GÉANT

CONNECT

THE MAGAZINE FROM THE GÉANT COMMUNITY | ISSUE 10 JANUARY 2013

A NEW ERA – HIGH SPEED UBUNTUNET NETWORK WILL TRANSFORM EU-AFRICAN COLLABORATION

CERN'S NEW DATA CENTRE GETS 100GBPS LINKS
GROWING ROLE OF RESEARCH NETWORKS

SERVICES BEYOND EUROPE
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CONNECT is the quarterly magazine from the GÉANT community. The aim is to highlight key areas of interest, provide updates on the project and its vital work in supporting European research and education, as well as give an insight into the users who depend on the network, and the community that makes GÉANT what it is. If you'd like to get in touch with us about anything CONNECT related, we'd love to hear from you at **connect@geant.net**

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UbuntuNet – transforming research and education in Southern and Eastern Africa

'My daughter Grace' by Joe Kimaili, UbuntuNet

WELCOME

By Cathrin Stöver, Chief International Relations and Communications Officer, DANTE

2013 started for our community with the sad tidings that Milan Sova, our colleague at CESNET died unexpectedly. Milan was a valued member of several international working groups including TERENA and GÉANT, and most of all a dear friend to many of us. He put his mark on many developments in our community and we will greatly miss his contributions, innovative thinking, his humour, wisdom and friendship. I'm sure you will join me in extending our deepest sympathies to his family and friends.

Our community enjoyed far better moments at the end of last year when the combined effort of many people was at long last realised with the launch of the regional component of the high-speed UbuntuNet network. The first regional interconnect in Africa which ensures African traffic is exchanged locally. The contribution of everyone involved in turning this vision in to a reality is immeasurable, particularly when you consider the vast opportunities the network will create for research and education in Southern and Eastern Africa. Today, through the collaboration with GÉANT, the UbuntuNet network is boosting EU-African collaboration, bringing research and educational opportunities unprecedented in Africa. The implications for socio-economic development go far beyond anything we could ever have dreamed of before, putting African research on the map and transforming the lives of millions. I am proud that GÉANT is the first R&E network to connect to Africa!

In Europe, GÉANT has many accomplishments that have reached fruition in the last few months. Not least GÉANT's continuous migration to the next generation terabit backbone, which is now supporting CERN's new data centre in Hungary (see page 12). By the end of March 2013, there will be 24,000km of actual fibre making up the GÉANT network - which equates to half way round the world. Just think for a moment. This provides over 40 million users with superfast and highly resilient terabit networking, which is helping to reconfigure the way we see, understand and react with the world around us!

This is an exciting time to be part of the GÉANT project and I'm already looking forward to the next iteration GN3plus, which will provide a new set of challenges for the network, particularly within the services area. (See our 'Services beyond Europe' article on page 6 to see how GÉANT services are being relied on beyond Europe.) These challenges and the vision for GN3plus will also be covered in the April issue of CONNECT, so watch this space! In the meantime I hope you will enjoy reading CONNECT magazine as I have.

FEATURE: **THE NEW UBUNTUNET NETWORK**

Dr. F F Tusubira and Cathrin Stöver at the Lisbon launch event

NEW HIGH-SPEED INTERNET FOR AFRICAN RESEARCH SET TO TRANSFORM EU-AFRICAN COLLABORATION

November saw the highly anticipated launch of the regional component of the high-speed UbuntuNet network, the first of its kind in Africa, which will connect scientists and academics throughout Southern and Eastern Africa to each other, and to peers in Europe.

The initiative is being financed as part of the AfricaConnect project, which is co-funded by the European Commission and beneficiary countries, and which has two phases: the planning and procurement of the network; and its subsequent operation.

Following the launches in Africa – at the UbuntuNet-Connect 2012 event in Dar-es-Salaam, and in Europe, as part of the 2012 Africa-Europe Cooperation Forum on ICT in Lisbon, Portugal – it is clear the first of these phases is well underway!

"This unique network will transform our higher education and research, with collaboration being at its core. Access to higher education will be expanded. Participation in high level scientific projects and teams will be so much easier. Medical research and healthcare delivery will be enhanced."
The Honourable Eunice Kazembe, Malawi's Minister of Education, Science & Technology

"DANTE continues to develop connectivity in regions around the world, and we have built on our experience to support research and education networks as together they transform the research environment in Africa. We are fortunate to be working with the UbuntuNet Alliance, the African and European NRENs on this important initiative."
Cathrin Stöver, DANTE's Chief International Relations & Communication Officer

"Since the EC gave its official approval for this project in 2011, we've made great strides in procuring the right network.We needed to ensure the network topology provides cost benefits to participants and a highly resilient, secure network."
Daniel Lete, senior network engineer at HEAnet – Ireland's National Research and Education Network.
HEAnet provides valuable technical support to the implementation of UbuntuNet.

Participants at the launch in Lisbon

WHAT WILL THE NEW NETWORK OFFER?

The network will dramatically accelerate the development of the Information Society in Africa, providing the advanced data communications infrastructure that African researchers and students need to collaborate more easily together. And thanks to high-speed links to GÉANT, users in Africa can collaborate with over 40 million users in Europe, and further benefit from GÉANT's links beyond Europe.

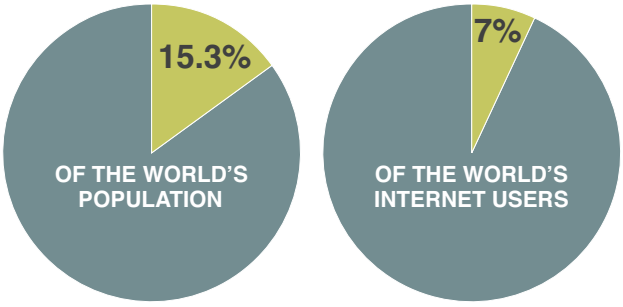
Until now, network traffic exchanged between two UbuntuNet Alliance countries had to travel via routers in London – and latterly Amsterdam – incurring delays and additional cost. With the launch of the regional component of UbuntuNet, African member states are now connected directly, able to share data quickly and simply and bringing much-needed regional collaboration to what is a vast geographical area.

Those involved see this as a great benefit not just to Africa, but to Europe also. As Dr. F F Tusubira, CEO of the UbuntuNet Alliance puts it, "Africa is a rich resource of intellect that will be tapped into by many European institutions, both profit and non-profit, in advancing research in different sectors."

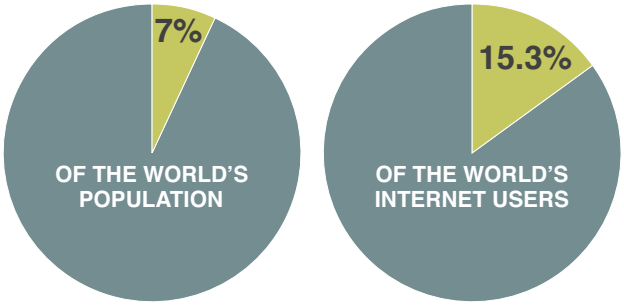
See overleaf for the full interview with Dr. F F Tusubira.

INTERNET USE

AFRICA has



EU has



Source: Internet World Stats

"The European Commission is pleased to contribute to the development of this important regional higher education and research network. African researchers now have an additional instrument to improve communication among them and with their colleagues in Europe."
Denis Salord, Head of Unit, Regional Programmes Sub-Saharan Africa & ACP wide (Directorate-General for Development and Cooperation – EuropeAid) European Commission

"GARR has been working tirelessly to involve African Countries in the "NREN club", so we're really happy to see this happen. The launch of a unified African backbone serving research and an education institution is a big step forward, and will help African students, teachers and researchers in closing the gap with most advanced economies."
Enzo Valente, Director GARR

"The AfricaConnect project is a fundamental resource for the development of a new level of relations by the world-wide research community with those researchers working in Africa. FCCN has a long history of relationship with African research communities and looks forward to using AfricaConnect services to improve and develop further those relationships."
João Nuno Ferreira, Technical Manager, FCCN

Q&A WITH DR. F F TUSUBIRA

DR. F F TUSUBIRA
UBUNTUNET ALLIANCE CEO

Dr F F Tusubira (Tusu), Chief Executive Officer of the UbuntuNet Alliance (UA) since 2007, has had the opportunity to witness its birth and growth. Passionate about self-led African development as well as the exploitation of ICT as a tool for development, he has researched and led on national and regional boards and initiatives to this end. Having served as a telecommunications regulator and trainer of policy makers and regulators for several years, Tusu has been well positioned to engage the same people in arguing the case for NRENs.

THIS IS A MAJOR MILESTONE FOR THE UBUNTUNET ALLIANCE. COULD YOU BRIEFLY DESCRIBE THE JOURNEY TO THIS POINT?

The seeds of the Alliance were born out of the frustration of accessing online resources provided for African universities, organisations like INASP and the Carnegie Corporation of New York. The initial motivation was "more bandwidth at lower cost". The focus for all of Eastern and most of Southern Africa at the time was on satellite, because there was not a single optical fibre along the east coast. Oppressive policy and regulatory environments gave monopoly providers full opportunity to milk the market without growth in infrastructure. The Bandwidth Task Force (BAND-ITs) led the Bandwidth Consortium to lower prices from $7,000 per semi-duplex Mbps per month to less than $3,000, as well as creating the first human network of IT Directors, supported by the Partnership for Higher Education in Africa and IDRC of Canada.

The mooting of EASSy, the first cable planned to land along the eastern coast of Africa, and an IDRC supported fibre study that revealed the extent of unused fibre within Africa were the main catalysts for the Alliance: existing and budding NRENs agreed to form and register the Alliance so that, with development partner support, they could buy into EASSy. This is was also the time of first contact with the EUC for support – a contact that has culminated in AfricaConnect. However, the development partners could only support a legally constituted entity: The Alliance was registered during August 2006. In the event, the plans for the first EASSy cable unravelled, but the Alliance was born.

A first step was CORENA – Consolidating Research and Education Networking in Africa - a study of the environment in which the Alliance would operate in. This investigated the status of NRENs; policy and regulatory environments and how to foster a more conducive environment for formation and growth of NRENs; identification of stakeholders; human capacity and training needs; status of and prospects for connectivity, with focus on fibre. This brought the required actions of the Alliance in to sharp focus and led to the EU funded Feasibility Study (FEAST) which identified the region as ready to benefit from EUC funding.

The huge size as well as the political and cultural diversity of Africa has been a challenge. It quickly became evident that the tensions that resulted from our intent to make UbuntuNet pan-African would stop any growth. So we strategically turned to supporting the growth of regional RENs.

Policy and regulation were also a major challenge that required engaging policy makers and regulators at all levels country by country. The Association of African Universities has been very supportive in helping us create opportunities for the growth of human networks.

The fourth challenge, the dearth of technical human capacity, is being addressed through a well-structured training programme founded on collaboration with specialist organisations like the Internet Society, the Network Start-up Resource Center at the University of Oregon, the Africa Network Operators Group, and twinning with more advanced NRENs.

Finally, sustainability. A key element of our Master Plan. Whatever we do must be based on assurance of sustainability within the short to medium term, along with ensuring that there are the requisite human skills to sustain and support operations.

WHAT DO YOU SEE AS THE MOST IMPORTANT BENEFIT THE NEW NETWORK WILL BRING?

It has been a matter of embarrassment for us that our links to each other as Africa NRENs have to date followed the old airline routes: Tanzania talks to its neighbours with a long border, Kenya, via Europe as it is easier and cheaper to exchange traffic in Europe than across many of the African National borders. AfricaConnect has brought on board larger players who can deliver integrated solutions and therefore eliminate the cross-border challenge.

DATA NETWORKS ULTIMATELY ARE ABOUT PEOPLE, AND THE BENEFITS THEY BRING TO SOCIETY. WHAT DO YOU SEE THE NEW NETWORK BRINGING TO AFRICAN CITIZENS?

ICT is not about technology: it is about people. We must articulate the relationship say between advanced networks and a six month old baby with a hole in the heart, who can receive open-heart surgery in Uganda, because an expert surgeon in South Africa or India can be virtually present. And advanced collaborative research, that translates plants occurring naturally in the African tropical forests into medicines, that can address diseases such as malaria (which can take more lives than 9/11 without mention in the press). And what about the opportunity for African children growing up as natives of the knowledge economy, who with global access and interaction, can become the human resource for a developed Africa? Yes, UbuntuNet – with emphasis on Ubuntu – is about people, mutual support, and development.

