>// TERENA
ANNUAL REPORT 2005

> The core business
of TERENA is bringing
people together.

> Contents

> Foreword

Dear Reader,

This year has seen flourishing activity among TERENA members - both nationally and internationally. More people than ever have been active in TERENA task forces, and the year 2005 saw many more TERENA workshops than any previous year.

These events take place all over Europe, and I would like to take this opportunity to thank the TERENA members and other organisations that host workshops and task force meetings and contribute to the programme of these events.

Many thanks are also due to the Poznań Supercomputing and Networking Centre (PSNC), which hosted the TERENA conference in Poznań in June. The conference attracted more than 500 participants and was rated the most successful TERENA Networking Conference ever – quite an accomplishment, since the two previous conferences both received very favourable ratings as well. PSNC also managed to get quite a bit of press coverage, highlighting the current tremendous progress in European research networking.

Indeed, public relations is becoming increasingly important for our community. Therefore it is positive to note that the TERENA task force on public relations and information dissemination, TF-PR, had another active and successful year. During 2005, the public relations activity of the GN2 project also evolved, and the first GÉANT2 PR Network meeting took place in September, back-to-back with a meeting of TF-PR.

The attention for public relations reflects the growing interest among research networking organisations in the business aspects of their operations. Following a birds-of-a-feather session at the TERENA Networking Conference 2004, four meetings took place during 2005 to discuss lifecycle and portfolio management. This has led to the creation of a TERENA task force on this subject, which will start its activities in January 2006.

Providing connectivity and services to schools can be an interesting component of the service portfolios of national research and education networking organisations. Some of them have been connecting schools for a long time and some have only just started, while others may never do so, but there is a growing interest in the subject. This was confirmed in a first workshop organised by TERENA in February, so UKERNA offered to host a second workshop in London in October. That event was well attended, and has led to a new initiative concerning video services for schools.

The people providing networking services at the university level are becoming increasingly important to the TERENA membership. Campus-level networking is a crucial part of the service

provided by the research networking community as seen by the end-user. TERENA is therefore focusing increasingly on the networking practitioners at campus level. In June, an agreement was signed between TERENA and EUNIS, the European University Information Systems association. EUNIS and TERENA will link to each other's websites, and the organisations will assign slots to each other at their annual conferences to help disseminate information about activities and promote co-operation between members.

The contacts made through EUNIS have been helpful in the organisation of EuroCAMP workshops. In the United States, CAMP (Campus Architectural Middleware Planning) workshops have been taking place for a number of years. Following this example, TERENA organised in 2005 two EuroCAMP workshops, with the aim to develop the knowledge and skills that are needed by the staff involved in the set-up of identity management systems for authentication and authorisation. Together, the two events attracted more than 200 participants from universities and research networking organisations all over Europe.

An example of a service provided at the level of individual institutions but co-ordinated at national and international level is eduroam®. During the year, there has been a substantial increase in the number of participating institutions, and TERENA's task force on mobility has been active in promoting the pilot service and extending its coverage. At the same time, the Joint Research Activity on Ubiquity (Mobility) in the GN2 project has taken the eduroam technology as a starting point to develop and formalise a roaming infrastructure, which together with the development of an interoperable authentication and authorisation infrastructure will lead to the piloting of a single sign-on system for network and application access.

TERENA is a dissemination partner in the project EGEE (Enabling Grids for E-SciencE). After a discussion in the General Assembly meeting in June, it was decided that TERENA should not offer to continue this role in the successor project after the completion of EGEE in March 2006. Intensifying the communication between the research networking community and the Grids community is very important, but can be pursued more effectively in other ways. During the year, TERENA has organised two successful workshops to bring these two communities together.

It is a great pleasure for me to thank all the people involved in the diversified TERENA activities through the year – the Secretariat staff, the members of the Executive Committee, the members of the General Assembly and all those who participated in TERENA task forces and events. This year, 2005, has shown an exceptional engagement and high level of activity that is most encouraging. In my mind, there is no doubt that European research networking is leading the way, and that the high ambitions of the TERENA member organisations together with collaborative spirit are producing really good results.

> **Dorte Olesen,**
> **President**

> Policy and Outlook

In the past few years there has been very substantial progress in the development of research and education networking in Europe. In many aspects, Europe now has a leading position worldwide, and other continents are looking at Europe as an example to follow and as a place to find guidance on the future evolution of advanced networking technologies and services.

Many national research networking organisations in Europe have made the transition to the paradigm of customer-empowered networks. In various different ways they have obtained access to dark fibre and have taken control of the management of their own networks, no longer being dependent on the services offered by commercial telecommunications companies. At the pan-European level, the rollout of the GÉANT2 network will be completed in 2006, and already in its first phase this backbone will encompass a 'dark-fibre cloud' connecting a very large number of the participating countries. These developments are very positive, but also pose significant challenges to the research networking community, and many technical issues, such as those related to the control plane, still need to be investigated.

In the middleware area, other continents recognise European leadership in the development of authentication and authorisation technologies. However, also in Europe there are still no widely deployed and harmonised running services, and much work remains to be done.

In the deployment of IPv6 and the development of IPv6 applications, the European research networking community is ahead of its counterparts in the United States. But still even in Europe only a small part of the traffic on research networks is IPv6 traffic.

In the area of security incident handling, the collaboration, organisation and services in the European academic community serve as an example for the research and education environment and the business and government sectors in other continents. But only a small percentage of hosts in Europe are served by a Computer Security Incident Response Team (CSIRT), and the deployment of 'dark-fibre' networks brings new security challenges.

Europe has also a strong position in Grid applications, but the effort is fragmented, and close collaboration between the various Grid projects and the research networking community, for example in the middleware area, still needs to be developed further.

There is great diversity between countries in Europe. Although some countries have turned their less favourable starting position into an advantage, leapfrogging to the deployment of the most

advanced technologies, there is still a significant divide between the level of networks and services that can be found in certain European countries and that which is considered to be satisfactory in Europe generally. The problem of the digital divide is receiving more attention than before, and new opportunities arise for bridging the gap.

The expected future development of research and education networking brings significant challenges. Researchers, teachers and students continue to put forward new network and service requirements, and technological developments continue to offer new opportunities. With essentially no examples from other continents or sectors to follow, the European research networking community will itself have to formulate and agree the path that it will want to take in the coming period.

European collaboration is obviously very important. Since research networking organisations in Europe are going to enter unknown territory, it is vital to learn from each other's experiences, to jointly study alternatives for further progress and to obtain a general consensus on the direction to be taken. As the joint organisation of the European research networking community, TERENA is expected to promote and facilitate this collaboration.

TERENA is first and foremost a collaborative organisation. Bringing together managers, technical specialists and other people in the research networking community with their counterparts from other countries is the core business of the association. In view of the current challenges to European

> TERENA Executive Committee (December 2005)
Lajos Bálint, Sabine Jaume-Rajaonia, Claudio Allocchio, Shirley Wood, Marko Bonač, Dorte Olesen

> Executive Committee and staff members at lunch in Poznań

research and education networking this core role is more important than ever.

The collaborative character is the strength of the organisation: TERENA is able to mobilise the expertise and experience of hundreds of professionals in the research and education networking environment. This also means that the TERENA activities are highly dependent on the human and other resources that are contributed by the research networking community. The TERENA Secretariat staff and the TERENA Executive Committee make important contributions, but the successful results of TERENA activities are most of all the achievements of the community as a whole.

All activities are undertaken under the guidance and responsibility of the TERENA Executive Committee and under the ultimate authority of the TERENA membership, as represented by the TERENA General Assembly.

The General Assembly had two meetings in 2005. The first meeting took place in Poznań, Poland on 9-10 June, following the TERENA Networking Conference 2005. The meeting was hosted by the Poznań Supercomputing and Networking Centre, the Polish national member of TERENA. The General Assembly received the Annual Report of the Executive Committee on the year 2004 and adopted the financial accounts for that year. The meeting decided that the TERENA membership of the national member from Iran would be terminated unless payment of at least one year of the outstanding membership fees were be received by 1 September 2005. As a consequence, the Institute for Studies in Theoretical Physics and Mathematics (IPM) lost its TERENA membership on that date.

Dorte Olesen (UNI•C, Denmark) and Marko Bonač (ARNES, Slovenia) were re-appointed as President and Member at Large of the TERENA Executive Committee, respectively, for a three-year term of office. The General Assembly had a discussion about the relation between research networks and Grids, and decided that TERENA should play an active role in trying to bridge the gap between the two worlds, but should not pursue that goal by joining individual Grid projects.

The autumn meeting took place in Budapest on 21 October. It was combined with a meeting of the Policy Committee of the GN2 project on the previous day, and was hosted by HUNGARNET, the Hungarian national member organisation of TERENA. The main points for decision concerned financial matters. The General Assembly adopted the association's budget for the year 2006. It decided to increase the membership fees by approximately 1.4%, to compensate for the ongoing inflation. Because of the large increase in the Gross National Income of Turkey, overtaking the GNIs of some other countries represented among the TERENA membership, the national member organisation from Turkey was promoted to a higher membership category.

The Executive Committee's Activity Plan for the year 2006 was introduced by TERENA President Dorte Olesen. Reports were presented on the TERENA Technical Programme, the preparations

of TERENA's annual conference, the 2005 edition of the TERENA Compendium and the work in assessing the networking needs of the research and education community in countries in 'underserved' regions. Following up on its previous meeting, the General Assembly had an extensive discussion about possible topics to be investigated as part of the Foresight Study in the GN2 project. Finally, the meeting heard updates and exchanged opinions about a number of other issues, including the start of registrations of .eu domain names, and the current political controversy between the United States and a number of other governments about the governance of the Internet.

