ASREN
Arab States Research and Education Network

ASREN Newsletter
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Call for Papers
EDUCATION, SCIENCE AND INNOVATION - The e-AGE 2017 Conference

Cairo – Egypt, 3-4 December 2017

In this issue

CAIRO - The e-AGE conference had established itself as an important venue for networking among experts and scientists. In 2017, e-AGE will be held under the patronage of His Excellency Mr. Ahmed Aboul-Gheit, the secretary general of the League of Arab States in Cairo, Egypt during 3 – 4 December 2017. The main theme of e-AGE 2017 is "EDUCATION, SCIENCE AND INNOVATION".

e-AGE 2017 will include events, workshops and meetings centered around the following:

- 10th Event on Euro-Mediterranean e-Infrastructure
- 7th Annual Meeting of ASREN
- 9th Annual Conference of the Arab Organization for Quality Assurance
- EUMEDCONNECT3 and Africaconenct2 Project Meetings

- Technical workshops on R&E networking

Moreover, special sessions will be dedicated to specific domains, mainly focusing on experiences in connectivity and e-Infrastructure, applications and services across a variety of scientific domains. It is also important to show how research infrastructure creates tangible benefits to communities and collaborations. It is still critical to demonstrate how research connectivity can promote collaboration and innovation. Different discussions will be stimulated during e-AGE to drive outcomes and concrete results on practical steps towards developing a regional e-Infrastructure.

Authors are invited to submit full papers reporting on their original and unpublished research in e-Infrastructures and computational and data-intensive sciences. All papers will be peer-reviewed and accepted papers will be published in the conference proceedings.

Topics of interest include, but not limited to:

- Scientific computing and data-intensive e-Science in the scientific areas related to energy, environment, health, climate, water, agriculture, biology, economy, medicine, as well as in social sciences and humanities.
- Perspectives on NRENs, including challenges, operation, sustainability, funding, governance, business models, security and services.
- Problem-solving environments, Virtual Research Environments, Science Gateways and collaborative tools, applications and services
- Education and e-Learning Technologies, access to educational resources, repositories, libraries and contents, clouds, grids, parallel and distributed computing, and high performance computing.
- Internet technologies and trends, Internet of Things, Security, SDN and AAIs.

For more detai ls, please visit the conference website:
http://asrenorg.net/eage2017/?q=Page/call-participation

Pioneering SESAME Light Source Officially Opened

"AMMAN - His Majesty King Abdullah II officially opened the SESAME Light Source. SESAME is the first regional laboratory for the Middle East and neighboring regions The laboratory's official opening ushers in a new era of research covering fields ranging from medicine and biology, through materials science, physics and chemistry to healthcare, the environment, agriculture and archaeology."

Speaking at the opening ceremony, the President of the SESAME Council, Professor Sir Chris Llewellyn Smith said: "Today sees the fulfilment of many hopes and dreams. The hope that a group of initially inexperienced young people could build SESAME and make it work - they have: three weeks ago SESAME reached its full design energy. The hope that, nurtured by SESAME's training programme, large numbers of scientists in the region would become interested in using SESAME – they have: 55 proposals to use the first two beamlines have already been submitted. And the hope that the diverse members could work together harmoniously. As well as being a day for celebration, the opening is an occasion to look forward to the science that SESAME will produce, using photons provided by what will soon be the world's first accelerator powered solely by renewable energy."