HOW WILL IMPROVED CONNECTIVITY TO EUROPE HELP THE DEVELOPMENT OF ICT IN AFRICA?

Connectivity benefits both Africa and Europe. Africa is a rich resource of intellect that will be tapped into by many European institutions, both profit and non-profit. It is a rich source of genetic resources. It provides the large quiet spaces for deep space research, i.e. the SKA. Africa has especially demonstrated the rich creativity when the barriers of legacy systems are non-existent: the many mobile applications developed in Africa are a clear demonstration of this.

Advanced connectivity will provide immediacy of access to ICT along with the opportunities for exploiting or improving these. Best practices will be more easily accessed and utilised. Human networks around ICT will expand into Africa and IT-enabled services and industry will start developing. As these develop, more technically competent human resource will be required to implement and service the industry, creating a demand for good telecommunications and computer science programmes in local institutions. A virtuous cycle will be created, other conditions being equal.

OF COURSE, EUROPE WILL BENEFIT GREATLY FROM THE MINDS OF THE AFRICAN RESEARCH AND EDUCATION COMMUNITY. ARE THERE PARTICULAR PROJECTS THAT UA PARTNERS ARE INVOLVED IN WHICH WILL BENEFIT?

Apart from AfricaConnect, the Alliance is active in EU FP7 projects. In recent years, ERINA4Africa and CHAIN projects have been looking at projects with amazing societal benefits and applications in fields such as agriculture, climate change, e-learning, bioinformatics, natural resources management, e-health and many others. There is an upcoming climate project around Lake Victoria and the on-going genomics work between the Wellcome Trust Sanger institute. With climate change altering the geographic pattern of disease incidence, collaborative research in areas such as rainfall in relation to malaria will have practical benefits in both Europe and Africa.

WHAT DEVELOPMENTS CAN WE EXPECT TO SEE OVER THE NEXT FEW YEARS?

Ensuring that each country in our membership region has a strong operational NREN, based in good campus networks and the continuing engagement of content and application networks so that the data networks can deliver real value.

We see our content and application networks engaging around for example, analysis of LHC data and the planned SKA; research around global warming and the impact of African agricultural output as well as research around the leading killer diseases.

We're urging our NRENs to reach out to all sectors of education. The overwhelming majority of students do not have internet access: an untenable situation for countries that want to develop.

We're working with Regional RENs in Africa – the West and Central African Research and Education Network (WACREN) and Arab States Research and Education Network (ASREN) – to share our assets, and interconnect Africa. Also working with CLARA and C@ribNet towards a direct link across the Atlantic to strengthen South-South collaboration.

We have already engaged with DANTE and the GÉANT Community about our member NRENs being part of eduroam, which is already taking root in Kenya and South Africa, and later eduGAIN.

FEATURE: SERVICES BEYOND EUROPE

perfSONAR MDM eduGAIN eduroam NSI eduPERT

EUROPEAN INNOVATION GOING GLOBAL

FACILITATING THE VIRTUAL GLOBAL RESEARCH VILLAGE

From its first inception 12 years ago, GÉANT and its NREN partners have been enabling world-class research by allowing universities to collaborate easily and efficiently across borders.

By investing at the forefront of networking technology, GÉANT has helped to remove the barriers of distance and location from Research and Education (R&E) networking. This has allowed European researchers to share knowledge and expertise helping Europe build and maintain its position as leader in a range of advanced research projects, from high energy physics to the environment to medical research.

"Enabling collaboration and facilitating the open sharing of information, research and knowledge is a core goal of the GÉANT project."

Niels Hersoug, Joint Project Manager of GÉANT (GN3)

GLOBAL CHALLENGES, GLOBAL SOLUTIONS

Such collaboration on a worldwide scale is increasingly vital to addressing global crises and challenges. These range from climate change, and the security of food and energy supply, to providing medical care for an ever-growing aging population. Finding solutions for these challenges makes global collaboration essential across a wide range of disciplines.

Research is increasingly carried out at a global level, with participants in projects located worldwide – often in remote locations. For example there are currently over 800 EC-funded projects that have partners in countries outside the GÉANT community. These organisations are connected to the GÉANT network via its global connectivity and partners.

By working with international partners across areas such as Africa, South America and the Far East, the GÉANT project has been able to share its skills, experiences and now services, to help these regions collaborate effectively. This sharing around the world demonstrates the value of GÉANT as a centre of excellence in high performance networking serving the R&E community.

MORE THAN JUST A NETWORK

Of course, the GÉANT project has developed skills, services and expertise beyond the network itself. Over the past years, and moving forward, more and more emphasis has been, and will be, placed on delivering the tools and services that users need to get the most out of the network.

From Bandwidth on Demand, to performance monitoring tools, and from AAI applications to expert support teams, GÉANT is striving to ensure that its NREN partners have a range of services and tools available to them for their campuses and other users. These enhanced tools and services not only support European users but are also increasingly being used globally. This global adoption enhances the level of interoperability, making it easier for European NRENs and users to collaborate with international partners.

The following pages highlight the ways in which many of the services developed by the GÉANT project have helped both the European and global R&E communities by improving capacity, efficiency, performance, and access to the network and its resources.

EDUPERT – NETWORK PERFORMANCE EXPERTISE TO GET THE BEST FROM THE NETWORK

Alessandra Scicchitano, eduPERT Task Leader

As networks and networked applications grow and develop, so do the demands they make on performance and reliability. Ultra-high speed data applications, real-time cloud based systems, high definition live video transmission and remote computing applications all increase demands on the network and the expectations of the users.

There is an increasing need for skilled support teams working in the R&E community to respond rapidly and help solve their users' problems efficiently. Performance Enhancement and Response Teams are therefore a crucial community resource. eduPERT is part of the commitment of GÉANT and its NREN partners to helping network users get the best performance from their connections.

eduPERT has been assisting network performance enhancement for almost 10 years, providing multidisciplinary support in solving issues like network degradation or inherent limitations such as long distance or end system capabilities. With its new enhancements, eduPERT is in an even stronger position to help support teams across Europe, and beyond.

WHO CAN JOIN EDUPERT?

eduPERT provides the independent PERTs (GÉANT, National, Local and Project PERTs) with a portfolio of central services and tools to aid them in their network investigations. Membership is not limited to European NRENs and Universities; other organisations and international projects are also encouraged to join by setting up "local" or "project" PERTs and becoming part of the eduPERT Knowledge Base. The eduPERT community is also opened up to individuals interested in network performance as well as commercial operators.

WHAT ARE THE BENEFITS?

- Offer an improved level of service to users
- Collaborate with other eduPERT members on trouble-shooting
- Learn from the experiences of other PERTs through the sharing of investigations via the Knowledge Base and the Summer and Winter eduPERT Schools

HOW YOU CAN GET INVOLVED

Visit the new website at **http://edupert.geant.net** or sign up to the mailing list at **http://mail.geant.net/mailman/listinfo/pert-discuss**

ANNOUNCING PERFORMANCE U!

"Performance U!" stands for the eduPERT Performance University! This is an expert school that aims to train performance experts, providing validated performance resources and face to face training. Winter and summer schools will be hosted where the community can learn about performance implications of new tools and new technologies.

The eduPERT website **http://edupert.geant.net** will be hosting short video lessons on different topics of interest for PERTs and for other engineers interested in network performance enhancement.

To mark the launch of the new Performance U!, the eduPERT school is open for registration at **https://www.terena.org/events/details.php?event_id=2472**

The school will run from 6th to 8th March 2013 at SWITCH in Zurich and will cover vital areas such as TCP performance, Monitoring Tools, Performance and Virtualisation together with a range of case studies and expert reports.

Anyone wishing to give a presentation or find out more about the winter school should contact **alessandra.scicchitano@switch.ch**

EDUROAM® – SECURE WORLDWIDE ROAMING ACCESS

In May 2002, eduroam (then known as TF-Mobility) was a Wi-Fi roaming service developed to allow students and researchers to connect to the internet between sites, campuses and countries. From humble beginnings connecting just five countries (Netherlands, Finland, Portugal, Croatia and the UK), eduroam has built momentum to become one of the largest Wi-Fi roaming services in the world. In 10 years it has expanded to 59 countries, serviced by well over 5000 locations with more being added continually. This offers huge benefits to European researchers who can now access the network from an ever increasing number of locations worldwide.

A GROWING GLOBAL EDUROAM COMMUNITY

Sweden is one of the latest to join the federated community connecting 600,000 students and researchers to a secure internet connection on and off campus. Like all global eduroam users, students study either remotely or at multiple locations, greatly increasing demand for secure internet connectivity wherever they are.

A COLLABORATIVE EFFORT

The eduroam service is provided through a large-scale collaboration between hundreds of institutions, the majority of which own and operate the service's infrastructure. Roaming Operators (ROs), in many cases National Research and Education Networks (NRENs) coordinate this infrastructure with campuses and hotspot operators to ensure a consistent eduroam experience no matter where a user roams.

SECURE ROAMING ACCESS

Without the need to register for guest accounts or remember extra passwords, users can simply open their laptops or activate their mobile devices, and eduroam automatically authenticates them via the institution they are visiting. This benefits researchers, teachers and students and reduces the support burden for institutions themselves.

As the number of WiFi enabled devices grows, **CAT (eduroam Configuration Assistant Tool)** has been developed to simplify the process of enabling laptops, smartphones and tablets to connect.

EDUROAM CAT MAKES EDUROAM EASIER THAN EVER FOR BOTH USERS AND IT ADMINISTRATORS

Support for IT administrators

Intended to further support eduroam Identity Provider administrators, the eduroam CAT suite of tools allows campus administrators to present customised helpdesk information to users. This includes how to access CAT (either directly or as an integral part of their own online information) making the eduroam service much easier to install and manage.

Enabling CAT users

Once CAT is primed with information about a particular institution, so students, researchers and other staff can then install, configure and activate eduroam with just a few clicks on the CAT web pages.

How was CAT developed?

CAT uses various open source products, including some developed by the R&E networking community. Its development was led by Stefan Winter (RESTENA) and Tomasz Wolniewicz (PSNC, UMK), as part of the GÉANT project's joint research activity on multi-domain user applications.

The different language versions, testing and feedback were contributed by members of the wider R&E networking community via the TERENA Task Force on Mobility and Network Middleware (TF-MNM).

How to access CAT

The latest version of the eduroam CAT tool will be available in 11 languages. Materials on the benefits of the education roaming service are available to be adapted for national and local promotional campaigns.

If you are an IT administrator wishing to register to use CAT, please contact the national-level Roaming Operator in your country to receive an invitation token.

More information: **www.eduroam.org**

NSI - SEAMLESS WORLDWIDE INTERCONNECTING

By Guy Roberts, Senior Transport Network Analyst, DANTE

The immense power of R&E networks across the world is down to their ability to connect researchers in different countries, and to render distance and location no barrier to research.

For many years the power of packet-based networking (almost invariably IP-based) has delivered seamless connectivity and made the network virtually invisible.

As research demands have grown, the data volumes and the needs for assured bandwidth, minimal jitter and delay, have become ever greater and traditional packet switch networking may not always meet these needs. This has led to a re-emergence of switched virtual circuit services and the development of a range of Bandwidth on Demand services.

The Open Grid Forum (OGF) has been developing the Network Service Interface (NSI) protocol. In November the NSI Working Group recently carried out a PlugFest at the SC12 exhibition in Salt Lake City to trial NSI v2.0 between the following R&E network operators:

- NORDUnet (Denmark)
- SURFnet (Netherlands)
- GÉANT (Europe)
- AIST (Japan)
- KDDI Labs (Japan)
- DynamicKL (Korea)
- ESnet (USA)

NSI is a core component of Bandwidth on Demand services and this latest interoperability test is an important step on the path to global availability of these services.

This exciting development is helping to ensure that GÉANT and its NREN partners are at the forefront of the latest networking technologies.

WHAT IS NSI?

NSI defines a protocol for end-to-end circuit reservation and provisioning along with the associated service architecture. New features include:

- Modify Command – allowing reservations to be modified
- Topology Service – describing and exchanging network topology information
- Discovery Service – share information on the NSI series supported and versions
- Enhance Queries – supporting hierarchical queries
- Security Framework - to enhance inter-organisation security for configuration requests

EDUGAIN - ENABLING EASIER ACCESS TO RESOURCES

In an era of ever-increasing collaboration, students and researchers need access to R&E content hosted across Europe and beyond. This must be easy, secure and seamless.

