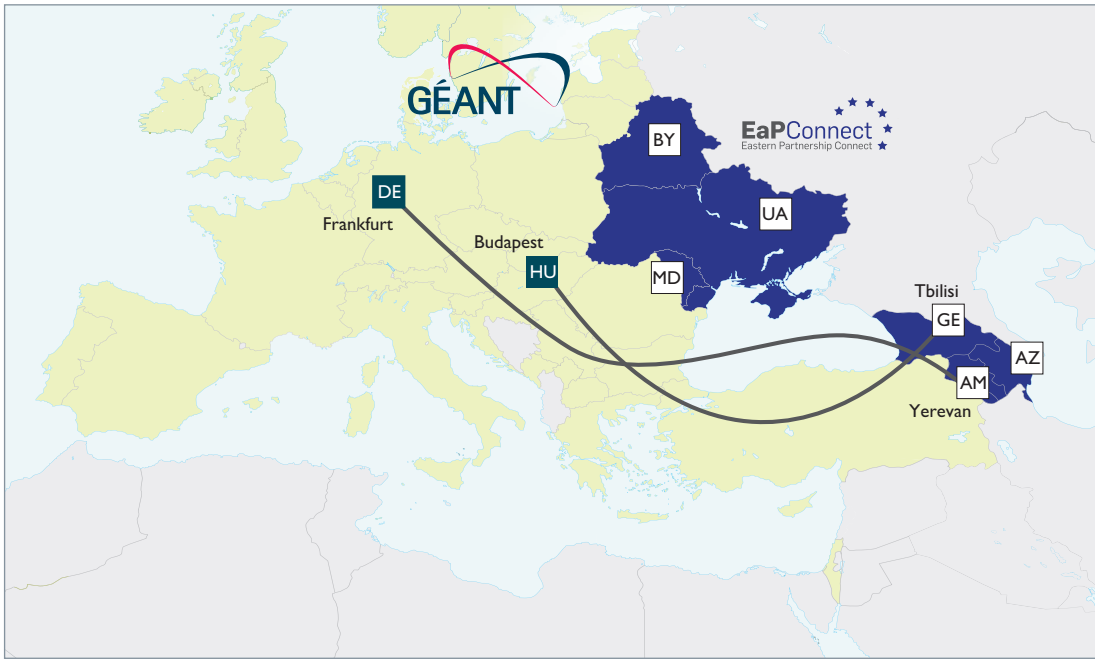
Operated by the National Institute of Informatics (NII), the 5th generation of the SINET network commenced operation in April. Shigeo Urushidani, Director of the Cyber-Science Infrastructure Development Department at NII commented: "With its 100Gbps full-mesh backbone, SINET5 opens up new possibilities for 3 million users at over 800 connected universities and research centres across Japan. Enhanced international connectivity, including a direct connection to Europe, is a vital element of SINET5's strategy to support our user communities and to advance global scientific research."

Pictures
Top: SINET5 officially launched in Tokyo.
Left: GÉANT CEO Steve Cotter delivering his keynote speech.

The two 10Gbps circuits connect with the GÉANT network in London where NII's network equipment is supported at GÉANT's new data centre at Slough, UK. SINET5 also connects there to the GÉANT Open exchange which enables direct links with other research and education networks. GÉANT and NII retain a back-up interconnection in New York.

The relationship between GÉANT and NII is longstanding. NII has been a major partner from the outset in TEIN, the EU-funded Asia-Pacific research and education network established by GÉANT and now successfully connecting 20 countries in the region. NII remains a major partner in TEIN and currently connects to the TEIN network in Singapore.

EAPCONNECT REACHES 1ST MILESTONE AND CONNECTS ARMENIA AND GEORGIA



The EU-funded EaPConnect project has achieved its first milestone by connecting Armenia and Georgia to the pan-European GÉANT network thus enabling local researchers and students to participate in collaborative work with their peers in Europe and other parts of the world.

"We are proud to welcome two new members to the European research and education community and expand to over 40 connected networks" said Steve Cotter, CEO of GÉANT. "GRENA and ASNET-AM are already established partners of global scientific institutions such as CERN in nuclear research and physics and the European research community looks forward to extending their collaboration with their Georgian and Armenian colleagues."

GRENA and ASNET-AM, the Georgian and Armenian R&E networks, have been connecting scientists, students and academics in their countries for over two decades providing them with valuable services such as eduroam, eduGAIN, FileSender and others.

Dr Ramaz Kvatadze, Executive Director of GRENA commented on the newly established link: "The Georgian research community has a strong interest in European technologies and scientific values. I believe that scientists working in high-energy physics, medicine, meteorology, climate change, seismology and computational biology will greatly benefit from the wider network and implemented services."

"Armenia has a long history of achievements in scientific research. Being part of the GÉANT network will bring positive outcomes to our pool of talents and projects while contributing to advance European and global science" said Dr Hrachya Astsatryan, head of the Center for Scientific Computing at the National Academy of Sciences of Armenia.

Two 1Gbps links to the GÉANT network now enable over 50 universities and scientific institutions locally to join a 50 million-user community and collaborate with their peers across borders.

Next to join the GÉANT network is Azerbaijan, which has started negotiations to connect their national network, AzScienceNet, to GÉANT. A tender is still under way to link the Belarus network, UIIP NASB, to the pan-European network. All Eastern Partnership countries are expected to be fully connected to GÉANT by the end of 2016.

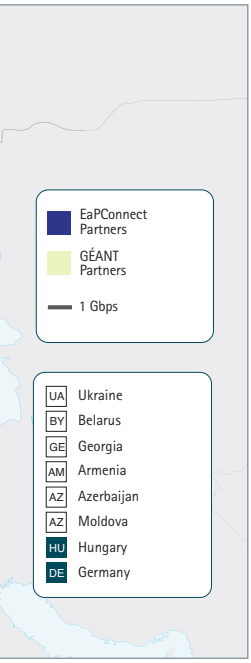
BENEFITING FROM THE POWER OF THE GÉANT COMMUNITY

Allowing EaPConnect to reach its 1st milestone, associate partners from the GÉANT community have been providing capacity building, knowledge exchange and service implementation support to the Eastern Partnership NRENs:

SURFnet in the Netherlands and PSNC, the Polish NREN, have kindly organised training workshops on services and applications as well as marketing to accompany the EaPConnect partners in their mission; LITNET in Lithuania is also bringing project management support; The Hungarian National Information Infrastructure Development Institute (NIIF) is providing network cabling assistance in Budapest. Looking forward, SURFnet is mentoring the partners in the organisation of a regional Enlighten Your Research* competition enabling them to reach out to their research community and create exposure for the fast-developing regional network. And last but not least, we will see the first Eastern Partnership E-Science Conference (EPEC 2016), taking place in Tbilisi, Georgia, from 6-7 October. The conference organisation is led by DFN, the German NREN, and will feature contributions of all project and supporting partners.

Congratulations and thank you all.

*Enlighten Your Research is a programme dedicated to match NREN services to researchers' needs. For more information please visit: **https://www.enlightenyourresearch.net/about-2/**



THE IN THE FIELD BLOG: A GLIMPSE OF THE HUMAN SIDE OF WHAT NETWORKS ENABLE

The In the Field blog (**www.inthefieldstories.net**) features fascinating stories that illustrate how R&E networks around the world are utilised to solve problems and make a real difference to the everyday lives of people. Developed by AARNet, the blog is a truly global collaboration of the R&E networking community. and welcomes contributions from all NRENs and RRENs around the world.

