

CONNECT

THE MAGAZINE FROM THE GÉANT COMMUNITY | ISSUE 20 2015

SUPERCHARGING EU-CHINA ICT COLLABORATION

NEW 10GBPS LINK
STRENGTHENS
PARTNERSHIP

ICT FOR HEALTH
SUPPORTING
MD-PAEDIGREE AND
CARDIOPROOF

WOMEN IN ICT
TIME TO CLOSE THE
GENDER GAP

BEYOND THE CAMPUS
EDUROAM IN PUBLIC
PLACES

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



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These are exciting times for the GÉANT community! Following the launch of the new unified branding earlier this year at TNC15 and the start of the new GÉANT project, the recent announcement of GÉANT's new CEO (page 3) has been very well received. Steve Cotter is well known across the global research and education networking community, and his journey to GÉANT is the culmination of many years of building collaborative relationships and driving innovation. Steve's leadership and vision, a global perspective on research and education networking, and the ability to hit the ground running will stand our community in good stead as we look ahead to new opportunities.

A strong global perspective is something GÉANT has an excellent

reputation for, and the new 10Gbps link connecting Europe and China (page 5) will supercharge the EU-China partnership and further cement ICT collaboration, benefiting over 80 million researchers, academics and students across the two continents.

Whilst we narrow the gaps between continents and bridge digital divides, so we also need to close another gap: the gender gap. Strong collaborative efforts are already underway (page 10) and your involvement is welcomed, whichever chromosome you harbour!

You may notice in this issue the introduction of a new type of article: opinion pieces. Our community is happily never short of them, and we invited two experts in their respective fields (pages 12 and 30) to share their views on areas of work they are either



Editors
Paul Maurice
& Tamsin Henderson

leading or closely involved with. Your feedback is of course welcomed.

Finally, and with a heavy heart, the community has been greatly saddened by the sudden loss of our close colleague, Jim Buddin. Jim was integral not just to the training and events work he was so heavily involved with, but to the warm and friendly atmosphere he helped create at those events. He will be sorely missed.



GÉANT APPOINTS STEVE COTTER AS NEW CEO

In August GÉANT announced the appointment of its new CEO, Steve Cotter. His mission: to complete the restructuring of the organisation and take on the challenges of a rapidly changing global science environment.

Steve is presently CEO of REANNZ, New Zealand's NREN (National Research and Education Network). Under his tenure, the company achieved its first surpluses after operating in the red since inception, re-architected its network and added specialised capabilities to provide a faster, resilient and more customised service to its members. As a result, the network is now "essential" to 98.6% of REANNZ members, up from 53% when he joined.

Steve will assume his new role at GÉANT in November, where he will be responsible for creating and executing the organisation's strategic vision, through streamlining GÉANT's day-to-day operations, strengthening relationships with NRENs and the European Commission; and developing major international collaborations.

Steve brings a successful track record of working with government funders and research and academic users. Formerly Department Head of ESnet, he also ran the network operations for U.S. NREN Internet2, and was in charge of the network build-out for Google in Europe, the Middle East and Africa.

WHAT LED STEVE TO GÉANT?

Steve's journey to GÉANT is the culmination of many years of building collaborative relationships and driving innovation. He recognises this as a unique opportunity to not just think big but act big: to make things better, faster, smarter and position GÉANT as the undisputed world leader in its field. Just as important, Steve says, "it's a chance to ignite a sense of excitement within the organisation, making GÉANT a fun, invigorating, thought provoking place to work. I have always believed in building a strong sense of community within every organisation where I've worked and cohesion, at this juncture, is a critical component to GÉANT's success."

Bob Day, Executive Director of Janet (the UK's NREN) and former Chair of DANTE, took on an interim CEO role to allow the restructuring of GÉANT to proceed whilst a permanent CEO was sought. He will continue in that role until Steve comes into post in November.

"I am delighted that the Board has been able to appoint in Steve a leader who will be able to hit the ground running as this will give GÉANT and its staff the continuity needed to maintain and develop the world class services enjoyed by our users, along with the capacity to address the many new opportunities that are waiting to be taken."

Bob Day, Interim CEO of GÉANT

"We needed a CEO with a global perspective on research and education networking, coupled with strong leadership and vision, to complete the restructuring process and take us into the next phase. Steve brings an understanding of the NREN environment and substantial experience in change management. He is already very well-known and respected by the GÉANT community and staff, in his capacity as chair of the GÉANT External Advisory Committee, speaker at our annual TNC conference, and participant in the Global R&E Network CEO Forum. We wish him well and look forward to the benefits he will bring to the community."

Pierre Bruyère, Chairman of GÉANT



NEW 10GBPS LINK SUPERCHARGES LONG-TERM EU-CHINA PARTNERSHIP

GÉANT and CERNET sign MoU to strengthen
ICT collaboration at EU-China Summit



LINKING CHINA AND EUROPE

Over 80 million researchers, academics and students across Europe and China are set to benefit from a new 10Gbps R&E internet link, formally inaugurated at the EU-China High Level People-to-People Dialogue (HPPD) Summit held on 15 September in Brussels.

Jointly funded and operated by GÉANT and its Chinese counterpart CERNET, the link provides long-term direct and super-fast connectivity between the two regions, enabling innovative EU-China R&E collaborations to flourish. Operational since the end of July, the circuit is contracted for a 10 year term and, with costs of less than 4 cents per user over its lifespan, represents a substantial cost saving compared to the current connectivity.

CEMENTING THE PARTNERSHIP

This cost-effective, long-term connectivity solution is a clear reflection of the increasingly close relationship between GÉANT and CERNET which they further underpinned by signing a Memorandum of Understanding at the Summit, witnessed by Chinese Vice Premier Liu Yandong and EC Education Commissioner Tibor Navracsics in front of over 250 delegates from both regions.

The signatories intend to formalise and further strengthen ICT collaboration between the European and Chinese R&E communities. They agreed, in particular, to monitor and review link utilisation and plan for higher capacity to meet user needs with the aim of achieving 100Gbps+ as soon as required and affordable. In addition to connectivity provision, the parties committed to supporting the deployment of advanced network services (e.g. eduroam and perfSONAR) as well as of Future Internet testbeds and to jointly undertaking outreach and user support activities within their R&E communities.

GÉANT and CERNET look back at over a decade of fruitful partnership, initiated in 2005 by setting up TEIN, the regional network for Asia-Pacific and, subsequently, by establishing direct EU-China connectivity via the EC-funded ORIENT and ORIENTplus projects (2007-2015) which now seamlessly continues thanks to the new link. Prior to connecting with the GÉANT network, CERNET interconnected with Europe via a link to the German network DFN (1994-1998) and via a circuit between CERNET and the UK NREN Janet (1998-2005).

UNDERPINNING EU-CHINA R&E COLLABORATIONS

Running between Beijing and London, the circuit connects the Chinese NRENs (CERNET and CSTNET) to the 50 million users of the pan-European GÉANT network. It underpins a wide range of data-intensive and/or time-critical scientific collaborations between Europe and China including participation in the Large Hadron Collider (LHC) experiments, cosmic ray observation, radio-astronomy, agriculture, severe weather forecasting and life sciences projects. The high-capacity link also opens new possibilities for students and academics, supporting interactive knowledge transfer through innovative e-learning tools and stable videoconferencing, thus overcoming the complexities of multi-cultural and interdisciplinary learning.



BUILDING ON A STRONG BRAND

Whilst the partnership agreement opens a new chapter of EU-China R&E networking collaboration, CERNET and GÉANT can build on the achievements of ORIENTplus. Although the ORIENTplus project has now successfully completed the 'brand' name will be retained for continued joint activities to promote the route for innovative EU-China collaborations.

“CERNET has been closely linked to the GÉANT community for over 10 years. From starting out together in 2005 to building a regional R&E network across Asia-Pacific, we quickly established the first direct connection between GÉANT and China through the ORIENT and ORIENTplus projects, which were jointly funded by the European Commission, the Chinese government as well as the Chinese and European NRENs until the end of 2014. With the new link, which is based on equal cost sharing, we have guaranteed seamless continuity of network connectivity to support millions of users. We at CERNET look forward to continuing our fruitful working relationship with GÉANT over the next decade and beyond”.

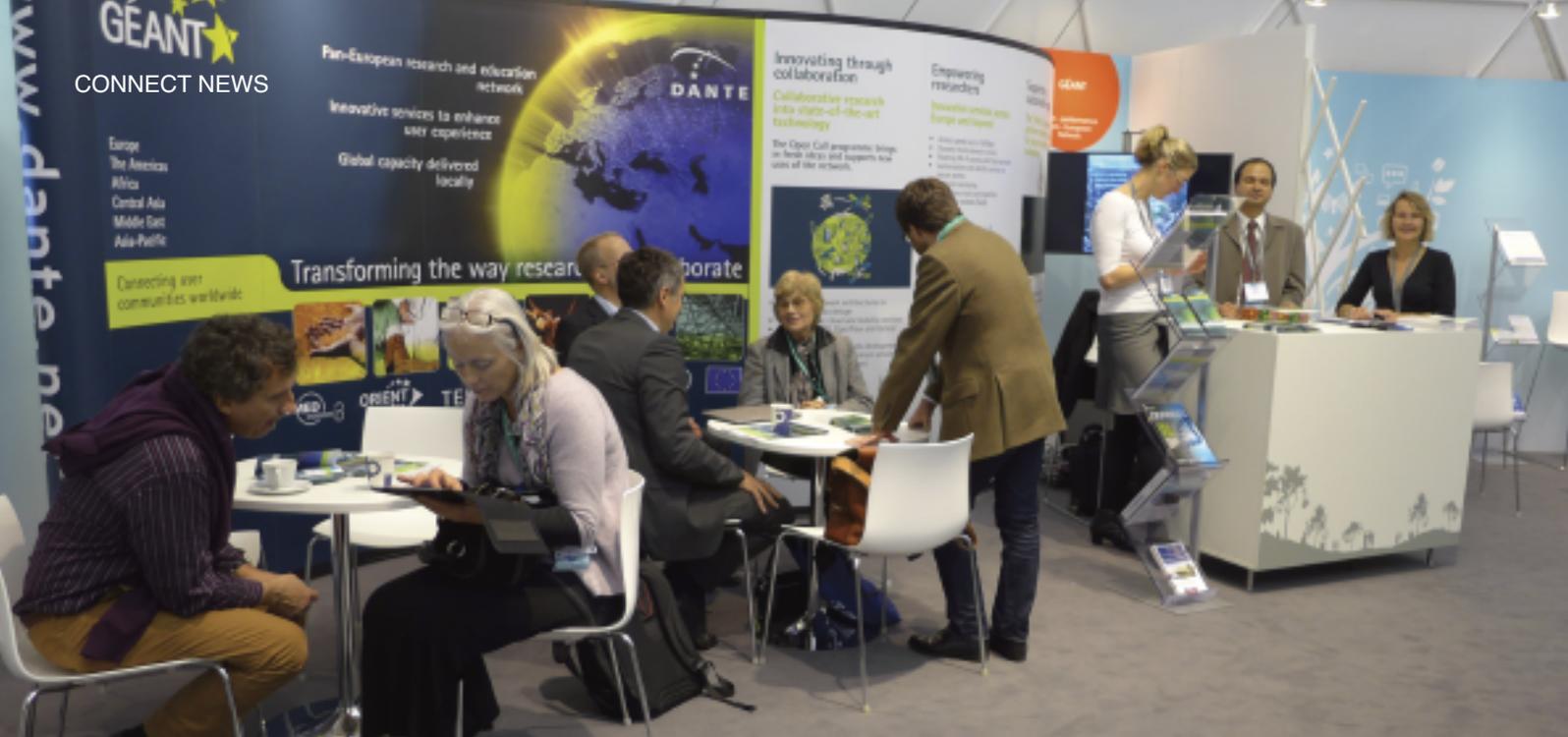
Professor Jianping Wu, Director of CERNET Center

“The growing number of research programmes and academic collaborations between Europe and China clearly highlighted the need for high-capacity connectivity to continue post ORIENTplus. For many applications with significant economic impact in the long term, such as the ITER global energy fusion programme, this new link will be the only viable solution. We are proud to be able to provide this solution jointly with our Chinese partners”.

Pierre Bruyère, Chair of GÉANT Board of Directors

Picture

Professor Jianping Wu, Director of CERNET Center, and Pierre Bruyère, Chair of GÉANT Board of Directors signing MoU to strengthen their partnership, witnessed by Chinese Vice Premier Liu Yandong and EC Commissioner Tibor Navracsics



GÉANT AT ICT 2015: OPEN SCIENCE FOR RESEARCH AND EDUCATION

This October GÉANT will be exhibiting at ICT 2015, the high profile 3-day event running from 20-22 October in Lisbon. ICT 2015 is an interactive exhibition that will dynamically showcase the best-in-class results of existing European ICT Research & Innovation; advanced products from individual companies that started with, and have grown and benefited from European funding.

With the GÉANT network a flagship e-infrastructure key to achieving the European Research Area, and contributing to Europe's economic growth and competitiveness, GÉANT has been invited to exhibit in the EC Village, one of six areas within the main exhibition under the title of Open Science.

Demonstrating its support of a breadth of research and education disciplines, GÉANT will be hosting 2 ICT for Health projects on its booth, highlighted below.

SUPPORTING ICT FOR HEALTH

GÉANT and two ICT for Health projects, MD-PAEDIGREE and CARDIOPROOF, will showcase revolutionary applications to support clinical diagnostic and decision making directly at the point of care. The projects will demonstrate how Big Data can be accessed for diagnosis, care planning, and follow-up of

paediatric diseases, allowing the personalisation of treatments and simulation of outcomes, thanks to mature VPH modelling, ready to be validated. In modern healthcare, the use of such data is key to patient safety and treatments efficacy.

For an in-depth look at MD-PAEDIGREE and CARDIOPROOF, please see pages 24-27 of this issue.

More information:
<http://www.cardioproof.eu/>
<http://www.md-paedigree.eu/>

DATA SONIFICATION FOR CANCER RESEARCH

Could data sonification deliver while-you-wait cancer diagnosis? Converting human tissue spectroscopy data into sounds could enable GPs to make instant, non-invasive cancer diagnoses during a routine check-up. A recent study shows how data sonification

(where data is conveyed as audio signals as opposed to visual illustrations such as graphs) can improve standard techniques currently used in spectroscopy stem cell analysis.

The preliminary study was launched recently at the 20th International Conference on Auditory Display. It is a collaboration between GÉANT, Anglia Ruskin University, Birmingham City University and the University of Central Lancashire.

At ICT 2015 delegates can listen to the different sounds that data sonification can produce to aid faster cancer diagnosis, and Domenico Vicinanza will explain to delegates the difference between the sounds and what they mean.

More information:
 What is Data Sonification? Domenico Vicinanza explains in this 2-minute video: <https://www.youtube.com/watch?v=ndLkP-bNL1s>

2015 COMMUNITY AWARD WINNER: KENT ENGSTRÖM



Kent Engström (SUNET and Linköping University, Sweden) has received this year's research and education networking Community Award. Kent was honoured for his contributions to the Trusted Certificate Service (TCS – formerly known as TERENA Certificate Service), which helps to increase security in online transactions by facilitating the deployment of digital certificates.

Kent had developed and maintained the 'Djangora' software that was a vital part of the service for

around six years. The selection was made after open nominations and deliberation by a panel of judges. The prize was presented during the closing plenary session of this year's networking conference, TNC15, in Porto, Portugal.

The award was presented on behalf of the judges by João Nuno Ferreira, who was a director of the TNC15 host organisation, FCT|CCN. He said: "Kent was instrumental in putting together Djangora and the means for delivering thousands of certificates across Europe. This work was voluntary and that's an outstanding contribution."

The fact that Kent had done all this work without seeking the limelight was seen as a plus by the judges. "Picking out someone who's not well known who's doing something fabulous for the community is what these awards should do," said João.

ABOUT KENT ENGSTRÖM AND DJANGORA

Kent Engström is a Systems Expert at the National Supercomputer Centre at Linköping University in Sweden and

regularly works with SUNET, the Swedish national research and education network (NREN) organisation. Six years ago, when the TCS provider's web interface proved too complicated, Kent programmed 'Djangora' on top of the secure API and then maintained it with new versions. Djangora is credited as the essential piece of software that made scaling up delivery of server certificates and code-signing certificates possible, and with turning out more than 100,000 certificates.