But as different NRENs use their own Authentication and Authorisation Infrastructures (AAIs) to validate users, it has previously been difficult for users to gain access to the resources that are located in other countries. This makes collaboration difficult and also adds to IT administration and costs.

SPREADING ITS WINGS

GÉANT eduGAIN has been created to solve this problem, and enables easier access to resources for users across the GEANT Service Area. It brings together the identity federations of the participating NRENs, enabling users to work seamlessly wherever they happen to be.

From being a primarily European service, interconnecting European research establishments, eduGAIN has spread its influence across the world with Canadian and Brazilian members joining during 2012. Now students and researchers from these areas can access information and resources from within other member federations with far less effort and with improved security.

eduGAIN is anticipated to continue its strong growth during 2013 with many more AAIs joining which will help research and education develop worldwide.

JOINING EDUGAIN:

To find out how your organisation or service can benefit from eduGAIN, visit **http://edugain.geant.net**

PERFSONAR MDM – STANDARDISED NETWORK PERFORMANCE MEASUREMENT

EXTENDING THE GLOBAL FOOTPRINT

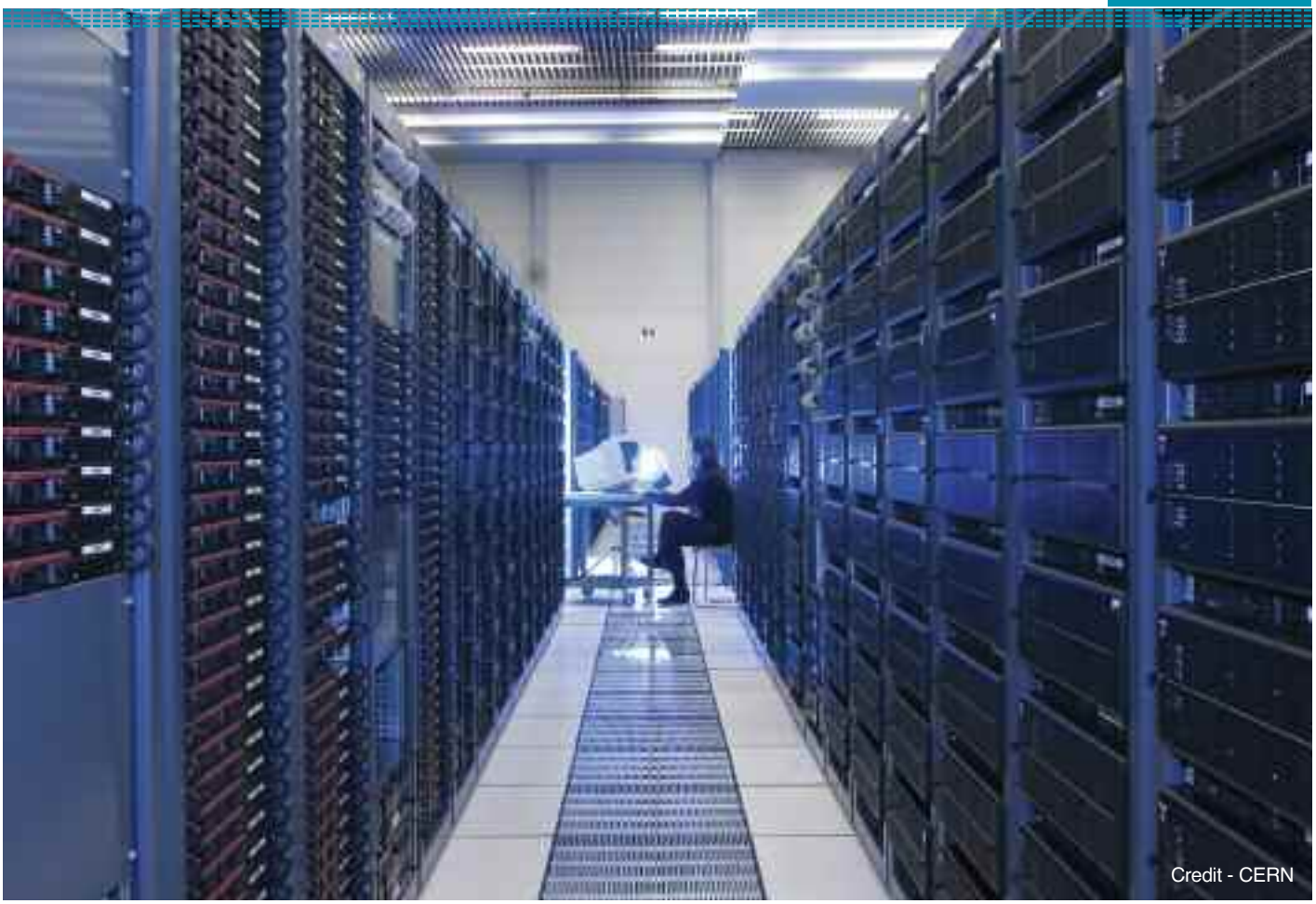
The perfSONAR MDM (multi-domain-monitoring) service continues its global roll out with further deployment over the ORIENTplus link, via a measuring point in Beijing and also across the TEIN network in Hong Kong and Singapore. Deployment of perfSONAR MDM in Mumbai is also currently underway. These locations, together with 12 countries in Europe, give perfSONAR MDM unrivalled international coverage in the R&E community.

Adding to the large number of points already installed across North American research networks, perfSONAR MDM now has 22 monitoring points across multiple domains around the world making it simpler and quicker to measure network performance – wherever researchers are located.

As research projects have become increasingly global it is vital that engineers (whether in the NREN or campus) have the ability to monitor network performance and pinpoint potential issues across multiple networks. The new extended footprint of perfSONAR MDM across Asia-Pacific will enable operations staff in NRENs to have access to standardised performance information across multiple domains around the world faster than ever.

HOW TO GET PERFSONAR FOR YOUR NETWORK

For more information and to find out how to install perfSONAR on your network visit:
http://perfsonar.geant.net


Credit - CERN

CERN GETS FIRST GÉANT 100GBPS LINK

In December, the new 100Gbps link between Geneva and Budapest was formally handed over to CERN after a big push by GÉANT's operations team to deliver the new links before other commercial providers.

The link provides connectivity between CERN and the Wigner Research Centre for Physics, which will host CERN's new remote data centre, processing and storing data from the Large Hadron Collider (LHC). The route is part of the network-wide migration to terabit capacity (web search 'next gen GÉANT terabit network' for more) utilising industry-leading equipment from Infinera and Juniper Networks.

The advanced new facility will act as an extension to CERN's existing "data centre as well as providing business continuity in case of any issues that could affect on-going service. With an IT area of 1100m2 it will be one of the most sophisticated technology infrastructures in Europe. Rapid distribution of data from the LHC is vital to the success of the world's largest scientific experiment.

GÉANT, together with its National Research and Education Network (NREN) partners are essential to this fast and secure data transmission, providing a pan-European managed network. Information will flow from CERN across GÉANT to its Point of Presence in Budapest. NIIF/Hungarnet, the Hungarian NREN, will then provide extreme high speed connectivity to the Wigner Research Centre.

Peter Levai, Director General, MTA Wigner Research Centre for Physics, Budapest, commented, "Now in high energy physics one billion proton-proton collisions must be investigated to identify a single Higgs event. We can only do this with the help of special data centres having very high availability and reliability. The Wigner data centre will satisfy this demand, but as a remote, hosted infrastructure, it could not be used by CERN without an excellent network connection between the two institutes. The newly established 100Gbps line between CERN and Wigner is the basis of our collaboration and a vital part of the whole project. The expertise of the GÉANT partners including DANTE and the Hungarian NREN, NIIF, guarantees the accomplishment of the mission from the networking side."

THE RISE OF THE RESEARCH DATA CENTRE

Research is creating ever greater amounts of data, requiring increased processing power to analyse, share and store it effectively. Consequently research organisations are expanding their use of data centres to efficiently centralise information, such as databases and experimental results. High speed research networks provide the backbone for sharing this information nationally and internationally, linking data centres and users together to enable fast, seamless access to information wherever a researcher happens to be.

CSC CELEBRATES NEW GREEN DATA CENTRE

By Ms Riina Salmivalli, Project Coordinator, LEAR, CSC - IT Center for Science Ltd.

CSC – IT Center for Science has formally launched its new data centre in Kajaani, in the former premises of UPM's paper warehouse. Modern data centre technology, the reuse of old factory premises and free cooling made possible by the chilly climate as well as hydro-electric power have made it possible to construct an environmentally friendly data centre with a reliable power supply.

The grand opening of the data centre took place simultaneously in two locations: at CSC's main premises in Espoo and the Datacenter CSC Kajaani itself, located almost 600 kilometres north of Helsinki. The opening revealed Finland's newest supercomputer, a Cray Cascade, with Hewlett-Packard's supercluster completing it and of storage capacity. Its computing power is triple that of CSC's current Louhi supercomputer, and in 2014 will reach the petaflops class. CSC is among the first in the world to receive the Cascade-type supercomputer, which will be one of Europe's fastest supercomputers.

The Funet Network (Finnish University and Research Network) connects Datacenter CSC Kajaani to GÉANT thus ensuring excellent networking capabilities for Finnish and international researchers. Eventually the new supercomputers will be part of the PRACE resources and Funet is prepared to update network connectivity to 100 Gigabit per second whenever required by users.

ENVIRONMENTALLY-FRIENDLY COMPUTING POWER

The idea for an eco-efficient data centre in a disused paper warehouse, close to a source of energy production was first thought of several years ago. With changes in the industrial structure, there are now several paper mills and other industrial properties that have shut down in Finland. Old paper mills already have a reliable power supply, sufficient for the needs of data centres, and there is often an environmentally friendly source of energy production nearby, such as hydro-electric power or a biopower plant.

The carbon footprint of the operations of Datacenter CSC Kajaani will be minimised. The supercomputers are to be cooled with the help of outdoor air and primary power generated with certified hydropower. The data centre is aiming to achieve energy efficiency equivalent to PUE (Power Usage Efficiency) value 1.15. This means up to 20 percent better energy efficiency when compared with CSC's current data centres. The PUE value expresses the ratio of the data centre's total energy consumption to the energy consumed by the servers. Some of the heat generated by the supercomputers will be re-used for heating.

GÉANT is close to the completion of its terabit network, working closely with leading networking suppliers Infinera and Juniper Networks. Here Geoff Bennett of Infinera gives his view of the challenges in producing a cutting-edge network.

SCALING THE GÉANT BACKBONE

By Geoff Bennett, Director of Solutions & Technology, Infinera

There are few certainties in life but arguably one of them is that global demand for internet bandwidth will continue to grow, with industry surveys indicating a rate of about 40% per year. Demand in Europe's R&E community is also growing – examples include the need to support "Big Science" experiments at CERN, and to facilitate the transfer of astronomical data from the observatories on the summit of La Palma in the Canary Islands to the supercomputing centres of Spain and the rest of Europe.

The optical fibre that links together the various NREN locations around Europe is capable of carrying astonishing amounts of data – but what is the best way to tap into this resource so that NRENs get the most reliable, responsive and cost-effective service possible? One key aspect is to ensure that all parts of the network are able to scale in concert – without any single technology creating bottlenecks that would increase costs or cause delays in delivering services.

Figure 1 shows a typical transport network divided into two major functions:

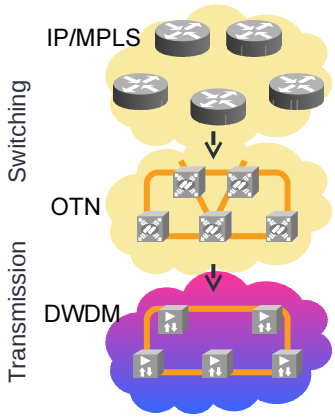
- Transmission – sending optical signals over very long distances, maximizing the total capacity of the fibre while minimizing the cost of transmitting each bit
- Switching – managing that data to make it more useable and efficient for end user and network operator.

SCALING TRANSMISSION

Over the fifteen years or so that DWDM has been a commercial technology, transmission has gradually evolved so that today it is possible, on a single pair of fibres, to carry 8Tbps (terabits per second) over distances up to 3,000km.