The Activity Plan for 2006 states that TERENA will build on the achievements of recent years and further develop its activities. Some specific highlights are:

> A large-scale Foresight Study into the expected development of research and education networking will start in March 2006. This study will be funded by the European Union as part of the GN2 project and is planned to be completed before September 2007. TERENA will lead the study, but the work will require the active involvement of organisations providing research and education networking services at international, national and local (campus) level, governments and funding bodies, industry and representatives of the network user communities.

> The GN2 project also provides funding that will make it possible to expand TERENA's work in support of research networking organisations and activities in the less advanced regions in and around Europe. During 2005, this work has been limited mostly to preparatory arrangements and assessments of the needs of specific countries, but in 2006 these will be complemented by workshops, training courses or other activities that will concretely address specific problems in the countries concerned.

> In 2006, TERENA will again publish an edition of the TERENA Compendium of National Research and Education Networks. Compared to previous editions, the publication will be enlarged with further analysis of trends over time and of differences between developments in various parts of Europe.

> In the TERENA Technical Programme, task forces will organise common work of the European research and education networking community to address the technical challenges of, among others, control-plane and middleware issues.

> In recent years TERENA has organised an increasing number of workshops on specific topics, and this line of activities will be continued and expanded. Some events exchange information about the needs of specific user groups; examples are the workshops that bring the Grids community and the networking community together to discuss networking requirements and opportunities, and the workshops on the issues involved in connecting schools to national research and education networks. Other workshops, such as the EuroCAMP workshops and the training courses for CSIRTs, provide education to people delivering network-related services.

> After the recent rapid development of research networks at international and national level, the campus network may in many cases have become the bottleneck. Moreover, applications increasingly require end-to-end service provision, and as a consequence the interaction between those responsible for research networking at international and national level and those responsible

at local level needs to be intensified and built on a different footing. The research networking community at local (campus) level will therefore be a focus of TERENA activities, including the Foresight Study and the knowledge transfer activities.

www.terena.nl

TERENA Executive Committee in 2005:

President	Dorte Olesen
Vice President Conferences	Shirley Wood
Vice President Technical Programme	Claudio Allocchio
Treasurer	Lajos Bálint
Members	Marko Bonač
	Sabine Jaume-Rajaonia

// Outreach

// Information Dissemination

The TERENA Secretariat is intensifying its contacts with the member organisations. TERENA staff members try to visit national member organisations whenever they attend a meeting in a country. TERENA Secretary General Karel Vietsch visited Tehran in January and gave presentations for the Iranian member organisation about various TERENA activities. He also visited Denmark to attend a seminar in Horsholm in May to celebrate 25 years of collaboration between the Nordic research networks and to give an address in Lyngby in October at the 40th anniversary of UNI•C.

Another way to make more contacts in the research networking community is for TERENA staff to participate in relevant conferences. For example, at the NORDUnet Conference in Longyearbyen on Svalbard in April, TERENA Chief Administrative Officer Bert van Pinxteren presented an overview of the development of research networking in the past five years on the basis of the data in the TERENA Compendium. At the same conference, TERENA's Licia Florio presented the TACAR repository. She also spoke at the EUNIS 2005 conference in Manchester, England in June, where she won the best-paper award with a presentation about eduroam, and at the GridNets 2005 workshop in Boston, Massachusetts in October, where she discussed access to fibre as a way to close the digital divide. In November, Baiba Kaškina spoke about the activities of TF-CSIRT at the European Network and Information Security Conference in Vilnius, and Valentino Cavalli visited Dubrovnik to present the SEEFIRE project at the CARNet Users Conference. Karel Vietsch presented the work of the TERENA task forces at the BELNET User Day in Brussels in October.

TERENA Chief Technical Officer John Dyer gave a presentation at the International Workshop on African Research & Education Networking at CERN in Geneva in September. As a follow-up, he contributed to the Conference on African Research and Education Networking Infrastructure that was held in Tunis in November, adjacent to the World Summit on Information Society.

The TERENA Secretariat publishes announcements on new developments in the TERENA activities on the TERENA website. The form and structure of these announcements has been revised: a distinction is now made between short 'TERENA News' items and 'TERENA Features', which provide more background information. The announcements are distributed via an email list to which any interested person can subscribe. The website also contains a calendar of events that are of interest to the research networking community. Members of the General Assembly receive by email a monthly TERENA Executive Newsletter, which contains information that is of interest to managers of research and education networking organisations.

www.terena.nl/news/
www.terena.nl/events/

// TERENA Compendium

This year, the fifth annual edition was published of the TERENA Compendium of National Research and Education Networks in Europe. After an interval of one year, the production of the Compendium was again financially supported by the European Union, this time through the GN2 project. The 2005 edition distinguishes itself from previous editions by the comparison of aggregate data of groups of national research networks and by the analysis and where possible explanations of trends over time. These analytical and explanatory texts have been highlighted throughout the publication. Important trends have been summarised as key findings in a special chapter of the Compendium.

Like previous editions, the 2005 edition of the Compendium consists of two parts. One part contains basic information on national research and education networks in Europe and surrounding regions. This part is available on the Web only. For each network organisation, the webpages offer- in addition to the basic data - information about staffing, finances, user base, network capacity, services, plans and developments. The second part consists of a compilation and analysis, giving information on various dimensions of a large number of networks. This second part is available on the Web and also in printed form. It is presented in chapters about basic information, users/clients, network dimensions, traffic figures, and staffing and funding. There is also a new chapter with information about services. Two appendices contain additional tables, an alphabetical list of national research and education networks, and a glossary of terms.

The data for the Compendium were collected through a questionnaire, which was developed with the help of a review panel. Like last year, the panel consisted of Lajos Bálint (HUNGARNET), Marko Bonač (ARNES), Urs Eppenberger (SWITCH), Sabine Jaume-Rajaonia (Renater), Peter Kaufmann (DFN) and Mike Norris (HEAnet). The panel had three face-to-face meetings and carried out most of its work via email. The Web interface that was developed in 2004 was adapted and used again. This interface allows organisations to enter information themselves directly into the Compendium database, using a simple login/password system.

The final version of the second part of the Compendium 2005 was published at the end of September. It contains 70 graphs and tables, presented on 106 pages. The publication includes data from 47 countries in Europe and neighbouring regions.

The Compendium was used as a valuable source of information for researchers and policy makers in a number of countries. Several TERENA member organisations distributed copies of the publication nationally, or used the data in their dialogue with policy makers at the national level. For the first time, national research and education networking organisations were able to download many of the source spreadsheets and to select relevant data for their national situation. The Compendium has also been a useful initial source of information in the preparations of country needs assessments as part of TERENA's networking development support activities.

www.terena.nl/activities/compendium/

// Networking Development Support

There is a significant disparity between European countries and regions in the status and the development of research and education networking. Wide gaps, spanning multiple dimensions - technical, financial, political – exist between countries. Narrowing these gaps is of the utmost importance for achieving the European Union's political goal of equal opportunities for researchers throughout the European Research Area.

Since the start of the GN2 project in September 2004 there are new opportunities for providing support to the development of research and education networking in less advanced countries, because some modest European Union funding is made available for this purpose. The geographic scope of this action was originally defined as the countries whose national research and education networking organisations participate in the GN2 project and the countries that have obtained connectivity to GÉANT through the SEEREN and EUMEDCONNECT projects. The action is co-ordinated by TERENA.

The staff members who are working in this part of the GN2 project are assisted by an advisory panel composed of senior representatives of national research and education networking organisations. Claudia Battista (GARR), Marko Bonač (ARNES), Sabine Jaume-Rajaonia (Renater) and Jorge Sanchez-Papaspiliou (GRNET) are the current members of the panel, which is chaired by TERENA's Valentino Cavalli.

On the basis of the information collected in the TERENA Compendium and other reports, a limited number of countries have been selected on which the development support activities will be focused. To provide a basis for the various activities to assist in the development of research and education networking, needs assessments will be carried out for each of the focus countries during the lifetime of the GN2 project. The result of each needs assessment is laid down in a report that includes recommendations and that is made available to the relevant actors in the country as well as to the European Commission.

The work on a country needs assessment for Albania started in March and was completed with a report that was produced during the summer. The assessment was carried out by TERENA's Valentino Cavalli and John Dyer, with the assistance of Vasilis Maglaris (National Technical University of Athens) and Enzo Valente (GARR). This team visited Albania on 26-27 May to meet with various stakeholders in research and education networking.

The general advice in the assessment report is to make sure that the Albanian government gives higher priority to the Information Society and to research and education networking. In addition, there are two specific recommendations. The first is to promote the establishment of a national research and education networking organisation by helping research and education institutions in the country to reach consensus on one institution representing the whole community. The second recommendation is to promote the creation of a national network backbone for research and education.

As a follow-up to the Albanian needs assessment, TERENA organised a workshop in Tirana on 1 December, which was attended by some 30 people representing the most important universities and research institutions in the country. Massimo Carboni (GARR), Valentino Cavalli and Vasilis Maglaris were speakers at the workshop, which had the goal to communicate the recommendations from the country needs assessment, to raise awareness about the importance of having a national research networking organisation and about its role, to reach consensus on the need to interconnect all research and education institutions in the country, and in particular to (re)start a dialogue aimed at creating an action plan for the reform of the managerial and technical boards that were formed some years ago to create the Academic Network of Albania.

A country needs assessment for Morocco was carried out in the April-September period by Valentino Cavalli and John Dyer, with the assistance of Enzo Valente and Dany Vandromme (Renater). The team visited Morocco on 20-22 June for extensive talks with relevant actors in the country.

