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# CREATING THE GLOBAL RESEARCH COMMUNITY

ANNUAL REVIEW  
2006



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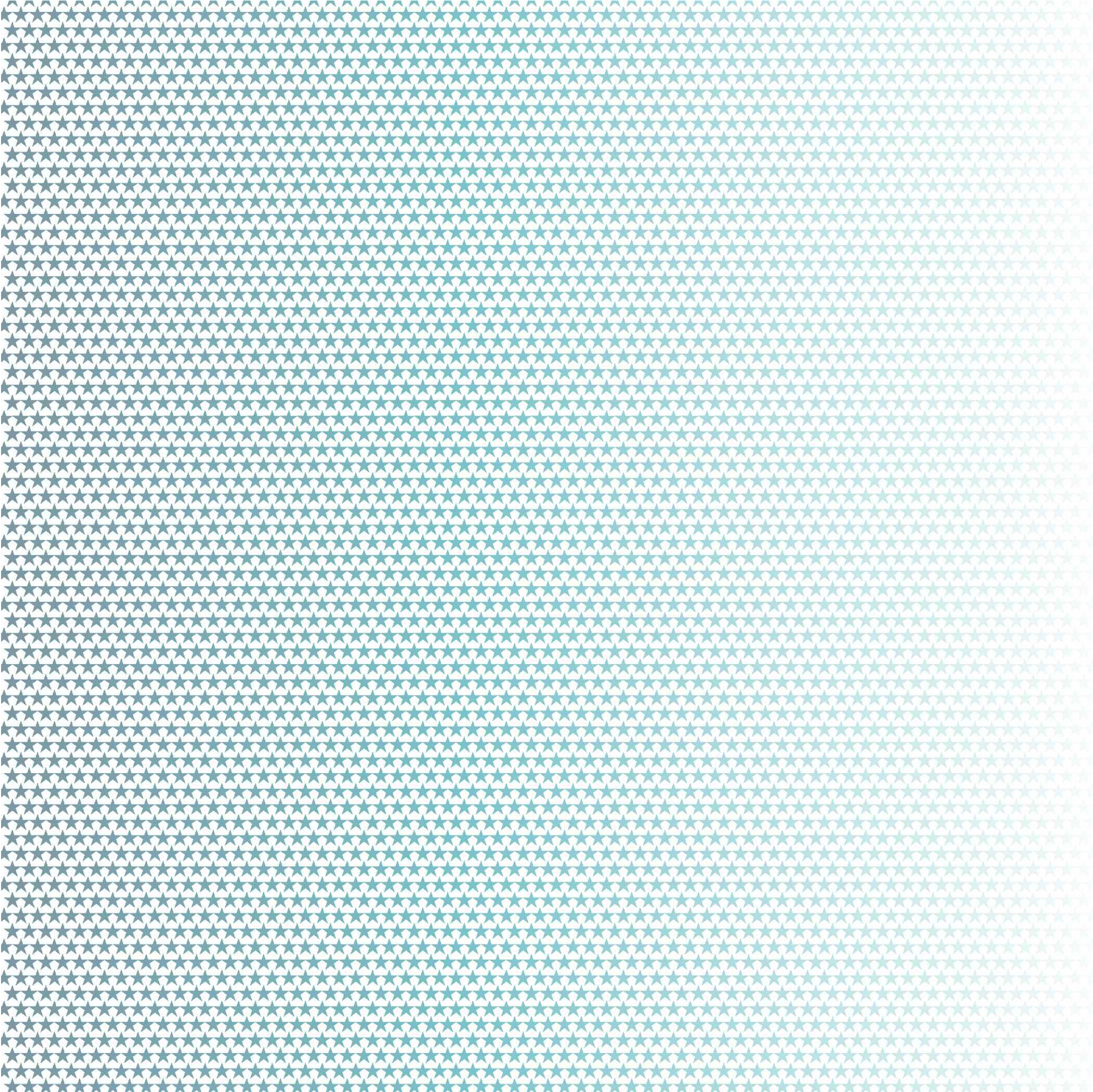




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## 2006 – the Chairman’s view

Welcome to the DANTE Annual Review for 2006. This year has confirmed the value of DANTE's global achievements and prepared the stage for the renewed boost that the Seventh European Framework Programme (FP7) will bring to research infrastructures and global research networking. The networks DANTE builds and operates, in close co-operation with its partner European NRENs, now benefit researchers across Europe – and an increasing number of their academics and researchers across the globe. We are proud of our achievements but recognise there is more still to do.

Traditionally, science research has been undertaken by small groups working on their own and sharing their methods and findings at the end of the task. Communications technology has revolutionised the process by allowing researchers geographically remote from each other to collaborate fully at every level and in real time – as though they were sharing a laboratory. Research networking helps to bring together colleagues working across both the European and worldwide research landscapes. It actively contributes to their research, supporting new scientific and academic discoveries.

DANTE and the NRENs builds the networks that are helping to create a truly global research community where advanced resources and new learning can be shared to the benefit of every partner. Networking projects led by DANTE now span the globe:

- **Europe:** GÉANT2 links NRENs in 34 European countries with a further 8 countries connected via the SEEREN2 network in south-eastern Europe
- **Mediterranean:** EUMEDCONNECT brings together 11 NRENs from the Mediterranean, North Africa and the Middle East, and provides links to Europe
- **Latin America:** the ALICE project's RedClara network connects 14 NRENs across Central and South America, and to Europe
- **South East Asia:** – The TEIN2 network connects 10 partners in the region to each other and to Europe
- **China:** the 2.5 Gbps ORIENT link – the first direct overland connection between Europe and China – is fostering closer collaboration between scientists in the two regions
- **India:** a new direct link with India strengthens TEIN2's presence in the Asia-Pacific region
- **North America:** extensive connectivity provided from Europe to both the US and Canada stimulates collaboration with European researchers
- **Africa:** connections from London to South Africa have been supplemented by a new peering agreement with the UbuntuNet Alliance

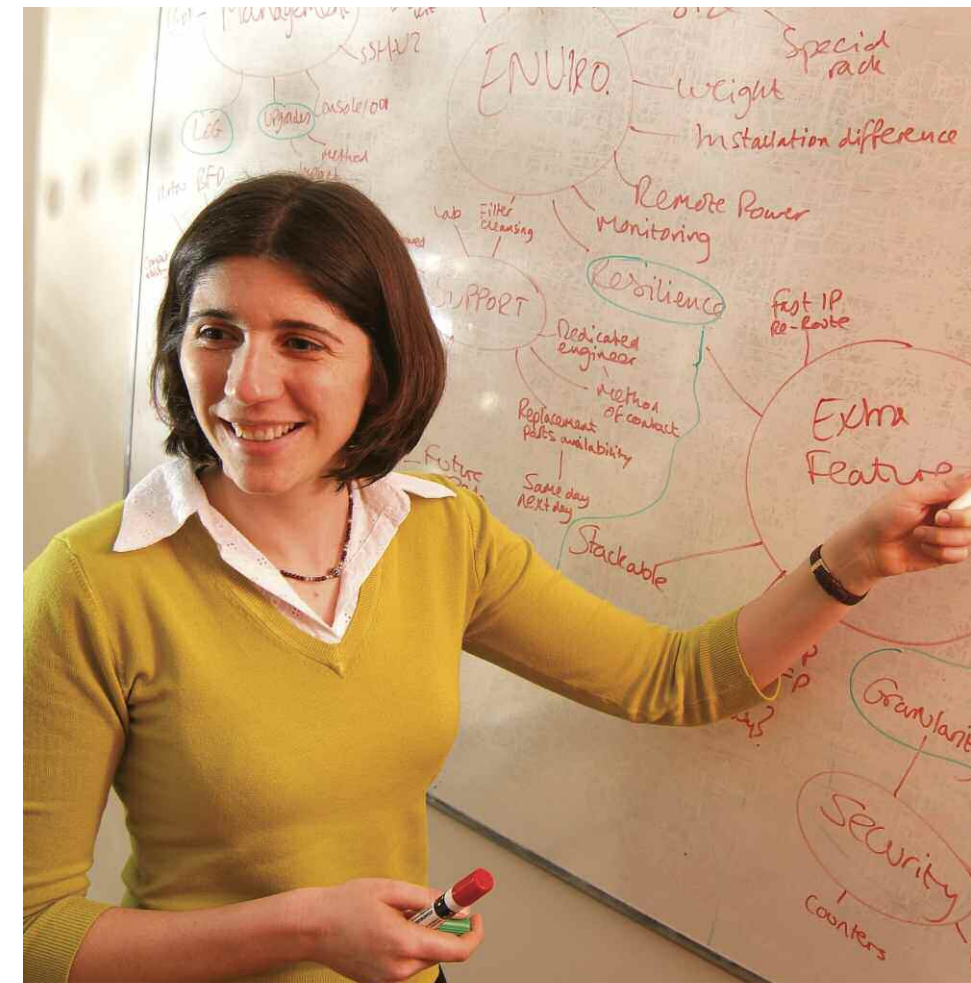
With this global research orientated connectivity now established and running successfully, our focus is turning to ensuring that both our partners and our EC supporters derive value from their investments. For our part, we are enhancing our 'transition to service' arrangements to ensure that European NRENs, end users and international network partners can exploit the new technologies to best advantage. As well as full implementation support and troubleshooting, GÉANT2, DANTE's biggest and most important project, is introducing formal training programmes for NREN engineers and, derived from the research activities, a range of new tools to help users make the most of the high speed global connections now available to them.

The central significance for Europe of DANTE's work is evidenced by the importance attached to research infrastructures in the 7th Framework Programme for Research and Technological Development (FP7): "Research infrastructures play an increasing role in the advancement of knowledge and technology and their exploitation ... they are at the core of the knowledge triangle of research, education and innovation."

Our Annual Review 2006 looks at the broad range of DANTE's activities and achievements and reports on our key projects. To provide a deeper insight into our organisation and 'the people behind the networks', we have organised this year's review into six themes that illustrate the kind of organisation we are, the work we do and our approach to working with our partners, users and suppliers in Europe and around the world.

Klaus Ullmann





## LEADING EDGE TECHNOLOGY

DANTE plans, builds and operates cutting edge research and education networks and our flagship is GÉANT2 – amongst the most advanced networks of its kind in the world and the first to deploy hybrid communications technology on an international scale. DANTE's business is delivering innovative networking solutions for the European research community that help underpin the vision of a European Research Area. Our work is at the forefront of communications technology and generally well in advance of the commercial marketplace.

**“Extending the boundaries of worldwide research depends on developing and installing leading-edge communications infrastructures. DANTE devises innovative networking solutions that feed into the development of GÉANT2 – the world’s first international scale hybrid network. We are setting new standards for what can be achieved.”**

**Marian Garcia Vidondo,**  
**Operations Manager,**  
**DANTE**



GÉANT2
“The internet
of the future”

- ★ Connect
- ★ Communicate
- ★ Collaborate

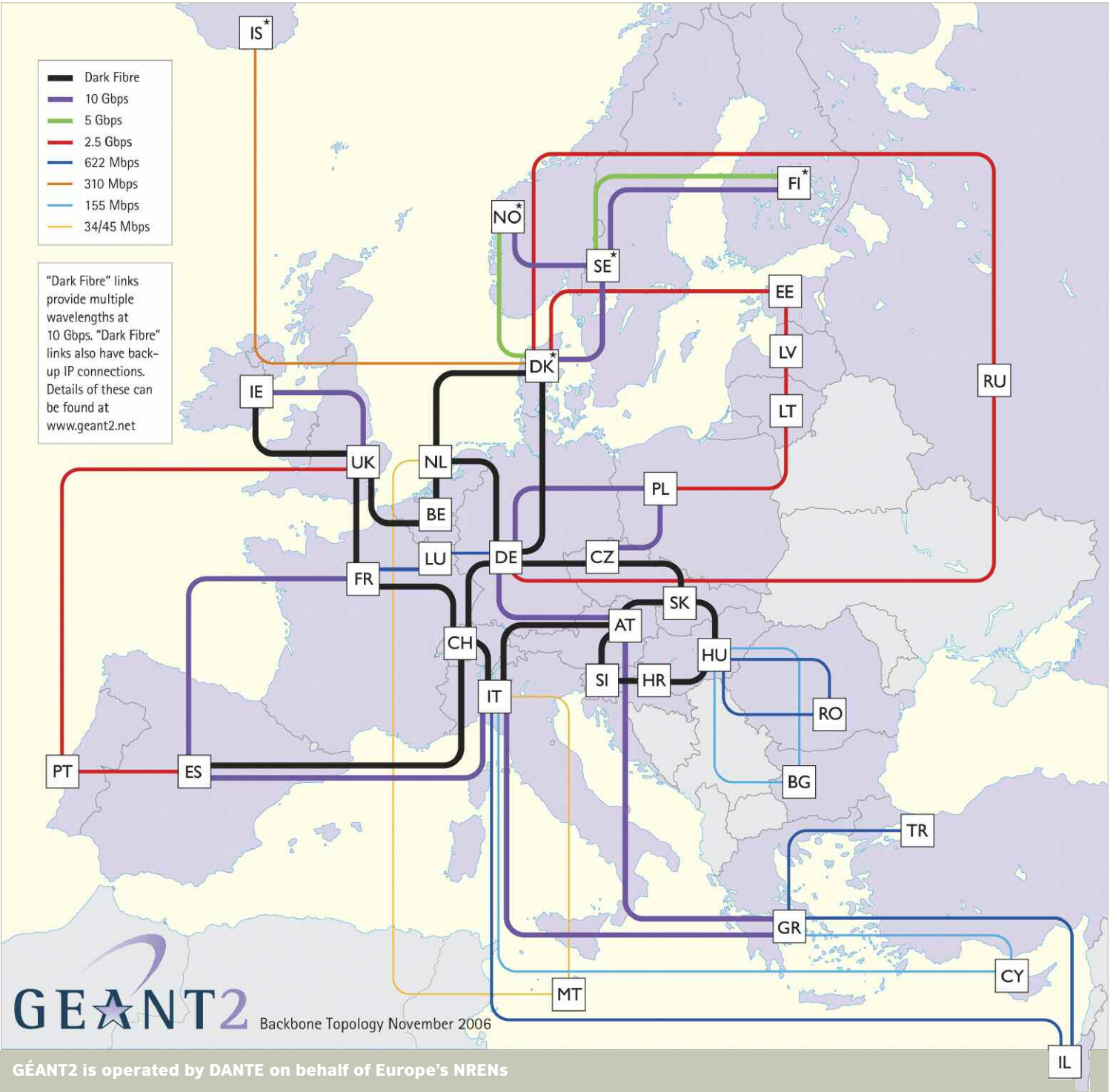
GÉANT2's leading position and role among European infrastructures is widely acknowledged. In the 7th Framework Programme for Research and Technological development (FP7) work programme for 2007, the EU recognises that GÉANT2 is “the fundamental underlying enabler for the realisation of e-Science and the European Research Area. The advanced communication capabilities of GÉANT and the associated NRENs will foster new paradigms of collaborative research across Europe and globally. GÉANT should represent an instantiation of the 'Internet of the future' by making timely use of state-of-the-art communication technologies.”