But consider the challenge that this kind of capacity causes to the network engineers who have to bring it into service. Each time an optical line card is brought into service there is a process of wavelength planning, ordering the optical line cards, and a very careful process of bringing those line cards into service on an optical fibre. The reason this process is so delicate is that existing wavelengths may already be using that fibre, and it's essential that the new waves do not "disturb" the old waves in any way. An error in this process will result in service outages – something that is unacceptable on a vital network such as GÉANT.

The ideal situation in the face of rapidly growing demand is to bring as much capacity as possible into service in a single operational cycle ready for services to use it. Figure 2 shows how this would work. On the left is the "old way" – using multiple 100Gbps line cards that each have to be installed according to an exacting planning process. On the right is a super-channel line card that still requires careful installation – but delivers five times the capacity for the same operational effort.



IP/MPLS layer provides service interface and switching specifically for packet services, and provides statistical multiplexing (overbooking).

OTN layer provides standard service interfaces, and digital bandwidth management for all digital service types. This boosts efficiency and manageability.

DWDM layer provides high capacity *transmission* by inserting the optical signal into the long haul optical fiber.

Figure 1

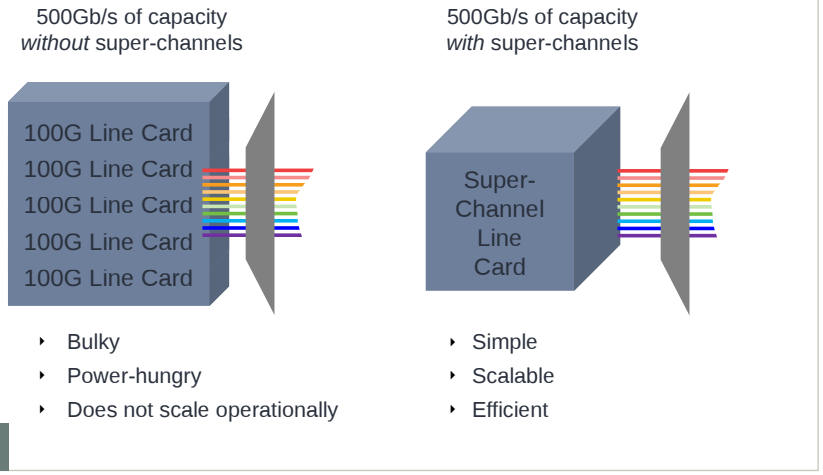


Figure 2

Super-channels have become the favoured technology for implementing DWDM capacity at 100Gbps and beyond. However, by putting many wavelengths onto a single line card, the cost of the optical components involved could become prohibitive. This is why, in collaboration with GÉANT project partners, DANTE (the organisation that has on behalf of Europe's NRENs built and operates the GÉANT network) made the decision to procure a super-channel technology that is based on large scale Photonic Integrated Circuits (PICs). A PIC is the optical equivalent of a multi-core Pentium CPU – and shares all of the same advantages of electronic integration; namely smaller footprint, lower power use, higher reliability, and lower cost compared to a line card built from discrete optical components.

SCALING SWITCHING

The raw optical transmission capacity from a super-channel is a little like the torrent of water from a fire hydrant. Something has to manage that torrent so that it can be used in an effective way – and that is digital switching. Several key processes are involved, including multiplexing, grooming, fault management and service protection.

Multiplexing

DANTE knows from experience that the typical services that will use the backbone network will be sub-wavelength (or "sub-super-channel") in data rate. In fact most services today (and for the foreseeable future) will be Gigabit Ethernet or 10GbE, whereas long haul wavelengths will operate at 100Gbps and super-channels at 500Gbps. A digital multiplexing function "gathers together" lower rate service demands at the network access points and aggregates them onto a wavelength or super-channel so that it's filled efficiently. At Node A in Figure 3 we see there are ten, 10GbE services that will be multiplexed together to share a single 100Gbps wavelength (shown in red).

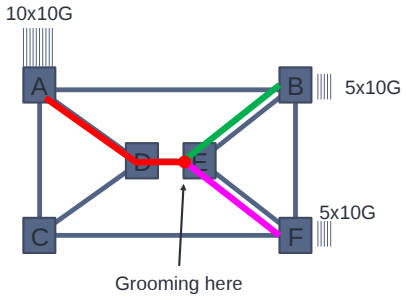


Figure 3

Grooming

Figure 3 shows that traffic may take different directions once it's on the backbone. In this case, five of the 10GbE service originating at Node A are destined for Node D, while the other five are destined for Node H. Without digital switching in the core of the network it would be necessary to install two pairs of interfaces – one pair that takes the Node A to Node D traffic, and the other pair that takes the Node A to Node H traffic. Two separate wavelengths would carry these services, and each would be 50% full. But with switching only one line card is needed in Node A, and traffic can share the same wavelength (or super-channel) until it absolutely has to take separate paths (shown in green and pink), in this case at Node E. While this may seem simplistic, modelling studies on large scale service deployments show that integrated switching can result in up to 50% fewer wavelengths needed on the backbone to carry the same amount of user traffic.

Fault management

Sooner or later things go wrong with even the most reliable equipment. However, thanks to GÉANT services such as perfSONAR MDM (multi-domain network monitoring service) any faults can quickly be tracked down by DANTE's Network Operations Centre (NOC) or by network engineers involved in the route, thereby isolating and addressing the issue. It is this capability that contributes to GÉANT's 99.999% availability.

Service protection

Even better is the fact that digital switching allows services to be protected. For vital services, protection can be achieved in sub-50 milliseconds, and most applications would not even notice that there'd been an outage. But the GÉANT community can also take advantage of highly effective shared protection that will reroute services (assuming a backup path is available) within a few seconds.

SCALING TRANSMISSION AND SWITCHING IN CONCERT

Transmission and switching are obviously both important if the objective is to deliver a cost-effective, efficient, and responsive network backbone. But it's essential that these functions scale together to avoid "awkward" compromises in the network design or operation. For this reason DANTE and the European NRENs have chosen the Infinera DTN-X platform, which provides integrated digital switching in every node, along with PIC-based super-channel line cards. This platform began shipping commercially in mid-2012, with the GÉANT network as one of the first applications. In just three months of commercial shipments it has captured the Number One position in the "100Gbps and above" marketplace.

This state of the art platform offers the only PIC-based super-channel solution in the industry – and thus confirms DANTE's decision to adopt leading edge technology for the next phase of GÉANT's growth.

Geoff Bennett is Director of Solutions & Technology for Infinera. He has over 20 years of experience in the data communications industry, including IP routing, ATM, MPLS and optical transmission and switching experience. Geoff is a frequent conference speaker, and is the author of "Designing TCP/IP Internetworks", published by VNR.

Q&A WITH DORTE OLESEN

Dorte Olesen from the Technical University of Denmark was recently announced as the new Chair of the National Research and Education Network Consortium Policy Committee (NREN PC). She is a highly experienced member of the research networking community, having held high profile roles such as president of TERENA (2003-9) and most recently in 2011 was part of the high level independent GÉANT Expert Group (GEG).

YOU WERE PART OF THE GÉANT EXPERT GROUP (GEG) THAT WAS APPOINTED BY THE EUROPEAN COMMISSION TO ARTICULATE A 2020 VISION FOR EUROPEAN RESEARCH NETWORKING. WHAT WERE YOUR KEY CONCLUSIONS?

The GEG report - Knowledge without Borders - encapsulated our vision for GÉANT in 2020, underpinning close research collaboration across Europe and beyond. Essentially GÉANT should act as the European communications commons, where talent anywhere is able to collaborate with their peers around the world through instantaneous and unlimited access to the right resources.

THE GEG REPORT INCLUDED AN ACTION PLAN TO REALISE ITS VISION OF KNOWLEDGE WITHOUT BORDERS. IS EUROPE ON TRACK TO DELIVER ON THIS PLAN?

In the report we set out four key goals to fulfil the vision and the good news is that I can see progress towards achieving all of them.

Supporting knowledge communities by providing world class connectivity and services

We are definitely on track to achieving this – the rollout of GÉANT's terabit network and heavy investment by NRENs in their own capacity is delivering world class connectivity to users. We've seen a major expansion in the deployment of services that are based on user needs in areas such as roaming and authentication.

Supporting the growth of communities within and outside Europe

Steps are being taken to break down barriers and drive a culture of openness to increase collaboration and sharing, not just within Europe but further afield. New connections to other regions, such as Africa and the Caribbean and investment to expand existing links to the Americas and Asia show the desire to build a global research community that allows talent to flourish, irrespective of location.

Push the state-of-the-art of the communications commons by constant innovation

In many ways this is the most challenging goal as innovation never ceases, and in many cases technological change is accelerating rapidly. For European competitiveness it is vital that research networks don't innovate in isolation – we must work closely with the ICT industry to successfully transfer innovation to wider markets, often by acting as testbeds for future developments.

Reorganise to cope with the constantly changing environment

I'm pleased to see that very definite steps have been taken by organisations such as DANTE, TERENA and the NREN Policy Committee to match their structures to changing needs. From the outside the research networking universe can appear confusing, so I'm very positive about how much has happened to make roles and responsibilities clearer.

WHAT DO YOU SEE AS THE BIGGEST CHALLENGES FACING RESEARCH NETWORKS ACROSS EUROPE – BOTH FROM A TECHNICAL AND A USER PERSPECTIVE?

The biggest challenge is not really technical, but revolves around better understanding user needs in order to provide the services they require. Research is changing hugely – there is now a growing number of large, international, collaborative projects that don't fit the traditional point to point model of research networking. With projects sharing data between hundreds of locations in multiple countries across the world it is much more complicated to deliver connectivity and services that cross boundaries. This means there is a constant need for research networks to interact with users at a national and international level to provide the services they require.

WHAT ARE YOUR KEY AIMS IN YOUR NEW ROLE AS CHAIR OF NREN PC

I have three major aims. Firstly, to solve the challenge of better understanding user needs and ensure there is the structure in place to meet the requirements of international projects.

Secondly, we need to benefit from the scale of bringing so many NRENs together, using the aggregate buying power of the group to lower prices when dealing with suppliers.

Finally, as a community I'd like us to become even better at collaborating on leading edge innovation. Much is already happening across GÉANT and between NRENs, but to ensure European competitiveness we need to strengthen relationships with the ICT industry.

WHAT IS THE ROLE OF THE NREN PC WITHIN THE GÉANT PROJECT?

The NREN Policy Committee is essentially the governing body of GÉANT and acts as the forum to make high level decisions. Through the Executive Committee, which is a smaller subset of the PC, we are also involved in the day to day decisions that require NREN input.

WHAT DO YOU SEE AS THE STRENGTHS OF THE CURRENT GÉANT PROJECT? WHAT HAS IT ACHIEVED THAT HAS IMPRESSED YOU PERSONALLY?

Firstly, that it has brought together all of Europe's NRENs working towards a common goal. The power of this should never be underestimated. Speaking personally I'm impressed with the current rate of introduction of new services and the advantages they provide for users. People really benefit and appreciate services such as eduROAM as it allows them to work in any institution seamlessly, without the need to re-register or fill in forms.

LOOKING AHEAD TO THE NEXT PHASE OF GÉANT (GN3PLUS) WHAT DO YOU SEE AS THE MAIN OPPORTUNITIES AND CHALLENGES?

As I've said the main challenge is to solve the problem of connecting big international research projects. We also need to strengthen relationships with other research resources such as high performance computing and Grid initiatives so that end users receive a seamless service that combines connectivity and processing power.

The potential positive impact of GN3plus is both enormous and far reaching. Education is the basic building block of a successful economy. Successfully underpinning research and education will therefore drive innovation and provide the ability to give a lift to the entire European Research Area and wider economy. GN3plus therefore marks a big step towards achieving the 2020 vision set out in the GEG report.

WHAT DO RESEARCH NETWORKS SUCH AS GÉANT NEED TO DO TO CONTINUE TO MEET USER NEEDS IN 2020?

We have to understand what different user communities and projects are aiming to do so that we can work with them to introduce the right services to enable them to work effectively. Users aren't necessarily technologists so don't know how new services will benefit them – it is up to us to understand and communicate with them if we are to deliver a competitive European research community in 2020.

SHAPING THE FUTURE OF NRENS

By Alberto Colmenero, Optical Network Architect, NORDUnet A/S

Over the years it has been proven that human networking, collaboration and the sharing of ideas improves the capabilities of NRENs to design, plan and build better data network infrastructures, while raising awareness of future requirements and the challenges they face.