More than 80 stories involving over 40 networks across 6 continents have been published since the blog was launched in October last year. The stories cover a diverse range of topics, including food security, education, disaster warning, arts & culture, health, biodiversity and much else besides, painting impressive global picture of the impact of our networks.

We welcome contributions from all NRENs and RRENs around the world – the blog is a great platform to showcase how your network supports your communities! If you need help with developing ideas or writing a story or would like to provide feedback, please contact the editorial team at **jane.gifford@aarnet.edu.au**

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WACREN 2016: AFRICAN RESEARCH AND EDUCATION COMMUNITIES GATHER IN DAKAR

The 2nd annual WACREN conference for research and education (R&E) networking took place in Dakar, Senegal on March 17-18 following three days of intensive workshops promoting e-infrastructure, federated identity and Open Science in Africa.

Hosted by the Senegalese research and education network (snRER) with the support of the Senegalese Ministry for research and higher education with a theme of enabling virtual research and education communities, the conference was attended by over 200 participants including all West and Central African national research and education networks (NREN), managing directors of the North African and Eastern and Southern African regional networks – ASREN and the UbuntuNet Alliance – , representatives of the Association of African Universities (AAU), the World Bank as well as UNESCO.

The conference was supported by major e-infrastructure organisations, telecom providers and training bodies such as XON, Cisco, MainOne, Thomson Reuters, NSRC and GÉANT. The AfricaConnect2 project which has WACREN, the UbuntuNet Alliance and ASREN as partners building the first pan-African R&E network was a major sponsor of the event and gathered much attention from local NRENs as well as R&E actors in the region and across Africa.

Presentations ranged from NREN survival and sustainability models, taken from the experience of international NRENs and regional organisations such as SURFnet, TENET and the UbuntuNet Alliance to the deployment of valuable services including the eduGAIN federated log-in tool, eduroam campus Wi-Fi roaming access and cloud computing. In this stimulating and forward-thinking environment academic and technical participants were able to share their challenges and kick-start future collaborations, which goes to show once again that the success of African research and education lies in its people.

Thank you WACREN for allowing this to happen and congratulations for a great conference!

WE MET: BOUBAKAR BARRY, CEO OF WACREN

Leading the West and Central African networking community Boubakar Barry is no stranger to the pan-African and global research and education family. Involved in the very first stages of AfricaConnect he has acted as a REN coordinator for the Association of African Universities for many years, given lectures at the Internet Society and collaborated with research centres in Senegal, his home country, to encourage innovation and entrepreneurship locally.

6 years ago, following the success of AfricaConnect in Eastern and Southern Africa, he established WACREN, the West and Central African regional network for research and education which he is now developing through AfricaConnect2 and thanks to the support of an energetic and committed team. WACREN2016 is the achievement of a man and a team of people who are more than ready to connect the world to Africa.

WACREN2016 was the 1stmajor West and Central African networking conference and gathered more than 150 participants ranking from academics and researchers to engineers, ministries and representatives of UNESCO. How do you explain this success and how did you manage to engage with such a wide spectrum of participants?

WACREN is a young organisation, as it was established only in 2010. However, since the beginning, we have worked hard to build a strong community and to establish partnerships, always putting the end-users in the middle of our preoccupations and involving them in every aspect of WACREN development. This certainly explains why our community, our partners and our supporters have responded in large numbers to the invitation to WACREN 2016.

What doors would you say the WACREN conference has opened for research and education networking in Central and Western Africa?

I think that the conference gave the opportunity for more visibility for WACREN. It also showed that we have a strong community that is worth supporting and working with. The policy-makers, decision-makers and potential funding partners got the opportunity to interact with leaders and members of our community. This is important, as they could note that the ambitious goals of WACREN are to address real needs of our research and education community.

I think therefore that the NRENs are likely to get more attention from governments, institution leaders and development partners.

What was the main learning for WACREN?

The first lesson learnt from the conference is that it's not easy to plan and organise such an event, but that with hard work, it's possible to do it successfully. I must also add that the international participation shows the support of partners as well as the trust they have in WACREN. That is much appreciated.

Prior to the conference several workshops were organised, based on strategic priorities for WACREN, namely identity federation, open science and TANDEM. How do you foresee the development of these 3 areas of work in West and Central Africa?

Identity federation is very high in WACREN agenda. Most of our researchers don't have access to many resources just because the platforms these resources are on require federated access. We are therefore helping our NRENs and their member institutions to build their authorization and authentication infrastructure.

Open science is also very important to us, and in the framework of Sci-GaIA,

an EC-funded project WACREN is participating in, we have adopted the Dakar Declaration for Open Science in Africa, which has been signed by very large number of individuals and organisations.

As for TANDEM, it's another important EC-funded project WACREN is part of. The project is helping us reach out to our communities and also raise awareness among policy and decision-makers.

What insights did you retain from these workshops?

The workshops allowed to bring together many researchers from the region to share experience and demonstrate how lack of adequate IT infrastructure, including connectivity, is impacting negatively their research activities.

The workshops gave also the opportunity to identify researchers who could initiate, with the support of WACREN, a number of virtual research communities.

How do you think WACREN and AfricaConnect2 can use these insights in the future?

AfricaConnect2 is not just about building a network infrastructure, it's also about catalysing and supporting collaborations between researchers within the region, and between these researchers and their peers around the globe. The project can therefore definitely build on results of Sci-GaIA and TANDEM.

EDUROAM ON AN AFRICAN ROLL...

AfricaConnect and the EUMEDCONNECT projects have created regional internet backbones to connect dozens of countries across Eastern and Southern Africa and Northern Africa over the last few years. The expected outcome of this internet stream is the availability of NREN-provided services to facilitate R&E work.

eduroam ranks highly in today's students and researchers needs. Indeed the best way to allow information sharing and seamless communication while supporting mobility is WiFi. Knowing that you can access internet for free across your country as a member of an R&E institution has changed the lives of many students and researchers. In Kenya eduroam is currently available at 18 universities facilitating communication and collaboration between campuses. At Kenyatta University, Nairobi, 70000 students can access the internet via eduroam every day. At the highest peak of the day over 3000 students are connected at the same time.

In addition to the six African countries to have deployed eduroam several NRENs have now enrolled in pilot programmes to offer the best possible internet services to their national members and facilitate R&E collaboration across the continent. The latest development to date is GARNET in Ghana which counts most public universities among their members.

With AfricaConnect2 expected to establish R&E bandwidth throughout the African continent by 2020 and the higher education student population rising at exponential rates, eduroam is set to cover Africa very soon.

EDUROAM IN SENEGAL

In Senegal, snRER has run several successful testbeds with the help of GÉANT and now eduroam is available at the University Cheikh Anta Diop (UCAD) of Dakar, Senegalese Virtual University (UVS), and the Ministry of Higher Education and more than 90 000 students can get connected on Wi-Fi using eduroam. As a result, snRER was also able to provide eduroam at the 1st WACREN conference held last March at Novotel Hotel in Dakar. At TNC2016 in Prague on 15 June, Mrs Khoudia GUEYE from UCAD will give a lightning talk on the deployment of eduroam in Senegal and future expectations.