Leading the field in global research networking

GÉANT2 is a network of networks, connecting 30 European National Research and Education Networks (NRENs) and linking more than 3,500 research and educational establishments in 34 European countries to each other and to regional networks in North America, Latin America, Asia-Pacific, the Mediterranean rim and South Africa. The GÉANT2 network employs sophisticated switching and routing technologies and forms a key component of Europe's strategy to deploy a world leading e-Infrastructure for Science.

Launched in June 2005 GÉANT2 is the world's first international scale, production hybrid network, combining a packet-switched IP service and a data stream-switched point-to-point capability to provide a wide range of advanced networking services to Europe's growing research and academic community.

GÉANT2 is the result of cooperation between the European Commission, DANTE, TERENA (the Trans-European Research and Education Networking Association, DANTE's sister organisation) and 30 of Europe's NRENs (National Research and Education Networks) and has enabled European researchers and academics to collaborate on projects at the forefront of exciting developments in their fields.



GÉANT2 – focusing
on the future

GÉANT2 celebrated its anniversary in June 2006 by reaching a total of 50,000 km of installed network, offering its innovative technology, unrivalled geographical coverage, and high bandwidth capacity to more than 30 million researchers in Europe via its partner NRENs, and as many again around the world. Funding for GÉANT2 is in place at least until August 2008.

Now that the GÉANT2 network is operational, DANTE is focusing greater attention on ensuring that best use is made of these leading edge networking resources. Working in partnership with the NRENs, our research and engineering teams are developing tools and services that help our community and its end users to understand and exploit the full potential of the networks.

The frontline
of technology
– deploying hybrid
networks

GÉANT2 is a hybrid network, designed to switch both data packets and data streams. Combining the two methods in one network is innovative and opens up new service possibilities.

Switching data streams between two defined points on the network enables the creation of paths dedicated to specific users (point-to-point) and carrying only their traffic. This contrasts with the switching of data packets in a conventional IP network and allows extremely large volumes of data to be sent with unparalleled stability and with none of the network congestion characteristic of IP networks. At the same time the network can carry normal IP traffic.

This hybrid technology – never before deployed on such a scale – allows dedicated connections of up to 10 Gbps between distant research centres on an intercontinental scale – all supported by a new system that monitors traffic status across the multiple network domains that connect the centres. GÉANT2 will be able to satisfy demand from data-heavy users, such as CERN's particle physicists, for the high bandwidth, on-demand connections that are vital to major projects.

Point-to-point
– creating optical
private networks

The extension of point-to-point (P2P) services has been a key step forward this year. A basic element of GÉANT2 technology, the effect of P2P is to increase overall network capacity and, therefore, to allow larger amounts of data to be transmitted in a given time than is possible in an IP switched network.

P2P connections guarantee the quality of the connectivity, enabling researchers to handle large quantities of data with stability and security. DANTE reserves paths across the network that create dedicated, high bandwidth links between their defined end points – in essence a private network. P2P services are particularly suited to researchers needing to transmit large volumes of data and are essential to a growing number of data intensive projects, typically in the particle physics and radio astronomy disciplines.

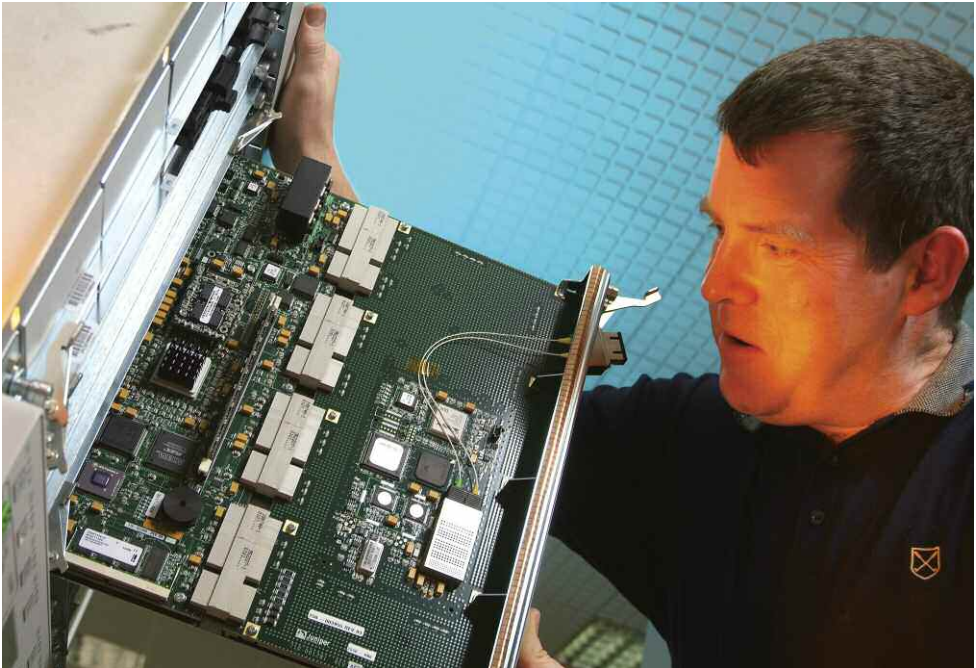
P2P's ability to handle large volumes of data is being exploited by CERN (the European Organisation for Nuclear Research), which is currently building the largest scientific experiment ever undertaken – the Large Hadron Collider (LHC).

Scheduled to go live in early 2008, LHC experiments will create conditions similar to those in the immediate aftermath of the Big Bang and are expected to generate some 15 million gigabytes of data each year. This amount of data is too much for one centre to handle, so it must be distributed immediately and safely to processing centres around the globe for analysis. GÉANT2's P2P technology will allow this to happen quickly and efficiently. In 2006, DANTE also installed the very first transatlantic P2P connection, supporting the work of physicists at Fermilab in the US and IN2P3 in France.

Looking ahead – end-to-end
co-ordination

Co-ordinating the monitoring of dedicated circuits creates new challenges since each end-point may lie in a different NREN, each having its own approach to monitoring, troubleshooting and liaison with its providers. With NREN support, DANTE will oversee the creation of a GÉANT2 End-to-End Co-ordination Unit (E2ECU) in 2007 to monitor E2E circuits, enabling NRENs to concentrate on their own networks while providing users with stability for their international data transfers.





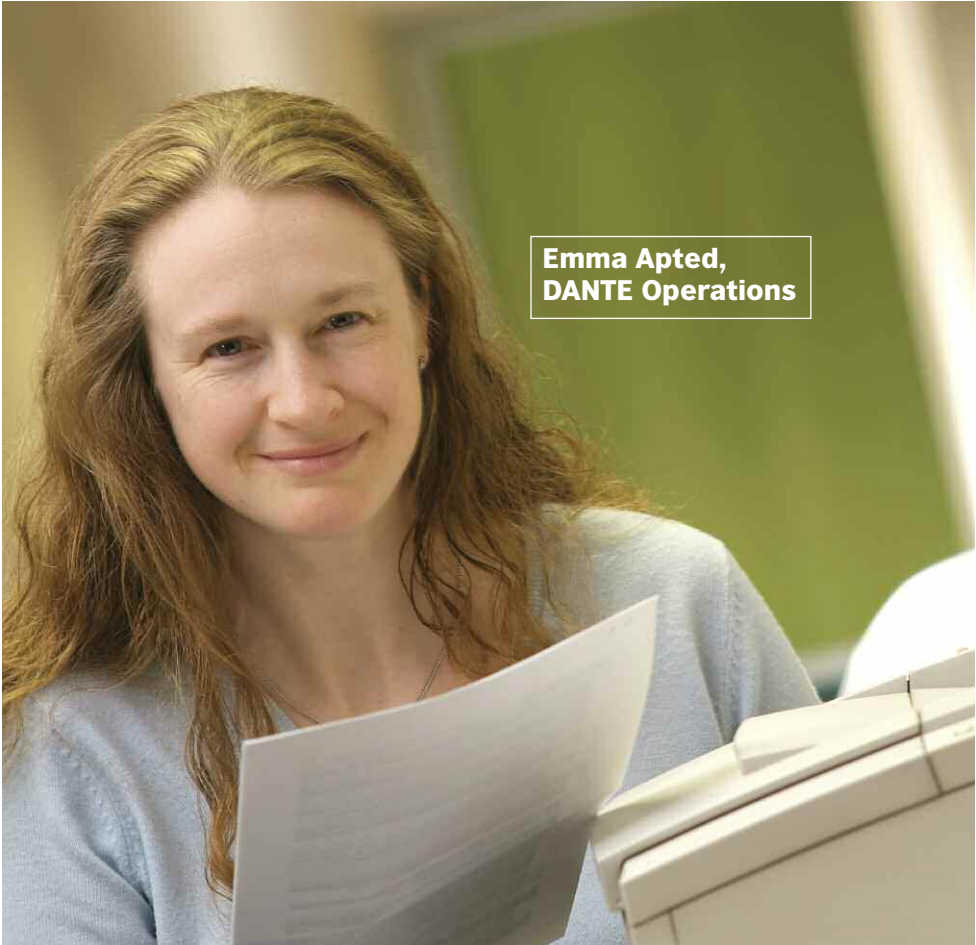
Paul Cullen, DANTE Operations

### DANTE in action – Top of the PoPs

Paul Cullen is the network engineering specialist who looks after DANTE's PoPs – the 32 Points of Presence across Europe that provide NRENs with connectivity to the GÉANT2 network. This is a hands-on role, for which Paul's background as a network engineer – for several blue-chip financial institutions, service providers and equipment manufacturers – is invaluable.

Paul is responsible for planning and project managing elective upgrades to PoPs, either in response to changes in service requirements, or as part of a programme of routine equipment upgrade. Even this work is much more than a desk-job though. Beyond designing, planning and ordering for an upgrade, the work of commissioning will begin with Paul pre-configuring delivered equipment in the labs at DANTE's Cambridge HQ and assembling the kit-of-parts that will be needed for the field installation. A short while after that, he will be found somewhere in Europe, on-site with his sleeves rolled up, either supervising electrical power or installation engineers (whose work-packages he himself will have defined), or personally carrying out some of the trickier engineering tasks, not infrequently on his hands and knees.

Although he is usually personally involved with major upgrades, there is far too much routine work taking place keeping PoPs at the leading edge of communications technology for him to visit every site for every job. In these cases, much of the routine work will be undertaken by 'remote eyes and hands' – so his role includes supervision-at-a-distance of work whose quality he has to assure. DANTE is now replacing the JUNIPER routers that lie at the heart of each PoP as they reach the end of their planned in-service life and this programme will continue in 2007.



Emma Apted,  
DANTE Operations

**Emma Apted joined DANTE in November 2006. Previously working in the commercial sector for Telstra Europe Ltd, she brings over 11 years of IP networking experience and a service-orientated approach to DANTE's Operations team.**

#### What is your role at DANTE?

Much of my current role is focused on helping to establish the first End-to-End Coordination Unit (E2ECU) for the research networking community. The E2E circuits that are now being implemented cross various operational domains, each of which can host a local measurement system. The E2ECU engineers can now watch a monitoring system which uses data gathered from Measurement Points placed in each domain.

#### What are you most looking forward to in 2007?

I'm very pleased to be working on the development of the E2ECU. 2007 will be the year it really gets going with more NRENs and research institutions getting involved, and it's exciting to be a part of something new. Now is also a time of change in the GÉANT2 network itself, with both a connectivity and router tender this year.

#### Who do you work with?

Operations always has a close collaboration with the Network Engineering and Planning team, especially during tenders. I am also liaising with the End to End Monitoring System developers in JRA4 as their tools are essential to making the E2ECU a success. This and software written by the E2ECU, together with the perfSONAR monitoring suite is the communication bridge between all the different domains we are monitoring. I'm also working with engineers from across the NRENs, particularly those involved in the E2ECU but we want more NRENs to come on board! The more partners we have, the greater the range of monitoring information we can offer about the End-to-End circuits.

#### What do you do when you're not at DANTE?

Having moved into a new house with a garden recently, I've taken up gardening with the usual passion of a hopeful if not always successful novice. It's thrilling to pick fresh salad that I've grown from seed and I recently nursed my physalis plant back to life. The next challenge will be a pond for the frogs that keep visiting! I also enjoy making my own bread and going to T'ai Chi Chuan classes.

#### What would you have been in another life?

In another life, I would have been a technical author or trainer, or maybe an interior designer.

