

CONNECT

THE MAGAZINE FROM THE GÉANT COMMUNITY | **ISSUE 11 APRIL 2013**

THE POTENTIAL OF CLOUD SERVICES



**INTRODUCTION
TO GN3PLUS**
THE NEXT STEP
FOR GÉANT

**GÉANT SUPPORTING
NUCLEAR FUSION
SCIENTISTS IN SEARCH
FOR CLEAN ENERGY**

DOUBLE AWARD WINS!
GÉANT RECEIVES
TWO HIGH-PROFILE
ACCOLADES

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CONNECT is the quarterly magazine from the GÉANT community; highlighting key areas of interest, updates on the project and its vital work supporting European research and education. We give insights into the users who depend on the network, and the community that makes GÉANT what it is. We welcome feedback at **connect@geant.net**

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WELCOME TO CONNECT

By Editors: Paul Maurice & Tamsin Henderson

Welcome to the April issue of CONNECT magazine. This issue marks the start of GN3plus, the next phase in the development of GÉANT, the world-class research and education network.

We kick off this stage having just received not one, but two fantastic award wins; Computer Weekly's 'Best Technology' and an 'Excellent Science' accolade from the European Commission. You can read more about these and many other exciting new developments inside; from the

immense job that has been the terabit-capacity network upgrade to how GÉANT is supporting nuclear fusion research in the global search for clean, sustainable energy.

As well as looking at what GN3plus is likely to bring, you can also read about how GÉANT will contribute to the future of the connected world with the Future Internet Initiative.

As usual we have updates from our global partners and on page 11, we announce GÉANT's first ever Open Call, a €3.3 million funding opportunity for multi-domain network R&D activities.

Enjoy this issue of CONNECT and as always we'd love your feedback.
connect@geant.net



WELCOME TO GN3PLUS

By Dorte Olesen, Chair of the GÉANT Assembly

Welcome all to the GN3plus project. The next two years in the GÉANT lifecycle herald new changes across the infrastructure, not just from a technological point of view, but also in terms of governance and rigorous research and innovation activities.

A focus on service provision, always with our users in mind, is driving this augmented effort. We must always remember what the network is here to do, focusing our efforts on developing not just a world-class network, but a tool through which the R&E community can work to solve some of mankind's biggest challenges.

GÉANT is the invisible glue which binds together a highly complex and fragmented structure of global research communities, who are increasingly reliant on each other to communicate and share data between important scientific projects. Our objective is to connect researchers across the world, completely unimpeded by geographical location or bandwidth restrictions, and to provide an unrivalled service portfolio that allows them to make the most of the GÉANT network. Therefore we have now also created an International Users Advisory Committee in GN3plus, a committee which obviously has relevance also for the future developments beyond this specific project. This committee will work alongside the External Advisory Committee which was formed during the last part of the GN3 project and consists of members from NRENs in other parts of the world, the HPC and Grid communities, industry and universities.



On behalf of GÉANT and its 41 partners, I welcome you to learn more about our leading-edge network in the following pages. Here you will see how we are working hard to enable globally significant research projects to take place; projects which have the potential to change the face of our world today.



Kostas Glinos, European Commission, presents award to Dorte Olesen.

EUROPEAN COMMISSION AWARDS EXCELLENT SCIENCE PRIZE TO GÉANT

GÉANT has received first prize in the Excellent Science category for its entry 'Driving technology across the digital divide'.

Winners were announced at the 10th e-Infrastructure Concertation Meeting, held in March in Brussels. The meeting was organised by the European Commission Services with the support of the e-ScienceTalk project. Its aim was to bring projects together to discuss issues related to the completion of the 7th Framework programme and the start of an e-infrastructures activity during Horizon 2020 (2014-2020).

EXCELLENT SCIENCE

The objective of the FP7 Success Story Competition was to highlight the three best success stories from the FP7 Capacities funding programme in e-Infrastructures.

The Excellent Science category showcased how the project has raised the level of excellence in Europe's science base, making it an attractive location for the world's best researchers. Success stories were used to highlight examples of how the project supported the best ideas, developed talent within Europe and provided researchers with access to priority research infrastructure.

Dorte Olesen, Chair of the GÉANT Assembly and recipient of the award on behalf of GÉANT, said; "It's very pleasing to receive recognition for the project. It is a result of the collaboration of so many talented and dedicated people all over Europe, all with a shared vision of providing the most advanced network and associated services. Being selected as a winner of such a prestigious award is testament to that shared vision and effort."

GÉANT 100GBPS NETWORK UPGRADE UPDATE

Infinera switching equipment:

- Yellow fibres 10Gigabit traffic
- Blue fibres 100Gigabit traffic
- Red fibres 500Gigabit traffic

STAYING AHEAD OF THE DATA DELUGE

By Marian Garcia-Vidondo, Chief Operations Officer, DANTE

The upgrade of the GÉANT infrastructure is due for completion in June 2013, delivering speed and bandwidth above and beyond current requirements. Offering individual users data transfer speeds of 100Gbps, and supporting up to 2Tbps (terabits per second) capacity, this effectively future proofs the network to support research and education data requirements until 2020.

The upgrade began in earnest last year after DANTE awarded contracts to Imtech/Juniper Networks and Infinera to build the next generation of GÉANT, the pan-European research network infrastructure.

Juniper is the supplier of the MX series Universal routers with 100Gbps capability. This infrastructure is underpinned by Infinera's latest DTN-X optical transmission platform designed to provide 500Gbps super-channels across long-haul distances.

GÉANTPLUS SERVICES FOR ALL NRENS

The Juniper implementation started in July 2012 and DANTE has since deployed 35 Juniper MXs in 24 European Points of Presence (PoPs), all the way from Moscow to Lisbon. With this platform all the National Research and Education Networks (NRENS) will have access to GÉANTPlus services.

The GÉANTPlus services provide point to point Ethernet circuits configured either statically or dynamically using Bandwidth on Demand (BoD). They offer the flexibility, reachability (with services extending to the US and other world regions) and quality that major projects require.

The roll out of the Infinera platform began in September 2012 and DANTE has since completed the installation of 15 main sites, where services are handed over to the NRENS, 77 In line Amplifiers sites (ILAs) and over 4,261 km of network infrastructure (8,592 km of actual fibre).

A SCALABLE NETWORK

With the new Infinera platform, DANTE and the GÉANT community are building the network of the future. The next generation of GÉANT is scalable and capable of fulfilling the growing capacity demands of the research community, able to rapidly provision 100Gbps wavelengths and multiplexing lower rates of, for example 10Gbps using OTN (Optical Transport Network) technology.

Quality is also key to delivering critical data, such as that produced by the CERN experiments. With robust management and the expertise of the GÉANT Network Operations Centre, the network will continue to provide the outstanding levels of availability that GÉANT is known for. Together with NIFF/Hungarnet, GÉANT delivered its first 100Gbps connection for CERN's LHC project in December 2012.

With the roll out due for completion in June 2013 we are on track to delivering this major investment in global networking technology. It is an exciting project which supports the important work of the European research community.



DANTE WINS BEST TECHNOLOGY INNOVATION AWARD FOR GÉANT NETWORK

DANTE (Delivery of Advanced Network Technology to Europe) has been awarded 'Best Technology Innovation' for the research and education network GÉANT, in the 2013 Computer Weekly European Awards.

ComputerWeekly
European User Awards Networking

The GÉANT project was recognised for its far-sighted approach to handling the sky-rocketing growth in data generated by European science and innovation. Employing world class solutions using Infinera's new DTN-X platform to meet the ever-expanding requirements for higher speed transmission to support this 'data deluge', GÉANT is able to provide highly resilient terabit networking above and beyond current requirements.

With capacity to handle continued growth in data volumes, GÉANT is continuing to transform the way researchers collaborate, supporting research projects that deliver real societal benefit in a variety of research disciplines such as climate change, fuel and food sources and security, medicine and healthcare.

Computer Weekly judges said: "Being able to deal with the vast volumes of data involved in real (or near real) time requires solid technology and different approaches. The project does a great job of dealing with tomorrow's problems."

Michael Enrico, Chief Technology Officer, DANTE said:

"It is crucial that the GÉANT network has the bandwidth to support the growing data needs of our users. Our current upgrade to 500Gbps (gigabits per second) involves refreshing 50,000km of cabling and replacing all existing equipment with the latest transmission and switching technology. No mean feat. It's fantastic that our endeavours have been acknowledged by the Computer Weekly European Awards and we are always pleased when the potential impact of R&E networks on global science and innovation is recognised."



GÉANT PAVES DATA HIGHWAY FOR NUCLEAR FUSION ENERGY RESEARCH

HIGH-SPEED NETWORK ESSENTIAL LINK IN SEARCH FOR CLEAN, SUSTAINABLE ENERGY

Finding clean, sustainable energy is one of the biggest challenges facing society today. As we scramble for fossil fuel alternatives, energy related emissions still account for an unprecedented percentage of greenhouse gas emissions, a major cause of global warming. With the future of our grandchildren in mind, Europe and the rest of the world is placing innovative alternative energy at the top of the research agenda.



Helios supercomputer - Bull copyright.

There are several promising emerging energy technologies, with opinion leaning towards nuclear fusion. Considered by many as safe and environmentally friendly; on paper it sounds like the perfect energy source. Nuclear fusion could be a real carbon-free energy option for the future, with no radioactive waste or greenhouse gas emissions. The problem is that this promising potential is a very difficult theory to put into practice. But why is this?

What is nuclear fusion?

Nuclear fusion is effectively recreating the same process that powers the sun and the stars. The world's fusion scientists are working to develop the same process, by fusing together light atoms, such as hydrogen, at extremely high pressures and temperatures – hence the term nuclear fusion.

Gas from a combination of types of hydrogen is heated to 100 million degrees Celsius via one method called 'magnetic confinement' – controlling the hot gas (known as a plasma) with strong magnets. A device for this is the 'tokamak' (pictured), Russian for a ring-shaped magnetic chamber.

The results of this technology could one day fuel the power stations of tomorrow.

Data driven science

Data driven research such as this requires the combined processing power of powerful, multiple computers to store, analyse and share scientific data between the many researchers working collaboratively worldwide.

High-speed networks provide the essential link to support this massive global processing power. GÉANT is now paving the data highway in the search for nuclear

fusion energy research with a 10Gbps link to the International Fusion Energy Research Centre (IFERC), in Rokkasho, Japan.

IFERC hosts the Helios supercomputer, a system with a compute power exceeding 1 PFlops and attached to a storage capacity of 50 PB. It is provided and operated by the French Alternative Energies and Atomic Energy Commission (CEA), France and is a Fusion for Energy (F4E) resource.

Industrial demonstration fusion reactor

GÉANT's link connects Helios with scientists involved in ITER (a large-scale scientific experiment that aims to demonstrate that it is possible to produce commercial energy from fusion) and DEMO (the demonstration fusion reactor), follow-on project of ITER. It is hoped that the first fusion plasmas will be generated by 2020, at ITER in Cadarache, France. Once achieved, the DEMO project will hopefully lead to full-scale fusion energy production, which will reach the commercial market in the second half of the century.

Massive data sets

"The combination of major new scientific projects like IFERC and the use of supercomputers like Helios is creating an explosion of data for which we need to be ready. GÉANT's link is a first and crucial step to supporting the data networking needs in the global search for cleaner, sustainable energy and to assist scientists in their ground-breaking work." Roberto Sabatino, GÉANT Business Solutions Consultant.

Via SINET, a Japanese National Research and Education Network (NREN), IFERC is connected to the GÉANT network and European NRENs, like RENATER, DFN, SWITCH, Janet and many others, together supporting the research activities for fusion in Europe.

