



GÉANT and TEIN3: Bringing Cultures Together Across Continents

Having performers in Kuala Lumpur dance in real time to music that's being played 9,300km away in Stockholm might sound impossible, but that is precisely what was achieved thanks to the power of high-speed data networking and the collaboration it enables. This unique inter-continental performance took place in 2009 as part of two concurrent events, one marking the third generation of GÉANT and the other a Gala Dinner as part of an ASEM (Asia-Europe Meeting) Workshop.

The combined performance was the result of extensive collaboration between international and national research networks, and a clear demonstration of how the use of such high-speed, dedicated networks can bring people together across vast distances, enabling them to work together in real-time.

Networks create a virtual stage for performers

Music performed by the Lost Sounds Orchestra at the Museum of Modern Art in Stockholm – connected with optical fibre to SUNET, the Swedish research and education network – was captured, digitised and sent through the networks to the ASEM workshop at the Kuala Lumpur Convention Centre. From SUNET, the music travelled to Copenhagen on the Nordic NORDUnet link, to London on the GÉANT network, to Singapore and Kuala Lumpur over TEIN3, and finally was delivered to the venue by the MYREN (Malaysian network) dedicated connection.

The same path was followed in reverse by the video footage of Arts Exchange dancers performing live on stage in Kuala Lumpur, which was then projected on a screen in Stockholm.

Delivering lag-free, high-quality audio-visual content across 9,300km

The events in Stockholm and Kuala Lumpur were connected using a bi-directional audio-visual (AV) channel, set up using a



This world-first performance not only united continents and cultures, but was also a powerful demonstration of how research networking enables collaboration across disciplines, and can promote global virtual research communities. The demonstration clearly shows the potential that networks, such as TEIN3 and GÉANT, offer research communities across Europe and the rest of the world.

*Cathrin Stover
International Relations Manager, DANTE*



Digital Video Transport System (DVTS). To deliver such high-quality AV content, the DVTS multi-platform streaming application relies on a high-bandwidth network infrastructure, such as that offered by the GÉANT and TEIN3 networks, making it possible for data to be transferred at super-fast speeds of up to 2.5 Gbps (gigabits per second).

Ancient instruments add an extra dimension

And, if getting performers to dance in real time to music being played on the other side of the world wasn't enough of a challenge, the music played by the Lost Sounds Orchestra in Stockholm featured the first playing of the Barbiton, an ancient Greek instrument whose sound was recreated through the ASTRA project, a high-profile user of the GÉANT network.

Network performance tests confirm stability of connection

A key part of the GÉANT launch event preparation was testing the link between GÉANT and TEIN3. The tests were focused on the achievable bandwidth, packet loss and jitter, checking the quality of the connection and its stability. It was vital to find out if the network could facilitate the world's first intercontinental, high quality digital audio-visual (AV) transmission in real time.

The results were highly encouraging. The TEIN3 link performed extremely well, with no losses during the tests and enough bandwidth to reliably host the AV streaming.

When the network setup was finalised with a fibre connection from the Kuala Lumpur Convention Center to the Stockholm Modern Art Museum, further tests were carried out. A constant, bidirectional User Datagram Protocol (UDP) traffic of 30 Mbps (megabits per second) was generated to simulate streaming AV content over the intercontinental path. Extensive testing was carried out to check the stability of the link over time, with some tests lasting up to 24 hours, without interruption.

Tests were conducted in both Stockholm and from Kuala Lumpur, to make sure that the link was behaving in the same way in both locations. The results showed that the server in Stockholm was able to receive all the traffic generated by the server in Asia with no packet loss during the whole duration of the test.

Knowledge of this 2,000 year old musical instrument is based on archaeological findings, historical pictures and literature. This archaeological data was inputted into a computer and then transformed through an audio rendering technique to model the actual sound of the ancient instrument.

The success of this event demonstrates the sheer power of high-speed networking technology and the opportunities that it offers students, researchers and artists to collaborate all over the world.

Being part of this cross-region live collaboration was an honour as it gave us the opportunity to showcase our talent and undoubtedly displayed the powerful capability of the MYREN, TEIN3 and GÉANT high speed networks. This historical event marked a great achievement linking two cultures together. The success of this live performance truly marked a new era of collaboration made feasible only by high speed networks provided by MYREN, TEIN3 and GÉANT.

Kamal Hisham Kamaruddin
Network Operations Manager, MYREN

connect • communicate • collaborate

The world is criss-crossed with high-capacity data communications networks, connecting and serving research and academic institutions across the globe. The most advanced of these is GÉANT, serving Europe. GÉANT interconnects with counterparts across the world, such as TEIN3 in the Asia-Pacific region.

Separate from the public Internet for reasons of security and performance, many of these networks are designed, deployed and run by the networking organisation DANTE and make an enormous practical contribution to research in a wide variety of areas – saving lives, building knowledge and establishing real-time collaboration between scientists all over the world.

GÉANT and TEIN3 provided the fast and reliable connection needed to deliver the world's first intercontinental, cross-cultural performance. Without access to the 2.5 Gbps link between the two networks it would have been impossible for this demonstration to take place.

For more information:

GÉANT: www.geant.net

SUNET: www.sunet.se

NORDUnet: www.nordu.net

TEIN3: www.tein3.net

MYREN: www.myren.net.my

View multimedia video of the performance:

<http://www.geant.net/Events/LaunchEvent/Pages/CulturalPerformance.aspx>