### GÉANT2 at a glance

- Network access for more than 30 million users in 34 European countries and an estimated 60 million worldwide
- A network that extends more than 50,000 km providing high speed connectivity, plus Optical Private Networks for Europe's most demanding users
- Direct connections with peer networks in the USA, Canada, North and South Africa, Latin America, Asia-Pacific, the Middle East and, now, China and India
- GÉANT2's comprehensive programme of research and service development keeps Europe at the forefront of global research

### GÉANT2 objectives

Beyond network deployment, GÉANT2's objectives are agreed in consultation with all partners and DANTE manages a number of different networking, service and research activities to achieve these key goals:

- Implement end-to-end Quality of Service provision
- Develop a wider range of network services
- Provide user support and consultancy
- Benchmark and support development of NRENs\*
- Coordinate research and network service activities
- Conduct strategic studies into the future of European research\*
- Disseminate benefits and achievements of the network

\* These activities are led by TERENA, working in close collaboration with GÉANT2 partners

 [www.dante.net](http://www.dante.net)  
[www.geant2.net](http://www.geant2.net)



**“GÉANT2 is a flagship project for the European Commission and a major success story. The innovative and ambitious network will provide the technology and service to support the evolving needs of researchers. GÉANT2 is a fundamental building block of the European Research Area.”**

*Viviane Reding,  
Commissioner for the Information Society  
and Media,  
European Commission*





**“Global challenges require global solutions. DANTE is committed to helping close the digital divide by bringing the benefit of advanced communications technology to regions of the world that do not yet enjoy its huge advantages.”**

*Dai Davies,  
General Manager,  
DANTE*

## GLOBAL REACH

DANTE's role extends far beyond the GÉANT2 network in Europe, delivering transnational connections in other world regions, to bring added value to both European research and to the countries within those regions. DANTE is actively involved with partners in every world region and this section reviews our major activities in Latin America (ALICE), South East Asia (TEIN2), the Mediterranean (EUMEDCONNECT) and North America (DICE), as well as our achievements and progress in extending GÉANT2 connectivity to China and India.



The challenges of global reach

There are many challenges to overcome in extending advanced internet connectivity to new world regions. Different regulatory regimes for communications can throw up obstacles to building, maintaining and extending high capacity networks, for example in countries where telecoms operators have monopolies and can be slow or unresponsive to innovation. These obstacles can also have severe cost implications: in some regions the cost of a 34 Mbps connection can be as much as the cost of a 10 Gbps link in others, making it more expensive for these regions to capitalise on research opportunities.

Geography also makes a difference, as DANTE extends its reach into world regions where inhospitable terrain and extremes of weather make it more difficult to establish and maintain high tech networks than it is in Europe. The implementation of the ORIENT link, the first ever to take the overland trans-Siberian route, demonstrates what can be achieved in less than favourable geographic conditions.

With the support of the European Commission and the NRENs, DANTE is using its experience and expertise to address these difficulties. DANTE is also supporting overseas NRENs as they move to take fuller responsibility for their own networking to develop their own intra-country connections.

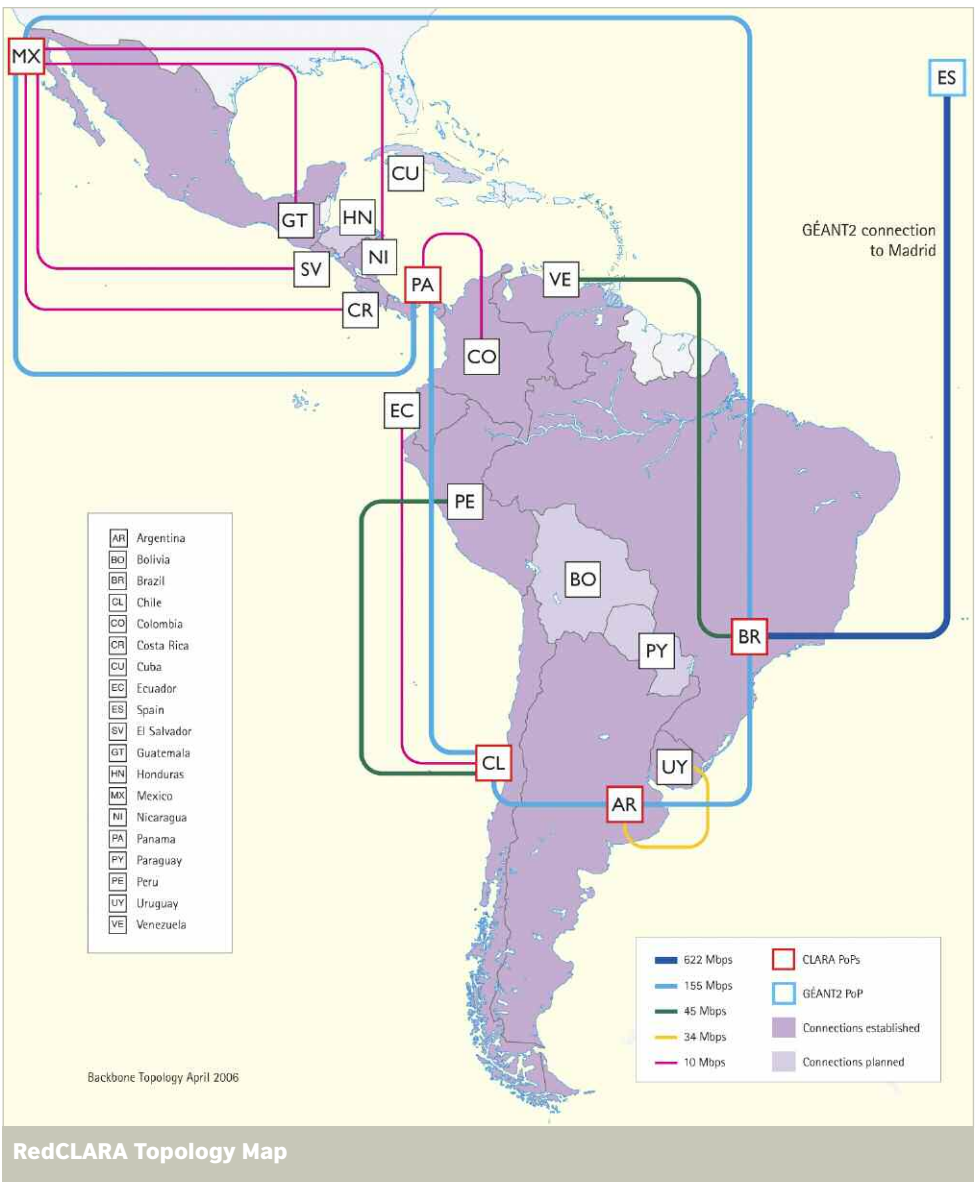
ALICE - reaching to Latin America

- ★ Infrastructure
- ★ Education
- ★ Development

ALICE (America Latina Interconectada Con Europa) is the project responsible for creating RedCLARA – the first regional research and education network for Latin America. RedCLARA connects regional researchers to each other and connects them with their counterparts in Europe and around the world via a connection to GÉANT2. Involving 23 Latin American and European partners, RedCLARA went live in 2004 and has stimulated the development of many NRENs in the region.

Since its launch researchers in 750 universities across 12 Latin American countries have enjoyed the benefits of closer collaboration with their regional colleagues and with European partners through the interconnection of GÉANT2 and RedCLARA. RedCLARA is itself a partnership – between ALICE's regional partners, DANTE, CLARA – Latin America's research networking organisation – and the NRENs of France (RENATER), Italy (GARR), Portugal (FCCN) and Spain (RedIRIS) – with more due to join, including Bolivia's NREN.

Managed by DANTE, ALICE is seen by the EU as one of the projects critical to resolving the digital divide – the gap between the haves and have-nots of the information age. The success of ALICE has been recognised by the EU, which has decided to contribute further co-funding until the end of March 2008, so extending the project and enabling it to continue promoting regional integration. In 2007 CLARA will gain greater independence and take greater responsibility for building a sustainable regional research network community.



If a volcano could sing ...

The ability to predict volcanic eruptions has always eluded mankind. Whilst not solving the age-old problem, the interconnection between GÉANT2 and RedCLARA is helping scientists understand more about volcanic eruptions. The EELA (E-Infrastructure shared between Europe and Latin America) sponsored project collects geophysical information on seismic movements that is translated into audible sound waves and can be 'scored' as music. The 'scores' from different volcanoes can be compared and analysed for similarities that can help volcanologists understand the conditions that precede eruptions and so help in predicting them.

The technique was developed to analyse 'Il gigante buono' – Mount Etna in Sicily – and this year was extended for use on Tungurahua in Ecuador. Scientists in Europe – at the Italian Institute of Nuclear Physics and in the University of Catania – are sharing data over the RedCLARA and GÉANT2 networks using a 622 Mbps transatlantic connection to collaborate with colleagues studying Tungurahua.

**“The firm foundation for research that ALICE has built is demonstrating the benefits of collaboration for global and regional development, benefiting the wider community through initiatives such as monitoring climate change, telemedicine and e-learning. This work is a reference model for those beginning to build research communities in other geographical regions.”**

Antonio Crespo,  
@lis programme co-ordinator,  
European Commission



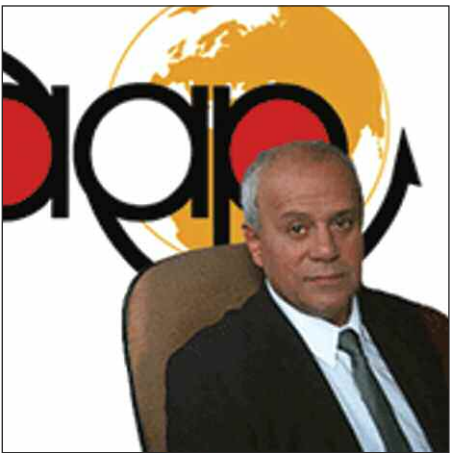
T@lemed - visiting the e-doctor

RedCLARA has demonstrated that it is possible to bring first class healthcare to remote regions of Brazil where small communities can support a local health centre but have no access to specialists. T@lemed uses the power of RedCLARA to bring specialist medical services to these small communities. Installed at the local clinic is portable scanning equipment that can be used to help detect conditions from pregnancy to cancer. And, using Brazil's research network RNP, the local doctor is able to transfer images to a hospital in a regional centre and to discuss the case in real-time with a specialist. Using RedCLARA, the information can be forwarded to other hospitals in Latin America for expert diagnosis.

[www.dante.net](http://www.dante.net)  
[www.redclara.net](http://www.redclara.net)  
[www.eu-eela.org](http://www.eu-eela.org)  
[www.alis-telemed.net](http://www.alis-telemed.net)

**“Since connecting to RedCLARA in April 2005, we have seen significant benefits from collaboration with our colleagues across the region. By working together in areas such as crop science we have been able to contribute to several major regional initiatives.”**

Joaquin Guerrero,  
former President,  
RAAP,  
Peru



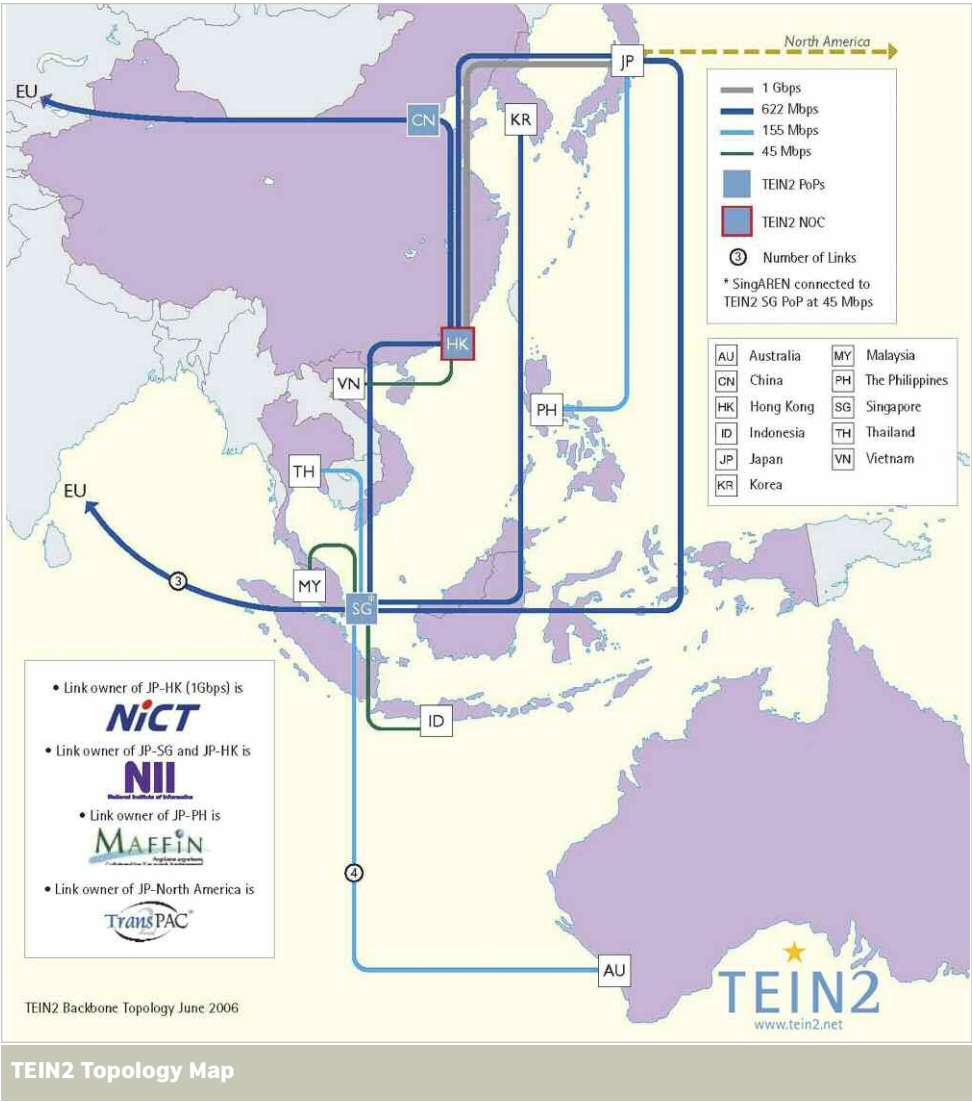


TEIN2 - reaching to the Far East

Connecting East and West

TEIN2 (Trans-Eurasia Information Network) is responsible for extending the expertise of the well-established Asian NRENs – like those of Japan, Korea and China – to countries such as Thailand, Vietnam and the Philippines whose research networking capacity is less well developed. The project has created the first large-scale research and education network for the Asia-Pacific region. It connects regional researchers with each other and with their counterparts in Europe via GÉANT2, providing a gateway for global research collaboration.

