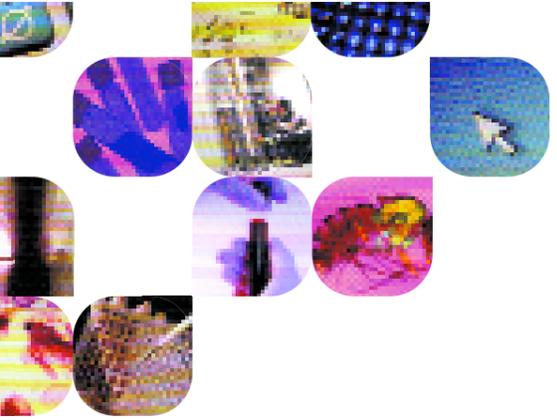




**Annual Review**  
2005





## DANTE Highlights 2005

- Launched world-leading GÉANT2 hybrid network linking more than 30 million users in 3,500 institutions in 34 countries across Europe.
- Secured funding extension to groundbreaking ALICE project linking 14 countries in Latin America to each other and Europe, helping promote social cohesion.
- Built and deployed TEIN2 network, working with 10 partner countries in Asia Pacific for formal launch in 2006.
- Making the global research village a reality by exploring and developing links to and with China, India and Africa.

### About DANTE

DANTE is a non-profit organisation whose primary mission is to plan, build and manage research and education networks. Established in 1993, DANTE has been fundamental to the success of pan-European research and education networking. DANTE has built GÉANT2, which powers European research with advanced networking infrastructure. DANTE is involved in initiatives worldwide to interconnect countries in other regions to one another and to GÉANT2. Although based in the UK, DANTE is a truly international organisation with a multi-national workforce and global outlook. For more information please visit [www.dante.net](http://www.dante.net).

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## Chairman's report 2005

Welcome to the DANTE Annual Review for 2005. This year has seen particularly strong achievements across DANTE's portfolio of projects and work.



Klaus Ullmann

Research collaboration takes place on an increasingly global scale, and this is reflected in DANTE's operations. The main focus of activity has been the construction of the GÉANT2 network, which is now nearing completion. Creating the world's most advanced research and education network has been a huge technical challenge, and has been made possible by the close collaboration of all the project partners. Thanks to the efforts of the European NREN community the vision to create a truly flexible, user-friendly network is now becoming a reality. We've seen promising results from the GÉANT2 research and service programme in a number of areas. Bringing together experts from across the NREN partners, these activities include Performance Monitoring, Bandwidth Provisioning, and Mobility and Roaming, and are delivering tangible results for the whole research community in Europe. 2006 will see these services develop to provide GÉANT2's users with indispensable tools to improve their networking experience.

Creating advanced environments for research and education relies on collaboration between all project partners. Whilst DANTE takes the co-ordinating role in networking projects such as GÉANT2, TEIN2 and ALICE, the successes outlined here would not have been possible without our NREN partners. 2005 saw the deployment of the TEIN2 network –the first regional research and education network in the Asia-Pacific. Connecting ten regional partners to each other and to Europe, the project is already showing exciting potential for regional researchers and facilitating advanced applications in fields such as e-Health and e-Learning. Collaboration between Europe and Asia will be further enhanced by the 2006 deployment of ORIENT, a direct connection between China and Europe – a first for Europe's research and education community.

The ALICE project, which has created the RedCLARA network in Latin America, has been rewarded with an extension until March 2007. Now connecting 14 partners, the project has delivered real results in the infrastructure, education and development of the region, and demonstrates the benefits of building closer working relations between Europe and Latin America. EUMEDCONNECT also benefited from a funding extension, and will now operate until at least July 2007. EUMEDCONNECT is the enabling network for projects such as EUMEDGRID. Easing the digital divide, and promoting e-Inclusion, EUMEDCONNECT extends the European Research Area to its near neighbours in the Mediterranean.

My thanks for all achievements go first to all members of the DANTE staff and finally to all cooperation partners who contributed to the overall success in 2005.

Klaus Ullmann

### DANTE's Management Team



Dai Davies



Hans Döbbling



Dale Robertson



Roberto Sabatino



Matthew Scott

## DANTE – Networking the world's researchers

DANTE has created GÉANT2, a network that serves the education and research communities of Europe and underpins the European Union's vision of a European Research Area. DANTE has been fundamental to the success of pan-European research networking for the past decade. Our success in Europe has encouraged the further development and growth of national and regional research networks that, linked together, are making the global research community a real possibility.

DANTE's unparalleled experience in planning, managing and operating education and research networks is now well recognised around the world. Although our main focus remains on GÉANT2 and our activities in Europe, DANTE's work is helping to create a truly global research community where advanced resources and new learning can be shared to the benefit of every partner.

- **Europe:** GÉANT2 now links 34 countries in Europe and a further eight countries are connected via the SEEREN2 network.
- **Mediterranean/Middle East/North Africa:** EUMEDCONNECT brings together researchers from 11 countries in the region.
- **Latin America:** The RedCLARA network connects 14 countries and more than 750 institutions.
- **Asia:** TEIN2 brings together 10 countries in Asia-Pacific and a direct interconnection between China and Europe is imminent. Discussions to include India continue.
- **Africa:** South Africa has a direct link to GÉANT2 and we are preparing a submission for a broader feasibility study.
- **North America:** longstanding connectivity and excellent working relationships continue with colleagues in the US (Internet2 and ESnet) and in Canada (CANARIE).

A recent EU-supported survey showed that Europe's citizens see research as critical. Eighty-eight percent recognised the importance of pan-European collaboration and believe it will better serve both European industry and the national interests of member countries. As many as 60 percent felt strongly that research is currently under-funded and that more resources should be allocated. DANTE believes that GÉANT2 shows the benefits that can be gained from connecting people, countries and regions, and sharing learning and expertise through research networking. To secure the greatest benefits, DANTE believes that the momentum of growth and connectivity should extend to encompass all the regions of the world.

“ We can all take pride in what has been a year of tremendous progress. But we must recognise that our operational successes are founded on the open and harmonious working relationships that we have built between people in many countries, enterprises and institutions. I would like to thank our colleagues in the European Commission and its many offices for their support and our partners in the national NRENs for their continuing in-country and regional commitments to providing access to information and services for the research community. Together, our collaborations have helped build a GÉANT2 network that will enable and enhance research collaboration globally and contribute to a better, more equal world. ”

Hans Döbbling, General Manager, DANTE

“ The creation of the GÉANT2 network has been our key achievement this year and it stands as a fine example of what is possible when technological innovation is combined with political will, appropriate funding and effective management. The first hybrid technology network to be deployed on an international scale, GÉANT2 is at the heart of global research networking, providing Europe with high speed connectivity across the continent and to other world regions. Our work in Latin America and Asia-Pacific is paving the way for groundbreaking change as it brings together communities of interest across the globe. ”

Dai Davies, General Manager, DANTE

For more information about DANTE, visit our website at [www.dante.net](http://www.dante.net).  
Subscribe to our regular newsletter, The Works of Dante, by visiting [www.dante.net/newsroom](http://www.dante.net/newsroom).



