

## SURFnet and NORDUnet collaborate to create an international, multi-domain 40Gb/s Alien Wave network over more than 4300km

*University of Amsterdam conducts successful groundbreaking data transfer demonstrations over a leading-edge 40Gbps ultra long-haul network.*

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SURFnet, Ciena, NORDUnet, Mellanox, Telindus-ISIT, CERN and the University of Amsterdam demonstrated a collaborative experiment that produced a high-speed, ultra long-haul 40 Gigabit Ethernet (40GbE) network to demonstrate capabilities of 40G Ultra Long Haul technology for terrestrial applications and over multi-vendor DWDM networks. The demo was shown for the first time at the TERENA Networking Conference (TNC) 2011 in Prague. The organizations came together to create a 40 Gbps long-haul optical service across 4300 kilometres of fiber via the SURFnet and NORDUnet networks, including an unregenerated ultra long-haul section over 2700km between CERN in Geneva and the University of Copenhagen in Copenhagen, Denmark. This 40Gb/s ULH technology allows SURFnet and NORDUnet to groom their network for a future in which they continue to be an enabler not only for local, regional and national but also for wide area international research collaboration through the support of high-performance data distribution, next-generation video and data processing.

Distributing scientific data from the world scale e-Science experiments for processing and analysis requires the use of 40 and 100 Gbit/s connectivity with constant and lowest possible latency, on cross border dark fiber spanning distances up to 6000 kilometres. For example: distributing and replicating data from CERN (LHC) in Geneva to other locations such as in the Nordic countries, connecting computer clusters for distributed multi scale simulations (<http://mapper.eu.org/>), or digital cinema material distributed editing and processing (<http://cinegrid.org/>).

Utilizing shared expertise in advanced photonic, leading-edge hardware and high-performance computing to complete the demonstration, the organizations created a service using existing production network links of SURFnet and NORDUnet, including an all-optical 40Gb/s ULH link between Geneva and Copenhagen that extends over 2700 kilometres, with 37 fiber spans comprising a mixture of different fibre types (i.e. TWRS, TW+ and AllWave). Between Amsterdam-Geneva and Geneva-Hamburg the 40Gb/s link runs on Ciena's ActivFlex 6500 Packet-Optical Platform; between Hamburg and Copenhagen the link is provisioned as an alien wave over Alcatel-Lucent equipment, creating a cost-effective, low-latency, all-optical 40Gb/s link between Geneva and Copenhagen.

The goal of the demonstration is to gain experience in setting up efficient ultra long haul photonic connections passing through several different domains containing various vendors' DWDM equipment, work on transport protocols and tuning, and monitor and measure different properties of the traffic, in particular latency and throughput as function of different tuning parameters and architecture choices including solid state drives at the sending and receiving end.

"We're honoured to work with these leading-edge research organizations as we continue to invest in opportunities to remove capacity bottlenecks and expand the capabilities of our converged optical Ethernet solutions portfolio," said Rod Wilson, senior director for Ciena's external research program. "The creation of next-generation infrastructures is vital to supporting e-Science applications, and Ciena is proud to be a participant in successfully enabling the innovative development of these complex and adaptive networks."

"We are excited that we are able to push the envelope further for long-haul transmission for research and education," continued Bram Peeters, head of the Network Services department at SURFnet. "This 40G ultra long haul demo across different networks showed that we can do efficient single stream end-to-end transport at rates well above today's common limit of 10 Gbps. Doing this with a single photonic link over two different domains makes this a feasible solution for high end research."

"The novelty of this work is the unobstructed 40 Gbps optical signal crossing six countries and two different vendors optical systems without being regenerated. This marks the next step in the vision of an international photonic switching network," said Cees de Laat, professor in system and network engineering at the University of Amsterdam. "These capacities are essential not only for data intensive

e-Science but also, for example, in high-resolution 3D digital cinema and movie processing. The photonic network vision and technology as developed by Ciena integrates the communication building blocks seamlessly with the rest of the e-Infrastructure.”