Initiated in 2004, in operation in early 2006 and funded until 2008, the TEIN2 network is managed by DANTE, working in collaboration with regional partners and the European NRENs of France (RENATER), the Netherlands (SURFnet) the United Kingdom (UKERNA) and Australia. As well as funding from the EU, TEIN2 also receives support from Japan, Korea, Singapore and Australia.



“TEIN2 represents a substantial ASEM effort that we are proud to have been involved with since its inception at the ASEM 3 Summit in Seoul in 2000. The network has clearly demonstrated the positive benefits it brings to the region. Extending it further across Asia can only be a good thing, and I look forward to collaborating with additional countries using TEIN2 and GÉANT2.”

His Excellency,  
Mr Rho Jun-hyong,  
Korean Minister for Information  
and Communication



“Collaboration between Europe and Asia is increasingly critical to solving global issues, such as climate change and health threats.”

Benita Ferrero-Waldner,  
EU Commissioner for  
External Relations

“TEIN2 validates the European Union’s strategy for promoting global connectivity by supporting a regional backbone and interconnecting it to GÉANT2, linking Asia-Pacific to Europe and beyond.”

Geoffrey Barrett,  
ASEM Coordinator of the  
European Commission



TEIN2 surgical training

Launched at the Asia-Europe Meeting (ASEM) in September 2006, TEIN2 is another demonstration of DANTE’s ability to deploy regional networks based on the European model of co-operation. Linking the national networks of ten countries – China, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Thailand, Vietnam and Australia – TEIN2 is transferring expertise and extending the benefits of research networking to large parts of Asia. The collaboration is another example of how high-speed networks are helping to create an effective global research community.

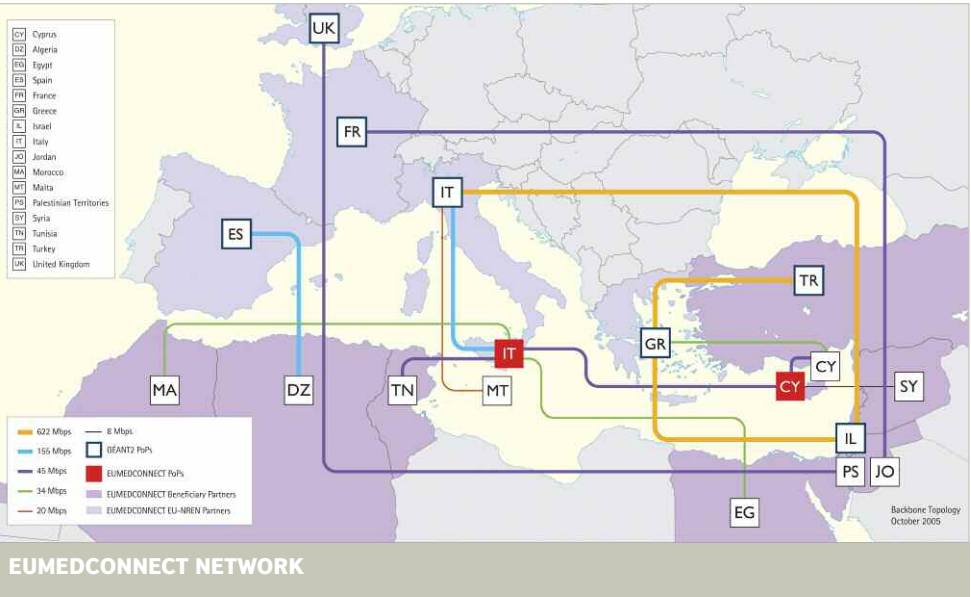
- Teleconsultations between the Royal Children’s Hospital in Melbourne, Australia and the National Children’s Hospital in Hanoi, Vietnam
- Medical education services including streaming high quality video of live surgery to medical students in classrooms sited remotely
- Disaster warning, oceanographic research and climate modelling studies with earth scientists from across the earthquake-prone regions of Asia-Pacific

With powerful network links now in place, academics in Asia-Pacific have an unparalleled ability to participate in world class collaborative research projects. Many of the applications supported by TEIN2 (Trans-Eurasia Information Network), are of high societal impact, bringing tangible benefits to the general population as well as the scientific community. TEIN2 is already supporting several important collaborations:

**Looking ahead**

Now that TEIN2 is deployed, the priority is to promote its use, to extend further its geographic scope within the region and to ensure its sustainability at least until 2008. To help achieve these objectives, DANTE has appointed a full-time consultant to work with the NRENs as a catalyst in the development of international applications.

 [www.tein2.net](http://www.tein2.net)



EUMEDCONNECT - Reaching to the Mediterranean

The EUMEDCONNECT project has created the first research and education network for the Mediterranean region. The 11 project partners – Algeria, Cyprus, Egypt, Israel, Jordan, Malta, Morocco, the Palestinian Territories, Syria, Tunisia and Turkey – are connected and benefiting from an IP network running at speeds up to 622 Mbps. This infrastructure is helping to reduce the disparities that exist between the Mediterranean and European regions, and increase academic collaboration, effectively extending the European Research Area.

EUMEDCONNECT is co-funded by the European Commission’s EUMEDIS Programme until late 2007. Six of the EUMEDCONNECT partners took the first step towards forming an association of Mediterranean NRENs at a meeting in Rome during September 2006. The ‘Rome Declaration’ was signed by the NRENs of Algeria, Egypt, Jordan, Morocco, the Palestinian Territories and Syria.



**The GeMed Network and the EUMED CANCER project**

The GeMed (Genetic Medicine) Network – hosted and connected by EUMEDCONNECT and supported by the European Genetics Foundation and the EUMEDIS programme – is helping to train health professionals by providing specialised courses and practical workshops online. A network of clinical geneticists is being established to provide mutual help in diagnosing problem cases. The GeMed network also enables testing and comparison of new technologies for the laboratory diagnosis of genetic diseases prevalent in the Mediterranean region.



EUMED CANCER – the Euro-Mediterranean network for Genetic Medicine and Cancer Prevention – is the first major deployment of this approach and encompasses both specialised training of health professionals in line with the European School of Genetic Medicine's approach to Genetic Medicine and Cancer Genetics, and is a response to specific needs raised by countries in the region.

**“Without the access to bandwidth that EUMEDCONNECT provides, sharing research knowledge and expertise was difficult and slow. By enabling easy access to specialist research and training modules and events, EUMEDCONNECT is helping to uplift the understanding and practice of clinicians to the direct benefit of patients throughout the region.”**

*Dr Michele Bianco,  
European Genetics Foundation*



**“GÉANT2's partnership with ERNET is an invaluable step towards the advancement of India's information society. India's ability to communicate and share expertise with researchers in Europe and beyond is a positive step for India's integration into the wider research community and will also help to stem the migration of scientists and students from India.”**

*Dr Gulshan Rai,  
Executive Director,  
ERNET*

**Linking to India**



India's ERNET became the latest NREN to benefit from high-speed global connectivity, as communication links between India and Europe went live in October 2006. DANTE and ERNET co-ordinated work on the 45 Mbps link, facilitated by Telecom Italia in Milan and VSNL in Mumbai which enables universities, and academic and research institutes in India to collaborate on a global level.

**New link stimulates new projects - EUIndiaGrid**

ERNET's partnership with GÉANT2 has given rise to the EUIndiaGrid initiative, a consortium of Italian, Indian and British research and industrial partners that aims to develop the current Indian grid infrastructure to the point where it is interoperable with Europe's peer grid project, EGEE (the Enabling Grid for E-Science). The link is already being used for collaborative research with CERN connecting directly to the Tata Institute of Fundamental Research in Mumbai to transfer huge volumes of experimental data.

**Linking to China**



We reported last year on our groundbreaking work to foster closer collaboration with researchers in China and are proud this year to have created the first direct link through the ORIENT project (Oriental Research Infrastructure to European Networks). Whilst China is also a member of the TEIN2 consortium, the ORIENT link offers the highest bandwidth direct connection between China and Europe. ORIENT is a networking first –deploying the first ever overland trans-Siberian connection between China and the West.

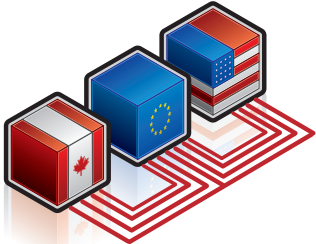
Collaborative work funded jointly from China and Europe has lead to the installation of a 2.5 Gbps direct link between the two regions. ORIENT now connects GÉANT2 with the Chinese research and education community and is the product of collaboration between the EU, DANTE, the Chinese NREN CERNET and six European NRENs.

Several important scientific programmes are already taking advantage of the expansion in global research capability brought about by the new link. These include work in the fields of radio astronomy, meteorology, high energy physics and cosmic ray detection. The EUChinaGrid – China's e-Science grid computing project – also expects to gain from being able to work with its counterparts around the world.



**North America**

DANTE has strengthened its long established relationships with its partners in North America with the formation of DICE (DANTE, Internet2, CANARIE and ESnet). The partnership has contributed extensively to research activities on network performance monitoring and reviews configuration plans for GÉANT2's interconnections to North America, making it a fully integrated part of the global research community. Currently there are four 10 Gbps connections spanning the Atlantic. Amsterdam, London and Paris all connected to New York, and an additional link connects Frankfurt and Washington. These connect to the GÉANT2 PoP in New York with onward connectivity to the Abilene Network, to ESnet and to CANARIE in Canada.



Internet2 – the US equivalent of DANTE – is following GÉANT2's lead in the deployment of a hybrid network with dark fibre, an initiative that will further strengthen US-EU research potential.

**Africa**



GÉANT2 has been connected to South Africa's Tertiary Education Network (TENET) since 2004 via its London PoP. EUMEDCONNECT's connection to GÉANT2 has now altered the landscape for research networking in countries in North Africa. Momentum is building behind initiatives to improve connectivity in southern and eastern Africa too. GÉANT2 has recently reached agreement with the UbuntuNet Alliance – an association of African NRENs – for a similar approach to TENET, connecting to GÉANT2 from a new UbuntuNet router to be located in London. Research networking in Africa has only recently begun to be addressed in a concerted manner and efforts are focused on how to address the connectivity needs of other parts of the continent.



**David West has been with DANTE for six years, supporting the development of regional research networks in the Mediterranean and North Africa and in Asia and their connection to GÉANT2.**

**What is your role at DANTE?**  
My role is to help research networking develop in key parts of the world and gives me the chance to make a real difference. I manage the EUMEDCONNECT programme which links NRENs in North Africa and the Middle East to each other and to Europe's research networks, and TEIN2, which connects both developed and developing countries in East Asia. My job is whatever is required – sometimes I'm dealing with technical issues or administrative work, but more often I'm acting as a commercial negotiator with suppliers or as a diplomat, bringing different people together in a common cause.

**What was your highlight of 2006?**  
The key success was working on the promotional programme for TEIN2, which has been recognised and applauded by Heads of State and Ministers in both Europe and Asia as a major success and a project that they should continue to support.

**Who do you work with?**  
I work with an amazing microcosm of world cultures and experiences but we all share a common purpose in making the world more accessible for researchers, academics and students.

**What do you do when you're not at DANTE?**  
I spend time trying to control nature – working dutifully to tame my beautiful but wild garden. This can be both tiring and thirsty work and it is fortunate that there is a local English country pub nearby.

**What would you have been in another life?**  
In another life I'd have been a guitarist in a famous rock and roll band.





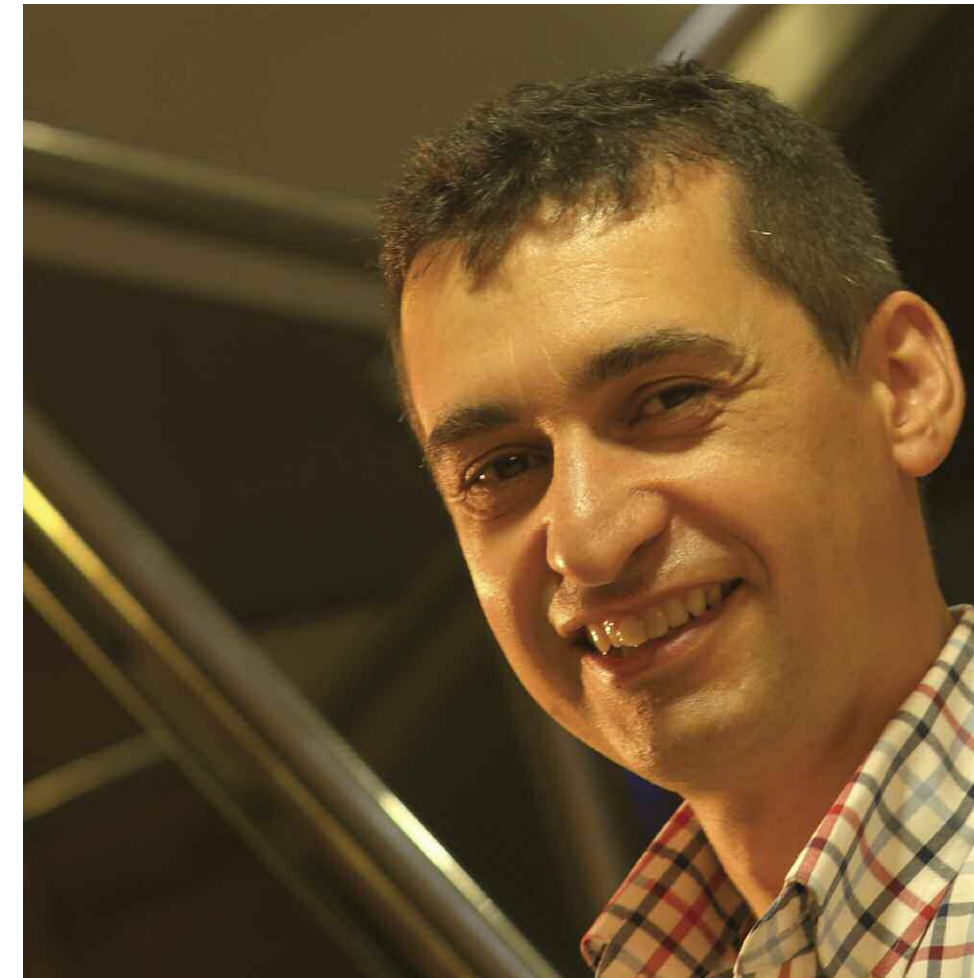
Rachael Beale

Karin Bane

Hayley Martin

Xavier Martin Rivas

Maurizio Molina



## WORLD CLASS ENGINEERING

“Delivering tomorrow’s networking technology relies on world-class engineering expertise. DANTE’s international engineering team generates groundbreaking research results. Transition to service – turning leading-edge lab solutions into leading-edge user services – is just as great a challenge and one we take very seriously indeed.”