With the advent of the new TCS service since 1 July 2015 Djangora is no longer required. However, Kent has continued to dedicate his time and expertise to the new service too. Alessandra Scicchitano, Project Development Officer at GÉANT explains: "Kent has participated actively in the transition phase, testing the main features of the new TCS, giving suggestions about new features and how to improve the service, on a voluntary basis. Through this transition, his work has been invaluable for me and for the entire community."

GÉANT GOING TO SC15



From 16-19 November this year the international supercomputing community will gather in Austin, Texas for SC15 spotlighting High Performance Computing (HPC), scientific applications, and innovations from around the world.



This year's SC15 focuses on how HPC transforms. HPC is transforming our everyday lives, as well as our not-so-ordinary ones. From nanomaterials to jet aircrafts, from medical treatments to disaster preparedness, and even the way we wash our clothes; the HPC community has transformed the world in multifaceted ways.

GÉANT will have an exhibition booth in the research area of the show. If you're visiting, you can find GÉANT at booth number 3218, for a series of demonstrations and pioneering collaborations – as well as a chance to speak to the experts directly.

Annually the event attracts over 10,000 attendees at the show, who visit each year to discover the latest solutions that will keep them at the leading edge of their professions.

There'll be demos featuring GÉANT testbeds and the world premiere of "Modern Symphony on 5 Supercomputers and InfiniCortex" and many others. People will also get the chance to hear about exciting developments with perfSONAR a widely-deployed test and measurement infrastructure that is used by science networks and facilities around the world to monitor and ensure network performance.



JIM BUDDIN – 26/07/1974 TO 12/09/2015

In September, with great sadness GÉANT announced the untimely death of staff member Jim Buddin, who passed away on Saturday 12 September after a sudden illness. As GÉANT's training coordinator and, for many years, an events organiser, Jim had become well known in our community, especially through the GÉANT Project symposia and online 'Showcases', and among the TRANSITS and TF-CSIRT security groups. Known among his colleagues for his hard work, loyalty and sardonic wit, Jim has already been much missed.

Within moments of the announcement being made, tributes began to arrive.

"Super Jim" was praised by Sabine Jaume (Renater) for "his smile, his energy, his professionalism". From within the GÉANT Project, Michel Wets and Andres Steijaert expressed their sadness and how the cloud services team "valued Jim very much in helping us think about underlying questions. He was able to bring out the best in others. That is what a true trainer does and we will miss him immensely". On behalf of CERN, David Foster expressed "our great sadness at Jim's untimely passing. He served our community so well and with much enthusiasm. I personally will retain very happy memories of Jim."

Andrew Cormack first met Jim when presenting TRANSITS training courses for new Computer Security Incident Response Team (CSIRT) staff. "He was always a friendly and reassuring presence at any event. He was an ideal host, setting the relaxed and welcoming

tone that both trainers and trainees needed to get the most out of our time together. Even though the courses were often held in out-of-the-way places, we knew that the organisational things would just work and that we didn't need to worry. His suggestions on how we could improve the training were always good: a lot of the success of the TRANSITS programme was thanks to him."

Jacques Schuurman, another of the TRANSITS trainers, said: "Jim was a person who, in the true spirit of our community, contributed to its growth and strength, and I do not remember a single occasion in which something that was asked of Jim, proved too much or difficult for him."

Don Stikvoort, TRANSITS head tutor, coordinated a letter highlighting memories of Jim from the global CSIRT (Computer Security Incident Response Team) education community, with signatures from several world regions. "I worked closely with Jim for I don't know how many years," he said. "We were on

friendly terms and did biking together several times. I also remember a drive together with a lot of deeper talk. Under his irony, Jim was very serious - and had a heart for people. A kind soul."

Bob Day, interim CEO of GÉANT added on behalf of the whole Board: "These and other tributes all go to show the respect and affection our community had for Jim. We know also how much he was an invaluable part of the team in Amsterdam, always ready to help and turn his hand to what was needed. And, as many others have said, with just the right sense of humour to maintain the sanity of all around him. He will truly be missed."

These and many other messages were collated in a booklet by Jim's colleagues and shared with his family and fiancée. Any further messages can be sent to Laura.Durnford@geant.org.

A web page with further information is at http://www.geant.org/News_and_Events/Pages/Jim_Buddin.aspx



TIME TO CLOSE THE GENDER GAP

Despite women having a long history in ICT (think Ada Lovelace for starters), comprising half the world's population and making up a significant proportion of the professional workforce, they are considerably under-represented in the sector - particularly in technical and decision-making positions. This is widely recognised; dozens of ambitious initiatives, regional and national organisations, task forces and academics are studying the issues behind this problem and fuelling the search for solutions that will usher in an age of true gender diversity and equality.

The motives behind these efforts go deeper than the need for equal opportunities and treatment. Research shows that diversity benefits organisations in terms of productivity, profitability, creativity and innovation.

The EC's "Women active in the ICT sector" report concludes that the lack of women in ICT roles is costing the European economy €9bn in lost revenue. It found that only 3% of women have a degree in ICT subjects compared with 9% of men; and that women struggle to reach the top roles in the sector with 19% of ICT workers having a female boss compared with 45% of non-ICT workers.

SO HOW IS THE R&E NETWORKING COMMUNITY DOING WHEN IT COMES TO GENDER DIVERSITY?

At first glance, it appears that the NREN community, which is closely tied to academia and government, enjoys a greater diversity compared with the private sector. But following a number of sessions on the subject at TNC15, it is clear we still have a long way to go.

Ann Harding, head of GÉANT project's Trust and Identity services and a member of the AAI team at SWITCH, the Swiss NREN, is spearheading community efforts on the issue, calling on all to join the effort toward solutions to assure NRENs of a pipeline of female ICT skills, with an open career path of their choosing, from technical to management.

During her Lightning Talk at TNC, Ann described how the idea that girls are less well equipped for technical subjects is rooted in early experiences in which "a boy simply makes mistakes as an individual but a girl makes mistakes on behalf of her gender".

In the panel discussion on Women in ICT, chaired by Nicole Harris (GÉANT), Cathrin Stöver, GÉANT's Chief International Relations and Communications Officer, noted that men tend not to attribute their success

Words
Audrey Gerber (IUCC), and
Melanie Pankhurst (GÉANT)



to external factors as women often do - such as luck or a good boss - and urged women to have a stronger belief in their own abilities.

During her TNC plenary speech, Avis Yates Rivers, President and CEO of Technology Concepts Group International, talked about unconscious biases that we have at individual and organisational levels. She shared research and observations on the ways in which gender biases intersect with those on race, religion and sexuality, as well as institutional barriers such as biased recruitment.

There are many differences between countries and we have much to learn from one another on how to break down deeply ingrained cultural attitudes, and unconscious biases, towards gender, career and personality stereotypes in the workplace.



WHAT CAN WE DO? A FEW DOS AND DON'TS

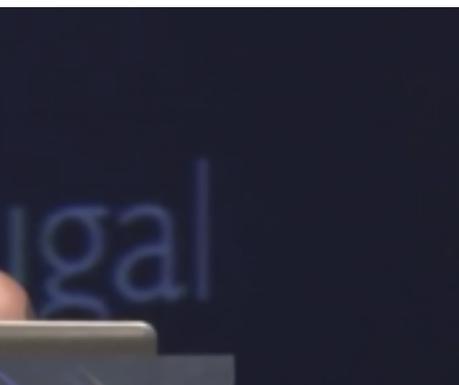
- Don't lower hiring standards
- Don't slap a boilerplate diversity statements on job adverts
- Don't form development teams with just a 'lone' diverse engineer
- Don't depend on underrepresented employees to advance diversity goals
- Do remove biased language from job descriptions
- Do evaluate interview questions and include diverse representation
- Do audit physical spaces, and review processes for unconscious biases
- Do assure inclusive team meetings and social events

From "Unconscious Biases: Addressing Stealth Barriers to Innovation & Productivity" presentation delivered at TNC15 by Avis Yates Rivers, CEO of Technology Concepts Group international and Director, National Center for Women & IT (NC-WIT)

Pictures

Top: Women in ICT panel discussion, TNC15. Nicole Harris (GÉANT), Cathrin Stöver (GÉANT), Ingrid Melve (UNINETT), Avis Yates Rivers (Technology Concepts Group International) and Ana Hunsinger (Internet2).

Left: Ann Harding presenting at TNC15



Actions of course speak louder than words, and the NREN community is rising to the challenge. Led by Ann and Cathrin, an impromptu BoF session at TNC15 attended by 22 women and men led to the formation of an online community, NREN-WIT.

Active email-list discussions and sharing has begun, and web resources are planned for sharing of best practise and ideas to reduce the gender gap in our community. "These efforts are a work-in-process, and will take time and a lot of collaboration," says Ann. "We need to work together, and build the practical tools to share information and affect change but are well on our way."

CONNECT readers are invited to participate in the NREN-WIT community by sending a blank email to: nren-wit-subscribe-request@listserv.heanet.ie.

LEARN MORE

HeForShe-UN Solidarity Movement for Gender Equality

<http://www.heforshe.org/>

The National Center for Women & Information Technology (NCWIT)

<https://www.ncwit.org/>

TNC2015 Presentations
<https://tnc15.terena.org/core/presentation/174>

<https://tnc15.terena.org/core/presentation/191>

http://www.geant.org/News_and_Events/Pages/importance-of-women-in-ICT.aspx

International Girls in ICT @ITU
<http://www.itu.int/en/action/women/girls-ict-day/Pages/2015.aspx>

EC Digital Agenda for Europe

Initiatives

<https://ec.europa.eu/digital-agenda/en/women-ict>

<https://ec.europa.eu/digital-agenda/en/pillar-vi-enhancing-digital-literacy-skills-and-inclusion/action-60-increase-participation-women-ict>

Every Girls Digital Facebook Community

<https://www.facebook.com/girlsdigital>

Ada Awards Recognising outstanding girls and women in digital fields

<http://adaawards.com/>

Women in HPC

<http://www.womeninhpc.org.uk/>

Anita Borg Institute

<http://anitaborg.org/>

Grace Hopper - Celebration of Women in Computing

<http://gracehopper.org/about/>

Women active in the ICT sector

http://europa.eu/rapid/press-release_IP-13-905_en.htm

THE GÉANT NETWORK: COST-EFFECTIVE AND LEADING-EDGE NEED NOT BE MUTUALLY EXCLUSIVE

MARK JOHNSTON,
CHIEF NETWORK
OPERATIONS OFFICER,
GÉANT



One of my biggest challenges is addressing the short-term demands of multiple users, while also evolving the network for the future. Against a backdrop of financial uncertainty, we also have the additional challenge of not just doing the same with less, but doing more with less.

The GÉANT network was upgraded to be 100Gbps capable and to be able to provision large volumes of capacity rapidly and simply. Operating a high performance 100Gbps capable network that delivers uncontended bandwidth is inherently expensive. The pressures created by the Eurozone uncertainty, reduced government incomes and the start of Horizon 2020, leading to a changing EC agenda resulted in pressures from the community to reduce the cost of the GÉANT network.

There is a programme of continual improvement that runs within GÉANT Operations with a focus on continual optimisation of the network and the way we work to increase efficiency and effectiveness and to ensure costs are controlled and driven down. Even so in 2014, an even greater focus had to be applied to very quickly to address the cost of the network and redesign parts that had only been built in 2012. This required close collaboration with the community to ensure everyone's needs were met while driving down costs as value for money was a concern.

The GÉANT network is one of the most advanced terabit networks in the world. We have an infrastructure that delivers an excellent user experience and gives European researchers a data network for today—and one secured to meet future needs.

WORK HAS ONLY JUST BEGUN

To build the current network is a huge achievement, but the work has only really just started. We need to ensure GÉANT delivers operational excellence and remains at the leading-edge of networking technology.

Doing this and operating a cost effective network are somewhat contradictory, and I think there's still a gap in people's understanding of what's needed to keep the GÉANT network performing in the way users demand.

Compare building the GÉANT network to buying a house. It's not just a case of laying down the deposit and securing the mortgage. There's the total cost of ownership to consider.



The ongoing maintenance and repairs. The fixtures and fittings. The renovations and upgrades. You've got to keep that house secure and running efficiently—then update it as necessary. People have short memories – we need to remember that investment is required after the initial purchase.

YEAR-ON-YEAR INVESTMENT

To keep the network running efficiently, we must continually ask: how can we better deliver services and network infrastructure? How can we utilise resources differently? How can we offer value for money and keep pushing the boundaries of networking? This requires year-on-year investment.

After all, pushing the boundaries is one of the reasons we're here. And it's why the EC regards GÉANT so highly. We're here to implement next-generation networking technologies—to provide scientists and researchers with uncontended capacity—to enable them to do great things. And to keep Europe at the forefront of research and networking innovation.

As I mentioned earlier, I think there are misunderstandings within the community of what is needed to keep the GÉANT network running and performing in the way users demand. In the past, we've struggled to communicate the complexities around the decisions we make and the costs associated with the network, to the wider community. As a result, I think we've suffered from a few misconceptions.

UNDERSTANDING AND COMMUNICATING OPERATIONAL COSTS

A 100Gbps network is expensive. Operational fibre networks are expensive. Operating latest-generation technology is expensive. Beyond the initial investment, there will always be crucial incremental and long-term costs, for a network with such capabilities and capacity. I needed to ensure this was fully appreciated by the community.

So in 2014 we put together briefings to make the network costs more visible and transparent, to explain why the network cost what it did and how much we spend on the various network components: fibre, lease circuits, support, PoP housing – as well as how much we typically have to invest each year to meet the growing needs of the community.

This culminated with a presentation to GÉANT’s members in December 2014, during which we shared the cost make-up and categories of spend. At the same time we went through our plans to address those costs—and these were very well received.

PUTTING PLANS INTO ACTION

In 2015, we set to work putting the plans into action. Our team, together with procurement, have cut the cost of operating the service desk by €250k. We’ve reduced transatlantic connectivity costs by €500k and saved over €1m on European lease lines. We’ve avoided spending over €1m on equipment by better utilising network resources. And we’ve saved a further €250k from optimising network infrastructure.

We’re in the process of putting together a deal to save €300k on PoP housing and will soon be signing another to save €400K on support for the Infinera optical platform, while obtaining a €300k saving on hardware.

We’re also working to reduce the support costs of the IP/MPLS platform. We’ve achieved everything we said we would; but 2016 will be the first year where we will be significantly balancing the reduction of costs with investing for the future.

DOING MORE WITH LESS: THE FUTURE

In 2016 we’re looking at the longer term evolution of the network, beyond the expiration of the fibre connects in 2020. A big focus of that work will be to investigate and develop plans to use more NREN infrastructure so the costs of the GÉANT network can be significantly reduced by using infrastructure that the NRENs have in place to meet their national needs, rather than buying independent infrastructure to build this pan-European network. We’ll be doing a lot of work to understand how we join the NRENs national networks together to create an international infrastructure.

We also want to take advantage of the research work undertaken by the Joint Research Activities (JRAs) as part of the GÉANT project. For instance, we’re starting to see there’s potentially production ready SDN solutions that we need to evaluate.

I need to make sure that the money to invest in those changes is protected. We spend a lot of time working with procurement, looking at contracts, market trends, anywhere we can get lower market rates or take advantage of market price erosion.

We’re always considering how we could do things differently to reduce costs without reducing effectiveness. For example we’re looking at supporting the equipment in the field with community resource rather than paying vendors for this service; if this is feasible we will investigate to come to a conclusion. Support for all the equipment deployed in over 100 locations across Europe is expensive. The implications to availability and time to repair have to be thoroughly assessed – so we don’t impact the service we provide.

With over 100 suppliers to manage, it takes a lot of time and resource. We need to balance this carefully to ensure we don’t take valuable resource away from the network, while keeping enough back to refine and evaluate better ways of doing things.

COMPARING R&E NETWORKS WITH COMMERCIAL NETWORKS

With economic uncertainty comes belt tightening. The funding streams of our National Research and Education Network (NREN) partners appear less certain and we’ve seen people comparing GÉANT network costs against commercially available IP transit.

But you can’t design an R&E network to have the same economics as commercial ISPs—they’re doing two different things. R&E networks are designed for high performance and high availability. They’re built to support high throughputs and bursts of traffic, rather than highly contended best efforts traffic.