“As research and education networks we continually strive for solutions that facilitate the most advanced applications in a cost-effective manner. Our continued collaboration with other NRENs, research institutions, and industry partners to exploit technologies such as photonic networking and wavelength selector switching enable us to further keep networking in the optical domain and provide high-capacity, effective and efficient networking for European and global e-Science collaborations.”, said Lars Fischer, CTO of NORDUnet. “The result demonstrated today marks an important milestone for European R&E networking.”

"Collaboration is the key to the largest world-wide science projects and it is essential to be able to innovate in all areas of technology needed in the scientific endeavor. The GLIF community is very active in showing what is possible with networks today" commented David Foster, IT deputy department head at CERN. "We are excited by the achievements at the TNC that demonstrate high speed long haul network capabilities for the science community and which will bring new possibilities for organizing scientific data processing and discovery"

### **About SURFnet**

SURFnet is the National Research & Education Network (NREN) organization in The Netherlands. SURFnet develops and provides innovative services for education and research in the field of a hybrid network infrastructure, trusted identity and a pioneering collaboration environment. SURFnet provides access to these services to over one million users in higher education and research in The Netherlands. The aim of SURFnet's innovation project GigaPort3, is to innovate the existing SURFnet network infrastructure and to integrate it seamlessly with the other ICT infrastructure facilities. The Dutch Government has provided EUR 32 million in funding for GigaPort3 from the Economic Structure Enhancing Fund (FES). SURFnet is part of SURF, the collaborative organization for higher education institutions and research institutes, which are together working on breakthrough innovations in ICT. More information can be found at [www.surfnet.nl/en/](http://www.surfnet.nl/en/).

### **About NORDUnet**

NORDUnet is the Nordic Infrastructure for Research & Education and is a joint collaboration by the five Nordic National Research and Education Networks: Denmark (Forskningsnettet), Finland (Funet), Iceland (RHnet), Norway (UNINETT) and Sweden (SUNET). NORDUnet operates a world-class Nordic and International network and e-Infrastructure service for the Nordic research and educational community. NORDUnet monitors international network research activities and development projects and coordinates Nordic involvement in these projects, also acting as the Nordic representative towards the GÉANT and DANTE bodies.

### **About Telindus-ISIT**

Telindus-ISIT, part of the Belgacom Group, is specialized in the field of convergence of voice, data, video, storage and security. The organization distinguishes itself by providing objective advice and a high level of innovation. As “The Network & Storage Company” Telindus-ISIT is one of the few market players to deliver fully integrated end-to-end network and storage solutions to both companies and governmental (and semi-governmental) organizations. Telindus-ISIT also offers various managed services, from the management and monitoring of network and storage environments to complete outsourcing of all network-related activities, such as managed storage and managed WAN optimization. Finally, Telindus-ISIT's Education Services department offers a wide range of ICT training courses, primarily including vendor-specific certification programmes pertaining to networks, storage and office applications.

### **About Ciena**

Ciena is the network specialist. We collaborate with customers worldwide to unlock the strategic potential of their networks and fundamentally change the way they compete and perform. With focused innovation, Ciena brings together the reliability and capacity of optical networking with the flexibility and economics of Ethernet, unified by a software suite that delivers the industry's leading

network automation. We routinely post recent news, financial results and other important announcements and information about Ciena on our website. For more information, visit [www.ciena.com](http://www.ciena.com).

### **About University of Amsterdam**

The University of Amsterdam is a research-intensive university, a prime example being the Faculty of Science. The System and Network Engineering research group (SNE) in the Informatics Institute of the Science Faculty focuses its research on emerging new local and wide area optical networks and the associated models, systems and protocols. The group is building tools and proof of concept applications that promote optimal use of these high-speed networks. The group develops grid middleware to empower applications to optimally allocate and use these infrastructures. Security of the required mechanisms, infrastructure, middleware, applications and the privacy of data in distributed processing environments is an essential aspect of the research. For more information visit: [www.science.uva.nl/research/sne](http://www.science.uva.nl/research/sne).

Information about this demonstration can be found at: <http://tnc11.delaat.net/>