*Roberto Sabatino,  
Chief Technical Officer,  
DANTE*



# The GÉANT2 joint research programme

As well as designing, deploying and maintaining GÉANT2 and other networks, DANTE and the NRENS together run a joint programme of research and development that takes new networking technologies all the way from concept to service. This programme is at the forefront of research in advanced communications technology, generally well in advance of the marketplace, and helps foster a culture of co-operation between the NRENS. Carefully structured and user-centred, the research programme is designed to deliver the tools engineers need to get the most from working with GÉANT2.

The results of this research would count for little if they remained on the test bench. DANTE puts considerable effort into 'transition to service' – delivering research activities from the labs to the users and ensuring they understand and can use the new tools. Transition to service is as important as the research itself, not just for GÉANT2 in Europe, but also across DANTE's other regional networks.

## Joint research activities

The current joint research activity (JRA) programme concentrates particularly on extending advanced services across the GÉANT2 and NREN networks and the following summaries cover the activities of each of the joint research teams.

## Network performance measurement and monitoring

Analysing performance in global research networks is complex. Any single path between two end points might run through a variety of domains – university networks, backbone and national networks as well as GÉANT2. And there could be an even wider range of policies, monitoring tools and network information collection methods in use, creating confusion rather than clarity when investigating faults and other network performance issues.

This research activity is developing a solution. Using network-independent tools, it collects a wider set of performance data and network management information that presents data tailored to the user and can be used by NRENS, the Performance Enhancement and Response Team (PERT) and high-volume users to monitor network performance.

For more information on the PERT, please see the Customer Focus section.

## perfSONAR

The result of the research into network measurement and monitoring is the perfSONAR suite of software and tools. DANTE and GÉANT2 engineers have been founding partners in this worldwide collaboration, building and deploying an inter-domain infrastructure to make network monitoring more transparent and more user friendly.

# perfSONAR

Individual networks use their own tools for routine performance monitoring and perfSONAR acts as an intermediate software layer between these tools and the diagnostic applications utilising the data collected. perfSONAR is deployed worldwide with implementations in Europe, Latin America and the US, and regular workshops and development courses bring together engineers from across the NRENS. The collaboration is now creating training and deployment programmes – to give guidance and advice to those NRENS wishing to install perfSONAR within their own domains.



perfSONAR training session

## DANTE in Action – training the trainers on perfSONAR

The first GÉANT2 training workshop was held at DFN's (the German NREN) offices in Berlin. The aim of the event was to train an initial group of potential trainers, and also to carry out important beta testing of the training materials and course, which will deliver practical training in the perfSONAR suite of network monitoring tools.

The three-day course was designed to support the perfSONAR pilot programme, and to equip participants with the knowledge and high quality course materials that they will need to cascade user training on the installation and use of the perfSONAR suite. The success of the course was due to solid collaboration between TERENA, DANTE and the participating NREN partners.

## Network security

In an online world, network security is of paramount importance. The security research activity focuses on enabling GÉANT2 and the NRENS to take a more proactive and co-operative approach to security, in line with the 'end-to-end' philosophy that characterises research networking. The key elements are:

- Securing GÉANT2 network elements through design and implementation of recommended access and usage policies
- Building proactive security services, such as events databases, anomaly detection and mitigation of denial-of-service attacks
- Drawing up a proposal for a common approach and processes for co-ordinating responses to security issues

The user community is strongly involved in this work to ensure that the toolset will reflect the unique multi-domain, multi-managed environment that research networks operate within.

## Bandwidth on demand – creating AutoBAHNs for research traffic

Dedicated capacity is now offered within GÉANT2 via point-to-point connections. Taking this concept a stage further is AutoBAHN, the research activity looking at "Bandwidth on Demand". "Bandwidth on Demand" services aim to deliver truly flexible networking where users can automatically reserve the bandwidth they need, as and when they need it. AutoBAHN aims to engineer, automate and streamline the setup of dedicated capacity end-to-end paths, in a multi-domain, multi-technology environment, like the NREN community. The potential benefits of this type of service, which gives the user greater control of their networking needs, are huge, but it relies on cross collaboration from across the entire NREN community. Currently, AutoBAHN has been successfully piloted across the GÉANT2 testbed, GRNET (Greece) and HEAnet (Ireland). AutoBAHN will be extended to more NRENS, and a transatlantic trial is being developed with colleagues in North America.

Complementary to AutoBAHN is the Advanced Multi-Domain Provisioning System (AMPS). This aims to expand GEANT2's Premium IP service throughout its connected networks. AMPS will be the inter-domain IP QoS management system where reservations are not made "on demand" but in advance. To ensure scalability, AMPS is distributed, with only one system per participating network, and each system peers with just its neighbours. AMPS has been developed by GRNet, PSNC (Poland) and DANTE. Test instances have been successfully deployed, temporarily, in ESnet in the US. Plans exist for a pilot multi-domain service between France, Slovenia, Lithuania and Ireland.

## Testbed and technology testing

There is little value in devising new tools and techniques if you cannot be sure they will add value rather than complexity or further difficulties. To ensure this is the case for all network elements, this research activity focuses on the development of a testbed to satisfy the need for methodical testing of all the technologies and techniques developed for use with GÉANT2.

Incorporating gigabit IP routers and switches and dense wavelength division multiplexing (DWDM) transmission equipment to match performance of the live network, the testbed provides an effective environment for implementing next-generation architectures.

Although the facility is being built to support development in GÉANT2, it is also available to other projects supported by the EU's Framework Programme.

## Roaming and authorisation

To achieve the vision of a truly open European Research Area, individual researchers need to be able to log on to the network wherever they are working and access their resources, wherever on the network they are located. The goal of this research activity is to create one seamless resource in which the many interconnected networks are invisible to users but where access to confidential project data remains strictly controlled.

The key to achieving this is to build interoperable systems that allow 'roaming access' by verifying users' identities and rights (authentication) and granting access to resources as appropriate (authorisation).

A major output of this research activity is the EduRoam confederation service, a pan-European infrastructure based on authentication at the home institution and authorisation at the visited establishment. Aimed at NREN-based EduRoam federations – the participating NREN constituencies – it will provide network access at any of the federations' sites. Powering this service is EduGAIN –the enabling technology that acts as a bridge between the federations. EduGAIN offers three important elements to users – the trust fabric so that a user can be sure of safe access; the technology to make roaming authentication possible; and the service which authorises a user's rights to access his or her home environment.





# First GÉANT2 technical workshop

In January 2006, the first ever GÉANT2 technical workshop brought some 180 project partner users and engineers together at DANTE's HQ in Cambridge to participate in development workshops and cross-topic discussions. Participants heard status updates from all the research activities and had the chance to discuss achievements and future developments with NREN representatives. Since then, workshops have been held twice a year to encourage cross-collaboration amongst the research activities as new services are developed.

 [www.geant2.net/research](http://www.geant2.net/research)



Peter Webster,  
Training Manager,  
DANTE

**Peter Webster recently joined DANTE as its first dedicated Training Manager, to support the ‘transition to service’ initiative.**

### What is your role at DANTE?

My role at DANTE is to plan, organise and deliver technical training in support of the GÉANT2 project. My particular focus is introducing our NREN partners to the new products, tools and services that the joint research activity teams have produced. This ‘transition to service’ process will help all GÉANT2 users – from NREN specialists to their end users in research and academic institutions across Europe - gain the benefits of the latest network management tools and techniques.

### What are you looking forward to in 2007?

Whilst GÉANT2 was in development, training needs were addressed as they arose. Now GÉANT2 is operational, we need to share best practices and develop a consistency of approach, so 2007 will see the rollout of our first face-to-face training programme. We have already identified ‘perFSONAR installation and use’ and ‘defining standards and processes for PERT’ as topics.

### Who do you work with?

I’m in daily contact with a wide range of people - engineers, research activity leaders and NREN staff – from many different countries and I’ve been really pleasantly surprised to find just how multi-national DANTE is. I also work closely with DANTE’s technical author, Ian Thomson and with a colleague in TERENA, Jim Buddin, who is providing valuable event and logistics expertise and support for the training programme.

### What do you do when you’re not at DANTE?

Two young children make certain I don’t have a chance to get bored but I also make time for music, playing guitar in a duet.

### What would you have been in another life?

I had ambitions to study history but life has its twists and turns – who knows, the opportunity may come again!









**“Our successes are built upon strong collaboration with partners across the international arena. Such cooperation is fundamental to creating a first class service for the research and education community”**

*Hans Döbbeling,  
General Manager,  
DANTE*

## COLLABORATION & COMMUNITY

Scientific research has always involved practical collaboration between scientists working on similar problems in many different parts of the world, but geographical barriers have often hampered the effectiveness of such partnerships. Interconnected national research networks have transformed this picture and are making routine global collaboration an everyday reality.

Stronger scientific collaboration has a parallel amongst the organisations that build and operate research networks. DANTE, the NRENs and their peer organisations around the world are developing strong collaborative links at all levels of their work – at the practical level, the policy level and the promotional level.



Practical collaboration – working together to extend the research community

The GÉANT2 joint research programme

DANTE and the NRENs together run a joint programme of research and development to take advanced networking technologies all the way from concept to service. As well as ensuring that GÉANT2 remains at the forefront of its field, the programme helps promote a culture of co-operation between its participants. For detail of the activities that make up the joint research programme, please see the World Class Engineering section.

TERENA



DANTE's sister organisation is TERENA (Trans-European Research and Education Networking Association). TERENA is the organisation that brings together the European NRENs in a partnership to discuss and resolve the technical issues arising in the development of a high-quality European networking infrastructure. DANTE is an associate member of TERENA and our activities are separate but complementary. Within the GÉANT2 project, TERENA leads the activity concerned with NREN development and support.

SEEREN2



DANTE is a partner in SEEREN2 (South Eastern Europe Research and Education Network), the second generation research and education network serving South East Europe, bringing to the region the benefits of belonging to the European Research Area.

The successor project to SEEREN was launched in 2005. SEEREN2 is led by GRNET (the NREN in Greece) and is a partnership between DANTE, TERENA, NIIF (Hungary), RoEduNet (Romania), ISTF/BREN (Bulgaria), AMREJ and UoM/MREN (Montenegro), MARNET (Macedonia), ASA/INIMA (Albania) and BIHARNET (Bosnia and Herzegovina). SEEREN2 aims to ease the digital divide that still separates most of the south-eastern European countries from the rest of the continent.

Russia

The three Russian NRENs have agreed to form a single representative body to facilitate their participation in GÉANT2. Improving connectivity to Russia and developing eastern European networking is important to DANTE and we are planning to establish a PoP in Moscow to make it easier to connect to the wider Asian research community via our existing trans-Siberian link to China, ORIENT.

Ukraine

DANTE has welcomed URAN (the Ukrainian Research and Academic Network) to the European NREN community as the representative for the Ukraine. URAN is installing a link to Poznan, in Poland, from where they will establish connection with GÉANT2 with an interface supplied by the project. DANTE Chairman Klaus Ullmann wrote to Ukraine's Vice-Premier Minister in February: "It is very encouraging to see that URAN has your support for its activities and for its connection to GÉANT2 ... I am taking steps to open discussions with URAN to find the most effective way to facilitate interconnection and will recommend to the GÉANT2 Policy Committee that URAN is connected as soon as technically possible. I hope that we can make rapid progress in welcoming Ukraine into the European research networking community."

DICE



DICE is a collaborative group covering North America in which DANTE works with three other advanced networking organisations – Internet2 (US) CANARIE (Canada) and ESnet (US). DICE builds on earlier transatlantic co-operation, holding regular technical meetings that provide the opportunity to discuss issues of common interest, helping build a more complete picture of the international context in which research networks operate. Three joint DICE workshops have been held during the year and there is continuing routine collaboration in specific areas within GÉANT2's technical programme.



EARNest meeting (copyright TERENA)

Policy collaboration - helping determine the future of European research networking

EARNest

As part of its work on GÉANT2, DANTE is collaborating on the TERENA-led EARNest Foresight study (Education and Research Networking Evolution Study). Running until October 2007, the project provides inputs for initiatives to help keep European research networking at the forefront of worldwide developments and to enhance the competitiveness of the European Research Area. EARNest is a forum bringing together managers and technical specialists working in European research networking. The study is preparing the ground for the development of the research networking infrastructure beyond GÉANT2 and is looking at researchers' needs and at technical, campus, economic, geographic, organisational and governance issues.