Europe's vision for sustainable energy

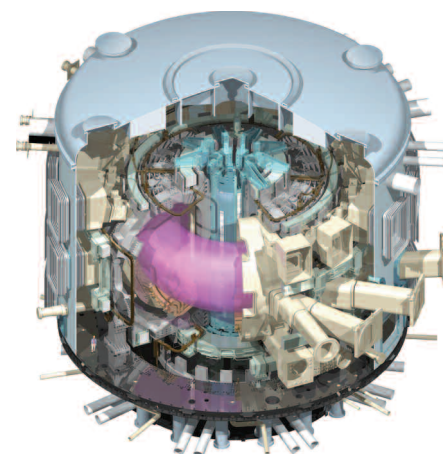
ITER is funded and run by seven international parties – Europe (contributing 45% of the cost), India, Japan, China, Russia, South Korea and the US. DEMO studies are carried out by individual ITER members, and in the case of Japan and Europe, jointly in the IFERC, in the framework of the Broader Approach Agreement. The investment is in line with the EU Horizon 2020 focus to find new solutions to societal challenges, including to secure clean and efficient energy. (This is just one of the aims.) GÉANT is an essential component in driving European ICT.

"Helios users are running codes ranging from fundamental physics in hot ITER plasmas to technology and engineering calculations so as to build components in very challenging environments as expected in DEMO. Supercomputers are crucial in solving these complex problems and good data communication channels such as the high-speed GÉANT network can provide the essential links to help scientists all over the world to analyse their findings. Ultimately, all these initiatives will bring us a step closer to fusion as a potential energy source" Susana Clement Lorenzo, F4E Group Leader for IFERC

Big science reliant on high-speed networks

IFERC joins many other big science projects supported by GÉANT, which are changing the way the world collaborates. For example, CERN's Large Hadron Collider, societal research addressing climate change, disease diagnosis and food security.

Further info on F4E:
<http://fusionforenergy.europa.eu>



Tokamak magnetic chamber

FINAL REPORT FROM ASPIRE FORESIGHT STUDY PUBLISHED

By Cora Van den Bossche,
Communications Officer, TERENA

ASPIRE (A Study on the Prospects of the Internet for Research and Education) provides strategic recommendations to policy and decision makers on topics likely to have a significant impact for the future of research and education (R&E) networking: the adoption of cloud services; the integration of mobile services into national R&E networking organisations' (NRENs) service portfolios; middleware and managing data and knowledge in a data-rich world; the future role of NRENs.

The report recommends that the future development of R&E networking capitalises on the wealth of experience and knowledge acquired by NRENs and

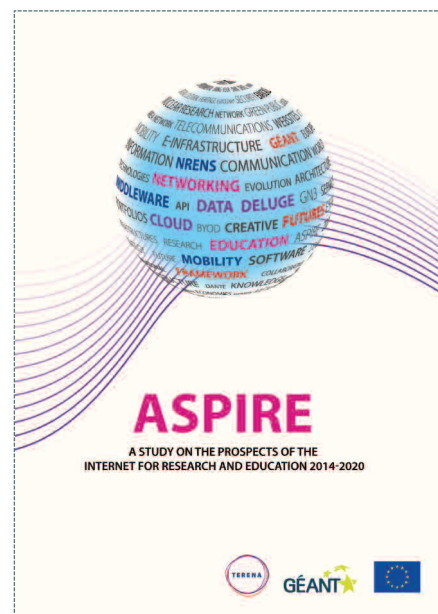
GÉANT to date. Disseminating technical and managerial expertise more widely would support community building.

Many services traditionally delivered by NRENs are now available on the marketplace. The community should therefore collaborate with commercial partners to jointly deliver these services.

The community must lead the way on identity federation policy and systems, a field where NRENs excel. This leadership role is also relevant in developing integrated mass mobile connectivity.

Another goal is to reduce the current governance complexity. The community should expand to include all other publicly funded users. A revised, more streamlined governance model should be implemented, based on the Reykjavik Group's recommendations.

ASPIRE was led by TERENA (Trans-European Research and Education Networking Association) as part of the GÉANT project. The final report and



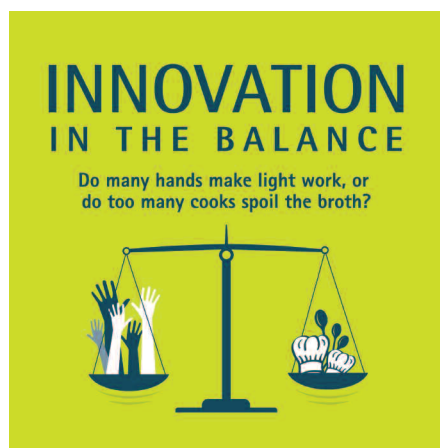
four topic reports can be downloaded from the TERENA website –

www.terena.org/publications.

Print copies can be ordered from the TERENA Secretariat :

secretariat@terena.org.

GÉANT AT TNC 2013



GÉANT is looking forward to its annual participation at TNC, this year hosted by SURFnet in Maastricht, 3-6 June 2013.

The GÉANT panel on "Innovation in the Balance" looks set to cause a bit of a stir. Experts from across the community are getting ready for a lively debate to examine how innovation can be best achieved within the GÉANT project - through collaborative research programmes or by going it alone?

Follow #TNC2013



Don't miss joining in - Wednesday 5 June, 14.00 – 15.30, in Alfa.

GÉANT will also have an exhibition booth with demos and information on the latest services and technology developments, including the chance to see the Infinera technology that the new GÉANT 100Gbps network is built upon.

<https://tnc2013.terena.org/>



FEATURE:

GN3PLUS – NEXT STEP FOR THE
WORLD'S LEADING RESEARCH
AND EDUCATION NETWORK

Over the last four years, GÉANT has delivered a strong portfolio of services and products to the research and education community. This phase - GN3 - ran from 1 April 2009 to 31 March 2013.

Achievements to date include; a new terabit network providing 100Gbps bandwidth to 38 European National Research and Education Networks; a portfolio of services to enhance user experience, increased geographical reach and improved industry collaboration. In combination, these offer a world-class infrastructure, which is influencing global standards in networking.

GN3plus is the next phase in the lifecycle of GÉANT and takes the infrastructure one-step further. With a two-year programme of concentrated effort on innovation and user needs, GN3plus is an ambitious expansion of GN3's successful output, with intensified focus and new developments, such as GÉANT's first Open Call.

The independent EC review of GN3 will take place later this year. Keep an eye out in future issues of CONNECT which will highlight the achievements and lessons learned from the project to date.

For now, we would like to welcome you to GN3plus, which began on 1 April 2013. This latest iteration of the project will embrace many emerging technology and application areas, including cloud services, mobility, test-beds, and Federation-as-a-service.

Seen as playing a vital role in securing Europe's prosperous future, GÉANT aims to reinforce its status as the unified European Communications Commons.

Key Facts	GN3plus
Start date	April 1 2013
Duration	24 months
Total budget	€84,283,018
EC contribution	€41,800,000
Participants	250+
41 Project Partners: 38 NRENs, DANTE, TERENA, NORDUnet (representing 5 Nordic countries)	

By driving knowledge creation and innovation, GN3plus will position GÉANT as the global hub for research networking excellence tomorrow and beyond.

GN3plus aims to:

- Deliver excellent networking services, at the highest levels of operational excellence, to research and education communities, building on GN3's success.
- Support the growth of R&E communities within Europe in both breadth and depth, and expose them to talent elsewhere, providing opportunities to meet across the divides of resources and distance and in so doing transform the way research is done.
- Innovate to meet the needs of the community, and act as a catalyst to translate this into a competitive European ICT sector.
- Research, collect and share knowledge about network technologies and services through cooperation and community collaboration.

INNOVATIVE SERVICE PROVISION

GN3plus will deliver fast and efficient provisioning of advanced services. From developing operational support across management domains, to enhancing security, service integrity and protection of network resources.

Complemented by the development of application services in a federated environment, these initiatives will include mobile and wireless roaming, and supported Authentication and Authorisation Infrastructure (AAI) meta-service environments for individuals in the R&E community.

THE JOINT RESEARCH ACTIVITIES - DRIVING INNOVATION

The Joint Research Activities (known as "JRAs") will focus on investigating new technologies and service trends, which will influence the future development of networking services required by the global R&E community.

Research into service provisioning and management will give users enhanced control over the network and service stack. This will include very active participation in global interoperability/standardisation developments. For instance; Software Defined Networking (SDN), virtualisation, Network-as-a-Service (NaaS) and Networking Standards Interface (NSI). These will contribute to international initiatives, such as the International Network Development and Deployment Initiative (iNDDI) and OpenNaaS.





GN3plus aims to spearhead technological innovation, developing new products and services through requirements-based R&D, with the Open Calls and Public Private Partnerships potentially presenting new opportunities to work with industry and academia.

THE SERVICE ACTIVITIES – SUPPORTING USER NEEDS

In order to better support the users' needs, the project will build on the GÉANT “eco-system” through development and delivery of a world-class networking service portfolio.

Through the Service Activities (known as “SAs”), the GÉANT portfolio will expand to include new areas of value to the R&E community, encompassing flexible connectivity options and test-bed facilities across the network. This will offer robust support and performance expertise; and advanced AAI, cloud and mobility services, to give end users, their projects and institutions secure access to the network, with the resources they need.

THE NETWORKING ACTIVITIES – EXTENDING OUTREACH AND FOSTERING PARTNERSHIPS

The Networking Activities (known within the project as “NAs”) will provide management and targeted outreach support for all GN3plus activities, including internal and external communications, product marketing and business development initiatives.

HELPING USERS CHANGE THE WORLD

Together with Europe's NRENs, GÉANT reaches over 50 million users in over 10,000 institutions across Europe, including universities, higher education institutes, research institutes, libraries, museums, and hospitals. The network also connects primary and secondary schools in many European countries. In addition, via extensive global links, GÉANT reaches a further 65 NRENs beyond Europe.

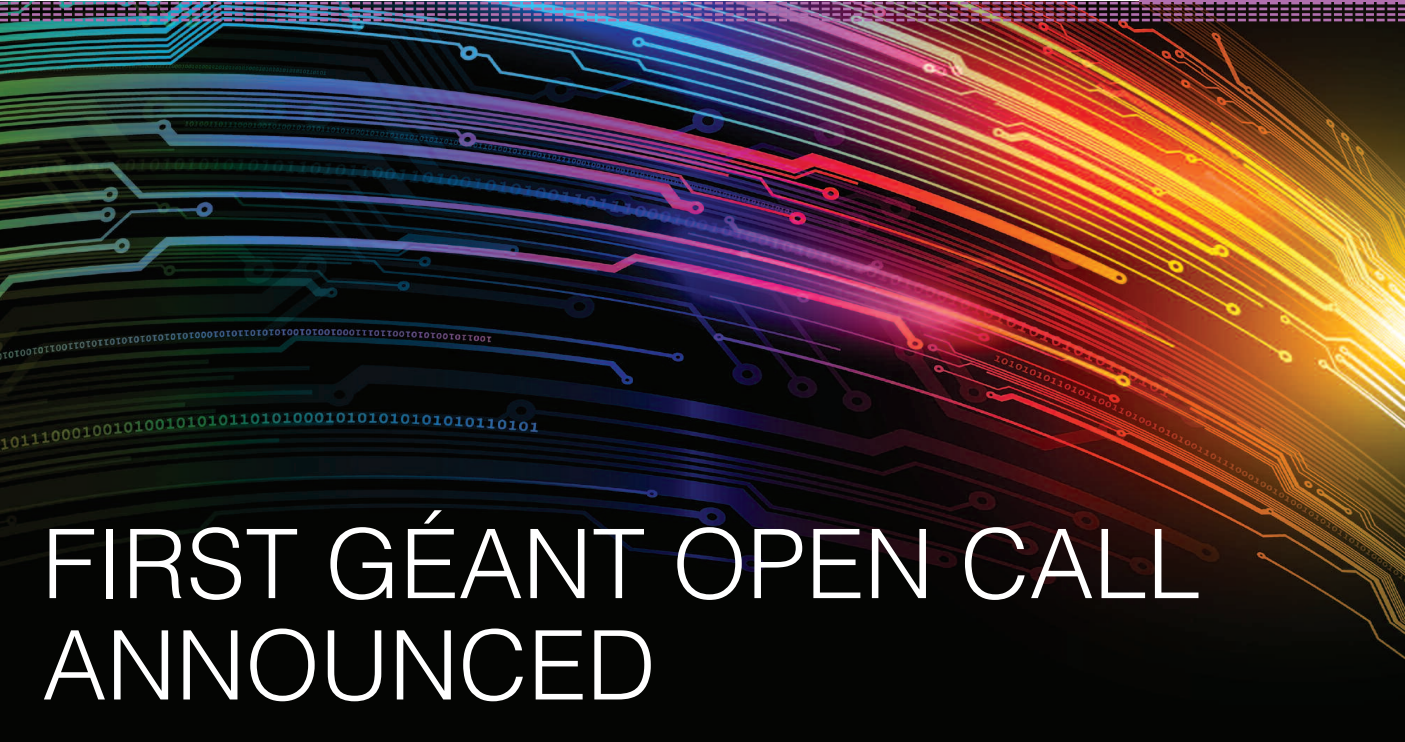
Nearly all scientific disciplines are now generating an ever-increasing volume of data in their research. The 100Gbps GÉANT network - due for completion in

June - will be vital to support this data deluge. Global scientific collaborations rely on new database and analysis tools and instruments, supporting every aspect of scientific research in physics, astronomy, biology and more.