With this in mind, the Joint Research Activity within the GÉANT project (JRA1 Future Network), in cooperation with TERENA (Trans-European Research and Education Networking Association) organized a workshop with the purpose of sharing ideas, views, concerns, and more importantly different approaches to solutions for common issues and challenges.

The workshop was hosted by NORDUnet (the Nordic regional networking organization) at their premises in Copenhagen back-to-back with TERENA's first Network Architects Workshop.

The Carrier Class Transport Network Technologies research team (known in the GÉANT project as JRA1 Task 1) presented their work on technologies like Ethernet OAM, EoMPLS, MPLS-TP, PBB-TE, OTN, GMPLS, Open Flow and Next Generation Routed Transport Networks. The Photonic Switching and Experimental Photonic Facilities research team (JRA1 Task 2) presented their studies about Alien waves and Photonic Services. Alcatel-Lucent, CIENA and Infinera presented their views on how networks will evolve in the years to come.

During the second day participants were given user case studies to work with in groups. The cases represented a common challenge that most NRENs currently face when designing their next generation networks. The main purpose of this exercise was to inspire the participants into constructive discussion keeping in mind background information learned from the presentations on day one. The providers represented by Alcatel-Lucent, CIENA and Infinera participated actively in the discussion and gave relevant inputs and information.

The outcome of this workshop will be described in a white paper to be issued during the first quarter of 2013.

The presentations from the workshop are available on TERENA's homepage: **http://www.terena.org/activities/netarch/ws1/agenda.html**

SUPERCOMPUTING 2012

In November, GÉANT exhibited at SuperComputing 2012 (SC12), the international conference for high performance computing (HPC). Here GÉANT demonstrated Bandwidth on Demand, NSI v2.0, GEMbus and using a sonification tool, showed the power of high-speed international networking. The collaboration with America Connects to Europe (ACE) was also featured to highlight the partners involved in delivering the Transatlantic infrastructure.

WHAT DOES THE EDGE OF OUR SOLAR SYSTEM SOUND LIKE?

To illustrate the power of research and education networks along with grid computing, GÉANT used data from the 35 year old space probe 'Voyager 1' transmitted 18 billion kilometres from Earth - to create music via data sonification. The demonstration was conducted live to audiences at the NASA stand at SuperComputing 2012, at which GÉANT was also exhibiting. Here a sonification algorithm converted data sent live across the Atlantic to EGI.eu, the biggest grid computing facility in Europe, and back again, before arranging it in to a concert piece.
Listen to the melody:
http://soundcloud.com/musicfromthespace/voyager-1-magnetic-field-1

GÉANT JOINS 'HELIX NEBULA - THE SCIENCE CLOUD' PARTNERSHIP

Helix Nebula, the big science cloud-computing project has welcomed GÉANT (represented by DANTE - project coordinator and operator of GÉANT), into its partnership, joining some of Europe's biggest research powerhouses and IT companies to support the massive IT requirements of European scientists.

Officially known as "Helix Nebula — the Science Cloud," the new tool will allow European research organisations to access additional cloud-computing power to analyse huge sets of data and carry out large complicated calculations to probe some of the biggest mysteries of the universe.

New service paradigms like cloud technologies are gaining momentum in the rapidly evolving research and education environment and the delivery of world-leading broadband services to across Europe is unanimously acknowledged as an outstanding success story of the last two decades, enabling unsurpassed levels of innovation and collaboration.

In a joint statement, Matthew Scott and Niels Hersoug, Joint General Managers of DANTE said;

"We are delighted that GÉANT has joined the Helix Nebula partnership, in order to take an active role in the development of what we consider the natural solution for cloud computing in Europe. We see GÉANT as a key element of this solution, and Helix Nebula as a way to continue our leadership in enabling researchers worldwide to collaborate."

Participation in Helix Nebula provides an important strategic step in enabling further innovation, particularly as the next generation of the GÉANT network approaches in April 2013.

Further information:
http://helix-nebula.eu/

The European Space Agency (ESA), along with the CERN physics lab (home of the world's largest particle accelerator, the Large Hadron Collider, or LHC) and the European Molecular Biology Laboratory (EMBL), hope to use the Science Cloud to carry out some of the world's biggest science experiments.

NETWORK PERFORMING ARTS PRODUCTION WORKSHOP

The fourth European Network Performing Arts Production workshop, hosted by the **University of Music and Performing Arts Vienna (mdw)** on 12 – 14 March 2013, is aimed at people producing performing arts events (music schools, dance, arts and music academies, etc) who want to explore the possibilities and challenges that advanced education and research networks can offer.

More information:
http://www.terena.org/activities/network-arts/vienna/

BOOST FOR RESEARCH NETWORKING IN EASTERN EUROPE

December saw the signing of a Joint Declaration aimed at boosting research networking in Eastern Europe, at a workshop on e-infrastructures in Eastern Partnership countries, in Moldova. Signed by members of national governments and practitioners of research and education ICT Infrastructures from the Eastern Partnership countries and key stakeholders, the aim is to improve awareness of the importance of computer networks and their impact on a country's development; possible greater integration of Eastern partnership countries with the pan-European GÉANT network; and a sustainable future for research and education networks.

GÉANT is a vital part of the European research e-infrastructure, which includes high performance networking, distributed computing infrastructures, supercomputing and data storage. Here we welcome our many partners to shed light on their activities.

MOONSHOT - PREPARING FOR LAUNCH

By Josh Howlett, Head, International Collaboration, Janet

janet futures

GÉANT provides its users with world-leading single sign-on to wireless networks and web services across Europe and other world regions, thanks to the authentication and authorisation capabilities of its eduroam® and eduGAIN services.

Moonshot is a next-generation identity management technology that builds on this existing infrastructure. Originally created by Janet, the UK's Research and Education network, and developed further in collaboration with CESNET, NORDUnet, REDIRIS and RESTENA (through GÉANT), Internet2 and industrial partners, Moonshot delivers:

- Single sign-on for a wider set of services and infrastructures, such as desktop sign-in for visitors, or secure shell access for remote collaborators.
- More control in defining the organisations and individuals authorised to access these systems, such as a research group distributed across multiple campuses and countries.
- Consistent and manageable authentication and authorisation policies across an entire infrastructure, as demand grows for users to deploy these systems anywhere – locally, distributed, or pushed into the Cloud

- Standardisation of the Moonshot technology is fast approaching completion within the Internet Engineering Task Force's Abfab working group, which is co-chaired by Leif Johansson (NORDUnet) and Klaas Wierenga (Cisco, formerly SURFnet).

HOW CAN MOONSHOT HELP?

Janet has successfully trialled Moonshot within a UK-based technology pilot involving a broad range of organisations, including the Diamond Light Source, the UK's national synchrotron science facility with over 3000 users and part of the EU PANDATA project.

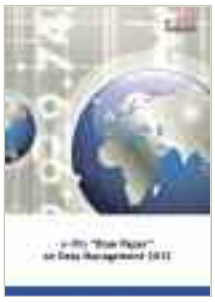
"Moonshot has thought beyond websites", says Bill Pulford, Head of DASC at Diamond Light Source, "and looked at all requirements in authentication – right down to the point when you open your laptop to begin work."

In GN3plus, Moonshot will take a major step forwards with the start of a Pan-European Moonshot service pilot. The goal is to validate the suitability of the Moonshot technology across a wide range of research and education use cases across Europe. If you are interested in participating, please contact John Chapman (John.Chapman@ja.net).

To keep up to date with the UK's service pilot, and find out more, please join Janet's Moonshot community group at: **https://community.ja.net/groups/moonshot**

CLOUD COMPUTING AND SCIENTIFIC SOFTWARE DOCUMENTS FROM E-IRG

By Ari Turunen, Communications Manager, Cloud Software Program



OVERVIEW ON CLOUD COMPUTING FOR RESEARCH WITH POLICY RECOMMENDATIONS

There exist many cloud computing projects and cloud computing services. Consequently, several business models rapidly evolved to harness this technology by providing software applications, programming platforms, data-storage, computing infrastructure and other hardware as services. While all the above components refer to the core of cloud computing services, their interrelations have been ambiguous and the feasibility of enabling their interoperability has been debatable. Main questions still arise concerning data handling, security and multi-tenancy.

Cloud Computing for research and science: a holistic overview, policy, and recommendations published by e-IRG aims to present cloud computing in a holistic way, elaborate its applicability for research and science, investigate related policy aspects and provide policy recommendations to the research community. The document takes into account the particularities of the European activities in these fields.

NATIONAL LEVEL RECOMMENDATIONS

- Support integration of cloud technologies in existing e-infrastructures
  - Adapt national e-infrastructures and ensure the participation in the European e-infrastructures in order to be able to exploit upcoming European cloud resources
  - Promote and financially support the innovation and evolution of national public e-infrastructure providers
- Stimulate integration of several e-Infrastructure components at national level, so as to facilitate a single point of access for European researchers
- Establish necessary policies, rules and legal framework allowing the funding and use of public cloud resources for research activities and work on the control procedures of such resource usage
- Promote establishment of repositories of standards and applications running in the cloud to support the reproducibility of the research experiments and allow the take-up by the commercial sector
- Support provision of training activities for new technologies such as virtualization and cloud technologies in cooperation with related European activities and industrial entities.

EC LEVEL RECOMMENDATIONS

- Evaluate use of commercial cloud resources as part of a hybrid community cloud environment during Horizon 2020 and support the development of related business models for the procurement of such commercial resources
- Evaluate integration of several e-Infrastructure components at European level, so as to facilitate a single point of access for European researchers
- Stimulate all member states to participate in the European e-infrastructures including cloud initiatives to develop innovative and interoperable services
- Establish a directive for all e-Infrastructure providers that receive European funding to ensure publication and open access to data about governance, policy and funding of their e-Infrastructures
- Promote establishment of the necessary policies, rules and legal framework for the use of cloud resources for European research activities and work on the control procedures of such resource usage
- Invest in research, methodology and development that ensure the elimination of the vendor-lock-in problem and promote interoperability among commercial and research-owned clouds and grids
- Invest in research about management, provenance and privacy of the data in cloud environments
- Support provision of training activities for new technologies such as virtualization and cloud technologies in cooperation with national and regional activities, also involving industrial entities

The report Cloud Computing for research and science: a holistic overview, policy, and recommendations can be downloaded at:
http://www.e-irg.eu/images/stories/dissemination/e-irg_cloud_computing_paper_v.final.pdf

E-IRG POLICY PAPER ON SCIENTIFIC SOFTWARE

With the successful establishment of a European e-Infrastructure ecosystem, how to maintain and improve the scientific software base has become an urgent issue. Many applications depend on legacy software that is difficult to maintain and run efficiently on current and future e-Infrastructures. There is a clear need for a coherent process and major efforts targeted towards enhancing the European software base for efficient use of European e-Infrastructures to increase the scientific output while ensuring the best value for money.

In view of the Horizon2020 program there is a clear need to develop a consistent framework and related policies for establishing a European Software Strategy taking a holistic view of the national, European, and international ecosystem.

The paper aims to lay the ground for a European software strategy. The focus is on "scientific software", i.e. that is primarily used in research and development, both within academic and industrial environments.

The report proposes that the EC and the member states should provide support and funding for the establishment of Centres of Excellence for Scientific Software (CESS), focusing on scientific software on the application layer using a holistic approach and building up and retaining the necessary competence of future European software developers.
The policy paper can be downloaded at:
http://www.e-irg.eu/images/stories/publ/task_force_reports/e-irg_tfss_final.pdf

CARNET (CROATIAN ACADEMIC AND RESEARCH NETWORK)

By Goran Skvarc, CARNet

THE FIRST PRESENTATION OF THE 3D 4K TECHNOLOGY IN CROATIA

Croatian Academic and Research Network – CARNet (**http://www.carnet.hr/en**) in cooperation with Poznan Supercomputing and Networking Center (PSNC) prepared a demonstration presenting advanced streaming and 3D 4K technologies required for transmission of ultra high-resolution multimedia streams. Croatian President H.E. Professor Ivo Josipović attended this event hosted by the CARNet CEO Mr. Zvonimir Stanić.

The event was organized as a part of INFO fair held in Zagreb, Croatia on November 15-17th. The presentation was dedicated to the development and use of 3D 4K technology in various fields of science, medicine, arts, entertainment and industry. The main aim was to present the existing as well as future possibilities of streaming the 3D 4K technology, and its application in medicine and medical appliances in Croatia.