So the cost per megabit is going to be very different. And whilst there may be doubts over GÉANT using resources to carry traffic destined for the internet (the GÉANT Open service) if this can be done at very little incremental cost and at the same time save our members money, it does make sense. Certainly, as more R&E e-infrastructures are being formed out of commercial e-infrastructures, so more and more traffic to the internet is now classified as research traffic – again blurring the lines.

This is one of our biggest challenges: to meet the needs of researchers who need high capacity and high performance, and those of who need more standard commercial type services. We work very hard to balance the needs of all NRENs while delivering a cost effective network.

OPEN COMMUNICATION

We need to ensure GÉANT’s members have complete confidence in our ability to provide a cost-effective network, and full transparency about costs and cost-saving plans is crucial to this. Therefore, going forward we’ll be communicating regularly on the progress of making those savings.

When we reported back to our members in February 2015, we showed that we can deliver cost savings, while securing the future of network. But the pressure is still on to do more—and the challenge ahead is significant. I’m confident we can continue to evolve the network at a sustainable rate, as long as we seek out flexible solutions that scale and grow with the needs of individual NRENs.

I’d like to end this post by extending an open invitation to anyone in the community—our partners and members—to visit us here in Cambridge. My team and I would welcome the opportunity to show you what we do here in operations, to show you what we are doing every day to ensure maximum value for money, and to answer your questions. If a trip to Cambridge is too far, you can also call me directly on +44 1223 371374 or write to me at mark.johnston@geant.org.

GÉANT TESTBED MAKES NETWORK UPGRADES EASIER



Imagine when notice of a network upgrade doesn't conjure up images of frantic backups, reworking schedules and making sure there is enough coffee for the anticipated "all-nighters" ahead. GÉANT's Network Engineering team have found a way to make the dream of easier, faster and painless upgrades become a reality.

The GÉANT network testbed is a scale replica of the entire production network that lets GÉANT network engineers stress software to duplicate real production conditions to accurately evaluate the impact of the proposed changes on services and hardware performance.

Rick Havern, GÉANT Head of Network Engineering, tells CONNECT how this testbed lab came into being, how it makes the network more agile and how it keeps GÉANT on top of the "power curve" with cutting edge network technology.

WHERE DID THE IDEA OF DEVELOPING THE TESTBED COME FROM?

"It was actually developed organically. Upgrades invariably mean finding bugs, stopping work, rolling back, finding workarounds, or waiting for the vendor to find a fix. All this means delays in scheduled upgrades, support and service roll out.

"The fact that we find these bugs is no surprise. Despite the fact that our network deploys hardware and software from leading vendors like Juniper and Cisco, a lot of what we do is not typical for our vendors' ISP customers. Like MDVPN or multicast. When we query these bugs, we often can't find anything in the knowledge bases. If we had a place to stress the software exactly the same way it is used in production and run a known set of certifications, we could anticipate problems before they occur and avoid delays. That's how the idea for the testbed was born just a short time ago."

WHAT DOES THE TESTBED ARCHITECTURE LOOK LIKE?

"Our testbed has three layers. Four Juniper MX routers simulate the GÉANT core. Customer edge routers simulate NREN connections and a set of virtual machines simulate NREN traffic. We also go a level deeper to simulate the GÉANT backend with netflow collectors, packet sniffing hosts, traffic generation software to generate unicast and multicast traffic over IPv4 and IPv6."

IS THE TESTBED COMPLETELY OPERATIONAL?

"We have completed the baseline certification on the current production environment. We are still ramping up and expect to be able to complete type certification testing on target code versions within a two week period. James Burnett is working on this full time. Aleksandr Kurbatov, Niall Donaghy and Sebastiano Buscaglione and I work on it in our 'spare time'. Eventually we expect our Network Engineering team will be able to keep the testbed up and running as part of their regular workload."

HOW DOES GÉANT BENEFIT FROM THE TESTBED?

"By verifying new versions of code and testing if new services work and do not adversely affect network performance, we get a real head start on smooth upgrades and updates. Also, if we do find bugs in the lab environment, we can fix them and check the fixes. In the end, this will result in a better performing production network. And because we help our vendors discover problems they may never even know existed, we are like 'beta users' and maintain a close working relationship with them. In fact, Juniper added GÉANT's router configuration to their regression testing". The bottom line is that the testbed saves GÉANT time, reduces downtime and helps us be more responsive to our users' needs".

Interview

Audrey Gerber, IUC

Picture

Left to right: Sebastiano Buscaglione, Aleksandr Kurbatov, James Burnett and Rick Havern

EDUROAM BEYOND THE CAMPUS



WHAT IS EDUROAM?

eduroam (education roaming) is the secure, worldwide roaming access service developed for the international research and education community. Since its launch in Europe in 2003, eduroam has gained popularity throughout the research and education community and is now available in 74 territories worldwide. eduroam allows students, researchers and staff from participating institutions to obtain internet connectivity across campus and when visiting other participating institutions quickly and easily without the need to find local login details. The next step for eduroam is to further expand into public places, to provide an ever-increasing mobile platform for its users.

EUROPE LEADING THE WAY IN EDUROAM ACCESS

eduroam has grown substantially over more than a decade and now GÉANT wants to push the boundaries further by inviting public, commercial and city Wi-Fi initiatives to offer the service. Already eduroam can be found in airports, city centres and other public spaces throughout Europe. Some forerunners can be found in Switzerland, Norway, Luxembourg, The Netherlands, and in Sweden.

SWITZERLAND

SWITCH, the Swiss National Research and Education Network (NREN) has pushed the eduroam service beyond universities, schools and research labs. In Switzerland, you can also use eduroam in the university hospital of Bern, in libraries (Zentralbibliothek, Zürich; Pädagogisches Zentrum, Basel-Stadt / Bibliothek) and last but not least at Geneva Airport.

David Foster, Deputy head of the IT department at CERN, underlines the importance of eduroam: "Collaboration is fundamental to global research and CERN is a first class example of global science collaboration. It is important then that the tools and infrastructure that facilitate global collaboration are developed and deployed. This is why CERN supports the ability for researchers to be connected wherever they are, and eduroam is key to getting connectivity, anywhere, anytime, in a trusted and easy manner. The installation of eduroam at Geneva airport is a great service for the many researchers and students that travel to and from CERN and extends the reach of eduroam in Switzerland."

NORWAY

In Norway, the use of eduroam is even more widespread: the nineteen biggest airports in the country all offer the service. Additionally, in several towns there's eduroam coverage in public spaces, offered by the local university. "Trådløse Trondheim" (Wireless Trondheim) provides coverage at a number of addresses throughout the city and a similar solution is provided in Kristiansand. Similarly, eduroam is provided in a number of hospitals throughout the country. In the future, UNINETT hopes to expand the service to secondary schools as well.

LUXEMBOURG

The ability to expand eduroam beyond the education community is successfully demonstrated in Luxembourg, where a partnership exists between RESTENA (the Luxembourg NREN) and hotcity S.A. which owns a Wi-Fi infrastructure in many places, including the downtown areas of the major cities. This partnership delivers eduroam to a big percentage of the Luxembourg populace in densely populated areas. eduroam usage data (March-July 2014) shows that on average more than 10,000 distinct devices are connected in any given month, most of which belong to students of the University of Luxembourg. Outside of the capital,

both the country's second-largest town Esch-sur-Alzette and Luxembourg International Airport offer eduroam.

THE NETHERLANDS

SURFnet, the Dutch NREN and inventor of eduroam, has of course adopted it right from the start. Throughout the country, eduroam is heavily used in education and research institutions. A good example is the ROC Midden-Nederland school. They are one of the biggest educational organisations in the Netherlands, catering to over 28,000 students, and they've been using eduroam for over ten years.

Frank Pinxt, ICT Manager at ROC Midden-Nederland says, "We're very happy with eduroam, especially since our organisation doesn't need to configure and maintain it. On top of that, outages are almost non-existent. Another benefit is that we can use eduroam outside of the school premises as well. Recently, I experienced this myself, when I had to visit a hospital in Aarhus (Denmark). When I was waiting in the hallway, all of a sudden I saw email messages coming in, and I discovered I was automatically connected to eduroam."

EDUROAM VISITOR ACCESS (EVA)

Institutions in the Netherlands can now offer eduroam to visitors too, by using the eduroam Visitor Access service. Since February 2015 the ROC MN school is offering eVA through reception desks in all school buildings, which are spread over six towns throughout the country. Temporary personal visitor accounts are given to individuals. It is also possible to provide secure eduroam access to large groups of visitors during events and seminars. Frank Pinxt, ICT Manager at ROC MN: "Visitors are very happy with this service, and it works great!"

Words

Karim Mostafi,
GÉANT

EDUROAM CONQUERS SWEDEN

Sweden is a worldwide leader when it comes to public ICT infrastructure, and so it's easy to understand why it's one of the leading countries in offering eduroam in public spaces.

eduroam was initially offered to Swedish universities and colleges, and almost all of them run eduroam today. More than 100,000 unique devices are authenticated per month, roughly 500,000 individuals are active within higher education in Sweden. The implementation and usage of eduroam in Sweden has indeed been a great success, but Sweden is aiming even higher.

The Swedish National Research and Education Network SUNET sought a partner to provide eduroam in places where students hang out outside normal campus areas. The solution that was chosen is to offer eduroam via SUNET's provider The Cloud through their existing access points, says Valter Nordh who is in charge of eduroam at SUNET, Sweden.

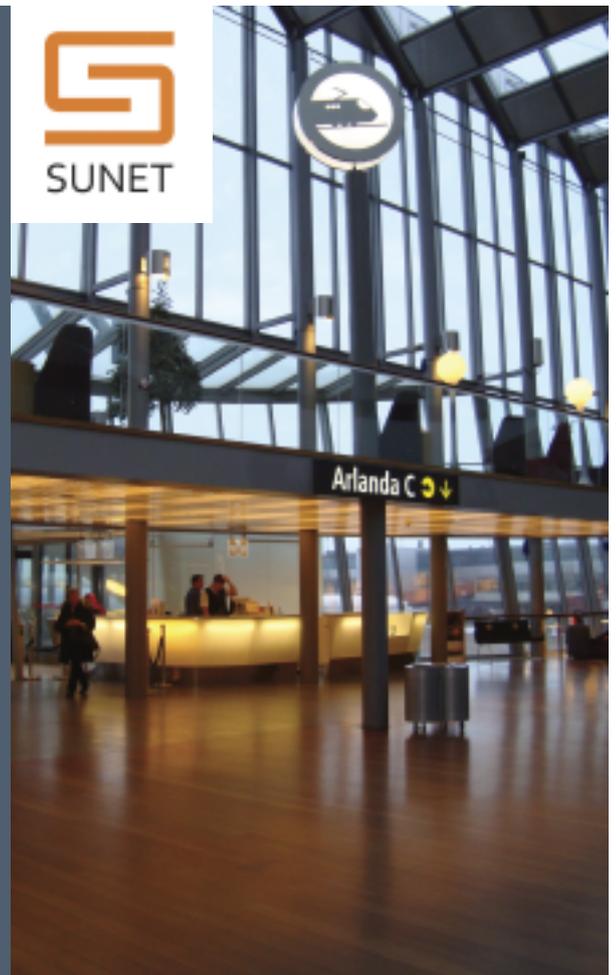
The first places targeted were travel hubs, such as airports and railway stations. Today, SUNET can provide eduroam in 934 locations through 16,146 access points all over Sweden. The locations are universities and colleges, municipalities as well as commercial venues. City centers, railway stations, ten of Sweden's airports, ferry terminals, municipal buses and libraries. Hotels, fast food restaurants, cafés, gas stations and malls also offer connection through eduroam.

Stockholm Arlanda Airport is the biggest airport in Sweden with more than 22 million passengers on a yearly (2014) basis. Stockholm Arlanda Airport is operated by Swedavia AB, a Swedish nationally owned company that owns and runs ten major airports. In total more than 35 million passengers are travelling from Swedavia's ten airports (2014).

Pär Weilow is the Product Owner in charge of mobile solutions at Swedavia Airport Telecom AB. He notices a keen demand for the service. "In May 2012 we started offering free Wi-Fi connections to all visitors throughout all Swedavia airports. At that point, we had to restrict the usage, but that was not a popular move. Despite quite generous amounts of data we soon got feedback from many customers about the data limitations. But, when we launched eduroam the complaints almost disappeared. It turns out it was mostly students complaining about restricted usage of Wi-Fi. Overall, airport visitors are a crowd that expect excellence, and Wi-Fi is an extremely important part of the experience. So, today we are very happy to be able to offer eduroam together with SUNET and The Cloud."

Roald Sandén, General Manager of The Cloud Nordics adds: "The benefit from the eduroam service is apparent not only for the users, but also for our venue partners in all segments." He continues: "The transport segment where we cover the airports in cooperation with Airport Telecom, and the railway stations in cooperation with Jernhusen was the initial focus, but the benefit of offering services in the public, hospitality, and retail/fast food sectors is also obvious for our partners in those segments."

What is in the pipeline when it comes to eduroam? The target is threefold: Increasing awareness about eduroam amongst students, looking into monitoring of the service and setting up automatic testing. "Two very exciting things ahead are firstly, an agreement with the Swedish school federation in order to provide eduroam in all elementary schools, says Maria Häll, in charge of SUNET. "And secondly, we need to make a new eduroam procurement, within a couple of years from now."



Some of the commercial venues providing eduroam in Sweden:

Hotels:

- | | |
|--------------|---------------|
| Best Western | Park Inn |
| Clarion | Radisson |
| First Hotel | Quality Hotel |

Restaurants, cafés & bars:

- | | |
|-------------|-------------------|
| Burger King | O'Learys |
| Starbucks | Stars and Stripes |
| Barista | |

Swedavia AB is a Swedish nationally owned company, which owns and operates the ten major airports of Sweden:

- Åre Östersund Airport
- Gothenburg-Landvetter Airport
- Kiruna Airport
- Luleå Airport
- Malmö Airport
- Ronneby Airport
- Stockholm-Arlanda Airport
- Stockholm-Bromma Airport
- Umeå Airport
- Visby Airport

Links:

- <https://meta.eduroam.se/>
- <http://www.thecloud.net/>
- <https://en.wikipedia.org/wiki/Swedavia>

EDUGAIN GAINS TRACTION IN GREECE

CROSSING OCEANS TO CONNECT

The appropriately named ~okeanos service is an ambitious Infrastructure as a Service (IaaS) rolled out by GRNET, Greece's NREN in 2011. Okeanos is the Greek word for ocean – a symbol of abundance. Oceans are a force that transforms our world by storing and delivering energy, oxygen and life to our planet – an unfailing well of resources.

~okeanos delivers production-quality IaaS to the Greek Academic and Research Community so that students, professors, and researchers can dive into the 'ocean' for free and get the full power of virtual infrastructures in computing, networking and storage – easily and cost effectively. The service is run from their own data centres, over their own dark fibre network.

What this means is that users can “build” their own computer, always connected to the Internet, without worrying about hardware failures, spaghetti cables, connectivity hiccups and software troubles. Users can manage, destroy, connect and do almost anything they like to the virtual machines and network all from inside their favourite web browser. They can also store your files online, share them and access them anytime, from anywhere in the world.

Is the spirit of making computing and access as easy as possible, GRNET offers federated login using Shibboleth. This has enabled GRNET to offer ~okeanos-global (<https://okeanos-global.gnet.gr>), an ~okeanos installation available through eduGAIN. Greek ~okeanos users have always been able to use the same credentials they use to login to university or research centre accounts; eduGAIN users can also get a taste of ~okeanos by using their home credentials to login to ~okeanos-global.

When the developers of ~okeanos expanded their reach to offer the services to the global R&E community, having eduGAIN in place and working helped them gain visibility for the service throughout the world. According to Panos Louridas, project manager for GRNET's cloud initiatives, this “soft power” approach has paid off. “We know a great deal of people have used ~okeanos-global, and so through that they have become more familiar with our services. Today, we have users all over the world adopting ~okeanos. We believe that this growth comes from spreading knowledge by word-of-mouth, so the investment in the eduGAIN infrastructure has paid off.”

Based on this success, GRNET is considering integrating more “GRNET-grown” services via eduGAIN. “For quite a while, we have been operating a production quality e-polling and survey system called Zeus. The next step is to make it available throughout GÉANT so that people can carry out fully anonymised, verifiable surveys and polls, rather than relying on Doodle or proprietary systems.”