COLLABORATION AT HEART OF GÉANT SUCCESS

Praised for its collaborative approach, the success of GÉANT so far is thanks to the close working relationships of its partners, and the teamwork within and between the Activities. GÉANT remains a complex and large project; with over 250 participants from 41 partners working in one of fourteen Activities. These cover 'Support to Clouds', 'Network Architectures for Horizon 2020' and 'International & Business Development' amongst others. And, as part of the new Open Calls initiative, GÉANT will also be working more closely with industry.

Collaboration is the cornerstone of GÉANT, delivering high bandwidth and flexible, secure networking services to research communities across Europe - and increasingly beyond.



FIRST GÉANT OPEN CALL ANNOUNCED

€3.3 MILLION EUROPEAN COMMISSION FUNDING FOR MULTI-DOMAIN NETWORK R&D ACTIVITIES

On April 1, GÉANT issued its first competitive Open Call for additional beneficiaries to carry out Multi-Domain Network Research and Development activities.

ENABLING INNOVATION

The GÉANT Open Calls are structured around three key themes:

- **Theme 1:** Research and Technological Development (RTD) users/use cases/projects to make use of existing GÉANT production and experimental network facilities.
- **Theme 2:** Self-contained utility packages of work that can be used by the on-going RTD work programmes in GN3plus.
- **Theme 3:** RTD to promote, develop and demonstrate Innovation in a Multi-Domain Research and Education Networking Environment.

Activities will be partly funded rather than fully funded, in alignment with the funding schema defined for

research activities by the European Commission (up to 75% of direct costs).

Full details of how to submit a proposal can be found at:
<http://www.geant.net/opencalls>.
The deadline for submissions is 29 May, 2013.

ENABLING BETTER AND FASTER COLLABORATION

GÉANT's role is seen as vital to boosting Europe's competitiveness by enabling better and faster collaboration between research teams worldwide. The GÉANT network provides the essential bandwidth to support all scientific disciplines, such as those addressing societal challenges such as ageing populations, disease diagnosis and climate change, to big science projects such as high-energy physics and deep space research.

"In order to meet the needs of the R&E community we must maintain excellence in innovation. Our first Open Call opportunity reflects our commitment to GÉANT's users and our vision for GN3plus. The goal for which is to drive knowledge creation and learning in Europe, by delivering world-class connectivity and services.

We are appealing to the best and brightest minds. We hope to hear from partners with early-stage research projects that could lead to breakthrough networking technologies. This is a fantastic opportunity to work with the world-class GÉANT network and help promote the unimpeded movement of scientific knowledge."

DANTE CTO, Michael Enrico

TOWARDS THE CLOUDS, TOGETHER



CLOUD SERVICES AND GÉANT

By Karl Meyer, Product Marketing and Communications Officer, DANTE

Cloud computing and cloud services in particular, offer the research and education (R&E) sector huge opportunities to both maximise effectiveness and reduce the capital investment and development time for projects.

Cloud Services offer the R&E community a number of key benefits:

- Reduced capital costs
- Reduced support costs
- The ability to leverage purchasing power across the community
- Easier remote access for collaborative projects and users
- Scalability

By utilising shared and off-the-shelf services for commodity activities, the R&E community can refocus its design, development and support resources into fields that cannot be easily provided by the commercial sector.

CLOUD SERVICES AND THE R&E COMMUNITY

In recognition of the huge potential benefits of cloud services to the R&E community and the need for a coordinated approach, GÉANT has started a major new service activity, Support to Clouds. This service aims to help National Research and Education Networks (NRENs) to bring cloud services to their users.

GÉANT will help the community to select, purchase and manage cloud services with the right conditions of use; amongst them topics like interoperability, data portability, security and privacy.

The activity works with NREN partners to identify existing successful cloud services (either built by the NRENs or brokered for their national audience) and scale these up to the wider European community.

In addition, GÉANT will work with established and emerging commercial operators to find the best way to offer their services to the community. To reach these goals, the Clouds service contains specific tasks dealing with cloud strategy; cloud standards and interoperability; cloud brokerage and vendor management and cloud integration.

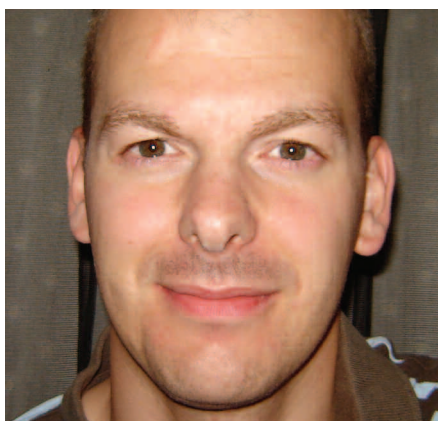
To help NRENs achieve the benefits of cloud services the Cloud team will focus on the following five areas:

- **Cloud strategy:** developing a common strategy based on community requirements, shared principles and values; knowledge dissemination and information exchange.
- **Cloud standards and interoperability:** creating policies, rules and best-practices to establish standards and help ensure interoperability and effectiveness.
- **Cloud brokerage and vendor management:** by aggregating demand across the community and negotiating integrated brokerage and service delivery (framework contracts, terms and conditions of use) NRENs will be able to get the best possible value from cloud services.

- **Cloud integration:** Cloud services radically change the data requirements of users and ensuring consistent performance and reliability will require enhancing the integration between GÉANT and the NRENs
- **Mobile data service:** the combination of mobile access and cloud services offers huge opportunities and so Support to Clouds will have an area of work targeted at providing mobile data network capabilities to GÉANT and NRENs, which suit the needs of education and research.



Many NRENs are already offering valuable services using Cloud providers. SUNET in Sweden has successfully integrated Box (www.box.com) into its offerings to provide a simple to use Cloud Storage service to staff and researchers. By linking Box to SWAMID (the identity federation for higher education in Sweden) the creation and management of accounts is greatly simplified and allows for easier control. By February 2013, SUNET had 17 organisations, with nearly 5000 users and approximately 9TByte of stored data using the service.



MEET THE CLOUD SERVICES ACTIVITY LEADER - ANDRES STEIJAERT

Andres Steijaert is the activity leaders for the GÉANT Support to Clouds Activity. At SURFnet, as member of the SURFnet-taskforce Cloud, he initiated and directed the cloud brokerage and vendor management activities. Previously he worked as program manager on the development of the SURFconext collaboration infrastructure; a middleware framework which interconnects cloud vendors and higher education organisations in the Netherlands. Andres is a frequent speaker on cloud computing.

ANNOUNCING OPENFLOW COMPETITION RESULTS

GÉANT OpenFlow is the next generation of Software-Defined-Networking (SDN) for improved performance and flexibility. The OpenFlow testbed allows network configurations at the software level allowing users to virtualise the core infrastructure. Researchers can now experiment with new communications protocols across a high capacity international network with a dedicated "slice" of the network.

A competition to find the first user project was launched earlier in the year. Entries covered everything from Future Internet to OpenFlow technology research and development, and originated from a wide range of academic research teams, as well as National Research and Education Networks (NRENs).

In February, MTA-BME Future Internet Research Group in the Budapest University of Technology and Economics (Department of Telecommunications and Media Informatics) were announced as the winners.

The team has an extensive track record of scientific achievements in internet architectures and network management. They will be using OpenFlow to research network resiliency at the transport layer, utilising the capabilities of the testbed to provide edge-disjoint routes on top of a network core. The research aims to eliminate concurrent resiliency mechanisms at the physical, transport and network layer and associated complexities/costs.

The facility provides a particularly good example of how to exploit the unique capabilities of OpenFlow by providing a realistic environment to measure resilience mechanisms and convergence times.

The outline results of the MTA-BME work will be published in a later edition of CONNECT.

More information on the competition: http://www.geant.net/Pages/openflow_competition.aspx

GÉANT OPENFLOW AT OPEN NETWORKING SUMMIT 2013

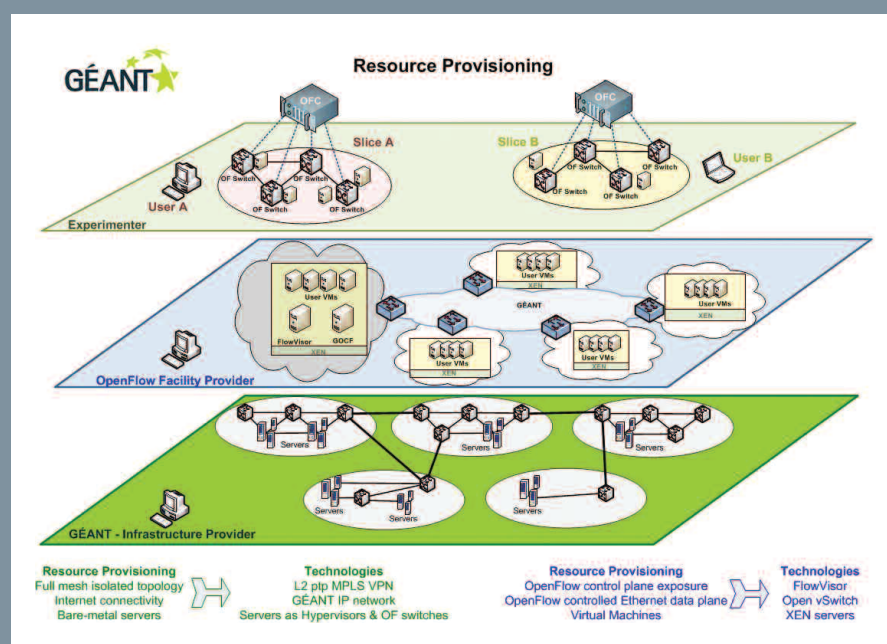
In April, GÉANT gave a demo at the Open Networking Summit 2013 (ONS 2013) in Santa Clara, one of the most recognisable SDN/OpenFlow events globally. Created by the founders of SDN it is a non-profit summit which shares and explores key developments and deployments in OpenFlow/SDN activities.