The 3D 4K equipment required to conduct the demonstration was provided and transported by PSNC in scope of the VISIONAIR project (**http://www.infra-visionair.eu/**), the goal of which is to provide access to unique facilities offered by the project partners for the European scientific community. The entire stream was conducted via the GÉANT network.

During the three days of presentations, CARNet in cooperation with Poliklinika Svjetlost also demonstrated the application of 3D technology in the field of eye and jaw-surgery.

CARNet, as a pioneer in usage of multimedia and streaming technologies in Croatia, once again positioned itself as a technology leader in the advanced usage of ICT in Croatia.

20 YEARS OF INTERNET IN THE REPUBLIC OF CROATIA

On 17 November 1992, the first Croatian Internet connection to the world was established by the Croatian Academic and Research Network – CARNet project, thus inaugurating the age of the Internet in the Republic of Croatia.

At the end of 1991, activities began organising a network that would enable the communication of every researcher or student with all other researchers in the Republic of Croatia and the entire world. As early as in September of 1992, the first FTP and IRC servers were set up, and on 17 November 1992 the first Internet connection between Croatia and the rest of the world was set up. Croatia was then connected via Austria, at the speed of 64 kbps, and the country's institutions were connected at a speed of 19-200 kbps.

The first institutions to be included in the National Research and Education Network and to use the international Internet connection were the College of Economics and Business in Osijek, the College of Electrical Engineering in Zagreb, the College of Electrical Engineering, Mechanical Engineering and Shipbuilding in Split, the Ruđer Bošković Institute, the Ministry of Science and Technology, the College of Natural Sciences and Mathematics in Zagreb and the College of Engineering in Rijeka.

Via a public computer, Internet access was enabled to all citizens of Croatia, making CARNet the only ISP in the Republic of Croatia for several years. With a lot of resourcefulness, combining the existing infrastructure and new equipment, the core of the CARNet network was built, which today has expanded to 239 member institutions from the academic community connected at 450 locations (34 of which are institutions from the health care system), and 1,388 member institutions from the school system connected at 2,041 locations, with connection speed levels from 2 Mbps to 10 Gbps. CARNet is also very active within the GÉANT and other EU funded projects, as well as in the cooperation with international organizations like TERENA and RIPE.

CARNet still manages the national top-level .hr domain.

ITALY'S NEXT GEN NETWORK IS HERE

GARR-X, the first Next Generation Network in Italy was officially launched in November at an event with Minister of Education, University and Research, Francesco Profumo. Over 8500 km of optical fibres between the backbone and access infrastructure are now available to 2.5 million research & education users.

The integrated e-infrastructure, which provides very-high bandwidth, is capable of supporting worldwide collaboration thanks to international Gigabit links, and an enabling platform for transparent access to computing, storage, data and cloud resources. E-Infrastructures are thus a key element in the Italian strategy to enhance cohesion in participation in Horizon 2020.

Said Profumo "GARR-X will be an important ally for introducing 'more Europe' into the Italian Research and Innovation system – i.e. for aligning our policies and our tools with European ones."

"In order to improve our position in Europe, it is very important to foster cohesion in the community, not just in Big Science, but across all who adopt new technologies, for example schools. GARR-X has already enabled very-high bandwidth capacities up to 1Gbps in 100 schools, and another 100 to follow soon, with the objective to reach most institutes. This will sharply accelerate digitalisation within the education system."

With its vast user base and an impressive volume of data traffic of over 85 Petabytes in only ten months, between January and October 2012, GARR-X is the largest and most significant community network in Italy. Tailored to its users' needs, the infrastructure can be modelled in response to real-world requirements. And, thanks to direct control across lower levels of the infrastructure, and to synergies with public MANs and RANs, GARR-X is able adapt to new developments both in terms of bandwidth needs and evolution of technologies, and to connect new sites quickly and without major investment.

"In Italy there has been a lot of talk about NGNs, but not much in terms of implementations, so far" comments Marco Pacetti, GARR President "thus today our Country is far from having true, widespread broadband. With GARR-X we intended to bridge this gap for the research and education community, we hope this is can be an example for others to follow."

PRACE PROJECT 'UPSCALE' CONNECTS WITH GÉANT TO HELP UNDERSTAND THE BIGGEST CLIMATE ISSUES OF OUR TIME

By Marjolein Oorsprong, Communications Officer, PRACE

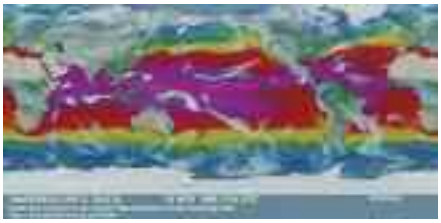
The Partnership for Advanced Computing in Europe (PRACE) supports 'UPSCALE', the research project set up to investigate climate related extreme events, awarding the project 145 million hours of computing time on the Hermit Supercomputer (provided to PRACE by the Gauss Centre for Supercomputing (GCS)) at the High Performance Computing Centre Stuttgart (HLRS) in Stuttgart, Germany. Thanks to the high-end computing resources awarded by PRACE and the high-speed network connections of GÉANT, the vast amounts of data created from this massive experiment can be studied by a team of researchers led by NCAS-BADC to gain a deeper understanding of natural climate variability and the character of extreme weather events.

QUANTUM-LEAP FOR CLIMATE SCIENCE

In a world where tropical storms, typhoons and other extreme weather wreaks havoc on the lives of thousands every year, the experiments are expected to provide a quantum-leap for climate research and a valuable resource for the study of current and future climate.

The collaboration between the National Centre for Atmospheric Science: British Atmospheric Data Centre (NCAS-BADC, UK) and the High Performance Computing Centre Stuttgart (HLRS) required data transfer speeds in excess of 5 Terabytes per day, or 60 Megabytes per second. Transferring 300 Terabytes of data could take up to two years via a standard 5 Megabytes per second connection. With increasing complexity and detail in climate simulations, and improvements in satellite instruments, Petabyte (one Petabyte is about a thousand Terabytes) data sets are already being planned.

PRACE and GÉANT are proud to have been able to support the UPSCALE project requirements and are looking forward to the results and further interpretations and calculations once the data has been fully transferred.



LINKS

PRACE: **http://www.prace-ri.eu**

HLRS: **http://www.hlrs.de/**

UPSCALE: **http://climate.ncas.ac.uk/HRCM/**

Gauss Centre for Supercomputing: **http://www.gauss-centre.eu/**

CEDA: **http://www.ceda.ac.uk/**

JASMIN: **http://www.jasmin.ac.uk**

GridFTP: **http://www.globus.org/toolkit/docs/latest-stable/gridftp/**

The GÉANT project is a collaboration between 34 project partners: 32 European NRENs, DANTE and TERENA; and four Associate NRENs. Through the NREN partners, GÉANT delivers a range of services across the network for institutions, projects and researchers. In this regular section we take a closer look at some of those NRENs. All information is provided by the NREN partners.

PARTNER PROFILE: ARNES

ACADEMIC AND RESEARCH NETWORK OF SLOVENIA

By: Domen Božeglav, Senior Consultant, ARNES

ABOUT ARNES

ARNES connects more than 1,000 research and educational organisations, with around 200,000 users. Its optical backbone is connected to the GÉANT network, and links major Slovenian cities. It offers users high-end network services. ARNES also operates SIX, the Slovenian Internet eXchange, and is the registry for the .si top-level domain name. Dedication to knowledge dissemination and international collaboration helps Slovenian organizations remain a leader in the global research and education arena.

BACKBONE

ARNES provides powerful resilient backbone network infrastructure, with 46 Points-of-Presence (PoPs) in 35 major Slovenian towns. Connections between ARNES network PoPs are based on leased optical fibres. Fibres follow a variety of routes to ensure a high degree of reliability. All connections are based on DWDM or CWDM technology, with IPv4 and IPv6 support provided on the network layer.

Marko Bonač, ARNES director (left) and Dr. Tomaž Kalin.

SERVICES

In addition to IP connectivity via optical fibres, ADSL, xDSL and other technologies, ARNES also offers quality assurance, bandwidth on demand, and diagnostic testing of connections. Multi-gigabit dedicated point-to-point connections are offered for demanding projects. Eduroam services with AAI infrastructure are offered to most members. A wide range of hosting packages based on cloud computing are available, along with domain name registration, DNS hosting and other services. Members can choose between high-quality videoconferences and web based conferences, with the option of storing the recordings online in both cases. Individual users are eligible for electronic mail, web hosting and other services.

CONNECTING KNOWLEDGE

As well as providing high-end infrastructure and services, ARNES focuses on knowledge transfer. This is achieved through various initiatives, projects, conferences and workshops organised by ARNES and its partners, publications, and user support. Events include ARNES' Annual Users' Conference, Campus Best Practice workshops and IPv6 Summits, to name just a few. Partnership in such projects as the Slovenian national Awareness Centre, and collaborating with users on the LOw LAtency audiovisual streaming system extend this role even further.

CELEBRATING 20TH ANNIVERSARY

On 29 November 2012, ARNES celebrated its 20th anniversary, inviting users to a technical conference and ceremony, with the keynote address given by Dorte Olesen, Chair of the NREN Consortium Policy Committee. Over the last 20 years, ARNES has made a significant ICT contribution to the Slovenian research and education community, a fact acknowledged by the President of the Republic of Slovenia, the Minister of Education, Science, Culture and Sport, and representatives of users from the research, education and culture sectors.

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Tw: **@ArnesInfo**

PARTNER PROFILE: FCCN

By: Daniel Gomes, Project manager Portuguese Web Archive, FCCN
Daniel Gomes is leader of the Portuguese Web Archive and manager of the web development team at FCCN.

WEB EPHEMERALITY

Invented to exchange data between scientists, the web is now used to share publications and knowledge, with students from all educational backgrounds using it as their primary source of information. But how much of this will still be available in years to come?

It is estimated that 80% of web pages will be updated or disappear within 1 year. Even printed scientific publications suffer the effects of web ephemerality citing on-line resources that become unavailable. Professor Diomidis Spinellis observed that half the URLs cited in articles from the ACM and IEEE digital libraries published 4 years before were already inaccessible.

Many scientific ideas take years to be applied. Leonardo Da Vinci designed sketches that inspired inventions five centuries later. Nowadays, researchers communicate through the web. They share their work through blogs, interest groups or institutional sites. However, this knowledge may not be around to influence scientists in the future.

Besides losing important scientific and historical information, web ephemerality may also affect our personal memories, as people tend toward publishing them digitally and exclusively on the web. Broken links degrade the performance of popular web applications such as shared bookmarks, search engines and social networks.

The web needs preservation mechanisms to fight web ephemerality. Its information must prevail across time to transmit knowledge for future generations. Web archiving is the process of acquiring, storing, preserving and providing access to information published on the web. The Portuguese Web Archive project began in 2007. It is undertaken by the Portuguese NREN - Foundation for National Scientific Computing (FCCN) and aims to preserve web information of major interest to the Portuguese speaking communities.

Today the Portuguese Web Archive preserves 1 590 million files, archived from the web since 1996 (45 TB) which can accessed through freely available full-text search service - www.archive.pt. Most information is in Portuguese, but users can also search the interface in English via translation tools such as Google Translate.

Contact info:

daniel.gomes@fccn.pt
FCCN - Foundation for National Scientific Computing
Av. do Brasil, 101
1700-066 Lisboa
Portugal

Web: **www.archive.pt**

ADDITIONAL INFORMATION

OVERVIEW:

The Portuguese Web Archive preserves and provides access to information published on the web of main interest to the Portuguese community. It provides a free and publicly available full-text search service over 1 billion web archived since 1996.

ABOUT THE NETWORK:

FCCN is the Portuguese National Research and Education Network, NREN. It is a private non-profit organisation that provides infrastructures and services to education, science, technology and culture institutions.

SERVICES:

The FCCN core activities are:

- Manage and operate high-performance Internet network for science, technology and social community organizations, the PIX, the main Portuguese Internet Exchange, the registry for the .PT top level domain
- Creating services to promote internet security, support the generation and dissemination of e-learning contents and enable advanced videoconference communications, to spread activity to areas relevant to stakeholders
- Leading national initiative to promote open access to scientific publications, providing an online service to host open access repositories and journals (RCAAP)
- Manage the national digital library that enables continuous access to subscribed scientific publications (b-on), and develop and manage a repository for educational, scientific and cultural videos (Zappiens.pt).