AN INTUITIVE, SIMPLE AND EFFECTIVE APPROACH TO ACHIEVE EUROPEAN-WIDE AAI INFRASTRUCTURE

The eduGAIN interfederation service enables Identity Federations to unite academic and research institutions and participate in a global network via REFEDs (Research & Education Federations). This allows users to seamlessly connect and collaborate with colleagues across the globe via Web Single Sign On (Web SSO) and ensures trustworthy and secure identity, authentication and authorization, locally and in collaboration with partners around the world. With simplified administration, institutions only have to be responsible for their own users' accounts. Content providers and member institutions can reach a larger academic audience with more services, and users enjoy a diverse service portfolio.

eduGAIN is leading the way for more intuitive, simpler access and increased service adoption throughout the GÉANT network.

Every day over 40 federations across the globe participate in, or are in the process of joining eduGAIN, with approximately 1,500 identity providers and 1000 service providers. eduGAIN is helping them to leverage the power of online services that are crucial to research and education.

GÉANT'S ONOS ICONA DEPLOYMENT DELIVERS BENEFITS OF OPEN SOURCE SDN TO EUROPE'S RESEARCH AND EDUCATION NETWORKS



In August, GÉANT and the Open source SDN Network Operating System (ONOS) community actively deployed ONOS on the GÉANT Testbeds Service network allowing researchers to define, build, test and rebuild highly scalable, high capacity virtual networks quickly, easily and cost-effectively.

The research experiment in GÉANT's Testbeds Service is running a new Inter Cluster ONOS Network Application (ICONA) – developed by CREATE-NET and the University of Rome Tor Vergata/CNIT in collaboration with the ONOS project – to manage the intercommunication of geographically distributed ONOS clusters and deliver faster controller response time during network events such as failures or congested links.

For similar experiments, organisations may connect to a network slice offered on the GÉANT Testbeds Service (GTS), a virtual network environment where pools of virtualized resources can be programmed and reserved using a Domain Specific Language to create and access powerful self-contained networks for

experimentation and early pilot deployments of new technology or distributed applications.

"ON.Lab and its ONOS network operating systems are a great example of emergent network paradigms that would be difficult or impossible to test or evaluate at full European scale without the infrastructure provided by the GÉANT network and the virtualization capabilities provided by the GÉANT Testbeds Service," said Jerry Sobieski, GTS Activity Leader.

"We are thrilled to support and collaborate directly and through GÉANT to the development and research in new networking technologies using the ONOS platform," says GARR Research and Development Coordinator, Mauro Campanella. "A joint international effort greatly facilitates the innovation towards an open source SDN production environment."

Links:
<http://services.geant.net/gts>
<http://onosproject.org/>
<http://onlab.us/>
<http://www.create-net.org/>

GTS TECH+FUTURES WORKSHOP – BUILDING A ROADMAP FOR THE FUTURE OF GTS

In order to help guide future developments in GTS and to introduce potential new users to GTS in GÉANT is running a GTS Tech+Futures Workshop at the NORDUnet offices at Kastrup, Denmark on 20-22 October.

The primary purpose of this Workshop is to gather information for the evolution of the GÉANT Testbeds Service and discuss new features and a long-term roadmap. There will also be a large community of interested GTS users to share experiences and see how their know-how and proficiency can affect GÉANT and steer the evolution of the GÉANT Testbeds Service. This will help set the future direction, feature sets, and development priorities.

The workshop will also be of great interest to researchers who may not have had a chance to try out the Testbeds Service and are new to GTS, but are searching for a network platform to support their experiments.

For more information visit services.geant.net/gts or the events booking page at <https://events.nordu.net/display/GN4SA2/Welcome>

WIRELESS CROWDSOURCED PERFORMANCE MONITORING AND VERIFICATION

Your wireless network rocks, or sucks, depending on who you ask and when you ask them. The problem can be attributed to a range of components in the provision of a service but we often can't tell which until it's too late.

When a user reports a problem with wireless connectivity on campus, often the data for troubleshooting isn't available. So was it their device? Was the room too crowded with devices competing for wireless connectivity? Is there faulty equipment? Have we under provisioned the network for the number of users? And typically the only information the helpdesk gets is that "the internet is too slow." All the helpdesk can do is send someone to the room after everyone has left - which is often too late. Our usual approach of attempting to replicate the problem fails. There has to be a better way.

AN APPROACH

Today, a helpdesk has three main sources of information on performance measurement:

- The access points and controllers themselves.
- Network Management Systems, including probes that periodically provide objective tests.
- The end user's device.

We think that on a user's device, it doesn't pay proper attention today. It would change a lot if we could get a better view of what the experience is really like on the device. What we would need to do then, is find a way to run non-invasive bandwidth tests on users' devices, report the results back, and coordinate them by clusters of access



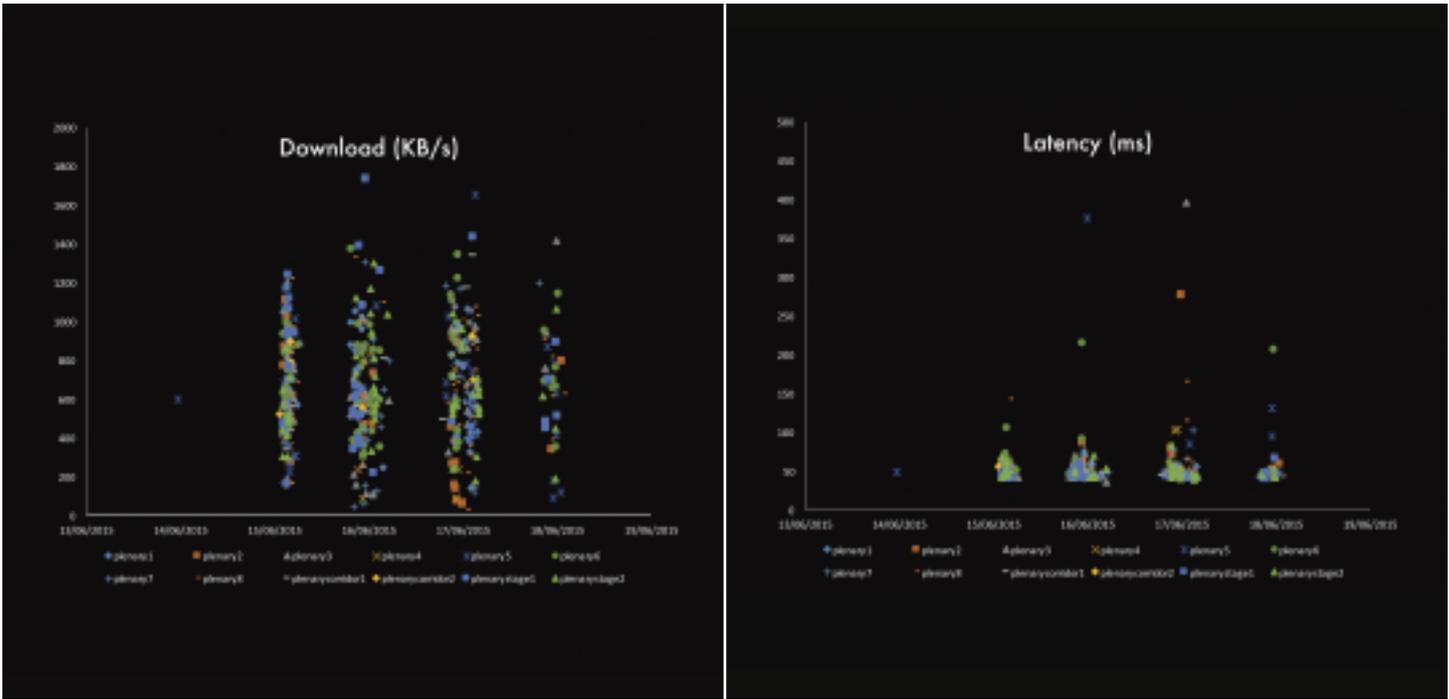
points. It turns out that most of the ingredients for this are already in place. So for troubleshooting, the address-to-device mapping is already recorded by wireless networks.

But how do we run the performance tests? If we ask the user to run an app, we'll get occasional results but not a broad, ongoing view of the network. However, much like APNIC's use of advertisements to test DNS and IPv6 connectivity [1], we can use JavaScript on a frequently-visited website (such as a virtual learning environment [VLE] or a conference program) to run our own series of tests.

WHAT IT DOES

Once we have this in place, we can learn what's going on. Nothing replaces the objective measurements from probes or a network management system. But we can add to this the experience of users on their own devices:

- If a number of users in a single room show poor performance, there's a problem in that room.
- If a single device shows poor performance in many locations, it's probably a problem with the device.



As a picture builds up over time, we can evaluate this information that may be useful, e.g. for capacity planning.

A FIRST TRIAL – TNC15 IN PORTO, JUNE 2015

But that’s all very well in theory. We wanted to try it out, somewhere we could find a few hundred people who would all be repeatedly visiting the same website. We asked the TNC web team to add Nettest [2] on the TNC15 website. We IP locked it so the tests wouldn’t trigger for people who are off-site. Then, during the week of the conference, we got to work analysing the RADIUS logs so we could work out which test came from which room. It worked! After performing some combat-scripting and analysis over the first couple of days, we presented the results during the lightning talk session on the penultimate day of the conference [3]. Now that we’ve had a bit of time to look at them, here are some more results.

The first image is the download speeds we saw in the plenary room over the whole week. Each symbol is a different access point. We were a little disappointed when we saw this at first – there’s no clear pattern to pick out. The image size we picked, 1 megabyte, was probably too small to get reliable measurements. But then we looked at latency.

This is much clearer! Most of the results are clustered in a range of about 20-30ms (milliseconds), which shows a pretty healthy network. There are outliers, but none are repeated, so it doesn’t look like any device was showing a particular problem. And clearest of all, at the bottom you can see no test took less than about 40ms or so - showing the distance to our test server in another city.

HOW TO PARTICIPATE

We are thrilled with the results from TNC15, but we’re even more excited about iterating on it, and deploying at more sites as we develop now. This project comes from a real world problem identified by one of HEAnet’s clients, and we’re very interested in hearing from any institutions that would be interested in trying it out or working with us on a service angle. If you are interested in please contact us at gn4-1-sa3t3wifimon@lists.geant.org.

REFERENCES:

- [1] <http://stats.labs.apnic.net/ipv6/> and <http://stats.labs.apnic.net/dnssec>
- [2] <https://code.google.com/p/nettest/>
- [3] <http://geant.23video.com/tnc15-8a-thunderclap-talks> beginning at 39m30s.

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WEBRTC – WALKING THE TALK

It's not enough just to talk about WebRTC, we must talk using WebRTC. But what is WebRTC, why did this buzzword suddenly turn the traditional video conferencing upside down and what should NRENs do to keep up with the growing demand for web-based real time communications?

WEBRTC – CHALLENGING THE STATUS QUO

Web-based Real Time Communications relying on the WebRTC protocol seeks to deliver cost effective, easy-to-use video conferencing across many platforms using IP connectivity and without the need for expensive dedicated equipment and software. Its attractiveness for the service providers has grown as it has become clear that maintaining and operating traditional Gatekeeper (GK) and Multipoint Control Unit (MCU) based video conferencing infrastructures is expensive and does not provide a long term sustainable solution.

The new entrants into the commercial video conferencing space such as Vidyo, Zoom, or BlueJeans are offering similar video and audio quality for the fraction of the price. This is due to their cutting-edge software platforms, gateways for any-to-any interoperability, easy-to-use clients and, last but not least, cloud based delivery models that require no local IT support. Adapting these tools and services by NRENs seems to be the logical step but with the current risk of vendor lock-in.

The key success factors of the WebRTC technology – that is also behind the aforementioned tools - are in the standard protocol natively adopted by browsers and mobile platforms and in the seamless interoperability and bridging capabilities. However, the full standardisation and platform compliance is yet to come. The bridging capability for instance is expected to be increasingly important to enable linking together the still existing traditional video conferencing infrastructures with the emerging web based platforms that is in the interest of NRENs.



EDUCONF – SUPPORTING NRENs

With a large installed base of Video Conferencing facilities, NRENs need to maximise the return on their existing investments and continue to provide solutions to users while planning the next generation of services. The eduCONF service of GÉANT helps support the traditional infrastructure of NRENs and their connected institutes, with growing attention to the developing countries, and ensures the reachability of video end-points to make inter-domain calls more reliable.

Visit educonf.geant.net for more information on the eduCONF service

GÉANT AND THE NRENs – WORKING TOGETHER TO EXPLOIT WEBRTC

A group of dedicated NRENs and other organisations with undisputed expertise in real time communications gathered under GÉANT to answer the questions of the community: how to get quick business benefits without risking the long term strategy and what is the executable roadmap then for research and education to follow?

Finding the way in the rapidly developing cloud market is not that easy. The biggest challenge is to stay in line with the technology trends and longer term strategic visions of tomorrow while seeking for quick business benefits of today. Therefore,



the cloud service delivery activity of GÉANT is working closely together with the real time communication experts to ensure the balance.

Moreover, the GÉANT task force on WebRTC - that is open to all interested communities, even to commercials and industry - is liaising with the GÉANT Project to shed light on all the possible aspects of this disruptive technology and its obvious benefits for the research and education community.

The demand for these services is undoubted as can be clearly seen by the success of the Rendez-vous service of RENATER. Therefore, the GÉANT project has decided to not just talk but walk and build a GÉANT infrastructure of WebRTC compliant video servers using the Jitsi open source software platform. RENATER, NIIF and NORDUnet have already engaged while GRNET, SURFnet, FCT and UNINETT are considering joining the infrastructure. An open Application Programming Interface (API) will also be available to this multi-NREN Jitsi platform and will be provided for innovative application developers to come up with any crazy application pilot not only targeting but originating from the research and education community.

THE FUTURE?

Latest trends show that real time video is not enough for research and education. There must be added functionality for real-time sharing, annotation and content viewing. This includes document sharing, video, audio, images and graphics, with the ability to markup and embed presentations. The standard nature of WebRTC and the open Jitsi API provide an ideal platform for innovation and for future application development. From the video conferencing service perspective, the future is in the community agreement for an infrastructure-agnostic service layer that effectively brings the traditional infrastructure together with the new WebRTC-based platforms and includes all the crucial functionalities for service scalability and robustness. We are just beginning to "walk the talk".

For more information on the WebRTC Task Force and how to take part visit www.geant.org

GÉANT OPEN FOR BUSINESS

GÉANT is always looking to enhance the business of research connectivity; to improve the productivity of the research cycle through connectivity and ICT improvements. Improved connectivity can bridge both academic disciplines and provide greater interoperability between the many e-infrastructures serving the research community, both commercial and funded from EC or national sources.

The overall requirement is to deliver improved collaborative abilities for the research community benefitting both individual researchers and supporting the strategic aims of national and EC policy.

The use cases include supporting the long tail of science, where research is produced by small groups of researchers with budgets under €1m versus the large science and technology projects.

Having analysed these commitments, GÉANT will continue to support the research community with a number of targeted developments;

1. An expansion of GÉANT Open Exchanges across Europe to enhance collaboration between European research and innovation, industry and international partners. For example to allow access to High Performance Computing (HPC) and e-infrastructures for SMEs (Small and Medium Enterprises).
2. Developing self-service networking capabilities to enable cost effective collaboration for research projects across Europe and the world, regardless of their local network capabilities.
3. Enhancing network access for European and global research networks with further developments in dynamic circuit provisioning. Large projects and e-infrastructures will be able to build network access into their end-user applications.

These developments will serve to support improvements in productivity through the use of cost effective self-service networking, allowing industry to access high value e-infrastructures to accelerate product development. Lastly, GÉANT will support the multitude of e-infrastructures with network building blocks allowing applications to intelligently build paths to researchers and resources.

PERFSONAR HELPS SUPPORT INTERNATIONAL CONFERENCE ON HPC

The International Conference for High Performance Computing, Networking, Storage, and Analysis, better known as SC, brings together the international supercomputing community—an unparalleled ensemble of scientists, engineers and researchers all viewing and demonstrating the latest developments in High Performance Computing (HPC).

During the week of the SC conference, many demonstrations showcase cutting-edge technologies and applications in HPC and “big data” science. To run these latest and greatest technologies, the network, built by a committee of volunteers, needs to be extremely fast and reliable. This network is called SCinet (<http://sc15.supercomputing.org/scinet>).