Picture
Dark blue: eduroam; Light blue: pilots

MAJOR BOOST FOR EU-ALGERIAN SCIENCE BRINGS FOUR-FOLD CAPACITY

International connectivity available to Algeria's scientists, academics and students has recently been upgraded from 622Mbps to 2.5Gbps by CERIST (Research Centre on Scientific and Technical Information – the organisation that manages Algeria's national R&E network ARN), GÉANT and its regional partner ASREN (Arab States Research and Education Network). The fourfold capacity increase is an early result of AfricaConnect2, the EU-funded pan-African connectivity project which supports the establishment of research and education (R&E) internet networks across Africa.

Aouaouche El-Maouhab, ARN Manager at CERIST, underlines the importance of being part of the AfricaConnect2 project and, by extension, of the global R&E community: "Over the last decade the connectivity needs of academic and research institutions in Algeria have increased significantly. As a result, we have seen our international networking capacity increase by a factor of 50 – from an initial circuit of 45Mbps in 2004 to the current 2.5Gbps. Within AfricaConnect2 and in conjunction with ASREN and our partners in Europe our focus is now on providing value-added services on top of connectivity such as eduroam and eduGAIN."

SUPPORTING THE HEP COMMUNITY

ARN currently interconnects over 800,000 users at 124 research and academic institutions across Algeria. Through its interconnection to the pan-European GÉANT network, ARN enables researchers, academics and students in the country to participate in world-class international research and educational activities in areas such as high-energy physics and earth observation.

"The connectivity boost opens up exciting possibilities for Algerian scientists to participate in the Large Hadron Collider experiments", commented Prof. Abdelhafid Aouragh, Director General at the General Directorate for Scientific Research and Technological Development (DGRSDT) in Algeria. "We are in the process of setting up a Tier 2 and Tier 3 cluster of computational centres connected to the ARN network, which will be part of the CERN infrastructure and will allow our physicists to contribute to specific analysis tasks within the ATLAS programme".

A LONG-STANDING PARTNERSHIP

"Algeria has been connected continuously to Europe since 2004 - the longest of any partner country in the regional networking projects GÉANT manages", commented Steve Cotter, CEO GÉANT. "The capacity boost clearly reflects the long-term commitment to facilitating collaborations between Algeria and the global R&E community."

Algeria joined the AfricaConnect2 project in June 2015 as part of the North African regional project cluster, alongside Egypt, Morocco and Tunisia. Previously, the North African countries participated in the EU-funded EUMEDCONNECT project which between 2004 and 2015 provided high-capacity connectivity and interconnection to the GÉANT network for the R&E communities across the southern shore of the Mediterranean.

Algeria is also a shareholder in ASREN which acts as GÉANT's regional AfricaConnect2 partner in North Africa. ASREN CEO Yousef Torman commented: "We welcome the Algerian connectivity upgrade as important step in our mission to connect Arab national research and education networks (NRENs) across North Africa, the Middle East and the wider Arab region and are expecting further AfricaConnect2 connectivity announcements ahead."

ASREN CONNECTION OPENS DOOR TO GLOBAL HIGH-SPEED CONNECTIVITY FOR MIDDLE EAST SCIENCE HUB

Picture
Signing of connectivity agreement on 13 April 2016 (left to right): Jérôme Hénique (CEO Orange Jordan), Dr. Khaled Toukan (Director SESAME), Dr. Talal Abu-Ghazaleh (Chairman ASREN)

ASREN
Arab States Research and Education Network

Via its dedicated link from Amman to its PoP in London, the Arab States Research and Education Network (ASREN) has recently connected SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) in Jordan to GÉANT and, by extension, to the global R&E networking infrastructure, thus preparing the ground for tackling the data deluge in the years to come.

SESAME

SCIENTIFIC HUB IN THE MIDDLE EAST

Set up on the CERN model and due to go live in 2017, this first synchrotron radiation facility in the Middle East is destined to become a major scientific hub in the region with unrivalled opportunities for international collaborative research. SESAME will provide a vital resource for a wide variety of physics applications, both in the region and further afield: developing new materials, probing the structure of DNA, penetrating the secrets of chemical compounds, designing pharmaceuticals, performing disease infrared imaging, assessing archaeological artefacts, measuring soil pollution and much else besides.

TACKLING THE DATA DELUGE

Once the facility will reach full working capacity, it will produce thousands of gigabytes every day which will be transferred to HPC centres in and outside the region for analysis, including partners in the EU-funded Virtual Research Environment Vi-SEEM project.

Initially at 50 Mbps, the link is the first step in providing an advanced international connectivity set-up for this endeavour to succeed and is anticipated to act as proof of concept for significantly higher capacity in the future.

EU SUPPORT

ASREN is partner in the EU-funded EUMEDCONNECT3 project which supports R&E networking for the Eastern Mediterranean (Jordan, Lebanon, Palestine). SESAME is expected to be a major regional driver of connectivity to GÉANT for the region.

Synchrotron partner laboratories from Germany, France, Italy, UK, Sweden and Spain are supplying expertise, equipment and technical support, and the EC has contributed over €10 M, including funds for the construction of the magnet system for its main storage ring.

"Advanced connectivity is essential for regional and international inter-disciplinary research and for scientists to fully reap the benefits of SESAME. In particular, we look forward to collaborating with our partners in the Vi-SEEM project to support scientific communities of Life Sciences, Climatology and Digital Cultural Heritage."

Dr. Khaled Toukan - General Director of SESAME

"SESAME creates a motivating scientific environment that encourages the region's best minds to stay in the region, whilst tackling global challenges. ASREN welcomes this connection as it prepares the ground for SESAME to become a major player on the global scientific scene."

Dr. Talal Abu-Ghazaleh, Chairman ASREN

IMAN ABUEL MAALY WINS GLOBAL WOMAN ENGINEER AWARD

In Issue 20 of CONNECT we interviewed Dr Iman Abuel Maaly Abdelrahman, the ex CEO of SudREN, shortly after she had been awarded 'Distinguished Arab Woman Engineer' for Sudan.

We are proud to now announce that Iman has now won the Global Woman Engineer Award and continues to inspire thousands of women in ICT from around the world.

An engineer, researcher, NREN CEO, REN Board member and a promoter of women's rights, Iman is determined to break stereotypes and make people connect to each other to overcome their differences and advance global research.

She features in the recently published NUANCE magazine, the UbuntuNet Alliance e-newsletter. Read the interview at: **https://www.ubuntunet.net/april2016#article5**

KREONET INTERCONNECTS WITH GÉANT

GÉANT has recently signed an agreement with Korea Research Environment Open NETwork (KREONET) to interconnect with the GÉANT network at NetherLight in Amsterdam. The 10Gbps peering extends GÉANT international connectivity and allows researchers in Korea to collaborate with peers in Europe and in other world regions in fields such as high-energy physics, fusion energy, climate research, astronomy, genomics and eCulture.

Buseung Cho, Director of KREONET's Department of Operations and Services commented: "International high-capacity connectivity is essential for big science projects such as e-VLBI, the ITER fusion energy programme and the LHC experiments. This agreement will allow Korean scientists and research centres connected to KREONET to be main players in these global scientific endeavours".

There are two major R&E networks in Korea: KOREN and KREONET. GÉANT has been connected to KOREN via the EU-funded TEIN network in which KOREN has participated from the outset in 2006. Run by KISTI (Korea Institute of Science and Technology Information) since 1988, KREONET currently connects a further 200 major organisations in Korea including government research institutes, major universities and industrial research laboratories.