## DANTE's Operations Team



Marian Garcia Vidondo



Sam Kyakilika



Boris Mimeur



Martin Mogensen



Toby Rodwell



Ana Romero Oses



Tim Streater

# GÉANT2: Connect ★ Communicate ★ Collaborate

## Delivering the world's most advanced research network

Building on the success of the first GÉANT project, GÉANT2 delivers the next generation research and education network for Europe, linking more than 30 million users in 34 countries. GÉANT2 powers European research, providing academics with the state-of-the-art tools they need to carry out cutting edge research.

GÉANT2 offers unrivalled geographical coverage and high bandwidth, combined with innovative hybrid networking technology and is fundamental to the realisation of the European Union's vision of a European Research Area. GÉANT2 also provides advanced connectivity to other world regions, enabling efficient collaboration in the global research community.

## GÉANT2 – Connecting Europe's research communities

GÉANT2 is a network of networks, connecting 30 European National Research and Education Networks (NRENs) to each other and linking 34 European countries to other regional networks in North America, Latin America, the Mediterranean rim, North Africa and Asia-Pacific. The GÉANT2 network employs the most up-to-date optical and routing technologies and forms a key component of Europe's strategy to deploy a world leading e-Infrastructure for Science. With GÉANT2, researchers will be faster and better connected in Europe than anywhere else in the world.

GÉANT2 represents the seventh generation of pan-European research and education networks. The project is co-funded by the European Commission under the Sixth Research & Development Framework Programme. The Commission provides half of the total funding with the remainder provided by the NREN project partners.

## Innovation in hybrid technologies

The original GÉANT network used lit capacity leased from connectivity providers. Whilst this is still true for parts of the GÉANT2 network, the project is also taking responsibility for lighting dark fibre on 12,000km of routes. GÉANT2 has acquired its own transmission equipment to light dark fibre routes, which delivers greater control over performance and costs.

GÉANT2 is the first hybrid network deployed on an international scale and by combining dark fibre with more traditional broadband technology, offers switched links alongside routed IP connections on some routes, to open up new service possibilities. The switched circuits can reserve point-to-point links for the most demanding applications and create 'priority lanes' for data traffic flow, helping to avoid congestion on the IP backbone. Users gain the benefit of having a 'virtual private network' but not the cost or complexity of building or managing one. GÉANT2 has been designed to anticipate future bandwidth requirements with only a marginal increase in costs for each additional bandwidth.

“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

## Rolling out GÉANT2 across Europe

As of early 2006, almost 90% of the network had been installed. The transition from GÉANT to GÉANT2 has been a huge undertaking and includes a fibre footprint of more than 50,000km.

From GÉANT to GÉANT2

- 0 km of dark fibre to 12,000 km of dark fibre on 18 routes
- 22 main PoP (Point of Presence) sites to more than 200 PoPs and inline amplifiers
- From 100 to 400 systems

Details of the GÉANT2 topology can be found on page 10.

“Building the first international hybrid network of its kind is a massive technical challenge. Above all, it has been important to ensure continuity of service as we migrate the connected NRENs to GÉANT2. Through extensive testing and stringent quality control we are ensuring that GÉANT's reputation for excellence is maintained during this transition.”

Marian Garcia Vidondo  
Operations Manager, DANTE

### Improved international links

- Frankfurt – Washington (10 Gbps)
- London – New York (10 Gbps)\*
- Amsterdam – New York (10 Gbps)\*
- Paris – New York (10 Gbps)
- Copenhagen – Beijing (622 Mbps, is being upgraded to 2.5 Gbps)
- Frankfurt – Singapore (3 x 622 Mbps)
- Milan – India (34 Mbps)

\* Internet2-funded link  
\* NSF-funded link

## DEISA – high performance computing

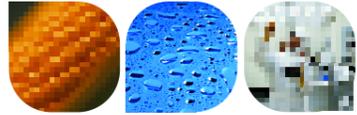
DEISA (Distributed European Infrastructure for Supercomputing Applications) is a consortium of leading national supercomputing centres that deploys and operates a distributed supercomputing environment with continental scope. The combination of DEISA and GÉANT2 infrastructure will provide powerful tools to enable research across a diverse range of science and technology topics. DEISA is currently carrying out research in areas such as cosmology, materials science and plasma physics and will benefit by being able to create a 'virtual private network' for its traffic separate from the bulk data transfers of less demanding network users.

"We set out to design a very different kind of network – with a combination of switched and routed infrastructure we can offer a truly flexible and user-focused network."

Dai Davies, General Manager, DANTE

## Getting more from GÉANT2

GÉANT2 has been successfully redesigned to be efficient and user-focused and most of the construction and deployment phase has been completed. Attention must now focus on key issues such as ease of use and convenience that drive customer satisfaction. By improving usability, flexibility and transparency, GÉANT2 will create new standards of service to match the technical achievement of creating the world's first hybrid network on an international scale.



# GÉANT2: Connect ★ Communicate ★ Collaborate

## Working for users – developments in research and services

Though it is an impressive achievement, creating and managing a set of complex data connections is not enough. In order to realise the full benefits that GÉANT2 provides, DANTE, NREN partners, and end users are pooling their expertise in a number of joint research activity teams to improve standards, practices and processes. These key activities will help ensure that GÉANT2 performs at its peak and is easily accessible to all its users.

### Performance monitoring and measurement

Monitoring the performance of individual networks is a well-established practice but methods for collecting and analysing data can vary widely. Creating an international data path between two research institutions can involve multiple networks – for example, two campus networks, two NREN backbones and the GÉANT2 European backbone – and any disruption to one can affect the service that a user will experience. Being able to see and respond to the bigger picture across multiple network boundaries is the broad aim of this joint research team.

- In close cooperation with ESnet and Internet2 in the US, the team has created perfSONAR – a network monitoring architecture that provides information on link capacity and link utilisation across all connected domains. The aim is to establish a new seamless monitoring method that enables a true end-to-end view of network performance.

A Performance Enhancement and Response Team (PERT) has also been set up to troubleshoot network performance issues across different network domains, providing an essential link between users and experts and a responsive service to NRENs.

### Security

The joint research activity on network security seeks to equip GÉANT2 and connected NRENs with the ability to take a proactive and cooperative approach to advanced security services. Activity focuses on:

- Design and implementation of recommended security policies for GÉANT2 and connected NRENs.
- Building proactive security services including an alert system, monitoring and anomaly-detection tools, detecting and mitigating Denial of Service (DoS) attacks and creating an events database.

### Network allocation/bandwidth on demand

GÉANT2 aims to provide guaranteed, dedicated capacity to an increasing number of its users. Activities in 2005 achieved:

- The definition of the Framework and General Architecture for the provisioning of a Bandwidth on Demand (BoD) service in the inter-domain environment.
- Specification and design of components for monitoring BoD circuits to ensure that the tools developed are compatible with the perfSONAR environment.