Building the future of research networking DANTE is contributing its expertise to the EARNest study which consists of seven work areas examining:

- **Researchers' needs** – assessing the services users expect from research networks in 5 to 10 years' time and examining the impact of recent developments in infrastructure and services on research in various disciplines
- **Technical issues** – focusing on transmission technologies, control planes, operations and performance, and middleware
- **Campus network issues** – looking at bottlenecks, provision of network services, rolling out IPv6, training network staff and collaborating with other infrastructure providers
- **Economic issues** – examining key trends in the availability and cost of fibre and in national approaches to pricing and cost-sharing
- **Geographic issues** – investigating the impact of overall national and regional policies and priorities with a view to better understanding the challenges
- **Organisational and governance issues** – suggesting improvements in the planning and delivery of new services
- **Other users' needs** – analysing in greater depth user groups outside research and education – their needs and how NRENs respond



CERN's Large Hadron Collider (copyright CERN)

DANTE in Action – collaboration with CERN

CERN's Large Hadron Collider is the largest scientific instrument on the planet and its core experiment is the largest undertaken in the history of scientific endeavour, expected to produce around 15 million gigabytes of data every year. Handling this amount of data – analysing, archiving and making it all available to around 5000 researchers in some 500 institutes worldwide – is a gigantic undertaking, requiring in the order of 100,000 CPUs. The LHC Computing Project has chosen an innovative globally distributed model for the task – a computing grid.

The entire enterprise rests on the ability of the research networking community to provide the necessary bandwidth, as well as the support and security that LHC needs. DANTE is a key player in this worldwide collaboration, and is responsible for the operation and implementation of the LHC Optical Private Network (OPN).

The network topology supporting the LHC Computing Project brings together 12 NRENs as first tier distribution points (two in the US, and one in each of Taiwan, Switzerland, Italy, France, Germany, Holland, Scandinavia, Spain, UK and Canada), and substantially more organisations at lower tiers. The size and complexity of the project is mirrored in the complex collaboration that has been established between the research networking organisations that are essential to its success.

To make this happen effectively requires close working relationships between stakeholders at strategic, technical and operational levels. Key DANTE personnel are involved in a number of long term working groups delivering the capability that CERN needs for the success of the LHC.

Milos Karapandzic, Project Manager, GÉANT2

Milos Karapandzic joined DANTE as project manager on the original GÉANT project and brings continuity, professionalism and depth of experience to managing GÉANT2.

What is your role at DANTE?

My role is to keep the GÉANT2 project on track so I have to maintain an overview of all project activities and progress, including research and development and network build. My personal responsibilities include project-level budgetary and administrative matters and maintaining good working relationships with the European Commission on contracts, contractual amendments and on reporting progress on deliverables.

What was your highlight of 2006?

It was rewarding to see the many years of hard work that DANTE and the European NRENs have invested in GÉANT2 culminate in its recognition as Europe's flagship research e-infrastructure in the FP7 programme.

**Who do you work with?** My key working contacts in the EC are with the recently renamed "E-infrastructures and GÉANT2" unit in the EC's Information Society directorate. I work with managers, engineers and civil servants from across the European networking scene and also act as secretary to the NREN Executive Committee which oversees the project, and to the Policy Committee which discusses emerging network needs, future directions and priorities. Having a clear 'big picture' overview means I can provide useful information, advice and guidance to colleagues on how best to address problems and resolve issues when they arise.

**What do you do when you're not at DANTE?** I'm away travelling, preferably somewhere with sea and sand. Or else I'm playing sports, especially basketball. In quieter moments, I enjoy films and good theatre.

**What would you have been in another life?** My early ambition was to be a marine biologist. Coming from a landlocked country like Serbia, I've always been fascinated by the seas and open oceans.







Simon Watts

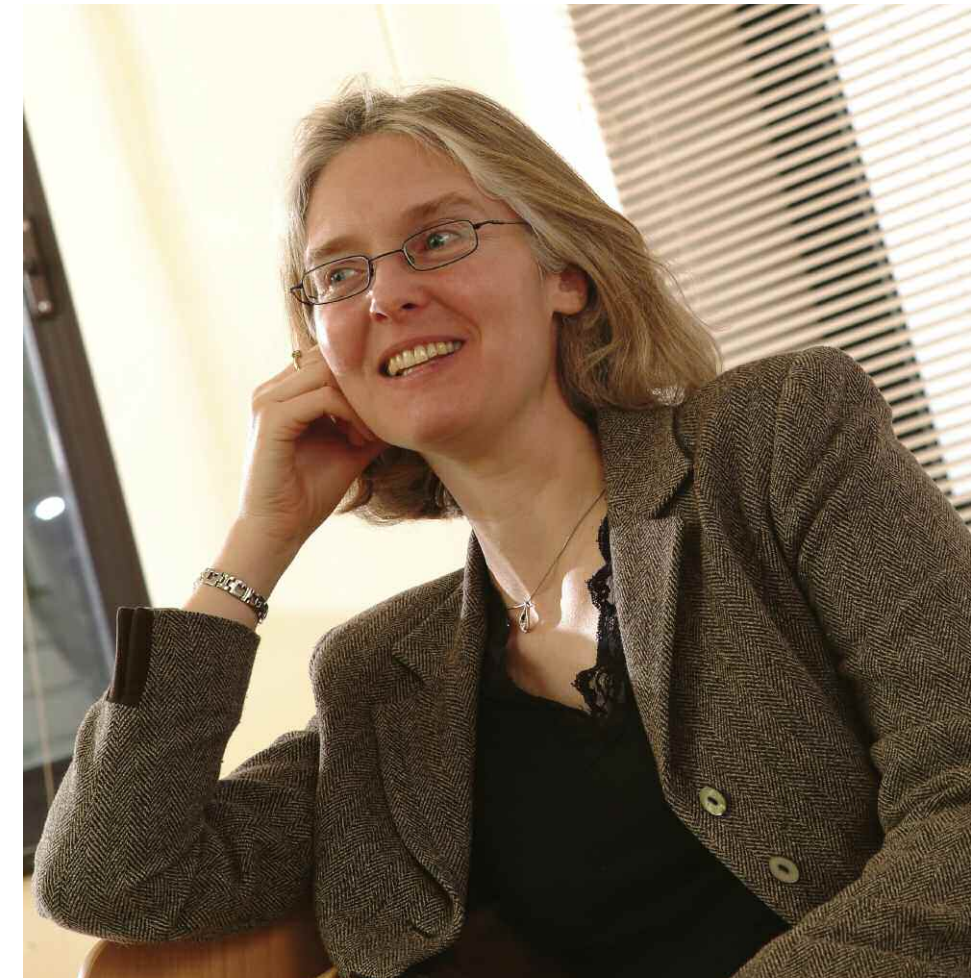
Jean Reynolds

Peter Webster

Loukik Kudarimoti

Anton Antonov

Julie Ball



**“DANTE supplies much more than network connectivity. We are extending our portfolio of services to provide support and guidance for network users, enabling and enhancing their research potential.”**

*Dale Robertson,  
Public Relations Manager,  
DANTE*

## CUSTOMER FOCUS

Delivering networks and connectivity is DANTE's main business but making sure that users can exploit the technologies and also rectify any operational issues that arise are both crucial elements in DANTE's end-to-end service. DANTE offers advice on network solutions and resource management.

Our customer focus is expressed in two main ways. First, through the quality of user support that we offer to both NRENs and academic and research institutions and to major projects. Responsive and helpful user support services help to increase the value partners and users gain from accessing our networks. Second, we seek to raise awareness of our networks, services and activities through the communications and publicity materials that we produce. Good communications help to promote end user uptake of new facilities and to encourage participation in further developments and in research work.



User support services

Performance and Enhancement Response Team

Research networks and the computer end-systems connected to them are distinguished by their high performance and advanced services. The user community expects correspondingly high levels of performance and DANTE has set up a Performance Enhancement and Response Team (PERT) to deal with less than optimum end-system performance on a case by case basis. PERT – a group of network specialists committed to helping users gain the best possible performance from their networking – consists of a rotating team of GÉANT2 case managers enhanced by a pool of specialists drawn from the networking community at large.

Many end-systems are not optimised for Europe's high capacity, long distance networks – fitting a gigabit ethernet card to a computer, for example, does not automatically enable it to facilitate data at that rate. But the reasons – and the solutions – can be quite subtle and need expert intervention to resolve. PERT provides that expertise and is part of DANTE's commitment to helping users get the best possible service from GÉANT2.

DANTE World Service



NRENs connecting to GÉANT2 have connectivity to all other European NRENs, but not necessarily to the public Internet. For a variety of commercial or other reasons, NRENs may not be able to organise their own connections to the Internet and DANTE has established a service that makes this possible. DANTE World Service is based on GÉANT2's connection to two Service Providers with worldwide connectivity – Level3 and Telia – at a total of six interconnection points. Traffic destined for these providers exits GÉANT2 at the closest point to its entry, and return traffic enters GÉANT2 at the closest point to the NREN. Several NRENs connect directly to Level3 and Telia routers on accesses procured by DANTE as part of the overall service.

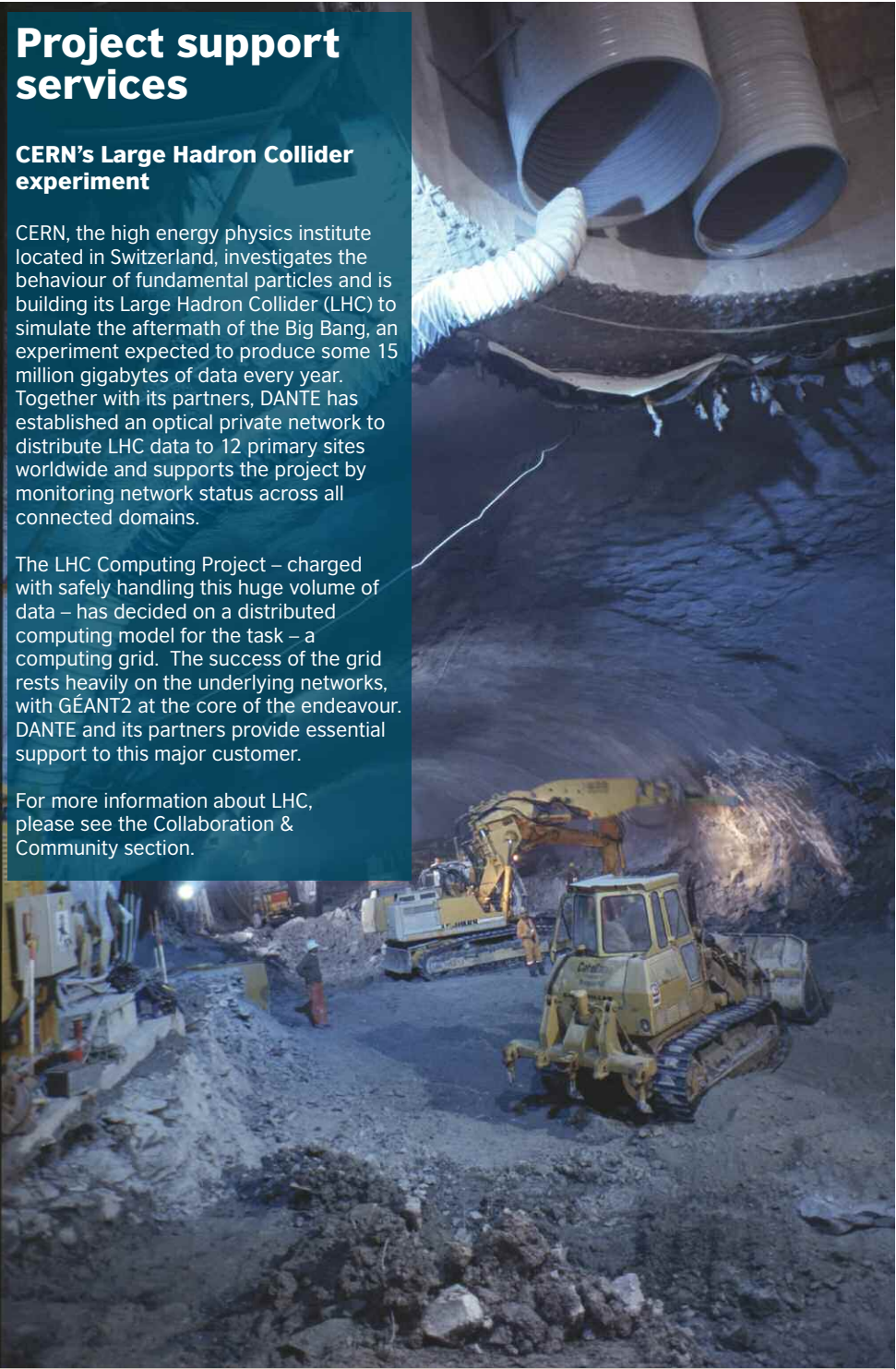
Project support services

CERN's Large Hadron Collider experiment

CERN, the high energy physics institute located in Switzerland, investigates the behaviour of fundamental particles and is building its Large Hadron Collider (LHC) to simulate the aftermath of the Big Bang, an experiment expected to produce some 15 million gigabytes of data every year. Together with its partners, DANTE has established an optical private network to distribute LHC data to 12 primary sites worldwide and supports the project by monitoring network status across all connected domains.

The LHC Computing Project – charged with safely handling this huge volume of data – has decided on a distributed computing model for the task – a computing grid. The success of the grid rests heavily on the underlying networks, with GÉANT2 at the core of the endeavour. DANTE and its partners provide essential support to this major customer.

For more information about LHC, please see the Collaboration & Community section.



Construction of the Large Hadron Collider (copyright CERN)

DEISA

DEISA – Distributed European Infrastructure for Supercomputer Applications – is a production quality, distributed European supercomputing environment running across Europe. It provides leading scientific users with transparent access to a pool of European high performance computing facilities.