Components of the perfSONAR project (a collaboration between ESnet, GÉANT, Indiana University, and Internet2) have been used to support the high performance network, SCinet, built specifically to support the SC

conference each year, since 2004. The perfSONAR tools enable both the organizers of the event, as well as attendees, to visualize network performance in real-time. Additionally, perfSONAR is a critical tool for troubleshooting the end-to-end performance of demonstrations at the conference such as those featured in the SC15 Workshop on Innovating the Network for Data-Intensive Science (INDIS) (http://sc15.supercomputing.org/schedule/event_detail?evid=wksp105) and the SCinet Network Research Exhibition (<http://sc15.supercomputing.org/conference-program/research-scinet>).

Beginning this year for SC15, members of the perfSONAR team, in cooperation with Indiana University International Networks team, will be showcasing small-form factor perfSONAR devices. This work is in part supported by the US National Science Foundation grants for ACE (#0962973)



and NetSage (#1540933). The team is identifying small, inexpensive, devices that are able to perform at gigabit network speeds for rapid deployment within a network architecture. These testers will enable a “plug and check” capability, allowing for faster diagnosis of performance problems.

For more information on perfSONAR visit <http://www.perfsonar.net>

For more information on The International Conference for High Performance Computing, Networking, Storage, and Analysis (the SC conference) visit:

<http://sc15.supercomputing.org>

Picture

A number of small-form factor, single-board LIVA boxes will be running perfSONAR tests during SC15. These nodes have 1 Gigabit-per-second interfaces with 64 GB of memory.



MD-PAEDIGREE

MD-PAEDIGREE – A CLINICALLY-LED, MODEL-DRIVEN, EUROPEAN PROJECT

MD-Paedigree stands for Model-Driven European Paediatric Digital Repository. It leverages an information processing and knowledge discovery evolutionary framework for personalised and predictive treatment in paediatrics, leading to newly defined model-based clinical workflows, directly available at the point of care.

MD-Paedigree focuses on four paediatric disease areas: cardiomyopathies, obesity-related cardiovascular disease risk, juvenile idiopathic arthritis, and neurological & neuromuscular diseases.

Using MD-Paedigree tools, physicians are able to select highly individualised treatment options, and to receive on-the-spot support in predicting treatment outcome based on each patient's personal medical data, also making it possible to reduce the timeframe from disease evidence to medical treatment.

MD-Paedigree builds disease models taking into account also routine clinical data gathered from seven hospitals, with the aim of applying big data analytics tools to provide three key functionalities:

- Similarity search, through the CaseReasoner tool developed by Siemens, enabling clinicians to access “patients like mine” (therefore finding decision support for optimal treatment based on comparative outcome analysis), and allowing patients to get in touch with “patients almost exactly like me”;

- Physio-pathological models for patient-specific simulation and prediction;
- Patient-specific clinical workflows

Beside these core features, MD-Paedigree provides a whole set of tools useful for the clinicians to use more effectively the available datasets:

- The data anonymization tools make it possible to automatically anonymise and thus safely share the datasets, uploading them onto the MD-Paedigree online platform without jeopardising the patients' privacy.
- The data curation and validation tool (DCV), a web application that provides a (semi-) automatic cleaning process able to handle the heterogeneous MD-Paedigree datasets, spotting out the missing or inconsistent information.
- Hypothesis generation service, which helps the clinicians to formulate prognosis on the basis of the available information on anamnesis and symptoms, by directly querying these elements of information in the system.

- Furthermore, MD-Paedigree will also make it possible to get outcome analyses and patient-cohort stratification through CaseReasoner's further developments.

MD-PAEDIGREE AND THE BIG DATA CHALLENGE

MD-Paedigree moves from the assumption that only by applying data analytics and model-computation to massively available biomedical data, clinicians can adequately simulate perspective outcomes and prevent patients from undergoing ineffective treatments. In other words, using data and computer-models to acquire a deeper understanding of pathophysiological processes will result in effective knowledge discovery and ultimately in healthcare improvements, making personalised medicine a reality.





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A PATH TOWARD THE TRANSLATION TO THE CLINICAL ENVIRONMENT: USER REQUIREMENTS AND VALIDATION

The final clinical acceptability and usability of the implemented tools is a core objective of MD-Paedigree, which is a clinically-led project. To ensure a smooth translation to the clinical environment, an agile methodology has been adopted, prompting a continuous iteration between clinicians and technical partners, in order to effectively take into account the end-users' requirements and clinically validate the developed modelling tools.

To this end, the ongoing iterative "agile process" is aimed at checking what answers can be given to questions such as: "what kind of parameter and information are the clinicians interested in extracting from the models?", or "what kind of data management and analytics tools and features are the clinicians most interested in?"

In parallel, a multi-phase validation process of the developed models is also ongoing, as phase being a fundamental step for getting closer to the implementation of the modelling tools into the daily clinical practice.

CASEREASONER

CaseReasoner is a prototype Decision Support System (DSS) developed by Siemens over the last 9 years, in conjunction with a number of EC funded projects (Health-e-child, Sim-e-child, and now MD-Paedigree). It gives users the ability to browse and query patient records in a visually meaningful way. CaseReasoner allows to visualise existing clinical data from the patient history, inter-patient similarities, and patient-cohort stratification, integrating all clinical and imaging data with other knowledge, for example in the form of ontologies.

THE MD-PAEDIGREE MODELS

In paediatric diseases, predicting response to treatment, and selecting and timing the appropriate treatment for a specific patient, can be particularly challenging. Computational models of physiology may provide some of those parameters that belong to the patterns of risk factors. These models may give access to parameters that otherwise cannot be directly measured, or only invasively. MD-Paedigree expects that such parameters can be seen as abnormal well before the development of hard intermediate outcomes, increasing, as such, the predictive value of measurements as such currently already available in the clinical environment. The first need is therefore model personalisation, i.e. the process of tuning the parameters of the model to make it patient-specific. Once personalised, a model will mimic the patient's conditions. The second requirement is that these personalisation methods need to work with data that are routinely available and necessitate only little manual interaction. The processing time needs also to fit a routine clinical workflow. The last requirement deals with the presentation of the model outcome to physicians. Biophysical models can provide additional clinically useful information, but all outcome parameters may not be easily understood by physicians and there may be an excessive quantity of information.



CARDIOPROOF

CARDIOPROOF – A PROOF-OF-CONCEPT OF MODEL-BASED CARDIOVASCULAR PREDICTION

CARDIOPROOF aims to ascertain the applicability and effectiveness of predictive modelling and simulation tools for cardiology, validating them in interrelated clinical trials conducted in three European centres of excellence in cardiac treatment (in Germany, Italy and the UK).

Previous research efforts developed some powerful tools for computer-based modelling of various cardiovascular (CV) diseases, raising significant expectations to make such tools available for early diagnosis and for predicting disease behaviour and evolution as well as treatment outcomes. The translation into a routine clinical environment has, however, remained challenging and substantially bounded. In fact, despite an increasing interest from the medical community to apply modelling methods to CV diseases, limited results have been achieved so far: currently, clinical guidelines are highly complex and rely mostly on imaging diagnostics and clinical parameters, without benefiting, as yet, from patient-specific disease modelling based prediction.

CARDIOPROOF goes beyond the current state of the art by conducting validation trials aimed at covering and comparing the complete spectrum of cardiovascular treatment in aortic valve disease (AVD) and aortic coarctation

(CoA), predicting the evolution of both diseases and the immediate and mid-term outcome of treatment. With more than 50.000 interventions per year within the EU, the diseases addressed by CARDIOPROOF have a significant socio-economic impact.

In brief, using already developed modelling methods, the primary objectives of CARDIOPROOF are to:

1. Conduct validation trials in patients with AVD or CoA that reflect a real-world approach by covering and comparing the complete spectrum of cardiovascular treatment
2. Provide first data about comparative clinical and cost effectiveness of in silico approaches compared to conventional diagnostic and treatment algorithms.
3. Accelerate the deployment of CV model-based methods by improving their usability and interoperability in the clinical context.

FROM LABS TO HOSPITALS: BRINGING MATURE CV MODELS TO THE CLINICAL ENVIRONMENTS

CARDIOPROOF aggregates information from multiple biological levels with regard to the patient-specific disease state, and pays particular attention to user-friendliness as a key component of clinical usability. While improving usability and interoperability, CARDIOPROOF aims also to enhance the role of the physician in the modelling process chain by markedly improving data management, allowing to access cloud-based central resources, and making use of user-friendly human interfaces.

A TRIAL TO EXPLORE THE IMPACT OF THE APPLICATION OF IN SILICO MODELS IN THE CLINICAL DECISION-MAKING PROCESS

To prove the concreteness, effectiveness and significance of in silico modelling, CARDIOPROOF evaluates the impact of the cardiac simulation modelling tools as compared to current standard practice on clinical decision making.

A comparative effectiveness study is underway, to evaluate whether the additional parameters that are made available through image-based simulation modelling would result in different clinical decision making. In doing so, the questions addressed through randomized controlled experiments are aimed at ascertaining whether taking into account image-based modelling results clinicians would be led to adopt different decisions as compared to current clinical practice guidelines.

In collaboration with its three clinical partners, two separate imaging datasets are generated for each of the patients recruited in CARDIOPROOF. The first dataset includes the imaging parameters currently recommended by clinical practice guidelines (referred to as "limited dataset"). The second dataset includes an expanded list of parameters, inclusive of information that is available from traditional imaging parameters (as recommended by the guidelines) and simulation modelling (referred to as "image-based modelling dataset").

A computerized random-sample function is used to randomly allocate interventional cardiologists (not directly involved in CARDIOPROOF) into two separate groups. Each group is then provided with one set of imaging data, either the limited dataset or the image-based modelling dataset. Thus, it can be checked whether the two groups come with different treatment decisions, due to the information made available by the image-based modelling dataset.

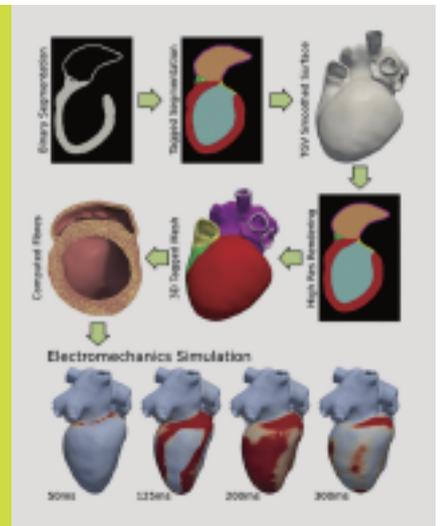
VIRTUAL STENTING

One of the tools implemented within CARDIOPROOF is the virtual stenting software, which facilitates the treatment of the aortic coarctation. This simulator, developed at Fraunhofer MEVIS in Bremen, can be installed on Windows or Mac OS operating systems and allows clinicians to simulate treatment options prior to the intervention. The virtual stenting allows them to extract the patient-individual anatomy, to assess the pre-interventional haemodynamics, and to interactively simulate the stent placement and deformation.



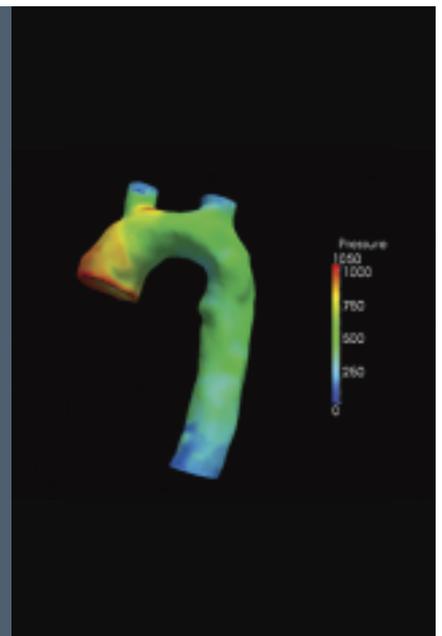
ELECTRO-MECHANICAL MODEL OF THE HEART

The team of Prof. Plank at the Medizinische Universität of Graz, is working on the development, application and validation of a modelling methodology for performing patient-specific in-silico simulations of ventricular electro-mechanics. Such simulations provide deformation data, which become usable as boundary condition for fluids flow simulation in other modelling activities within CARDIOPROOF. This model development targets both cardiac anatomy and physiology, with sufficient detail to facilitate a direct clinical interpretation of computed simulation results. Besides serving as input for CFD simulations, physiologically important parameters such as regional distribution of strains, stresses, myocardial work and energy consumption are also computed.



COMPUTING THE PRESSURE-DIFFERENCE FIELD FROM 4D FLOW DATA

Knowledge of pressure and velocity of blood flow in the human cardiovascular system can be decisive for clinical evaluations (initial and post-procedural) and procedure planning. For example, the severity of the cardiovascular diseases targeted in this project (CoA and AVD) can be assessed by intraluminal pressure gradients. The team of scientist at SIEMENS has developed a method to non-invasively compute, from magnetic resonance imaging (MRI), the relative pressure within the aorta. This technique has been applied to some first CARDIOPROOF patients, delivering sound results even with still limited data. The whole pipeline will now be validated using the coarctation cases, which include invasive pressure measurements. This way, it will become possible to directly compare the simulated pressures with the measured ones, and to investigate the relationship between treatment outcomes and simulation results.





HOW CERN DEALS WITH THE DATA TORRENT

Experiments at CERN generate colossal amounts of data. The Data Centre stores it, and sends it around the world for analysis.

Research and education networks such as GÉANT and its European NREN (National Research and Education Network) partners provide the high-capacity bandwidth required by CERN to transport this data all over the globe. Without them, these types of colossal science projects—which have the potential to change our understanding of the world—could not take place.

In this article, extracted from the CERN website, CERN gives us a window into the wonderful world of high energy physics—and the vast, ambitious and collaborative Large Hadron Collider project.



The server farm in the 1450 m² main room of the DC forms Tier 0, the first point of contact between experimental data from the LHC and the Grid. As well as servers and data storage systems for Tier 0 and further physics analysis, the DC houses systems critical to the daily functioning of the laboratory. The servers undergo continual maintenance and upgrades to make sure that they will operate in the event of a serious incident such as an extended power cut. Critical servers are held in their own room, powered and cooled by dedicated equipment.

By early 2013 CERN had increased the power capacity of the centre from 2.9 MW to 3.5 MW, allowing the installation of more computers. In parallel, improvements in energy-efficiency implemented in 2011 have led to an estimated energy saving of 4.5 GWh per year.

COPING WITH INCREASING REQUIREMENTS

In a complementary effort to cope with the increasing requirements for LHC computing, the Wigner Research Centre for Physics in Budapest, Hungary, operates as an extension to the DC. The Wigner Data Centre as a remote Tier 0, hosting CERN equipment. The site also ensures full business continuity for the critical systems in case of a major problem on CERN's site at Meyrin in Switzerland.

The Meyrin site currently provides some 120 petabytes of data storage on disk, and includes the majority of the 110,000 processing cores in the CERN DC. The Wigner DC extends this capacity with 43,000 cores and 70 petabytes of disk data.

In 2012, the Wigner Centre was one of the first beneficiaries of GÉANT's terabit network, utilising multiple 100Gbps links. At the time David Foster, Deputy Head of the CERN IT Department said, "The GÉANT network is fundamental to our data transfer needs, and we're delighted that we will be continuing this successful relationship."

Approximately 600 million times per second, particles collide within the Large Hadron Collider (LHC). Each collision generates particles that often decay in complex ways into even more particles. Electronic circuits record the passage of each particle through a detector as a series of electronic signals, and send the data to the CERN Data Centre (DC) for digital reconstruction. The digitized summary is recorded as a "collision event". Physicists must sift through the 30 petabytes or so of data produced annually to determine if the collisions have thrown up any interesting physics.

A COMMUNITY OF 8000 PHYSICISTS

CERN does not have the computing or financial resources to crunch all of the data on site, so in 2002 it turned to grid computing to share the burden with computer centres around the world.

The Worldwide LHC Computing Grid (WLCG) – a distributed computing infrastructure arranged in tiers – gives a community of over 8000 physicists near real-time access to LHC data. The Grid builds on the technology of the World Wide Web, which was invented at CERN in 1989.

ONE PETABYTE OF DATA EVERY DAY

The Data Centre processes about one petabyte of data every day - the equivalent of around 210,000 DVDs. The centre host 11,000 servers with 110,000 processor cores. Some 6000 changes in the database are performed every second.