2006 will see the prototype implementation, deployment and testing of the Inter-Domain Manager and the strengthening of relations with similar research projects and standardisation bodies. Future plans also include work on interfacing with existing BoD systems such as the GÉANT2 AMPS (Advanced Multi-Domain Provisioning System).

### Testing Technologies

GÉANT2 has created a parallel network for the testing of tomorrow's networking technologies without impact on today's services. It provides real value to GÉANT2 researchers and developers, who can use the GÉANT2 testing network to assess and confirm the quality and resilience of their new technologies and services before launch on the live network.

### Roaming and authorisation

Legitimate users should have the opportunity to work as easily in another institution – or even in the field – as they do at their own desks. The joint research team is developing a Europe-wide infrastructure that will link to the users' home institutions to ensure they gain access to all their normal privileges. A universal system of authentication and authorisation makes boundaries disappear, giving researchers the freedom to roam and gain access from anywhere with a single sign-on.

Activities for 2005 in Roaming:

- Analysis of existing eduroam architecture and discussion of alternatives to the strict hierarchical RADIUS infrastructure.

A policy document has been written, to bring eduroam towards a service level. In addition, the legal background in the participating countries has been studied.

Activities in 2005 in Authentication and Authorisation Infrastructure (AAI):

- Design of eduGAIN architecture as a means to interconnect already established AAI's.
- Implementation began using basic eduGAIN components. Practical experience provided feedback into architecture development.

This work will continue in 2006. More detailed reports on the research activities can be found at [www.geant2.net/research](http://www.geant2.net/research)



## DANTE's Network Planning Team



Michael Enrico



Maarten Buchli



Otto Kreiter



Nicolas Simar

## Working with suppliers

In creating and developing GÉANT2, DANTE has worked closely with commercial suppliers. The groundbreaking hybrid nature of the GÉANT2 network means that suppliers can gain valuable insight and experience from testing new technologies before commercial deployment. Some suppliers see GÉANT2 as helping to create a new market for networking technologies and view close involvement and co-operation as of strategic benefit, allowing them to apply the knowledge they gain in other business areas. This sharing of knowledge and expertise also contributes to Europe's overall competitiveness.

## GÉANT2 – research networking in action

### Sharing biodiversity data

There are many biological collections across Europe, ranging in size and scale from dinosaur bones to delicate orchids. The information these collections contain must be accessible to the scientific community so that high resolution images, video and sound files, and DNA samples with their associated data can be consulted quickly and easily in the field or in the laboratory. The BioCASE (Biological Collection Access Service for Europe) project is building the portal for making biodiversity collections accessible via the internet and GÉANT2 and national networks currently link 65 data providers and more than 150 separate databases from all over Europe, allowing records to be studied as a single resource.

### Probing the beginnings of time

Research into the origins of the universe is being aided by GÉANT2. The EXPReS project links 19 international partners to create a unique astronomical telescope that can look deep into the early universe using electronic VLBI (Very Long Baseline Interferometry). GÉANT2 provides the high speed network necessary for data transfer allowing astronomers to share images within hours not months. The ability to electronically combine the data from a large number of radio telescopes means greater sensitivity and operational reliability, helping astronomers build a more complete view of the origins of the universe.

### Forecasting the world's weather

A new Global Interactive Forecasting System (GIFS) is being planned to improve weather prediction speed and accuracy to help both the developed and developing worlds reduce the effects of extreme weather. GIFS is being developed by a number of national weather centres across Europe and could utilise the pan-European power of GÉANT2 to transmit vast amounts of data – as much as 500 gigabytes or the equivalent of more than 700 CDs of information each day – between researchers. To ensure the closest collaboration and to share the processing power of national weather computers, GIFS would use advanced grid computing technology, allowing workloads to be shared automatically via GÉANT2 and its partner networks.

## New partners, building closer links in 2005

Bulgaria's Information Society Technologies Foundation (ISTF) became directly connected to the GÉANT2 network during 2005 and the NRENs of Serbia and Montenegro (AMREJ) and of Macedonia (MARNet) can now attend future policy committee proceedings as permanent observers.

The successor project to SEEREN (South-Eastern Europe Research and Education Network) was launched in 2005. SEEREN2 is led by GRNET, the Greek NREN and involves eight organisations representing the NRENs of Albania, Bosnia-Herzegovina, Bulgaria, Macedonia, Greece, Hungary, Romania and Serbia-Montenegro. SEEREN2 will integrate with the GÉANT2 network and aims to ease the digital divide that still separates most of the southeastern European countries from the rest of the continent. DANTE has provided support and expertise in the tender process for networking elements.

In South Eastern Europe, DANTE joined ten partners in the SEEFIRE (South-East Europe Fibre Infrastructure for Research and Education) project, which will study the options for deployment of dark fibre and the management of optical transmission by NRENs in the region.

## Looking ahead – research networking in 2006 and beyond

GÉANT2's priorities for 2006 are to complete the network rollout and to focus on the usability issues that will ensure NRENs and end users can both make the most of the exciting new possibilities for collaborative research in Europe. The first point-to-point links for demanding users will be implemented. GÉANT2's links with other regions across the globe will deepen and strengthen as new inter-working relationships form and develop, making a global education and research community a more practical reality.

For more information visit:

- [www.geant2.net](http://www.geant2.net)
- [www.seeren.org](http://www.seeren.org)
- [www.eduroam.org](http://www.eduroam.org)



“ The ALICE project has created a real sense of integration and has catalysed the creation of NRENs throughout the region. It has succeeded in making a dream come true – a dedicated Latin American backbone for research and education. ”

Luis R. Furlan  
Director, RAGIE, Guatemala

## ALICE – Infrastructure, education and development in Latin America

Researchers in over 700 universities and research institutes across 14 countries in Central and South America can now contribute to global research projects and enjoy unprecedented collaboration with their European colleagues by interconnecting with GÉANT2. Delivered by the ALICE (America Latina InterConectada con Europa) project, the RedCLARA network helps to promote the information society and social cohesion and to reduce disparities within Latin America.

ALICE's success has encouraged the European Commission to extend funding into 2007 to improve operations and install new services. ALICE remains one of DANTE's proudest achievements – a fine example of how providing network connections can stimulate both interest and further investment at the local, country and regional levels and deliver new applications and services that benefit every community.

### Extending success, promoting use

As recently as 2003, research collaboration in Latin America was limited by the lack of cost effective, high speed data connections within and between countries. Collaboration between Latin America and Europe had always been hindered by the absence of dedicated, high bandwidth connections between the two regions.

The ALICE project created the first research and education network for Latin America, known as RedCLARA, in 2004. ALICE is a partnership between DANTE, CLARA – Latin America's organisation for co-operation in advanced networks – and the National Research and Education Networks (NRENs) of France, Italy, Portugal and Spain, as well as 18 Latin American NRENs. RedCLARA began operations with a connection linking Chile and Brazil to Europe and has grown rapidly as regional partners have joined the community. 14 national networks were connected as of April 2006.

