



Delivery of Advanced Network Technology to Europe

DANTE was established in Cambridge in 1993. It was founded by Research and Education Networks from across Europe to organise, manage and build international networking services on their behalf. As its name suggests, the objective is to build communication networks using the most advanced technology and operating at the highest speeds on a pan-European basis.

Research networks have two primary objectives. They exist as an infrastructure support to researchers. In addition, they have a research role in their own right, implementing new services in advance of the general marketplace for telecommunications. They are ideally placed to do this as their users are generally computer and communications literate and are prepared to experiment with new technology. DANTE is an active participant in the development of new networking services to support European research.

building and managing networks to provide international connectivity for research and education

The ability of Europe's universities and its research institutions to exchange knowledge and collaborate in research at a world-leading level relies on their ability to communicate effectively using the most powerful computer and communications technologies available. At a national level, this infrastructure is provided by National Research and Education Networks in each country. Increasingly, the vital information sources and collaborations necessary for research are international. DANTE's principal role is to build and manage the network that provides most of the international connectivity for the Research and Education Networks, serving over 3000 research centres across Europe and connecting to other regional research communities across the world.

DANTE has an exciting and challenging role to meet the exacting requirements from the research community for production and experimental services. This demands deployment of the latest and most advanced technology, operating at the highest possible speeds across Europe. The resulting network covers more countries at higher speeds of connectivity than any other network existing today.

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Design and production www.artdept.co.uk



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the network

DANTE's principal activity is the pan-European network. The current generation of network, GÉANT, is the 6th to be implemented in 12 years. Each generation has implemented more advanced technology than its predecessor. However, whereas each of the previous networks was an evolution of its predecessor, GÉANT marks an enormous step forward. With capacity over 20 times that of the previous network (TEN-155), GÉANT offers huge potential to co-operating researchers across Europe. In addition, GÉANT extends its capacity to North America.

GÉANT is based on a shared core network of nine 10 Gbit/s wavelengths. This is complemented by a further fourteen 2.5 Gbit/s wavelengths and additional slower speed connectivity to those locations where high capacity infrastructure is not yet cost-effectively available. From each of the core nodes where wavelengths are deployed, Juniper M160 routers are used to provide the routing engine for this enormous IP network. In addition to providing basic IP services, a development programme is implementing new and advanced services. Of particular importance is our piloting and deployment of IPv6, which makes GÉANT the only production network running both IPv4 and IPv6. A team from DANTE, ARNES (the Slovenian NREN) and RedIRIS (the Spanish NREN) recently achieved an IPv6 land speed record (a trial which involved transmitting data using the IPv6 protocol), proving GÉANT's IPv6 capability and the commitment of European networks to deploying IPv6. Other important areas of continuing development include Security, IP Quality of Service, and Multicast.

Three 2.5 Gbit/s wavelengths now interconnect the GÉANT network with the key North American research networks (Abilene, ESnet, CANARIE). This link represents a step towards a more global co-operation in research networking and is managed by DANTE. In addition, GÉANT has a 155 Mbit/s connection to Tokyo from London.

Support is provided to an increasing number of international research projects to ensure their connectivity requirements are met. DANTE is working with the Joint Institute for Very Long Baseline Interferometry (JIVE) to help meet their requirement to transfer data from a number of radio telescopes across Europe to their centre in the Netherlands using GÉANT. (JIVE have previously transferred their data between project sites using magnetic tape!) In addition, collaboration agreements with other projects are being used to develop new services. For example, ongoing work with the European DataGrid project has already resulted in successful piloting of a 'Less Than Best Efforts' service on GÉANT which is ideal for large data file transfers across a network.

the projects

In addition to operating and developing the network, DANTE carries out a number of projects to help promote the development of the Information Society:-

EUMEDconnect

EUMEDCONNECT

The EU's programme to extend the Information Society in the Mediterranean region, called EUMEDIS, is promoting IP infrastructure and applications projects for Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, Morocco, the Palestinian Authority, Syria, Tunisia and Turkey. The main infrastructure project is EUMEDCONNECT which is being managed by DANTE in co-operation with INFN/GARR (Italy), GRNET (Greece), RedIRIS (Spain) and RENATER (France), together with most of the National Research Networks eligible for EUMEDIS funding.