DEISA is building a continent-wide supercomputing grid to provide a distributed terascale computing facility. This will be used to power research in areas such as Cosmology, Fusion Research and Environmental Sciences.

DANTE is guaranteeing the GÉANT2 capacity needed for the project and DEISA's ambitious plans are based on the provision of further GÉANT2 dedicated connections running at up to 10 Gbps, the first three of which have been delivered in 2006. The consortium deploys and operates an environment in which the aggregated power of 21,900 processors had reached 145 teraflops by mid-2006.

DEISA's principal activity is to co-ordinate the environment of existing supercomputing power to enable new, ground-breaking applications in computational sciences. Structured as a layer on top of national supercomputing services and coexisting with them, the infrastructure requires coordination between participating supercomputing environments to ensure both efficiency and performance.

The systems that comprise DEISA are interconnected by means of dedicated 10 Gbps links provided by the NRENs and GÉANT2. This network and its powerful bandwidth capacity is crucial to accessing the remote data that each application needs, rather than having to carry the overhead of communications between processes necessary when a single application is distributed on several different computers.



Barcelona Super Computing Centre (copyright BSC)



## e-VLBI

The Electronic Very Long Baseline Interferometry (e-VLBI) network is a collaboration of major radio astronomical institutes in Europe that work together on data collected by an array of European telescopes. GÉANT2 provides network resources to allow rapid data transfers and participates closely in planning discussions with the project.

e-VLBI is a technique that involves the collection of simultaneous observations from a number of telescopes which are then correlated to form very sharp, high-definition images. The e-VLBI network works with similar Asian and South African projects.

The use of GÉANT2 and NRENs in participating countries enables significantly faster processing and correlating of radio telescope data. Data can now be transferred using dedicated gigabit links at near instantaneous speeds allowing data correlation and processing to produce images in near-real time. The European e-VLBI community is one of the first to benefit from this level of service.

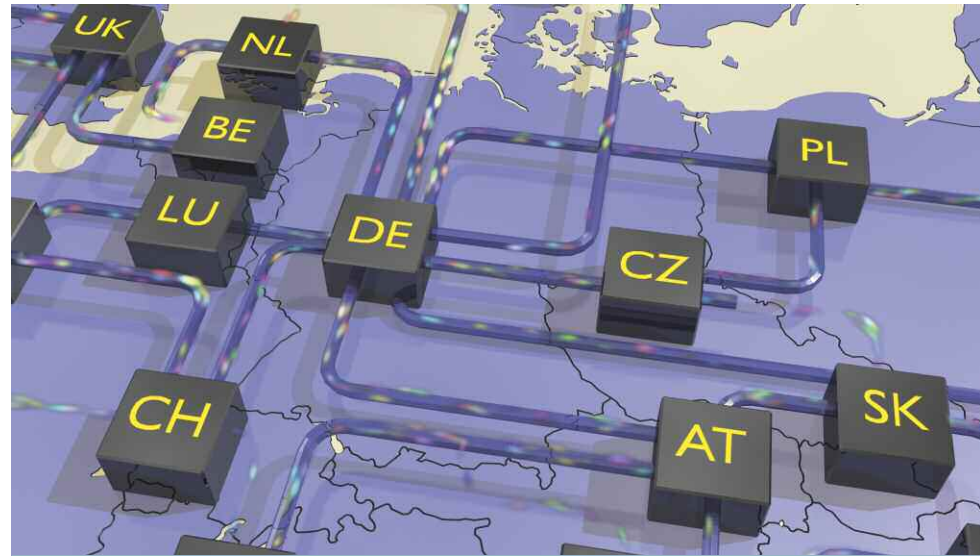


Radio Telescope

## DANTE in action – providing point-to-point services

Different end users and larger scale projects can require additional dedicated bandwidth to support the high data volumes that their research activities generate. DANTE has introduced a new streamlined process to receive new requests for services and progress them efficiently through to provision.

The first step for researchers needing to establish a P2P circuit is for each potential ‘end point’ to discuss requirements with the home NREN. A P2P circuit connects two in-country networks via GÉANT2, so both networks must be involved in the provisioning process. Once the order has been placed a series of technical conversations take place between DANTE and the NRENs to define and confirm the requirements. Upon installation, benchmark and acceptance testing takes place, to ensure the circuit meets end-user requirements. Once in operation, DANTE and the NRENs monitor and maintain the circuit, to deliver optimum performance for Europe’s leading researchers.



## DANTE in action – what are point-to-point services?

The benefits of establishing optical private networks using point-to-point (P2P) services over GÉANT2 are becoming clear to an increasing number of large projects. Our P2P services connect defined end users to each other via their in-country networks and to GÉANT2, providing guaranteed additional bandwidth seamlessly. Two classes of point-to-point service are offered:

- GÉANT+**  
NRENs pre-subscribe to an additional 10Gbps that can be quickly configured or re-configured to meet the needs of up to nine different end users, providing direct connections to different destinations. At additional cost, GÉANT+ can also provide transatlantic P2P connections routed via London or Paris.
- Complete wavelength**  
At a fixed additional cost, DANTE will light dark fibre (installed and as yet unused optical fibre) to provide a dedicated 10Gbps ‘column of light’ between any two countries with fibre connections, giving NRENs and their end users access to vast bandwidth. Further extension of fibre links is envisaged but will be determined by economic and infrastructure needs.



John Chevers,  
Project Manager,  
DANTE

**John Chevers has been with DANTE for almost three years, supporting GÉANT2 projects and the introduction of point-to-point services, and taking the lead on the groundbreaking ORIENT connection between Europe and China.**

parts of the world was a major challenge too. But, as an equal 50/50 partnership, the ORIENT project is different from the other regional networks that DANTE operates. Looking to the future, the circuit will enable up to 20 million end users at more than 2000 universities in China to collaborate with EU researchers.

**Who do you work with?**  
I work with people from across Europe and around the world, depending on the project. I keep in close contact with the Chinese network (CERNET) and with members of the European NREN community, as well as with DANTE’s own engineers and project and PR teams.

**What do you do when you’re not at DANTE?**  
I like to play with old cars and recently took a risk buying a supercharged 1932 MG from Singapore –fortunately it paid off!

**What would you have been in another life?**  
A car designer and engineer in the 1920s, the golden age of motoring – building classic models alongside Ettore Bugatti.

[www.geant2.net/users](http://www.geant2.net/users)  
[www.dante.net/orient](http://www.dante.net/orient)

### The Works of DANTE

**Welcome**

Welcome to the SubnetWise 2006 edition of the Works of DANTE. This edition features a new overview of GÉANT2 connectivity in 2006, an update on the status of the network, and details of ongoing research that is making use of the network. It also features a new overview of the GÉANT2 network in 2006, an update on the status of the network, and details of ongoing research that is making use of the network. It also features a new overview of the GÉANT2 network in 2006, an update on the status of the network, and details of ongoing research that is making use of the network.

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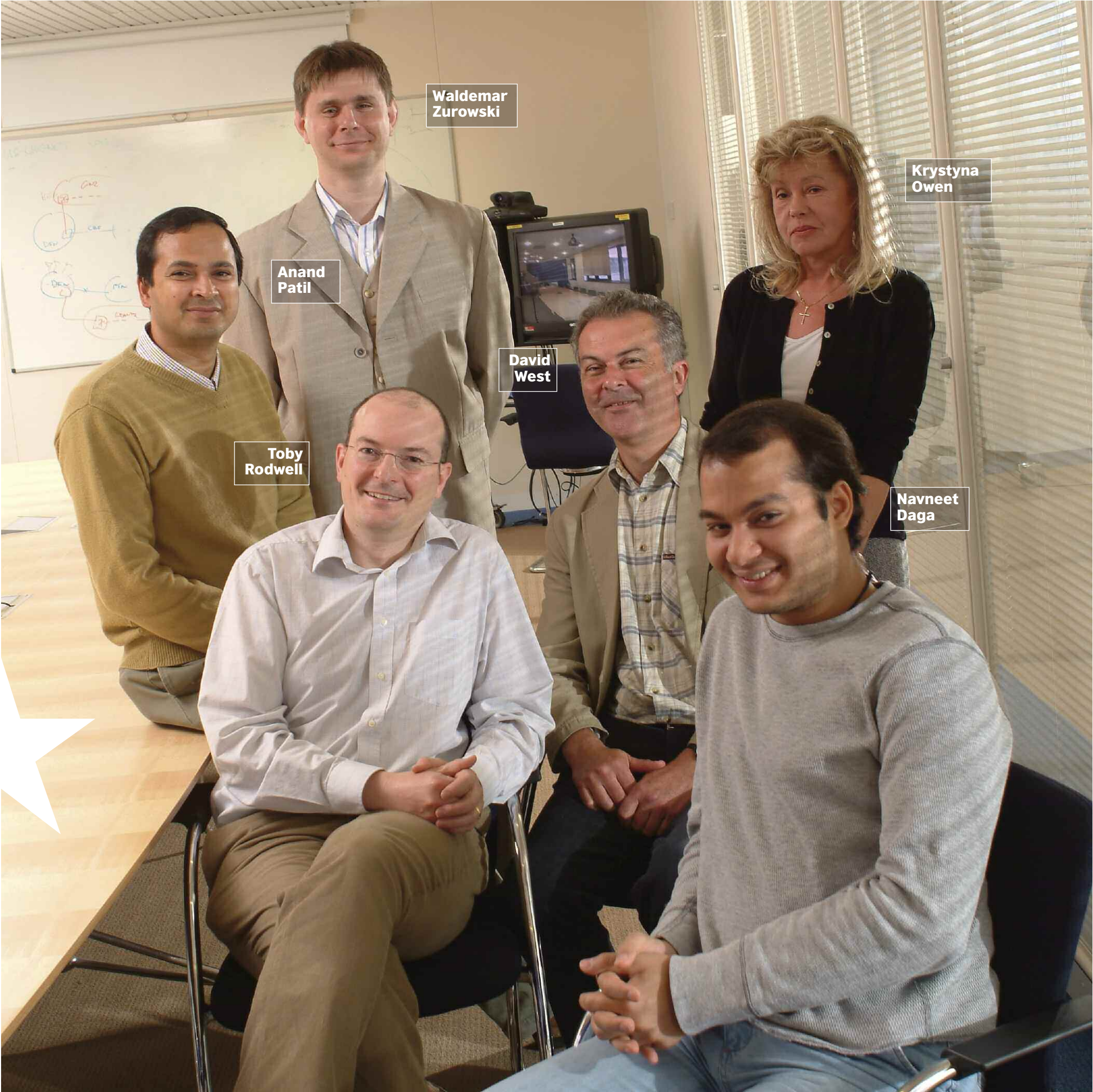
**DANTE**  
www.dante.net

## Disseminating results and information

Our NREN project partners and potential users need to know what services DANTE can and does provide and what each may be able to do for them, their fellow researchers and academics and for their forthcoming projects. DANTE produces a full range of publicity materials including interactive guides, brochures and case studies covering our major projects such as GÉANT2, ALICE, TEIN2, EUMEDCONNECT. DANTE attends conferences and events throughout the world to support its partners and to promote the potential to be gained from research networking across its global networks.

**View the GÉANT2 DVD at**  
[www.geant2.net/dvd](http://www.geant2.net/dvd)





**“DANTE is owned by the NRENs and operates on behalf of the NREN community. Being responsible for managing total annual funding in excess of 55 M€ to pay for the projects' activities under DANTE's supervision, requires robust project and contract management with strong accounting practices and controls. We are proud of our achievements and our reputation as an organisation that delivers.”**

*Matthew Scott,  
Chief Financial Officer,  
DANTE*

**ACCOUNTABILITY**

DANTE aims to work to the highest professional and ethical standards in all its dealings with partners, suppliers, contractors and users and has established a regime of rigorous management processes to secure value for money and fair and transparent trading at every stage.



## Procurement

Commercial procurement is a crucial element in the building and operation of any network, especially one on the scale of GÉANT2. DANTE, as the co-ordinating partner, conducts contractual activity strictly according to EU procurement policies with all work overseen by an evaluation sub-committee of the NREN Policy Committee.

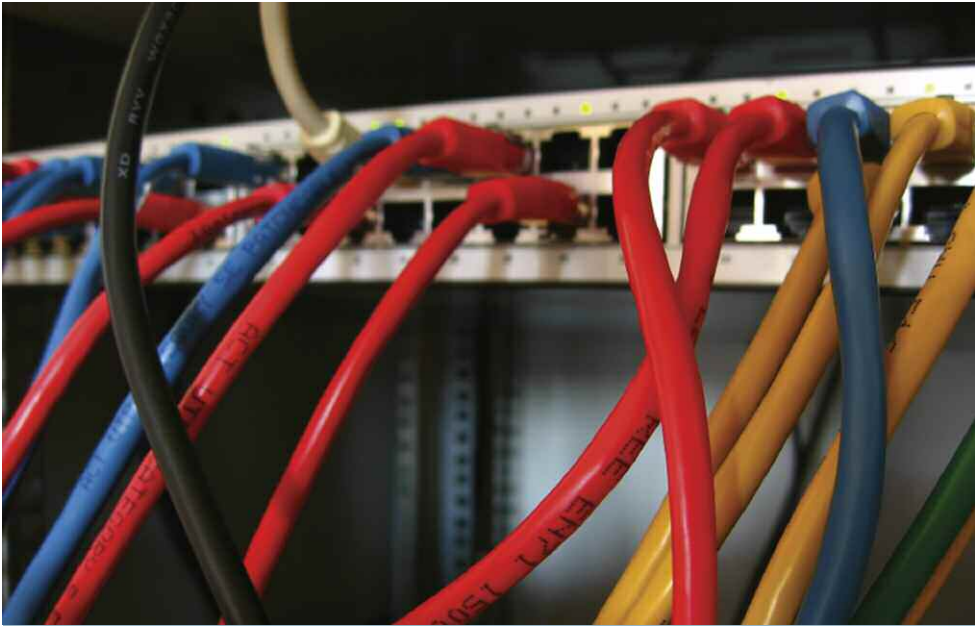
GÉANT2's infrastructure and equipment is leased or purchased according to these established policies. GÉANT2 technologies are at the leading edge of the market and we offer suppliers an attractive opportunity to be involved at the forefront of networking. In terms of scale and reach, GÉANT2 is one of the largest users of dark fibre in Europe. GÉANT2 is built on leased IP circuits and bought-in dark fibre, for which public invitations to tender are published in the Official Journal of the European Commission. Equipment – such as routers or switches – is usually purchased outright and upgraded as advances in services and technologies dictate. For GÉANT2's points of presence we usually lease co-location spaces.