The European Commission's decision to extend funding into 2007 will help to improve RedCLARA operations and install new services, driving up use of the network to aid its longer term sustainability. Newly created NRENs and those only recently connected to RedCLARA will now have more time to assess the impact and demonstrate the benefits of research networking to the research and education communities in their countries.

### Expanding the user base – promoting regional integration

ALICE has helped improve the regional infrastructure and stimulated development of national research networking organisations. As a result, much of Latin America's research and education community now has access to high capacity connections and a link to the world beyond their institutions. Researchers and academics are now working together freely across national borders, sharing learning and specialist knowledge and promoting regional integration through academic partnerships.

ALICE's immediate interest is in meeting and promoting research and education networking needs, but the benefits of in-country and regional investment in communications infrastructure also spread out to the wider community, improving people's own access to ICT technology and the internet and including them in the information society.

#### ALICE – connecting the partners

|          |  |
|----------|--|
| Stage 1: | Brazil, Chile, and Europe                      |
| Stage 2: | Argentina, Peru, Mexico, Uruguay and Venezuela |
| Stage 3: | Panama, Costa Rica, Guatemala and El Salvador  |
| Stage 4: | Ecuador, Colombia and Nicaragua                |



#### DANTE's Systems Team



Anand Patil



Anton Antonov



Navneet Daga



Loukik Kudarimoti



Maurizio Molina



Waldemar Zurowski

### Looking to the future – ALICE2

Based on its tremendous success, consideration is now being given to extending the ALICE project to a further phase – ALICE2 – to stimulate and help mature the recently-formed NRENs. As well as developing the expanding user base across Latin America, ALICE2 would enable the RedCLARA network to gain its full independence from DANTE, with CLARA adopting sole responsibility for the continuing project and for control and operation of the network. Regional ownership and management should help ensure the network's sustainability in future. Other countries in Latin America and the Caribbean have already expressed their interest in joining the ALICE family.

“ We congratulate you on your achievements thus far and look forward to seeing the research and education communities of Latin America and Europe benefit from further strong results. The development of new national networking organisations across the region and planned EU-Latin American research projects demonstrate the benefits that close collaboration has for both the academic and wider communities. ”

Riccardo Gambini  
EuropeAid, European Office of Co-operation

“ Through the ALICE project we have been able to bring together academics, research experts and governments. Even with the national differences in economic policies and political situations, each partner has been able to create its own model for a research network. It's a complex project – there are 18 different nations involved, with different rules and different cultures. ”

Florencio Utreras  
CEO, CLARA

For more information about ALICE and RedCLARA applications, visit:

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

### Applications – ALICE in action

#### Infrastructure: EELA – bridging Europe and Latin America

2006 will see the start of the EELA (E-infrastructure shared between Europe and Latin America) project. EELA aims to build a digital bridge between the existing e-infrastructure based in Europe (EGEE) and those that are emerging in Latin America. With European Commission funding, the two year project will create a collaborative network to share grid infrastructures between the two continents. This will drive the development of advanced applications in areas such as biomedicine, high energy physics, e-learning and climate modelling. RedCLARA supports the EELA project, enabling the grid applications and connecting Latin America to its GÉANT2 counterpart network in Europe.

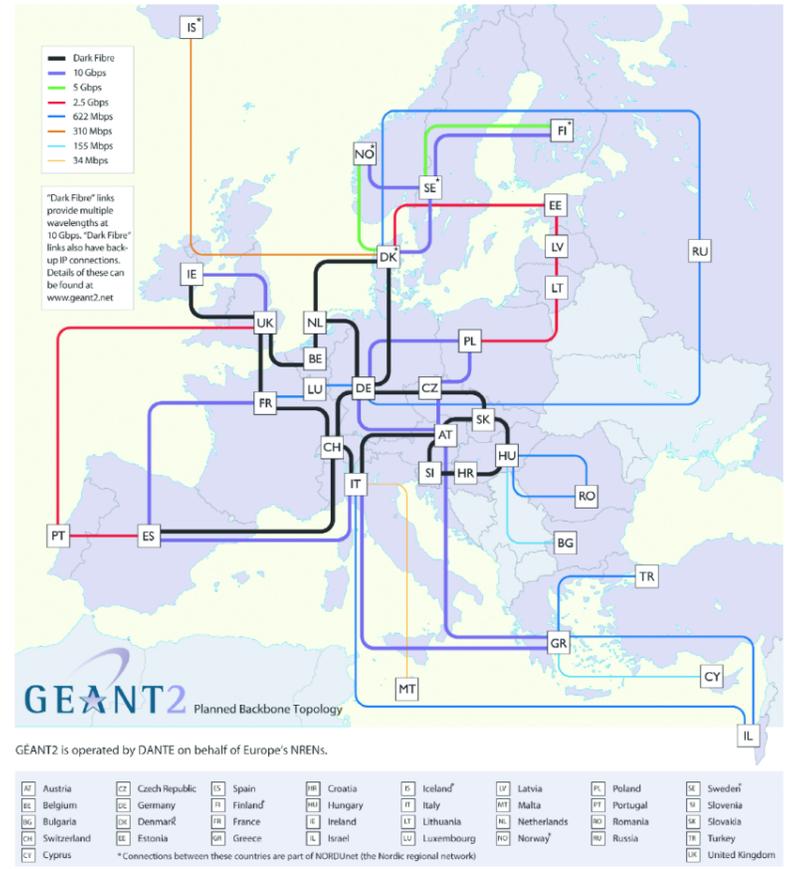
#### Education: @LIS Technet – e-learning environments

The @LIS Technet project has created a highly innovative teaching environment at universities across seven countries. The environment is continuously live, connecting all project partners, and includes a wide range of tools and software that can provide services for users. The virtual teaching environment spans the infrastructure, enabling students, teachers and researchers to gain hands-on experience of using the latest web and internet technologies to create their own complex online applications. RedCLARA's implementation has halved data round-trip times and will extend the project throughout the region.