In welcoming the agreement, Steve Cotter, CEO GÉANT said: "GÉANT's relationship with KREONET originated through the Global Lambda Integrated Facility (GLIF) forum meetings. We are pleased to further extend the relationship by directly interconnecting our networks which will increase advanced collaborative research connectivity between Europe and Korea."

SDN DEVELOPMENTS IN GÉANT: PAVING THE WAY FOR FUTURE NETWORK SERVICES

Software Defined Networking (SDN) is transforming the way networks are operated and utilised today. The use of vendor-independent software has enabled user control of the network infrastructure and many of its functions traditionally embedded in legacy hardware. Implementation-specific features are abstracted by software components and applications. Software can be used to program the network to handle traffic in fine granularity and dynamically. Different traffic flows are identified, to which specialised, differentiated treatment can be applied. Ultimately, users and user applications are enabled to directly program network behavior to meet their traffic requirements.

Requirements for advanced applications and use cases from the R&E community, coupled with the need for infrastructure agility and cost-efficiency in operations, are placing expectations on GÉANT and the NRENs to revise traditional service provisioning and operational models. These requirements include:

- Multi-tenancy, multi-point network fabrics, e.g. for interconnecting clouds.
- Programmable traffic processing for troubleshooting, network monitoring, application performance tuning or security purposes.
- User-empowered configuration and provisioning (always in alignment with core management and operations).
- Traffic engineering controls to serve data transfers (e.g. being able to define a transfer shortest path or optimal path as part of application-to-network, interaction-based optimisations).

The GÉANT project team has delivered a number of SDN-enabled solutions to drive the evolution of the GÉANT and NREN network in the direction of SDN. The chosen technologies include the Open Network Operating System1 (ONOS) as the core, community-built, carrier-grade software component (controller) to deliver SDN functionality on top of the network infrastructure, and the OpenFlow protocol2 for interaction between the controller and the individual network elements.

Among the solutions being developed are:

- Applications to enable a backbone network to turn on SDN in specific points of presence or parts of its topology in the form of Software Defined internet eXchange Points (SDXs), featuring external peerings with other IP networks and private point-to-point exchange of traffic between SDX users. SDX features enable a network to be operated both as an Internet Exchange Point for multiple providers (e.g. cloud service providers) to interconnect and as a provider of IP transit services, while introducing the additional benefits of SDN.
- A solution for intra-domain Bandwidth-on-Demand (BoD) services based on SDN, offering extra features such as advanced path computation and resiliency, while maintaining compatibility with REN multi-domain solutions.
- An application that uses ONOS to signal circuit requests to the optical transport layer of the GÉANT network. This will make it possible for users/applications to control transport resources using software to maximise their utilisation and dynamic use.
- Multi-tenancy features within a data centre environment.
- Specialised traffic handling within the campus, combining legacy hardware with SDN features.

GÉANT has been closely collaborating with the global ONOS community to develop features that meet the SDN requirements of the GÉANT and European NREN network. These efforts serve to ensure the continued compatibility of the solutions developed by GÉANT with ongoing improvements in the ONOS codebase. In the process, the GÉANT SDN team has acquired significant expertise on ONOS and benefited from a thorough review of its approach by the ONOS community. It has gained the community's recognition through contributing the new functionality delivered to the ONOS core codebase, leading to its wider dissemination.

The project team has also been working with vendors supporting SDN, including Corsa Technologies Inc. and Infinera Corporation, the GÉANT network's current optical platform provider. In collaboration with Corsa, GÉANT has worked to define, deliver and test specialised hardware features to enhance SDN-capable switches to support GÉANT requirements. On the other hand its work with Infinera has focused on developing the interworking of ONOS with hardware cards to create, delete and modify circuits directly on the transport layer. Meanwhile, GÉANT continues to pursue synergies with other vendors.

The interworking of network applications, SDN controllers and underlying network elements, while complex to implement, brings powerful capabilities. GÉANT's approach, which ensures that the same core SDN component (controller) can manage different use cases and network layers, means that users only have to code lightweight applications (which are often technology agnostic) and deploy them on top of the SDN controller to gain control of the network. At the time of writing, the solutions developed stand ready to leave the lab environment and be deployed as pilots in an operational environment.

The ongoing implementation and integration with production hardware of software-based features is contributing to accrue significant 'know-how' which will serve as the basis for future SDN development. SDN's next-generation networking approach is widely applicable. Standards-based SDN protocols, as well as community-built controllers and applications, ensure synergies and support for SDN solutions globally. In GÉANT, the new SDN features will soon serve as the basis for advanced network services that are less dependent upon legacy hardware and increasingly adapted to its user community's needs.

Words
Afrodite Sevasti, Activity Leader for Network Infrastructure Evolution in the GÉANT (GN4-2) Project

1. The Open Network Operation system, http://onosproject.org/
2. "OpenFlow allows switches from different vendors — often each with their own proprietary interfaces and scripting languages — to be managed remotely using a single, open protocol", source: Wikipedia

CERTIFICATE TRANSPARENCY

A SHORT INTRODUCTION INTO PKI

The safety, reliability and security of the internet currently relies heavily on the use of TLS/SSL (Transport Layer Security/Secure Sockets Layer). This gives end users confirmation that they are really looking at the site they intended to visit and also means that content no longer travels the wires unencrypted, diminishing the opportunities for eavesdropping and unwanted interception.

This increase in security relies on the trustworthiness of the Public Key Infrastructure (PKI), the system for requesting, generating, and handing out certificates for domain names. Within this system, Certification Authorities (CAs) are the entities responsible for signing certificates for domains after checking that the requester is entitled. CAs are required to have proper procedures and technical means in place to ensure the trustworthiness of the certificates that they issue. This to prevent rogue certificates, by hacking or other means. Browsers have a list of keys from CAs they trust. The check performed by CAs to tie a public key to a domain name together with the list of CA keys in browsers ensure that users visiting a web site can rely on the validity of the lock icon as displayed by their browser.

DISPOSING OF ABSOLUTE AND GLOBAL TRUST

The PKI approach works in principle, but does place a lot of trust in the role of CAs and in the assumption that all CAs always have reliable processes and security measures in place. A typical browser trusts hundreds of CA keys, any of which is trusted to sign any domain name. Having to trust all the CA keys for all domain names is one of the fundamental problems of this approach and there have been enough examples over the past years to show that this trust can be misplaced [1][2][3][4].

A big worry is also that wrongly issued certificates can go undetected for quite some time. Introducing a healthy level of scepticism and distrust of individual entities would help. It's already a reality that one can no longer blindly rely on the validity of a certificate by trusting all CAs to behave flawlessly, so a way is needed to increase the chances of detecting mis-issuance of certificates. A good way of achieving this should be to increase the transparency of the system as a whole. If anyone is able to see which CAs have issued which certificates for what domains, then detecting mistakenly or maliciously issued certificates becomes easier. For example: Owners of domains can check whether all known certificates for their domains are all issued by their 'own' CA. Any certificate issued by another CA is immediately suspect and warrants further investigation (and possible action).

CERTIFICATE TRANSPARENCY

Certificate Transparency (CT) is an open framework "to detect SSL certificates that have been mistakenly issued by a certificate authority or maliciously acquired from an otherwise unimpeachable certificate authority" [5]. In essence CT is an append-only externally verifiable log of certificates - logging the existence of TLS certificates as they are issued or observed - allowing anyone to submit to and inspect the log. The goal is to identify certificates that have been either mistakenly issued or issued by a compromised certificate authority (CA). By empowering domain owners, by giving them means to keep an eye out for certificates for their own domain, the chance of detection should increase. A good introduction to the reasoning behind CT, as well as a more technical explanation on how it works, can be found on the Certificate Transparency website [6].