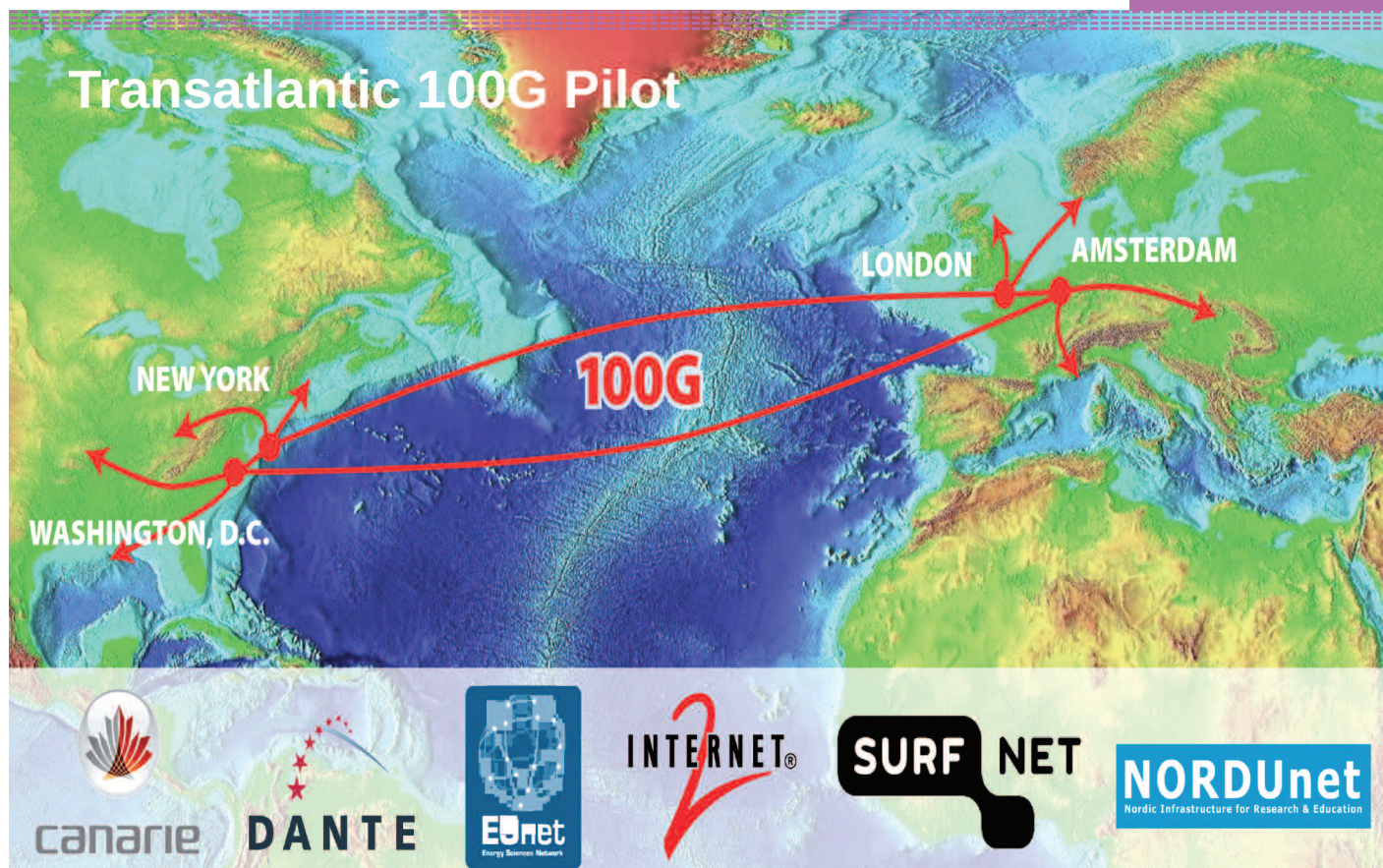
The demo featured GÉANT's OpenFlow provisioning capabilities, and the research results of the MTA-BME Future Internet Research Group (winners of the OpenFlow competition).

Audiences at the event were taken through the visualised impact on TCP traffic when traditional resilience mechanisms are enabled (at the optical and IP layer) and able to compare it with the performance achieved when path diversity and OpenFlow-directed flow routing across GÉANT PoPs are introduced.

The demo provided a show-case for how researchers can benefit from a real-world OpenFlow-enabled facility in real

time and how its capabilities can be steered to leverage research in wide-area environments.





GÉANT AND PARTNERS TO BUILD WORLD'S FIRST 100G INTERCONTINENTAL TRANSMISSION LINKS FOR RESEARCH AND EDUCATION COMMUNITY

Pioneers invite commercial sector and others to advance global networks

On 24 April, it was announced that six of the world's leading research and education (R&E) networks intend to build the world's first 100 gigabits-per-second (Gbps) intercontinental transmission links for research and education.

Leaders from Internet2 (USA), JNORDUnet, (Nordic countries), ESnet (U.S. Department of Energy), SURFnet (Netherlands), CANARIE (Canada), and GÉANT (Europe) made the announcement at the 2013 Internet2 Annual Meeting before 800 technology, education and research leaders.

They will create a public-private partnership with the commercial sector, such as equipment vendors and carriers active in the North Atlantic, to advance global networks for research and education.

National research and education networks (NRENs) and their constituencies from around the world are invited to participate in the project, titled the "Advanced North

Atlantic 100G Pilot" or ANA-100G. The goal is to stimulate the market for 100 Gbps intercontinental networking and to advance global networks and applications to benefit research and education.

In the past year, many NRENs around the world have upgraded to 100 Gbps transmission speeds. But until now, intercontinental network links have not followed suit. ANA-100G will accelerate discovery in data-intensive science disciplines such as high-energy physics, radio astronomy and genomics, as well as spur development of revolutionary new networking applications and architectures.

The six leaders will test the new transmission links, applications, resources, monitoring techniques and advanced technologies such as software-defined networking, between as many as four open exchange points, including MAN LAN in New York City and NetherLight in Amsterdam. These efforts will help determine the operational requirements needed to effectively run

100 Gbps wavelengths between North America and Europe.

DANTE Joint General Managers Matthew Scott and Niels Hersoug commented on behalf of GÉANT,

"We welcome this opportunity to collaborate in trialing 100 Gbps capacity across the Atlantic and support our NREN partners and their users. As R&E collaboration becomes increasingly global the huge increases in transatlantic data transport requirements mean that it is not sustainable operationally to continue at multiple 10Gbps connections.

It is imperative that R&E networks work together – and quickly – to push the envelope of networking technology and deliver economies of scale as well as seamless global connectivity."

Read the full story: <http://www.geant.net/MediaCentreEvents/news/Pages/first-transatlantic-link.aspx>



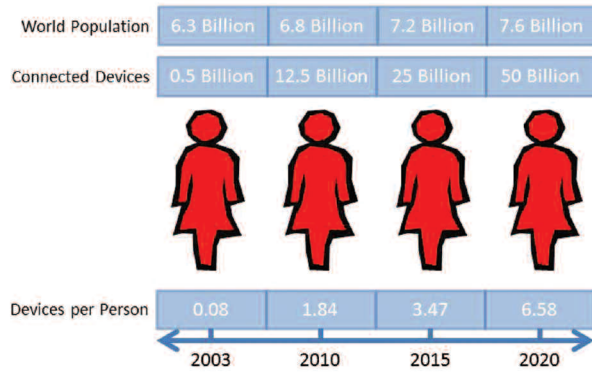
THE FUTURE INTERNET INITIATIVE

DRIVING THE FUTURE OF THE CONNECTED WORLD

Over the past 20 years, the internet has provided a sea-change in the way that the majority of Europeans work, connect and collaborate.

From the early days of dial-up modems and connection speeds of less than 5Kbps to the current generation of always-on, multi-megabit, mobile enabled connectivity; the internet is virtually un-recognisable.

As the technologies have developed, the networks and the applications have changed radically. As the number of tablets, smartphones and, most importantly, semi-autonomous wireless devices grows, the number of systems connected to the internet is greater than the number of people on the planet.



Growth of Internet Connected Devices - Source CISCO

The European Commission (EC) predicts that by 2015 there will be 25 billion wirelessly connected devices globally – more than three devices for every person. By the end of 2012, Cisco estimated the data volumes from all these devices reached 885 petabytes (885 million gigabytes) per month.

This increase in user numbers and data volumes is anticipated to escalate as newer technologies arrive. The so-called Internet-of-Things (IoT) will drive a large proportion of this growth which will see more and more autonomous devices connected to the internet. These range from traffic lights and bus stop signs, through to stress sensors on buildings, bridges and wind turbines. These devices will report on their status and their surroundings, managing many aspects of the environment without human interaction.

So how can the technologies that created the first public internet cope with such a

huge increase in user numbers and data speeds and volumes?

In an 'always on' world with multi-megabit connectivity, and a proliferation of wired and wireless infrastructures, how can a network designed around error prone dial-up analogue phone lines cope?

This is where the Future Internet Initiative comes in. FII is an umbrella activity which encompasses a range of projects funded by the EC under the Seventh Framework Programme (FP7). It aims to bring together public and private organisations across Europe on a wide range of activities ranging across all aspects of the Future Internet. From development of smart sensors in the healthcare sector to large scale projects investigating the shape of networking technologies (such as OpenFlow), FII projects cover the full spectrum of usage and technology.

The issues facing the internet are huge – from simple IP addressing and data

bandwidth through to the need to allow all these diverse devices to interact and interoperate securely and reliably. The participants in the FII have the joint challenges of finding solutions to tomorrow's requirements whilst building a structure that has the flexibility to cope with the unknown future direction of the internet.

In total there are 43 separate projects working under the FII banner with 47 universities and research institutes participating alongside 105 other organisations. Nearly a third of the facilities are based within universities or research institutes, with the remainder in Commercial or Government facilities. Just as researchers within CERN are widely credited with inventing the WorldWideWeb, the new technologies that will power the Future Internet may emerge from these European projects.

Both GÉANT and the NRENs have the opportunity to contribute hugely to the Future Internet Initiative both at the practical level, providing the infrastructure for universities and institutes to collaborate; and through the development of testbeds such as OpenFlow, a platform to test out these exciting new technologies.

In future issues of CONNECT we'll be looking at how the FII is developing with insights into the shape of the Internet to come.

For more information on the Future Internet Initiative go to <http://www.future-internet.eu/>

GÉANT AND THE NRENS HELPING TO DEFINE THE NEXT GENERATION OF NETWORK TECHNOLOGIES

As the volume of data and devices on the internet increases rapidly, there is a need to investigate new networking paradigms to support them. Testing new protocols and software under high capacity and high bandwidth conditions is extremely difficult and expensive, so "virtual network" testbeds are crucial.

The FEDERICA project (Federated E-infrastructure Dedicated to European Researchers Innovating in Computing network Architectures) is a two-and-a-half-year European project to implement an experimental network infrastructure for trialling new networking technologies.

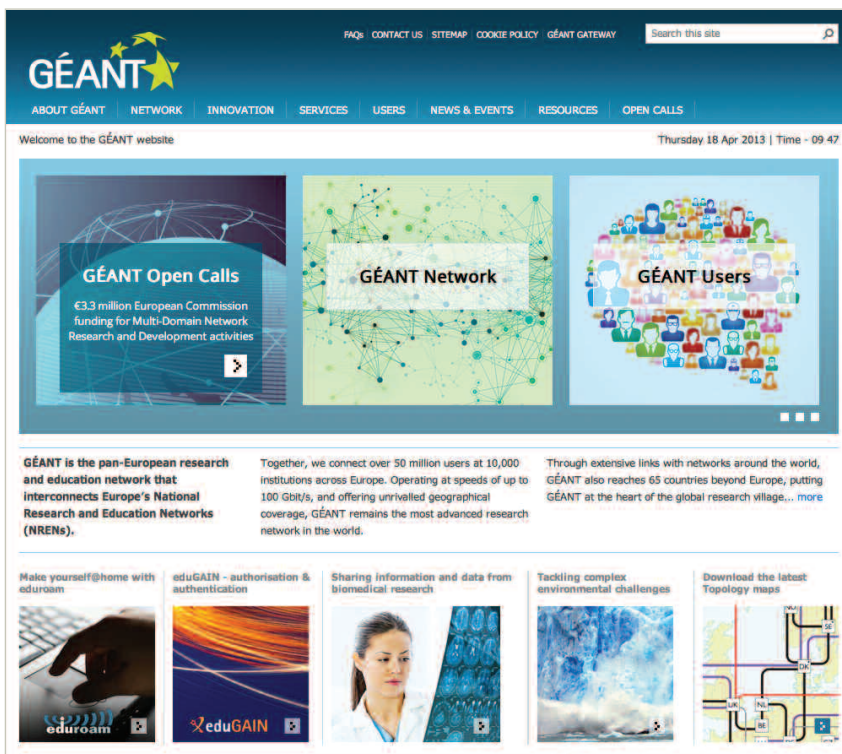
By creating a "technology agnostic" infrastructure, FEDERICA is based upon Gigabit Ethernet circuits, featuring transmission equipment and computing nodes capable of virtualisation. This allows users to host experimental activities on new internet architectures and protocols.