Find more at: **www.fccn.pt**

PARTNER PROFILE: REDIRIS

By: Cristina Lorenzo, PR of RedIRIS

REDIRIS: 25 YEARS CONNECTING RESEARCHERS
TWO MILLION POTENTIAL USERS FOR SPANISH NREN

RedIRIS is the Spanish National Research and Education Network (NREN) that has been providing advanced communications services to the Spanish scientific community and universities since 1988. It has over 450 connected institutions, mostly universities and public research centres, representing more than 150,000 researchers and about 2 million potential users.

From an organisational perspective, RedIRIS is a cooperation project between the Ministry of the Economy and Competitiveness (MINECO), which establishes the network's strategic guidelines and funds its activity, and Red.es, the agency of the Ministry of Industry, Energy and Tourism in charge of promoting the Information Society in Spain, which is, inter alia, in charge of the technical and operational management of RedIRIS.

RedIRIS started operating in 1988, and has pioneered the introduction of internet and various electronic services in Spain. Over the years it has become a key element for supporting the development of collaborative projects, in particular in the field of e-science. The network's pivotal role was acknowledged when it was included in the Map of Singular Scientific and Technological Infrastructures of the MINECO, a list of Spain's most important scientific infrastructures and facilities.

RedIRIS has recently deployed its new backbone, RedIRIS-NOVA, a dark fibre network equipped with optical transmission equipment which will be in operation over the coming decades.

Thanks to this communications infrastructure, the Spanish research community, including the astronomical observatories in the Canary Islands, will have access to multiple circuits of up to 100 gigabytes per second.

This network puts optimal national and international connectivity at the disposal of researcher collaborating with other national or international centres.

In order to provide its users with the best possible connectivity and to keep abreast of new electronic services, RedIRIS cooperates with other research and education networks on both a regional and international scale. Examples of the latter include the Pan-European GÉANT research network, in whose management RedIRIS participates. Through GÉANT, RedIRIS connects with other European National Research and Education Networks, as well as with other research networks, such as RedCLARA (Latin America), EUMEDCONNECT3 (southern Mediterranean), Internet2 (USA) or TEIN3 (Asia-Pacific).

RedIRIS also provides several applications and middleware to its affiliated institutions (digital identity and mobility systems, mailing lists, security services, support services for Grid computing, multimedia, etc.), and it also engages in outreach activities (publications, organising technical seminars and courses, etc.).

For more information, visit:
www.rediris.es

CANARIE
Canada's advanced research and innovation network
www.canarie.ca

EUMEDCONNECT3
Southern and Eastern Mediterranean research networking
www.eumedconnect3.net

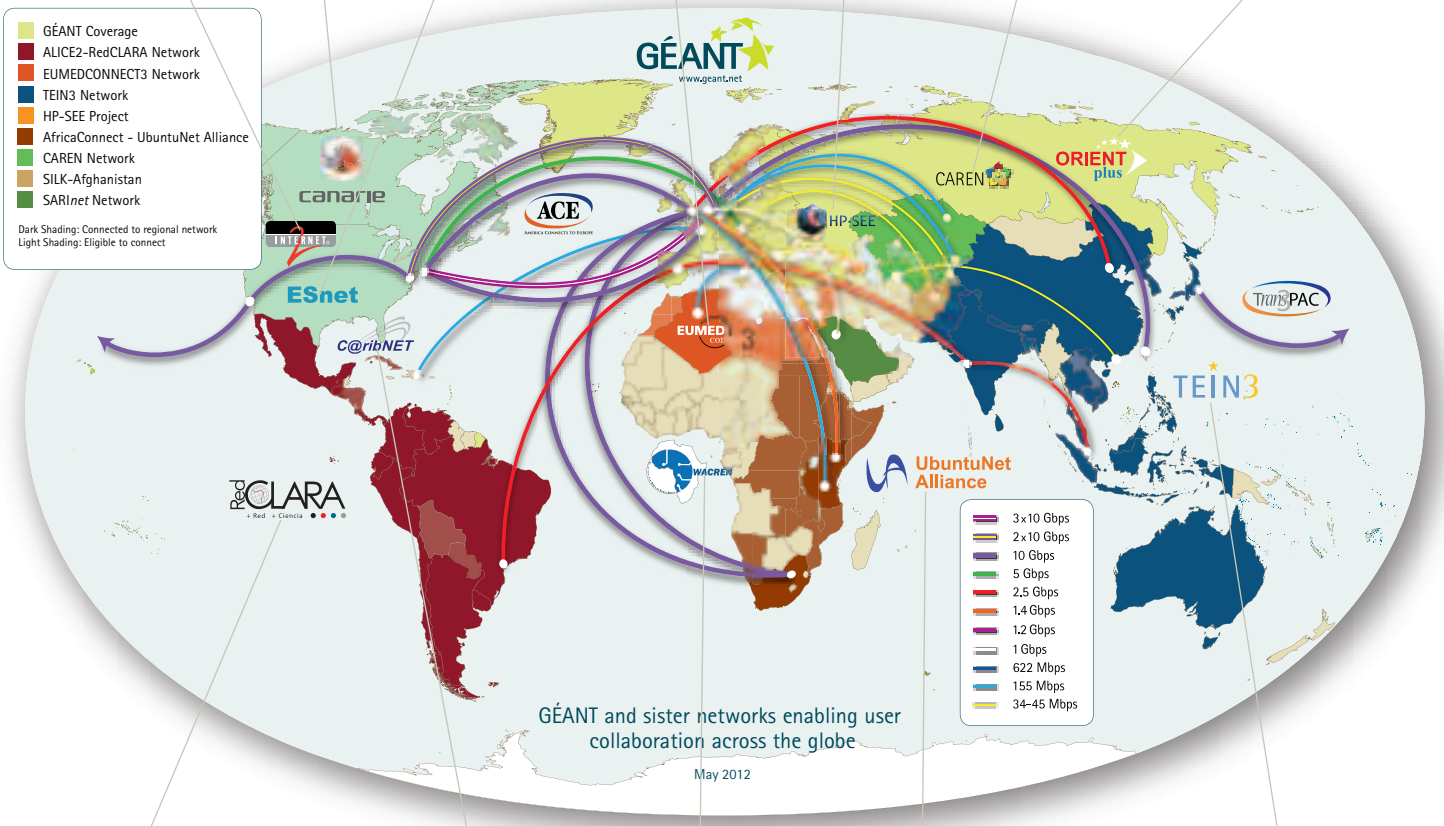
CAREN
Central Asian Research and Education Network
www.caren.dante.net

Internet2®
Research and education connectivity for US universities
www.internet2.edu

ESnet
The Energy Sciences Network
www.es.net

HP-SEE
High-Performance Computing Infrastructure for South East Europe's Research Communities
www.hp-see.eu

ORIENT plus
Linking European and Chinese Infrastructures and Communities
http://www.orientplus.eu



RedCLARA
The Latin American Research and Education Network
www.redclara.net

C@ribNET
The Caribbean Research and Education Network
www.ckln.org

WACREN
West and Central African Research and Education Network
www.wacren.net

UbuntuNet Alliance
Regional Research and Education Network for Eastern and Southern Africa
www.ubuntunet.net

TEIN3
The Trans-Eurasia Information Network
www.tein3.net

GLOBAL NEWS

By Tom Fryer, International Relations Officer, DANTE, and Helga Spitaler, Senior Communications Officer, DANTE

ALGERIA SPURS ICT UPTAKE WITH LARGEST-YET EUMEDCONNECT3 CONNECTION

Demand-driven circuit upgrade to provide reliable internet support to growing academic and research user base

Algeria has recently upgraded the international connectivity available for its scientists and academics to 622 Mbps through its participation in EUMEDCONNECT3, the regional high-capacity Internet network serving the research and education (R&E) communities across Northern Africa and the Middle East. ARN, the Algerian NREN, currently interconnects over 600,000 users at 120 research and academic institutions across the country, increases of 20% and 40% respectively since the start of the previous phase of EUMEDCONNECT in 2008. The upgrade marks a vote of confidence in EUMEDCONNECT by one of our longest serving partner countries. It shows the benefits of the programme for providing high-capacity, high-quality connectivity for 21st century scientific research in the region.

For more information please visit: **http://www.eumedconnect3.net/server/show/ConWebDoc.3441**

ASREN ANNOUNCES NETWORK PLANS AT E-AGE 2012

At the second e-AGE conference, 12-13 December 2012 in Dubai, the Arab States Research and Education Network (ASREN) has unveiled plans to start to develop its regional Arab network. The event was attended by 150 high-profile participants from 36 countries under the Patronage of His Excellency (HE) Sheikh Nahayan Mabarak Al-Nahayan , UAE's Minister of Higher Education and Scientific Research. In a new report on Arab e-Infrastructures, ASREN sets out the importance of research networks for the region while contrasting the continuing digital divide faced by research and education in the Arab world compared to more developed regions.

HE Dr. Talal Abu-Ghazaleh, chairman of ASREN, announced that ASREN is to invest in its first cable connection between ASREN and Europe with the plan of establishing an ASREN hub in London which will be connected to GÉANT. The plans build on the existing close partnership between ASREN and EUMEDCONNECT, the EC-funded Mediterranean research and education network project, in which ASREN is a major partner. So far Jordan, Morocco, Somalia and Sudan's NRENs are ASREN shareholders and other Arab NRENs are preparing to join.

ASREN sets out to extend the geographical footprint of EUMEDCONNECT towards creating a truly pan-Arab R&E network potentially serving a population of 250 million people.

Dr Abu-Ghazaleh's announcement marked the first concrete step of implementing this strategy and securing long-term sustainability of e-Infrastructures in the Mediterranean and the neighbouring Gulf region.

During e-AGE 2012, national and regional research and education networks in other parts of the world were studied, along with specific applications and lessons for longer term sustainability. The full set of presentations from e-AGE 2012 is available at: **http://eage2012.asrenorg.net/en/program.html**

HEADS OF STATE AND GOVERNMENT ENDORSE TEIN AT THE ASEM 9 SUMMIT

Leaders at the 9th Asia-Europe Summit (ASEM), held on 5 – 6 November 2012 in Vientiane, Lao PDR recognised the success of the TEIN initiative and welcomed the launch of the new phase, TEIN4 under the theme 'Friends for Peace, Partners for Prosperity'. Here they recognised its important role in enhancing collaboration among the research and education community in Asia and also exchanges between Asia and Europe.

For more information please visit **http://www.teincc.org/teincc/b/recent_news/152**

FUTURE OF DIRECT REDCLARA-GÉANT LINK SECURED

RedCLARA and GÉANT Agree to Cost Share on Transatlantic Link

In 2003, the start of the EC-funded ALICE (Latin America Interconnected with Europe) Project enabled the creation of the Latin American Research and Education Network, RedCLARA. Today, with the end of the successor project, ALICE2, in sight, the RedCLARA network has grown to connect a total of 13 Latin American NRENs and provides backbone capacities in the region of up to 2.5 Gbps and even 10 Gbps. In addition, a major success of the ALICE2 project has been to increase the capacity of the transatlantic link interconnecting RedCLARA and GÉANT from 622 Mbps to 2.5 Gbps.

In January 2013, the ALICE2 project will come to an end and with it, European Commission funding towards the cost of the transatlantic link between the two regions. In recognition of this, the NREN PC approved at its meeting on 26th November 2012 a proposal that the costs of the link be shared equally between the Latin American and European Research and Education Communities. The agreement, will ensure that the needs of the many inter-regional R&E collaborations, including European facilities in Latin America such as the ESO observatories (Astronomy) in Chile and the Auger Observatory (Cosmic Rays) in Argentina, are met through the provision of a direct link between the two regions.

On learning the NREN PC's decision, Florencio Utreras, Executive Director of CLARA said, "I would like to thank the NREN PC for a decision which will further enhance long-term collaboration between our two continents, and strengthen the close relationship between our respective communities which has been built up over the past eight years under the ALICE and ALICE2 projects".

C@RIBNET INSPIRES EFFORTS TO CREATE CARIBBEAN NRENS

Efforts underway to establish NRENs in numerous Caribbean countries

In May this year CONNECT reported on the establishment of C@ribNET, the Caribbean Research and Education Network, which currently connects a total of 13 Caribbean countries to each other and to the European, Latin American and North American R&E communities.

