

CONNECT

THE MAGAZINE FROM THE GÉANT COMMUNITY | **ISSUE 35 2020**

BECOME A **CYBER HERO**



ALSO IN THIS ISSUE

CONNECT INTERVIEW:
SARAH JONES,
EOSC ENGAGEMENT
MANAGER, GÉANT

HUMAN BRAIN PROJECT:
THE GAME-CHANGER IN
NAVIGATING BRAIN
NETWORKS

CAREN SUCCESS:
KEY FIGURES LOOK
BACK AT THE CAREN
PROJECT



tnc21

Making Waves

21-25 June 2021 | Brighton, UK

02

Contents

02 TNC21 – a new format for a new reality

04 How to become a cyber hero

06 What Maastricht University learned from the ransomware attack

14 CONNECT Interview: Sarah Jones, GÉANT

18 The Human Brain Project: the game-changer in navigating brain networks

30 CONNECT Interview: Veronika Di Luna, GÉANT

44 CONNECT Interview: Dave Heyns, OCRE

48 eduGAIN welcomes CSTCloud to the eduGAIN Family

67 About GÉANT

04

14

18

44

67

06

30

48

OCRE Open Clouds for Research Environments



Welcome from Cathrin Stöver

The GÉANT community is at its very best when it acts together, and this month we have seen how the very visible issue of cyber security is being addressed by our community. In support of the European Commission's Cyber Security Month campaign, held annually in October, our partners have shared experiences, knowledge and tips to help all of us become cyber heroes. I hope you've seen much of this campaign on GÉANT's social media channels and within this issue we highlight many of the articles and initiatives.

Earlier this year I was very pleased to welcome Sarah Jones into my team, whose new role is to bring the community closer together to enable Open Science. GÉANT and our NREN partners are ideally placed to become key enablers in this area, and knowing Sarah as I do, I am confident we have exciting times ahead of us! Her interview in this issue is a great insight into her plans and ideas and I hope you will enjoy working with her, even if it's only over VC.

Speaking of which, this community continues to inspire with its energy, ambition and spirit even though most of us haven't seen each other face to face for many months. As we all look forward to handshakes and hugs in 2021, we continue to push on in our virtual worlds for the benefit of the diverse communities we support, and I hope you find within the articles in this issue – which highlight past achievements and future plans in equal measure – your own inspiration.

Stay safe and enjoy the issue.

Cathrin Stöver, GÉANT

CONNECT is the magazine from the GÉANT community; highlighting the activities of Europe's leading collaboration on e-infrastructure and services for Research and Education.

The Team Behind CONNECT

Reflecting the breadth of our community, the articles you read in CONNECT are contributed by a wide range of people from GÉANT Association, the GN4-3 project, and from our NREN and regional partners. The planning, production and editing is performed by a small team highlighted below.

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This magazine is published by GÉANT, as part of GÉANT Specific Grant Agreements: GN4-3 (No. 856726), GN4-3N (No. 856728), and BELLA-S1 (No. 731505), which have received funding from the European Union's 2020 research and innovation programme under the GÉANT2020 Framework Partnership Agreement (No. 653998).

The following projects mentioned throughout the magazine also receive funding from the European Union: AfricaConnect3, CAREN3, and Asi@Connect (DG DEVCO), EaPConnect and EUMEDCONNECT3 (DG NEAR).

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TNC21

— a new format for a new reality

In the uncertain times caused by the events that have been affecting our world in 2020, the TNC21 programme committee has been evaluating all possible options regarding the format of GÉANT's flagship conference.

Words: Rosanna Norman, GÉANT

TNC21 preparations and the conference itself will certainly be different from any TNC we have organised in the past. This is a challenge, but it is a challenge which is full of opportunities. As things stand, GÉANT and Jisc plan to host a hybrid conference in Brighton, UK, where the physical and virtual elements will coexist. But we need to see how the pandemic develops and therefore a final decision about the overall conference structure will only be made in February 2021.

We chose the theme of "Making Waves" for TNC20 and we have decided that this theme will continue: it successfully draws a parallel with the transformative and disruptive capabilities that digital technologies across networking, T&I and cloud services can deliver for Research & Education across the globe. NRENs around the world connect the teams delivering

discoveries that impact and improve our lives via some of the fastest data networks, most trusted identity services and collaboration. NRENs have the intellectual bravery to inspire, disrupt and make waves. NRENs enable progress.

The Call for Proposals for single presentations and demonstrations is now open and all contributors are encouraged to submit new content. This is the moment to reflect and 'put on paper' how NRENs have been making waves (still are) for R&E globally during the COVID pandemic. The community's enthusiasm and creativity will give shape to a new, exciting and thought-provoking conference programme where presenters will need to show their flexibility by being prepared to deliver their talks in a physical and a virtual environment

In the words of our Cathrin Stöver: 'When you submit, be concrete where you need to be, but flexible where you can be – just go with the flow! TNC21 will be a conference, where from paper submission to making the event happen, all our standard thinking will need to be challenged'.

Cathrin continues: 'Very often in life, before you can actually make any sort of wave, you need to go with the flow. We all know that life is not as plannable as events used to be and we will need to accept that also with regard to TNC21 we will have to go with the flow. I am certain, that together and as a community, we can pull this off and make waves again!'



Call for Proposals Submission Deadlines

30 November 2020 (24.00 CET)
– Single presentation

28 January 2021 (24.00 CET)
– Demonstration

Submit your proposals [here](#).

Monitor the GÉANT channels for further communications in the coming weeks, visit the [TNC21 website](#), TNC21 Twitter account [@TNC_GEANT](#) for news and updates and get in touch with tnc@geant.org for any further information.

You can subscribe [here](#) to join our TNC-specific mailing list and receive TNC21 updates directly in your inbox.

TNC21 Programme Committee

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How to become a cyber hero

GÉANT joined Cyber Security Month 2020, a EU initiative which has been taking place every October since 2012, with a campaign aimed at raising cyber security awareness within its community.

Words: Davina Luyten, Belnet and Rosanna Norman, GÉANT

What is the European Cyber Security Month (ECSM)?

ECSM is an EU awareness campaign promoting cyber security among individuals and organisations. The focus is on the importance of information security and the simple steps that can be taken to protect users' personal, financial and professional data. The main goal is to create awareness, change behaviour and provide users with information on how to protect themselves and their organisations online. The campaign is deployed by ENISA, the European Commission DG CONNECT and participating partners.

Become a cyber hero!

Based on an initiative of the Security Package (WP8) within the GN4-3 project, NRENs' marcomms departments took part in a survey to address their individual organisation's cyber security needs and concerns.

The feedback collected provided the background for a specific campaign aimed at the participating R&E institutions and their end users: "Become a cyber hero". The initiative's principal objective was to encourage end-users to arm themselves against digital threats and feel empowered to protect themselves and their organisation. If it's true that the human element is the "weakest link" when dealing with cyber security breaches, this initiative aimed to prove that everyone can be a cyber hero! Throughout the month of October, the campaign highlighted, with the publication of interviews, blogs, articles and practical tips, four specific cyber security topics:

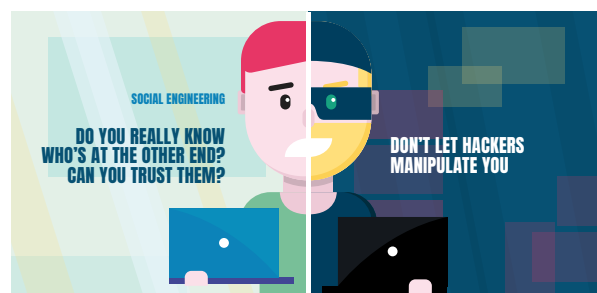
- social engineering (week 1)
- phishing (week 2)
- ransomware (week 3)
- password security (week 4)

Alf Moens, Senior Security Officer for GÉANT commented:

"I am really impressed with the positive impact of this popular campaign, which is the outcome of close collaboration between Belnet, SURF and GÉANT. Thorough planning and coordination have enabled the active participation and involvement of NRENs from around the world with content of the highest standards. On behalf of the Security Package WP8 and GÉANT I would like to thank all the participating NRENs and I am confident of the beneficial ripple effect that this initiative will have for our community."

In addition, all graphic and promotional material produced for the campaign has been shared with the GÉANT community to promote the initiative locally. Cyber Security Month 2020 is not over yet, so you can catch up with the activities by keeping an eye on **CONNECT online pages** and **@GEANTnews Twitter account** throughout the month of October and remember to follow the hashtags **#CyberSecMonth** and **#BecomeACyberHero**.

Cyber Heroes of the world unite! Not a Cyber Hero yet? If you need any information on how to become one, please feel free to contact **cs2020@geant.org**



BECOME A CYBER HERO
Cyber Security Month 2020

connect.geant.org/csm2020



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Case study:

What Maastricht University learned from the ransomware attack (part 1)

On 23 December last year, Maastricht University (UM), which is connected to the Dutch education and research network SURFnet, was hit by a major ransomware attack. After thorough investigation and serious consideration, the institution decided to pay the requested ransom. We spoke with Bart van den Heuvel, Chief Information Security Officer (CISO) at UM. 'A cyber attack is going to happen to you anyway. It is a matter of preparing yourself as well as possible and limiting the impact.'

Words: Davina Luyten, Belnet

The ransomware attack on 23 December took place very quickly. In just 30 minutes, hackers managed to lock the data on 267 servers of the university, including quite a few critical systems. The email and numerous file servers (with research and business operations data) were affected. The hackers also managed to encrypt several backup servers.

In this article we will explain how the attack occurred and what lessons UM learned from the crisis. Through knowledge sharing and information exchange, the university aims to help other educational and research institutions in the GÉANT community to better arm themselves against cyber attacks. In this first part of the case study we will discuss the phase preceding the actual attack.

Malware via a phishing email

On 15 October, the attackers sent a phishing email to several people within UM. One of the employees clicked on the link in the mail. This led the user to an Excel document containing a macro. The macro then retrieved malware from a remote server and installed it on the user's workstation.

Bart van den Heuvel: 'The malware itself was known by our virus scanners, but because the attackers had made small changes, it got through our virus scanners anyway. A second phishing email with a link to a similar document was clicked a day later by another user. From that moment on, the attackers had initial access to the UM network.'

Always stay alert

The important lesson was that anyone can be fooled by a phishing email. 'The user in question even reported the mail to the university's Service Desk afterwards. They turned out to be someone who was very 'internet savvy', but in these circumstances clicked on a fraudulent link anyway. I am convinced that it is impossible to completely prevent someone from clicking on a harmful link, but awareness remains crucial', says Bart.

Even after the ransomware attack, UM was not spared from phishing. 'For example, a phishing email circulated at UM which explicitly referred to the ransomware attack in our institution and asked users to change their password as a precautionary measure in response to the incident at UM. Variations on this, also with reference to UM, also circulated at other institutions. In other words: other cyber criminals also tried to grab their share. This means that we have to remain very alert at all times and communicate very specifically to our users.'

Tailoring awareness campaigns to target groups

Before the summer UM launched an awareness campaign with dos and don'ts. This went beyond phishing and focused on basic cyber hygiene, like locking your screen when you are not using your laptop for a while. This will be repeated for students at the start of the new academic year in the beginning of September. 'In order to bring the message in an attractive and playful way, we called in a cartoonist. In the autumn, we will also be giving awareness training courses specifically tailored to our IT staff and our management. We also plan to send phishing emails ourselves, in close cooperation with our lawyers and communication service, to train our users', Bart explains.

The ransomware attack itself has already borne fruit in terms of awareness. For example, UM's Service Desk has received five times more reports from users about phishing this year than last year, although there are no indications that the number of phishing emails has risen so sharply.

Better segmentation

In the period between 15 October and the ransomware attack on 23 December, the hackers gradually worked their way into UM's network. 'Their goal was to map out our network as well as possible and stay under the radar in the meantime. By abusing unsafe backdoors, the hackers were able to get further and further into our network. For example, they managed to use an encrypted password of an administrator, which was in the memory of a certain server, to gain access to the next server'.

UM drew important lessons from the analysis of this 'lateral phase' and has already implemented various measures in order to be able to intervene more quickly in the future. 'Our objective is clear: if attackers do get in, we must ensure that they cannot penetrate further into the network. We do this by segmenting our network even better, with each server behind its own firewall. We will also better separate our administrator accounts, so that an administrator does not have automatic access to everything.'

Better monitoring

The university is also committed to improved and refined monitoring of the network, 24/7. 'Last year, we were already setting up a Security Operations Centre (SOC). Two employees were supposed to start in January 2020, but due to the incident they already started in the last week of December. The crisis made it possible for us to recruit a third Full Time Employee (FTE). That person has been hired in the meantime.'

Detailed mapping of infrastructure

'We are going to improve our configuration management database (CMDB), so that we have a better overview of the systems that are part of our network. We also want to map in detail which processes are running on our servers and how those servers are connected to our more than 3,000 internal and external sources. This is quite a challenge: our central IT service alone manages 3,000 workstations. In addition, many systems are set up in a decentralised manner, and we do not have a good overview of these right now,' Bart explains.

In the second part of the case study you will learn how UM handled the crisis and what considerations were made before proceeding with the ransom payment.

Picture
Maastricht University (MU)
Cyber Attack Symposium,
5 February 2020



Case study:

What Maastricht University learned from the ransomware attack (part 2)

Words: Davina Luyten, Belnet

267 servers locked in just 30 minutes

The actual ransomware attack took place on 23 December. The hackers executed a command installing 'Clop' ransomware on 267 servers of the Windows domain. As a result, almost all of UM's operational processes were disrupted. Several online backup servers were encrypted as well.

Bart Van den Heuvel: 'We immediately activated our crisis management plan and, in view of the impact, very quickly decided to call in external help. We got this from Fox-IT. They took on the forensic investigation and monitoring and assisted us with advice throughout the crisis. We were also assisted by SURFcert, the NCSC (National Cyber Security Centre), the police, etc. Internally, the full breadth of our organisation was involved: IT services, management, our finance department, Marketing & Communications and our legal team... In total, more than 150 people were involved in the crisis.'

Transparent communication

UM immediately shut down its network to prevent the situation from worsening. Furthermore, the university decided from the outset to communicate transparently and openly. 'Everything that was communicated internally also reached the outside world. Unlike most organisations that fall victim to cyber attacks, we wanted to be open with our stakeholders from the beginning. In any case, in the Netherlands we are bound by the Act on public access to government information, which gives citizens the right to inspect the government's actions. Transparency was therefore an obvious choice for us', says Bart.

Through regular updates on the UM website, end users were able to follow the status of the incident. There was also proactive communication to the press, although speculation and inaccurate reporting could not be completely avoided. 'Contrary to what was claimed in some media, we did have backups that were still usable. Not all our data was encrypted either.'

Even so, the impact of the attack was huge. Quite a few critical systems were affected. '267 locked servers: this meant that a lot of people were involved. In addition, it took us several days to

find the infected laptop. It also quickly became clear that if we had to restore our backups and rebuild the other systems, we would have months of work.'

A serious moral dilemma

In the meantime, UM contacted the attackers. As the mail servers had been affected, the communication took place via Bart's personal email address. 'We communicated with them very regularly: on the one hand to gain time, on the other hand to make sure we were talking to the right party. For the latter reason, we also came up with both technical and financial control questions such as making a test payment.'

In the week between the attack and the decision to pay the ransom, UM carried out analyses and investigated various options. 'In three days, we managed to set up a new mail server. Its database was not encrypted. The archive system, on the other hand, was not usable: you can do without an archive for a few days, but not for months. Our external partner Fox-IT had managed to unlock one small file, but it had taken them a whole night to do so. We knew that we would lose a lot of valuable time if we chose this option.'

Even so, the decision to pay the ransom constituted a serious moral dilemma for the UM Board. 'The Board did not make the decision lightly and considered all interests thoroughly. After long deliberation they finally decided to pay the ransom in the interest of the continuity of education and research at our institution. The fact that the teaching and the exams in January were able to continue without too much hindrance and that there was little impact on scientific research has strengthened our idea that we made the right decision.'

Quick wins

Exactly one week after the incident, UM proceeded to pay the ransom and the university received the key to unlock the servers. 'Obviously, we had a further in-depth investigation carried out afterwards. Fox-IT found no evidence of data exfiltration except for the passwords and our network topology. We have carried out an additional investigation ourselves – which is still going on – and have come to the same conclusion: no evidence has been found that our data has been deleted, modified or made public.'

In the report that was drawn



up about the crisis, the Ministry of Education concluded that UM did not act negligently and handled the situation very satisfactorily. 'This crisis had a huge impact, but on the other hand it also taught us a lot and enabled us to improve our security policy. In addition to our long-term actions, we were able to carry out several quick wins. For example, on 2 January we already decided that students had to set a new, strong password. That decision would undoubtedly have met with resistance in other circumstances but was now adopted without a murmur.'

Knowledge sharing

Even after the crisis, UM continued to communicate in a very transparent way. 'We absolutely wanted to share our lessons learned with other institutions. On 5 February this year, barely a month after the crisis, we already organised a symposium to share our experiences.' 'Above all, we want to emphasise that this is about more than UM. Last year we were the victims, today is the turn of a different institution and tomorrow a different one again. It is important that we take cyber security to a higher level, as it is one of the greatest challenges in our society,' Bart concludes.

Pictures

Left: MU buildings

Above: Bart van den Heuvel, Chief Information Security Officer (CISO) at UM



It's now or never! – and it never is as expected

When it's time to talk about social engineering it's difficult for me to decide from where to start, because it is everywhere around us. The definition of social engineering is “the psychological manipulation of people into performing actions that they wouldn't normally do”. And this happens over and over again, every day.

Words: Simona Venuti, GARR



Every mum tries to convince her children that broccoli is much tastier than Nutella, by hiding the green suspect stuff under layers of more appetising food. And they (almost) always win! That young lady at the supermarket said that I could have a huge 5% discount if I bought 20 kilos of pasta, “Hurry, it's now or never!!” – Then I bought it, and now I need a bigger cupboard!

And what about the boy in line at the ticket machine, who is missing his train and needs to jump the queue? It would be very mean of me to let him be late home. And then he buys a ticket for the following day...

My granny used to skip the line at the doctor's by saying she had to cook for me, but I used to live with my parents in an entirely different location... And so I've been an unintentional accomplice in her little mischiefs!

Historical scams

If these are only a few examples of harmless social engineering, now let's have a look at some historical big, risky scams.

Probably the oldest evidence of social engineering attack is in the Bible, Genesis 27, where Rebecca deceives her husband Isaac into blessing the second-born Jacob, making him his successor, instead of Esau, the eldest. Later, in 1211 AC, let's move to the

Picture
The Procession of the Trojan Horse in Troy by Giovanni Domenico Tiepolo.
© Copyright The National Gallery, London

Chinese Empire: it seems that the Mongol emperor Genghis Khan was able to pass the Great Wall of China by simply tricking the enemy soldiers: unable to directly attack the impregnable passage, he decided to lure the Jin soldiers out for an open field battle. After several small attacks, the Mongol soldiers threw down their weapons, left their horses and fled (pretending to be afraid). As expected, the Jin soldiers on guard left the passage to chase them. Suddenly numerous Mongol soldiers, who were hiding nearby, easily conquered the (now unmanned) passage.

But the most famous social engineering attack in history is in Virgilio's Aeneid, when Ulysses was able to take the city of Troy by tricking its inhabitants into allowing in the city walls a beautiful and incredibly large wooden horse. As everybody knows, the horse was packed with Greek soldiers. The trick of the trojan horse is so exemplary that we call “trojan horse” the kind of malware that persuades the victim to be harmless and bona fide, while it plans to destroy or steal data from a device.

Cyber security context

In the cyber security context things are not so different, and this kind of attack can be very dangerous or harmful to our organisation, and to ourselves too.

One of the latest big social engineering attacks was carried out against Twitter, in July, where 130 VIP personal profiles were hacked (Barack Obama, Bill Gates, Elon Musk, Jeff Bezos and many others). In all of these profiles the following post appeared: “All bitcoin sent to our address below will be sent back to you doubled!”. Of course, none of the involved celebrities posted this message. It was a group of teenage hackers, who were able to manage all of the 130 accounts at one time: they contacted by phone selected Twitter IT staff who were using a custom application to manage Twitter accounts pretending to be the application helpdesk and induced them to give their own passwords. And, unbelievable but true, some of Twitter IT employees actually gave the hackers their passwords.

The damage was double: Twitter users lost \$140.000 donating bitcoins to hackers, while the celebrities' accounts were breached, their contact list stolen, and probably their personal data was ‘nicked’ too.

There are so many examples of social engineering in cyber security that it is not possible to list them all: every day a new technique is used to steal data, money and to cause harm inside an

organisation, as ransomware does. But they all obey some rules, based on the emotional nature of human behaviour, and this knowledge can help us to recognise and mitigate them.