GÉANT'S INVOLVEMENT IN CT

As part of the GÉANT (GN4-1) Project, the CT work item team, consisting of people from the Swedish NREN, SUNET, and the Royal Institute of Technology in Stockholm (KTH), participating in the project through NORDUnet, has designed and implemented a distributable implementation of Certificate Transparency, called Catlfish [7], as specified in RFC6962 [8].

CATLFISH

Google's implementation of CT was less suited for deployment in a multi-organisation internet-wide environment such as GÉANT, which is why the CT team developed their own implementation "Catlfish" (1).

The system is divided into four types of nodes – front-end, storage, merge and signing nodes. The front-end nodes provide the public HTTPS service for submissions and queries. Submitted certificate chains are validated and sent to all storage nodes. When a configured quorum of the storage nodes report that they have stored the data on disk, a signature is requested from a signing node and a Signed Certificate Timestamp (SCT) is returned to the submitter. The primary merge node periodically collects all new log entries from the storage nodes, orders them, builds a new tree, signs the root hash and distributes the new entries and the signed root hash to the front-end nodes.

GOSSIP

Care should be taken not to move the need for trust from CAs to CT logs, since that would only move the trust problem to another entity. The ultimate goal is to have a setup such that no component needs to trust any other component fully.

Untrustworthy CT logs could provide different views to different clients. Each client might then see a unique and seemingly correct view of the log, leaving targeted groups of clients vulnerable. To thwart this type of partitioning attack, log clients need to talk to each other ('gossip') about their view of a log, while not divulging any information that may be privacy sensitive (which the act of verifying a specific certificate from a log may very well be).

The CT team has led the effort of standardising Certificate Transparency Gossip [9] as part of the IETF Public Notary Transparency working group [10], which has led to an accepted draft.

CONCLUSIONS

The design and implementation of Catlfish has resulted in a stable and useful CT system, currently used for a log that holds around 6 million certificates and suitable for deployment in a multi-organisation internet-wide environment such as GÉANT. The software is also used as a building block for other types of public append-only externally verifiable logs.

The work on Gossip significantly enhances Certificate Transparency goals by providing a means for thwarting potential partitioning attacks on the CT system.

The two combined lead to a more robust and trustworthy PKI and thereby improve security for the internet as a whole.

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Words
Linus Nordberg (NORDUnet) and Remco Poortinga - van Wijnen (SURFnet)

Figure 1
Catlfish Certificate Transparency Architecture.

STORING HISTORIC MEMORIES USING GLOBAL HIGH-SPEED NETWORKS AND HIGH-CAPACITY DATA STORAGE

One of the Shoah Foundation's Visual History backup repository archives has been installed within the Malach Centre at Charles University in Prague and interconnected by CESNET and the GÉANT network.

Words
Radovan Igliar, CESNET

Picture
Above: Opening ceremony of the Malach centre with (from left to right) Stephen D. Smith, a director of USC Shoah Foundation; Prof. Jan Hajic, LINDAT/CLARIN - director of Czech node; Prof. Václav Hampl, rector of Charles University in Prague (at that time, now a emeritus rector)

One of the Shoah Foundation's Visual History backup repository archives has been installed within the Malach Centre at Charles University in Prague and interconnected by CESNET and the GÉANT network.

The Malach Centre for Visual History of Charles University in Prague was established in 2010 as an access point to the University of Southern California's Shoah Foundation's Visual History Archive (**http://sfi.usc.edu**).

This digital archive is one of the most extensive projects based on the so called "oral history" method. It was launched in 1994 at the initiative of director Steven Spielberg who founded the Los Angeles-based Survivors of the Shoah Visual History Foundation. The goal was to collate the highest possible volume of audiovisual interviews with the witnesses and survivors of the genocide of Jews (holocaust) during the World War II worldwide.

Recently, the archives have been enriched with recordings of the interviews with the survivors and the witnesses of other genocides (in particular the genocide in Rwanda and Armenia). The efforts yielded a total of 53 000 audiovisual interviews recorded in 39 languages and 61 countries.

In order to enable searching through more than 105 000 hours of video recordings, the digitalisation of the recordings and their referencing began at the turn of the century. This marked the beginning of the scientific cooperation between the Shoah Foundation and Charles University in Prague, under the framework of the Multilingual Access to Large Spoken Archives (MALACH, see **http://malach.umiacs.umd.edu/**) research project. The name of the Malach Centre, established several years later, is actually a reference to this project which ran from 2002 to 2007.

The main objective of the Malach Centre is to provide technological, spatial and personnel background to enable working with high-volume archives of oral-history data. The Malach Centre uses all resources available in particular for educational and research purposes; dozens of research papers have been drafted using these resources.

Due to capacity reasons, only a portion of the entire archive is being stored locally. These are data which are most frequently requested by the researchers from the CEE region. The creation of a new digital archive was launched in 2015. The digital archive should enable the Malach Centre to become the node of the backup archive network in which full copies of all data are kept.

The new hierarchical storage with capacity of up to 8 Petabytes is currently being configured and tested. Upon its initialisation and during the subsequent operation, large data volumes will need to be transferred between the Malach Centre's archive and the primary storage at USC's Visual History Archive. In such cases, attention needs to be paid to the architecture of the computer network and the transmission route.

After discussions with our partners from USC, CESNET and GÉANT, a direct optical fibre 10 Gbps route was established between the newly built archive of the Malach Centre and the CESNET's network node, with the possibility to enlarge the capacity to n x 10 Gbps, when necessary. CESNET currently disposes of an international connectivity of 100Gbps towards the GÉANT network, and the GÉANT network has further a total of 5x 10Gbps into the Internet2 network in the USA, which connects the USC.

In the near future, the network protocol parameters should be optimised and the archive will be initialized. This, however, requires the cooperation of all partners, who monitor the transmission route and have the necessary real-life experience. The experience indicates that the implementation of the entire archive including the gradual connection speed increase should be successful.

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Faculty of Mathematics and Physics, Charles University in Prague
[1]Institute of Formal and Applied Linguistics, [2]LINDAT/CLARIN, [3]Malach Centre for Visual History

SHARED INFRASTRUCTURE TO ENHANCE IT SERVICES

IT infrastructures and services have become critical success factors at universities. Requirements of researchers and lecturers are changing faster than ever. How can universities expand their IT infrastructures and services in a flexible and cost efficient way while remaining committed to their academic mandate?

While IT is becoming a more and more important backbone service, it is also required to perform an increasingly broad variety of tasks. One of the solutions many universities are looking into to handle these challenges are hybrid services that closely integrate with their existing infrastructures. Our discussions with universities show clearly that, in addition to technical requirements, these solutions must fulfil various criteria in terms of governance, control and also trustworthiness.

DEVELOPED FOR THE ACADEMIC COMMUNITY

Since its very beginning, SWITCH has specialised in providing complementary IT services in close partnership with universities. Services were traditionally provided at network level and have recently evolved to include computing and storage services. Starting with SWITCHengines (see text box), SWITCHdrive and SWITCHfilesender, there will be more specialised services to come. All these services were developed to address the special requirements of the SWITCH academic community and are fully hosted in Switzerland in data centres at Swiss universities.

While many service providers start and end with technical features, the following points are very important to SWITCH and its academic community, the goal being to support the institution's IT professionals in multiple dimensions.