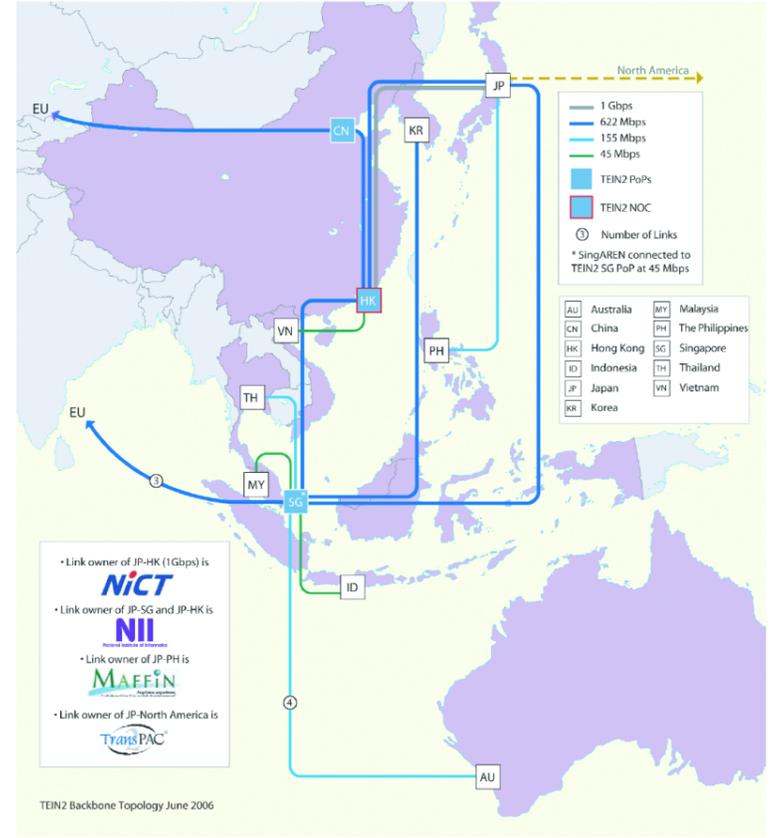
#### Development: T@lemed – bringing healthcare to the Amazon

The T@lemed project brings e-health services to isolated regions of Brazil and Colombia, allowing doctors to diagnose conditions and prescribe treatments to patients remotely. When necessary, referrals can be made to metropolitan hospitals many thousands of kilometres away and even in Europe via RedCLARA's interconnection with GÉANT2. T@lemed is also testing services that are helping to combat malaria and tuberculosis in Brazil. T@lemed is managed by Germany's Fraunhofer Institute.