Principles of Social Engineering

Cyber criminals know that social engineering works best when focusing on human emotions and risk. Taking advantage of human emotion is much easier than hacking a network or looking for security vulnerabilities. These examples of social engineering emphasise how emotion is used to commit cyber-attacks:

- Authority: people will tend to obey authority figures, even if they are asked to do strange things. "I'm the President of XXX Bank (or Police Office Chief or President of the own working organisation) and ask you to do YYYY"
- Urgency/Panic/Fear of getting into trouble: "You have a virus (both digital and biological)! Before losing all your data (or dying) click HERE!"
- Scarcity: "there are only 2 places left... It's now or never!"
- Greed: "Give me 10 euros and I'll give you back 100" or "You won the lottery!" or "I have this big wooden horse as a gift for you"
- Sense of guilt: "I know what you downloaded on your PC. Send money and nobody will know it"
- And, on the other side, the "secret desires": "Do you want to see your favourite celeb half-naked? Click HERE"

Human vulnerabilities

The underlying principle of social engineering is to exploit the human factor, which is to put people in situations where they will rely on the most common forms of social interactions:

- The desire to be helpful and polite, especially in a public environment
- The tendency to trust people
- When people are praised, they are likely to talk and divulge more information
- Professionals desire to exude intelligence and superiority in a field
- Most people respond as pleasantly as possible to people who appear to have concern about them
- Conflict avoidance

Tactics: Elicitation

In the context of social engineering, elicitation is used to draw targets out through a set of questions that stimulate them, leading them to the behaviour that the social engineers want. Elicitation is quite low risk and extremely difficult to detect. More often than not, targets never know where the information leak about them comes from, and, even if a request does seem suspicious, targets usually put it down just as a question that they should or should not answer. Nobody cares or even remembers the content of the withdrawn information.

Just ask the target the right question at the right moment and all doors will open.

Types of Social Engineering

Now let's see the most common type of social engineering vectors used in our digital scenario.

Pretexting: it is the art of creating a fake but realistic world. It is where the attacker becomes anyone in a position to influence the target into making some decisions. The attacker chooses a certain personality that befits the character he or she opts to become during the social engineering attempt. With the advent of the internet, it is easy to become anyone, for example on Facebook or Twitter. Pretexting can also be used to impersonate co-workers, police, bank, tax authorities —or any other individual who could be perceived as wielding authority or right-to-know in the target victim's mind.

Phishing: It is a systemic-based attack that utilises a fraudulent email in order to get people to execute malicious code or reveal pertinent information. The email is crafted in a way that makes it appear from a legitimate company. Or this can just be a really cool advertisement for a product that no one would want to live without.

Phishing can be targeted to a specific organisation (spear-phishing) or to the CEO of one organisation (whale-phishing).

Baiting: baiting takes advantage of the most basic of human traits, curiosity. In baiting, a social engineer will leave a media such as a CD, DVD, USB Stick, or floppy drive in a conspicuous location relying on the curiosity factor of a passer-by to pick up the media and try to take a look at what it contains. Which is mostly keylogger and malware.

Physical: social engineering can also take on a physical form where the cyber criminal will try to gain access to a facility or sensitive/restricted area in a facility.

Mitigation

Advice could be infinite, and the space for this article is almost up!

Don't trust anyone, any mail, don't reveal your personal or working information, don't click on links in suspicious emails, don't download and open any attachment. If an object you won is too good to be a prize, probably it is not the real prize. Report any suspicious case to your local IT department.

And finally, the golden rule: Remember the National Cyber Security Alliance tag line: **STOP, THINK, CONNECT™**



About the author

Simona Venuti is security manager at GARR, the Italian research and education network. Since 2007 she has been working at the GARR-CERT (Computer Emergency Response Team) of the Consortium GARR. Her task is to develop automation systems in the reporting and management of cyber incidents and to carry out research in the field of new cyber threats, cyber security, monitoring, defence and containment systems. A fundamental part of her work is to establish a network of relationships with national CERTs of the European and non-European Union, security experts, company CERTs and Italian and foreign providers, to share experiences, studies, solutions, and above all to establish relationships of mutual trust in the eventuality of joint management of IT incidents involving several CERTs.

Simona also deals with the dissemination of information and training for systems engineers and security officers.

Twitter: **@Simo_GARRCERT**

CONNECT Interview:

Henry Hughes,

Security Director, Jisc

During Cyber Security Month 2020 CONNECT meets Henry Hughes, Security Director for Jisc to talk about opportunities and challenges faced by Research & Education (R&E) in the current cyber security landscape dominated by the COVID pandemic.

Words: Interview by Rosanna Norman, GÉANT

The cyber security landscape is evolving all the time, what are today's major challenges and opportunities for R&E?

Because of the events that have been affecting our world in 2020 we have all become more digitally dependent (and will be so for the foreseeable future).

A major challenge faced by R&E is the extremely lucrative nature of cyber-crime, which contrasts with budget pressures across the sector. This is exacerbated by the rapidly changing threat landscape and the perception that cyber security is purely an IT issue, rather than one of many significant business risks.

One of the challenges lies around encouraging greater ownership of digital resilience amongst senior leaders and recognition that cyber security is a business risk just like health and safety. Cyber security needs to be viewed as an enabler and not a barrier to the business and has an important role to play in protecting the business. The cost of cleaning up after a successful cyber attack, far outweighs prudent defensive measures.

This is being reflected in the development of British and international standards, such as BS 31111 - a UK standard which focuses on cyber risk and resilience within organisations. In addition, in the last couple of years, the National Cyber Security Centre (NCSC) in the UK, has delivered a toolkit to make the boards of organisations more



cognisant of cyber risks. The toolkit looks at the challenges represented by limited budgets and limited skills and the requirement to measure the return on investment, which is not a straightforward task in security.

One opportunity is the adoption by R&E organisations of standardised managed services as these can drive costs down whilst offering greater levels of automation, integration and visibility.

How has cyber-crime been affected by the pandemic?

There has never been a more challenging time for security professionals than during the Covid-19 pandemic. Overnight, staff and students have had to adapt to working remotely, creating a range of additional security challenges that we continue to face.

Cyber criminals have been capitalising on increased homeworking and the extensive use of remote access services (for example VPNs and RDP) by targeting new and existing vulnerabilities in such services. Recent ransomware campaigns have focused on exploiting weaknesses and vulnerabilities in RDP

services. Publicity surrounding the payment of ransoms by high profile organisations has fuelled an increase in ransomware campaigns.

In 2020, for reasons beyond our control online meetings and conferences became the norm. Whilst we all recognise that face-to-face interaction is irreplaceable, could you talk to us about some of the benefits of hosting Jisc Security Conference online?

Our fifth annual Security Conference will take place online on 3-5 November 2020 with the theme: Building a cyber aware culture together. This year the conference's programme has been extended to three days with the addition of more interactive and practical sessions covering open source security. Our objective is to attract at least one representative from every Jisc member organisation, 600 approximately.



The new online format will make the conference more accessible to professionals who either have cyber security as part of their remit but might not be a full-time responsibility. We have already registered a higher number of delegates where cyber security may only be part of their responsibility.

The online format will also enable us to reach a wider international audience because cyber security has no borders and is not country specific; most cyber security challenges are shared globally. This will also enable R&E representatives to share their experience, find common grounds with their international counterparts and create collaboration opportunities.

Cyber security is everybody's problem. What more can R&E security professionals do to empower and educate users to prevent security breaches for their organisations?

Members of staff are an organisation's first line of defence. Cyber security training should be mandated for all staff and students, it doesn't need to be regarded as a dark art. It's everyone's responsibility.

The broader challenge for cyber security professionals is to ensure that organisations recognise the business risk and individuals understand that they are an integral part of the cyber security landscape.

Cyber security awareness best practice should be part of the curriculum: students should be made aware of how the various areas of social engineering operate, the process behind it and how to get help and support. Users need to be given the tools to deal with cyber threats and understand how and why they become targets. Cyber security is about education and understanding and also about removing the stigma of being cyber-crime victims, it's about sharing when things go wrong and mistakes are made to prevent them from happening to others.

What has Jisc been doing to support the 2020 Cyber Security Month campaign?

We are pleased to support raising awareness of cyber security challenges through this exciting programme and have been given the opportunity to contribute with some great content on social engineering and password security. Our thanks go to Laura Pooley, Information Security Officer for her articles 'Don't let hackers manipulate you!' and 'Managing Passwords' and Jon Hunt, Cyber Services Delivery Manager for his article 'Why having a strong password isn't enough to secure your account'.

We look forward to collaborating closely with the GÉANT community in the field of cyber security in the coming months.

Jisc runs a number of webinars and courses with a security theme. Some of these are free to attend and for others they are offering a 10% discount (code is SECCONF10%) to Security Conference participants.

Developing effective security awareness campaigns

Online Course

<https://www.jisc.ac.uk/training/developing-effective-security-awareness-campaigns>

Hands-on incident response

Online Course

<https://www.jisc.ac.uk/training/hands-on-incident-response>

Information security policies

Online Course

<https://www.jisc.ac.uk/training/information-security-policies>

Penetration testing - think like a hacker

Online Course

<https://www.jisc.ac.uk/training/penetration-testing>

ISO 27001: foundation

Online Course

<https://www.jisc.ac.uk/training/iso-27001-foundation>

ISO 27001: lead implementer

Online Course

<https://www.jisc.ac.uk/training/iso-27001-lead-implementer>



CONNECT Interview: **Sarah Jones,** **EOSC Engagement** **Manager, GÉANT**

As a writer, researcher, trainer and consultant, Sarah Jones has left her mark on the fields of data management, data policy, FAIR data, Open Science and the European Open Science Cloud. CONNECT spoke with Sarah in her new role as EOSC Engagement Manager at GÉANT.

Words: Interview by Laura Durnford, GÉANT



Tell us about your background and what initially inspired your involvement in data management, FAIR data and Open Science?

During my undergraduate degree in German and Economic and Social history, we did a project using archival material and I really loved exploring the collections. I continued this interest by doing a traineeship and then qualifying as an archivist. I specialised in digital preservation because I saw that as a skills gap and thought it would be best chance job-wise. It led to work on various EC-funded projects, then at the Digital Curation Centre focusing on data management, FAIR and Open Science. One thing has led to another and I've just gone with the flow!

How does all this experience equip you for this new EOSC role at GÉANT?

A lot of my previous roles have involved training, consultancy and community building. It seems that will be a really good fit for this GÉANT role as Open Science is a new area of activity for many NRENs. I will help them explore opportunities and decide what is best for their specific context. I also know lots of people across Europe and internationally from the digital curation, RDM and Open Science fields. I hope to use this network to broker new contacts and collaborations for NRENs. I'm very much a people person and am most at ease running events or chatting with colleagues rather than doing research or writing.

What is the purpose of the new role?

Although my job title is EOSC Engagement Manager, I don't want to focus solely on EOSC. I want to work broadly in the field of Open Science. The federated approach of EOSC means that national and domain infrastructure is critical, and this is where GÉANT and the NRENs play a big role. They're trusted service providers in the national context, and I think the GÉANT community at large is really well placed to help coordinate Open Science programmes across Europe. I'd like to foster a partnership between the GÉANT community and the Research Data Alliance, which is where all the data community hang out.

How will this role help the work of EOSC to unfold?

I see EOSC as a follow-on step from national investment in Open Science. Many NRENs are already engaged in the Governance Board or plan to be a member of the EOSC Association and that's great to see, but I believe it's critical that they're well connected and engaged on a national level too, in order to feed into EOSC effectively.

Research communities also look for support close to hand – in their institutions or from their peer networks. This is another reason why local support services really matter. Users need assistance from people who speak their language and understand the cultural context in which they're working. With 39 members across Europe, the GÉANT community is uniquely well placed to serve here.

What initial goals and challenges are you tackling and how?

The first challenge for me is understanding GÉANT and the NREN community. I'm not from this field so am learning lots of new acronyms and hearing lots about cables! I've taken the first couple of months to brainstorm a plan of action and identify potential opportunities or areas of work in the data space. I've started soliciting feedback on this to shape the plan further and am at the stage of talking to NRENs. Speaking at SIG-MSP at the end of September was really exciting but also a little daunting. I hope NRENs are interested in expanding their service portfolios and engaging in Open Science, or I may need to get quite creative about what I do on a day-to-day basis!

I'm also working with the GÉANT partner relations team to develop a series of InfoShares on Open Science. I'm introducing the concepts in October, and then we'll work with others on sessions covering Open Access, FAIR data and Research Data Management. I've also just taught in a free online course about Delivering RDM Services. This may be of interest to NRENs, to learn about the challenges universities face. And I'm planning a workshop on this topic co-located with the Research Data Alliance plenary in November too.

Good luck with all of that. Perhaps to end with, one fun fact about yourself?

I've always enjoyed being outdoors, either gardening on the allotment, hiking or crafting. A few years ago, I actually qualified as a drystone wall builder, so if work in the data field dries up (or my brain gets fried from too many Zoom meetings), I am likely to retreat to the country and keep old skills alive. I fell in love with Tasmania when I holidayed there this Spring right before COVID lockdown, so that may be my retirement plan...

CERN, SKAO, GÉANT and PRACE to collaborate on high-performance computing

The next generation of high-performance computers holds significant promise for both particle physics and astronomy but key challenges remain to be addressed

In July, a pioneering collaboration was formed that will work to overcome challenges related to the use of high-performance computing (HPC) to support large, data-intensive science projects. The members of the collaboration are CERN, the European Organization for Nuclear Research; SKAO, the organisation leading the development of the Square Kilometre Array radio-telescope; PRACE, the Partnership for Advanced Computing in Europe, and GÉANT.

The next-generation of HPC technology offers great promise for supporting scientific research. Exascale supercomputers – machines capable of performing a quintillion, or a billion billion, calculations per second – are expected to become a reality in the next few years. This change in the power of HPC technology, coupled with growing use of machine learning, will be vital in ensuring the success of big science projects scheduled to come online this decade, such as SKA and CERN's High-Luminosity Large Hadron Collider (HL-LHC).

"Heterogeneous architectures hold the promise of delivering significantly more computing power which we have to harness to address the computing challenges of the HL-LHC," says Eckhard Elsen, CERN Director for Research and Computing. "The smooth integration of these resources typically available at HPCs into the globally distributed Worldwide LHC Computing Grid [WLCG], will be essential for the computing model of the future," adds Maria Girone, CERN openlab's Chief Technology Officer.

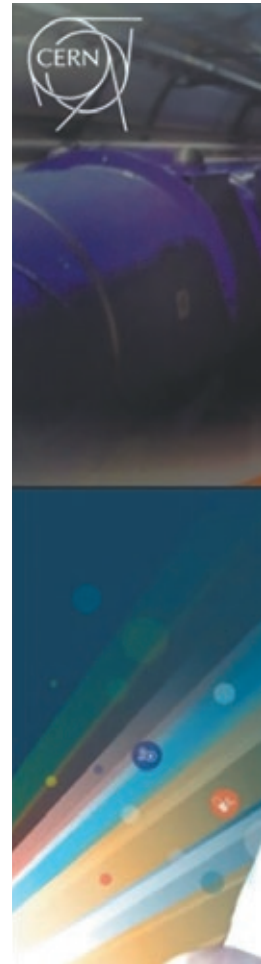
The collaboration between CERN, SKAO, GÉANT and PRACE will see the organisations work together to help realise the full potential of the coming new generation of HPC technology. During an initial period of 18 months, the collaboration will develop a benchmarking test suite and a series of common pilot 'demonstrator' systems.

Establishing a common benchmark suite will help the organisations to measure and

compare the performance of different types of computing resources for data-analysis workflows from astronomy and particle physics. The suite will include applications representative of both communities – reflecting today's needs, as well as those of the future. It will be for running on both HPC resources and high-throughput computing (HTC) resources, like the WLCG.

"With the sheer quantity of data that will flow from the SKA antennas towards two supercomputing centres, one in Australia and one in South Africa, developments in high-performance computing and high-speed networks will be key for the SKA Observatory," says Professor Philip Diamond, SKA Director-General. "The value of this collaboration was demonstrated by the recently concluded H2020 AENEAS project," adds Chiara Ferrari, SKA-France Director and Chair of the AENEAS General Assembly. "Working with such leading organisations is of paramount

Picture
Eckhard Elsen (top left), Director for Research and Computing at CERN; Philip Diamond (top right), SKA Director-General; Erik Huizer (bottom left), Chief Executive Officer of GÉANT; and Philippe Lavocat (bottom right), PRACE Council Vice-Chair, signed the agreement for the new collaboration.





importance to identify optimised solutions for the future world-wide network of SKA regional centres.”

The series of pilot ‘demonstrators’ developed will also include systems for data access and authenticated workflows. It is indeed vital that data can be delivered and accessed quickly and in a secure manner.

“GÉANT exists to serve research and education and, together with Europe’s National Research and Education Networks, we provide networking and access services that are vital to large-scale, highly data-intensive projects such as the HL-LHC and the SKA,” says Erik Huizer, Chief Executive Officer of GÉANT. “We look forward to further strengthening our long-standing relationship with CERN, SKAO and PRACE and ensuring next-generation HPC technology is easily accessible for all scientific communities.” Enzo Capone, Head of Research Engagement and Support at GÉANT, adds, “GÉANT is extremely proud to be part of this

agreement, alongside partners and communities with which we have a long-standing relationship already, but now specifically focussing on a number of innovative activities that aim to scale the synergies between big-data production, data movement, AAI services and high-performance computing to the next level”.

In addition, the four organisations will work together to establish a training programme to help researchers make the most of the new computing architectures that are becoming available.

“Big science needs deep and intense collaboration across disciplines, organisations and borders. PRACE is very proud to see four large European and international infrastructures come together in this historic collaboration. Now that the paperwork is done, the real work can start, mixing numerical simulation, scientific theories and data even more intimately, and we are looking

forward to it”, explains Philippe Lavocat, PRACE Council Vice-Chair. “One of the central aspects of this collaboration that PRACE will lead is training and education: creating and supporting the next generation of supercomputing experts, and filling the gaps that we currently see in the skills available in the HPC ecosystem,” adds Florian Berberich, Member of the PRACE Board of Directors.

The agreement was signed on 22 July in an online meeting by Eckhard Elsen, Director for Research and Computing at CERN; Philip Diamond, SKA Director-General; Erik Huizer, Chief Executive Officer of GÉANT; and Philippe Lavocat, PRACE Council Vice-Chair.

This text has been slightly modified from the joint release issued by the four organisations, to take account of past tense.



The Human Brain Project:

the game-changer
in navigating brain
networks

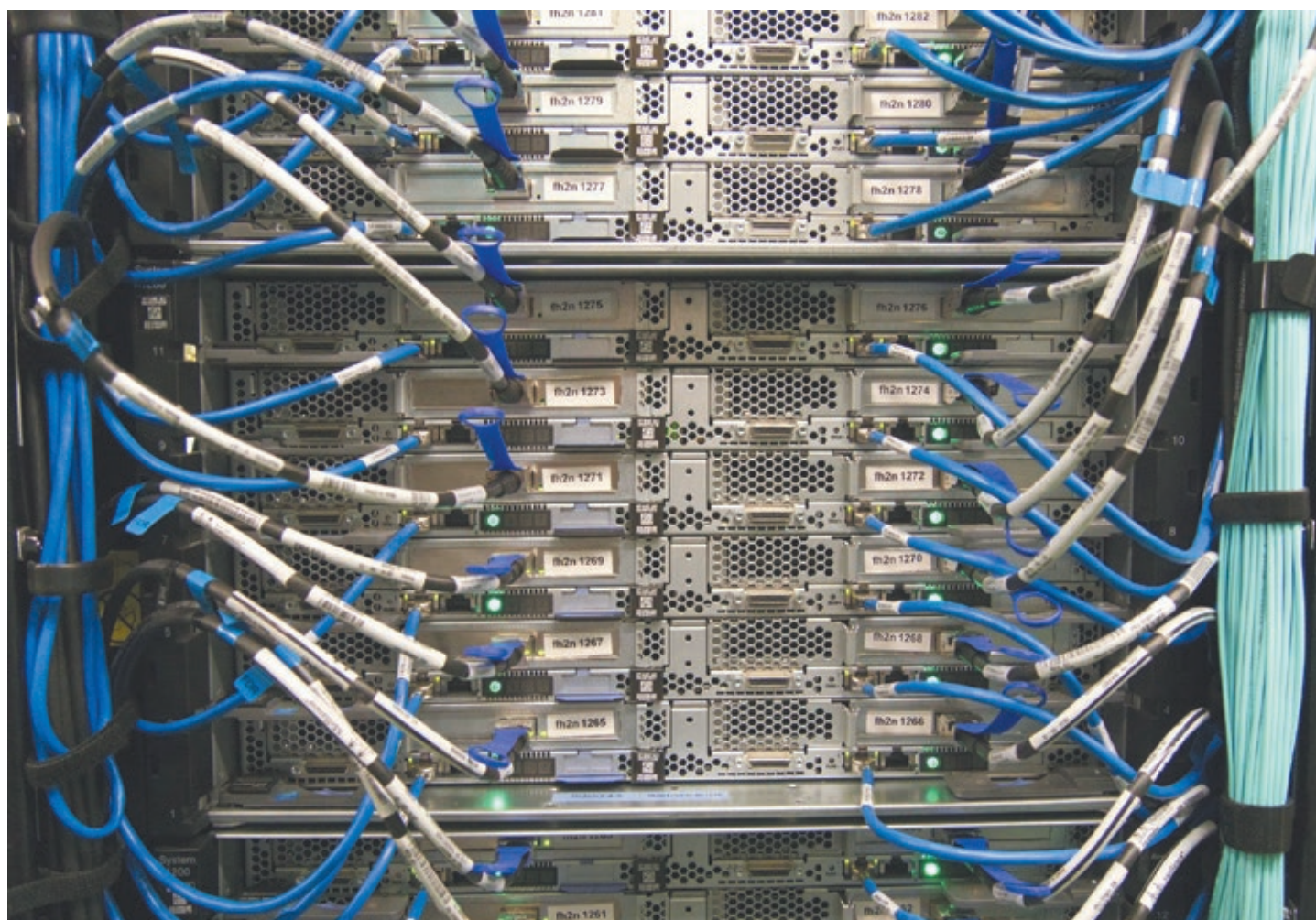


The human brain is a truly amazing and awe-inspiring thing, performing feats that even the most sophisticated computers are only just starting to tackle and doing so using a tiny amount of energy. Consisting of a vast network of around 86 billion nerve cells each with 10,000 synaptic contacts, understanding its multi-level organisation and behaviours is a challenge so extraordinary that no single research project could claim to provide the full picture. And with simulations and analysis demanding enormous computing power, collaboration on a vast scale is needed.