SESAME, which stands for Synchrotron-light for Experimental Science and Applications in the Middle East, is a particle accelerator-based facility that uses electromagnetic radiation emitted by circulating electron beams to study a range of properties of matter. Its initial research program is about to get underway: three beamlines will be operational this year, and a fourth in 2019. Among the subjects likely to be studied in early experiments are pollution in the Jordan River Valley with a view to improving public health in the area, as well as studies aimed at identifying new drugs for cancer therapy, and cultural heritage studies ranging from bioarcheology – the study of our ancestors – to investigations of ancient manuscripts. Professor Khaled Toukan the Director of SESAME, said "In building SESAME we had to overcome major financial, technological and political challenges, but – with the help and encouragement of many supporters in Jordan and around the world – the staff, the Directors and the Council did a superb job. Today we are at the end of the beginning. Many challenges lie ahead – including building up the user community, and constructing additional beamlines and supporting facilities. However, I am confident that - with the help of all of you here today, including especially Rolf Heuer, who will take over from Chris Llewellyn Smith as President of the Council tomorrow (and

like Chris and his predecessor Herwig Schopper is a former Director General of CERN) - these challenges will be met."

The opening ceremony was an occasion for representatives of SESAME's Members and Observers to come together to celebrate the establishment of a competitive regional facility, building regional capacity in science and technology.

Planning for the Future of the GÉANT Network

CONNECT magazine spoke to the GÉANT Operations Team to find out more about the network, how efficiently it is run and to share their plans on how to handle the exponential growth in traffic.

How much traffic does the GÉANT network carry every day?

During 2016, GÉANT received an average of 3.9 Petabytes (that's 3.9 million Gigabytes) of data per day. That adds up to a total of more than 1.4 Exabytes of data accepted and transmitted by the GÉANT network in 2016.

What sort of traffic is this, and who are the big data producers?

GÉANT receives traffic on its two main networks: the Lambda network delivered by the Infinera DWDM system and the GÉANT MPLS/IP network delivered on Juniper MXs.

GÉANT Lambdas provide customers with 10Gbps and 100Gbps point-to-point Ethernet services and this accounts for about 40% of the total GÉANT traffic. Of this, CERN has the lion's share, amounting to approximately 80%, with other major users such as PRACE (see page 16), LOFAR (Low Frequency Array), GTS (the GÉANT Testbed Service) and others with much lower volumes.

The GÉANT MPLS/IP network provides all other services, such as GÉANT R&E IP, LHCONE,

Internet access, GÉANT Plus, MDVPN and BoD, and receives the remaining 60% of the total traffic. 89% of the traffic received by this network is absorbed by three main services: GÉANT R&E IP 41%, LHCONE 23%, Internet access 25%, whilst the remaining 11% is shared among all other services. Also here CERN, with its high-energy physics community, is still the biggest data producer.

Of the NRENs, the largest users are DFN (Germany) and Jisc (UK), each accounting for over 15% of the total amount of data produced by NRENs, followed by GARR (Italy) and RENATER (France), then RedIris (Spain), with a share of 4% whilst all other NRENs' share of the traffic is lower than 3%. Data for consumption may show a different distribution, but the largest NRENs remain the main users.

What makes the network so special?

Firstly, GÉANT is a virtually lossless network, meaning that any data received by GÉANT is transmitted to its destination without dropping any packets. In order to achieve this, GÉANT actively manages capacity to accommodate for bursts and periodic changes in the traffic volume. Transmission of traffic at line rate should be possible at all times with minimal or no buffering in order to maximise throughput of host data flows. This way data is transferred unchanged and protocols running on hosts can be tuned to work on the assumption of transiting a virtually lossless environment. GÉANT also allows for elephant flows (single flows of very high rate use by HPCs) by keeping its core links running on the highest speed interfaces available on the market.

Secondly, GÉANT is a high-speed network and links are procured to ensure that delay between GÉANT PoPs in major European cities is as small as possible. This also ensures the best response time between any two entry points to the GÉANT network.

Thirdly, GÉANT strives to connect all countries with enough capacity to allow for high-speed networking. This enables the community to bridge the digital divide with the provision of adequate connectivity in countries where such resources are scarce and the market is closed.

How has the amount of traffic grown over the past few years?

From 2015 to 2016 traffic on the IP/MPLS network grew year-on-year by 64%, meaning that our traffic volume on this network is doubling every 15 months.