Through EC-funding provided through the World Bank, C@ribNET is able to connect the largest institutions in the connected countries such as the University of the West Indies. However, in order to extend the reach and benefits provided by R&E connectivity to more institutions, including universities, colleges, healthcare facilities, libraries and schools, the creation of NRENs is considered essential by CKLN.

For this reason, CKLN is working with the local authorities, institutions and other bodies around the region to drive the momentum towards the establishment of NRENs, by sharing the benefits of NRENs, governance structures and sustainability models. Successes to date include Barbados, Jamaica and Trinidad & Tobago and the Dominican Republic where NRENs have been established. CKLN continues to work with the other emerging NRENs in the Bahamas, Haiti, Belize, the Eastern Caribbean States and Suriname.

THE LAUNCH OF C@RIBNET

2nd C@ribNET Meeting: a Showcase

Following the establishment of the Caribbean Research and Education Network in 2012, CKLN will launch the C@ribNET network at its second C@ribNET Meeting which will be held in February 2013 in the twin-island Republic of Trinidad and Tobago. The event, which will showcase applications running on the network, will bring together representatives of regional governments, academics, researchers and telecoms, as well as representatives from other international networks. According to the CEO of CKLN, Mr. Ken Sylvester, "By the time we officially launch, C@ribNET will have been delivering connectivity services to several Caribbean NRENs, including the Dominican Republic, Jamaica, Barbados, the Bahamas, Belize and the Eastern Caribbean States".

For more information on CKLN and C@ribNET, visit: **http://www.ckln.org/home/content/cribnet**

The Merzbacher monitoring station: a watchful eye on the Tien Shan glaciers

TRACKING KYRGYZSTAN'S MELTING GLACIERS

EU-Central Asian collaboration relies on high-speed networks to monitor climate change and provide early flood warning

In July 2012 Lake Tez-Tor in Kyrgyzstan, swollen with water from melting glaciers, burst and flooded the inhabited Ala Archa Valley. This was not an isolated incident - climate change is having a major impact on Central Asia, with retreating glaciers leading to large scale flooding, avalanches and mudslides, with often disastrous results.

Understanding how the environment is altering through ongoing monitoring is key to coping with the effects of climate change. Only then is it possible to devise mitigation and adaptation strategies and create early warning systems to protect lives and livelihoods. Various initiatives have begun, involving glaciologists and geohazard experts across Central Asia and Europe. This international collaborative research generates large amounts of data which needs to be shared, often in short timescales from remote locations. Consequently, the fight to mitigate climate change relies on high-speed research networks, such as GÉANT (in Europe) and CAREN (in Central Asia) to underpin these vital activities.

The Kyrgyz academic network (KRENA), GÉANT, CAREN and national European networks combine to share the data and scientific results amongst geographically dispersed researchers and allow international access to the Central Asian Institute of Applied Geoscience's (CAIAG) growing Geo Database of Central Asia (GDB). Working with European partners, CAIAG is now able to monitor melting glaciers and mitigate the risks to the local population

"Research networks are central to all of our work at CAIAG. Thanks to GÉANT and CAREN we can quickly share information with our European partners, speeding up the processing of monitoring data and enabling us to work together to predict the impact of climate change and protect our local environment."

Dr Bolot Moldobekov, Co-Director of Central Asian Institute of Applied Geosciences (CAIAG).

Read the full case study:
GÉANT and CAREN tracking Kyrgyzstan's melting glaciers

VICKY FORD MEP VISITS DANTE TO LEARN ABOUT SUPERFAST NETWORKS

Left to right: Niels Hersoug (Joint General Manager of DANTE), Dale Robertson (Head of EC Liaison, DANTE), Vicky Ford MEP, Matthew Scott (Joint General Manager of DANTE)

Vicky Ford was elected a Member of the European Parliament in 2009. She is the UK Conservative Spokesman for Industry and Research on the Parliament's ITRE committee, which also includes work on energy. She is a member of the Economic and Monetary Affairs Committee and was the Conservative Spokesman for this committee from 2009-2011. Ms Ford visited DANTE to learn how superfast networks are delivering research and innovation (R&I)

WHAT DOES YOUR ROLE AS AN MEP ENTAIL?

I usually spend three days a week in Brussels/Strasbourg attending committee meetings. I also meet with other MEPs to negotiate the Parliament's position on legislation, table amendments to draft legislative proposals, and meet with a wide range of stakeholders to discuss my legislative work. I spend the rest of the week travelling across the East of England visiting local organisations and universities to see first-hand what they do and take their views back to Brussels.

HOW INVOLVED ARE YOU IN HORIZON 2020 [THE EU'S FRAMEWORK PROGRAMME FOR R&I FUNDING], AND WHAT ARE THE MAIN BENEFITS OF THIS PROGRAMME?

I'm one of seven MEPs leading on Horizon 2020 in the European Parliament so am very involved in shaping the draft legislation. I have been meeting with the other MEPs from the different political groups on a regular basis, to try to come up with compromises that all of the political groups can agree upon.

The benefits of the programme are enormously far-reaching, from boosting economic growth and jobs through kick-starting innovation, to developing treatments for diseases, plant science solutions to feed our growing global population and cutting-edge technology to combat climate change.

WHAT IS YOUR INTEREST IN RESEARCH INFRASTRUCTURES?

E-Infrastructure can support our scientists. Sharing information quickly and effectively is hugely important to allow researchers to work together from all over the globe. I am interested in supporting the best science, the best research and the best innovation. To achieve this, we need to have the best e-Infrastructure.

GÉANT UNDERPINS RESEARCH AND INNOVATION IN EUROPE - HOW IMPORTANT IS R&I TO A REGION'S ECONOMY?

R&I is key to creating new jobs as we develop new products, services and businesses which keep us globally competitive. Creating hubs or clusters draws people to an area so they can work amongst those who are pioneering the next ground-breaking discoveries. But in my opinion you can't create a cluster without first having a seed

HOW WILL HORIZON 2020 DIFFER FROM FP7, AND WHAT DO YOU FEEL THIS WILL MEAN FOR GÉANT?

The new structure of Horizon 2020 aims to be much simpler than FP7. There will be a single set of rules for all projects so participants should know what to expect from engaging in a European R&I project and in applying for EU money, opening it up to a more diverse range of projects. There is a greater focus on innovation which will sit alongside the fundamental research programmes typical of FP7 such as Marie Curie.

There is also a specific section dedicated to research infrastructures, where GÉANT is held up as an example of a world-class facility. In the Parliament we are fighting for a significant proportion of the budget for research infrastructures to go towards innovation, to ensure that important e-Infrastructures like GÉANT can be supported.

HISTORICALLY, GÉANT HAS BEEN FUNDED EQUALLY BY THE EC AND EUROPE'S NRENS [WHO PROVIDE RESEARCH NETWORKS AT THE NATIONAL LEVEL]. IN LIGHT OF THE ECONOMIC CRISIS HOW CAN THE CONTINUED DEVELOPMENT OF E-INFRASTRUCTURES BE FUNDED?

It is incredibly important that we protect the European and national budgets for R&I. UK Conservative MEPs have been fighting for an increase in the research budget in the context of an overall reduced EU budget, arguing that we need to re-allocate funds from areas which have much less EU added-value.

HOW DO YOU SEE GÉANT AND E-INFRASTRUCTURE OVERALL SUPPORTING EUROPE'S 'GRAND CHALLENGES'?

World-class research must be supported by world-class e-Infrastructure. To solve our greatest global challenges we will need our best researchers on the task. Access to e-Infrastructures, like GÉANT to facilitate high speed communication between researchers across the world, ensures that the research carried out by these amazing people can be maximised to its full potential.

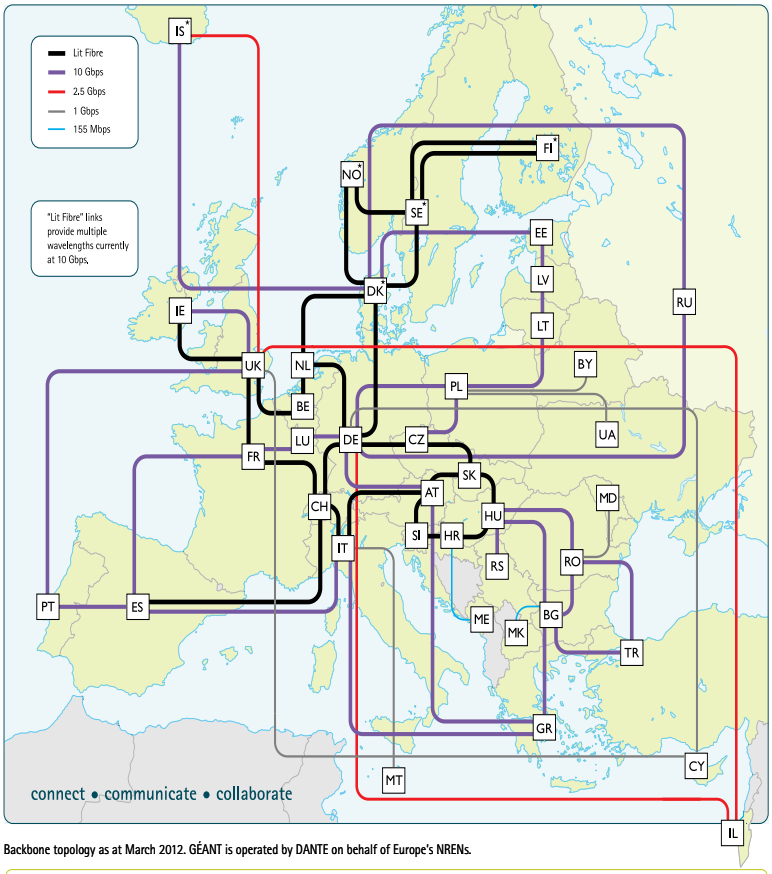
GÉANT is the pan-European research and education network that interconnects Europe's National Research and Education Networks (NRENs). Together we connect over 40 million researchers and students across Europe, facilitating collaborative research in a diverse range of disciplines, including high-energy physics, radio astronomy, bio-medicine, climate change, earth observation and arts & culture.

www.geant.net

www.twitter.com/GEANTnews

www.facebook.com/GEANTnetwork

www.youtube.com/GEANTtv



Backbone topology as at March 2012. GÉANT is operated by DANTE on behalf of Europe's NRENs.

GÉANT Partners

ACOnet www.aco.net	**IUCC** www.iucc.ac.il	**AARNIEC/RoEduNet** www.nren.ro
Belnet www.belnet.be	**GARR** www.garr.net	**AMRES** www.amres.ac.rs
BREN www.bren.bg	**SigmaNet** www.sigmanet.lv	**SANET** www.sanet.sk
CARNet www.carnet.hr	**LITNET** www.litnet.lt	**ARNES** www.arnes.si
CyNET www.cynet.ac.cy	**RESTENA** www.restena.lu	**RedIRIS** www.rediris.es
CESNET www.ces.net	**MARNet** dns.marnet.net.mk	**SWITCH** www.switch.ch
EENet www.eenet.ee	**University of Malta** www.um.edu.mt	**ULAKBIM** www.ulakbim.gov.tr
RENATER www.renater.fr	**MREN** www.mren.ac.me	**JANET** www.ja.net
DFN www.dfn.de	**SURFnet** www.surfnet.nl	**DANTE** www.dante.net
GRNET www.grnet.gr	**NORDUnet** www.nordu.net	**TERENA** www.terena.org
NIIF www.niif.hu	**PSNC** www.man.poznan.pl	
HEAnet www.heanet.ie	**FCCN** www.fccn.pt	

Associate NRENs

BASNET www.bas-net.by	**RENAM** www.renam.md
JSCC www.jscc.ru	**URAN** www.uran.net.ua

LATEST MATERIALS & CASE STUDIES

GÉANT and CAREN tracking Kyrgyzstan's melting glaciers

GÉANT and CAREN: delivering a brighter future for Turkmenistan

GÉANT and ORIENTplus – understanding cosmic showers

UPCOMING EVENTS

EGI Community Forum 2013
Date: 8 April 2013 to 12 April 2013
Location: Manchester, UK

More information: **http://cf2013.egi.eu/**

Network Performing Arts Production Workshop
Date: 12 March to 14 March 2013
Location: Location, Vienna, Austria

More information: **http://www.terena.org/activities/network-arts/vienna/**

GÉANT

www.geant.net

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