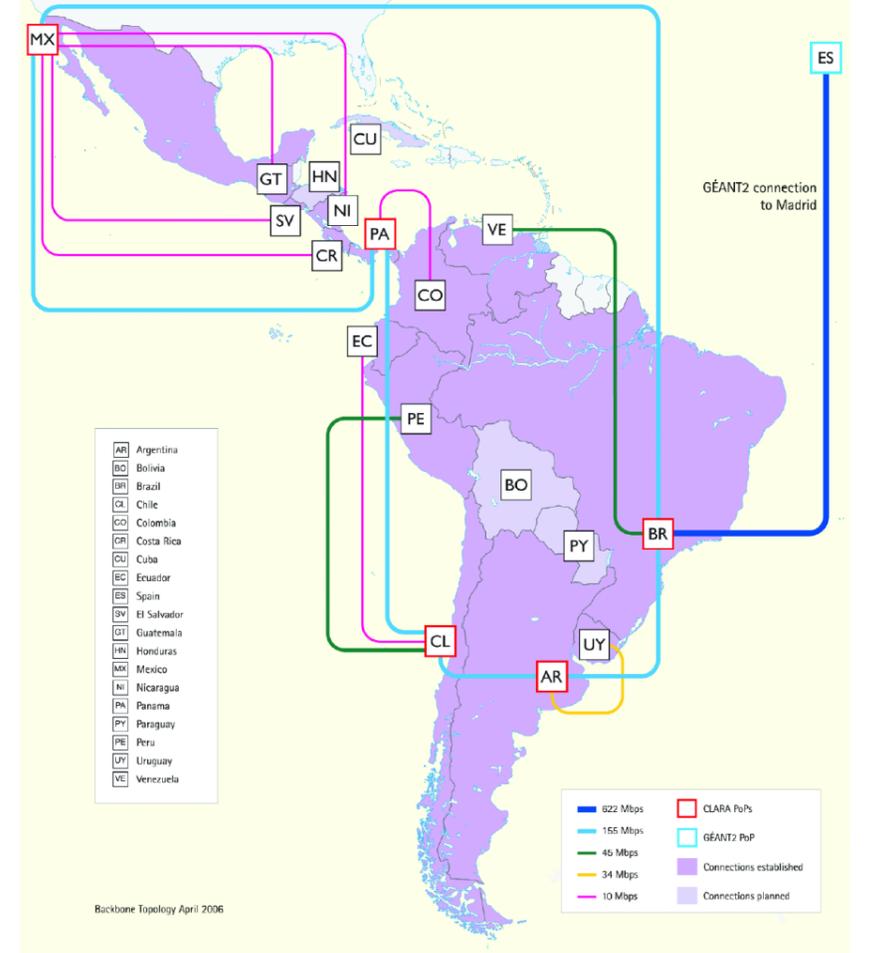
### GÉANT2 Topology May 2006



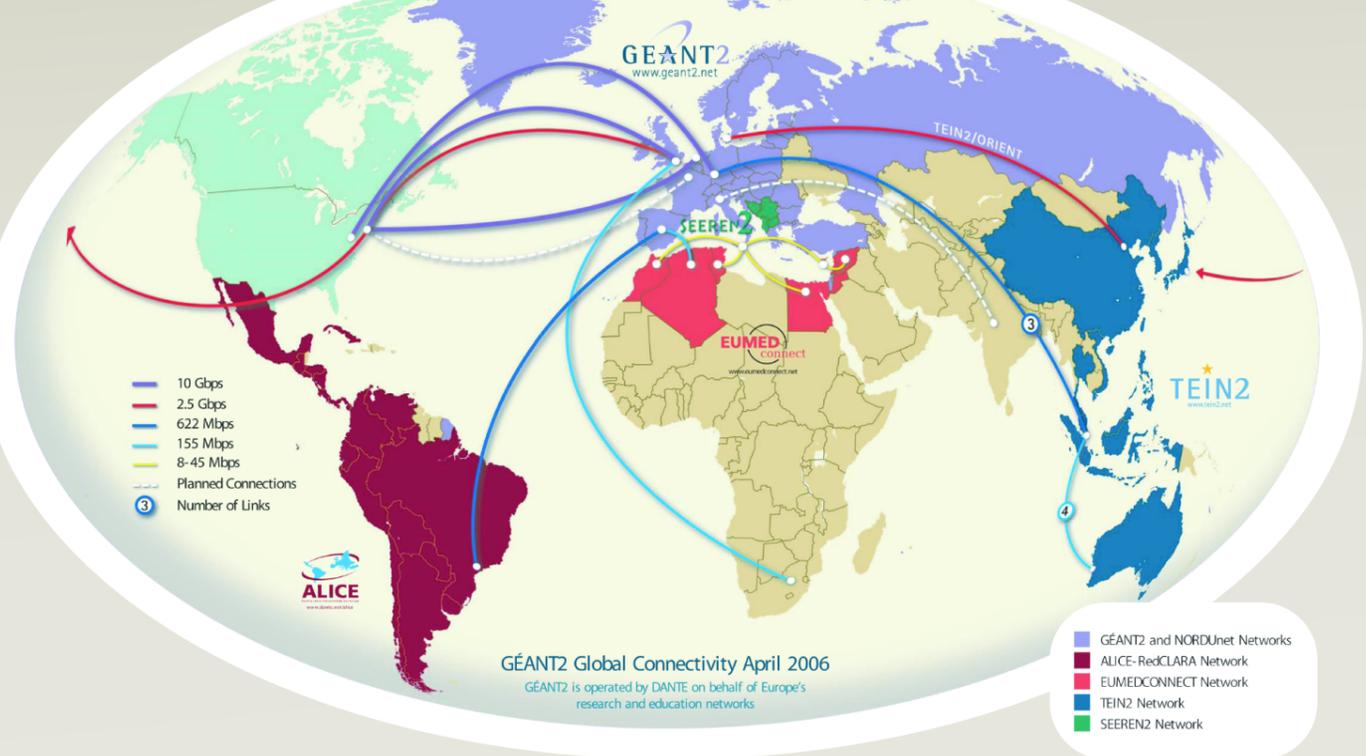
### TEIN2 Topology June 2006



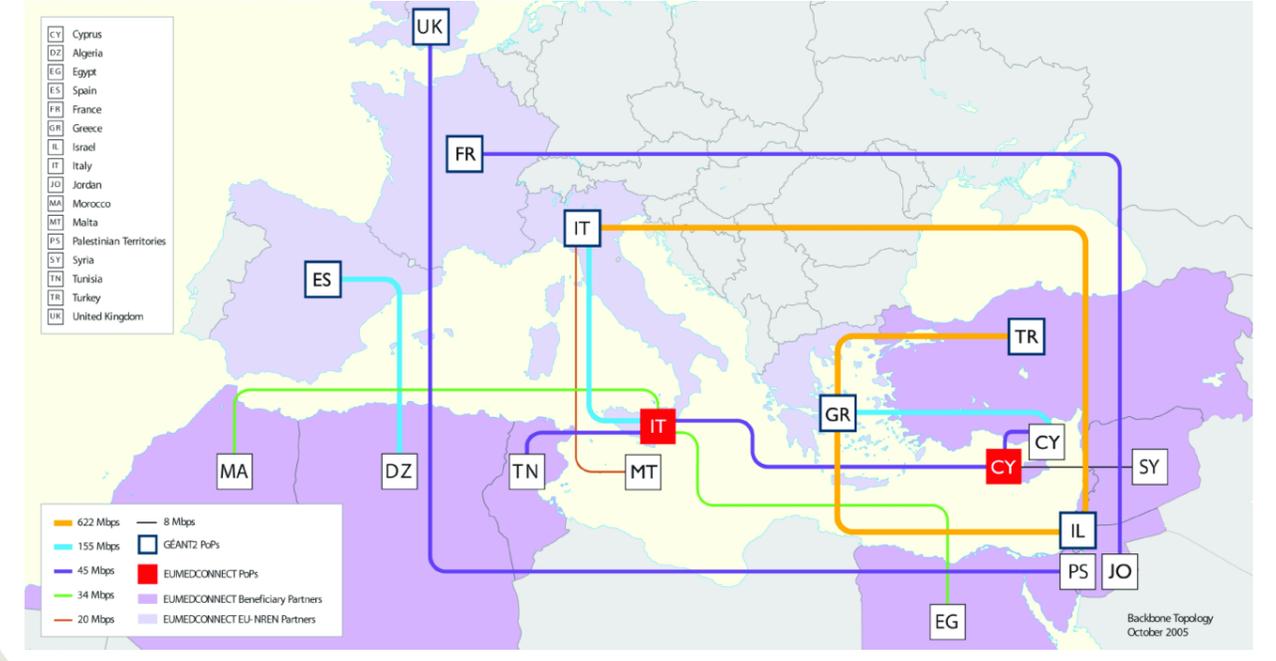
### ALICE Topology April 2006



### Global Connectivity April 2006



### EUMEDCONNECT Topology October 2005





TEIN2



## TEIN2 – Connecting Asia-Pacific research and education

TEIN2 – the Trans-Eurasia Information Network – is now live, with deployment starting in December 2005. TEIN2 provides the first large scale research and education network for the Asia-Pacific region. It connects regional researchers with their counterparts in Europe via GÉANT2, providing the Asia-Pacific countries with a gateway for global research collaboration. By providing a powerful and reliable communications channel, TEIN2 brings together eastern and western academic communities for the first time.

### Fostering regional cohesion and research collaboration

Wide disparities in the state of research and education networking are still evident in the Asia-Pacific region – some countries have near-universal access and advanced research networks whilst others are still in the earlier stages of development. The TEIN2 project fosters regional cohesion by removing some of the financial barriers to further involvement and by creating an extensive regional research network with connections to Europe.

The first TEIN connection was made in 2001 between France and Korea and was subsequently upgraded several times to meet user demands for greater capacity for research collaboration between the two regions. With demand for access continuing to exceed supply capabilities, the need for further links to the region was clearly demonstrated.

TEIN2 was initiated in 2004 and received approval from the European Union's EuropeAid Cooperation Office and funding towards the cost of connecting partners. TEIN2 is largely funded by the European Commission for the benefit of developing countries in Asia and is supported by a number of Asian ASEM (Asia-Europe Meeting) countries including China, Indonesia, Malaysia, Philippines, Thailand, Vietnam, Japan, Korea and Singapore; Australia also contributes to the TEIN2 project.

“Until TEIN2 inter-connectivity in the region was insufficient to support world-class research and education activities. The network provided by TEIN2 will be able to support current research activities and enhance international research collaboration in the future.”

Chalermpol Charnsripinyo  
ThaiREN, Thailand

### TEIN2 aims and objectives

TEIN2 is already fulfilling its three main objectives:

- Increase direct internet connectivity for research and education between Europe and Asia.
- Improve intra-regional connectivity within Asia.
- Act as a catalyst for the development of national research networking in the developing countries in the Asia-Pacific region.

The project is achieving this by building and operating:

- Asian regional infrastructure connecting TEIN2's partners.
- Connectivity between the TEIN2 regional backbone and GÉANT2.

### Deploying TEIN2

TEIN2 is now a reality and links national research networks in China, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Thailand, Vietnam and Australia. The central Network Operations Centre in Hong Kong is operational and most of the network is in service, improving intra-regional connectivity and providing a further incentive to the development of national research networking. TEIN2 is now well placed to fulfil its key aim – to help even out the disparities between different countries across the region and so bridge the digital divide and to enable new collaborations on projects both across the region and across the globe through its links to GÉANT2.

### DANTE's Project Management Team



Alex Gosnell



Milos Karapandzic



David West

### DANTE's Administration Team



Karin Bane



Janet Lipski



Jean Reynolds

### Managing for success

DANTE was chosen to implement the TEIN2 network as a result of its previous successes and it has achieved its objectives in two key ways:

- By building on the lessons learned and expertise gained on initiatives such as designing, building and managing the EUMEDCONNECT network in the Mediterranean/North African region, and the ALICE network in Latin America.
- By close liaison and discussion at every stage of the planning and implementation processes with partner organisations.