The assessment report contains three recommendations. The first is aimed at the funding body, which needs to comprehend the difference between the research network and the commodity Internet provided by commercial Internet Service Providers. The national research networking organisation MARWAN should aim to access lower-level transport technology in order to be able to deliver IPv6, multicast and Grid services. Eventually, MARWAN should investigate the opportunity to acquire dark fibre. The second recommendation calls on the heads of academic and research institutes and departments to encourage the introduction and use of advanced network services and applications such as videoconferencing, Grids and authentication and authorisation infrastructures in order to allow their institutions to participate and compete in the global research community. The third recommendation is to ensure that stable funding and sufficient, well-trained staff are available to MARWAN in order to meet the challenges of the foreseeable future.

In the summer, the advisory panel recommended to giving priority to Malta, Bulgaria and Romania in the second year of the GN2 project. Information from these countries was collected and further discussions with the relevant national research networking organisations were conducted in the last months of the year.

On 8-9 December, TERENA organised a meeting in Brussels for managers of national research networking organisations to learn about the opportunities for financial support from the European Union's Structural Funds. On the first day of the meeting, which was convened by Marko Bonač, action plans were presented from those countries that have already secured access to Structural Funds to develop research and education networking infrastructures and from countries that have plans ready to implement. On the second day, participants met with European Commission officials to learn about the opportunities, conditions and limitations of using Structural Funds for the development of IT infrastructures.

www.terena.nl/activities/development-support/

// TF-PR (Public Relations and Information Dissemination)

TF-PR promotes the collaboration between research and education networking organisations in Europe in the areas of public relations and information dissemination, through activities at the level of PR Manager / Information Officer. In September, the mandate of the task force was renewed for another two-year period, while at the same time Russell Nelson (UKERNA) took over the chairmanship from Sandra Passchier (SURFnet). TF-PR had three meetings in 2005: on 17-18 March in Lyngby, Denmark, on 5 June in Poznań, Poland and on 29-30 September in Tartu, Estonia.

> TF-PR

> Handing over the chair in Tartu

As the first in a series of tutorials on the basics of public relations practice, the first half day of the meeting in Lyngby was devoted to issues related to dealing with the press. Anne Mette Lundin (UNI•C) presented strategic ideas and practical advice, Zoran Birimiša (CARNet) gave a very practical presentation on the organisation of press conferences, and Joanne Barnett (TERENA) explained how to compile and maintain press lists.

Experiences with the preparation, implementation and analysis of user surveys and their results were presented by Dale Robertson (DANTE), Maria Ristkok (EENet) and Zoran Birimiša. Helga Spitaler (DANTE) led a discussion on the segmentation of the GÉANT user base and how to rationalise the data in target groups relevant to the needs of national research and education networking organisations.

Julia Gardner (UNI•C) led an interesting and practical session on testing the usability of websites. Her presentation provided background information as well as practical recommendations.

On the day before the TF-PR meeting in Poznań, task force members were invited by PSNC to a special hands-on workshop on testing the usability of websites. The training was organised by Gitte Kudsk (UNI•C) and gave participants an opportunity to try out some of the ideas and techniques learned at Lyngby. The short task force meeting in Poznań reviewed the proposed revision of the terms of reference of TF-PR.

In 2004, the task force had formed a team to prepare a survey collecting information about the staffing, budgets, responsibilities, publications and other activities of the TF-PR participants. TERENA's Carol de Groot presented a draft version of this compendium of PR and communications activities of research networking organisations at the meeting in Lyngby, and in Poznań the final version of the first edition of this publication was presented. It provides a benchmark against which progress of PR and communications activities can be measured in the coming years.

The meeting in Tartu was co-located with the first meeting of the GÉANT2 PR Network, creating useful synergy. The branding strategies of UKERNA and SURFnet were presented by Russell Nelson and Elise Roders. Robert Haymon-Collins (JISC) led a tutorial on how to write press releases, which included hands-on exercises in small groups.

TF-PR will organise a series of presentations where difficult and complicated technical issues related to advanced networks and services will be explained for a non-technical audience, to give PR practitioners a better understanding of what they are writing about and what their organisations are doing. In Tartu, David Fergusson of the National e-Science Centre in the United Kingdom gave the first of these lectures, presenting an in-depth explanation of Grids in general and the EGEE project in particular.

Tartu also saw the first meeting of a sub-group of TF-PR that will work on end-user communication and marketing communication strategies. The group will consider ways to get feedback from users of network services, segmentation of user groups and best practice in marketing communications.

www.terena.nl/activities/tf-pr/

// Lifecycle and Portfolio Management

On the morning of 17 March, immediately before the TF-PR meeting in Lyngby, a meeting was held to discuss possible collaboration between national research and education networking organisations in the area of lifecycle and portfolio management. This topic had already been discussed in a birds-of-a-feather session at the TERENA Networking Conference 2004 in Rhodes. More meetings about the initiative were held later in 2005: birds-of-a-feather sessions at the NORDUnet Conference in Longyearbyen in April and at the TERENA Networking Conference 2005 in Poznań in June, and a small workshop in the TERENA Secretariat office in Amsterdam on 23 November.

These preparations led to the decision of the TERENA Executive Committee to create a task force on lifecycle and portfolio management. TF-LCPM will start its activities on 1 January 2006. Topics to be explored by the task force include the introduction of new services within national research and education networking organisations, the discontinuation of existing services, alignment of the service portfolios of a research networking organisation with user requirements, marketing of services, and methods for defining the lifecycle stage of a particular service.

www.terena.nl/activities/tf-lcpm/

> Conferences and Workshops

> TERENA Networking Conference 2005

The TERENA Networking Conference 2005 was held in Poznań, Poland on 6-9 June, hosted by the Poznań Supercomputing and Networking Centre (PSNC), with local support from IKANOR. The new and impressive congress centre of the Poznań University of Technology provided a remarkable venue for the event. The evaluation forms clearly indicate that the conference was rated by participants as the best-ever TERENA conference, in particular as regards the conference programme. It was certainly the biggest. There were more than 500 participants and the actual conference programme consisted of over 130 presentations in five parallel tracks. An unprecedented number of other meetings were held before, after and during the conference.

The keynote speaker in the opening plenary session, Ed Seidel of Louisiana State University, challenged the network community to build the networks that scientists want to have. These networks would not only be bigger and faster, but pervasive; available anywhere, at any time and offering a large range of new applications. But they must also be simple, with easy-to-use toolkits and end-to-end quality of service, so that they can connect even to Grids and high-speed optical networks as if 'connected with a wire'.

In his keynote address, Dai Davies (DANTE) described the new GÉANT2 European backbone network, which will be rolled out between mid 2005 and mid 2006, the most visible result of the EU-sponsored GN2 project that will strive to provide European research and education with just the sort of backbone network and services as on Ed Seidel's wish-list. Many of the applications and services under development were presented in fourteen additional GN2 presentations, included in the appropriate topic sessions throughout the conference. This distributed form of the workshop encouraged a broad range of conference participants to learn about the activities of the project.

Grids will play an increasingly important role in facilitating the large applications that researchers want, and four sessions were devoted to advances in Grid technology, Grid access and the administration of Grids. Optical networks are also poised to play a key role in delivering network facilities on the scale required for big, distributed scientific collaborations and advanced e-science applications, and two conference sessions covered developments in this field.

Two EU-funded projects, MOME and LOBSTER, held workshops in the form of a dedicated stream throughout one whole day, including presentations and panel discussions on network monitoring; two further sessions were devoted to network performance. The bigger, faster networks create new opportunities in many fields such as real-time streaming, conferencing and multicast, and the challenges were addressed in two sessions on the new technology and management systems required. Middleware becomes an even more vital element to paste it all together and two sessions were devoted to technology and applications to deliver all of these services to the user in a pervasive way. Accounting was also addressed.

...thanx
Martin Bech

Mobility was the subject of three popular sessions at the conference, including talks on future directions, on academic roaming with eduroam and Edupass, and on the deployment and management of large-scale wireless networks.

> Plenary session at the TERENA Networking Conference 2005

Bob Cowles of the Stanford Linear Accelerator Center lectures worldwide on computer security. In his keynote talk he warned that security is an ongoing struggle. The hackers and attackers are getting smarter and the frequency and scope of attacks is increasing: fake service providers, phishing, pharming, spyware, etc. Co-ordinated international efforts, a global approach to information sharing and some practical research are required to protect the networks. Two sessions on security reinforced the messages from this keynote talk.

Bob Kvavik of the University of Minnesota spoke for the network administrators, explaining the current state of practice and expectations for the (very near) future. At present, results from his survey of a selection of universities in Canada and the United States indicate that 80% of a university network is used for administrative activities and only 20% for academic and research purposes. The new networks coming on line are expected to be used 80% for academic and research activities and will change the way research is done. The challenge for network administrators will be to provide, organise and manage the new services that the users require.

Consequently, user issues are becoming more important for the national research and education networking organisations. Three sessions at the conference were dedicated to the subject of broadening the research network user community, reaching the users and managing the products and services offered.

> Kevin Warwick shows his interview with film star Will Smith at the premiere of "I, Robot"

Sessions on new global connectivity and networking in other world regions provided participants with a look at international initiatives. Special attention was paid this year to networking in Eastern Europe, including a panel discussion on future developments in the countries in the region.

Jochen Schiller of the Free University Berlin gave a fascinating keynote talk on sensor networks, their uses, the technology involved and future requirements. Production sensor networks are already in use in such areas as monitoring environmental changes for agriculture and nature studies, the safety of firemen, the temperature loss of buildings, and water temperature and movement. Further research is needed to make the networks self-healing, and also on routing and management issues, on the use of energy, data transfer and on new applications and tools.