The network runs across the multi-gigabit GÉANT network. Circuits are terminated in Points of Presence (PoPs) of the participating NRENs, which host FEDERICA nodes capable of virtualising hosts, e.g. open source routers and end nodes.

Virtual slices of FEDERICA's infrastructure can be allocated to for testing, even with disruptive experiments within a large production substrate. Internal project research is focused on understanding and producing initial solutions for monitoring, management and control of parallel virtual networks in a multi-domain environment.

For more information, go to <http://www.fp7-federica.eu/>

NEW LOOK FOR GÉANT WEBSITE

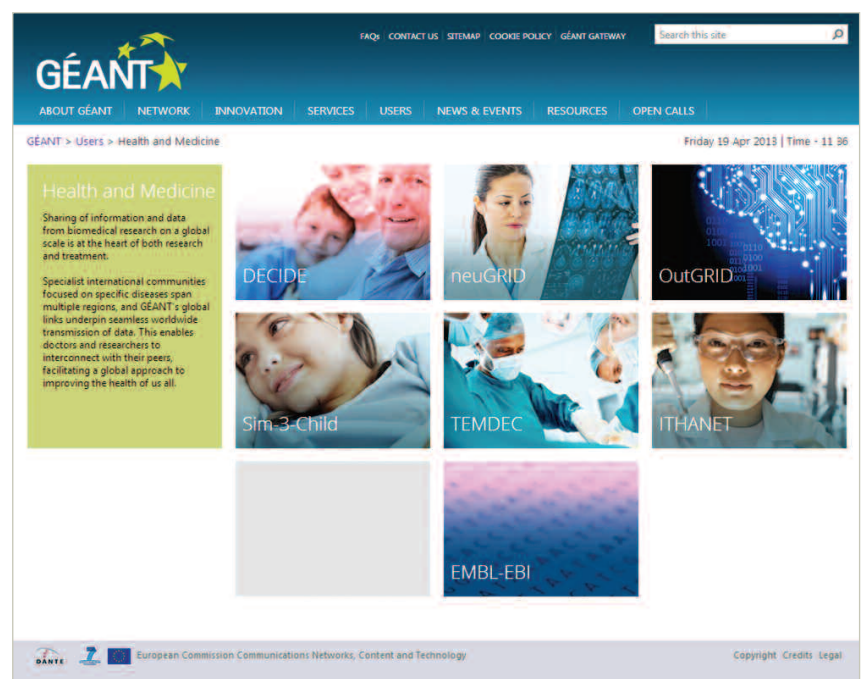


BRIGHTER,
FRESHER AND
EASIER TO
NAVIGATE;
THE NEW
GÉANT WEBSITE
IS HERE!

Updated to coincide with GN3plus, the GÉANT website is a great place to learn more about the network and how it helps over 50 million users at 10,000 institutions across Europe.

Check back regularly for up-to-date GÉANT news and events, services, case studies and the digital version of CONNECT magazine.

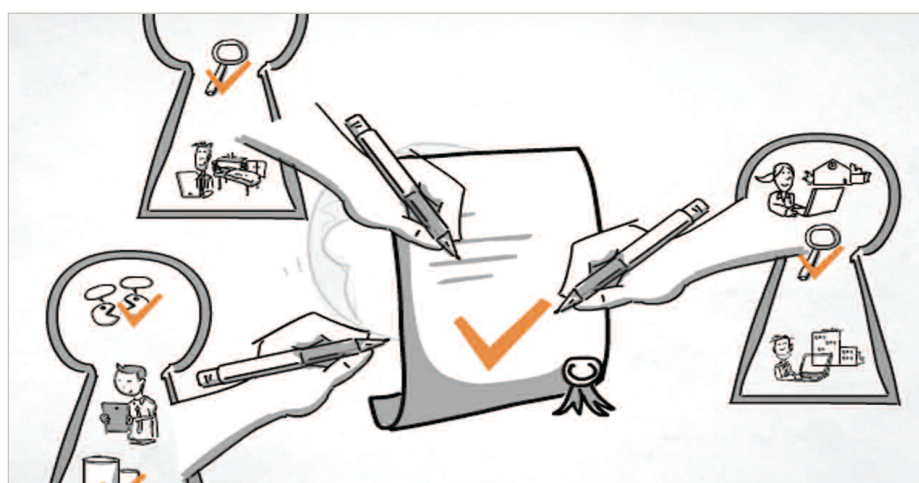
www.geant.net



eduGAIN

HELPING TO CONNECT RESEARCHERS WITH THEIR SERVICES

By Brook Schofield, eduGAIN Task Leader



Students and researchers need access to research and education (R&E) services and content hosted across many countries in Europe and beyond. The GÉANT eduGAIN inter-federation service enables easier access to resources by bringing together the identity federations of participating NRENs and helping to overcome barriers between their differing Authentication and Authorisation Infrastructures (AAI), with which they validate users.

When a user accesses an online service using their trusted 'federated' identity, the service requires some information about the user and whether the R&E institution that provided his identity authenticates him as a trusted user. To support their access control requirements, some services require only simple information, such as the fact that the user is a student, while others need more information, for example to be able to personalise the service.

By processing a user's personal data, a service is subject to the European Union's Data Protection Directive.

The challenge for an identity-providing organisation is to ensure that its users' data is sufficiently controlled and protected. The R&E community's federated environment is too vast to support bilateral agreements between organisations across different federations.

To help organisations and students simplify authentication and access eduGAIN offers a service that allows participating identity and service providers to co-operate easily and securely.

EDUGAIN VIDEO HIGHLIGHTS BENEFITS

To help identity federations highlight the benefits of inter-federating through eduGAIN, a promotional video has been created for them to re-brand and use to encourage Service Providers and identity-providing institutions to join. It emphasises the collaborative nature of inter-federation through eduGAIN and the agreements that underpin the service.

The video can be viewed here:
<http://edugain.geant.net>

GÉANT DATA PROTECTION CODE OF CONDUCT

The GÉANT Data Protection Code of Conduct has been developed to meet the Data Protection Directive's requirements in the context of inter-federated identity management. It balances the risk of information sharing and the ease with which it enables collaboration. The Code defines behavioural rules for Service Providers that want to

receive enhanced user information, and gives confidence to identity-providing organisations about the use of their users' information.

The policy and technical requirements needed to support the Code of Conduct are being validated through a public consultation and proof-of-concept pilot that involves a

multi-national team of federations and CLARIN - a pan-European research infrastructure project.

Work continues to have this Code of Conduct validated by the necessary data protection working groups and to expand the Code's coverage to a global audience.



eduCONF

EXPANDING REACH WITH VIDEO

In an era of increasing collaboration, the need for students and researchers to communicate with each other is growing dramatically. Videoconferencing offers the ability to arrange meetings quickly and easily without the time and expense of travelling from site to site.

To support this growing need for videoconferencing, GÉANT has developed the eduCONF service. eduCONF promotes higher quality video-conference experience within the academic world by providing a set of services and tools for NRENs, Institutions and end users. The aim of eduCONF is to provide users with confidence that they can find a video-conferencing facility that will work for them on the first attempt and without the need for expensive IT support. EduCONF certifies NRENs and rooms to assure quality and provides a directory to help users find a nearby room quickly and easily.

BEING PART OF EDUCONF – GET CONNECTED

In order to experience eduCONF benefits, NRENs must follow the certification Program and certificate their Videoconference Services and Infra-structure. This will enable NRENs to certify rooms within the country and provide quality service to the research and education community.

The eduCONF team has developed a set of tools to help NREN VC Managers and Room Managers to diagnose and handle common problems. Once registered, you will be able to access a range of diagnosis, monitoring and configuration tools to enhance the

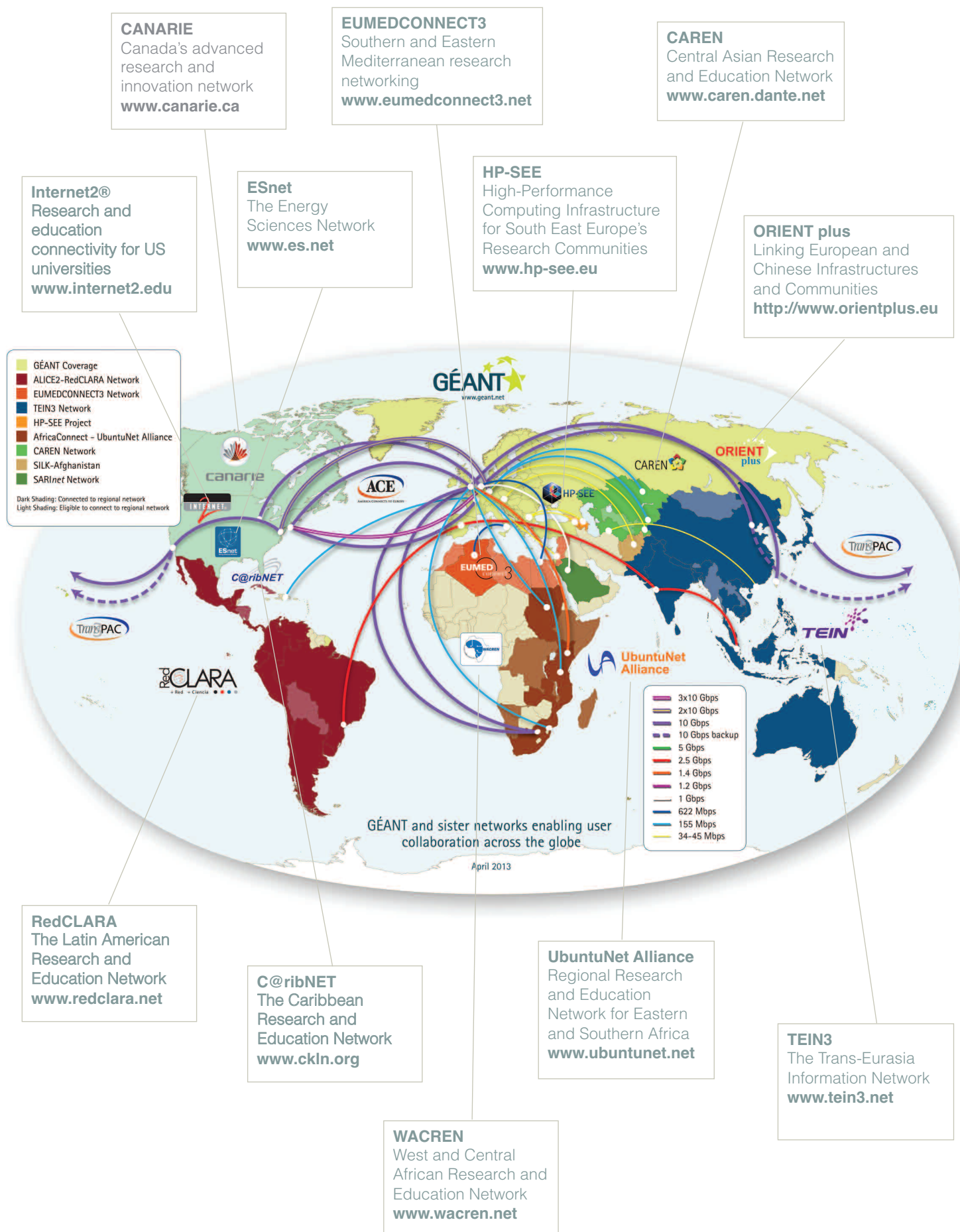
service to users. These tools provide early alerts, infrastructure status and creating statistics about reliability and usage. This gives NRENs much more information about the service they provide to help support and development of the service.