Therefore, the Human Brain Project (HBP) is providing a unique, lasting contribution by building a research infrastructure to harness multiple disciplines and computing, to help advance neuroscience, medicine and computing to the benefit of society.

Together with PRACE (the Partnership for Advanced Computing in Europe), GÉANT and the NRENs are providing networking and access services that ensure Europe's supercomputers can be relied upon by HBP scientists worldwide.

Words: Silvia Fiore, GÉANT



EBRAINS

With the current and third Specific Grant Agreement (SGA3) of the project receiving new funding until 2023, the HBP is focusing on expanding its innovative EBRAINS digital infrastructure, a unique infrastructure worldwide, in which it provides access to the most comprehensive set of brain data yet made available, along with an unprecedented array of digital resources for sharing, analysing and storing such data. It uses these resources to model and simulate the brain and test the results in virtual neurobotics experiments with advanced high-performance computing capabilities.



FENIX

From a technological view, EBRAINS is built on the FENIX infrastructure (Federated Network for Information Exchange) which opens up the major European supercomputing centres - BSC in Spain, CEA in France, JSC in Germany, CSCS in Switzerland, and CINECA in Italy - to neuroscientists and other researchers in a cloud-like manner.

With its long-term experience in operating federated services for the R&E community, GÉANT is working closely with FENIX for the design, implementation, operation and continuous evolution of the FENIX Authentication and Authorisation Infrastructure (AAI). The AAI is a core component of the research infrastructure, which aims to connect users as seamlessly as possible to the services offered by the supercomputing centres to the EBRAINS platform and other Generic Community Platforms, using a single set of credentials.

The subprojects

Under SGA3, the project focuses on getting HBP firmly operational with 12 Subprojects (SPs) contributing to building the HBP infrastructure and expanding scientific research. These SPs cover such areas as neuroscience – aimed at unified knowledge and tools to address Alzheimer's and other cognitive disorders; infrastructure – with the aim of creating ICT platforms to access and utilise brain data by the wider scientific community; and support services such as legal, ethics and outreach; all of which reflect the inter-disciplinary nature of the project and act as instruments to harness EBRAINS.

“The Human Brain Project is one of the most prestigious projects in the European Union and with added value beyond Europe. Projects such as the HBP consistently drive us to improving our digital infrastructures and optimising our support to science and innovation. It is a great honour to serve this initiative for the infrastructure and data management community, as it is a concrete realisation of the EOSC project mission, to turn the research data from information to knowledge, to do better science. Open Science, data management, and FAIR in action, via good implementation will open a new era for research and research result dissemination. One of GÉANT’s organisational values is community. We collaborate with our partners around the world proving every day that science has no borders. I am very glad to be able to bring this mission and experience to the HBP community.”

Cathrin Stover, GÉANT’s Chief Communications Officer, and Co-chair of the EOSC Executive Board, has joined the Science and Infrastructure Advisory Board (SIAB) of the HBP



The mission

There is no research infrastructure currently available in Europe that is or could be similar to EBRAINS in its goals, scope, multi-disciplinarity and level of technological development to decode the human brain’s complexity, and translate this knowledge into advances in technology, computing and medicine that deliver tangible benefits for society.

By mastering the knowledge and know-how necessary for effective prevention, diagnosis and treatment of brain diseases, the HBP wants to ensure Europe’s medical sovereignty. An increasing number of applications are built on EBRAINS new technologies. For example, a method for personalized modelling of patient brains is currently undergoing clinical trials, the first of its kind. This method is being used in 30 European clinics, enabling analysis of patient data, without the highly sensitive

information having to leave the hospital. It is expected that this technology will have an impact for future studies of rare diseases.

Improved understanding of the brain and the ability to harness that knowledge also provide an important underpinning for Europe’s economic competitiveness and digital leadership by mastering some of the key technologies which will determine the terms of future global competition, including AI, robotics, and brain-inspired high performance computing.

HBP also encourages the major challenges for neuroscience to be addressed collaboratively, generating the necessary synergy between research efforts across several different disciplines; providing a unique, distributed digital research infrastructure for all of Europe and beyond for a new era in brain research.

GÉANT’s role

The data handling requirements of a project such as the HBP are immense, and typical of such a large-scale collaboration. This is why GÉANT works with PRACE to ensure that the European supercomputing centres are interconnected across the National Research & Education Networks. In December 2016, GÉANT and PRACE launched a pathfinder project to upgrade the network infrastructure to extremely high performance virtual private networks between all the sites for a simple, secure and manageable network capacity.

To read more about the Human Brain Project and explore interactive 3D brain atlases, visit <https://www.humanbrainproject.eu/en/>



openUp2U: supporting students and teachers in times of crisis

In these unprecedented times of crisis schools and universities have faced great challenges. Desperate to keep their students moving forward they have taken learning online, but with varying degrees of success. At times like this not only does education need substantially more support, but the importance of advanced digital technologies to make this a success becomes paramount.

To help ensure that past and future lockdowns do not turn into educational shutdowns, the EU-funded Up2University (Up2U) project accelerated the development and launch of its trusted, remote learning platform – and offered it to all schools and universities across Europe.

About Up2U

Up2U is a collaborative project coordinated by GÉANT with the key objective to bridge the gap between secondary schools and higher education & research by better integrating formal and informal learning scenarios into a more open, effective and efficient school approach where students can co-design, co-create and use personalised, collaborative and experimental digital content, tools and services in preparation for university.

What is openUp2U?

The openUp2U platform is a Next Generation Digital Learning Environment (NGDLE) that is open-source, highly customisable and portable offered on a best-effort basis to secondary schools and academic communities who wish to develop and enhance their teaching and learning skills as it should be to university standards.



openUp2U was launched earlier this year following two weeks of intensive and dedicated work, mostly based on voluntary efforts. CONNECT spoke with Gyöngyi Horváth, Community Support Officer at GÉANT, to learn more about the potential of openUp2U and its impact on the GÉANT community.

Words: Interview by Silvia Fiore, GÉANT

How is openUp2U supporting students and teachers in these difficult COVID-19 times?

openUp2U provides students and teachers with online tools that can be incorporated into their daily teaching practices for fresh and innovative improvements. It helps students develop critical thinking skills and be more independent learners.

The platform allows to share school projects and get inspired by those of others that can be replicated. It provides access to a learning management system (Moodle), collaborative editing and document sharing tools (CERNBox, Swan), as well as seamless real-time virtual interactions (eduMEET).

What should students be most excited about using openUp2U services?

With openUp2U we are bringing new technology from the cloud to the classroom and back, which leaves room for experimenting with the informal learning spaces and developing new media and tech skills, much needed in today's higher education.

It is a leading-edge opportunity to access learning content anytime, anywhere and for students to independently create their personal learning path tailored to their own learning-specific goals and objectives.

openUp2U was successfully launched earlier this year. What can you tell us about the achievements so far and the feedback received?

openUp2U was developed and launched with the idea of having a simplified and scalable version of the original Up2U platform to meet urgent requirements for the continuation of education where it was needed the most.



The platform is non-commercial, GDPR enabled and privacy conscious, which is valued by most organisations, who have adapted it for their local educational institutions. Teachers have appreciated the easiness to create courses and convert from traditional teaching methods to virtual, especially during the COVID-19 pandemic.

Where can teachers and students access the openUp2U platform?

Information about the tutorials and materials can be found at the following locations:

Up2U tool tutorials:
<https://up2university.eu/tutorials/>

openUp2U user guide:
<https://cdn.test.up2university.eu/open/docs/user-guide.pdf>

Up2U users' video demonstration:
https://www.youtube.com/watch?v=tDOMbfGEy_w

Fitting within the UNESCO Global Education Coalition

With 109 countries affected by school closure, the COVID-19 pandemic is also an education crisis. In June 2020, GÉANT joined the Global Education Coalition launched by UNESCO, alongside other worldwide organisations from the private, media, and non-profit sectors, to address the challenges of remote learning and build more resilient education systems for the future.

The Coalition is an open partnership which seeks to 'facilitate inclusive learning opportunities for children and youth during this period of sudden and unprecedented educational disruption', and to 'ensure the continuity of education for all learners.'

openUp2U is an example of GÉANT's and its partners' efforts not only in Europe but on a global scale to support the transfer of knowledge, the development of skills and a joint response to a crisis.

For more information about openUp2U visit: <https://up2university.eu/open/>

2020 Network Performing Arts Production Workshop moves to online interactive version

Playing piano over a distance of 8000+ km during COVID-19 times? Yes, it is possible. In April 2020, the Network Performing Arts Production Workshops (NPAPWs) brought together the international community of students, academics, practitioners in the field of music, dance, theatre to help them teach, run courses, collaborate, rehearse, and perform remotely during these unprecedented times of crisis.

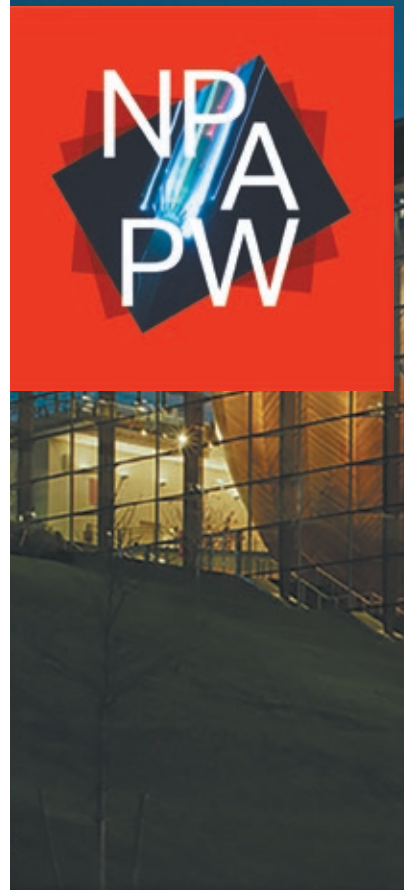
Words: Interview by Silvia Fiore, GÉANT

The workshop

Held in Europe and the United States annually since 2009, NPAPWs are a collaborative project of GÉANT, Internet2, New World Symphony, GARR and other European national research and education networks (NRENs) and various cultural institutions around the world.

The workshops have three main objectives:

- Outreach to new user communities in the arts & humanities by demonstrating the use of R&E networks in supporting real-time musical, dance, and artistic performances.
- Collaboration between R&E networks and cultural institutions worldwide.
- Expert knowledge exchange on the use of specific tools to support teaching, auditions, and remote performances.



The 2020 workshop was planned to take place at Rensselaer Polytechnic Institute in Troy, New York, USA at their Curtis R. Priem Experimental Media and Performing Arts Center (EMPAC). Unfortunately, due to the COVID-19 crisis, the event was postponed to 2021, leaving more than just a gap in the list of activities planned for the arts & humanities communities in Europe.



We interviewed Dr. Domenico Vicinanza, Senior Research Engagement Officer at GÉANT, music composer and orchestrator for cinema and television. He is coordinating the arts & humanities activities since 2011 and has seen five NPAPW successful editions come to life. Domenico tells us more about the challenges and opportunities of remote music performances.



The Curtis R. Priem Experimental Media and Performing Arts Center

Domenico, how did the idea of organising an interactive webinar come up and how was it received by the arts & humanities community?

It was the NPAPW Programme Committee who had the idea of moving the workshop to an online interactive version. The organisers thought that gathering in one virtual space long-time worldwide experts and collaborators who would share online teaching practices with students in the performing arts would be a valuable opportunity in the current circumstances.

What is the biggest challenge for making and performing music virtually?

The biggest difficulties of live streaming are timing constraints and latency issues, which make synchronous and asynchronous collaboration almost impossible. During the COVID-19 crisis, these challenges were even more frequent than usual. That is why the 2020 edition of the NPAPW aimed at

helping solve them, sharing tips and best practices with the attendees and giving them the know-how to unlock a new level of creativity and improve the online experience.

Can you tell us how else the community is supporting musicians and teachers during the COVID-19 crisis?

This crisis has allowed us to see more clearly the impact of new technologies extending outside of traditional theatres and established recording studios. In fact, several organisations and associations, such as the British Flute Society and the Association of European Conservatories, have put together a collaborative list of useful tools and technologies to help musicians and teachers during the COVID-19 crisis. The list compiles mental health support resources, educational advice, livestream concerts and useful apps.

What part did GÉANT play in organising the webinar and how are we supporting online music performances in the future?

GÉANT was co-host, co-organiser, and presenter of the webinar. The GÉANT community, in fact, plays a crucial role in Europe promoting, advocating, connecting, and enabling remote arts tuition, performances, and knowledge exchange as it is made up of many artists and technologists with specialist expertise in networking for the arts. Therefore, NRENs and RRENs have the unique responsibility of making distributed art performances possible by providing exactly that high-quality connectivity and extended reach they need to overcome timing and latency issues.

To watch the full webinar and stay tuned for future editions, visit:
<https://npapws.org/>

Access the full list of support material here: <https://bfs.org.uk/coronavirus-resources>



Funded under the EU4Digital
Initiative of the European Union

Eastern Partners anticipate benefits of 2nd EaPConnect project

EaPConnect entered a second phase in July 2020. The 60-month EU-funded 'EU4Digital: Connecting Research and Education Communities' (EaPConnect) project will build on the achievements of the first 5 years, bringing together the R&E communities from EU and Eastern Partnership (EaP) countries and reducing the digital divide.

Words: Laura Durnford, GÉANT

The project aims to:

- extend the network infrastructure to scale up scientific exchange across borders,
- increase the use and quality of services and offer new services to enhance international R&E cooperation,
- strengthen the position of EaP NRENs in their national R&E ecosystems in Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine,

- build knowledge, skills and community through events, training, mentorships, and other initiatives.

A key goal is to achieve long-term sustainability of EaPConnect partners, raise their visibility and show their value. Interacting with research communities that are potential users of partners networks and services is a growing focus of activity.

So what do the partners anticipate will be the most significant outcomes of the second EaPConnect project for their countries and organisations?



URAN:

"One of the most anticipated outcomes is bringing our digital services for R&E to European standards, as Ukraine is heading towards EU integration and standardisation is a very important part of the process. We also expect to build powerful new 100Gb/s channels to a GÉANT PoP and Moldova. These will allow us to connect Ukrainian big data scientists to special networks such as LHCONE, or, for example, to transfer very large photos of the Earth from Copernicus."

Yevhenii Preobrazhenskyi,
Executive Director



GRENA:

“I am certain that the new project will benefit Georgian R&E in numerous ways. One will be the increased number of users benefiting from the highly reliable network and the implemented services: eduroam, eduGAIN, cybersecurity, Cloud etc. EaPConnect will help establish new and strengthen existing collaborations between Georgian and European partners.”

Ramaz Kvatadze, Executive Director



RENAM:

“It is crucial for research teams from Moldova to collaborate with colleagues from the EU and EaP countries, to work with them on joint projects. EaPConnect will support this collaboration by providing extended connectivity, innovative services and by promoting Open Science principles to national research and educational institutions”.

Peter Bogatencov, Chairman of the RENAM Management Board



AzScienceNet:

“In the new project, I expect we will witness the introduction of ever smarter, increasingly advanced network services, that take into account any developments arising in the ongoing Fourth Industrial Revolution and artificial intelligence technologies.”

Prof. Rasim Alguliyev, Vice President of ANAS



BASNET:

“BASNET will become a more powerful and recognised partner for supporting national and international projects of R&E in Belarus, with greater network coverage and more services implemented for the benefit of researchers, students and lecturers. Thousands of researchers from Belarus would be able to access EOSC and European e-infrastructures in their projects using GÉANT and BASNET.”

Sergei Kozlov, Head of Network Administration Sector, UIIP NASB



ASNET-AM:

“Advanced high-speed networks using innovative technologies; a rich portfolio of services to address the current and future demands of academia and educators; accelerating scientific research by providing state-of-the-art e-infrastructures; and the availability of thematic Research Infrastructures shaping EOSC. These are the outcomes I am anticipating for ASNET-AM and Armenia.”

Hrachya Astsatryan, Director, IIAP NAS RA

Erik Huizer, CEO of GÉANT, also foresees that the project will further integrate the Eastern Partner countries with the GÉANT community:

“I hope and expect that EaPConnect2 will realise a sustainable national education and research network on a par with the rest of Europe in all six countries involved.”

Partners

The beneficiary partners are IIAP NAS RA (Armenia – ASNET-AM), IIT of ANAS (Azerbaijan – AzScienceNet), UIIP NASB (Belarus- BASNET), GRENA (Georgia), RENAM (Moldova) and URAN (Ukraine). Co-beneficiary partners are DFN (Germany), EENet of HITSA (Estonia), LITNET (Lithuania), GRNET (Greece), GARR (Italy), PSNC (Poland), RoEduNet (Romania) and SURF (the Netherlands).

The partners will work together in further conferences, workshops, mentorship relationships and other collaborative activities to achieve the project objectives and ensure the sustainability of research and education networking in the Eastern Partnership region.

Funding

The project is funded under the EU4Digital initiative of the European Union. The European Commission's Directorate General for Neighbourhoods and Enlargement Negotiations (DG NEAR) is contributing 95% (€10m) towards the costs, providing funding to the second EaPConnect project under Grant Agreement number ENI/2019/407-452; the remaining 5% is being co-funded by the six beneficiary countries.

EU4Digital aims to extend the European Union's Digital Single Market to the Eastern Partner states, developing the potential of the digital economy and society, in order to bring economic growth, generate more jobs, improve people's lives and help businesses. Through EU4Digital, the EU supports Eastern Partnership countries on reducing roaming tariffs, developing high-speed broadband to boost economies and expand e-services, harmonising digital frameworks across society, in areas ranging from logistics to health, building cyber security, developing skills, and creating more jobs in the digital industry.

Pictures

Yevhenii Preobrazhenskyi (© URAN), Ramaz Kvatadze (© GRENA), Peter Bogatencov (© RENAM), Rasim Alguliyev (© IIT of ANAS), Sergei Kozlov (© S. Kozlov), Hrachya Astsatryan (© GRENA)

Further information

www.eapconnect.eu

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Building the Next-Generation of Research and Education Networking

The GN4-3N project, 100% funded by the European Union, sees the biggest network renewal in a decade, bringing a new phase of connectivity to Europe. CONNECT spoke with Sebastiano Buscaglione, Network Architect at GÉANT, to learn more about what this means for European research and education.

Words: Interview by Karl Meyer, GÉANT

Sebastiano, I know you and your team are busy with the network implementation so thank you for your time. Briefly, what is the work involved in GN4-3N?

GN4-3N is a major network refresh designed to take advantage of both the changes in technologies and the changing face of network procurement, to give research and education communities improved performance, increased flexibility and reduced expense alongside long-term platform stability.

In GN4-3N there are two main workstreams dealing respectively with:

- Acquisition of infrastructure (Fibre or Spectrum).
- Refresh of the DWDM line system.

Regarding the first workstream, essentially GN4-3N changes the way we acquire infrastructure to build the network, allowing GÉANT for the first time to establish contracts of much longer length than has been possible before (the IRU covers 15 years). Until now GÉANT infrastructure was built through short-term leasing of the fibres or circuits, which involved short-term solutions and strategies.

The supply of these services from the telecommunications companies was, in many regions, very limited leading to

sub-optimal solutions, increased costs and situations where it was simply not possible to provide connectivity at the required capacity cost-effectively. This has exacerbated the digital divide with some regions unable to host data intensive research projects due to lack of (affordable) network capacity.

With the GN4-3N project, the approach has been reversed and the infrastructure has been designed based on long-term acquisition of dark fibres or portions of the (fibre) spectrum.

The second work stream covers the equipment, and here the benefit comes from GÉANT and the NRENs having responsibility for deciding how to implement and share this network.

In this way, the GN4-3N project enables fairly priced, high capacity connectivity across all of Europe.



What about commercial networks?

In 2019 the current GÉANT network carried 2.8 Exabytes of data, an increase of 17% over the previous year and we see substantial growth every year. The profile of this traffic is very different from typical commercial or domestic network traffic. Commercial networks also need to return a profit, balancing user requirements against capacity cost, and this can limit the capacity they make available to users.

In addition, there is a clear digital divide between European countries (and also within them), with highly developed areas from the point of view of access to the network and others that are still poorly served and often penalised by high access costs. This involves a vicious circle whereby investments in

technology tend to be attracted to areas that are already developed, leading to a progressive widening of the gap between countries, both in terms of infrastructures and in terms of know-how.

Without external intervention this vicious cycle will continue, further widening the digital divide.

How will GN4-3N Help?

GN4-3N is designed to level the field so that a Gigabit of capacity will cost virtually the same throughout the network and not only that, because of the 15 year IRU agreements, there will be consistency and predictability of costs. This will enable long-term planning for NRENs and research projects across Europe, as well as providing countries with equal opportunities in terms of connectivity and their ability to host data intensive projects.