In his closing plenary session, Kevin Warwick of the University of Reading challenged his audience with some ideas that seemed to be almost science fiction, but will in reality be influencing our lives in the near future. His research into connecting the human brain to computers and sending the neuro-signals over the Internet will offer the possibility of giving people new senses such as infrared vision, ultrasound hearing or the ability to calculate as fast and as accurately as a mainframe computer.

The conference programme was put together by a hard-working committee of international experts in their field, under the leadership of Olivier Martin (CERN). The best and most representative papers presented at the conference were selected by the programme committee for publication in a special edition of the journal Computational Methods and as a Web publication in the library on the TERENA website.

Generous sponsorship for the conference was provided by ALMA, Cisco Systems, Juniper Networks, IBM, ADVA Optical Networking, ATM, COLT, Exatel, Intel, TELEPERN, TeliaSonera, Nortel, Extreme Networks, Global Crossing, Level 3 Communications, Sun Microsystems, Glimmerglass, TANDBERG, Ericsson and PSNC. The conference was supported by the Polish Ministry of Sciences and Information Society Technologies.

www.terena.nl/events/tnc2005/

> Voice-over-IP Workshop

> Preparing the VoIP workshop

A workshop on Voice-over-IP (VoIP) was organised in Poznań on 5 June, the day before the TERENA Networking Conference. More than 50 technicians from research and education networking organisations and universities in Europe heard presentations by expert tutors from Europe, Australia and the United States. The workshop gave an overview of relevant VoIP and videoconferencing technologies from an application point of view, with the objective of making a contribution to the wider deployment of VoIP and videoconferencing in the research community by spreading the relevant knowledge. The event was organised by Bartlomiej Idzikowski (PSNC), and Erik Dobbelsteijn and Egon Verharen (SURFnet) with support from Baiba Kaškina (TERENA).

The workshop programme addressed five scenarios:

> **Replacement of PBX (Private Branch Exchange) systems**
When legacy PBX systems have been depreciated there is an opportunity to build an IP telephony service from scratch. Some of the issues involved were presented by Wojcieh Nawrot, Wojciehšronek and Krzysztof Turza of the Poznań Supercomputing and Networking Centre.

> **SIP.EDU deployment**
SIP (Session Initiation Protocol) was introduced in a tutorial by Stephen Kingham (AARNet) and Saverio Niccolini (NEC Europe). Ben Teitelbaum (Internet2) and Dennis Baron (MIT) presented SIP.EDU, a project of Internet2's VoIP working group aimed at increasing the number of SIP-reachable users, extending email identities to voice services, and supporting academic communities by developing and deploying SIP services.

> **Integration of VoIP and videoconferencing**
In his presentation on this subject, Saverio Niccolini made the point that IP telephony and videoconferencing are basically the same H.323 services. He presented examples of VoIP and

videoconferencing integration that are already in place in the SURFnet offices and in NEC's Network Laboratories.

> **Integration of H.323 and SIP protocols**
João Pereira (FCCN) presented the Portuguese experiences in bridging the H.323 and SIP worlds.

> **Future developments**
A view on future developments was presented by Stephen Kingham. One of the issues is how to integrate value-added services like presence and instant messaging in the various scenarios.

The workshop was rounded off by a hands-on experience session, which gave participants an opportunity to use equipment from different vendors installed for this purpose.

The initiative for the VoIP workshop grew from the activities of TERENA's task force on voice, video and collaboration. It was seen as an opportunity to actually show some of the features discussed in the IP Telephony Cookbook that was published by TERENA in 2004.

www.terena.nl/activities/tf-vvc/voip-wsh/

> EuroCAMP Workshops

EuroCAMPs aim to develop the knowledge and skills that are needed by staff who are involved in setting up identity management systems for authentication and authorisation. They intended for at Chief Information Officers, IT architects and IT managers of universities and research centres, persons who are involved in designing campus-wide digital identification systems, staff of national research and education networking organisations who are involved in harmonising digital identification systems at a national and international level, and any other persons who are involved with digital identification systems in academia. The model of CAMP (Campus Architectural Middleware Planning) workshops originates from the United States, where similar events have been held for a number of years.

Following the American example, TERENA has taken the initiative to organise CAMP workshops in Europe. This has been received enthusiastically by the community. For TERENA it means the start of a new kind of activity, reaching out to the European campuses to promote start-of-the-art middleware technologies.

The first European CAMP workshop was held in Turin, Italy on 2-4 March. The event, which was attended by almost 120 participants from all over Europe, was hosted by the Technical University of Turin and organised by TERENA's Licia Florio. The workshop programme was very interactive, with discussions after each presentation to find out what is really going on in the campuses in Europe. Michael Gettes (Duke University), Ton Verschuren (SURFnet), Ken Klingenstein (Internet2), Diego López (RedIRIS) and Miroslav Milinović (CARNet) chaired birds-of-a-feather sessions and panel discussions at the end of each day, successfully generating feedback from the audience and long, lively discussions.

The first day of the workshop addressed identity management issues, which focus on the digital identity of the users and how these are managed within campuses. Security, trust practice and privacy were also discussed by prominent experts. The sessions on the second day concentrated on state-of-the-art technologies for intra- and inter-organisational authentication and authorisation systems, including Shibboleth technology and case studies. Ken Klingenstein explained the general concepts of Shibboleth, and Ueli Kienholz and Thomas Lenggenhager described how SWITCH has implemented the technology in Switzerland.

On the third day, eduroam was presented: an example of federation access to a network. Carsten Bormann (University of Bremen) gave a general overview of the technology to access the network, followed by Klaas Wierenga (SURFnet), who explained the details of the 802.1X technology upon which eduroam is based. Chris Myers from GrangeNet summed up how Australia had joined eduroam.

The second EuroCAMP workshop took place in Porto, Portugal on 7-9 November. It was set up to aim for a slightly smaller number of participants than the first EuroCAMP, but still attracted more than 80 attendees. While the Turin event was already highly rated by participants, the workshop in Porto scored even higher marks in the evaluation questionnaires.

The workshop was opened by Ligia Ribeiro from the hosting organisation, the University of Porto. She welcomed the participants also in her role as president of EUNIS, pointing out the importance of the EuroCAMPs in promoting the collaboration between the TERENA and EUNIS communities.

Ken Klingenstein opened the series of lectures with an overview of identity management systems. Directories and meta-directories were discussed by Roland Hedberg (Umeå University) and Victoriano Giralt (University of Malaga). Public Key Infrastructure and its attributes were explained by Michael Gettes, Milan Sova (CESNET) and Diego López. Ingrid Melve (UNINETT) concluded the first day, reporting on Norwegian experiences in moving from identity management systems to federated solutions.

The second day of the programme focused on how to access applications in a federated way. Bart Kerver (SURFnet) and David Orrell (Eduserv Athens) opened the day, presenting the authorisation and authentication infrastructure landscape and the various systems that are being used by national research and education networking organisations and in some universities. Most of the programme of the second day was dedicated to Shibboleth. Ken Klingenstein introduced the topic and explained the concept of federations. Three case studies illustrating the use of Shibboleth were presented by Thomas Lenggenhager and Ueli Kienholz of SWITCH, and by John Paschoud (JISC). An intensive in-depth session on Shibboleth in practice was organised and led by Nathan Klingenstein.

Like in the first EuroCAMP, eduroam was presented on the third day as an example of a federation to provide network access. Ken Klingenstein gave a general overview of the technology for network access and the security problems that arise with roaming users. Klaas Wierenga explained the 802.1X technology. Two examples of eduroam deployment were presented, by Chris Myers and by Lino Santos (FCCN).

www.terena.nl/activities/eurocamp/

> NREN-Grids Workshops

The introduction of Grid technology brings new challenges to research networking, and requires close collaboration between the research networking community and the Grids community. In 2005, TERENA has started a series of semi-annual workshops to bring members of these two communities together. The objectives of these events are to exchange information on current practice and to reach a common understanding about the likely impact of Grids on national research networks. The workshops also investigate organisational and political issues, and consider with which initiatives or projects the TERENA community needs to engage.

> The second NREN-Grids workshop

Emerging Grid technology encompasses many facets: computational Grids with tens of thousands of processors, Grids that provide global access to petabytes of experimental data, Grids that provide remote access to specialist experimental equipment, and Grids that can be used for large-scale distributed meetings, collaborative work sessions, seminars and training. Some Grid applications make high demands on the underlying networks. In addition, Grid middleware must form part of the infrastructure that supports Grid applications end-to-end.

In the research networking community, the concept of hybrid networking has been developed, a technique separating the traffic of users requiring very high bandwidth point-to-point from the classic routed IP traffic. Development and prototyping work on authentication and authorisation infrastructure has been undertaken in the academic community in the past years. Some initiatives to put national infrastructures in place are underway and work on confederating these has begun. The Grids community has put in place its own ad-hoc authentication and authorisation infrastructures to satisfy its immediate demands, but it is generally agreed that these will not scale.

The first NREN-Grids workshop was organised by TERENA in Amsterdam on 12 May and attracted 35 participants from 21 countries. It had a wide-ranging agenda, covering network infrastructure, authentication and authorisation infrastructure, security, monitoring and support for virtual organisations. The scene for discussions was set by seven presentations from the networking community and the Grids community; speakers were Simon Leinen, Thomas Lenggenhager and Martin Sutter from SWITCH, Diego López (RedIRIS), Ludek Matyska (CESNET), Ian Neilson (CERN), Péter Stefán (HUNGARNET) and Mathieu Goutelle from CNRS/UREC who represented the EGEE project.