The timely and efficient way that TEIN2 has been managed and delivered has helped create a template for the way that such complex projects can be run cost effectively.

### Applications – TEIN2 in practice

TEIN2's high capacity network will help to overcome the disparities that exist between countries in the region and enable faster collaboration on projects across the globe through its links to GÉANT2. Applications such as natural disaster warning systems, e-learning and e-health initiatives bring significant social development and healthcare benefits to ordinary people. The scientific community gains from new opportunities to participate in world class research projects in disciplines such as high energy physics, linking radio astronomy telescopes and other projects where fast transfer of massive amounts of data is vital. TEIN2's extensive bandwidth will also enable transmission of high definition video and broadband videoconferencing.

Many of the applications that will now use TEIN2 already existed as collaborations between established national partners such as Japan and Korea. TEIN2 now provides a platform for the rollout of these applications across the region, enabling partners with less developed networks and connections to take up new opportunities and gain new benefits.

- ASEM OCEANS Initiative – creating a network of marine experts from Asia and Europe to protect the marine environment and enhance marine research.
- Tsunami Warning Systems and Modelling – monitoring changes in the natural world to develop understanding of potentially catastrophic phenomena and to formulate appropriate and robust reporting and warning systems.
- Healthcare collaborations – including teleconsultations and telesurgical training.

As partners become used to the broader opportunities that TEIN2 makes available, users' network needs for new applications will help to determine and drive further network enhancements.

### Improving regional healthcare

The TEIN2 network demonstrates the practical benefits that flow from the deployment of advanced networks and applications, with telehealth, telemedicine and telesurgical training initiatives that can transform access to healthcare in the region. The ability to interact directly over a reliable high speed network helps healthcare professionals share their expert knowledge and work closely together on issues of common concern. Australia has made a particularly effective contribution:

- Telehealth – collaborating across the region on an 'emerging infections' programme to aid understanding and readiness across national borders.
- Telemedicine – creating a virtual critical care unit in Vietnam to assist cleft lip and cleft palate treatment; using network connections to help with assessments and treatments; building close hospital-to-hospital relationships to drive up standards of care.
- Telesurgical training – multimedia bariatric surgical training successfully shared between hospitals in Australia, Japan and Singapore and followed up with live surgery relayed to ten sites in five countries.

### Looking to the future

The final links for the TEIN2 network will be put in place by mid 2006 and TEIN2 will be formally launched at a ceremony to be held in Helsinki, Finland in September 2006. With the network in place, development will focus on the practical experiences of its users and how they choose to use TEIN2's capacity.

TEIN2 will also be complemented by the ORIENT (Oriental Research Infrastructure to European NeTworks, see Global Perspectives, page 14) project that will connect China's main academic networks directly with Europe's GÉANT2 network. The additional bandwidth provided will be available to all TEIN2 partners.

The successful development and planned deployment of TEIN2 has encouraged partners to think beyond the current 2008 horizon and proposals for a possible TEIN3 upgrade and extension programme are being prepared to stimulate discussion among partners.

For more information about TEIN2, visit:

[www.dante.net](http://www.dante.net) • [www.tein2.net](http://www.tein2.net) • [www.apan.net](http://www.apan.net)



## Global Perspectives – Developing a global research village

DANTE's track record in Europe is impressive, delivering connectivity to European NRENs and enabling collaboration between their institutions and researchers through the GÉANT and GÉANT2 networks. DANTE shares the European Commission's recognition that even wider networking will benefit both Europe and the world's regions and is extending network links around the globe. This inclusive approach aids local and regional network development. In turn, their participation in research projects of global scale and common interest, enhances European research efforts. Everyone gains through greater opportunities for collaboration and working in partnership.

DANTE's work in Europe, Latin America and the Asia-Pacific regions is covered in detail above. The reports here cover DANTE's activities with NRENs and other bodies in other regions of the world and show how interconnection is driving the creation of a global research village.

### Mediterranean region: EUMEDCONNECT

The EUMEDCONNECT project has created the first research and education network for the Mediterranean region and partners can now communicate and collaborate with colleagues throughout Europe and beyond. EUMEDCONNECT links together a regional research community that now encompasses 11 countries in Europe, the Middle East and North Africa with a high capacity internet network dedicated to researchers and academics. EUMEDCONNECT aims to reduce disparities in network access between countries in Europe and the Mediterranean region and to increase academic collaboration. In recognition of the benefits that EUMEDCONNECT delivers, the European Commission's EUMEDIS Programme, which promotes the Information Society, has extended funding until at least July 2007.

The key activity in 2005 has been the support offered to the EUMEDGRID project that aims to empower e-Science across the Mediterranean and help bridge the digital divide. Funded by the European Commission, EUMEDGRID will enable experts to collaborate to develop a Grid e-Infrastructure for e-Science over the next two years. The objective is to foster the development of e-Science applications such as hydro-geological and medical applications within an extended European Research Area. Making best use of existing GÉANT2 and EUMEDCONNECT infrastructure, EUMEDGRID will actively collaborate with the EU's EGEE (Enabling Grids for E-Science) project to promote the growth of new user communities and the adoption of powerful new Grid tools and services.

### India

DANTE has been working with ERNET, India's research networking organisation, to plan a connection to the GÉANT2 backbone. ERNET has made a significant contribution to the emergence of networking in India, providing the largest nationwide terrestrial and satellite network with points of presence in research and education institutions across the country. The tendering process for connectivity has started and these offers are currently being considered.

### China

Connectivity between Chinese and European researchers will be revolutionised by the launch of a direct, high capacity network connection between Beijing and Europe in mid 2006. Coordinating activities with CERNET – China's first and largest national academic internet backbone network that connects about 1300 universities – DANTE will link the GÉANT2 network to ORIENT (Oriental Research Infrastructure to European NeTworks), creating a pool of as many as 45 million researchers and students.

The ORIENT project will facilitate closer collaboration between Europe and China on projects ranging from radio astronomy, space science and meteorology to sustainable development, grid computing, and e-learning. ORIENT is due to run until 2009 and is co-funded by China's Ministries of Education and of Science and Technology (50%) and by the European Commission and the European NRENs (50%).

China already links to the GÉANT2 network through its partnership in the TEIN2 network. The direct link offered by ORIENT will complement TEIN2, increasing bandwidth and providing backup facilities.

“ We welcome this link between Chinese and European researchers. By enabling collaboration between the two regions it will ensure a closer relationship and speed up research in vital areas. ”

*Professor Jianping Wu  
Director, CERNET*

### Africa

South Africa already has a connection to GÉANT2 that has brought it into the global research family. Naturally, attention now turns to its surrounding neighbours. DANTE has put together a consortium of partners, including African and European NRENs, and TERENA, to submit a proposal to the EC for a feasibility study. This would survey the current state of research networking in the region and explore the potential for improving connectivity. DANTE has received a large number of supporting letters from African organisations keen to join the wider research community. From the working level, there are clear and increasing user demands for basic network connectivity that the feasibility study team could assess and respond to in 2006.