In terms of addressing the digital divide, one of the benefits of the new network will be that high capacity connections will be available throughout the network so that interconnections to other regions can be made throughout the network rather than just in a few locations. As an example, the European connection for the BELLA-S1 project can be made in Portugal rather than having to be back-hauled to a central European location.

In the process we will be building the biggest network in Europe, dedicated to European research and education.

**Thank you,
Sebastiano – we look
forward to further
updates!**



CONNECT Interview: Veronika Di Luna

GÉANT's Veronika Di Luna was project manager for the CAREN3 Project, the last of a series of successful initiatives bringing high-speed connectivity and enhancing scientific collaboration for the R&E communities in Central Asia. CONNECT interviewed her about the project's achievements and the continuation of its legacy through the CAREN CC.

First part in a series of interviews on the CAREN3 Project.

Words: Interview by Leonardo Marino, GÉANT



Veronika, why is CAREN such an interesting case and what did it mean for research communities in Central Asia?

Central Asia is a complex region, standing on the geopolitical crossroads between Asia and Europe, and it's extremely rich in natural resources, culture and history. In terms of Research and Education, the CA countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan) have a vast potential and count on solid traditions, with roots in their Soviet past. However, the area

also suffers from being geographically isolated, with mountainous or desert regions and being far from the sea, and making physical connections with the rest of the world – by land or air – has always been difficult. Having family in Turkmenistan and having lived there myself at a young age, I personally remember travelling for days and days with my parents in order to get there. But while physically reaching those countries might still be quite complex, it can now be easy in a digital environment.

In that respect CAREN served as the enabler of Digital Highways for the R&E communities in Central Asia, offering students, academics and researchers the opportunity to collaborate and take part in global initiatives.

More than a project, CAREN has been a programme, running for 10 years, responding to tangible needs of these communities and significantly contributing to the reduction of their digital divide. Furthermore, it produced real use cases and allowed R&E communities in CA to grow, prosper and communicate in an international arena through high-quality and high-speed internet connection and using many of the services that the GÉANT community provides.

It was highly beneficial for the region that the European Union could create this opportunity by providing funding to CAREN projects for the past 10 years. In this respect we at GÉANT believe that investment in or funding for NRENs or regional R&E supports and enables the national and regional digital agendas.

Pictures

Left: Veronika Di Luna, GÉANT's project manager for the CAREN3 Project

Right: Veronika visiting the Hisar Observatory (HisAO) at the Institute of Astrophysics of the Academy of Sciences of Tajikistan. October 2018, Hisar, Tajikistan.



Expanding on your last point, in what ways did the NRENs in the region benefit from the collaboration with GÉANT?

Similarly to other international projects managed by GÉANT, together with our partners in CA, we focused on four main directions:

- **Connectivity:** relying on EU funding and on GÉANT's expertise in project management and procurement – we succeeded in connecting Central Asian countries (specifically Turkmenistan, Tajikistan, Kazakhstan and Kyrgyzstan at the time of maximum coverage) to GÉANT's pan-European network.
- **Deployment and promotion of Services:** this was made possible thanks to the expertise shared with CA NRENs by our European counterparts and to the funding that was made available for adoption, training and promotion.

- **Capacity Building:** several workshops and trainings were organised in the region for users and for the NRENs, ensuring their transformation into strong players in the global R&E environment and creating Knowledge Bases that would benefit the region for many years to come.
- **Promotion and visibility:** we organised large conferences every one or two years, attracting users, governmental representatives, funding organisations, e-infrastructures and other relevant international stakeholders. The discussions would then serve as a platform for further cooperation and digital development.

Overall, what are the project achievements you are most proud of?

When the project started back in 2009, NRENs were already established but we were lacking a legal entity that would act as regional coordinator.

In my opinion, one of the major achievements of the project was the establishment of the CAREN Coordination Centre (CAREN CC), that was established in 2017 and that took the lead on behalf of all NRENs. From GÉANT's point of view we see a strong value in having regional coordinators, to facilitate work with international donors, aggregate the demand and spread the knowledge.

Of course, other key achievements were also the stable and high-quality internet connectivity, going all the way back to Europe, and the introduction of key services such as eduroam and eduGAIN.

CAREN3 is the last successful chapter in a series of collaboration initiatives in Central Asia. What does the project owe to its predecessors?

The history of networking in Central Asia goes back decades, to the SILK project initially funded by NATO. Ever since then there was

Pictures
Above: CAREN topology as of April 2017

Top right: Veronika Di Luna, Istvan Tetenyj and Robert Janz at the Project ExCo meeting with partners from CAREN CC, KRENA (KG), TARENA (TJ), TURENA (TM). October 2018, Dushanbe, Tajikistan.



a succession of different projects that helped the establishment of NRENs, engagement of the R&E community and networking. Since 2009 the European Union (through DEVCO) started funding the series of CAREN projects, coordinated by GÉANT. During my past six years at GÉANT, I participated in various roles in CAREN and succeeded GÉANT's David West in the project manager role. It should be noted however that David was the main lead during most of the project's lifetime and that he has been instrumental in its success, together with a strong team of people who worked together for the past 10+ years. Among them Istvan Tetenyi from the Hungarian Institute for Computer Science and Control (SZTAKI), CAREN technical coordinator and closely collaborating with GÉANT in procurement, technical management of the services and network roll-out; Robert Janz, based at the University of Groningen and involved since the initial NATO projects; Askar Kutanov, pioneer and ambassador of the initiative in Central Asia and current director of the CAREN CC; Zarlyk Jumabek Uulu leading the CAREN Network Operations Centre (NOC).

After more than 10 years, the project just came to a conclusion in December 2019. Will this mark the end of CAREN?

Here we need to make a distinction between CAREN as a project, CAREN as a regional body and CAREN as a network for Central Asia. So yes, unfortunately the European Union was unable to secure sufficient commitment from the Central Asia governments to continue with a CAREN project. This is very unfortunate, especially in light of the recently published strategy on EU-Asia connectivity, with which the CAREN project was very much in line.

However, CAREN as a regional network remains connected to GÉANT. In fact, following the end of the project, GÉANT and the CAREN CC signed a Memorandum of Cooperation [MoC], serving as a basis for our future collaboration. Together we will continue to work on improved connectivity between the two regions, and on fostering scientific collaboration between user communities in Central Asia and Europe, specifically in the areas of climate change, seismology, water management, telemedicine, cultural heritage, educational support and gender inclusion. Additionally, there will be further collaboration on the provision of services in the CAREN region and on joint marketing and visibility activities.

Equally, within the region, the countries involved will still collaborate and maintain the regional function, through the coordination of CAREN CC.

What are your expectations for the future of academic collaboration between Europe and Central Asia and what would you like to suggest to the new coordination team at CAREN CC?

I very much hope that there will be renewed funding opportunities for R&E Networks in Central Asia, or for a further phase of CAREN, to support and build on the work we have done, address the requirements described by the strategy on EU-Asia connectivity, and also to promote and further develop the activities of the region. The contribution that Central Asia makes to global research is invaluable. In that respect I have high hopes and expectations. However, funding will be a key aspect to tackle: we will have to see how the current global pandemic will influence governments and I hope their digital agenda will remain a top priority.

My personal suggestion to the coordinator is to continue to be proactive, and to remember that GÉANT and CAREN CC share a history of collaboration which should continue. CAREN is part of our community, and we would also like to continue strengthening our relationship. It's only through the power of human networking that we can improve together.



CONNECT Interview: Robert Janz

Our series of interviews on the CAREN3 Project continues with Robert Janz, formerly from the University of Groningen, now freelance ICT consultant. Involved since the early days of the project, he told CONNECT about his past 20 years of experience in bringing connectivity and enhancing collaboration for R&E communities in Central Asia, through CAREN3 and its predecessors.

Words: Interview by Leonardo Marino, GÉANT



Picture
Left: Robert Janz, formerly from the University of Groningen, now freelance ICT consultant

Right: Rock formations in the Charyn Canyon, in Kazakhstan

Robert, when did the project originate and which were the parties involved?

It depends on what you define as THE project. The series of CAREN projects started in 2009, but it was the continuation of another series of initiatives, originating in the SILK project, which dates back to 2001. Funded by NATO and with some additional funding from the EU, the project aimed at creating a "Virtual Silk Highway" by connecting research communities in five Central Asian countries (Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan), plus Southern Caucasus (Armenia, Azerbaijan, Georgia) and later Afghanistan. Afterwards, CAREN focused solely on Central Asia, while countries in the Southern Caucasus eventually converged into other projects [now EaPConnect].

SILK was managed by the University College of London, with the Leadership of Professor Peter T. Kirstein, often recognized as the father of the European Internet, who recently passed away and who was the driving force of the initiative. At first, my contribution was on a personal basis as a technical advisor for NATO, while the University of Groningen got involved later on, mainly on training activities and events. When CAREN started, I was seconded to the new coordinator organisations DANTE and then GÉANT, which accepted the many challenges of a project in Central Asia and always provided their very professional expertise in project management and procurement.

What was the status of academic collaboration in Central Asia when you started?

If you ask where we came from, I would say we started from zero. But to explain better, I will have to go all the way back to the late 90's, when I first came into contact with the NATO Science Programme. We were just out of the Cold War, and all the former satellite republics of the Soviet Union were left without either a plan or a budget for academia and scientific research. Alongside its political and military programmes, it was a key priority for NATO to maintain and enhance collaboration between scientists from eastern and western blocks. As such they were funding several small scientific projects not only in Central Asia, but also in the Southern Caucasus and in Eastern European countries.

Furthermore, CA countries were paying enormous amounts of money for connectivity. Even in Europe the web was just at its beginnings and costs were higher, but in CA we were talking of 64kbps at tens of thousands of dollars per month! Peter Kirstein, who at the time was also chair of the Networking Panel of the NATO Science Committee, noticed this strong need for connectivity and convinced NATO to redirect funding from the multitude of loose grants into one larger grant that would allow CA to build its own communications network. It was then that the scientific collaboration between CA countries and with Europe really got off.

During this first phase of projects (SILK, SPONGE, OCCASION), lasting up to 2008-2009, we created the network (that still included Southern Caucasus countries) and started setting up NREN organisations, not yet present in CA. Further, with so called NATO Infrastructure Grants, we started building e-infrastructures within the countries to connect academic centres and universities to the Networking Operating Centers of the NRENs.

To summarise, at the beginning of SILK we had zero, after 8 years we had established NRENs in all CA, but it was only through the CAREN project we achieved a proper regional collaboration, which finally resulted in the CAREN Coordination Centre (CAREN CC) in Bishkek.

The series of SILK projects ended in 2009, marking uncertain times for a continuation of similar initiatives in Central Asia. What made CAREN possible and what impact did the project have on the region?

Towards the end of the 2000s, NATO's focus shifted, as they believed the initiative had gone out of their scope. New opportunities for funding came

instead from the EU, now willing to support CA countries on the condition that there was also formal and economical support from the local governments.

Coordinated by DANTE – later to become GÉANT –, the first in the series of CAREN projects started with a massive technological migration: from a distributed satellite network, with its hub in Hamburg, to a fibre optic network. Our initial aim was to set up a proper regional network, interconnecting CA countries among each other and with redundant links going out to Europe. However, we found out that this was not actually possible, mainly due to the monopolistic attitude of local telecom companies demanding huge prices. The absurdity was that connecting the 80km from Almaty (Kazakhstan) to Bishkek (Kyrgyzstan) was more expensive than linking a single CA country all the way back to Europe!

As a consequence, we ended up building 5 separate spikes, going either to Frankfurt – as the nearest point of presence in the GÉANT pan-European network – or to Hong Kong, linking to the TEIN Asian network. On top of that we built a virtual Central Asian network, even if there wasn't a direct connection between the countries. Clearly that resulted in latency problems, because the signal had to travel 5.000km and then come back, but we managed nonetheless to provide access to fundamental information, to enable key regional collaborations, introduce virtual environments, video conferencing and distance education to universities and academia in CA.

Tajik and Kirgiz academies of sciences even established joint doctorate degree programmes, with joint dissertations and defences via video conference. That, in my opinion, is a very nice and significant example of CAREN's impact on the region.

How did CAREN differ from its predecessors and what were its key achievements?

CAREN differed from SILK in several aspects. As I was mentioning, the first

major change CAREN had to face was in terms of technology, as we moved from satellite to a fibre optic network. The establishment of the CAREN Network Operating Centre (CAREN NOC) in Bishkek, Kyrgyzstan, was essential for the success of this operation.

Then in CAREN2 and CAREN3 we increased the focus on services and on their development in the regional context. Connectivity is essential but it is also meant to be a vehicle to provide advanced ICT services for the academic communities. In CA this proved especially challenging, mainly because of language barriers. In fact, as English was not so well known, services and documentation were often provided in Russian or even in local languages.

A major advance was the foundation of regional organisations. During SILK, the conversation was mainly one-way. But if we want our work to be sustainable and for CA countries to stand on their own feet, we needed a direct involvement of the local communities and bi-directional dialogue. Moreover, other than providing connectivity to the NRENs, we also needed to pass them the knowledge and capabilities to become more independent. In this respect, the foundation of the CAREN Coordination Centre (CAREN CC), was an absolute paradigm shift from the SILK period and the first step towards sustainability. Professor Askar Kutanov, a member of the Academy of Science who I already knew from SILK, was appointed as the regional coordinator for CA. Then again, the second step in this direction was creating the CAREN NOC within the region.

What would you say were the major challenges you encountered during all these years?

There were several, depending on the timeframe we are looking at, but overall I would say the main one was sustainability.

One of CAREN's main objectives was to accompany CA research communities through a transition towards self-sufficiency, with





progressive increase of funding and support from national governments and a consequent decrease of EU funding. From a first phase of CAREN with very little national funding, the requirement went up to 10% of the project cost in CAREN2, to be then based on the country's GDP in CAREN3. However, some of the governments did not consider research and education a priority and preferred not to invest further in the project and to withdraw. Now instead I feel like there is growing awareness of the potential impact of education on the development and economy of the region.

The lack of technical infrastructures in CA also posed a big challenge throughout all our work. Even now, the status is quite poor within the countries, as capitals are connected but provinces still rely on radio connectivity. This however can be tackled, if enough funding is provided.

I will renew the question we asked to CAREN3 project manager Veronika di Luna. Based on your 20-years' experience in the SILK and CAREN series of projects, what are your expectations for the future of similar initiatives and what would you like to suggest to the new coordination team at CAREN CC?

When CAREN3 ended we were in a near optimal situation: the CAREN CC was growing stronger, the NOC was operating well, more and more services were being supported and

Turkmenistan and Uzbekistan were either waiting to join or reopening dialogue with the EU. Had we obtained an extension for the project, our perspectives would have been better and in a couple of years we would have achieved to lower EU contribution and to connect up to five countries. Now the situation is more complex, and if no additional funding is provided, I fear that other global players might step into the vacuum.

At this stage, my suggestion to the CAREN CC team is to maintain a strong leadership, ensure long-term sustainability by picking up funding opportunities and keep the flame alive during these difficult times.

Picture
Robert Janz and his wife at the CAREN launch meeting, with Peter Kirstein (UCL), Hans Frese (DESY), Chris Dewispelaere (NATO), William Hanna (EU official), Bernard Fabianek (EU), David West (DANTE), Askar Kutanov (CAREN CC), Istvan Tetenyi (CAREN team), and directors of CA NRENs. September 2009, Bishkek, Kyrgyzstan.



CONNECT Interview: round table with the CAREN Cooperation Center

In the final chapter of our CAREN3 series, we interview the new regional coordinator and director of the CAREN Cooperation Center (CAREN CC) Almaz Bakenov, his deputy director Arianna Akmatova and the former director Askar Kutanov. Together they explain the current status of Research and Education in Central Asia following the end of the CAREN projects and their plans for the future of the initiative.

Words: Interview by Leonardo Marino, GÉANT



Almaz, first of all congratulations on your recent appointment as new director of CAREN CC. Could you and Askar tell us more about the CC and its role in Central Asia?

Almaz Bakenov: The CAREN CC was established in April 2017 to sustain the achievements of the EU-funded CAREN project. Its role is to support the development and strengthening of research and education networking in Central Asia, and to promote cooperation between academic communities, both within Central Asia, and with other regional networks in Europe and in the rest of the world.

This new role adds up to my primary job as director at the Department of Information Technologies at the American University of Central Asia. Coordinating the CAREN CC will not be an easy task, but I decided to accept this responsibility also because of my personal history with the initiative. I have been involved in the series of CAREN projects since their start back in 2009, and in their predecessor SILK, funded by NATO, on which I started collaborating with professor Askar Kutanov as soon as I came back from the US to Kyrgyzstan in 2003.

Askar Kutanov: After 20 years passed working in R&E, I thought it was a good time to step down from my role as CAREN CC's regional coordinator and director. I will keep helping and supporting Almaz and I trust that he will successfully continue the work done until now.

Central Asia is an area of historical and strategic importance and the series of CAREN projects accompanied the region during times of profound change. How did this reflect on regional and local development?

AK: In the beginning it was the SILK project, that established regional connectivity, but it was satellite-based, so limited by bandwidth and quite expensive. Even today a poor regulation of the telecommunications market maintains prices quite high for local NRENs. However, starting from 2009, the three phases of the CAREN project greatly helped to increase bandwidth and expand services for our NRENs.

Through CAREN, isolated academic communities of the Central Asian region became part of the global R&E community, and advanced network technologies and services were introduced to local users. Furthermore, the several regional conferences we organised in each CA country contributed to strengthen collaboration between scientists in the region.

How will the new management influence the future of CAREN CC and its work in the next period? And how do you plan to ensure the sustainability of the initiative?

AB: Our activity is currently going well and prices for connectivity are getting lower. At this stage, we need to rethink our role as CAREN CC, and work to bring on board neighbouring Central Asian countries as new members. Clearly, CAREN CC should also help in the process, and in the development of services and infrastructures, as not all NRENs receive subsidies. We would also need to increase the involvement of both CAREN CC and our NRENs in the global market and focus on finding further funding opportunities. In fact, I believe that a key indicator in my next years as director of CAREN CC will be the funding that we will have obtained to help scientists and educators in the region.

We are well aware that Central Asian countries – due to their economic condition – do not have much funding available for the scientific community and for higher education, especially during the current Covid-19 pandemic. Nonetheless, we aim to develop a solid funding strategy, catalyse intra-regional collaboration, join forces to initiate new projects, and even develop new services, even if to do so we would first need to solve the key issue of funding.

Do you foresee an involvement of other countries in the next period?

Arianna Akmatova: From my perspective, within R&E communities, we have many partners who are particularly interested to be involved in CAREN activities and would like to cooperate with the CAREN CC. This is surely true in Turkmenistan, and even in Uzbekistan, where our partners do not have their own Research and Education Network yet but are interested in establishing one and in starting to work with us. In Kazakhstan some

Picture
From left to right:
Askar Kutanov,
Arianna Akmatova,
Almaz Bakenov.
CAREN CC,
National Academy
of Sciences,
Kyrgyz Republic

considerations on commercial interests might be necessary: their prices for connectivity are cheaper so it could be less economically beneficial for them to join. However, the interest from their research exponents remains high, as a collaboration with the CAREN CC would greatly benefit their work.

So – even if on a higher level there might be political issues – I believe that in the near future it will be possible to get all countries together, because all these organisations understand the benefits of cooperation, the value of the services provided and of e-libraries, and the economic advantages of joining forces in a consolidated region.

What is the current status of scientific collaboration in Central Asia and how does CAREN CC support it?

AK: Researchers of NRENs in Central Asia continue to make great efforts for international collaborations in such areas as environmental monitoring, water management, telemedicine and distance learning, through which they share their experiences and gain knowledge from leading experts.

As an example, the Central-Asian Institute for Applied Geosciences partnered with the German Research Centre for Geosciences (GFZ) in Potsdam on water management and on environmental monitoring, with a focus on glaciers, that are extremely important in Central Asia and that have been melting of about 29% of their original volume for the past few years. Such collaborations and data exchanges between scientists are fundamental to tackle challenges related to climate change.

In Tajikistan instead, there are very good conditions for space and planetary observation and as such there are powerful telescopes in the region. The Institute of Astrophysics of the National Academy of Sciences of Tajikistan collaborates and shares data with many research institutes in Europe and in the US, monitoring asteroids that could fall on Earth and cause substantial damage.



Regional collaboration between archaeologists among all Central Asian countries also led to a great number of applications in the fields of e-culture and digital heritage.

AA: Another extremely important topic we cover is telemedicine. With CAREN CC we are continuing our collaboration with TEMDEC, the Telemedicine Development Centre of Asia, based in Japan.

They provide training on early detection of gastric cancer, involving both medical doctors and network engineers of hospitals, in Japan, Russia and Kyrgyzstan. Until last year – when the CAREN project was still active – we held several face-to-face conferences in which doctors came from Japan to deliver hands-on training for our doctors, but at the moment we are ensuring the sustainability of the initiative by regularly organising teleconferences. A big problem throughout all Central Asia is that there is a scarcity of good doctors, but now thanks to distance education and e-learning doctors from big cities are able to teach to doctors in provinces and save lives by spreading their knowledge.

The global Covid-19 pandemic is increasingly affecting the region. How can scientific collaboration help?