During the discussions in the afternoon, many practical issues were explored. There was also an extensive discussion about the equitable sharing of network resources and costs. In discussing the provision of authentication and authorisation infrastructure it was agreed that the Grids community could gain a great deal by collaborating with the national research networking organisations that are currently working on such infrastructures for general use. More generally, the conclusion was that while the technical work on the relevant topics could best be dealt with elsewhere, for example, in the TERENA task forces, discussions between the national research and education networking organisations and the widest possible Grids community should continue to take place in the context of TERENA's NREN-Grids workshops.

The second workshop took place at Amsterdam Airport on 17 October and was attended by more than 50 participants from national research and education networking organisations, Grid projects and industry. The programme focused on the topics of authentication and authorisation infrastructure and schedulable deterministic end-to-end pipes. The event started with presentations by John Dyer (TERENA), Klaas Wierenga (SURFnet), Milan Sova (CESNET), Christoph Witzig (SWITCH), Christos Kanellopoulos (GRNET and Aristotle University Thessaloniki) and Jean-Marc Uzé (Juniper Networks).

The second part of the workshop consisted of a lively discussion, which was moderated by TERENA's Licia Florio. One main conclusion was that it is vitally important to involve campuses in the development of a pervasive authentication and authorisation infrastructure, because they are generally the users' identity provider.

www.terena.nl/activities/nrens-n-grids/

> Workshops on Connecting Schools

> The second workshop discusses funding

The eEurope 2002 Action Plan, which was adopted by the European Council in June 2000, already stated that a very high-speed trans-European network for electronic scientific communications should link research institutions and universities, as well as scientific libraries, scientific centres and, progressively, schools. This appeal to connect schools to research and education networks has led to actions in some EU member states, but not in others. Some national governments had already taken (possibly different) initiatives earlier, and in other countries the time was apparently not yet ripe.

During the year 2004, a new interest in connecting schools arose among the European research and education networking community. Following requests from its membership, TERENA organised a workshop on connecting schools to national research and education networks, which took place on 22 February 2005 in Amsterdam. The workshop was attended by 40 persons, who represented nineteen different national research and education networking organisations as well as some policy and funding bodies and equipment vendors. They heard presentations about current initiatives to connect schools in the United Kingdom (Rob Symberlist, UKERNA), Portugal (Lino Santos, FCCN), Slovenia (Tomi Dolenc, ARNES), Norway (Petter Kongshaug, UNINETT), Greece (Dimitrios Kalogeras, GRNET), Italy (Gabriella Paolini, GARR), Ireland (Andrew Byrne, HEAnet) and Denmark (Per Thørboll, UNI•C).

It became clear from the discussions that user requirements are largely common across the countries represented; however, the financial and political situations vary significantly. There are many common issues and needs, but the solutions always require a number of choices that are very much dependent on the local political, technical and organisational environment. As a consequence, there is only limited scope for national research and education networking organisations to work together on developing technologies and services related to connecting schools. However, there is a substantial interest in exchanging information, so that the organisations can learn from each other's experiences. Facilitating this information exchange is a natural task for TERENA.

A birds-of-a-feather session was held at the TERENA Networking Conference in Poznań in June, to include more members of the community in the initiative. This was followed by the preparations for the second workshop, which was hosted by UKERNA in London on 24-25 October, with sponsorship from UKERNA and Becta. This event was also attended by about 40 participants, this time mostly representatives from national research and education networking organisations that are already involved in connecting primary and secondary schools to their networks.

The workshop started with in-depth presentations about issues involved in connecting schools to the national research and education network in Slovenia (Marko Bonač and Tomi Dolenc, ARNES), Ireland (Ronan Byrne, HEAnet) and Luxembourg (Stefan Winter, RESTENA).

A parallel session on technical issues was chaired by Rob Symberlist. In this session, participants tried to identify success factors and problems they had faced in connecting schools to the Internet and in providing value-added services to schools.

Another parallel session dealt with management, funding and political issues. It was chaired by TERENA's President, Dorte Olesen. Several experienced national research and education networking organisations made a commitment to prepare white paper, which will clearly set out the pros and cons for national research networks to connect schools.

Videoconferencing and security proved to be the topics of greatest interest to the participants. The first subject was treated in presentations by Simon White (WMnet), John Martin (UKERNA), Karen Perrins and Rob Symberlist (UKERNA), and Baiba Kaškina (TERENA). Tommy Ravn Jensen (UNI•C) and Lino Santos spoke about security issues. Finally, Mike McKeown of Cisco Systems gave a presentation about enabling a media-rich curriculum by content delivery networking.

Rob Symberlist volunteered to co-ordinate plans to set up a structure that will enable videoconferencing between schools in different countries. In the last days of December, UKERNA and ARNES sent out a call for participation in this initiative, to be known as VISIT (Videoconferencing In Schools Initiative – TERENA).

www.terena.nl/activities/schools/

> High-quality Video over IP Workshop

SURFnet hosted the second TERENA workshop on production of high-quality video for transmission over the Internet on 7 November in Utrecht, the Netherlands. The workshop was organised by TERENA and SURFnet as part of one of the deliverables of the TERENA task force on voice, video and collaboration, TF-VVC.

High-quality video is important in arts and culture and in many fields of scientific research, such as astronomy. It is vital for applications in such fields as medicine, where, for example, video is transmitted during an operation and a second opinion can be sought from a specialist in a remote location. Kazunori Sugiura of the WIDE project in Japan presented DVTS, software for running DV (digital

> Egon Verharen introduces the workshop

video) over IP, using laptops and cheap miniDV cameras. He covered the history, its present implementations and future developments. After the presentation, the participants had the opportunity to learn hands-on how to set up high-quality videoconferences using DVTS.

Egon Verharen of SURFnet presented high-definition (HD) video over IP. He highlighted some lessons learnt from executing both compressed HD and uncompressed HD over IP networks. In this part of the workshop there was also a hands-on session. This time, participants could learn how to send compressed HD over IP using freeware software and relatively cheap HD cameras and computers.

Jesus Alcobar of the i2CAT Foundation in Barcelona presented the HD wiki, the main information source for all things HD over IP. The workshop was wrapped up by a discussion of opportunities for collaboration, such as participation in a European project and activities in TERENA's task force TF-VVC.

www.terena.nl/activities/tf-vvc/hq-workshop/

-} Technical Programme

-} Introduction to the Technical Programme

The TERENA Technical Programme is a key element in the joint activities of the European research networking community. The work in the Technical Programme is organised in task forces and projects, and is driven by needs identified by the community. The strategic direction of the Technical Programme is set by the Technical Advisory Council, a body comprised of the senior technical managers of the TERENA member organisations. The Technical Programme is co-ordinated and supervised by the TERENA Technical Committee, a small group of experienced networking professionals.

TERENA technical task forces are open groups where specialists undertake joint work under terms of reference approved by the TERENA Technical Committee. As a rule, task forces have a limited lifetime, related to the nature of the work and the number and size of the deliverables that they set out to produce. Task forces have an important function in the exchange of information about other activities in their field and the development of plans for new initiatives. During 2005, many TERENA task forces have been providing feedback and ideas to the teams working on Joint Research Activities in the GN2 project. It is anticipated that some of the developments achieved in the TERENA Technical Programme may form the basis for new service offerings on the GÉANT2 network and the national research networks. The support that the TERENA Secretariat staff provides to the work of the task forces is co-funded by the European Commission through the GN2 project.

TERENA projects are carried out by experts and engineers on the basis of a contract with TERENA. Except for very small projects, funding requires a combination of contributions from TERENA's own resources and from TERENA members and other interested organisations.

In addition, the TERENA Secretariat staff participates in several projects in the Framework Programmes of the European Union.

-} The Technical Programme in 2005

The Technical Advisory Council held its annual meeting on 6 June, immediately before the start of the TERENA Networking Conference 2005 in Poznań. The meeting was attended by 45 delegates representing 27 TERENA member organisations. It was devoted almost entirely to a discussion of three major topics that are considered to be of significant importance to the research networking community:

> End-to-end and campus issues were presented by Martin Sutter (SWITCH). He pointed out that service to a user accessing remote resources is typically delivered via a concatenation of networks

that each are their own management domain. The mere existence of an end-to-end 'fat pipe' is not in itself sufficient to guarantee an acceptable level of end-to-end services.

> The second topic of discussion was the European Policy Management Authority for Grid Authentication in e-Science (EUGridPMA), which has been set up to establish requirements and best practices for Grid identity service providers. EUGRidPMA enables the creation of a common trust domain for authentication of end-entities in inter-organisational access to distributed resources. However, EUGridPMA may not be sustainable in the long term if it focuses only on Grid Public Key Infrastructure, and it was recommended that it be opened up beyond the Grids community.

> Finally, Diego López (RedIRIS) gave a presentation about building trust in Europe, in which he pointed out that there are many states, languages, priorities, laws and national prides. As a consequence, there is a tendency to undertake developments in a national context, which has resulted in several different authentication and authorisation infrastructures being developed. Against this background, Europeans are generally good at making successful inter-working agreements, even if they are in some ways a compromise. Diego López went on to discuss various initiatives under the TERENA umbrella, such as eduroam, the work in the Schema Harmonisation Committee (SCHAC) of TF-EMC2, TACAR and the EuroCAMPs.

The TERENA Technical Committee met three times in 2005 to discuss the progress of the various activities in the Technical Programme and to consider proposals for new TERENA projects. These meetings took place in the TERENA office in Amsterdam on 1 April, 5 July and 13 October. Authentication and authorisation infrastructure, and end-to-end and campus issues were topics that were discussed in-depth in the meetings of the Technical Committee.