The Grid runs more than two million jobs per day. While the LHC is running 10 gigabytes of data may be transferred from its servers every second.

In addition, the LHC science community makes use of GÉANT and its global partners to enable continual data sharing at aggregate rates of 15 - 20 gigabytes per second year round.

UPDATE: CERN RESTARTS MOST POWERFUL ATOM SMASHER

In June this year, the experiments at the Large Hadron Collider (LHC) started taking data at the new energy frontier of 13 teraelectronvolts (TeV) - nearly double the energy of collisions in the LHC's first three-year run. The collisions, which occur up to 1 billion times every second, send showers of particles through the detectors.

With every second of run-time, gigabytes of data come pouring into the CERN Data Centre to be stored, sorted and shared with physicists worldwide.

Published with kind permission of CERN.

The original articles can be found here:

<http://home.web.cern.ch/about/computing>

<http://home.web.cern.ch/about/updates/2015/06/lhc-season-2-cern-computing-ready-data-torrent>

MY THOUGHTS ON SOFTWARE DEFINED NETWORKING AND THE RISE OF OPEN NETWORKING

MICHAEL ENRICO,
GÉANT CHIEF
TECHNICAL OFFICER



In all areas of engineering endeavour there abound a myriad of Three Letter Acronyms (TLAs) and at any given time you will hear or read about a handful of these over and above the others which, of course, reflects the current trends and dare I say fads of the day. Back in the mid-90s in telecommunications and network engineering these three letters were ATM (by which I refer to Asynchronous Transfer Mode rather than Automatic Teller Machines). This lasted for a few years until developments in Ethernet and the flowering of MPLS (err, neither of which are TLAs!) had easily put pay to that particular future by the turn of the millennium. And now we have another TLA: SDN.

SOFTWARE HAS BEEN THERE ALL ALONG

Today it seems that almost everybody in telecoms and networking is talking about or at least has heard about SDN – which stands for “Software Defined Networking.” What does this mean exactly? Surely all contemporary networking is defined (or at least driven) by software in some form or other? Interestingly, although I refer to data communications networking here, I’d venture to say that another form of networking (the human variety) is also highly driven by software in the form of the seemingly infinite array of social networking apps that we have at our disposal today.

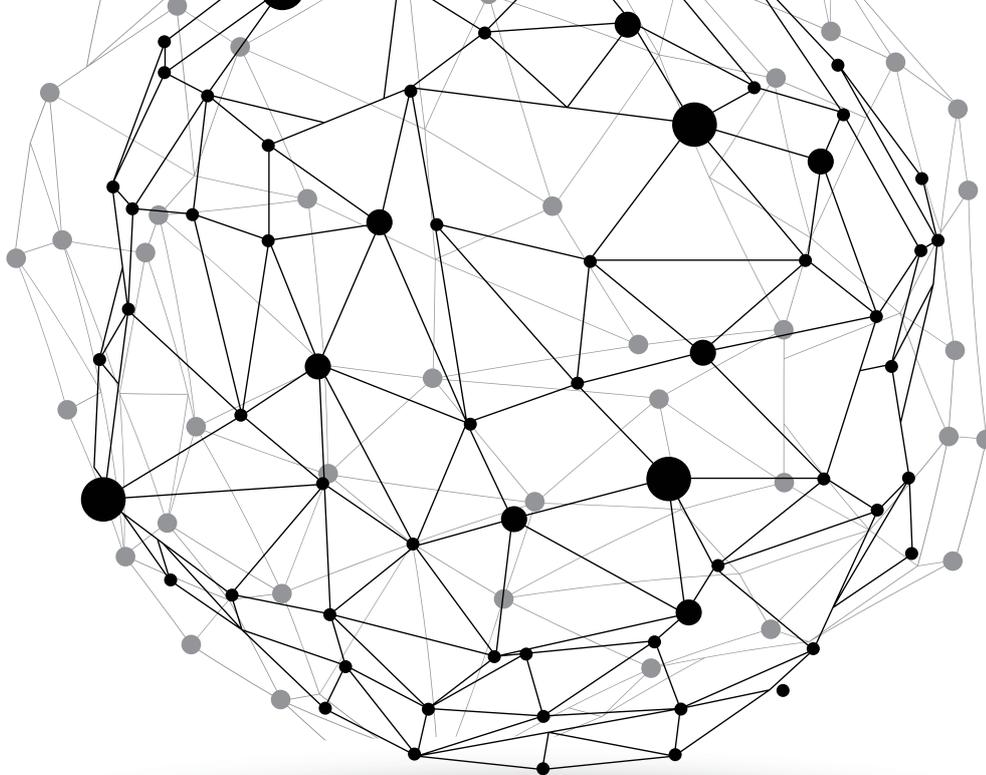
Returning to my question above, software clearly drives networking equipment – for example, the routing and signalling protocols that network operators have known and loved (and hated!) for years and which constitute the “control plane” of a network are, of course, implemented as software modules. By and large these have been implemented by coders working “in-house” for the networking equipment manufacturers or in the form of off-the-shelf software suites developed and maintained by specialist networking software

houses. Either way, this software is “closed source” and evolves quite slowly according to the measured shifts and changes that occur in the internationally agreed standards that define the behaviours of the relevant protocols such as those administered by the Internet Engineering Task Force (IETF).

Moreover, the behaviour of the “forwarding plane” of network devices like switches and routers is traditionally fairly invariant. This defines the way in which the data packets themselves are individually handled – how they are examined upon receipt at a device, how they are prioritised and queued, how they are re-marked in various ways before being forwarded to the next device in the network.

WHY IS SDN DIFFERENT?

The key thing about the contemporary paradigm of SDN (and, by the way, previous incarnations of the same ideas – more on this in a future column) is that it facilitates a much more intimate (low level) control of the forwarding and control planes of a network by removing the embedded behaviours described above and requiring control through standard interfaces by external controllers. In essence these interfaces



are like application programming interfaces (APIs) to the network through which the coders of these controllers can exercise fine-grained control over the network and how it handles the traffic it carries. It is the software constituting these controllers that do the “defining” referred to in SDN.

Furthermore, this software can itself be centralised or distributed, purchased or home-grown, commercial or open-source. In a hierarchical fashion it can and does export other APIs to other pieces of software that control at a more abstract level or that “plug in” to existing software suites that constitute “network operating systems.” In principle this allows for the network devices themselves to become much simpler and hopefully lower cost – some use the term “white boxes” to describe them – driven by this functional rationalisation and the expectation (perhaps misplaced) of competition amongst manufacturers of these more commoditised products.

To many network operations and technology strategists the potential cost savings indicated above are the main driver for their interest in looking seriously at what the SDN paradigm can offer. One does have to take care if this is the extent of one’s interest in SDN and all it stands for. The potential rewards that are brought by making the network more programmable come with increased responsibility. The fine-grained control that is possible and indeed necessary to drive networks comprised of “dumber” devices means that your software must tell the devices what to do with different traffic types in many more situations than would be the case with more autonomous traditional hardware. This can be likened to the driver of a car (with an internal combustion engine) being required to continuously operate many more controls than just the obvious ones – including all those subtle real time adjustments that are today handled by an engine management system like fuel/air mix, ignition timing and so on (just like it was in earlier days of motoring).

A MORE AGILE AND EFFICIENT NETWORK

Another tangible benefit, and one that is I think of more interest to the R&E networking community, is the facilitating of network architectural agility and more rapid introduction of new capabilities in the control and forwarding planes and hence novel services as and when the demand for such arises.

One of the protocols that has been at the heart of the current buzz about SDN is called “OpenFlow” which emerged from work done at Stanford University and is today further developed as part of a standards process administered by an industry membership organisation called the Open Networking Foundation (ONF). This brings me to the last point I wanted to make in this article and this centres on the rise of the principle of “openness” in contemporary networking. This is where the most interesting developments (in this case in network controller software) are done by communities of developers in an open and collaborative manner in much the same way as we have seen the rise of open source operating systems such as Linux. This point is nicely illustrated by the names of the two most interesting suites of network control software that are the focus of most attention by those seriously exploring SDN – these being the “Open DayLight” controller (ODL) and the Open Network Operating System (ONOS). There is also open source software designed to allow commodity server hardware to act as a packet switching device. This is called “Open vSwitch” and, of course, this now supports OpenFlow and the SDN-style forwarding described above. It is this – the rise of “open networking” that is the real reason for the innovation we have seen to date and should see more of in the future.

Finally, what of the work done in the GÉANT project and its partners in this area of the opening up and the “software-ization” of contemporary networking? Amongst the GÉANT partners there is actually quite a lot as indeed one would expect – ranging from in-depth evaluation of and familiarisation with numerous pieces of open networking software and the hardware that supports it up to active contribution to some of the open controller suites. Many of the experts engaged in this currently participate in the network-related service and joint research activities of the GÉANT project. In addition there is all the SDN-focussed work that was funded through the GÉANT Open Call (6 out of 21 of the projects) and brought in substantive expertise from industry and academia. This led to some genuinely interesting results with real global impact (some of which are being adopted in ongoing GÉANT activity) and a lot of which would not have been achievable but for the past and present efforts of the GÉANT project to support SDN-capable testbed facilities. These are the GÉANT Testbed Service or GTS and its predecessor – the GÉANT OpenFlow Facility developed by the Joint Research Work in the predecessor project, GN3plus.

FIND OUT HOW CLOUD IS BEING USED IN EDUCATION




U CISA's Chairman stated at Jisc's technology forum, 'cloud technologies and services create some challenges but certainly present great opportunities in education'.

With that in mind Jisc the charity which champions the use of digital technologies in education, undertook a survey to find out how and why it is being used.

What did they discover?

One of the main findings was that the collaboration and sharing opportunities offered by the cloud were key benefits and drivers for adoption.

This could be because cloud systems are not only more flexible for a normal user accessing their account from a range of devices and locations – therefore supporting collaboration – but they are also often more cost effective.

Collaboration itself can save both time and money, and by sharing data and resources organisations are able to learn from each other, which often supports innovation. The ability to collaborate on research projects is a good example here with 53% of HE providers using private cloud and 34% using public cloud for this purpose.

Is everyone taking the same approach?

The survey found a wide range and variety of use across providers. There are now a huge number of cloud services available offering different benefits and meeting different needs – whether that's better integration between the cloud and other software products, or because they offer flexibility to scale up or down as requirements change. When you consider this it's only natural that these services are being deployed to suit the providers.

What were the challenges?

The survey found there are certainly still barriers to cloud adoption. 61% of respondents said financial issues were their main challenge when trying to use cloud technologies. This is understandable as cloud can offer savings, but it can also work out more expensive if you're using it for the wrong purpose. For example if you need capacity only during specific points of the year, such as clearing, then renting from a cloud may be cheaper than buying as you're not having to pay for the tech when it's not being used. At the other end of the scale, if you require anything other than the standard service on offer this is likely to attract an additional charge. So cloud may be cheaper for standard or intermittently-used services, while in-house can be more cost effective for specialised operations.

How can you find out more about cloud services?

Jeremy Sharp, director of strategic technologies, Jisc says: "Jisc have developed national agreements with major cloud providers such as Microsoft, Google and Amazon and purchasing frameworks with a range of other Cloud providers. This allows our customers to take advantage of cloud services that have already been through a stringent procurement process saving time and money, coupled with tailored terms and conditions for UK education and research."

For more details on cloud services and brokerage deals offered by Jisc please visit <https://www.jisc.ac.uk/network/cloud>

WEB PORTAL REVOLUTIONISES CLOUD OFFER FOR EDUCATION AND RESEARCH

A new model for cloud services offering UK colleges and universities improved terms and conditions is gaining attention globally.

The bespoke central web portal developed in partnership by Jisc, Arcus Global and Amazon Web Services (AWS) gives education and research organisations a simple, cost effective and flexible way of buying and managing access to AWS resources.

Customers are able to authorise use and set budget limits for individual user accounts or departments. Jisc has also completed an OJEU compliant procurement exercise that ensures cost and time savings through pre-negotiated contracts, controlled costs, and volume discounts shared across members.

An additional benefit is that the cloud is peered to Jisc's world class Janet network – the UK national research and education network (NREN) – to offer high capacity connectivity to AWS technologies and real-time data transfer.

Within six months of launching in October 2014, 24 organisations had signed up for the portal, including King's College London, the University of Cambridge and Newcastle University.

Dan Perry, director of products and marketing, Jisc, said: "flexible access to world leading EU based cloud services that can be scaled up and down across individuals and departments is something our customers told us they would value."

"We have worked with AWS and Arcus to bring the benefits of one of the worlds largest cloud providers and come up with a solution that offers centralised management of user accounts and better control of costs. Feedback has been overwhelmingly positive, and we expect this to grow as more institutions subscribe."

Caleb Racey, systems architecture manager, Newcastle University said: "The Amazon web services portal is an asset in delivering scalable, well-governed cloud services to our university."

As AWS provides cloud services within the European Economic Area, there is an opportunity for other NRENs in Europe to adopt this model and Jisc is working with Géant to support this.

Dan added: "The project has proven a success in the UK and we are committed to working with other NRENs to explore how they can implement similar models."

Check out the portal or contact Jisc's service desk to find out about implementing AWS.



ROLLS-ROYCE JOINS SUPERCOMPUTING INITIATIVE THAT BREAKS DOWN BARRIERS BETWEEN INDUSTRY AND ACADEMIA

Jisc is pleased to announce power systems provider Rolls-Royce as the first company to join its high performance computing (HPC) agreement.

Through the brokerage scheme – developed in collaboration with the Engineering and Physical Sciences Research Council (EPSRC) HPC Midlands – Rolls-Royce will have easy access to supercomputing equipment worth up to £60m. There are enormous capital costs in setting up HPC centres and this agreement will allow Rolls-Royce to benefit from additional world-class HPC facilities and expertise, thereby supporting the company to be more innovative.

In addition, Rolls-Royce will also be taking advantage of a connection to the Janet network, the high-speed network for UK education and research. Through Jisc's Janet Reach scheme for industrial connectivity – which leverages £30m of public

investment in ultra-fast internet and is supported by BIS – a network circuit operating at 10 Gigabits per second will be installed by Jisc, so that it is able to fully-exploit the HPC centre.

The announcement follows a report by the Department for Business, Innovation & Skills' (BIS) Dowling Review into the complexity of current business-university collaborations – which recommended as introducing effective brokerage systems with 'simple as possible' interfaces that 'hide the wiring' to support innovation.

Rolls-Royce's HPC lead, Dr Yoon Ho says: "For many years now we have worked with universities and colleges across the UK and internationally, and we partner with a number of institutions on research and development through our University Technology Centres. This agreement was a natural next step to explore sharing facilities more broadly. We



have been impressed by the professional approach that Jisc and HPC Midlands have taken to this project, in particular around our tough information security and export control requirements, and we see a very bright future for our collaboration."

Jeremy Sharp, Jisc's director of strategic technologies, continued: "It is no longer the case that academia and industry operate in separate, parallel worlds. In an environment where resources are increasingly constrained, both sectors need to understand how they can work more closely together and learn from one another. I am very pleased that we have been able to come up with a two such solutions that break down some of these barriers. Rolls-Royce signing up as the first company demonstrates just how valuable these initiatives are to supporting UK business and the economy to thrive."



Picture
CC-BY Joao
Carlos Medau

CONTOURS OF THE FUTURE NETWORK

Education and research institutions in the Netherlands make use of a highly advanced network. It is essential to regularly implement innovations in the network to meet ever-increasing user demands. As the network manager and developer, SURFnet has defined three pillars underpinning the next-generation network: unprecedented quality, valued service portfolio and an open programmable network.

Higher demands on the network

"Users increasingly need specialist network facilities, not only fast, secure connections, but also easy access to services such as computing and storage. And those services should preferably be available on demand", says Jac Kloots, network development team leader at SURFnet. A good example is the study carried out by Dr. Henk Dijkstra (Utrecht University), who was able to give his research on climate change an impulse by connecting up four supercomputers with 10 Gbit/s light paths: the Cartesius supercomputer at SURFsara in the Netherlands and supercomputers in Germany, the UK and the USA. By connecting up the supercomputers, he obtained a more accurate simulation of ocean vorticity. Questions of such a specialist nature make ever-increasing demands on the network.