AA: The pandemics showed the weakness of the medical system in our countries: the poor healthcare management, the lack of medical doctors, the absence of necessary equipment. Sharing best practices of infected patient care, developing telemedical solutions, initiating projects to design mass ventilator systems in hospitals with a large number of patients in critical conditions would be priceless support.

AK: In the current situation e-learning became especially relevant. In fact, from September all schools and universities in Kyrgyzstan will start distance classes, using e-learning technologies and networks, and NRENs made special efforts to expand their services to the communities and provide our users with a variety of key tools and platforms.



Tell us more about the services and benefits that CAREN provides to researchers and NRENs in Central Asia. Will they still be available via CAREN CC?

AA: A decade ago, high-speed internet connectivity in Central Asia was only a dream of the researchers but CAREN projects brought not only a high-capacity network but also advanced ICT services. CAREN CC aims to become the Centre of Excellence for advanced ICT services for academia in Central Asia and does its best to keep the infrastructures and services established during the CAREN project. We continue to provide such services as eduroam, eduGAIN, e-learning and video conferencing tools and platforms, digital libraries and cloud services like the G Suite for Education.

Will the collaboration with GÉANT continue and how? What are its benefits for NRENs in Central Asia?

AB: CAREN CC has signed a Memorandum of Collaboration with GÉANT to ensure continued access to global advanced ICT services of the pan-European GÉANT network. This currently benefits the more than two million users at academic institutions represented by NRENs in Central Asia, who can exchange data and access to European R&E resources. We consider GÉANT our key partner and we look forward for our good history of collaboration to continue, hopefully also through new projects.

AK: A possible fourth CAREN project would be extremely beneficial for Central Asian countries and for their development, and together with further improvement of regional connectivity, it could help implement the strategy on EU-Asia connectivity adopted last year. I believe that our region, with its strategical geopolitical position would be key in connecting Europe and Asia, and that R&E networks would serve as a driving force for the development of bilateral partnerships.

Could you tell us more about your vision and plans for the next few years and about your hopes for the future of CAREN?

AK: We hope to enable other countries to join CAREN CC, improving the regional collaboration, to further strengthen our ties with Europe and Asia and perhaps also to have a continuation to CAREN projects.

CAREN CC will continue its mission to support Central Asian NRENs with a focus on information security, on strengthening the human capacity, and increasingly on the development of services, as we will need to compete with commercial providers. Covid-19 changed the plans of many organisations, but it also showed the importance of e-learning and proved to universities and users in Central Asia that NRENs provide unique services that commercial providers could not deliver.

AB: I agree with Askar, and I especially look forward for more countries to join the CAREN network, to represent the full picture of our region, its rich culture and history and its contribution to global research.

Picture
Toktogul Reservoir,
Talas Region,
Kyrgyz Republic.
Credits to
Robert Janz.

THE GÉANT PROJECT (GN4-3 AND GN4-3N) HIGHLIGHTS

In September, the EC-funded GN4-3/GN4-3N projects successfully completed (via VC) a three-day review by the European Commission and its panel of independent experts of Period 1 (January 1 2019 to April 30 2020). Here we present a few of the highlights from the projects, which are now in Period 2 which runs to the end of August 2021.



Words: Paul Maurice, GÉANT

GÉANT's vision is to provide users equal, high-performance network access to the research infrastructures and e-infrastructure resources across Europe.

The GÉANT projects are a fundamental element of the European e-infrastructure. Through its integrated catalogue of connectivity, collaboration and identity services, GÉANT, together with its National Research and Education Network (NREN) partners, provides users with unconstrained access to communication, computing, analysis, storage, applications and other resources, whenever and wherever needed.

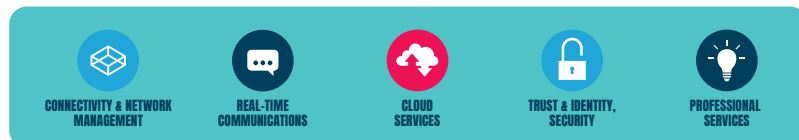
In a rapidly changing environment, GÉANT and its NREN partners are responding to the challenges posed by pandemics and the resultant global, economic and political crises by ensuring connectivity despite changing traffic profiles. GN4-3 also continues to deliver excellence in networking services, enables integrated High Performance Computing, and supports open science, which reinforces Europe as a global research hub. The data demands of the research and education community are evolving faster than ever, and GÉANT's flexible, agile and long-term approach remains vital.

Supporting the knowledge community

By interconnecting Europe's NRENs and facilitating high-speed links with other global regions, GÉANT connects schools, universities and the world's largest research projects, enabling scientific discoveries, supporting remote learning and upskilling communities.

- **Supporting NRENs in a changing landscape:** extensive requirements gathering, service outreach and proactive engagement activities to support NRENs during uncertain times, ensuring a range of services they and their users need.
- **Global collaboration and service leadership:** enhancing relationships, global connectivity and services to support international users; building network capacity and connectivity, including new 100Gbps links between Japan and Europe, and Asia and Europe, and providing a 10Gbps link with China.
- **Building the community:** the highest Community Programme attendance reported, with 36 meetings and 1900+ attendees; a virtual Community Café set up during the COVID-19 pandemic to provide additional community support.
- **Engaging with EOSC:** led multiple sessions to support NREN involvement in the European Open Science Cloud (EOSC), worked closely with EOSC Cluster projects, including: EOSC-Life, ENVRI-FAIR, FENIX, ESCAPE, SSHOC and PANOSC, to ensure GÉANT services fit user requirements.
- **Linking EuroHPC centres:** workshop organised with five, major high-performance computing centres to identify requirements and future strategies for networking needs, enabling pre- and exascale projects.
- **Closing the digital divide:** specialist support for South East Europe (SEE) in tandem with the World Bank, aimed at furthering collaboration across the region and introducing new project partners.
- **Communicating with audiences:** streamlined communications channels now include CONNECT community website, magazine and weekly newsletter; the IMPACT website showcases user communities supported by GÉANT and its NREN partners; social media raises awareness and drives traffic.
- **Outreach through events:** exhibited to the HPC community at SC19; flagship TNC19 was successfully held in Tallinn, Estonia in June 2019, and received multiple awards from the Estonian Convention Bureau (ECB) in the Conference of the Year and Smart Technical Solution categories.
- **Upskilling the community:** GÉANT's Learning and Development (GLAD) team increased number of videoconferences, online workshops and training events to support remote learning requirements; Emerging NREN Programme supported development of new NRENs; Future Talent Programme mentored selected students at TNC19; CLAW workshops successfully held, equipping NREN staff with crisis communications skills.





Optimising the network for all users

The GÉANT network continues to deliver excellent service and extremely high performance for all users, while implementing the largest network refresh of a generation to maintain and strengthen European and international high-speed networking for the research and education community.

- **Future-proofing the network:** procurement and implementation of a major, pan-European network refresh (GN4-3N) to create a more resilient infrastructure, increase network footprint, and future-proof connection speeds.
- **Decreasing the digital divide:** GN4-3N will bring dark fibre to more European regions.
- **Cost-effective:** Data Centre Interconnects (DCIs) deployed on dark fibre routes enable cost-effective IP trunk capacity upgrades to meet growing data requirements.
- **Prototyping components, modules, services, and applications:** Delivering new monitoring tools, investigating Quantum Key Distribution (QKD).
- **Pushing performance to the limit:** Low-Latency (LoLa) applications for e-health and real-time performances to support distanced analyses and learning.
- **Procurement expertise:** Dynamic Procurement System successfully set up to support large scale tendering for new routes; improved processes help to lower costs without compromising quality of service.
- **GÉANT Connection Service:** used to provision all Layer 2 circuits.

Developing services for a rapidly changing world

GÉANT's range of user-focused connectivity, collaboration and identity services remain vitally important to research, education and an evolving European e-infrastructure. Shorter and more agile development cycles ensure services continue to meet user needs in a rapidly changing environment.

- **Services of the future:** highly successful workshop on Future Service Strategy held for 70 attendees from project partners, supporting development of future services.
- **Accelerated development:** eduMEET service launch brought forward to meet rapidly growing demand for remote learning applications.
- **eduroam:** global Wi-Fi roaming service reached 1 billion international authentications in 2019, marking a 33% year-on-year increase.
- **Increased eduVPN uptake:** a valued service, providing more secure access to public and private networks, eduVPN experienced increased interest and uptake in line with remote learning growth.
- **eduTEAMS:** providing a platform to enable communities and research projects to create and manage their virtual teams and manage secure, group- and role-based access to shared resources and services, using existing federated identities.
- **Growing cloud usage:** IaaS framework services now consumed by 340 institutions, to a value of €27.6M.
- **InAcademia:** online student validation service launched, allowing growing number of merchants to validate whether a customer is a student 'or affiliated to education institute.
- **Leadership in cyber security:** many project partners took part in Cyber Security Month awareness-raising campaign; workshops organised on DDoS Mitigation and Security Operations Tools.
- **Trust & Identity Mentorship:** new initiative seeks to develop new AAI services and support talent in community.
- **Network monitoring:** new versions of the production perfSONAR and NMaaS software released.

To learn more about GN4-3/GN4-3N visit www.geant.org/geantproject



157
FTEs
500+ contributors
39 partners
42 countries



50M
users



805
attendees



500+
articles
on connect.geant.org



3.65
exabytes
TOTAL TRAFFIC VOLUME



€27.6M
value services
340 INSTITUTIONS
using the
IaaS offerings

CONNECT Interview:

Dave Heyns

Dave Heyns is the project director for OCRE (Open Clouds for Research Environments), the project set to accelerate cloud adoption in the European research community. CONNECT had a chat with him to learn about the status of the OCRE IaaS+ tender and its related open funding calls, its role in EOSC, the opportunities it offers for both researchers and service providers, and how the project will redefine cloud consumption in Europe.

Words: Interview by Leonardo Marino, GÉANT



Dave, when did you start working at GÉANT and what is your background?

I started working at GÉANT in June 2019, moving from Dimension Data (NTT Global) in the UK, which was one of the IaaS providers for GÉANT on the 2016

framework. As their group Director for Research, Education and Healthcare, I focused on driving the adoption of cloud and related services in the global research and education community, working with the likes of Internet2 in the US, AARNet in Australia, and with NRENs all over the world. Specifically, we helped NRENs connect their networks

to Cloud Points of Presence (POPs) and developed procurement frameworks so that NREN communities could easily consume cloud related services via their local network providers. I also come from a R&E tech background, as prior to that I had been the head of the solutions enterprise at the University of Cape Town for twelve years.

Tell us about OCRE, what's the aim of the project and what are its current activities?

The OCRE project has two primary ambitions:

1. Making Cloud and related digital services easily consumable by the research community in Europe.
2. Driving the adoption of these services and promoting them within the research communities, funding related initiatives and producing compelling case studies.

OCRE will provide access to commodity cloud services and at the same time seek particular solutions for Earth Observation (EO) services, providing added value to Copernicus data.

How does OCRE intend to achieve its objectives?

OCRE started in January 2019, focusing on the procurement of cloud services on behalf of the European research community and executed a cloud tender which registered an unprecedented response from the market. We gathered around 10,000 institutes across 40 countries eligible to procure cloud services under the OCRE framework. From a market perspective it's a very big opportunity.

Now we will engage in contracts with suppliers of commercial cloud services in each of the 40 participating countries, favouring suppliers that have structures in those countries that can provide the best possible support for the R&E community. This way researchers can consume services from local resellers of hyperscale platforms as well as original infrastructure providers (OIPs) best able to support their needs.

Our pan-European procurement is a framework that will run for four years, in which GÉANT will act as a Centralised Procurement Body (CPB), while institutes will be able to easily consume services by the means of a Call-Off Agreement through the local NREN, and even to make use of OCRE's support and expedited processes in case they need to run mini-competitions between suppliers in their countries.



Meanwhile, on the Earth Observation side, we are registering a Dynamic Procurement System (DPS), on which existing suppliers of EO Cloud services will register through affiliations with EARSC and ESA, the European Space Agency. This procurement system is quite different from the 4-year fixed framework, as its dynamic nature will allow suppliers to continuously register and onboard their commercialised products as they develop them, throughout the duration of the DPS. After the initial selection, through a process of evaluation and scoring, we will ask research projects themselves to describe the specific Earth Observation services that they require, and this will allow us to publish their requirements on the DPS. Basically, we will run mini competitions and procure services on behalf of the projects.

In both calls we will be reaching out to research institutes for projects where their activities and outcomes could be significantly accelerated through cloud services. Our final aim is to develop compelling case studies that the OCRE project can leave as a legacy for the broader EOSC environment, that will continue to motivate the consumption of cloud services based on their added agility and enhancement of research activities and outcomes.

What added value can cloud services – and especially commercial cloud – offer to NRENs and to the R&E community? Will OCRE impact the way research is done in Europe?

Opportunities for NRENs are substantial. OCRE provides real tangible benefits to the R&E community and significantly enhances the NRENs' relevance in terms of Cloud and Digital Services support for their local institutes.

In that OCRE is primarily focused on the research community, I will discuss cloud benefits in terms of their needs. Traditionally researchers procured physical servers through grant funding, that were then simply installed under their desk. Now however, virtual machines, virtual environments, and a whole host of cloud services have become more accessible. Commodity cloud services undoubtedly give you a lot more agility on compute capabilities and data storage services, for which today there is a high need, and that you can easily consume, pay for as they are being consumed and then - when you completed your research - simply shut down and stop paying for them. That's obviously a lot more efficient than buying

... continued on next page

OCRE

Earth Observation Services Funding for Research



a physical server and investing in the hardware, that at the end of your project will probably lie dormant.

There are many different advantages of moving towards cloud services.

Research activities often require High Performance Compute services and a researcher would previously need to get big research workloads to a HPC centre. With current network capabilities and improved bandwidth, the researcher can simply consume the compute services and compute capabilities of hyperscale cloud platforms, which are increasingly more agile and comparable in compute capacity to the traditional HPC systems.

Regarding data storage instead, one of the biggest benefits to research communities, is scalability. You will never need to buy additional storage, you can literally just scale up and consume, and then stop paying when you stop consuming these services. Moving your data into a hyperscale cloud storage would also help us tackle the “R” in the FAIR data principles, so the reusability of your research data. Certain of these solutions, cloud storage for example, come at a fractional cost and – once requested – may take 24 to 48 hours to come online.

Additionally, most cloud platforms have become more sophisticated and host marketplaces, where you can access and consume new cloud based capabilities such as platform support for advanced analytics, machine learning, algorithms that provide you insights through AI. As you see it's no longer just compute and storage.

With OCRE, research institutes don't have to run time consuming and

complex procurements and competitive tenders, instead they can easily consume services through the OCRE framework. This is a lot more significant than it sounds because these cloud services have been carefully vetted by the OCRE team: they are compliant in terms of GRPR and ISO standards, and they are connected to the GÉANT and NREN networks. CERN, in collaboration with the ARCHIVER project, provides the test suite to make sure that these services are compliant. Finally, as it was requested through the procurement, providers should waive any ingress and egress charges, so the institutes won't have to pay for all the additional bandwidth of cloud providers' networks (be they Microsoft, Google, Amazon, or European providers as CloudSigma or TI Sparkle).

There is also plenty of country-specific support and training materials on the use of those cloud platforms. In fact, some of our funding will allow for consulting from cloud companies, to help you get going. The NRENs will also be able to develop the relationship between the market, the supplier and the researchers and to host training and webinars for suppliers, to broker many of those facilities and drive their own relevance in terms of above the net services.

We are excited on the NRENs' behalf, as we have seen through the 2016 GÉANT framework that when NRENs strategically commit resources and effort to supporting cloud activities, cloud consumption scales up dramatically (e.g. in the Netherlands, where it has doubled annually since the framework has been in place).

OCRE is also part of the larger European Open Science Cloud initiative. How does OCRE fit into the complex EOSC ecosystem?

OCRE gives a new meaning to the word Cloud in EOSC. The project is part of the very diverse EOSC landscape, however EOSC has not yet really considered where commercial services fit within its context. This will need to be defined by the Rules of Participation Working Group that I recently joined, because the research community is very interested in the agility and flexibility that commercial services provide.

Commercial solutions are evolving at a very rapid rate. Every time you pick up your cell phone there is a new app, that does the same old thing in a much better way, and it's far easier to use. That is the nature of commercial services: it's a very robust and agile market that keeps investing in development and innovation and that's why I believe large e-infrastructures will need to coexist with commercial services, or cease to exist at all.

EOSC is still quite conceptual. What OCRE offers are real tangible solutions to many of the EOSC questions and requirements, to be delivered in short term, with ready to use and consumable commercial services available by the end of 2020.

As a starting point, OCRE signed a MoU with EOSC-hub and we are now looking at how we will make our services available and list them on the EOSC Portal Marketplace. Specifically, we are discussing how to make space for commercial services on a marketplace that is currently focused on services that EOSC provides through its own e-infrastructures. The position of the RoP Working Group is to consider services being free at Point of Demand, but based on the fact that a lot of research is done on grant funding, I am not sure that this would be the only way... I actually think that the research community should be able to procure all the available services and do it through EOSC. I'm sure we will be challenging some of the dominant ideologies in the next six months.

Specifically, how does the OCRE laaS+ framework agreement expand and update the GÉANT laaS Framework agreement? And how will OCRE influence GÉANT's activities in the field of cloud services?

This is a very interesting question because it does speak to my actual day job. A really important point - that has generated some confusion - is that all the contracts in the 2016 GÉANT laaS framework will come to an end in December 2020. As a convenient consequence of the timing of the OCRE project, the laaS+ contracts made available through the OCRE framework will seamlessly support any new laaS consumption, effectively providing for a continuation of the previous framework. Contracts supporting consumption that is already taking place under the GÉANT framework will continue to run their course. All of the entities that were eligible to procure off the GÉANT framework remain eligible to procure via the OCRE frameworks.

(More information on this question is available at [CONNECT online](#).)

The next few months will be quite busy for OCRE, what should we particularly keep an eye on?

Keep an eye open for the suppliers that will get awarded and will start appearing on NREN Cloud Catalogues and in the GÉANT Cloud Catalogue. It will be quite interesting to see who supplies which service in each country. Similarly, when we launch the Dynamic Procurement System (DPS), we will also see which suppliers of Earth Observation Services will be among early registrants.

Our first funding call for Cloud services was just launched on 15 September and it will remain open for six weeks, closing at the end of October. The research community was expecting it: more than 70 institutes have already registered their interest and we predict that number to increase dramatically now

that the call is open. The funding team will identify projects that we think make for great case studies, have a "coolness factor", are covering a significant research discipline (e.g. research on COVID), and that demonstrate how digital services have accelerated their activities and improved their outcomes. Once we have selected the projects, the OCRE External Advisory Board (EAB) – a body made by representatives of the broader research community - will ensure transparency by validating our decision.

Then, the first funding call for EO Services was launched on 14 October, after the registration of the DPS. This call provides a great opportunity for scientists that use Earth Observation data. What is really interesting, is that we are not just talking about EO Sciences but about any science or discipline that consumes EO data (e.g. all the sciences that focus on planning, environment, travel, and so on). There is so much information coming down from satellites, and we want to make it available for researchers.

To conclude, how do you imagine the future of cloud in European and global R&E?

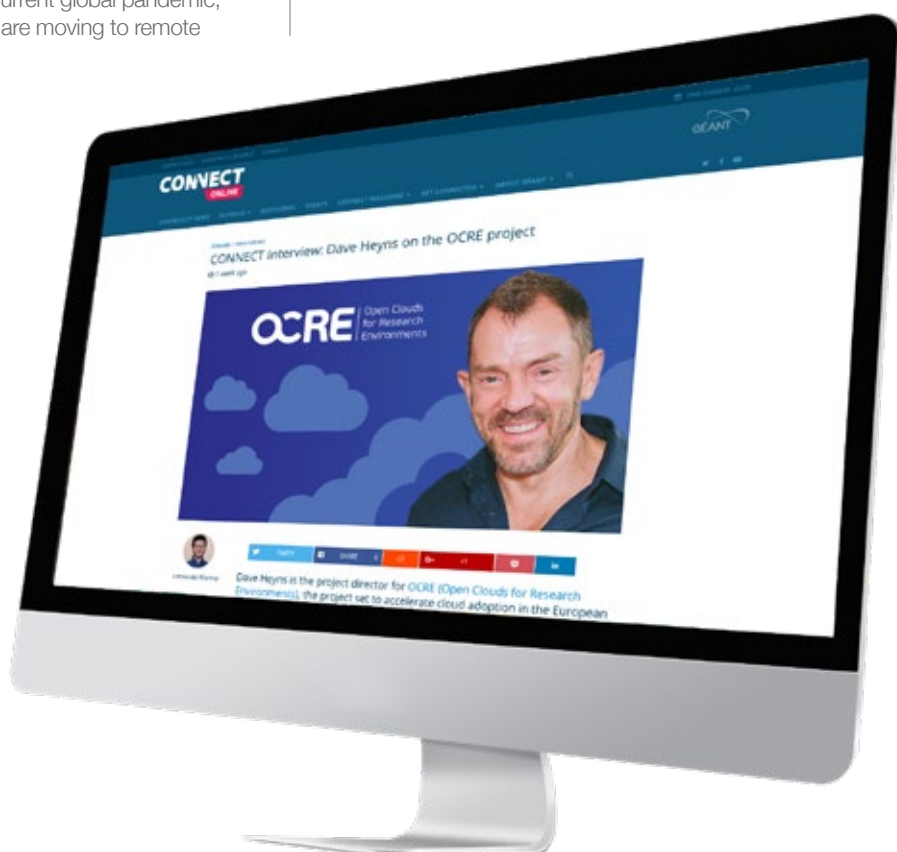
These days no research can really take place without creating data and requiring a certain level of computation. During the current global pandemic, researchers are moving to remote

working and becoming heavily dependent on cloud services to do that. In fact, all the online services that allowed this shift are cloud-based by definition: video conferencing itself is a cloud service!