TERENA Technical Committee in 2005:

Claudio Allocchio (chairman)	Vice President Technical Programme
Roberto Barbera	until 3 October
Andrew Cormack	from 30 June
Jean-Paul Gautier	from 16 December
Christoph Graf	until 25 June
Diego López	from 3 October
Victor Reijs	
Martin Sutter	
Ton Verschuren	until 7 November
Steve Williams	
Karel Vietsch	Secretary General
John Dyer	Chief Technical Officer

-} Technical Task Forces

> TF-CSIRT (Collaboration of Security Incident Response Teams)

TF-CSIRT is the task force where members of Computer Security Incident Response Teams (CSIRTs) meet, collaborate, exchange information and experiences, and develop a cohesive environment of trust. The participants come from different communities: national research and education networking organisations, universities, government institutions and commercial companies.

The task force met three times in 2005: on 27-28 January in London, on 12-13 May in Zürich and on 15-16 September in Lisbon. On the first day of every meeting, a seminar was held on issues related to computer and network security. Presentations in the seminar sessions covered technical and legal issues, and provided overviews of activities of local institutions, including law enforcement agencies and commercial companies. The second day of every meeting always included a task force business meeting, where the work of subgroups was reviewed and other related activities were presented.

A memorandum of understanding between TF-CSIRT and APCERT, its counterpart in the Asia-Pacific region, was signed in June 2005 at the annual FIRST conference in Singapore. An update on TF-CSIRT activities was presented at this conference.

One of the task force activities is to assist the establishment of new CSIRTs. A Starter Kit has been put together and made available on-line. The Starter Kit is a Web page with links to other useful Web pages that can help new CSIRTs to find the answer to frequently asked questions.

TF-CSIRT's Web-based clearinghouse for incident handling tools is hosted by DFN-CERT in Germany. The focus of the clearinghouse is on tools that are in current use in the CSIRTs whose staff members participate in TF-CSIRT. Recently, the service has been extended by adding basic workflows for incident response cases and information on teams that are using a particular tool.

In earlier years, TF-CSIRT had initiated the addition of an IRT (Incident Response Team) object to the RIPE database, in order to help CSIRTs discover who is responsible for the security aspects of a host or a group of hosts. The task force follows and supports the deployment of the IRT object by improving documentation and proposing changes in technology and procedures. It has investigated the usefulness of extending the mechanisms to other unique Internet Resources (for example, Autonomous System Numbers) as well as possibilities to implement similar mechanisms in other Regional Registry or Routing Registry environments. During 2005, the object format was updated and optimised to make it easier to use.

The task force exchanges information with the European Commission services responsible for EU policies and actions related to data and network security, and advises the European Commission as appropriate. The task force also closely follows the development of the new European Network and Information Security Agency (ENISA). Andrew Cormack (UKERNA) has been appointed a member of ENISA's Permanent Stakeholders Group. His

> TF-CSIRT meeting in London and in Zürich

candidacy was supported by a large number of CSIRTs in Europe. Updates on ENISA have been given at all task force meetings.

The task force has created a slide show about the TF-CSIRT activities. During the year, the slide show was presented at various events, for example, the FIRST conference in Singapore, an ENISA-sponsored conference in Vilnius and local security conferences.

The subgroup of TF-CSIRT that aims to create a unified Vulnerability and Exploit Description and Exchange Format continued its activities during the year. The group produced a series of documents establishing consolidated best practice for vulnerability and/or exploit description, taking into account the needs of vendors, CSIRTs and end-users. A birds-of-a-feather session was organised at the FIRST conference and links to the ENISA work programme were investigated.

The task force is a sounding board and a collaboration partner for the team working on the Joint Research Activity on Security in the GN2 project. That team has meetings back-to-back to TF-CSIRT meetings and progress reports from the activity are regularly presented in the task force meetings. An advisory panel has been established to provide advice on the work of the Joint Research Activity. The members of the advisory panel were recruited from TF-CSIRT participants.

The task force is liaising with E-CoAT (European Co-operation of Abuse Fighting Teams). E-CoAT has been created to discuss pragmatic approaches to abuse-handling issues. The discussions in this forum have focused on three topics: viruses and worms, unsolicited electronic mail, and copyright issues. E-CoAT organised two meetings during the year and reported about its work to the TF-CSIRT meetings.

Other spin-off activities related to TF-CSIRT, like the Trusted Introducer service, the TRANSITS training courses and the RTIR project, are reported on elsewhere in this Annual report.

www.terena.nl/activities/tf-csirt/

> TF-EMC2 (European Middleware Co-ordination and Collaboration)

The objective of TF-EMC2 is to promote the development and deployment of open and interoperable middleware infrastructures among national research and education networks and academic and research institutions. The task force serves as a dissemination and discussion forum and also provides a framework to support new ideas and initiatives. The task force had three meetings in 2005: on 16-17 February in Amsterdam, on 5 June in Poznań and on 8-9 September in Barcelona.

One of the work items of TF-EMC2 is to transform the design of the AA-RR (Authentication and Authorisation Requester-Responder) system and the proof-of-concept implementation into production-level software. AA-RR is a tool, developed by RedIRIS, to help in the validation of the interoperability of certain AA components. When a new component is developed and has to be integrated into a given infrastructure, or when two different infrastructures have to be connected, there should be some assessment mechanisms in place to verify the compatibility of the new element in the system. The main component of AA-RR is the use of metadata describing the requirements of a certain infrastructure in order to validate (or make an assessment of) the interoperability of a certain component with others.

The latest version of AA-RR, which was presented at the TF-EMC2 meeting in June, supports different protocols, such as SAML and RADIUS as well as the Spanish single sign-on system PAPI. The AA-RR design offers an open framework for easily incorporating support for new protocols.

In February, TF-EMC2 created the Schema Harmonisation Committee (SCHAC) as a subgroup to define and promote common schemas in the field of higher education with a view to inter-institutional data exchange. To date, eduPerson is the only successful attempt of this kind, but eduPerson is mainly tailored to American needs.

The need for interoperability between different components has increased awareness of the role that attributes play. Information is stored as schemas; each schema is a collection of definitions of attributes and these attributes describe the characteristics of the object that

> Middleware was a big topic at TNC 2005.

the schema represents. Interoperability between different software systems translates into the exchange of schemas and attributes. There is a great need for co-ordination of schemas in order to foster collaboration. In different contexts (i.e., in the schemas used in different countries) the same attributes can have different meanings, not to mention the fact that privacy issues related to attributes are dealt with in different ways by different regulations.

SCHAC started its work by collecting the national schemas of an initial set of countries, which were evaluated to look for commonalities. Two releases of the SCHAC attributes for personal data have been published. Both are available online and have been commented on by a large community, reflecting the growth of the SCHAC group. At the end of December, the first SCHAC LDAP schema was circulated for comments.

SCHAC hopes to provide support for eduroam, for the research work on authentication and authorisation infrastructure in the GN2 project, for Grids and for activities related to the deployment of federations. EUNIS is interested in using the SCHAC schema for the European Credit Transfer and Accumulation System. Institutions will not be required to give up their internal schemas, but will be requested to use the SCHAC schema for (inter)national data exchange.

Other spin-off activities related to TF-EMC2, like the EuroCAMP workshops and the Server Certificate Service project, are reported on elsewhere in this Annual report.

www.terena.nl/activities/tf-emc2/

> TACAR

More than two years after its launch, TACAR, the TERENA Academic Certification Authority (CA) Repository, is a well-established solution for cross-domain use of the root CA certificates (trust anchors) of the various Certification Authorities run by organisations in the academic community.
The certificates collected by TACAR are those that are managed directly by national research and education networking organisations or by institutions that belong either to a national academic Public Key Infrastructure in the countries represented by the TERENA membership or to non-profit research projects.

TACAR provides an online trusted repository where an academic CA can register its trust anchor and the related Certificate Policies / Certificate Practice Statements. A policy document defines the procedure to register a root CA certificate. Within TACAR, trust is established by means of a web of personal relationships among the participants in PKI-related initiatives that are co-ordinated by TERENA or in which TERENA participates.

Today, TACAR hosts 24 trust anchors and provides support to the European Policy Management Authority for Grid Authentication in e-Science (EUGridPMA). Since October 2005, TACAR also serves as a single source for all relying parties to validate their trust infrastructure for the International Grid Trust Federation and for many other academic identity providers.

www.tacar.org

> TF-Mobility (Roaming Services for Mobile Devices)

Under its current mandate, TF-Mobility focuses on exploring new roaming technologies and on security issues that may affect roaming services. Through its dissemination activity, TF-Mobility connects new countries and institutions to eduroam, the European network roaming pilot infrastructure for research and education. The task force provides technical support helping them to join eduroam.

TF-Mobility's electronic discussion list plays an important role in the work of the task force. Discussions on the list address operational issues of eduroam. The list also facilitates discussions on tests of new mobility devices and new technologies, giving technicians an opportunity to report on their experiences and to receive feedback from colleagues. In addition, TF-Mobility had three face-to-face meetings during the year. These took place in Zürich on 18 January, in Poznań on 5 June and in Barcelona on 6 September. Much of the work of TF-Mobility is carried out in four subgroups.

The subgroup on next-generation mobility focuses on the technical enhancement of the RADIUS infrastructure and some operational issues related to eduroam. This relates to the three different functionalities that eduroam currently provides:

- Authentication of users. The institution part of a user name of the type *user@institution.country*, also called the realm, is used to find the authentication server of the home institution; in the current implementation this is done via a static routing map. Investigations are carried out to make this process more dynamic. The use of RadSec is being explored.

- A protocol to transport user's credentials to his home institution. The authentication is currently carried over the RADIUS infrastructure. The possibility to provide direct ad-hoc connection from a guest network to the AA server of the user's home institution is being investigated through the use of RADIUS over IPSec and Diameter.