December saw the start of certification in AMRES, CARNet, FCCN and PSCN and the more NRENs that join the greater the value and benefits that users will see. For more information on the benefits of eduCONF and how to get your NREN certified, visit eduCONF.geant.net.

“An important task for an NREN like us is to provide our user community with the new tools which are at the forefront of technology and make a real difference to their work. eduCONF offers new opportunities and maximizes the return on our investment in Video conference facilities”.

Tim Boundy; Applications Development Team Manager, Janet

For more information on the eduCONF service or to find a room visit <http://eduCONF.geant.net>



GLOBAL NEWS

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

EGYPT RE-JOINS GLOBAL R&E NETWORKING COMMUNITY

Egypt has recently reconnected to the international R&E networking scene with a 622-Mbps link to GÉANT (Alexandria - Amsterdam).

The organisation representing Egypt is ENSTINET which provides NREN services for Egypt's science and technology research. International collaborations with Egypt are expected to benefit significantly from this step. Previously, Egypt had been connected through the EUMEDCONNECT project, but this had ceased following the events of the Arab Spring.



ASREN A STEP CLOSER TO SETTING UP A PAN-ARAB R&E NETWORK



Following its announcements at the e-AGE 2012 conference in Dubai last December (as reported in the last edition of CONNECT), ASREN (the Arab States Research and Education Network) has now taken first concrete steps towards becoming a network provider in its own right. In a recently published report, ASREN has reviewed the status of e-Infrastructures in the Arab world and highlighted the need to develop a regional R&E network (the report is available from http://www.eumedconnect3.net/Media_Centre/Pages/e-infrastructures-report.aspx)



Now, with its technical planning underway, ASREN has acquired its first IPv4/IPv6 address space and its Autonomous System number (AS199354) for its pan-Arab regional network. This marks the first concrete

step of securing long-term sustainability of e-Infrastructures in the Mediterranean and the neighbouring Gulf region.

To find out more about ASREN, please visit www.asrenorg.net

FIRST-EVER BACKUP AGREEMENT FOR R&E TRAFFIC AROUND THE GLOBE



Signing of the back-up agreement (from left to right): James Williams (TransPAC3), David West (ORIENTplus), Jiangping Wu (CERNET) and Dave Lambert (Internet2).



Vital research collaborations involving China, Europe and the United States will be safeguarded through the first major agreement among partners running the two main high-speed R&E internet routes across Asia, Europe and North

America. By agreeing to provide reciprocal backup services via a ring of 10 Gbps connections around the globe, the organisations involved will maximise connectivity and provide a stronger, more resilient service to researchers as they work together on major projects and share growing volumes of data.

ORIENTplus, Internet2, TransPAC3 and CERNET signed the agreement last month at the TIP2013 Conference in Hawaii, which involved more than 450

international technology leaders. This partnership reflects the recognition among national and regional R&E networking organisations that a collaborative approach is the most effective way to meet the needs of an increasingly global user base.

To read more about this great example of collaboration between network providers, please visit <http://www.orientplus.eu/node/38>

SINET AND GÉANT INCREASE CONNECTIVITY



Collaboration between Japan and Europe on projects such as ITER and the LHC is increasing the amount of traffic which regularly needs to be transferred between Japan and Europe.

To date, direct connectivity between SINET and GÉANT has been provided by a 10Gbps peering at MAN LAN in New York, in addition to the capacity between Europe and Asia provided by the TEIN interconnection with GÉANT. However, to cope with the increased capacity requirements in prospect, GÉANT and SINET implemented a second 10Gbps interconnection at the WIX internet exchange in Washington

DC at the end of March 2013. As well as providing for the ITER project and enabling collaborators in Japan to connect directly with the LCHONE network, the new peering will provide additional capacity for general purpose traffic between Japan and Europe.

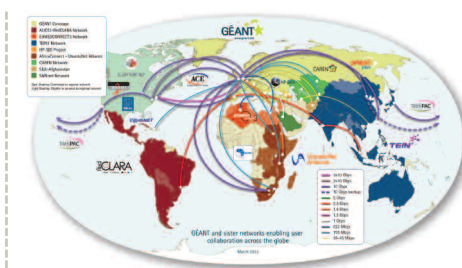
For more information on SINET, visit: <http://www.sinet.ad.jp>

GLOBAL CONNECTIVITY WEBPAGES - UPDATED

To coincide with the launch of the GN3plus project and the new GÉANT website, the Global Connectivity webpages on the GÉANT website have enjoyed a face-lift. The global connectivity webpages provide an up-to-date summary of GÉANT's global connectivity and the regional networks they connect to. The use of global connectivity is described in a section on

Global Collaboration Case studies. In addition, the new global site includes greater focus on the end user, describing the benefits provided by global connectivity and providing useful contacts for anyone with queries about national, regional or global connectivity.

To visit the new Global Connectivity webpages, visit: <http://global.geant.net>



C@RIBNET IS LAUNCHED TO THE SOUND OF STEEL DRUMS



Remote participants collaborate at master class

A master class in steel-drum-playing, involving Caribbean musicians and remote participants from the United Kingdom and the United States, provided the back-drop for a memorable launch ceremony for the Caribbean Research and Education Network, C@ribNET on 26th February 2013 at the University of Trinidad and Tobago's Academy of Performing Arts. With EC funding of €10 million, C@ribNET provides connectivity in the region, and to the rest of the global R&E networking community through links to GÉANT, RedCLARA and Internet2, enabling the Caribbean R&E community.

Witnessed by participants from CARICOM, the European Commission, the International Development Bank, GÉANT, Internet2, RedCLARA, the UbuntuNet Alliance, and the Minister of Tertiary Education and Skills Training in Trinidad and Tobago, the launch event demonstrated that the Caribbean is now a full member of the global R&E networking community, enabling Caribbean researchers and academics to collaborate with their peers around the world, and reduce the digital divide in the region.



For more information on CKLN (Caribbean Knowledge and Learning Network) and C@ribNET, visit: <http://www.ckln.org/home/content/cribnet>



Q&A

ORIENTPLUS: BOOSTING EU-CHINA COLLABORATION

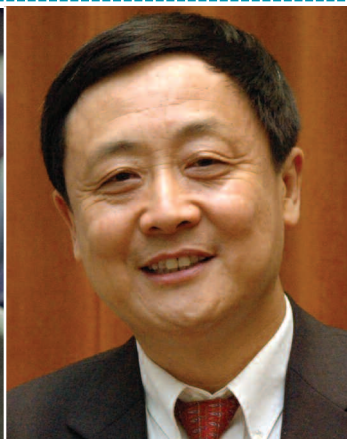
Between 2007 and 2010 the ORIENT project provided the first direct high-capacity Internet connection for research and education between Europe and China. Now in its second phase – ORIENTplus – the link has recently been upgraded to 10 Gbps, offering the shortest and fastest data communications route between the GÉANT and Chinese research networking communities, enabling innovative EU-China research and education collaborations to flourish. CONNECT caught up with project representatives in both regions and asked them what ORIENTplus means for scientists, academics and NRENs at both ends of the link.



DAVID WEST
DANTE, PROJECT MANAGER
ORIENTPLUS



CHRISTIAN GRIMM
DIRECTOR DFN, CHAIR
ORIENTPLUS STEERING
GROUP



JIANGPING WU
DIRECTOR, CERNET CENTER



KAI NAN
DIRECTOR, CSTNET

WHO IS BEHIND ORIENTPLUS?

DW: ORIENTplus was born out of the successful ORIENT collaboration between Europe and China. Through the planning and operation of ORIENTplus the relationship has further developed. We now have both major Chinese research and education networks, CERNET and CSTNET, fully involved in the project. We also have 9 European NREN partners*, though all European NRENs are connected via GÉANT, and DANTE is co-ordinating on behalf of the EU and Chinese partners. Operational management is jointly coordinated by the GÉANT and CNGI-6IX NOCs. The project is absolutely a partnership of equals between Europe's and China's NRENs - committed to work together to provide world class e-Infrastructure for world class collaborative research. The project receives financial backing from the EC's FP7 programme and from the Chinese government as well as from the NREN communities.

JW: CERNET was the Chinese partner in ORIENT and connected CSTNET in China. CERNET is very pleased CSTNET has become a full partner in ORIENTplus. The equal funding and project responsibility from China and Europe symbolises the shared commitment of both sides.

AREN'T 10 GBPS CONNECTIONS COMMONPLACE THESE DAYS? WHAT MAKES THIS UPGRADE SO SPECIAL?

CG: Not at all! I agree we have 10 Gbps in the European GÉANT footprint and on our links to the US. This is why most Internet traffic to Asia still goes the long way round, via the US and through the Pacific. But with ORIENTplus we now have a direct link between Europe and China which goes overland through Siberia. Unfortunately, this comes at a cost which is why we sought EC and Chinese government funding support. But it has the great advantage of being the only high-capacity connection between Europe and China using the shortest route available – a must-have for many data-intensive and time-critical research applications.

The upgrade from 2.5 to 10 Gbps was clearly needed to keep pace with the increased user demand we are seeing. To illustrate how capacity to China has grown I may recall that ORIENTplus evolved from a direct 2Mbps peering between the UK and China to a high-speed inter-regional link over a thousand times that capacity. Not to mention that in DFN we celebrated a 64kbps link between Germany and China less than 15 years ago.

JW: But ORIENTplus is more than just a link with huge capacity. Thanks to good co-operation between CERNET, TransPAC3, and Internet2, and ORIENTplus there is now also an integral element of “around the globe” connectivity support. A recent mutual back-up agreement between the four partners guarantees network reliability and resilience by automatically re-routing the traffic via the US in the event of any outage. I believe this is the first-ever global back-up partnership and a great example of collaboration between network providers.

WE UNDERSTAND THIS LINK IS OPERATED IN HYBRID MODE. WHAT ARE THE ADVANTAGES OF THAT?

CG: Indeed. The hybrid nature of the link means that it can carry both IP and point-to-point traffic. It will allow us to deploy tools and services, such as Perfsonar MDM, eduroam and dynamic point-to-point links. In addition to the upgraded link capacity, this will give us adequate flexibility to support communities with special networking requirements.

KN: Let us not forget the good team work to make this happen. We have set up a joint EU-China technical support team. So we have the most efficient and simplified troubleshooting process to ensure reliable and high quality network transmission. And I agree, the hybrid mode provides the opportunity to deploy different, innovative techniques and equipment, such as acceleration devices, to match specific application needs.

WHO USES THIS LINK TODAY AND WHAT ARE THE GROWTH AREAS?

CG: It comes as no surprise that users from the LHC community were among the first to fill the increased capacity. But we expect many more from other disciplines. As an interesting effect, by making the ORIENTplus capacity available to our users we learned a lot about the many existing collaborations between European and Chinese researchers.

KN: We have already seen take-up in the field of radio-astronomy. eVLBI, for example, relies on a stable network connection for correlating massive data in real-time from radio-telescopes in Europe and on CSTNET's network in China. Similarly, the ARGO-YBJ cosmic ray studies involve the transfer of terabytes of data every year from a telescope in Tibet to a processing centre in Italy – thousands of miles away. Real-time processing and analysis of these data do not work with packet loss or a jittery connection – so the applications need dedicated R&E network links, such as ORIENTplus, to deliver this.