Cloud services allow global collaboration, and that is fundamental in the field of research. I am sure that European researchers will consume more and more commodity commercial cloud services and increasingly rely on bespoke cloud services focused on their specific realm and on platforms that allow computations and advanced analytics and that support the use of machine learning, robotics, artificial intelligence – to name a few.

I would really like OCRE to become central to the short-term strategies regarding above the net services of both GÉANT and the NRENs, for which it provides huge opportunities, and to become the bridge to bring both the researchers and the NRENs closer to EOSC. It's a very exciting project to be working on.

You can read more from the interview at [CONNECT online](#)



eduGAIN welcomes CSTCloud to the eduGAIN Family

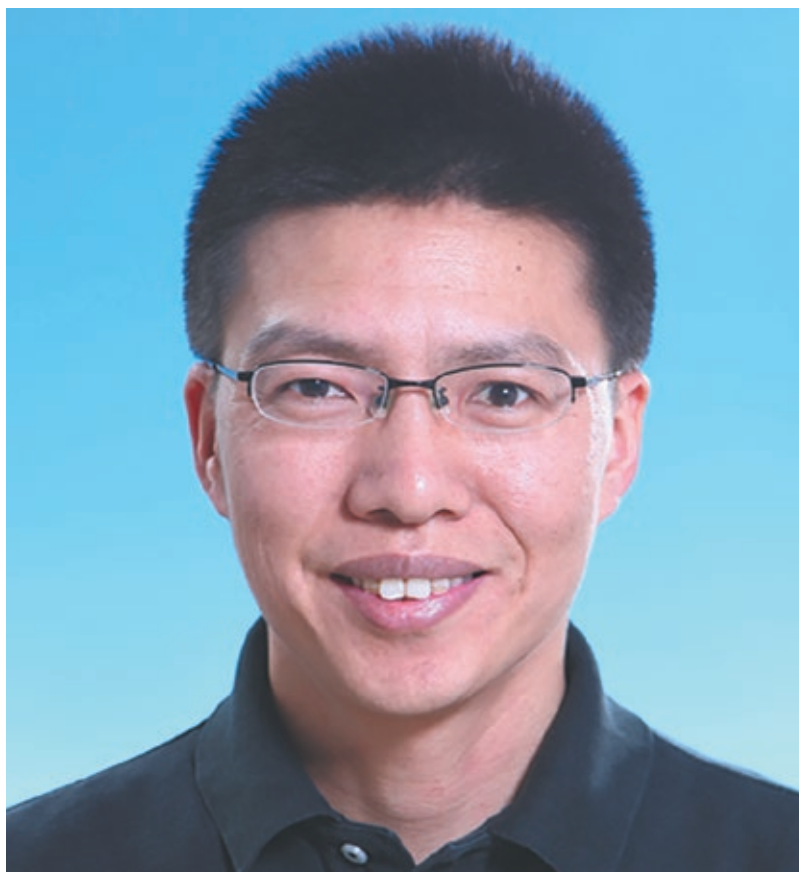
Rooted in the advanced cyberinfrastructure and digital information of the Chinese Academy of Sciences, China Science and Technology Cloud (CSTCloud) is a national platform to provide scientists with efficient and integrated cloud solutions in the retrieval, access, use, transaction, delivery and other aspects of sharing scientific information and relevant services. As big data, cloud computing and artificial intelligence are now the three chariots driving cutting-edge information technology worldwide, CSTCloud combines all three fields into a single, massive platform which will provide strong data and cloud computing services to support scientific innovation and socioeconomic development.

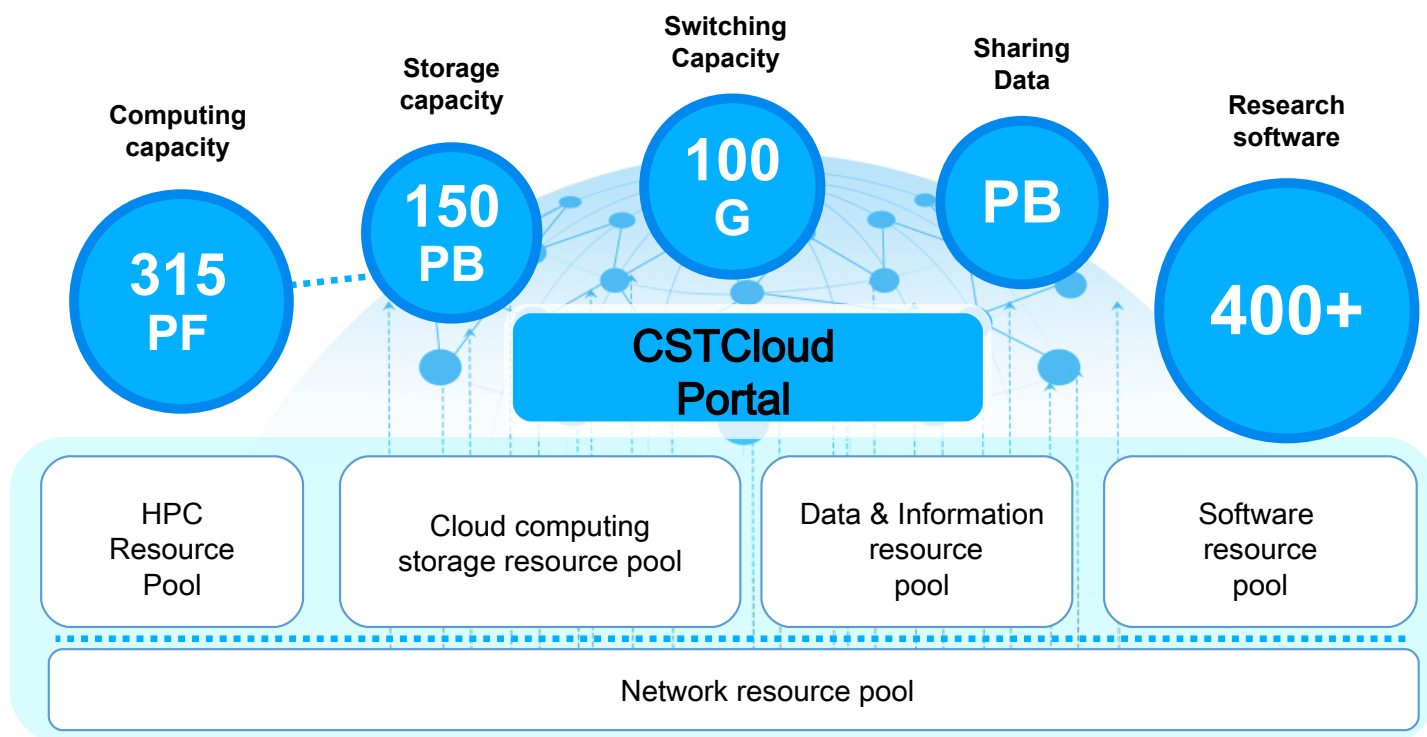
Words: Karl Meyer, GÉANT

This platform connects all the institutes in China Academy of Sciences (CAS), many national research institutes, scientific data centers and more than 80% of national research infrastructures. It also supports over 100,000 researchers across China in a wide range of fields of study. CSTCloud can provide efficient and integrated cloud computing solutions to support the storage, transmission, computing, analysis, and application of scientific data towards new discoveries.

CSTCloud was announced by CAS during the Fourth World Internet Conference in December 2017. Achievements include one-stop and tailored services for scientists, advanced demonstrations driven by key research initiatives and SDGs, technology development and multilateral collaboration for interconnection and interoperability.

After a prototype portal in April 2018, the improved 2.0 version was released at the end of 2019 which supports 409 software programs running online, classified into nine service categories and 52 tailored platforms with the total computing capacity and cloud storage reaching over 315 PetaFlops and 150





PetaBytes respectively. To support these services on top, CSTCloud has initially realized the integration and cloudification of high-speed research networks, massive data storage, large-scale computational analysis, scientific data, software resources and other information, etc. Mechanisms and technical systems for open source and service convergence have been established to support resource registration, management, dynamic release, and federated services.

Transformative technologies to support the network and cloud have been developed such as high-speed virtual private networks for scientific research and transmission acceleration, unified scheduling and sharing of heterogeneous computing resources, distributed data storage, and unified authentication and authorization across multiple resources. The core network switching capacity has reached 100G, with 121G of domestic Internet bandwidth and 113G international Internet bandwidth.

eduGAIN – the path to international collaboration

CSTCloud is extremely active in a range of advanced research projects from fusion energy research with ITER and particle physics with LHCONE to radio telescope observations with the Five-hundred-meter Aperture Spherical radio Telescope (FAST)

These huge global projects require CST researchers to access data and systems worldwide and for access to the CSTCloud systems to be enabled for distributed research teams.

These requirements for easy-to-use, secure and open access resulted in the work to incorporate CSTCloud into the eduGAIN inter federation service. CSTCloud now joins 68 other federations worldwide supporting millions of users and helping support international collaborations to speed up research worldwide.

“Becoming the member of eduGAIN, will help facilitate better flow of research resources between China and her partners around the globe and guarantee the consolidated foundation for the connectivity between CSTCloud and other research e-infrastructures in the world.”

Gaogang Xie, Deputy Director General of CNIC (CNIC is responsible for the operation and management of CSTCloud). Pictured left.

CSTCloud – Supporting COVID-19 research collaborations

To address urgent challenges brought by the pandemic, CSTCloud worked with CAS Shanghai Institute of Materia Medica to develop the antiviral drug screening platform, with self-developed parallel distribution module of the high-performance computing application middleware to overcome bottlenecks such as unbalanced computing task load and low distribution efficiency. The platform completed a virtual drug screening and evaluation task in five days, selecting 30 candidate components from around 70,000 compounds.

Extensive supercomputing resources have been allocated to support key COVID-19 research teams at CAS Institute of Microbiology in various areas such as virus genomes, metatranscriptomes, metagenomics splicing, pandemic spreading dynamics simulation and sequence data mining. CSTCloud also established a mirror site for COVID-19 data visualization in partnership with Peking University.

For more information about CSTCLOUD visit:
<http://cstcloud.net/>

For more information about eduGAIN visit:
<https://edugain.org>

eduVPN



— providing secure, privacy-enhancing remote access to research and education

With the growth of working from home and distance learning, the need for secure access to institutional services is increasing across the community. Commercial VPN services providing remote access are expensive and don't necessarily scale to the thousands or tens of thousands of users required in a university setting. Therefore GÉANT, together with support from RIPE NCC, the NLnet Foundation and the Vietsch Foundation have developed eduVPN.

Words: Tangui Coulouarn, DeIC

eduVPN is about accessing your institute's network or the Internet using an encrypted connection. eduVPN aims to replace the traditional closed source VPN concentrators by an open-source audited alternative which integrates smoothly with your federated identity environment.

The number of eduVPN instances grew considerably during the COVID-19 pandemic as people were sent home and had to access resources at their university remotely. Many universities were confronted with license, software and hardware limitations of their existing VPN solution. Some bought extra licenses, other turned to eduVPN. New instances of eduVPN used as corporate VPNs were deployed in Cyprus, France, Indonesia, Kenya, Malaysia, New Zealand, Norway, Portugal, Uganda. These added to the existing deployments in Finland, Germany, the Netherlands, Pakistan, Poland, South Africa. As the software is fully open source and freely accessible, the eduVPN team often becomes aware of new deployments only when organisations ask to be added to the applications.

eduVPN Success Stories

Marco Teixeira from the University of Minho in Portugal explains:

"Amid the COVID-19 first-wave pandemic, and the increasing necessity of teleworking that derived from the confinement period, the Information and Communications Systems Services Unit of University of Minho, was tasked with the development of a contingency plan in several areas, regarding this new scenario. Remote Access service (VPN) was one of the areas for which there was the need to increase the service capacity to support an exponential growth in remote workforce. After some research, we preselected the eduVPN, a community project supported by GÉANT. This community project has the features that meet our requirements and is based on well-known and tested open source technologies. After a brief assessment we decided to adopt it. The main points in favor are: i) the absence of licensing and financial costs; ii) simplicity of use for our end-users especially those with mobile clients; iii) has applications for all the major platforms; iv) an architecture capable of horizontal scalability that allowed us to repurpose some servers for the project."

Another example of a new deployment is CNOUS in France. CNOUS manages services for the 2.6 million students in France (for example by allocating grants, managing student restaurants, dormitories). It consists of 27 entities (the national CNOUS and 26 regional CROUS) at different locations in France. As the COVID crisis started, CNOUS heard about eduVPN from RENATER. It got their interest as the VPN solutions in use at CNOUS could not scale up to the potential 15,000 users. In less than two weeks, they put in production a full eduVPN solution covering all 27 organisations. CNOUS also developed a specific web interface which allows the IT department at each CROUS to monitor their own users (number of concurrent connections, list of current users, throughput, etc.). They configured different profiles for eduVPN. The "generic" profile offers an encrypted solution between the client device and the central infrastructure of CNOUS for users authorised by their regional organisation (using SAML). End-users can then have access to the intranet of CNOUS. But they also created specific profiles where a regional organisation can choose to customise which servers an end-user has access to, routing,



private and public IP ranges. There are typically several hundred simultaneous connections on the eduVPN server at CNOUS, which is relatively light (4 cVPUs, 8 GB memory). But how does eduVPN scale for larger organisations?

This increase in the number of deployments was particularly significant in countries where the NREs communicated about eduVPN to their member institutions and created guides to explain how to deploy eduVPN and how the NREN is willing to support institutions deploying the service (support, documentation...). In France for example, with the support of RENATER, universities were able to configure their newly deployed instances of eduVPN so that they could use SAML and become SPs in their federation. RENATER advertised for the service on its website, through Twitter and mailing lists, produced some guides both for operators and end-users in French. As a result, today there are at least 8 universities using eduVPN and others working on it in France while there weren't any before the COVID19 crisis.

Flexible Delivery Models

In the Netherlands, eduVPN is offered as a managed cloud service. This means the eduVPN servers are maintained by SURF. Melvin Koelewijn (Technical Product Manager SURF) is responsible for the Dutch eduVPN servers. When asked about his experience with eduVPN server scaling aspects he says:

"Our largest university handles 750 concurrent users effectively with a 2 CPU cores. Based on this I expect a 16 CPU core VM would be capable of handling up to 5k concurrent users. The eduVPN software also supports multi server scaling and we are now deploying an eduVPN cluster with 4 VMs in order to handle 10k+ concurrent users."

Most institutions start with a single server, but it is also possible to deploy multiple servers with OpenVPN processes in order to allow for a higher number of concurrent users or distribute over different locations. Typically, a server (with 16 cores and ≥ 10 Gbit) can allow up to 1,000 clients to connect (depending on Firewall and Connectivity capacity).

eduVPN Key Features

- **Fully open source, both server and clients.**
- **Integrates natively with many types of identity management systems, e.g. SAML, LDAP, RADIUS, X.509 Certificates.**
- **Scales up indefinitely[*].**
- **No (per seat) licensing fees.**
- **Secure and modern cryptography out of the box.**
- **Easy to install on modest (cloud) servers.**
- **Supported by the NREN community.**

To find out more about eduVPN visit
<https://www.edupvn.org/>



RENU Deploys 300 eduroam Hotspots For Off-Campus Internet Access

Students, researchers and staff of learning institutions connected to the Research and Education Network for Uganda (RENU) will now be able to access their institution Internet beyond their campuses after the NREN introduced the metro deployment of eduroam to enable users to connect to the wireless network while working away from their institutions.

Words: Hastings Ndebvu, UbuntuNet Alliance

eduroam is a secure wireless international roaming internet network which enables staff, researchers and students from higher education institutions to access internet connectivity when visiting another institution using credentials provided by their own institutions.

RENU unveiled the innovation on 1 September after deploying eduroam in over 300 spots in Kampala, Mukono and Entebbe to connect students, researchers and university staff that have challenges accessing the campus Wi-Fi due to the COVID-19 restrictions.

Under the initiative, the RENU IT team is helping institutions connected to the RENU network to deploy the secure, wireless network, allowing staff, students and researchers from such institutions to use their devices to connect to the campus network while off-campus.

"Before the deployment, staff, students and researchers could access eduroam only when they were working within the premises of their institution. Now they can access eduroam within the comfort of their residences, malls, restaurants, parks, streets, airports, etc," reads a statement released by RENU.

RENU Communications Officer Caroline Tuhwezeine Kumwesiga says the innovation is one of the measures the NREN came up with to help member institutions cope with the COVID-19 pandemic.

"The world-wide outbreak of COVID-19 has challenged RENU to be innovative and offer alternatives to the education and research communities. Prior to introducing this off-campus eduroam, RENU removed caps on its international traffic to support the research agenda to fight the COVID-19 spread, increased its web conferencing packages to support social distancing and introduced a cloud-based e-learning solution based on Moodle for remote learning and instruction. The NREN continues to cast its net wider for more solutions to enable the education and research community to keep on its feet in the current times," adds Kumwesiga.

Universities in Uganda have remained closed since March 2020 following a presidential decree aimed at curbing the spread of the COVID-19 pandemic in the East African country.

Following the decree, staff, students and researchers that relied on campus networks have been unable to access affordable internet connectivity due to high cost of data bundles from commercial Internet Service Providers.

The metro deployment of eduroam in Uganda, therefore comes as a relief to the users who will still be able to access high speed, secure, dedicated and affordable internet connectivity during the COVID-19 pandemic.

The solution will also go a long way to help students to effectively participate in online study which seems to be the most viable option for many learning institutions if they are to pursue their programs while keeping their students and staff safe from the COVID-19 pandemic.

To read more about metro eduroam, visit RENU website at <https://renu.ac.ug/>

Italy in the race for the Einstein Telescope

Italy has formalised the proposal to build the Einstein Telescope (ET) in Sardinia, the third generation pioneering observatory for gravitational waves that will considerably contribute to improve our knowledge of the universe.

Words: Maddalena Vario, GARR

The candidacy involves the main national institutions in the field of research such as the National Institute of Nuclear Physics (Infn, coordinator of the project together with the Dutch Nikhef, National Institute of Subatomic Physics), the National Institute of Astrophysics (Inaf) and the National Institute of Geophysics and Volcanology (Ingv). The Region of Sardinia, as well as the universities of Sassari and Cagliari have expressed their strong motivation to install this innovative infrastructure.

Sardinia has a site with exceptional technical characteristics and the construction of the Sar-Grav underground laboratory in Lula, hosting the INFN-funded Archimedes experiment, is a demonstration of this. Sardinia also hosts the Sardinia Radio Telescope, one of the largest and most advanced European radio telescopes. Thanks to its presence,

the region is playing a leading role in astrophysics and space research. A recent agreement with NASA and is showing the territory's ability to host a large research infrastructure. In this context, the financing from the region of €1 million to the GARR network, which already connects the Sardinia Radio Telescope with fibre, represents the first step to bring connectivity to the Sar-Grav laboratory. Other interventions will follow to extend the GARR fibre infrastructure to all the actors involved with the support of the Region. The goal is to provide a high-speed connection between Sardinia and the international scientific community and to ensure that the data collected by ET can travel in real-time to the most important international computing centres through the pan-European network GÉANT.

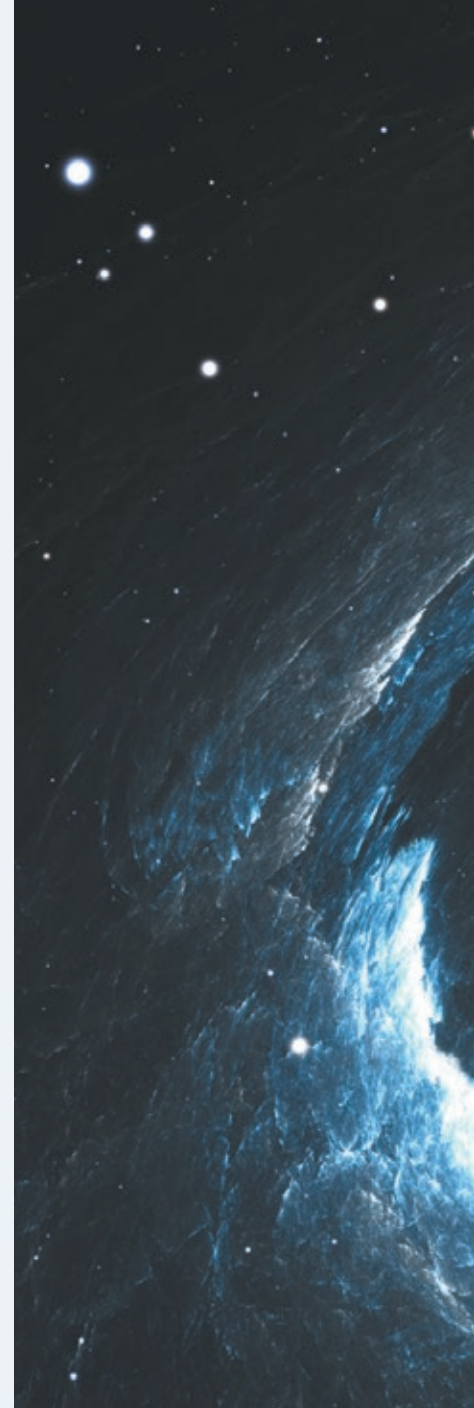
The 40-year experience of Italy in the study of gravitational waves

Pictures
Top right:
Neutron star

Bottom right:
representation
of European
Einstein
Telescope

developed within the Infn, also supports the candidacy. The Italian school has its roots in Edoardo Amaldi, a pupil of Enrico Fermi, one of the founding fathers of CERN, of which he was the first General Director. Italy also was the birthplace of the fathers of scientific research in this sector, Adalberto Giazotto and Fulvio Ricci, and it hosts a world-renowned school on gravitational waves at the Gran Sasso Science Institute (GSSI).