The growth has been driven by R&E, where the traffic volume has grown by more than 70% (LHCONE and GÉANT R&E IP), while in contrast, commercial Internet access traffic has grown by just 30%. Interestingly, this GÉANT commercial Internet traffic growth is in line with the Internet traffic growth seen by commercial providers. The R&E community is therefore faced with a major challenge: its traffic growth rate is over twice as large as the commercial Internet's growth rate.

The growth rate for the Lambda services amounted to 12% approximately, however growth in this type of network is mainly related to new service uptake rather than to traffic growth within existing services.

What implications does this have?

Should R&E traffic growth continue at this rate, in 10 years' time GÉANT would receive 140 times the amount of traffic it receives today. By comparison, within the same time frame, a commercial provider with a growth rate of 30% would see its traffic increase 14 times. The main implication of this is that classic/standard solutions cannot work for GÉANT in the longer-term and GÉANT must look at innovative ways of delivering its network.

What is GÉANT doing to plan for this?

Classic standard solutions are based on pieces of equipment with very broad sets of features, such as a Juniper MX router. Devices like this are able to provide all services and in the past were used to aggregate services delivery into a single high feature-set box. The downside of this is that the cost-per-bit on those devices is the cost-per-bit required by the data-stream that is the most complex to deliver.

Any other data-stream whose requirements, in terms of flow handling, are much more limited, still transits through the same expensive ASICS and is handled by the same complex software. This results in the payment of premium to transit traffic that could be delivered by a much simpler and less expensive network.

We are analysing traffic, gaining a deeper understanding of the various flows transiting our network and of the requirements from the network point of view for each flow. GÉANT is striving to understand which minimum set of features is required by the equipment that needs to service each group of flows with common requirements. We will subsequently look at groups of flows with minimum common requirements, whose aggregate traffic is large enough to justify disaggregation and find the most cost-effective way of delivering such traffic. All this will then come together in a future network architecture where the cost-per-bit is as optimised as possible and only the small amount of traffic requiring complex handling by expensive ASICS is transiting the devices providing the required capabilities.

The result is a modular layered architecture where best-in-breed for each module and layer can be selected with minimised impact on other modules/layers. A guiding principle in this architecture is ensuring that flows are handled at the lowest possible layer, which are the layers closest to the physical media.

Are there technologies that GÉANT is investigating/deploying to meet future needs?

Faced with such a high network growth-rate, GÉANT needs to look for solutions investigated and deployed by organisations with similar extreme growth levels: the datacentre world. In the past few years datacentres/cloud service providers have needed to develop their own solutions in order to be able to deal with their own growth. Primary examples include: Google, Microsoft, Amazon and Facebook. These content providers had to start optimising their networks; but as early adopters, they needed to drive the industry to produce the hardware and software they need.

These solutions have initially been tailored to the datacentre arena and consequently, in many cases, result in solutions that are of little use to

ISP networks such as GÉANT. Now, content providers are expanding beyond the datacentre, into the WAN, and have started generating major disruption in the WAN market whilst driving the industry to quickly provide solutions. GÉANT is looking at this phenomenon very closely and preparing to deploy the right combination of technologies as they become available.

In line with this, GÉANT has been following trends such as open line systems, alien waves, packet optical integration, coherent optical networking, open-source hardware projects (TIP), merchant silicon evolution, SDN and white boxes.

In particular, a big trend in the industry is the move toward centralisation of control plane, multilayer orchestration and programmability: forward-looking decision making based on a more centralised and holistic view evaluating the use of a richer set of inputs. GÉANT plans to follow this approach to enable its partners to interact more directly with network resources. NRENs and other e-infrastructures will have a view and understanding of resources utilisation, they will be able to reserve capacity whilst influencing the network behaviour to fit their specific needs. Bi-directional communication between software running the network and software utilising the network as a resource should improve, and in the longer term this will improve service and customer experience as well as network utilisation and costs.

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