The most important one is community competence. Institutions of the SWITCH community participate in the design and further development of service offerings. This allows all to generate knowledge that can be exchanged and shared. SWITCH's deep understanding of specific needs also allows it to provide better support for academic IT departments and their users.

> **"Institutions of the SWITCH community participate in the design and further development of service offerings."**

During the development of the services with the community, one thing became very obvious: by combining its core competencies, SWITCH can create services that add value and can easily be integrated into a university's service catalogue and processes.

The three key aspects of this integrated offering are:

- Network integration
- Tailored security features and know-how
- Identity management

The high-performance network SWITCHlan with speeds of up to 100 Gbit/s is the powerful basis for fast data transfer. Taking this one step further, we will be able to embed SWITCHengines seamlessly into universities' networks via the Virtual Private Cloud.

With regard to security, all services profit from having a strong SWITCH security team in-house. The infrastructure is constantly monitored for possible security breaches.

Finally, the services are accessible via the existing SWITCHaai and the next-generation Swiss edu-ID, meaning that they are compatible with the most accepted and broadly used identity management system in Swiss academia. It also means that access can be finely tuned and that universities can control processes for usage and governance, and it allows institutions to keep full oversight over usage and costs as well as governance of key service aspects. Together with Swiss data hosting this assures that data processing is in compliance with relevant Swiss laws and regulation.

In related articles on infrastructure services at SWITCH (see link below), users of SWITCHengines and SWITCHdrive describe their personal experience as well as specific reasons for using these services.

To address the most promising development topics, SWITCH is taking part in the Swiss SUC P-2 programme with the SCALE-UP project, collaborating with nine universities to build additional scientific services on top of our infrastructure. The spectrum ranges from 'Data Pools' to 'Big Data', 'Classroom in the Cloud' services and extended infrastructure elements like 'Rating, Charging, Billing'.

We also present the current situation and future vision for seamlessly embedding SWITCHengines in an institution via Virtual Private Network. Interestingly, libraries are also starting to use these SWITCH services.

The new services presented here are the first in a range with more to come. All of them are created with the deep know-how and passion of SWITCH staff and with invaluable help from the community

INFRASTRUCTURE SERVICES BY SWITCHENGINES

SWITCHengines is at the heart of our offering for hybrid IT infrastructures. It is built and deployed as an OpenStack-based community cloud service for higher education in Switzerland. The infrastructure has been growing constantly, starting with an eight-server test environment and scaling up to 120 servers in 2015. The project to create SWITCHengines as a national service was co-funded by the SUC P-2 programme.

The long list of real-world use cases of SWITCHengines includes computing of earthquake or glacial flow simulations, cancer research, Monte Carlo calculations, machine learning and much more.

SWITCHengines has seen over 70,000 virtual machines (VMs) started and decommissioned to date, and more than 1,000 VMs are active at any given time.

This article is available online also in German, French and Italian at **http://www.switch.ch/stories/infrastructure/**
Related articles on infrastructure services at SWITCH can be found here:
http://www.switch.ch/dossiers/infrastructure-services/

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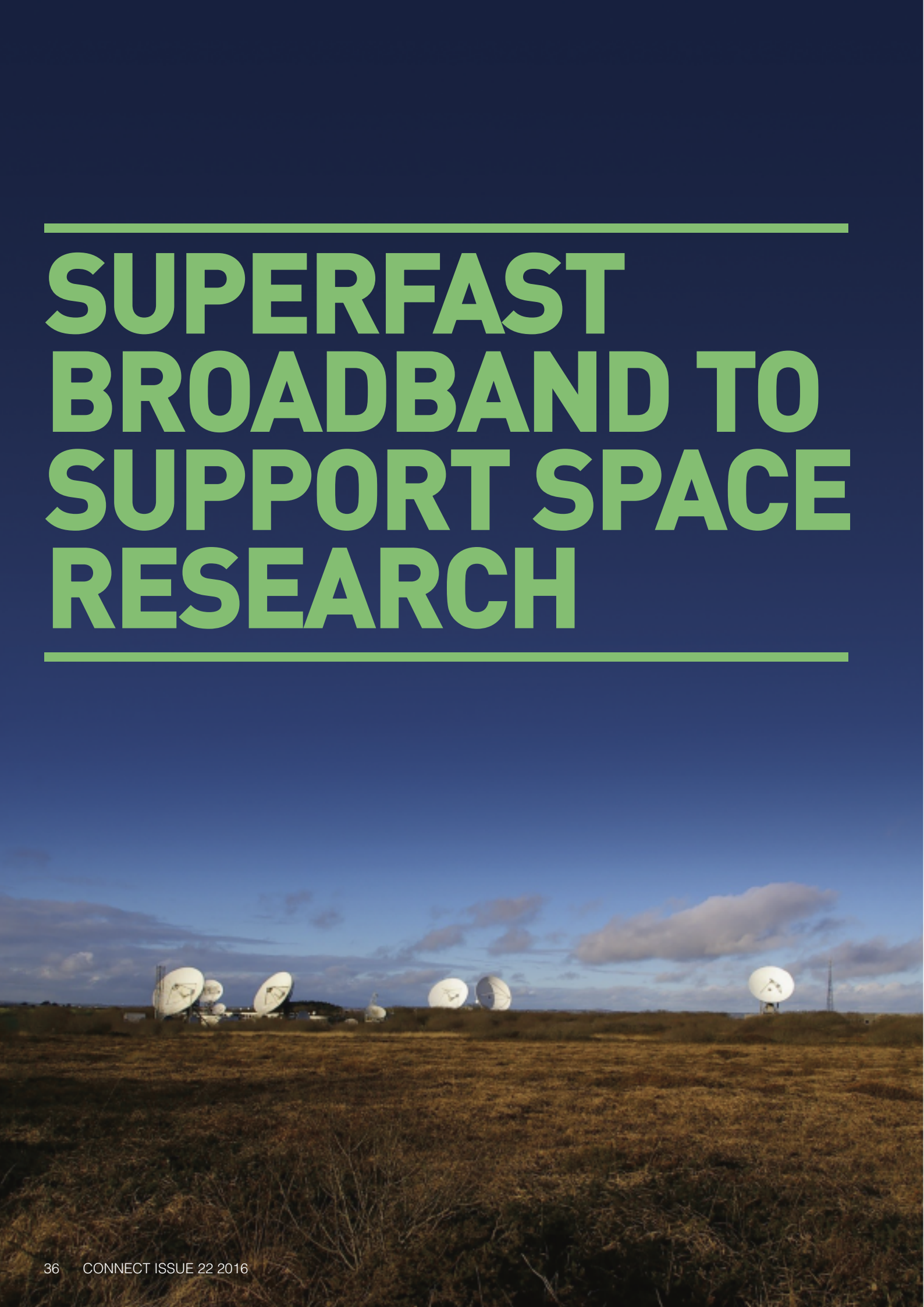
SUPERFAST BROADBAND TO SUPPORT SPACE RESEARCH



Images
All rights reserved, Goonhilly Earth Station Ltd.

The UK space industry and space science have received a boost as Goonhilly Earth Station Ltd - the communications hub currently supporting Tim Peake's space mission - and Jisc have signed a deal to transform connectivity.

Since March, Goonhilly Earth Station has been opened up to faster, more secure connectivity by taking a connection to the world-class Janet network through Jiscom, the commercial arm of Jisc, which provides digital solutions for colleges and universities.