EUMEDCONNECT plans to establish and run a major Internet network in the Mediterranean region that is dedicated to research and other non-commercial purposes and linked to GÉANT. It aims to boost Mediterranean research networking, foster greater levels of research collaboration, and accelerate the rate of Internet development in the region. The planning phase of the project is complete. A contract is agreed for the procurement phase to commence, with a view to providing operational services from late 2003.

ALICE (Acronym: America Latina Interconectada Con Europa)

The ALICE project is co-funded by the European Commission within the framework of the @LIS Programme. DANTE is the Co-ordinating Partner of the ALICE project. The NRENs of most of the 18 countries eligible for @LIS funding are participating in ALICE, namely Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay and Venezuela. On the European side, ALICE is partnered by GARR (Italy), FCCN (Portugal), RedIRIS (Spain) and RENATER (France). In addition, ALICE will be partnered by CLARA, the Co-operation of Latin American Advanced Networks. In Latin America, intra-regional connectivity is not currently highly developed. There is also no organised connectivity between GÉANT and the NRENs in Latin America. The objective of the ALICE project is to address these limitations by providing research networking infrastructure within Latin America and towards Europe. Thus, ALICE will foster research and education collaboration and advancement within Latin America and between Latin America and Europe. It is anticipated that the intra-regional Latin American research network and its interconnection to GÉANT will be operational by the beginning of 2004.

SEEREN (Acronym: South-Eastern European Research & Education Networking)

The SEEREN initiative seeks to improve the research and education infrastructure in South-Eastern Europe to meet the needs of researchers within this area and provide connection to GÉANT. It plans to interconnect the National Research and Education Networks (NRENs) of Albania, Bosnia-Herzegovina, Bulgaria, Former Yugoslav Republic of Macedonia (FYROM), Federal Republic of Yugoslavia – Serbia and Montenegro (FRY), Greece, Hungary and Romania. The project is being co-ordinated by GRNET (Greece) working in partnership with HUNGARNET (Hungary), RoEduNet (Romania), TERENA and DANTE and is being funded by the European Union. SEEREN started in late 2002 and will last 18 months. For more information visit www.seeren.org.

DANTE also takes part in projects aimed at developing its networking activities from a technical point of view, and makes an active contribution to development of research networking policy:-

SERENATE (Acronym: Study into European Research and Education Networking as Targetted by eEurope)

The success of GÉANT has given Europe a world-leading position in intra-regional Research Networking. As a consequence there is considerable focus on Research networking in the European Union Sixth Research and Development Framework Programme. In order to ensure the maintenance of this position, DANTE's sister organisation TERENA is leading a strategic study called SERENATE about the future direction of Research networking in Europe.

DANTE is actively involved in this study. We are leading the work that is examining future technology options, and are working together with CTI of Denmark on the study of the evolution of network economics and regulation. The study involves consultation with a variety of interest groups in Europe, with special emphasis on "End-Users", and will report in 2003.

The **6NET** project aims to further IPv6 development. DANTE is one of the project partners and plays two key roles: establishing the technical infrastructure for testing and pre-production services, and the operational management of the pilot networking environment.

6net

DANTE's own organisation

DANTE has considerable experience and expertise in the various technical and commercial disciplines required to meet the exacting demands of providing international networks and its staff are a crucial element to its success. Based in Cambridge, UK, with around 25 employees DANTE manages a turnover of approximately 50 M Euro connecting National Research and Education Networks to over 30 other European countries and other world regions. Its staff are divided into three functional groups specialising in different areas but working closely with one another.

The Administrative group is responsible for providing the functional areas of finance, office computer systems, personnel and administration as well as public and external relations, and has proven skills in project and financial management and external relations.

The Network Engineering and Planning team is responsible for the engineering of all network-related issues and for the introduction of new services. Initially, new services undergo a pilot phase, after which they are handed over to the Operations group. This team also leads the GÉANT Test programme (TF-NGN) and its members have proven expertise in various fields such as IPv6, Multicast, Multi-Protocol Label Switching (MPLS) and Quality of Service (QoS).

The Operations group has responsibility for the installation, good operation and performance of network services provided, or managed, by DANTE. This includes the provision of support for large international projects and grids. Its members are also in charge of the traffic-reporting activities of DANTE, as well as of such services as statistics collection and the deployment of new services, such as IPv6.