From management organisation to control organisation

The ever-accelerating pace of developments in ICT and the increasingly specialist demands made by users are making it more and more difficult for ICT departments to continue to meet user demand. This

has prompted institutions to more often opt to outsource ICT services in the cloud. Examples are Infrastructure as a Service, WiFi as a Service and Firewall as a Service. ICT departments are thus evolving from management organisations into control organisations, whose primary task is to bring together supply and demand. The actual provision of ICT services takes place externally.

Consequences of the cloud for the network

The greater dependency on service provision and data in the cloud requires a network that is reliable but flexible at the same time. To achieve the desired level of flexibility, the network architecture will need a major overhaul. The various network components should be less dependent on each other and the network must be open and programmable. With this set-up the network will facilitate the rapid development of new (cloud) services plus the development of the network itself.

Advancing towards the new network

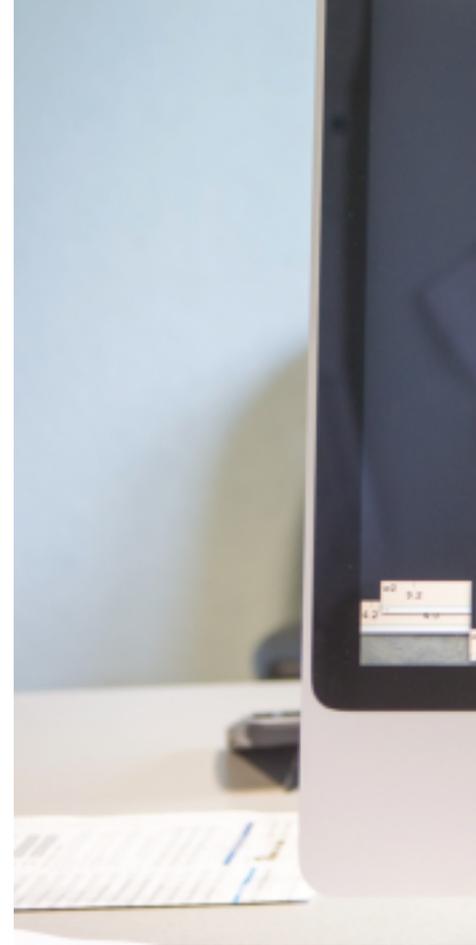
"It is both exciting and challenging to serve a demanding target group that makes such extensive use of the network. To develop our new-

Words
Jan Michielsen,
SURFnet

generation network, we would like to work with various market parties to find out how we can meet these high demands. The challenge is to pinpoint precisely what network users need so that we can develop the network in the right direction", explains Kloots. "Based on discussions with users we have defined three pillars underpinning the vision set out in our Request For Information (RFI): unprecedented quality, valued service portfolio and an open and programmable network. This will enable us to make clear to prospective suppliers which direction we believe the most significant developments are headed". Even though a specific target group uses this new network, the demands imposed on it are relevant not only to SURFnet and its users. They are of interest to all network managers and suppliers of network devices and services, given that they are bound to be faced with the same developments sooner or later.

Highly automated network infrastructure

Speed (high-bandwidth) and stability are vital for a modern network: the volume of data traffic has been growing every year, a trend which is set to continue for the time being. Numerous services are purchased in the cloud and many devices in campus





data centres have meanwhile been relocated to the cloud. Big data and the integrated use of services, such as computing facilities and data storage, demand a highly automated network infrastructure that can easily be integrated into a broader e-infrastructure. Layered networking and domain separation are the architecture principles required to create that infrastructure. And dynamic routing will help create a more stable and more redundant network. Furthermore, the core of the network is more intelligent and it can dynamically determine how traffic is routed.

Fast and easy access to new services

Kloots: "Defining the requirements imposed on a new-generation network is at times a rather nebulous activity. Innovative solutions are being devised across the globe. A service our target group would like to use could be launched on the market in a year's time. Either that or SURFnet will develop a new innovative service in collaboration with its member institutions. The flexibility to easily provide new services should be built into a new network. Users want services to be made available quickly. However, once a service has been ordered, a range of activities must be initiated to supply the service.

Automation of the necessary activities in the network, or Network Automation, will actually facilitate fast access to services. The transition to automation has considerable implications for network management.

Moreover, users want total control over the services they purchase. They should be able to order, configure and manage them with ease. This will be possible by making available a Network Service Portal in which users will be given control. To give them even greater control an API should be made available. An API will enable users to control the network and the services supplied across it with their own applications/tools.

Software-Defined Networking

The flexibility needed by the new network is far easier to achieve with software rather than hardware. Software-Defined Networking (SDN) offers a solution: each network device (switch, router, server, etc.) becomes programmable. A programmable network will thus be created with the open interfaces required to provide new services and to develop the network itself. SDN offers programmable interfaces (APIs) enabling external controllers to operate the network devices based on standardised open protocols such as OpenFlow. SDN is expected to become extremely important for the future of network applications.

Initial market exploration for the new SURFnet network

SURFnet published a Request For Information (RFI) on 20 July 2015, asking market parties to contribute ideas for innovative solutions and the use of advanced technologies. Responses to the RFI can be submitted until 30 September 2015.

SURFnet would like to upgrade its existing network infrastructure together with suppliers who can supply the following: (part of) the network solution, architecture and design consultancy, devices, software, and/or device and software maintenance and support services. Prospective partners are also expected to contribute to the further development of the network infrastructure in close collaboration with SURFnet.

Based on the initial market exploration, the Request For Proposal (RFP) will be published in spring 2016 and new partnerships will be entered into. In 2017, we will begin reproduction of the new, programmable network. Together with the institutions, we will examine whether the preferences of the end-users have been fulfilled and whether the updated version of the network is working properly. The open programmable network is scheduled for completion in 2018. All institutions will then migrate to SURFnet's new leading edge network.

PRACE SUPERCOMPUTERS HELP RESEARCHERS CALCULATE MASS DIFFERENCE BETWEEN NEUTRONS AND PROTONS

With the help of PRACE HPC resources, a team of physicists from France, Germany, and Hungary headed by Zoltán Fodor, a researcher from Wuppertal, has successfully calculated the tiny neutron-proton mass difference. The results of this research, published in the 27 March 2015 edition of *Science*, are considered a milestone by many physicists and confirm the theory of the strong interaction.

The fact that the neutron is slightly more massive than the proton is what gives atomic nuclei the properties affecting the existence and stability of atoms – the foundation of our world. Eighty years after the discovery of the neutron, Zoltán Fodor's team successfully calculated this tiny neutron-proton mass difference of only 0.14% of the average of the two masses.

During the expansion of the early universe, the Higgs mechanism broke this symmetry down and elementary particles acquired masses proportional to their couplings to the Higgs field. As the universe continued to expand, a QCD (quantum chromo dynamics) transition took place, confining quarks and gluons into hadrons and giving those particles most of their mass. This same theory today is believed to be responsible for the tiny isospin splittings, the topic of investigation for Fodor's team. To carry out the necessary calculations, the team developed a new class of simulation techniques combining the laws of quantum chromodynamics with those

of quantum electrodynamics in order to precisely determine the effects of electromagnetic interactions.

"Up to now, the most advanced simulations have included up, down, and strange quarks in the sea but neglected all electromagnetic and up-down mass difference effects. Such calculations have irreducible systematic uncertainties. This limits their accuracy to the percent level," says Zoltán Fodor. "With the calculating power of JUQUEEN and FERMI that we were allocated by PRACE, we were able to reduce these uncertainties significantly, yielding a complete description of the interactions of quarks at low energy, accurate below the per mil level. This is definitely a major step forward in my field. We have provided an indication of the extent to which the constants of nature must be fine-tuned to yield a universe that resembles ours." Fodor added. To exchange data between the supercomputing resources used, Fodor's team used national networks, as well as capacity provided by GÉANT.



Words
Marjolein
Oorsprong,
PRACE
Communications
Officer

Credits
Some of the text
in this article is
republished from
"Ab initio
calculation of the
neutron-proton
mass difference"
found at
arXiv:1406.4088v
2 [hep-lat] 7 Apr
2015. See
[http://arxiv.org/
abs/1406.4088](http://arxiv.org/abs/1406.4088)

Project details

Fodor's research team was made of physicists from France, Germany, and Hungary. Fodor is a researcher at University of Wuppertal, Jülich Supercomputing Centre, and Eötvös University. The results of Fodor's research were recently published in *Science* (Journal reference: *Science* 347:1452-1455, 2015 – see <http://arxiv.org/abs/1406.4088>). This publication is considered a world-premiere in fundamental physics.

His project entitled "QCDpQED – QCD plus QED and the stability of matter" received 91 million core hours on JUQUEEN @ GCS@FZJ, Germany through the PRACE 6th Call for Proposals for Project Access

EU AND EASTERN PARTNERSHIP WELCOME EAPCONNECT WITH OPEN ARMS

Following the contract signature at the 1st Eastern Partnership (EaP) Ministerial meeting on the Digital Economy held on June 11th in Luxembourg, the EaPConnect project received a warm welcome at the Horizon2020 information days in Tbilisi on 10-11 September. Gathering experts across Europe and the Caucasus, the H2020 information days on research and innovation in ICT marked the kick-off of the EaPConnect project in the Eastern Partnership region.

A joint initiative between the EU and Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine, the Eastern Partnership supports reforms in the region for the benefit of their citizens. Part of the EaP digital agenda, EaPConnect aims to connect the research and education networks of the EaP countries and connect them to the pan-European GÉANT network.



"Once completed, EaPConnect will allow the research and academic communities of the six partner countries to work together in virtual networks with their EU counterparts. It is success stories such as these, our common needs and shared vision that bring us together."

Andrus Ansip, EC Vice President for the Digital Single Market

In Tbilisi, partners reflected on further ways to improve EU-EaP collaboration on Digital Economy with Mr Vassilis Kopanas from the European Commission Directorate General for Communications Networks, Content & Technology (DG CONNECT).



During the event the 2016-2017 Horizon2020 work programmes in ICT and research e-Infrastructures were unveiled by Mr Morten Moller from DG CONNECT and EU policies Programme Officer Jean-Luc Dorel.

Seen as a tool to drive economic growth and create jobs, Horizon2020 is the biggest EU Research and Innovation programme ever with nearly €80 billion of funding available over 7 years (2014 to 2020). It supports creative ideas and encourages collaborative projects that will advance research at a European and global level. By providing cutting-edge e-infrastructure to the EaP research and education community, EaPConnect will facilitate the region's participation to Horizon2020.

The partners also had the opportunity to explore applications that will be supported by EaPConnect, such as earthquake monitoring and disaster prevention, with Mr Andreas Küppers from the German Research Centre for Geosciences, or language tools with Mr Dieter Van Uytvanck from CLARIN ERIC in the Netherlands.

GÉANT and EaPConnect presented their activities and services to an assembly of 100 stakeholders including policy makers, networking organisations, researchers and scientists from Europe and the Southern Caucasus.

There is no doubt this successful kick-off event will help strengthen further collaborations in the Eastern Partnership and beyond.

You can find a link to the 2016-2017 H2020 draft work programmes following the below link. Final versions will be made available later this year: <https://ec.europa.eu/programmes/horizon2020/en/draft-work-programmes-2016-17>

"High-capacity connectivity provided via the EaPConnect project will enable researchers in the Eastern Partnership to have fast and convenient access to language material archived at CLARIN centres worldwide and to make use of online linguistic analysis tools.

This opens up exciting possibilities to study the unique languages and cultures in this area."

Mr. Dieter Van Uytvanck, Technical Director CLARIN ERIC, Netherlands

Pictures

Left: Andrus Ansip, EC Vice President for the Digital Single Market, Image ©EU

Right: Pierre Bruyère, Chair of GÉANT Board of Directors, and Gerhard Schumann-Hitzler, Director at the European Commission's Directorate-General for Neighbourhood and Enlargement Negotiations, signing the EaPConnect project contract. Image ©EU

the new

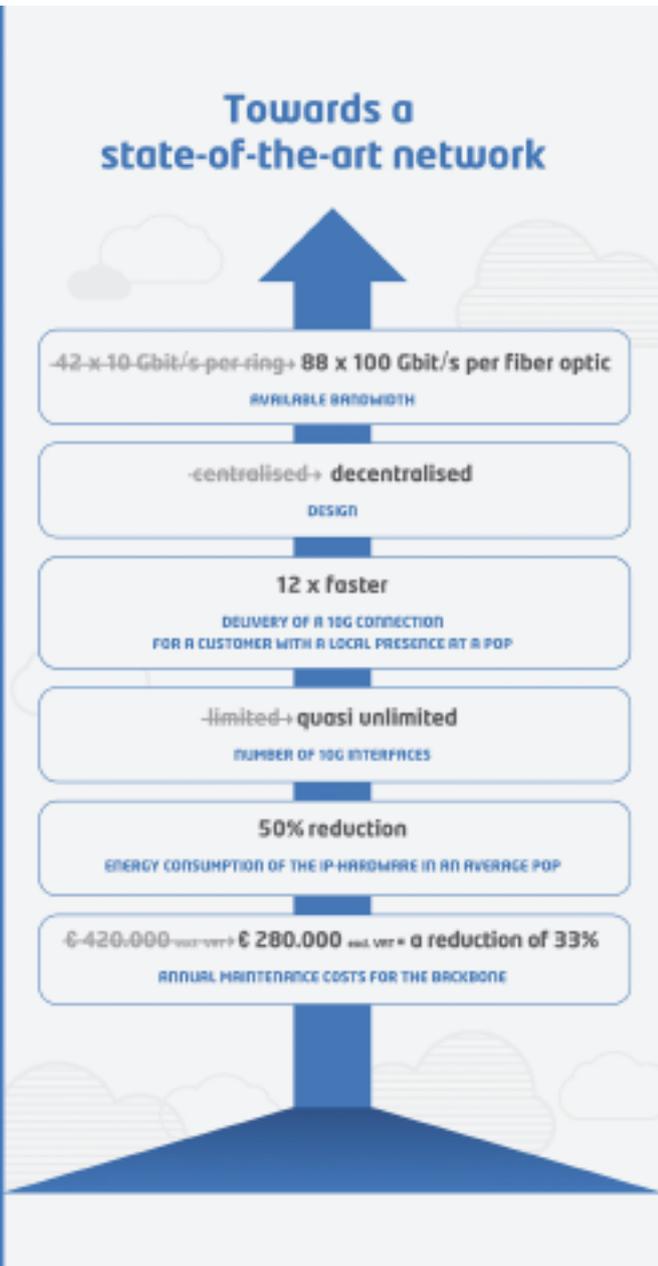
Belnet network

1983 km fiber optic | n x 100 Gbit/s available bandwidth

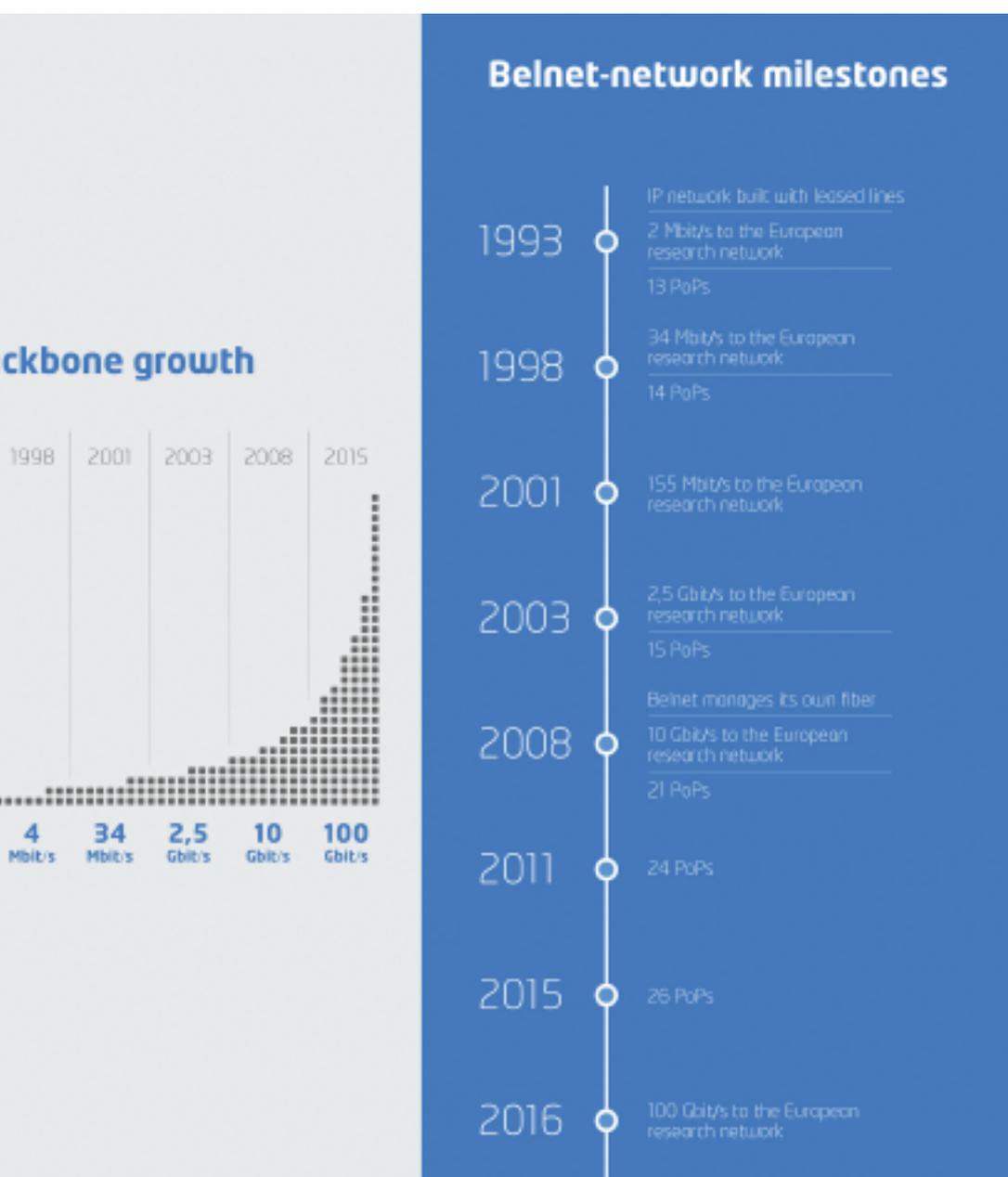
over 20 services provided in addition to the network

750.000 end-users | 26 number of PoPs

approx. 200 member organizations



NEW HIGH-PERFORMANCE NETWORK FOR SCIENCE, HIGHER EDUCATION AND GOVERNMENT SERVICES IN BELGIUM



Belnet, the Belgian national research network, is updating its IP network this autumn. The new network will give Universities and other schools of Higher Education, research institutes and government agencies even faster connection speeds and more efficient network services. The updated network will also be able to support as recent technologies as Software Defined Networking (SDN) and Network Function Virtualization (NFV).