Goonhilly's improved infrastructure is a significant benefit for the site's international collaborators, from the space and TV industries, to individual businesses and universities. Goonhilly currently supports and manages satellites for a number of global satellite operators. It is a downlink station for earth observation networks and is planning to become the world's first private Deep Space ground station. This rapidly growing business will need the extra capacity provided by the new connections to Janet, the UK's national research and education network.

Derek Thomas MP, said, "Support for business big and small is a crucial part of the development of the south-west and so I strongly welcome this new join-up. Goonhilly Earth Station plays a key part in a concerted effort to increase the number of skilled jobs in Cornwall and on Scilly and I am delighted by the growth of this high-tech business."

Jisc will also be enabling eduroam on the site. This will allow visiting students and academics seamless Wi-Fi through their institutional log-ins, so that the next generation of satellite scientists can benefit from the same connectivity.

Goonhilly Earth Station CEO Ian Jones said, "Goonhilly is a commercial satellite earth station – we need reliable, fast connectivity for our commercial clients. However, we also bridge a significant gap into academic research, teaching and data services. The Janet network's wide range of interconnect options coupled with a highly available, uncluttered service provides excellent value-for-money."

Tim Marshall, MD of Jiscom, said, "We are delighted to be supporting the Chancellor's initiative for a more innovative digital economy through this agreement with Goonhilly - not only does it generate additional revenue for the research and education sector that Jisc supports, but it very much speaks to our mission of research collaboration and innovation. It will be exciting to track the progress of Goonhilly as it continues to support education and the knowledge economy."

HOW DATA CAN IMPROVE THE QUALITY OF HIGHER EDUCATION

Big data are found in all segments of society. Even the Dutch higher education sector is increasingly recognising the potential for the vast volumes of data that it has at its disposal.

What opportunities does learning analytics offer? And what challenges are the early adopters facing? Are there any runners out there who still do not track their performance with an app? Is anyone still shocked by their electricity bill now that there is a smart meter that shows real-time household energy consumption?

Insight is the buzzword in the data revolution. People who have insight into their behaviour will be able to work more efficiently from now on. This equally applies to organisations, higher education institutions and nations. The digital revolution has brought about a tremendous increase in the volume of data and it is comparatively easy to access.

It would seem to be a lost opportunity to ignore such data. Just as all sectors in which ICT is used regularly, in the higher education sector too data are there for the taking, so to speak. From the moment students browse the higher education institution's website for information until the moment they are registered as alumni, they leave a digital footprint. Student information systems, the online learning environment and the library, but even items such as students' wearables, generate a wealth of potentially interesting data. If you connect all systems to each other, you will gain insight into students' learning behaviour, the quality of teaching and the institution's effectiveness. Greater insight translates into better education for students.

It obviously is not so easy to gather, analyse and report data from learning environments as suggested here. There are educational, ethical, legal and technical challenges which need more clarification. Even so SURFnet believes in the potential for learning analytics, the umbrella term for processing study data to understand and improve learning behaviour.

"Learning analytics always existed, but in the lecturer's mind," says Erik Huizer, SURFnet CTO. "The lecturer looked at the list of marks and was able to properly assess whether a student needed further support. Because lecturers have to work with ever larger groups, it is increasingly difficult for them to maintain oversight nowadays."

The scale of education stands in stark contrast to the call for customised education. The members of SURFnet aim to offer an environment in which they can provide students the most effective and preferably the most personalised programme possible. "Without automation it's just not possible," says Huizer. "A lecturer must have good insight into a student's progress. It's important for students to know at what stage they are in the programme and what next steps they are ready to take. This is where learning analytics comes in. SURFnet's challenge is to help create that environment for its members."

SURFnet believes that learning analytics has vast potential to help improve the quality of education. Whether it is the key to customised education, time will tell, but there is sufficient reason to experiment. In the longer term it is essential to obtain greater clarity on the didactical possibilities, the technical challenges and the ethical and legal boundaries.

SURFnet has an important role to play in sharing knowledge and defining the technical preconditions. The higher education institutions need to sit down together with SURFnet to determine the ground rules. They should not let any of the above aspects deter them from setting up pilots meanwhile, or from introducing top-down learning analytics at their institution and sharing these experiences with the Learning Analytics Special Interest Group. Added value can be derived not only for the organisation, but especially for students and lecturers. If they are convinced of the usefulness of learning analytics, the institutions will derive maximum benefit from the power of their data.

For the full whitepaper, visit: **https://www.surf.nl/en/knowledge-base/2016/whitepaper-how-data-can-improve-the-quality-of-higher-education.html**

vietsch foundation

AWARD OF THE MEDAL OF THE VIETSCH FOUNDATION 2016 TO JAN GRUNTORÁD

The Vietsch Foundation promotes research and development of advanced Internet technology for scientific research and higher education. Each year the Foundation awards a medal of honour to people who contributed to the development of a service, technology or approach that will be of lasting value to the research and education networking community and its users.

The Trustees of the Vietsch Foundation unanimously decided to award the 2016 Medal to Jan Gruntorád, for his unique combination of vision and management that lead to a successful and sustainable organisation.

After the fall of the Berlin Wall in 1989, only a limited set of people grasped the importance of the Internet and its relevance for Research and Education. At that time, even before the days of DANTE and TERENA, research networking in Europe as a whole was still in its early stages, and therefore the people who started pioneering Internet connections at the time were true visionaries. Jan Gruntorád was among those visionaries, leading to the first connection to EARN in 1990 and the establishment, in 1992, of the CESNET network, initially operated by the Czech Technical University in Prague, and as a legal body in 1996.

Since those early days, CESNET has grown from strength to strength. Today, we can say without exaggeration that CESNET is among the leading NRENs in Europe and the world, with a network, a portfolio of services and an influence that is unique, given also the size of the country.

Jan has not only provided visionary leadership inside the Czech Republic.