- A trust fabric. Currently the trust fabric is implemented as a chain of peer-to-peer shared secrets between RADIUS servers. Studies are carried out to use PKI to enhance the systems.

The second subgroup focuses on tools to make it easier for end-users to connect to an eduroam-enabled wireless network. Part of this work is the maintenance of the eduroam website. UNI•C has explored the possibility to connect iPass to eduroam. iPass is commercial software that through a client installed on the user's machine gives Internet access to travelling users in about 150 countries via local phone calls, WiFi or wired Ethernet.

The third subgroup monitors the eduroam infrastructure and in particular the RADIUS servers. They look into the availability of the RADIUS servers, the way the authentication is performed over the RADIUS infrastructure and the end-to-end monitoring. They will also provide guidelines about configuration and accounting.

Finally, the subgroup on deployment issues aims to support users and to help small institutions to participate in eduroam without large investments. The group has produced 'all-in-a-box', a cheap box containing all the necessary software to operate a fully functional Web redirect, VPN, 802.1X access point, including RADIUS server and a user interface to configure the device. Subsequently, ARNES has developed 'eduroam-in-a-box' to support system administrators to configure eduroam.

TF-Mobility also provides a forum for discussing the findings of the Joint Research Activity on Ubiquity (Mobility) in the GN2 project with international counterparts like Internet2 in the United States, organisations in the Asia-Pacific region and other persons and organisations not participating in that Joint Research Activity. TF-Mobility and the team working on the Joint Research Activity have complementary tasks. TF-Mobility supports the deployment of the current infrastructure. The research activity team is working to develop a new-generation roaming infrastructure, which will result in a full service with enhanced security and an agreed policy.

www.terena.nl/activities/tf-mobility/

> eduroam®

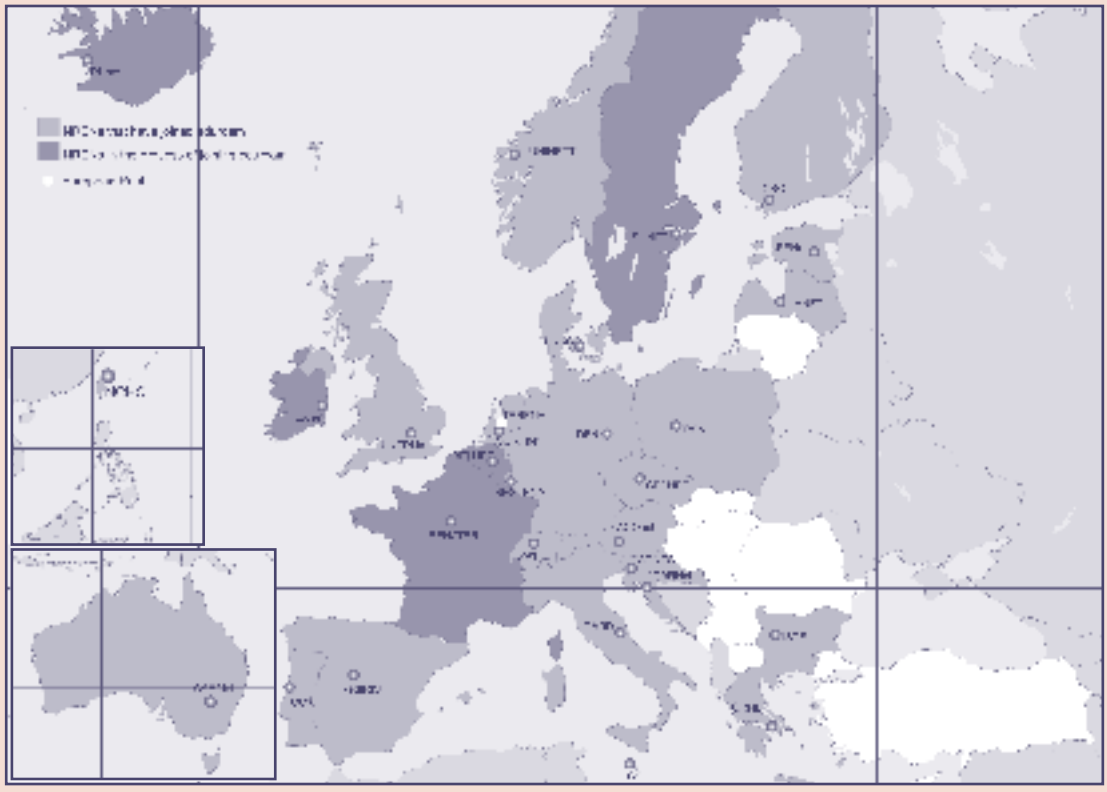
In 2003, the eduroam initiative started as a testbed to demonstrate the feasibility of providing roaming network access across research and education networks. The technologies that were tested were 802.1X and Web-based redirect, both using a RADIUS backend connecting the networks and their institutions. After the testing it was concluded that 802.1X was the technology of choice.

The pilot service resulting from these tests is now known as eduroam: the educational network roaming infrastructure based on 802.1X standard technology and RADIUS proxy servers to provide access to (wireless) networks.

TERENA deploys resilient European top-level RADIUS servers (run by SURFnet in the Netherlands and Forskningsnettet in Denmark) to which all participating European national research networking organisations connect with their national RADIUS server. Every institution that wants to participate in eduroam connects its institutional RADIUS server to the national server of their national research and education networking organisation. The role of the RADIUS hierarchy is to forward the user's credentials to the user's home institution, where they can be verified and validated.

Because the user credentials travel via a number of intermediate servers, not under the control of the home institution of the user, it is important that the credentials are protected. This requirement limits the types of authentication methods that can be used. Basically there are two categories of useful authentication methods, those that use credentials in the form of some public-key mechanism with certificates or those that use the so-called tunnelled authentication.

www.eduroam.org



> NREN's connected to eduroam at 31 December 2005

> TF-NGN (Next-Generation Networking)

TF-NGN investigates and tests innovative lower-layer networking technologies. It aims to determine their suitability for use on the GÉANT2 network and national research and education networks. It also provides a wider forum for discussing the work of the Joint Research Activities and the Service Activity on End-to-End Quality-of-Service of the GN2 project. In this way, the task force provides a framework for organisations that are not participants in the GN2 project to actively collaborate on GN2-related research.

The task force met four times during 2005: in Brussels on 13-14 January, in Zürich on 14-15 April, in Paris on 28-29 July, and in Athens on 3-4 November. These meetings were held in conjunction with meetings of teams working on GN2 research or service activities, in order to facilitate information exchange and promote collaboration between the different activities.

The earlier TF-NGN work on IPv6, multicast, IP routing and optical networking was continued; new areas of investigation were MPLS for Layer 2/3 VPNs and VPLS, intelligent control-plane architectures, transport protocols, and evaluation of novel routing and switching equipment. Previous TF-NGN activities that are now covered by the GN2 project were still reported on, and the task force was also kept informed about the work in other EU-funded projects relevant to its activities, the aim being to provide feedback to these projects from a wider technical community.

Multicast work focused on improving multicast performance by investigating monitoring tools and presentation mechanisms such as the Multicast Weathermap, SSMping, and dbeacon. The Multicast Weathermap is an intuitive Web-based application that processes, filters and presents data generated by standard multicast MIBs. SSMping works in a manner similar to regular ping, but it sends both unicast and multicast queries (IPv4 or IPv6) to determine whether a client is able to receive SSM. dbeacon is a distributed IPv4/IPv6 monitoring tool that gathers various statistics (for example, TTL, loss, delay and jitter) about the state of multicast groups.

The IPv6 activities mainly addressed the question of how to deploy IPv6 services from the GÉANT2 and national research network backbones into end-sites, while considering newer issues such as mobility, monitoring and security. MRD6, an open-source IPv6 multicast router, was evaluated and intrusion detection mechanisms for IPv6 were investigated. In addition, proposals to develop auto-transitioning mechanisms (to ensure that a host always has access to IPv6) and distributed security (to enable a host-based security approach) were advanced.

The latest developments in optical technology, the growth in physical infrastructure and Grid concepts make new demands on routing technologies. The IP routing activity investigated routing on dual-stack routers, load balancing, routing protocol extensions, very high-speed routing, dynamic circuit set-up and tear-down, and VPN communication. It also considered development of a worldwide multi-layer weather map.

Ethernet has long been the technology of choice for LANs, but is gaining popularity in MANs and WANs due to carrier offerings based on Gigabit and 10-Gigabit Ethernet. Ethernet over MPLS, SDH and ATM is already available, while VPLS can make deployment of switch-based Ethernet a solution for the WAN environment. VPLS was therefore tested between several sites in Spain, with the aim of installing a complete Grid testbed using nodes interconnected in this fashion.

A related activity was to investigate and test intelligent control-plane architectures, in particular those relating to the MPLS and GMPLS frameworks. TF-NGN looked at MPLS QoS provisioning, recovery techniques for GMPLS, and appropriate network topologies to complement the work being undertaken by the Joint Research Activity on Bandwidth Allocation and Reservation in the GN2 project.

Another area of interest was to undertake performance testing of the new protocols being developed to improve TCP transmission (for example, XCP, HS-TCP, H-TCP, Fast TCP and Westwood TCP). This is particularly an issue for long-distance high-speed networks, as well as for wireless connections. Two testbeds were established (between the Czech Republic and Switzerland, and between the Czech Republic and Poland), and actual testing started towards the end of the year.