The international coordinator of the project for the realisation of ET is Michele Punturo of INFN and many other Italian researchers have made an exceptional contribution to multi-messenger astronomy: among these, Professor Eugenio Cocchia, rector of the GSSI and the researcher Marica Branchesi, recognised among the top ten scientists in 2018 according to the journal Nature. Not to mention the important results

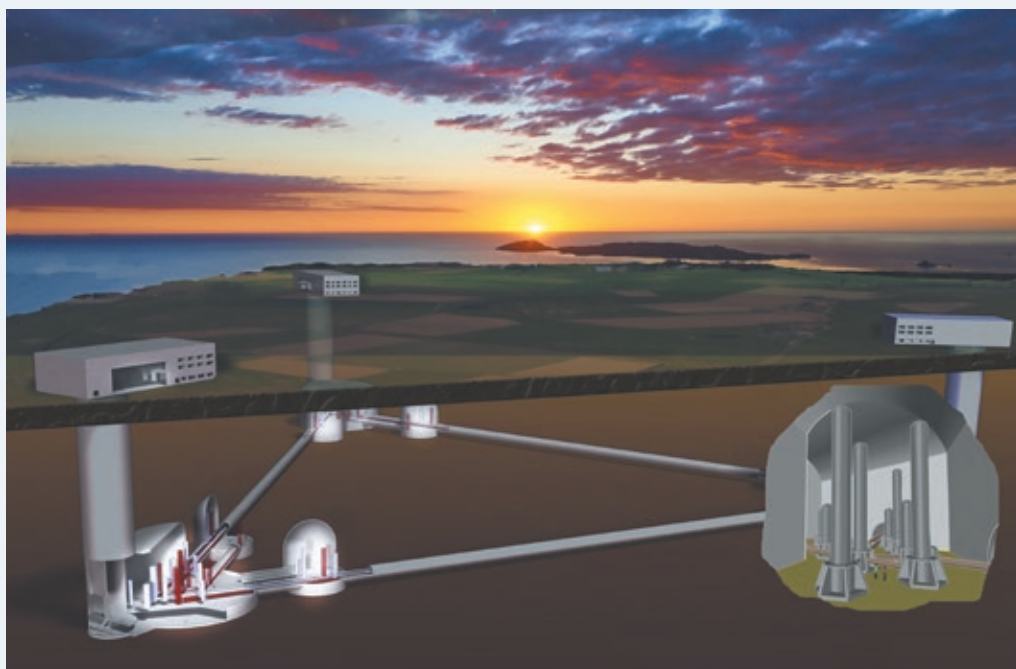




achieved by the Virgo experiment, funded by the National Institute of Nuclear Physics, which opened the doors to multi-message astronomy and revolutionised our understanding of the universe.

The Italian candidacy will compete with another European site, the Euregio Meuse-Reno, on the borders of Belgium, Germany and the Netherlands. The decision on the future location of the Einstein Telescope will be made within the next five years. Beyond the scientific prestige, the success of the Italian candidacy would transform Sardinia into one of the world capitals of astronomy, with important benefits not only at scientific level but also for infrastructural and related industries.

For further information:
<http://www.et-gw.eu/>





SURF develops e-modules on internet dangers for students and staff



How do you make students and staff aware of online risks?

How do you make students and staff aware of online risks? “Institutions in the Netherlands were looking for a way to achieve a basic level of knowledge among students and staff, and to significantly raise awareness,” says Albert Hankel, Product Manager Security & Privacy at SURF. “That’s why we developed two sets of e-modules, called the security and privacy license, for students and employees on how to deal safely with security and privacy.”

Words: Marieke Linn, SURF



Pictures

Left: Photo by Wes Hicks, Unsplash

Right: Albert Hankel, SURF

This article was also published in SURFmagazine - SURF's corporate magazine

Awareness essential

"More and more institutions are realising that awareness among staff and students plays an important role in cyber security," says Hankel. "In addition to having technology and policy in order, people must have knowledge of online risks. That way, they can support a safe online environment."

Part of curriculum

The idea of a digital certificate, the e-modules, was born at the end of 2018 at a conference on cyber security. Hankel: "Institutions expressed the need to educate (new) students and staff on keeping themselves and their organisation cyber secure. They wanted to be able to test this and to give cyber security more weight". For example, by making the lessons part of the curriculum via the learning management system and letting students receive one study credit for following the e-module. Or institutions can stipulate that employees must obtain this certificate before they are allowed to start work. Hankel: "It's possible, but it doesn't have to be. Institutions can make it as important as they want."

Films and multiple choice

The e-modules contain topics that students or employees encounter in the field of security and privacy at their institution. For example, a movie about phishing: a student receives an e-mail that seems to come from his institution, asking him to update his password with a handy link directly in the mail, so he can easily change the password. The message is that they should not just click on a link, even if the e-mail seems to come from a reliable sender. The e-modules consist of theory and practical examples in the form of text, image, film and multiple-choice questions.

Next step: in-depth modules

The ambition is also to develop in-depth modules. "Think of extra modules specifically for HR or for students working on their graduation research", Hankel explains. "We are also looking at additional working methods so that lecturers can integrate (parts of) the e-modules into their lessons, such as a workshop or work lecture."

Available free of charge

The e-modules can be downloaded free of charge, in Dutch and in English, as part of Cybersave Yourself, the SURF campaign through which institutions increase staff and student awareness of security and privacy. Cybersave Yourself consists of a website and an online toolkit with ready-made materials that institutions can use, such as various means of communications and a game.

More information

cybersaveyourself.nl

Cybersave Yourself e-modules:
<https://edu.nl/webmh>



Environmental education project in Portugal receives support from FCCN

The Portuguese NREN offers technological support to an environmental education project to raise environmental protection awareness and help create a more sustainable future.

Words: Ana Afonso, FCCN and Fábio Rodrigues

FCT Fundação
para a Ciência
e a Tecnologia

**Computação Científica Nacional
FCCN**

Videocast is a live broadcast service that the Fundação para a Ciência e a Tecnologia (FCT), provides through their FCCN unit – the Portuguese National Research and Education Network (NREN). Videocast allows the transmission of live events to the whole world, via the internet. FCCN provides a customisable web page where video and audio streams, from a specific event, are displayed. Whether the event is a class, an internal TV channel or life inside a seabird's nest, it is possible via this service, without invasive advertising or commercial breaks interrupting the stream.

Nuno Oliveira, a marine conservation biologist at SPEA – 'Sociedade Portuguesa para o Estudo das Aves' (Portuguese Society for the Study of Birds) describes the role that Videocast played in the project "Shearwaters in the Berlengas Island | Nature on the Web". The initiative seeks to "promote environmental education and awareness" through the uninterrupted live transmission from a nest of shearwaters.

How did the possibility to use the Videocast service arise for the project "Shearwaters in Berlengas | Nature on the Web"? And what can you tell us about this initiative?

The opportunity arose as an invitation from FCCN in 2019, when the revitalisation of the "Nature on the Web" programme was planned. The "Shearwaters in the Berlengas Island | Nature on the Web" is part of a set of activities developed by SPEA to promote education and environmental awareness - one of the pillars of our mission. As we see it, a well-informed citizen will more likely understand the importance of preserving our natural values.



What are the main advantages offered by this initiative to the general public?

The main goal of this initiative is to show people something that previously would not be normally accessible: life inside a seabird's nest, the shearwaters. Thus, with minimum disturbance, people can visit the nest and monitor the growth of the chicks or their feeding by the adult birds. Seabirds, despite being one of the most threatened groups of birds globally, are also the least known.

What Videocast features were ideal for integration into the project? And how do you evaluate the experience so far?

Including "Shearwaters in Berlengas" in a more comprehensive initiative and in partnership with other entities contributes to increase the potential for showing what is happening in these birds' little nests. On the other hand, maintenance costs for this system, although low, are a significant burden for a non-profit organisation without self-financing, as SPEA. For this reason, FCCN's support was vital for the long term life of this project, as it allowed for the cost reduction associated with the streaming service. This way, we can guarantee access to images on the web to a virtually unlimited number of users. The support of FCCN technicians has also been fundamental and has allowed this 'boat to reach the harbour'.

Are there any other similar projects planned?

The success of "Shearwaters in Berlengas" and the encouraging support by the public, has led us to adopt this type of tool for other projects. We are currently preparing the installation of two similar systems for recent initiatives that we are developing in Ria Formosa Natural Park - Life Ilhas Barreira in Algarve. One of the cameras will be broadcasting the activity of a colony of Audouin gulls, while the other will be placed in a colony of chirps hopefully in early spring next year.

Are there any other SPEA initiatives that you would like to disclose?

The first is an initiative led by BirdLife International (of which SPEA is a partner) that calls for the United Nations to declare a healthy natural environment as a fundamental human right, through a petition available at:

<https://www.spea.pt/campanhas/ambiente-saudavel-um-direito-humano/>.

The second follows the "Life Berlengas" project, which, after its successful completion, was selected as one of the 8 final projects for the Natura2000 European Prize. Voting is open and can be carried out at: <https://www.spea.pt/life-berlengas-entre-finalistas-do-premio-europeu-natura-2000/>



How do you foresee the evolution of the relationship between SPEA and Videocast?

Videocast is a tool that has come to stay at SPEA and has an enormous potential that we intend to continue exploring. In this sense, Videocast and FCCN represent essential support that we cherish and hope to keep. We think that the potential of these tools goes far beyond promotion. In the future, it could be used for remote monitoring systems in places with difficult access, for example. When working in small islands and islets, Videocast systems could revolutionise the way we study, monitor, and protect our planet's natural values.

And how do you evaluate the possibility of integrating other FCCN services?

We would like to look into other FCCN services to maximise the dissemination of SPEA's mission. Last year, during my visit at their studios, I thought that some of their spectacular equipment could be used for the documentaries we are planning for so many of our projects and initiatives. On the other hand, in the current reality affected by the corona virus pandemic, we could certainly explore the use of Colibri, FCCN's remote meeting services.

Pictures

Left: Nuno Oliveira at Berlenga Island – photo rights belong to SPEA

Middle: Shearwater and its baby in the nest - by Miguel Lecoq

Right: Artificial nest with shearwater incubating an egg - by Nuno Oliveira

Live link to the nest
https://videocast.fccn.pt/live/fccn/nnw_cagarra_berlengas



Emerging trends in cloud for advanced research computing

Research computing has come a long way from the mainframes of the 1960s. At the recent Practice and Experience in Advanced Research Computing (PEARC) conference, I noted four emerging themes that underscore how the field continues to evolve:

Words: Tara Madhyastha, Ph.D.



AI and ML continue to expand in application

Artificial intelligence (AI) and machine learning (ML) continue to expand in their application to advance research. Besides basic research in methods, machine learning is being used in applications ranging from digital pathology to exploring collections of research papers using steerable AI.

Cloud technology is a natural fit for AI and ML, both in terms of supporting the computational demands of training, and in collecting, storing, and sharing data at scale. At a booth presentation at PEARC, AWS demonstrated how researchers can use Amazon SageMaker, AWS Lake Formation, and AWS Glue to extract information from data stored in Amazon Simple Storage Service (Amazon S3), build a metadata store, query this data, and then analyze results using advanced AI and ML frameworks in a Jupyter notebook environment. If you missed the demo, you can read about the approach in the AWS Machine Learning Blog.

The cloud offers an opportunity for workforce development

The cloud is an opportunity to grow skills in the research computing workforce. New curricula and internship programs are available to train research computing professionals and address major gaps in existing training (such as reproducibility and project management). As scientific fields evolve to take advantage of modern computational resources, researchers need more support in how to use computers for research. This is an opportunity to teach technical skills to students with an interest in science. As a professor, I made it a point to engage undergraduates in my research, often through National Science Foundation (NSF) supplements to support research experiences for undergraduates.

But research computing is just one facet of the technological skills that organizations around the world need to develop. At AWS, we address this at scale through initiatives such as AWS Educate, which provides students and educators access to self-paced training, collaboration tools, and hands-on learning pathways for careers in areas such as ML, data science, application development, and cloud architecture..

Building tools for research: Gateways, workbenches, and workflows

Research computing experts can build things that enable research discoveries and outcomes. Many papers center on science gateways, workbenches, and workflow managers. Workflow managers are software products that allow researchers to express and execute complex parallel pipelines that might take advantage of HPC resources. Workbenches are environments that provide a simpler development environment to workflow managers. Science gateways are web-based resources for accessing data, software services, and computation. These represent different levels and approaches for allowing researchers to access and process data more effectively, advancing and accelerating science.

AWS presented a tutorial on “Best practices for research HPC in the cloud,” emphasizing how cloud technologies which were developed primarily to

support commercial applications have evolved to provide technical capabilities for high performance computing (HPC), while maintaining reliability, availability, and durability. HPC clusters can grow and shrink, and use of containers and NextFlow can make it possible to execute tightly coupled and loosely coupled workflows efficiently on the cloud, demonstrating the building blocks of research computing gateways on AWS. Check out our tutorial.

Beyond science: HPC for humanities

Many speak of the crisis in humanities at universities, where students turn away from majors such as art history or literature to majors that are the fastest growing in the job market. But science gateways have moved beyond science—bringing the growing job market to the humanities.

The SnowVision gateway is a pioneering application of HPC to humanities. Archaeologists recognized long ago that the designs on fragments of Native American pottery from the southeastern United States could be used to track populations and evolution of artistic designs, but this pattern matching was done by humans, and was slow and laborious. SnowVision uses advanced computer vision, accelerated by HPC, to automate this process, allowing researchers to upload a shard of pottery and match its design right away.

We also saw ML take an art history twist: a paper by Paul Rodriguez and colleagues described the potential application of deep learning to group historical paintings, opening up interesting questions about what is possible if models could be trained on features that trained art historians can see.

Data and analytics have the power to impact every field, and this power can be realized as more digital collections are created (such as Oxford University's Global Heritage Collections), using AWS to reduce the costs of digitization.

Learn more about research and technical computing on <https://aws.amazon.com/education/> or contact us with your questions.

Research networks in 2020

Research and Education networks demand performance, sometimes on the edge of what is commercially practical. Yet collaboration with the research networking community has long driven technology from an idea through lab testing to deployments, often first in R&E networks and later in service provider and enterprise networks. Nokia has long been amidst these technology evolutions, from invention of the laser through today's coherent optical processors maximizing fiber capacity very close to the Shannon limit. These innovations enable institutions to collaborate freely, supporting massive file transfers, high capacity computing, remote learning and research.

Words: Chris Janson, Product Marketing Manager, Nokia

2020: A year unlike any other

Today, current events are pushing research networks in ways not seen in the past and outside the realm of technical development. For example, the Covid-19 pandemic forced institutions to adopt remote research to an extent not seen in the past while teaching became nearly 100% remote almost overnight. This didn't just change total capacity needs on the network, it shifted where capacity was needed to reach people working or learning from their homes. It was hyper-flexibility forced by a crisis. Research networks, much like commercial networks largely were up to the task, adapting well to the shifts and keeping the wheels of research and education in motion.

Concurrently, though not a result of crisis, pressure continues to mount on

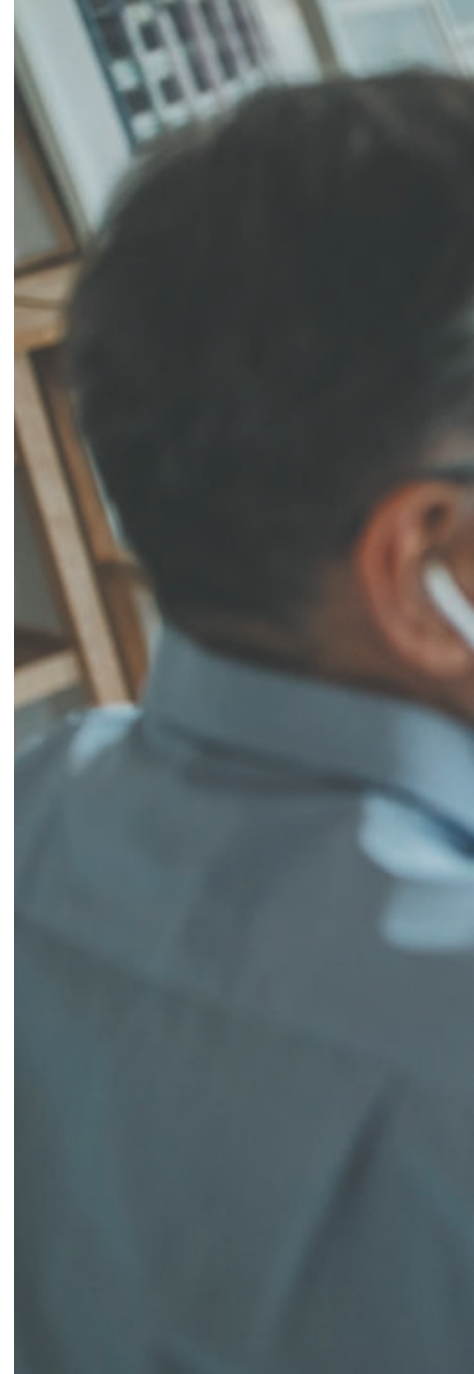
keeping network data secure from theft. The number of data breaches continues to grow at an alarming level. The Breach Level Index (**published by Thales**) reported that in 2018, there were an average of 214 data breaches every second, every day. Research networks are not immune to this threat and need to ensure data is protected through a set of protections, including physical network layer encryption.

At the same time, all these needs must be met in the face of a hard reality: money is not unlimited. Cost constraints are felt by the institutions responsible for research networks and budgets which were already strained now may be further stressed by budget cuts due to global recession and geo-political factors. Technology maturity and industry standardization can help with this, enabling research networks to remain on the cutting edge without extreme expense.

Solutions

Constructing this hyper-flexible network requires a consumable NREN, meaning a robust optical foundation upon which rides an IP routing structure, supported through OpenFlow™ software that allows institutions to easily configure and use precisely which network resources are needed. This solution includes elements of Nokia's optical networking portfolio such as super-coherent Photonic Service Engine (PSE) processors and advanced IP routing embodied in our FP4 silicon, controlled through our NSP software. Detail on how these solutions work together can be found in this **application note**.

These network solutions, including Nokia's optical transport platform can transform your research network into a consumable resource at reasonable cost. Recently, Nokia was approved





under a GÉANT framework agreement to supply these solutions to NREN GÉANT members. This agreement makes it easier for you to approve and procure solutions from **Nokia**. Learn more through the resources below or **contact us directly**.

Further reading:

NREN Photonic Nation: **Nokia's role in research and education networks**

White paper: **Nokia PSE V Coherent Solutions Beyond the Limits**

GÉANT webinars: **Nokia in R&E networks - Nokia optical trials**

Chris Janson

Chris Janson is Product Marketing Manager in Nokia's IP and Optical Network business unit where he follows trends in optical networking technology and its application to finance, healthcare, utilities, manufacturing, government, education and other enterprise network operators. Chris has held product development, management and marketing roles in the communications equipment and semiconductor fields. He has been a speaker at many conferences including Interop, Internet2, and other executive forums. He has also shared his work through many webinars, written publications, on-line videos and articles. Chris holds an MBA from Boston University and Bachelor of Science in engineering from Wentworth Institute of Technology.

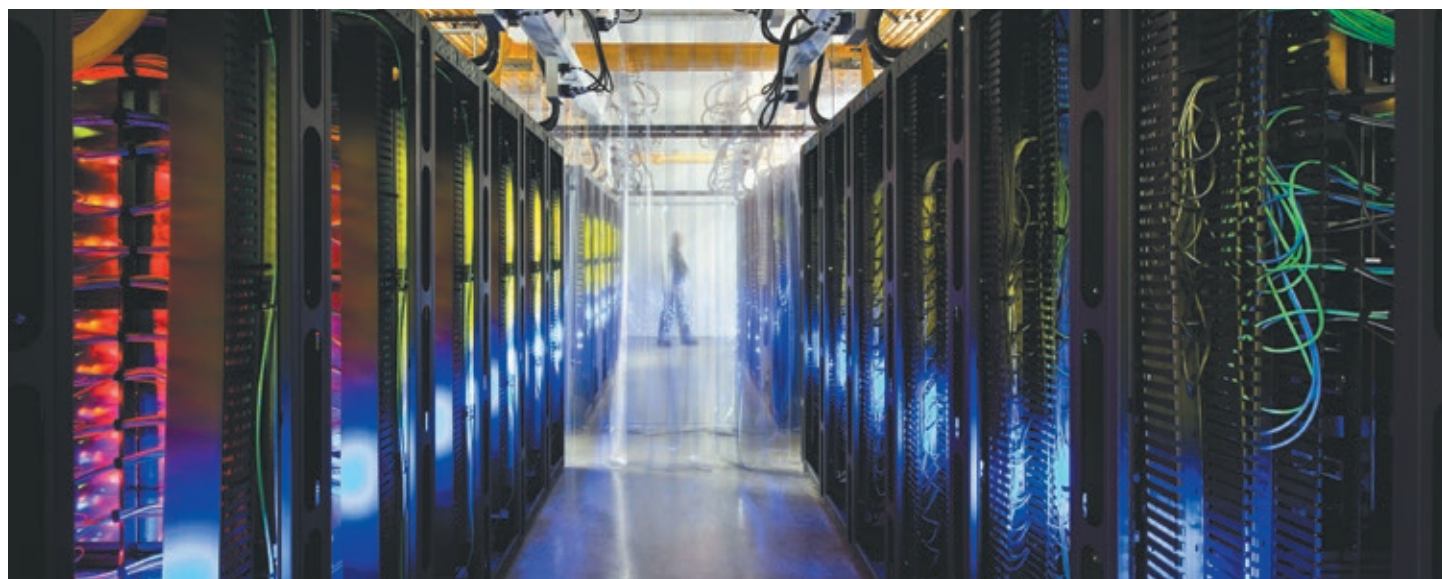




In pandemic conditions, biomedical researchers develop innovative tools with Google Cloud

As researchers struggle to advance urgent biomedical research, these teams have optimized their workflows to process more data more efficiently.