Beyond the initial procurement, DANTE actively manages and continually re-negotiates contracts in response both to user demand and developments in technology.

## Project management

Robust control structures ensure effective and efficient management oversight of DANTE's key project activities:

- **GÉANT2 NREN Policy Committee**  
– consists of representatives from each project partner, meets three times a year and is responsible for setting and overseeing overall policy
- **GÉANT2 Executive Committee**  
– appointed by the Policy Committee and is responsible for preparing the yearly work programme and for quality assurance
- **Project Co-ordination** - DANTE is the overall project co-ordinator and
  - provides overall project management and co-ordination
  - manages project finances and administration
  - formally reports progress and deliverables to the EC
  - is responsible for public relations and for overall communications between the project and the EC
- **Technical Management**  
– technical activity leaders directly manage the technical work of the project, overseen by the Technical Committee. It is chaired by DANTE's Chief Technical Officer, Roberto Sabatino, and consists of the activity leaders of:
  - The research and development programme
  - The task forces responsible for co-ordination of research and development initiatives
  - The multi-domain support services



### DANTE in action – procuring network equipment

Since its foundation in 1993, DANTE has procured six generations of pan-European research networks and links, giving the organisation an unrivalled depth of experience in negotiating successfully with equipment vendors and communication service providers. All procurement activities are organised and managed in line with EU public procurement rules.

DANTE has earned its status as the recognised international expert in procuring the range of telecommunications equipment and services that go to make up leading edge networks like GÉANT2 and the regional networks we have built and continue to manage, like ALICE and TEIN2.

Our procurement activity covers the purchase of:

- core transmission capacity
- transmission, routing and switching equipment
- dark fibre
- housing for points of presence
- maintenance contracts for all of the above
- a network operations service capability

In all this activity, we achieve and demonstrate value for money, stimulating demand for our services from peer organisations around the world for whom we are the acknowledged choice for the purchase and implementation of advanced networking capability.



Peter Nancollis ,  
Project Accountant,  
DANTE

### Peter Nancollis provides robust financial support to key DANTE projects and accounting advice and guidance to project partners to ensure full compliance with rigorous European Commission standards.

#### What is your role at DANTE?

My role is to look after the accounts for three projects – ALICE, TEIN2 and EUMEDCONNECT. I oversee accounting at the project level with NREN and regional partners and compile all required financial reports for the European Commission. My work also involves forward planning of budgets, working with the project managers, my colleagues in DANTE and contacts in the EC. As part of the DANTE Finance team I look after the purchase ledger, ensuring that invoices are correct and in accordance with contracts and purchase orders and that due credits are received.

#### What was your highlight of 2006?

The way we maintained accurate accounting during a lengthy period of heavy workload - generated by the introduction of new circuits and setting up in-house accounting controls. The three day visit by Mark Urban, head of finance for the CLARA project to see how DANTE operates was also an enjoyable change.

#### Who do you work with?

I work with a wide variety of people from officials at the European Commission to suppliers and engineers in the Far East, the Mediterranean and South America. I also work closely with colleagues at DANTE, including liaising with the Operations team on transactions with suppliers.

#### What do you do when you're not at DANTE?

I like to take things easy so you'll find me in the garden or the greenhouse ... or less often, watching the wake from the back of the SS Oriana, enjoying the setting sun with a long cool drink.

#### What would you have been in another life?

A Customs and Excise Officer.





## 2006 Financial Statements

**Directors**  
J Boland  
T Brunner  
J Gruntorad  
I Marie  
K Ullmann

**Secretary**  
M J Scott

**Auditors**  
Ernst & Young LLP  
Compass House  
80 Newmarket Road  
Cambridge  
CB5 8DZ

**Bankers**  
Barclays Bank plc  
Bene't Street Branch  
P.O. Box 2  
Cambridge  
CB2 3PZ

**Solicitors**  
Manches  
9400 Garsington Road  
Oxford Business Park  
Oxford  
OX4 2HN

**Registered Office**  
9400 Garsington Road  
Oxford Business Park  
Oxford  
OX4 2HN

## 2006 Report and Financial Statement

### Income and Expenditure Account For the year ended 31 December 2006

The full financial statements, directors' report and auditors' report are included in a separate document entitled DANTE Annual Report and Accounts 2006. This is available online at [www.dante.net](http://www.dante.net)

	2006 € '000	2005 € '000
<b>Turnover</b>	55,820	46,683
Cost of sales	52,200	43,183
<b>Gross Surplus</b>	3,620	3,500
Administrative expenses	(3,953)	(3,824)
Foreign exchange loss	(31)	(62)
<b>Operating Deficit</b>	(364)	(386)
Interest receivable	431	355
<b>Surplus/(deficit) on ordinary activities before taxation</b>	67	(31)
Tax on surplus/(deficit) on ordinary activities	2	63
<b>Surplus on ordinary activities after taxation</b>	69	32

There are no recognised gains or losses which have not been reflected in the above results for the current or prior period.  
The above results are from continuing activities.



BalanceSheet  
As at 31 December 2006

	2006 € '000	2005 € '000
<b>Fixed Assets</b>		
Tangible assets	9,410	7,827
<b>Current Assets</b>		
Debtors	15,252	18,090
Cash at bank and in hand	18,583	56,156
	33,835	74,246
<b>Creditors:</b> amounts falling due within one year	35,887	74,782
<b>Net Current Liabilities</b>	(2,052)	(536)
<b>Total Assets Less Current Liabilities</b>	7,358	7,291
<b>Provisions For Liabilities and Charges</b>		
Deferred taxation	350	352
	7,008	6,939
<b>Capital and Reserves</b>		
Called up share capital	1,576	1,576
Capital contributions	35	35
Income and expenditure account	5,397	5,328
<b>Total Shareholders' Funds</b>	7,008	6,939

K Ullmann  
Director  
26 June 2007

Statement of Cash Flows  
For year ended 31 December 2006

	2006 € '000	2005 € '000
<b>Net Cash (Outflow)/Inflow From Operating Activities</b>	(31,160)	19,238
<b>Returns on Investments and Servicing of Finance</b>	431	355
<b>Taxation</b>	(471)	(4)
<b>Capital Expenditure and Financial Investment</b>	(6,365)	(5,934)
<b>Management of Liquid Resources</b>	32,115	(7,947)
<b>(Decrease)/Increase in Cash</b>	(5,450)	5,708

DANTE Shareholders

Organisation	Country	No of shares
ARIADNET	Greece	22,000
ARNES	Slovenia	22,000
CESNET	Czech Republic	22,000
DFN	Germany	165,000
FCCN	Portugal	22,000
GARR	Italy	165,000
HEAnet	Ireland	22,000
HEFC-E on behalf of JISC (UKERNA/JANET)	United Kingdom	165,000
HUNGARNET	Hungary	22,000
NORDUnet	Nordic Countries (Denmark, Finland, Iceland Norway, Sweden)	82,500
RedIRIS	Spain	55,000
RENATER	France	165,000
RESTENA	Luxembourg	22,000
SURFnet	Netherlands	110,000
SWITCH	Switzerland	110,000

DANTE Staff  
(as of April 2007)

Name	Job title	Country
Dai Davies	General Manager	UK
Hans Döbbeling	General Manager	DE
Anton Antonov	Systems Administrator	RU
Emma Apted	Network Engineer	UK
Julie Ball	Accounts Assistant	UK
Karin Bane	Secretary/Administrator	UK
Rachael Beale	Webmaster	UK
John Chevers	Project Manager	UK
Paul Cullen	Network Engineer	UK
Kim Cunningham	Public Relations Officer (maternity cover)	UK
Navneet Daga	Network Engineer	IN
Michael Enrico	Network Engineering and Planning Manager	UK
Marian Garcia Vidondo	Operations Manager	ES
Alex Gosnell	Projects Administrator	UK
Milos Karapandzic	Project Manager	CS
Ruth Kirkman	Public Relations Manager (maternity cover)	UK
Otto Kreiter	Network Engineer	RO
Loukik Kudarimoti	Network Engineer	IN
Sam Kyakilika	Network Engineer	ZA
Janet Lipski	Secretary/Administrator	UK
Hayley Martin	Public Relations Assistant	UK
Xavier Martin Rivas	Network Engineer	FR
Maurizio Molina	Network Engineer	IT
Peter Nancollis	Project Accountant	UK
Krystyna Owen	Project Accountant	UK
Anand Patil	Head of Systems	IN
Simon Pauley	Webmaster (maternity cover)	UK
Jean Reynolds	Secretary/Administrator (part-time)	UK
Guy Roberts	Network Engineer	AU
Dale Robertson	Public Relations Manager	UK
Toby Rodwell	Network Engineer	UK
Roberto Sabatino	Chief Technical Officer	IT
Matthew Scott	Chief Financial Officer	UK
Nicolas Simar	Network Engineer	BE
Helga Spitaler	Public Relations Officer	IT
Cathrin Stover	Project Manager	DE
Tim Streater	Network Engineer	UK
Susan Taylor	Finance Manager	UK
Ian Thomson	Technical Author	UK
Simon Watts	Public Relations Officer	UK
Peter Webster	Training Manager	UK
David West	Project Manager	UK
Matthew Wright	Network Engineer	UK
Waldemar Zurowski	Network Engineer	PL

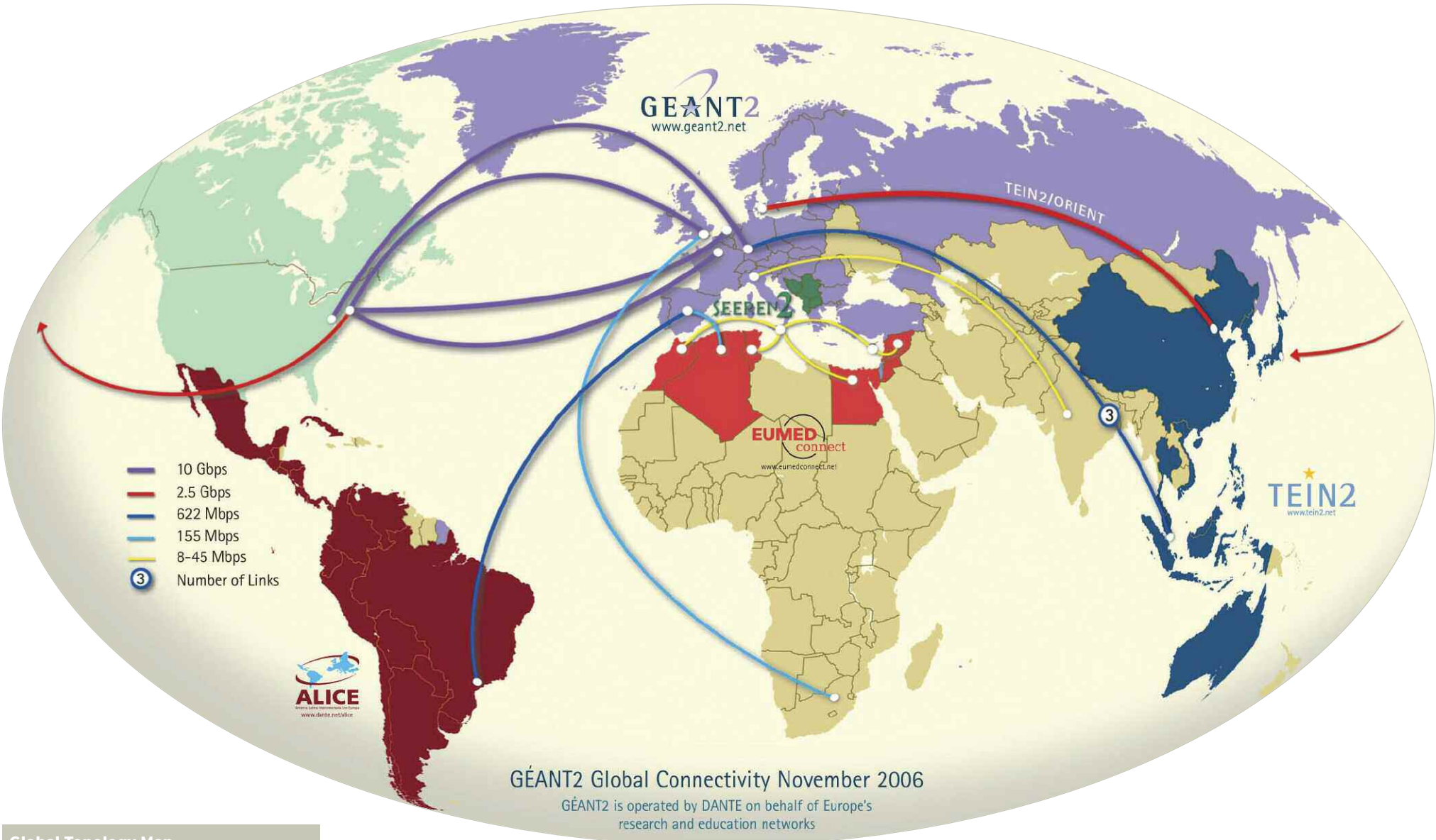




Working with partners around the world  
to support global research networking



global.dante.net



Global Topology Map



**[www.dante.net](http://www.dante.net)**