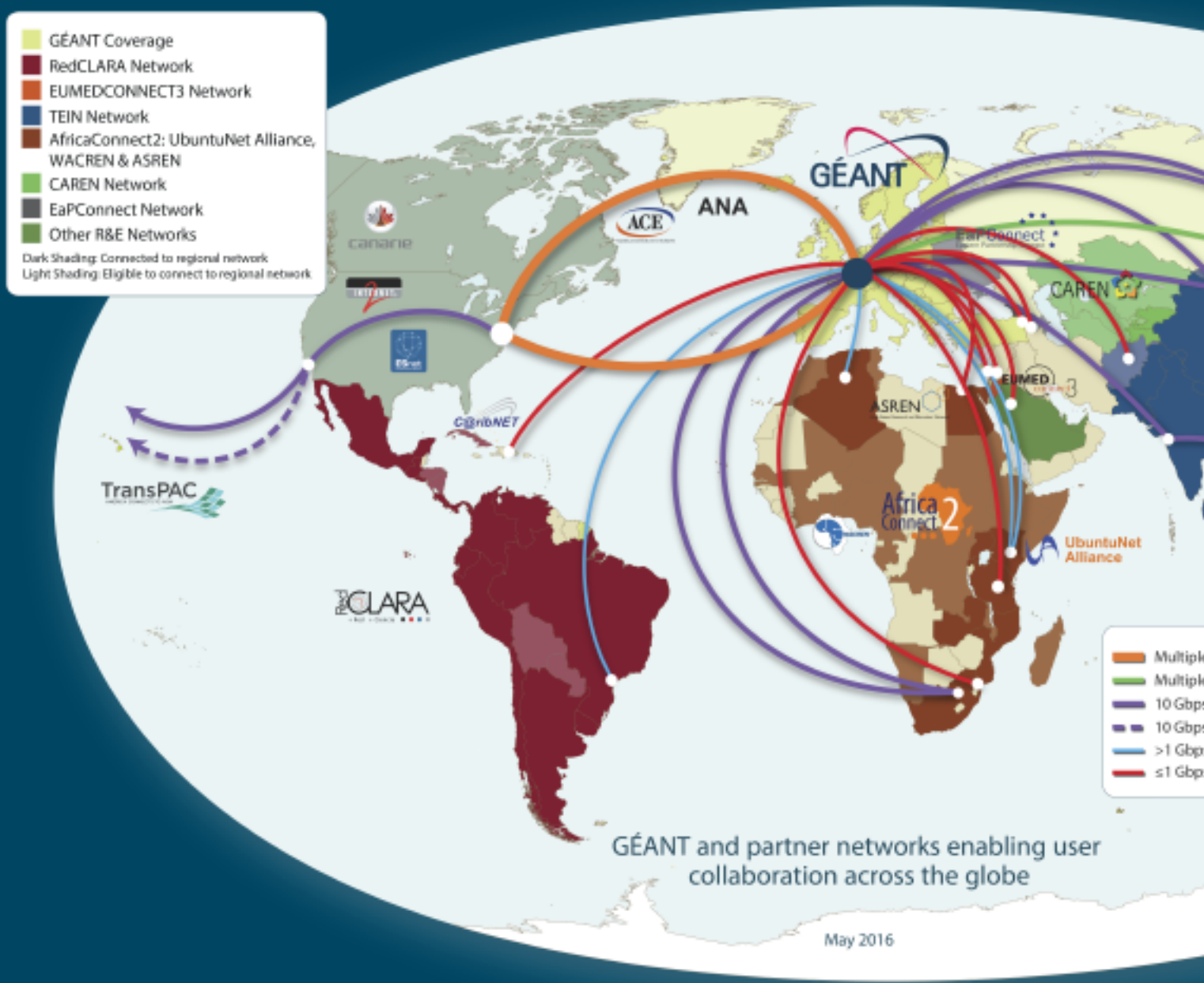
He is also a valued leader at the international level, having served on numerous international boards and committees, including the DANTE Board of Directors. Within the CEENET framework, he has helped to inspire and stimulate new initiatives in many other countries in Central and Eastern Europe.

Created by the will of the late Secretary General of TERENA, the Vietsch Foundation fulfills its goals also by funding specific research and development projects that demonstrate potential value to progress European and global research and education networking. In 2016, the Vietsch foundation has joined REFEDS and the GN4 project in funding FedLab, a test suite for identity federation protocols, OAuth, OpenID Connect and SAML. The project from Roland Hedberg and Rainer Hörbe will enable providers to identify compliance and interoperability issues and increase the uptake of standard profiles such as SAML2int and eduGAIN recommendations.

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.



PAN-EUROPEAN NETWORK

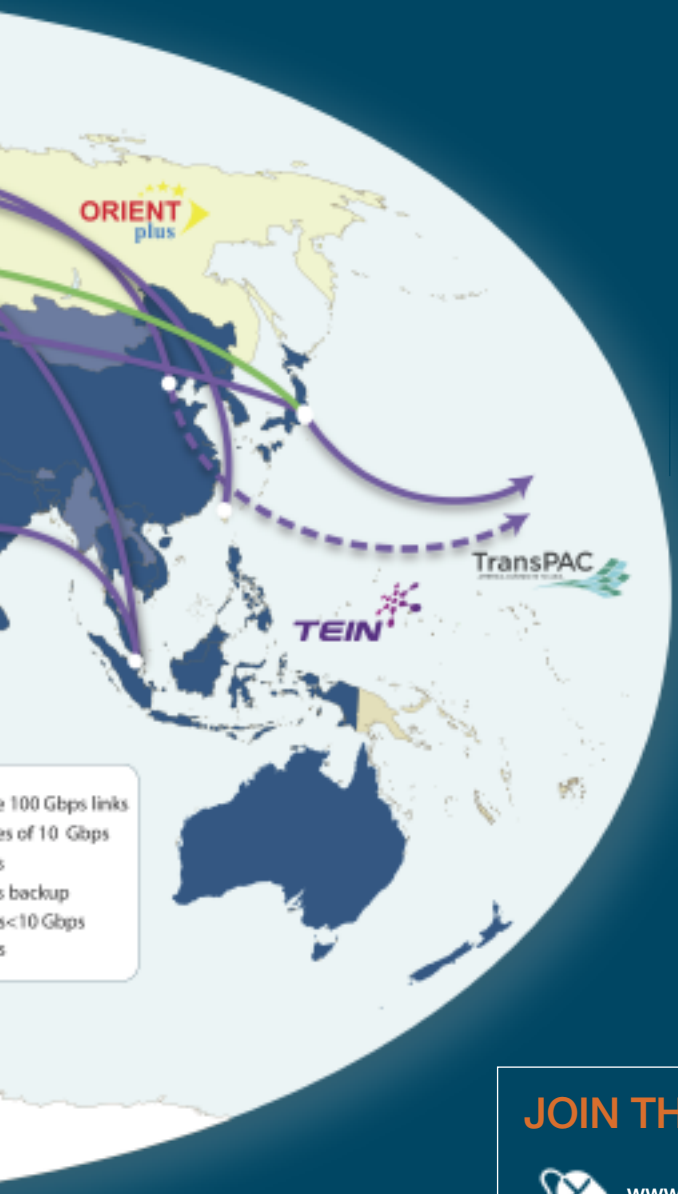
The GÉANT backbone offers capacities of up to 2 Tbps and, together with Europe's NRENs, connects over 50 million users at 10,000 institutions across Europe, supporting research in areas, such as energy, the environment, space and medicine.

HIGH PERFORMANCE NETWORK SERVICES

GÉANT's range of connectivity services, underpinned by the network, covers everything from robust, high-bandwidth IP, through Virtual Private Networks (L3VPN), point-to-point connectivity (Plus) to bespoke solutions for long term, highly data-intensive requirements (Lambda). As user needs change, the service portfolio has to scale and adapt, in order to ensure that GÉANT remains at the forefront of networking technology and service delivery. GÉANT advanced services in monitoring, trust and identity, security and certification, mobility and access, and media and real-time communications, all serve to enhance the user experience.

INTERNATIONAL COLLABORATION

GÉANT continues to cooperate closely with research and education networks across the world to ensure that the users' global connectivity and other service needs are being met. The focus of these global interactions covers North America, Latin America, the Caribbean, Sub-Saharan Africa, the Mediterranean, Central Asia and Asia-Pacific, and increased emphasis is being placed on dialogue with partners in countries where European research and education interests are high: USA (Internet2 and ESnet); Canada (CANARIE), Brazil (RNP), Chile (REUNA), South Africa (TENET and SANReN), India (NKN), China (CERNET and CSTNET) and Japan (SINET and JGN-X). Furthermore, GÉANT has signed Memoranda of Understanding with TEIN*CC (Trans-Eurasia Information Network * Cooperation Center) and with APAN (Asia-Pacific Advanced Network), to promote cooperation and collaboration between the organisations on various levels.



AT THE HEART OF GLOBAL RESEARCH AND EDUCATION

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

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