### DANTE's Public Relations and User Support Team



*Rachael Beale*



*John Chevers*



*Helga Spitaler*



*Simon Watts*

### North America

With much of today's collaborative research taking place on a global stage, international co-operation is integral to its success and DANTE is strengthening its links with partners in North America. GÉANT2 holds regular meetings with Internet2, ESnet (US) and CANARIE (Canada) to foster closer working relationships. The most recent meeting looked at configuration plans for the interconnection of GÉANT2, Abilene and ESnet in Washington DC. The partnership has contributed extensively to the work on network performance monitoring (see GÉANT2, Working for users, page 6) and is looking at future collaboration on the development of hybrid network services, the management of end-to-end services across multiple domains and on network security.

### DANTE World Service

For NRENs that do not have or do not wish to organise external connections to commercial service providers, DANTE offers a connectivity service to the wider internet – DANTE World Service. DANTE's GÉANT2 network interconnects with two global Internet Service Providers – Level3 and Teliasonera – at six points.

**For further information about DANTE's global projects and partners, see:**

- [www.dante.net](http://www.dante.net)
- [www.eumedconnect.net](http://www.eumedconnect.net)
- [www.dante.net/orient](http://www.dante.net/orient)
- [www.eis.ernet.in](http://www.eis.ernet.in)
- [www.tenet.ac.za](http://www.tenet.ac.za)
- [www.internet2.edu](http://www.internet2.edu)
- [www.es.net](http://www.es.net)
- [www.canarie.ca](http://www.canarie.ca)

## 2005 Financial Statements

### Directors

J Boland  
T Brunner  
J Gruntorad  
K Ullmann  
D Vandromme

### Secretary

M J Scott

### Auditors

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80 Newmarket Road  
Cambridge  
CB5 8DZ

### Bankers

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Bene't Street Branch  
P.O. Box 2  
Cambridge  
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### Solicitors

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OX4 2HN  
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### Registered Office

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### DANTE's Finance Team



*Susan Taylor*



*Peter Nancollis*



*Krystyna Owen*

The full financial statements, directors' report and auditors' report are included in a separate document entitled DANTE Annual Report and Accounts 2005. This is available on request and online at [www.dante.net](http://www.dante.net)

## Income and Expenditure Account

For the year ended 31 December 2005

|   | 2005<br>'000 | 2004<br>'000 |
|---|--------------|--------------|
| <b>Turnover</b>   | 46,683       | 48,968       |
| Cost of sales   | 43,183       | 45,421       |
| <b>Gross Surplus</b>  | 3,500        | 3,547        |
| Administrative expenses   | (3,824)      | (3,758)      |
| Foreign exchange loss   | (62)         | (1)          |
| <b>Operating Deficit</b>  | (386)        | (212)        |
| Interest receivable   | 355          | 218          |
| <b>(Deficit)/Surplus On Ordinary Activities Before Taxation</b> | (31)         | 6            |
| Tax on (deficit)/surplus on ordinary activities                 | 63           | 194          |
| <b>Surplus On Ordinary Activities After Taxation</b>            | 32           | 200          |

## Balance Sheet

As at 31 December 2005

|   | 2005<br>'000 | 2004<br>'000 |
|---|--------------|--------------|
| <b>Fixed Assets</b>                                   |              |              |
| Tangible assets                                       | 7,827        | 2,668        |
| <b>Current Assets</b>                                 |              |              |
| Debtors   | 18,090       | 25,686       |
| Cash at bank and in hand                              | 56,156       | 42,468       |
|   | 74,246       | 68,154       |
| <b>Creditors: amounts falling due within one year</b> | 74,782       | 63,915       |
| <b>Net Current (Liabilities)/Assets</b>               | (536)        | 4,239        |
| <b>Total Assets Less Current Liabilities</b>          | 7,291        | 6,907        |
| <b>Provisions For Liabilities and Charges</b>         |              |              |
| Deferred taxation                                     | 352          | -            |
|   | 6,939        | 6,907        |
| <b>Capital and Reserves</b>                           |              |              |
| Called up share capital                               | 1,576        | 1,576        |
| Capital contributions                                 | 35           | 35           |
| Income and expenditure account                        | 5,328        | 5,296        |
| <b>Total Shareholders' Funds</b>                      | 6,939        | 6,907        |

## Statement of Cash Flows

For the year ended 31 December 2005

|  | 2005<br>'000 | 2004<br>'000 |
|--|--------------|--------------|
| <b>Net Cash Inflow From Operating Activities</b>       | 19,238       | 26,780       |
| <b>Returns on Investments and Servicing of Finance</b> | 355          | 218          |
| <b>Taxation</b>  | (4)          | (6)          |
| <b>Capital Expenditure and Financial Investment</b>    | (5,934)      | (1,620)      |
| <b>Management of Liquid Resources</b>                  | (7,947)      | (16,612)     |
| <b>Increase in Cash</b>                                | 5,708        | 8,760        |

## 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 2006)

| Name                  | Job title                                | Country |
|-----------------------|--|---------|
| Dai Davies            | General Manager                          | UK      |
| Hans Döbbling         | General Manager                          | DE      |
| Anton Antonov         | Systems Administrator                    | RU      |
| Karin Bane            | Secretary/Administrator                  | UK      |
| Rachael Beale         | Webmaster                                | UK      |
| Maarten Büchli        | Network Engineer                         | NL      |
| John Chevers          | Project Manager                          | 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      |
| Otto Kreiter          | Network Engineer                         | RO      |
| Loukik Kudarimoti     | Network Engineer                         | IN      |
| Sam Kyakilika         | Network Engineer                         | ZA      |
| Janet Lipski          | Secretary/Administrator                  | UK      |
| Boris Mimeur          | Network Engineer                         | FR      |
| Martin Mogensen       | Network Engineer                         | DK      |
| Maurizio Molina       | Network Engineer                         | IT      |
| Peter Nancollis       | Project Accountant                       | UK      |
| Krystyna Owen         | Project Accountant                       | UK      |
| Anand Patil           | Head of Systems                          | IN      |
| Jean Reynolds         | Secretary/Administrator (part-time)      | UK      |
| Dale Robertson        | Public Relations Manager                 | UK      |
| Toby Rodwell          | Network Engineer                         | UK      |
| Ana Romero Oses       | Network Engineer                         | ES      |
| Roberto Sabatino      | Chief Technical Officer                  | IT      |
| Matthew Scott         | Chief Financial Officer                  | UK      |
| Nicolas Simar         | Network Engineer                         | BE      |
| Helga Spitaler        | Public Relations Officer                 | IT      |
| Tim Streater          | Network Engineer                         | UK      |
| Susan Taylor          | Finance Manager                          | UK      |
| Simon Watts           | Public Relations Officer                 | UK      |
| David West            | Project Manager                          | UK      |
| Waldemar Zurowski     | Network Engineer                         | PL      |



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