Words: Nicole DeSantis



The COVID-19 pandemic devastating the world has sped up the demand for innovative solutions in biomedical research. At the same time, researchers everywhere face unprecedented working conditions that have made in-person collaboration, travel, and planning for the future much more difficult. Everyday tasks like managing clinical trials have turned into complex challenges. In the current situation, GÉANT's members need a flexible infrastructure to support remote work and distributed computing.

They need access to powerful tools to scale up their data processing to get results faster.

Early in 2019 GÉANT and Google agreed to expand support for academic researchers in EMEA, enabling them to leverage the benefits of Google Cloud, our suite of cloud computing solutions for storage, compute, big data, and machine learning. "Google Cloud's commitment to supporting educational and academic research is core to our DNA, and we'll continue to find ways

to help researchers and organizations apply cloud technologies for the benefit of all," says Joe Corkery, M.D., Director of Product, Healthcare and Life Sciences at Google Cloud. "We're so grateful for the work of these experts, and want to support them with tools and technologies that can help them combat this pandemic."

Here are two examples of European labs that are re-imagining how they conduct their research:

Pre-training AI models to accelerate genomics research—for everyone

The problem is urgent: the search for a COVID-19 vaccine and treatments depends on first deciphering the virus' molecular mechanisms. Manipulating 3D models of chemical compounds is a crucial step in developing drug therapies, where molecules must fit together like puzzle pieces. A team at Rostlab in the Technical University of Munich (TUM) developed ProtTrans, an innovative way to use machine learning to analyze protein sequences. By expanding access to critical resources, ProtTrans makes protein sequencing easier and faster despite the challenges of working during the pandemic.

Ahmed Elnaggar, an AI specialist and a Ph.D. candidate in deep learning, and Michael Heinzinger, a Ph.D. candidate in computational biology and bioinformatics, pre-trained models to "read" up to 393 billion amino acid sequences from over two billion proteins that make up the protein universe as we know it today, including viral diseases like COVID-19. By using Google Cloud's high-speed Tensor Processing Units (TPUs) for data-intensive processing, they were able to train different models, including a model with 3 billion parameters on Google TPU V3-1024, which took several days to converge. The team has already done most of the heaviest computational lifting; now they are starting to distribute their pre-trained models to other researchers who can apply it to their tasks from any location, with ordinary consumer hardware. Compared to traditional methods which required expensive hardware to collect similar proteins via time-consuming database searches, ProtTrans models can be accessed and run by any researcher on a single GPU. Also, recent results show that the new ProtTrans models capture aspects of proteins which were not accessible by previous methods.

As more models are trained, the algorithms themselves become better at predicting complete protein sequences from partial strings of amino acids, which in turn generates faster and more accurate results. By the end of 2020 the Rostlab team hopes to launch a website where researchers can plug in a string of amino acids and quickly access a 3D model of the protein's structure. According to Heinzinger,

"the proposed approach has the potential to revolutionize the way we analyze protein sequences." Elnaggar points out that "this work couldn't have been done two years ago. Without the combination of today's bioinformatics data, new AI algorithms, and the computing power from GPUs and TPUs, it couldn't be done."

Creating the largest-ever DNA search engine—at 4 petabytes

The Biomedical Informatics (BMI) Group run by Dr. Gunnar Rätsch at ETH Zurich (Swiss Federal Institute of Technology) draws on huge datasets of genomic information to answer key questions about molecular processes and diseases like cancer. Their research benefits from the massive increase in genomic information now available in datasets like the National Center for Biotechnology Information's Sequence Read Archive (SRA), the largest public repository of high throughput sequencing data. By storing vast amounts of raw sequencing data, the SRA helps life science researchers facilitate new discoveries through data analysis.

This flood of data has disadvantages as well as advantages for researchers: for example, each time they need to analyze a DNA sequence dataset they first have to download the huge files and access the algorithms locally. That consumes time and resources, so with Google's help the BMI Group is developing a cost-effective search engine for DNA sequences that could bring algorithms to the data, instead of the other way around. Now the BMI Group team uses Google Cloud Storage to manage sequencing data and Compute Engine's Virtual Machine (VM) instances to process them. Called the Metagraph Project, this flexible solution is able to process four petabytes of genomic data, making it the largest DNA search engine ever built.

Faced with a rapidly-changing research climate, both TU Munich and the BMI Group found creative ways to rethink their workflows with the flexible, powerful resources of cloud computing. "IT procurement in universities is often optimised for long research projects," says André Kahles, Senior Postdoc in the BMI group. "You're locked into infrastructure for four to five years, without much flexibility to adapt in fast-paced projects. Google Cloud lets us constantly readjust the setup to our needs, creating new opportunities and preventing us from spending money on infrastructure we can't use optimally."

Getting started with Google Cloud

TU Munich and the BMI Group in Zurich are just two of the many innovative biomedical projects in EMEA that build on Google tools and infrastructure to make research easier, faster, and more efficient in these difficult times. To start or ramp up your own project, we offer research credits to academics using GCP for qualifying projects in eligible countries. You can find our **application form** at www.cloud.google.com/edu.

"IT procurement in universities is often optimised for long research projects. You're locked into infrastructure for four to five years, without much flexibility to adapt in fast-paced projects. Google Cloud lets us constantly readjust the setup to our needs, creating new opportunities and preventing us from spending money on infrastructure we can't use optimally."

André Kahles, Senior Postdoc,
BMI Group, ETH Zurich

"This work couldn't have been done two years ago. Without the combination of today's bioinformatics data, new AI algorithms, and the computing power from TPUs, it couldn't be done."

Ahmed Elnaggar, Department of Informatics, Bioinformatics, and Computational Biology, Technical University of Munich (TUM)

Visit <https://edu.google.com/programs/>

Powerful Vaccine Discoveries Accelerated

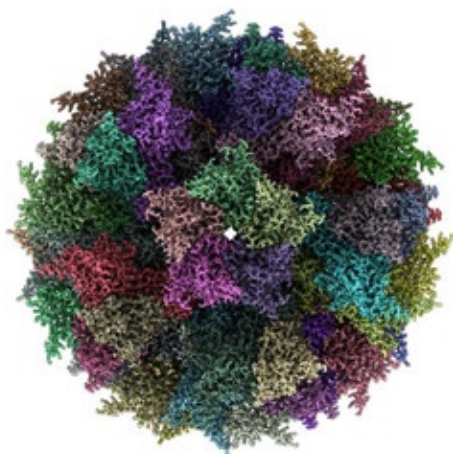
The Race to Combat Infectious Disease

"Our ambition is to create a platform to react quickly to disease, which involves the creation of terabytes of imaging data. Using Oracle Cloud, we can distribute the data across multiple processors and get results in a fraction of the time of a traditional on-premise system."

—Imre Berger, Professor Biochemistry and Chemistry, University of Bristol

Imre Berger, University of Bristol, and Imophoron researchers watched as the infectious mosquito-borne disease Chikungunya, a resilient disease once confined to sub-Saharan Africa, began to march its way world-wide at an alarming pace.

Research has proven vaccination is a powerful front-line defense in the war against viral and pathogenic diseases. Traditional vaccine design and production technology resources impeded innovative vaccine discoveries. University of Bristol researchers needed a new approach.



ADDomer®: Synthetic multipeptide display scaffold for next generation vaccines. We developed ADDomer, a next generation synthetic vaccine that mimics features of Chikungunya virus, to efficiently prime the immune system to protect against this pathogen.

Image credit: University of Bristol

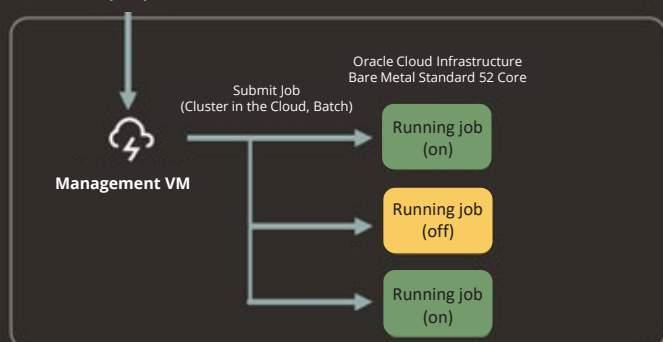
University of Bristol and Imophoron researchers wanted to design a novel vaccine delivery system that is easy to produce in high volumes—an advantage for combating fast spreading infectious diseases.

They envisioned a vaccine delivery system from a lab-produced, thermostable protein molecule that could be readily manufactured at low-cost and did not require refrigeration to retain viability—important for vaccine shipment to and storage in warmer climate locations.

On-premise super computers needed the power of enterprise computing to process the very large data sets from University of Bristol's cryo-electron microscope which is integral to digital modelling for their pioneering vaccine research. University of Bristol researchers turned to Oracle's high-performance cloud infrastructure to develop a novel computational approach to create an accurate, high resolution digital model of their synthetic vaccine in a fraction of the time and at a much lower cost than previously thought possible.



Oracle Cloud Architecture - Cluster in the Cloud



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Performance Characteristics

- Best suited to heterogeneous high-throughput tasks
- Pipelines needing different node type(s) for different parts
- Can be much more specific than the average on-premise cluster
- Always have access to the latest hardware
- Nodes are only switched on and paid for while jobs are running
- Nodes are switched off automatically when idle
- Great for teaching clusters

Timing

- Full system test ~ 20 minutes on Oracle
- Create Cluster from scratch
- Submit job, Run job. Tear down whole cluster
- Job submit → job start: < 3-4 minutes

ORACLE
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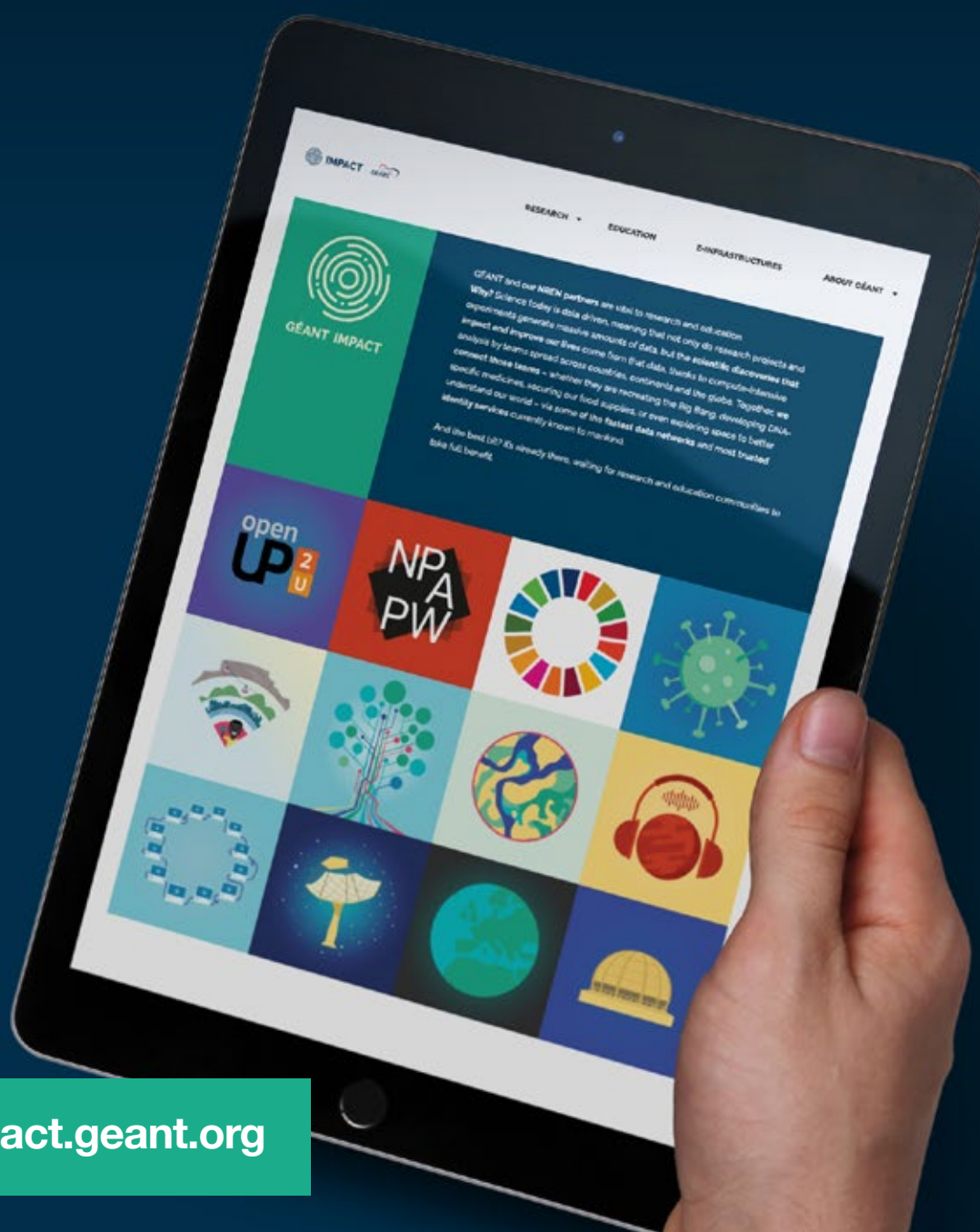
oracle.com/oracle-for-research

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Have you visited our IMPACT website recently?

Check it out to read about the science, education and technology projects GÉANT and our NREN partners support!



Visit impact.geant.org

GÉANT at a Glance

We're bringing you greater content across a wider range of channels: from our Annual Report to showcasing the amazing research projects the GÉANT community supports. And now CONNECT is online with a new website (connect.geant.org) and weekly newsletter. You can also get involved on social media – see you online!

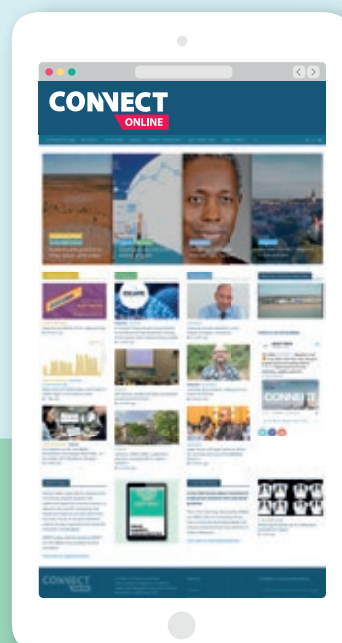
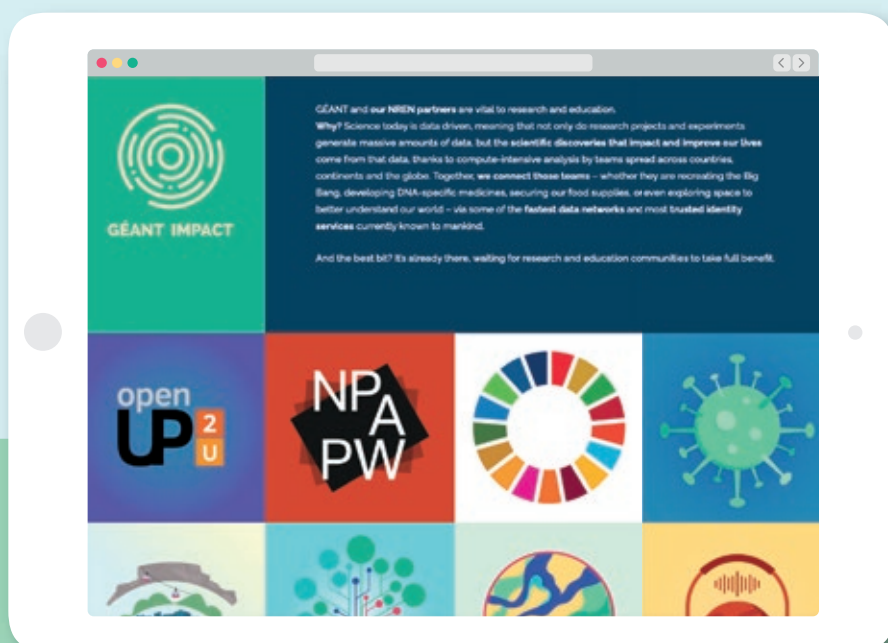
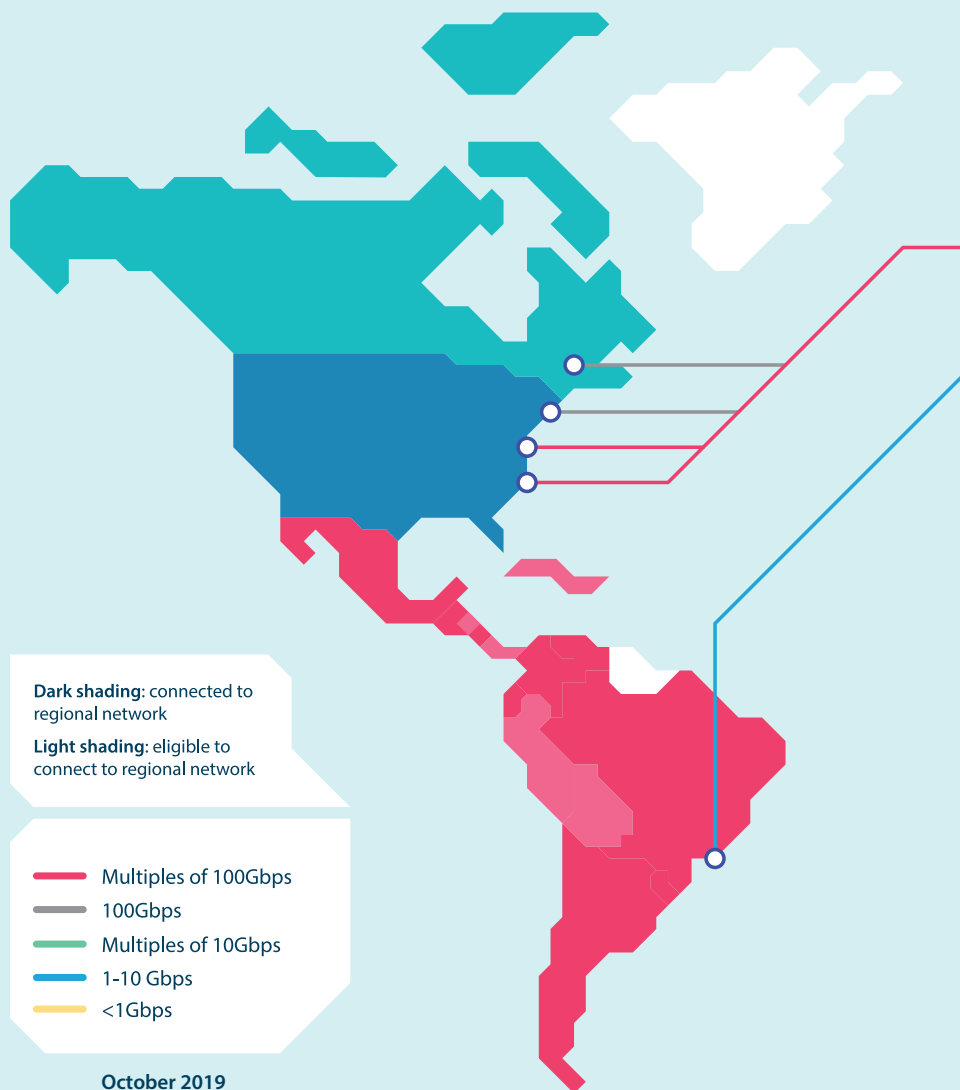


Dark shading: connected to regional network

Light shading: eligible to connect to regional network

- Multiples of 100Gbps
- 100Gbps
- Multiples of 10Gbps
- 1-10 Gbps
- <1Gbps

October 2019



GÉANT is Europe's leading collaboration on network and related infrastructure and services for the benefit of research and education, contributing to Europe's economic growth and competitiveness. We develop, deliver and promote advanced network and associated e-infrastructure services, and support innovation and knowledge-sharing amongst our members,

partners and the wider research and education networking community. Together with our NREN partners, we interconnect 50 million users at 10,000 research and education institutions; and via extensive global partnerships and GÉANT-managed networking projects, reach over 100 countries worldwide.