Genomic research between China and Europe needs the same strong networking. The commodity Internet would simply not be able to tackle the data traffic generated by DNA sequencing and processing by life sciences institutions, such as the Beijing Genomics Institute (BGI) and the European Bioinformatics Institute (EBI).

JW: More and more collaborative projects between universities in China and Europe have increasing bandwidth demands. There are, for example, many UK universities setting up remote campuses and offices in China, the online courses, videoconferences and other forms of virtual meetings and discussions are becoming a key part of this type of remote education. Certainly, ORIENTplus is the basic infrastructure to support these collaborations.

WHAT SPECIAL VALUE DOES CHINA SEE IN ORIENTPLUS?

JW: In the late 90's, before ORIENT and ORIENTplus, CERNET's first direct links to Europe were with JANET and DFN only. With ORIENT and now ORIENTplus, China's researchers can now reach the whole of Europe with just one link. As the link capacity grows and our researchers can collaborate more, the relationships get stronger and lead to new discoveries and innovation. On China's side we have the vision of global networking since research challenges are global. We are very pleased this is Europe's vision too. It leads to good partnership and success.

KN: ORIENTplus brings the best Chinese and European minds together. In addition to our major science programmes, there are important applications for all our people, such as e-health and environmental monitoring. During the Sichuan earthquake in 2008, for example, the ORIENT link was able to distribute high-resolution satellite images of the damaged region for immediate analysis to help plan rescue, relief and recovery.

HOW DO YOU SEE THE EU-CHINA COLLABORATION DEVELOP IN THE COMING YEARS?

DW: We already see China is the EU's 2nd largest trading partner and the EU is China's biggest trading partner. The current ORIENTplus project runs to the end of 2014. The growing research and technology development programmes between Europe and China mean there is a clear need for the world class e-Infrastructure links to continue to be provided and further developed. So we are now starting to discuss not 'if' but 'how' this is done, building on the already excellent working relationships. As well as the connectivity we would like to broaden this in to further service and user collaborations.

We have some way to go, but I hope it will not be too long before the project that follows on from ORIENTplus is able to tell CONNECT of its latest upgrade to 100 Gbps or higher!



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.

JANET6: DELIVERING THE NEXT GENERATION OF NETWORKING

By Rob Evans, Chief Technical Advisor, Janet



During the course of 2013, Janet will complete the build of our new network, Janet6, and migrate from the current network, SuperJANET5, that has been operational since 2006.

SuperJANET5 has served the Janet community well. During its lifetime it has been upgraded from 10Gbit/s through 40Gbit/s to the current 100Gbit/s Ethernet which has been in place for almost two years. It is now being upgraded again with a network that will last for the decade to come.

Designing, procuring and building Janet6 started in 2010 with a requirements gathering process. This included workshops targeting the various sectors that use Janet – research, higher education, further education and schools – and a survey. The requirements of the future network were built around these consultations, most of which will be familiar to you all.

In addition to volumes of data that continue to grow exponentially, the increased use of critical services that are no longer hosted on the campus has led to a requirement for a reliable network that can be used from a variety of locations and on a wide range of devices. This also requires Janet to engage with the commercial sector to deliver its products.

In every version of the network so far, a telecommunications company has provided circuits to Janet, albeit latterly on a dedicated infrastructure, and Janet has run the switching or routing layer on top of

that. Early in the process of Janet6, we decided that to give us the flexibility we needed to meet our customers' requirements, and the transparency to ensure capacity matches demand, we should operate the transmission infrastructure ourselves.

We began the process by engaging with suppliers of optical fibre and the transmission equipment – in both processes, we welcomed assistance from our colleagues at NORDUnet.

One thing that rapidly became apparent during the procurement of the fibre was that UK suppliers seemed reluctant to sell direct access to it; the 'fibre glut' of the early part of the 2000s was a distant memory. There were six potential fibre suppliers at the start of the process, but only two submitted a final bid. There was a much wider choice of transmission equipment, and several of the larger names did not make it through the pre-qualification questionnaire into the dialogue process.

With those that did, the project team at Janet went through several rounds of dialogue as some of the options for the network were exercised – should it be directionless? Colourless? Contentionless? Should there be OTN switching? Should there be chromatic dispersion compensation?

Both colourless and contentionless technologies are still in relatively early stages and would have been of limited value in Janet6. Directionless access however, was something we could see ourselves using, having the flexibility to route wavelengths around the network and not requiring separate channel multiplexers tied to each direction of a multi-directional node.

Janet already operates an Ethernet over MPLS switching infrastructure. The OTN offerings from the potential suppliers varied widely enough that it would have

been difficult to write a tender document that would have allowed fair competition for a service that we did not need.

The decision of whether to use chromatic dispersion compensation was driven by the requirement to make extensive use of 40Gbps and 100Gbps wavelengths across the network.

We wanted to be able to provision a circuit from any point on Janet to any other point, and whilst the advanced encoding schemes and coherent detection deployed for high-speed wavelengths allows that, having "traditional" on-off keyed signals sharing the fibre, and having chromatic dispersion compensation modules in-line would have reduced the number of channels and their reach.

As very few paths on Janet required a single 10Gbps circuit, we opted to do away with chromatic dispersion and use 4x10GE and 10x10GE muxponders to carry 10GE circuits on higher-rate carriers.

The build of the network is now well underway, and our Network Operations Centre has increased its strength to manage the transmission equipment by hiring a new optical engineer and seconding a Ciena engineer for 9 months. We're also taking this opportunity to look at overhauling our network monitoring, writing a support system that will display and correlate alarms from both the IP and the transmission networks.

We are now the owners of 5,900km of fibre, 130 10GE circuits and 28 100GE circuits although all three of those figures will increase before the end of the year as the fibre is extended to cover more research facilities. We're confident that the Ciena transmission equipment will have the capacity to scale to meet the demands of Janet's users. We'll be following Ciena's development roadmap closely looking to take advantage of higher-speed channel capacities as and when they are offered.

E-IRG ROADMAP 2012 PUBLISHED

By Ari Turunen, Dissemination Manager, e-IRG



The e-IRG Roadmap 2012 outlines a vision for the future of e-Infrastructures in Europe, to meet the challenges of implementing the EU's 2020 Strategy.

A single “e-Infrastructure Commons” for knowledge, innovation and science as a living ecosystem that is open and accessible, the roadmap presents the political, technological and administrative framework needed for such an e-Infrastructure.

To maximise the socioeconomic value of a common research e-Infrastructure, the e-IRG Roadmap 2012 provides policy makers, as well as e users and providers, insights and coherence on the future European landscape. Important external drivers include: the need to compete in a global

knowledge-based economy; the emergence of new models in research, innovation and learning; e-Infrastructures driving innovation in industry, business and public services; and technology bringing new paradigms for data and information services.

A LIVING ECO-SYSTEM

At present there is insufficient cohesion in Europe-wide research and education e-Infrastructures. Users need high quality services that are well managed and seamlessly integrated so that they can get on with their business of science.

As a living ecosystem, an e-Infrastructure Commons is needed that is flexible and can change dynamically in a future-proof manner. This can only be established through common strategic effort between users and primary strategic actors and suppliers. Hence, many barriers towards realising a European e-Infrastructures Commons 2020 are structural rather than technical. Organisational and funding models, governance structures and legal and regulatory landscapes face fundamental changes in the development of the e-IRG vision.

THE CHANGING WORLD

A complex ecosystem for e-Infrastructure services calls for governance structures that are transparent, streamlined, and responsive. European level bodies should have clear, non-overlapping mandates along the three core functions: community building and high-level strategy, service provisioning and innovation.

Governance should reflect the European dimension of e-Infrastructures and the global scale of its user base today and in the future, while respecting

that national level decisions still have an important role in all activities. It is not necessary for all national providers to participate in projects at every level.

Pan-European organisations like DANTE, TERENA, EGI.eu and PRACE AISBL, as well as emerging data infrastructures, should re-think their role in reference to the three core functions stated and reposition themselves accordingly for participation in the e-Infrastructure Commons 2020.

STRATEGIC USER PULL

To achieve a strategic user pull, e-IRG sees a need for a single e-Infrastructure umbrella forum, with sufficient user participation for community building, high-level strategy and overall coordination. It should be clearly separated from operational responsibilities. The current experiences in networking and grid computing provide useful input in setting up this overall strategic framework. TERENA and DANTE are now actively following up on the GEG recommendations and EGI.eu is also working actively towards a sustainable future structure.

A clear distinction between funding for service provisioning and innovation will be necessary, where service provisioning is “paid by the users”, and innovation will be justifiably (co-)funded by public R&D-funds according to the Horizon 2020 principles. The latter can drive novel service propositions that are not yet offered on the commercial market.

Obviously due care is needed to ensure that users have enough budget to pay for the services they require, for instance by including these as part of Horizon 2020 or national research grants. It is also clear that a healthy ecosystem requires closer collaboration between e-Infrastructure users and providers in developing and deploying new services.

GÉANT is a collaboration between 41 project partners: 38 European NRENs, DANTE, TERENA and NORDUnet (representing the 5 Nordic countries), delivering services to 50 million researchers and their institutions. Here the NRENs tell us about their services.

PARTNER PROFILE: NORDUnet



NORDIC COLLABORATION FOR 25+ YEARS

By: NORDUnet COM

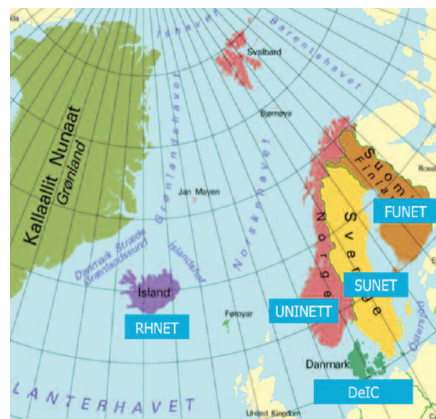
NORDUnet OVERVIEW

NORDUnet is a collaboration between the National Research and Education Networks (NRENs) of the five Nordic countries; Denmark (DeIC), Iceland (RHnet), Norway (UNINETT), Sweden (SUNET), and Finland (Funet). The Nordic region (five countries and three autonomous areas) has a population of 25 million, 9 official languages, and a strong tradition of collaboration. Together, the countries form the world's 7th largest economy.

NORDUnet was founded in 1985 as a result of the NORDUnet programme and is jointly owned by the five Nordic countries. Each of the Nordic NRENs has a seat on the board and share the base costs according to the country GDP.

NORDUnet operates a world-class network and e-infrastructure service for the Nordic R&E community. The five NRENs develop and operate the national research network infrastructures, connecting more than 400 research & education institutions with more than 1.2 million users.

Together with the Nordic NRENs, NORDUnet works continuously to further develop leading edge services and to push the technology envelope. NORDUnet provides global network connectivity, and is a key contributor to international partnerships such as GÉANT, GLIF, and GLORIAD.



It is the Vision of NORDUnet to be the NORDIC Infrastructure for Research and Education, by providing a common world-class network infrastructure, services, support and collaboration platform for the Nordic NRENs and research and education communities and by facilitating other common e-Infrastructures as requested by the Nordic national e-Infrastructure stakeholders.