After last year's update of the optical equipment, this autumn, Belnet will be replacing the routers in its 'Points of Presence', the connection points that make up the Belgian research network. The new routers are considerably more powerful and support a nearly unlimited number of 10G interfaces. "However, that's not all; our customers will also be able to enjoy 100G Internet access and 100G national and international research bandwidth in the future - a first in Belgium," says Jan Torreele, Director of Belnet. Belnet is investing more than € 2,250,000 in the new hardware. The project was awarded through a European tender to SecureLink, which is assuming the role of integrator. The equipment itself is being supplied by Juniper Networks.

More Reliable, Faster and More Flexible

Belnet currently has an IP network that operates as a layered model, with all traffic passing through the central routers in Brussels. This will no longer be the case with the new local network. Thanks to the faster and more reliable connections, Universities and research centres, which often work on highly data-sensitive projects, can look forward to even greater continuity and performance.

For the connected organisations, the new IP infrastructure also means more efficient access to Belnet's network services. The new network is constructed so that Belnet can offer SDN and NFV services in the future. "Our customers will be able to set up, configure and monitor their services themselves. A University, for example, will be able to set up its own Point-to-Point connection between its organisation and our data centres in order to use such services as cloud computing," explains Dirk Haex, Head of the Network Service division.

The new IP equipment is also significantly more energy-efficient. The energy consumption of the routers in an average Point of Presence is expected to decrease by more than 50%.

World-Class Thanks to Innovative Design

The optical layer of the network has taken over a series of functionalities that were previously performed by the core routers. This enables Belnet to construct its IP network more efficiently and to better utilise the available bandwidth. "The innovative design of the Belnet network proves once again that our infrastructure is among the best in the world and that is exactly what the Belgian science and academic community expects," adds Jan Torreele.

ENERGY CHALLENGES IN ARMENIA



In consideration of the ever-growing importance of the IT industry, in the year 2000 the Government of Armenia declared ICT to be one of the priority sectors of the country's economy. For the last 10 years, Armenia's ICT sector has seen a growth of about 27% per year. In 2008, the industry's share in Armenia's GDP was 1.2%, comparable to that of India (1.4%) and Germany (1.3%).

The Institute for Informatics and Automation Problems (IIAP) of the National Academy of Sciences of the Republic of Armenia [1] is a leading ICT research and technology development institute in Armenia in the sphere of applied mathematics and informatics, as well as in the application domain of computing technologies in various fields of science and technology.

On a national level, IIAP is responsible for e-infrastructures in Armenia [2], including the Academic Scientific Network of Armenia (ASNET-AM) [3] and the Armenian National Grid Initiative (ArmNGI) [4].

ArmNGI aims to establish an advanced infrastructure for scientific research and the application of new technologies in Armenia, and promote the integration of its researchers and research institutions in the European scientific and academic research community. It comprises an integrated distributed computing environment consisting primarily of computer and data resources located in the leading research and educational organisations of the country.

ASNET-AM is Armenia's National Research and Education Network (NREN), providing network connectivity and services to more than 60 organizations in 6 cities in the country. It seeks to contribute to future network evolution in Armenia through developing innovative services and

applications and introducing advanced technological tools to improve the quality of everyday life, reduce unnecessary travel, and improve efficiency in the country, so as to increase its effectiveness and competitiveness within the European and regional digital community.

Its national standing, its close relationship with higher education and research institutions and its track record of advocacy of leading-edge technology and applications, place ASNET-AM in an ideal position to foster the optimised use of energy and material resources that is essential to ensure that ICT services are both economically and environmentally sustainable.

It does this through adopting environmental best practices and promoting networking technology that can provide alternatives to current practices that result in high levels of pollutant emissions. ASNET-AM recently joined the GÉANT Green Team to work on these issues. This already has been a positive stimulus with developing an environmental policy as one of the outcomes of working on the team. The policy will help the ASNET-AM to reduce their carbon footprint and apply guidelines on the safe disposal of old technology.

At the same time, ASNET-AM is investigating the CPU power and memory efficiency of HPC applications for numerical weather prediction,

satellite image processing, molecular dynamics of complex molecules, monte carlo simulations, etc., with a view to optimising their performance in terms of power consumption and time of execution, especially considering that most of these applications will likely be run on Cloud systems in future. Research is also underway on live migration and implementation of memory ballooning techniques in virtual machines in order to optimise power on servers.

All these steps it is hoped will go a long way towards contributing to the development of a Green ICT and a more energy-aware society in Armenia in the near future.

ASNET-AM is a member of the EaPConnect project (see page 39).

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- [3] Academic Scientific Network of Armenia, <http://www.asnet.am>
- [4] Armenian National Grid Initiative, <http://www.grid.am>

SUDREN EX-CEO WINS NATIONAL WOMAN ENGINEER AWARD

Dr. Iman Abuel Maaly Abdelrahman has just received the 2015 Sudanese “Distinguished Arab Woman Engineer” award and is in line to compete for the same award at world level later this year.



Words
Dr. Iman
Abuel Maaly
Abdelrahman

What does this award mean to you?

I am honoured to be receiving this award. It is evidence to all young women who do not believe that they can have a family and meet their career goals. Sudanese women have a great history of achievements in all fields; there are many women engineers in Sudan, but very few of them reach the executive position and very few are present at the higher levels of academia. So, this award is an example to show them that it is possible to be a leader woman engineer. As to the global award, I would love to have the opportunity to cross borders and send a message to all women around the world and say: “If I succeeded in a community that’s known to have a big gender gap, what stops you?”. This would mean a lot to me.

Talking about the gender gap, do you have tips to help reduce it?

In my childhood my father was the man who drew the character I have now because he believed in me. He always encouraged me to be the best at what I do as an individual, not as a woman. I would like to share this piece of advice with all women.

Then there is resistance, from men. For years I’ve found myself the only woman in a meeting room full of men,

The daughter of Aziza Mekki Osman who fought for Sudanese women’s rights and remained a powerful social activist until her last breath, Dr Abdelrahman carries a long list of achievements including heading the Directorate for ICT at the Sudanese Ministry of Higher Education, being the Founding CEO of the Sudanese REN

(SudREN) and currently serving as deputy chair of the UbuntuNet Alliance, the networking organisation for Eastern and Southern Africa.

Also the Head of the Department of Electrical and Electronic Engineering at the University of Khartoum, Dr. Abdelrahman was delighted to answer our questions.

and in some cases I had to chair those meetings. It wasn't easy to be a woman and win a negotiation over men who had on their mind not to be defeated by a woman! This type of resistance needs time and perseverance to be solved. But everyone, man or woman, can contribute to changing the mentalities by showing that it is possible to work efficiently together and by supporting women to achieve their ambitions.

You are yourself a model for all women and men, who inspires you?

Since my childhood, my mother, Aziza Mekki, has been my source of inspiration. She was one of the women leaders who stood up and fought for women's rights in Sudan and founded the Sudanese Women's Union in 1952. At the age of 82 and until the last day of her life she was working as a volunteer at the Women Initiative Group that supports women in Sudan, organising meetings in her bedroom when she could no longer get out of the house. She was powerful, she was enthusiastic, she was a leader.

After joining the UbuntuNet Alliance, I have been lucky to meet two women who inspired me: Margaret Ngwira, the co-founder of the Alliance, from whom I learned that enthusiasm makes me stronger. And I learnt from Cathrin Stöver, the GÉANT project manager for AfricaConnect, that self-trust is the first step towards success.

Beside inspiration, what allowed you to achieve so much?

Support. The support of my family, my father who always believed in me, then came my husband who encouraged me to do my PhD and who always supported me. In my work field, I cannot forget those men who always expressed their trust in me and pushed me on the success ladder: Prof. El Siddig, the former Vice-Chancellor of the University of Khartoum and Prof S. Sharief, the former Academic Secretary of the university; then, after joining the UbuntuNet Alliance, I met Dr. Tusubira, the former CEO of the Alliance. I not only learnt from his amazing leadership skills, but also got the chance to fly with him towards the Alliance's success.

You are also an African engineer, from your experience what are the challenges faced by the African research and education community?

African countries have many similarities and if there were no borders between them, they could be one country. I believe the real borders and gaps between them are political. So African research and education communities can play a role in overcoming any borders through connectivity and collaboration, and through fostering joint research. The UbuntuNet Alliance is a practical example of unifying Africans by giving them the chance to be one family. It is an organisation that has succeeded at all levels: the human level, the services level and the connectivity level. All you need is a human network with the same goal, the same ambition, the same dream, and we have that ready for AfricaConnect2.

What is that dream?

I made a speech in 2010 at the UbuntuNet-Connect conference in Johannesburg that I had a dream of an African continent that would be as developed as Europe. In my opinion this dream can be achieved with connectivity. You just need to witness what AfricaConnect has changed in Eastern and Southern Africa. NRENs in landlocked countries such as Uganda and Zambia are now benefiting from high quality high speed connectivity at affordable prices.

I am not the only one to have this dream. In fact we are millions to have the same dream, including our European partners without whom we wouldn't be able to do it. This is why I believe it will come true.

Any advice on how to make it happen sooner?

It is happening in various places around Africa. Kenya is going through a technological transformation. Ethiopia is modernising at a very fast pace. Other examples abound. But it is very important to reconnect the networks that are ready and working and which have been cut off for political reasons. It happened in Sudan and other parts of Africa. These networks could provide connectivity to entire regions and connect continents. They would help save a lot of money and improve millions of lives, starting with our children, the next generation of researchers and the entire human race by accelerating scientific breakthroughs.

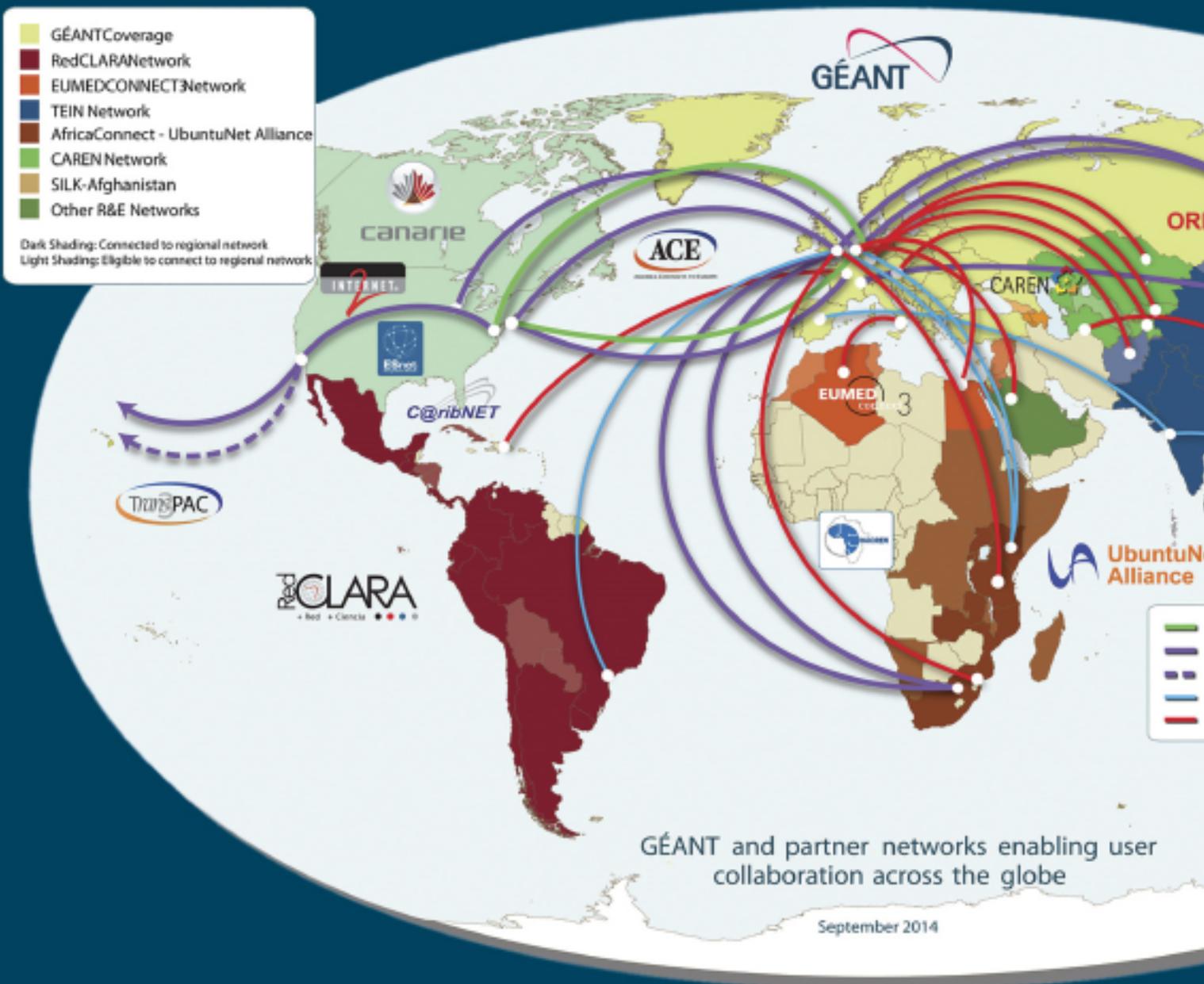
We would like to thank Dr. Iman Abuel Maaly Abdelrahman for sharing such a valuable input with us and wish her the best of luck for the globe award for Distinguished Arab woman engineer of the year. We are proud to support the African R&E community in achieving a dream we share.

CONNECT readers are invited to participate in the NREN Community Forum supporting Women in Technology, NREN-WiT, by sending a blank email to: nren-wit-subscribe-request@listserv.heanet.ie.

GÉANT AT A GLANCE

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

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



PAN-EUROPEAN NETWORK

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

HIGH PERFORMANCE NETWORK SERVICES

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

INTERNATIONAL COLLABORATION

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

AT THE HEART OF GLOBAL RESEARCH AND EDUCATION

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

Learn more at www.geant.org



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