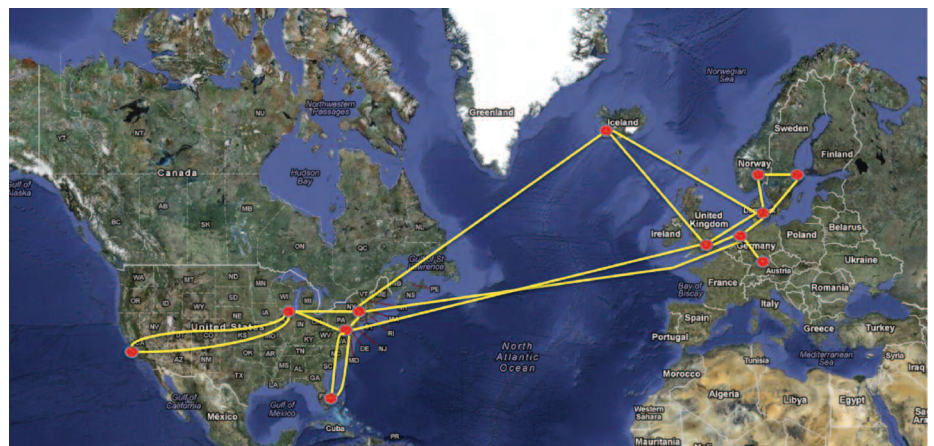
NORDUnet CORE NETWORK

NORDUnet operates an optical network backbone interconnecting Oslo, Stockholm, Helsinki, Copenhagen, and Hamburg. This network forms the northern extension of the GÉANT footprint, and through cross-border fibre connects to Amsterdam, Poznan and St. Petersburg. In addition, NORDUnet operates an MPLS fabric used for IP network services and settlement-free peering. The MPLS fabric has nodes in the five Nordic capitals, in Amsterdam and London, as well as at five locations in North America. Operating an independent, international network allows NORDUnet to effectively manage cost of IP transit and at the same time offer attractive, high-quality Cloud-based services in a fully controlled network environment.

The IP network is dual stack IPv4 & IPv6.

For more information:

Inspiration Paper – The Role of NREN's in 2020



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BUILDING NEMO, A TOOL TO TRACK ROUTING IN IP NETWORKS

By Frederic Raspall and David Rincón, i2Cat Foundation / UPC-BarcelonaTech

The routing subsystem is a fundamental component of any network. IP routing is what logically glues together all the networks that make up the Internet, offering end users the illusion of being connected to a single world-wide network.

Beyond granting “simple” reachability, routing determines the path that the traffic takes between any pair of hosts. Thus, it has a direct effect on how resources are used on any network in transit, playing an important role on network performance.

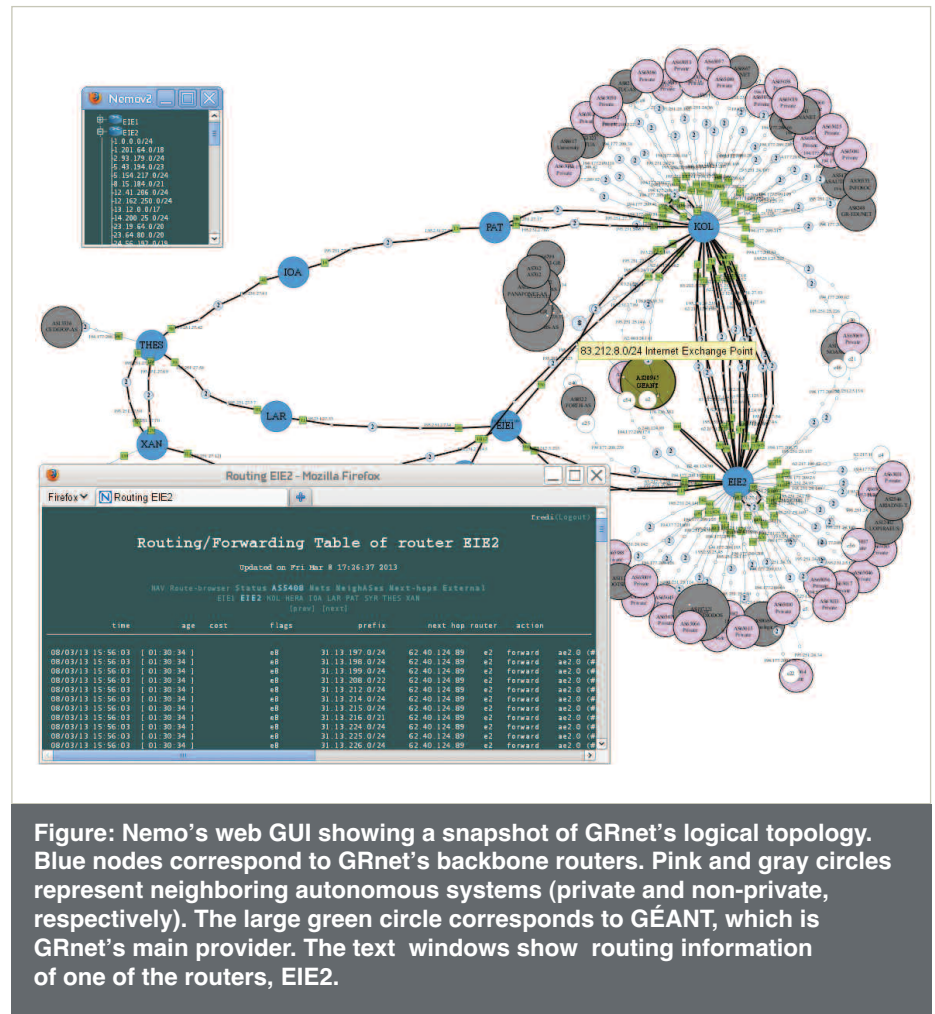
While routing protocols, interior and exterior, have been conceived to autonomously run and automatically react to topology changes, understanding routing behavior is needed to efficiently operate a network, aiding administrators to deploy traffic engineering policies or assessing their effect.

This need is particularly evident in the case of Border Gateway Protocol (BGP), whose behavior can depend on routing decisions taken at neighboring (and not-so-neighboring) domains, and whose decision process is not a simple matter and can be altered by numerous factors, some of which are vendor-specific.

TRACKING AND MONITORING

Tracking and monitoring routing state and its changes can, in addition, be very helpful to detect and troubleshoot network failures that could lead to network outages or poor performance. And, if correlated with Netflow-like tools, routing information can be used to determine the ingress and egress points of traffic flows, information that is key to estimate traffic matrices for instance.

Despite the advantages that having a network-wide view of the routing state offers, acquiring and keeping up-to-



date the full routing information of a network (e.g. an Autonomous System) is not simple. Routing protocols operate in a distributed fashion without human intervention, and were not designed to address such monitoring needs. Besides, the number of BGP routes that a single router may handle can easily exceed 400K, making the acquisition, storage and keeping in sync of routing data a challenging task, and raising scalability issues as the number of nodes increases.

NEMO (NETWORK MONITORING TOOL)

Nemo is the result of an effort undertaken in the GN3 project towards the goal of monitoring and showing routing state in a timely and comprehensible manner. The tool has been designed as a multi-threaded Linux process that is fed by several sources of information such as BGP, SNMP and DNS. Users can interact with the tool through a text-based command-line interface (CLI, with a

syntax similar to that employed by many networking equipment), and also by means of a web-based graphical user interface (GUI), as shown in Figure 1.

The tool is able to keep and store routing information in a scalable fashion without imposing too much load on network nodes or links. It discovers the current network topology and presents the user rich information about its routing state.

To ensure interoperability, Nemo has been designed to rely only on standard tools and protocols. When fed with traffic measurement data, it can estimate router-to-router traffic matrices. During its development phase, the tool was partially tested in RedIris (the Spanish NREN). At the time of writing, it is being deployed at GRnet (the Greek NREN), and we expect to test it in GÉANT very soon.

GÉANT is the pan-European research and education network that interconnects Europe's National Research and Education Networks (NRENs). Together we connect over 50 million users at 10,000 institutions across Europe, supporting research in areas such as energy, the environment, space and medicine.



www.geant.net



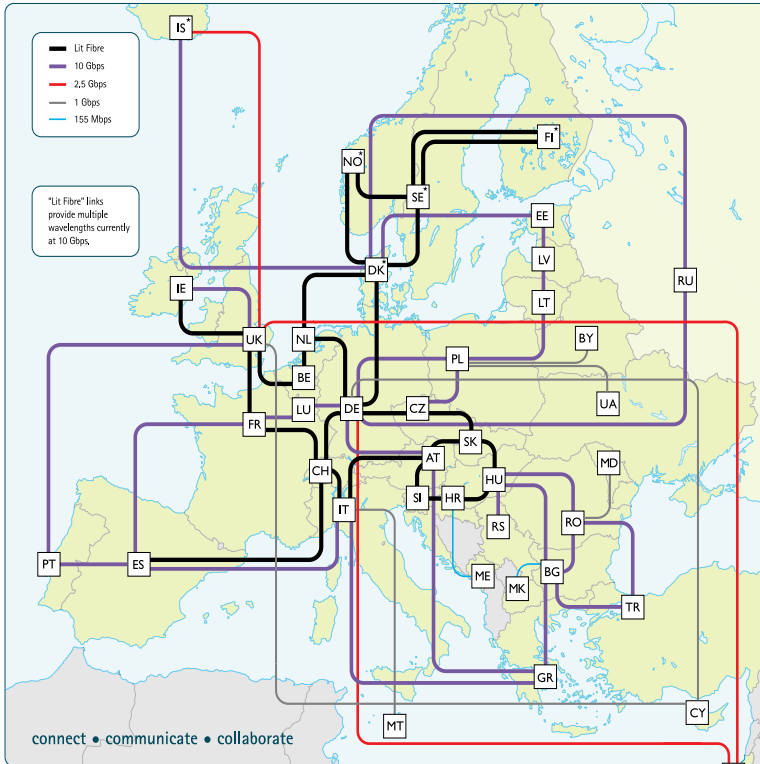
www.twitter.com/GEANTnews



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

SigmaNet
www.sigmanet.lv

RedIRIS
www.rediris.es

Belnet
www.belnet.be

LITNET
www.litnet.lt

SWITCH
www.switch.ch

BREN
www.bren.bg

RESTENA
www.restena.lu

ULAKBIM
www.ulakbim.gov.tr

CARNET
www.carnet.hr

MARNET
dns.marnet.net.mk

JANET
www.ja.net

CyNET
www.cynet.ac.cy

University of Malta
www.um.edu.mt

DANTE
www.dante.net

CESNET
www.ces.net

MREN
www.mren.ac.me

TERENA
www.terena.org

EENet
www.eenet.ee

SURFnet
www.surfnet.nl

BASNET
www.bas-net.by

RENATER
www.renater.fr

NORDUnet
www.nordu.net

BASNET
www.bas-net.by

DFN
www.dfn.de

PSNC
www.man.poznan.pl

RENAM
www.renam.md

GRNET
www.grnet.gr

FCCN
www.fccn.pt

URAN
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NIIF
www.niif.hu

RoEduNet
www.nren.ro

ASNET-AM
www.asnet.am

HEAnet
www.heanet.ie

AMRES
www.amres.ac.rs

AzRENA
www.azrena.org

IUCC
www.iucc.ac.il

SANET
www.sanet.sk

GRENA
www.grena.ge

GARR
www.garr.net

ARNES
www.arnes.si

UPCOMING EVENTS



TNC2013

The project has an exhibition booth, technology demonstrations and posters. The conference programme also features GÉANT Associated Speakers, and panel discussions.

Date: 03 June 2013 to 06 June 2013
Location: Maastricht, Netherlands

More information:
<https://tnc2013.terena.org>



Future Internet Assembly

GÉANT will have an exhibition booth.

Date: 08 May 2013 to 10 May 2013
Location: Dublin, Ireland

More information: <http://www.future-internet.eu/news/view/article/future-internet-assembly-dublin.html>

SubOptic2013

SubOptic 2013

GÉANT will be participating in the Masterclass Tutorial "OTN & Mesh Networking".

Date: 22 April 2013 to 25 April 2013
Location: Paris Marriott Rive Gauche Hotel & Conference Center, Paris, France

More information:
<http://www.suboptic.org/conferences/>



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