The task force continued to co-ordinate optical networking between national research networks, focusing on new technologies not covered by the Joint Research Activities in GN2. The group was kept updated on the latest generation of optical switches and supported protocols, and there were exchanges of information about optical network deployments (for example, RENATER-4, UKLight and the SWITCH LambdaTunnel). There was also an ongoing activity to evaluate and test new routing and switching hardware, in order to make recommendations to the research networking community and to provide vendors with important feedback.

www.terena.nl/activities/tf-ngn/

> TF-VVC (Voice, Video and Collaboration)

The remit of TF-VVC is to investigate the suitability of voice, video and collaboration technologies for implementation in research and education networks in Europe. The task force met five times during 2005. Three of these meetings were held via H.323 videoconference. TF-VVC met face-to face on 9 June in Poznań, after the TERENA Networking Conference 2005. The fifth meeting was held both face-to-face and via videoconference on 8 November in Utrecht, after the High-Quality Video over IP Workshop. The task force collaborates and exchanges information with working groups and organisations all over the world, including Internet2 and APAN working groups.

During 2005, TF-VVC participants worked in eleven different activity areas:

> The activity on video content overlaps largely with the FCCN project 'Projecto Estudios' and is led by FCCN staff members. This activity emphasises the importance of teaching the community how to use video content and how to produce good content. The correct usage of the technology would improve the videoconferencing experience.

> OpenCDN is the open-source Content Delivery Network software architecture for scalable live streaming over the Internet. The development is based on the Apple Darwin Streaming server, and aims to dynamically create a relay distribution tree upon a user's request. The software has been written and is available as open-source code. Plans for the next releases include support for multiple streaming server technologies hosted at the same OpenCDN node. The OpenCDN software has been used for streaming several large events.

> The Content Access Portal activity works with the Internet2 Research Channel Global initiative to expand their portal with European content and links. The draft content access portal has been created and will be developed further.

> As part of the Metadata activity, a survey was carried out to gather information about the metadata models used in the community. The survey report was published in November.

> The live-stream announcements portal that was created by TF-VVC's predecessor task force has been developed further, working towards an Academic Netcasting Channel. The portal is fully functional and the task force has been discussing some marketing actions to widen the user community.

> Issues related to a Global Dialling Scheme form another area of work. Information about available services in national research networks has been gathered and put on line. The group has been discussing numbering

> TF-VVC meets in Utrecht, combining videoconferencing with a face-to-face meeting

systems for SIP and trying to evaluate two possible solutions, namely to use ENUM or to create a temporary solution: a GDS system as for H.323. The group is focusing its efforts on integrating SIP with H.323 and GDS.

> The work on integration of conferencing, streaming and data collaboration systems aims at describing developments in various real-time Internet collaboration tools, with an emphasis on the integration of these tools. Video streaming, whiteboard and application sharing, co-browsing and instant messaging can add value to videoconferencing and help conference participants to support their message or discussion. Moreover, there is a high demand for recording and playing back conferences with all content involved in a session. TF-VVC tries to clarify the possibilities, describe standards and tools and provide guidelines for optimal use.

> A workshop on high-end/quality systems was held on 7 November and is reported on elsewhere in this Annual Report. Participants in this activity area have been working on HD (high-definition) over IP technologies and they have been collaborating with other initiatives all over the world, for example, the APAN working group and the bigvideo working group of Internet2's Research Channel. Two new initiatives were taken by i2CAT: a wiki on HD-over-IP technology, which is now used by all major research groups, and an investigation into SIP set-up of HD conferences.

> Another activity area focuses on provision of access control to restricted video resources in a distributed mode. The authentication should be solved in the user's local organisation, but the information providers should have full control over their resources. The solutions have been designed and RedIRIS has been working on implementation of a Darwin Stream Server that uses access controls to Video-on-Demand and live video resources.

> A survey of existing IP telephony deployments has been carried out and the results have been distributed via the task force website. The survey is the first step towards the set-up of cross-organisational IP telephony connections.

> End-to-end measurement of video and voice related applications has been discussed with network engineers and researchers. Possible videoconferencing and streaming end-to-end measurement scenarios are being investigated.

www.terena.nl/activities/tf-vvc/

Task Force Chairs in 2005:

TF-CSIRT	Gorazd Božič
TF-EMC2	Diego López
TF-Mobility	James Sankar (until February)
	David Simonsen (from February)
	Klaas Wierenga
TF-NGN	Michael Enrico
TF-PR	Sandra Passchier (until September)
	Russell Nelson (from September)
TF-VVC	Egon Verharen

-} TERENA Projects

> Guide to Network Resource Tools

The 'Guide to Network Resource Tools' is a popular publication, whose origins go back to 1993. It is a user-friendly guide, designed to provide a basic introduction to the Internet with sections on basic tools and services available on the network. The guide is available from the TERENA website. In 2005, the most recent version of the guide was published in book form by Pearson Education under the title 'Internet Users' Research Guide'.

http://gnrt.terena.nl/

> Survey of Group Collaboration Solutions

In July, TERENA contracted SURFnet to produce a survey of group collaboration solutions, such as voice, video and data collaboration tools that could be used to support large European projects. The authors, SURFnet's Egon Verharen and Erik Dobbelsteijn, submitted the report at the end of December, and the survey was published on the TERENA website early in 2006. The report contains an overview of available systems, including H.323 audio- and videoconferencing, SIP-based audio- and videoconferencing, VRVS (Virtual Room Videoconferencing System), Web-based integrated suites, application-based integrated suites, phone conferencing, data and application sharing, and commercial services.

www.terena.nl/publications/group-collaboration.pdf

> Request Tracker for Incident Response

The RTIR (Request Tracker for Incident Response) software is a useful tool supporting Computer Security Incident Response Teams (CSIRTs) in their daily work, registering incidents and keeping track of the workflow in handling an incident. RTIR is open-source software, making it possible for interested technical specialists to upgrade the tool and to expand it with additional features. JANET-CERT, the CSIRT of UKERNA, has been one of the earliest users of RTIR in Europe, and has contributed to the further development of RTIR using the services of Best Practical Solutions, LLC, the original creators of the software.

As more CSIRTs in Europe have adopted RTIR as their incident handling tool, TF-CSIRT established in 2004 an RTIR subgroup. The aim of the subgroup is to extend the current application by making it more stable and adding new functionality.

In September 2005, TERENA and Best Practical have signed a contract for a project to upgrade and expand the RTIR software. The project will cover a period of 18 months, starting in October 2005. The project costs, estimated at approximately 95,000 US dollars, will be carried by the nine CSIRTs that participate in the project: ACOnet CERT (Austria), CERT Polska (Poland), CERT.PT (Portugal), GOVCERT.NL (Netherlands), IRIS CERT (Spain), JANET-CERT (United Kingdom), LITNET CERT (Lithuania), SUNET CERT (Sweden) and SWITCH-CERT (Switzerland).

www.terena.nl/activities/tf-csirt/rtir.html

> Server Certificate Service

National research and education networking organisations are witnessing an increasing demand for SSL server certificates, due to a growing need for encrypted channels and the rollout of new authentication and authorisation middleware. When a user connects to a server (mail server, Web server etc.) to download, access and/or store critical data, it is important to guarantee that the user is indeed connected to the right server and that his communication with the server is secure, and is thus encrypted. SSL technology makes the communication between client and server secure, but requires server certificates to work.

Some national research and education networking organisations have set up a Certification Authority (CA)

issuing certificates to the organisation's user community. However, when accessing a server, a pop-up message will appear saying, "the issuer of this certificate is not trusted". This occurs when the server certificates are issued by a CA whose root is not listed among those recognised as a trusted one by popular Web browsers such as Internet Explorer or Mozilla Firefox. Other research networking organisations have circumvented this problem by obtaining certificates from a commercial CA provider whose root is recognised, but that solution tends to be expensive because tariffs are on a per-certificate basis.

In order to solve these problems, a number of TERENA member organisations have joined forces to contract, through TERENA, a commercial CA provider to issue server certificates to these organisations and their user communities by establishing and running a dedicated CA. This solution makes the cost per certificate very low when large numbers of certificates are issued. This takes away the barriers for large-scale use of SSL server certificates in the research and education communities: the CA service from a commercial CA provider allows the TERENA members involved to act as service providers for their constituency and issue a practically unlimited number of SSL certificates per year.

A call for proposals was issued by TERENA on 4 August to commercial CA providers calling for a proposal to provide server certificates that would be available to the participating national research and education networking organisations at a much lower price per certificate through combined buying power and would solve the browser 'pop-up' problem. On 1 October, a committee of experts from the participating TERENA member organisations started the evaluation of the proposals received, and on 19 December TERENA announced that GlobalSign NV/SA of Leuven, Belgium had been selected as the preferred supplier. The contract between TERENA and GlobalSign was signed early in 2006.

The participating organisations are ACOnet, CARNet, CESNET, UNI•C, RENATER, SURFnet, RedIRIS and SWITCH. The service may be extended to other countries at a later stage.

www.terena.nl/activities/tf-emc2/scs.html

-} External Projects

> 6NET

TERENA was a partner and work package leader in the 6NET project, which finished on 30 June 2005. 6NET was a project in the European Union's 5th Framework Programme involving 36 partners from the commercial, research and academic sectors. The project demonstrated IPv6 functionality and stability, and encourage its widespread adoption. Originally, 6NET was planned to be completed at the end of 2004, and had already demonstrated that IPv6 is stable and reliable enough to be deployed in production networks. However, the project was extended for a further six months in order to develop a number of IPv6 applications, and to undertake additional standardisation and dissemination activities.

At the end of 2004, the backbone IPv6 test bed had been decommissioned as the GÉANT and NORDUnet networks had moved to dual-stack operation. Several national research networks already supported IPv6, while many others either actively rolled it out during 2005, or had well-advanced plans to do so. A number of campuses also started to transition their local networks to support IPv6 services.

Much of the project activity therefore centred on development of IPv6 versions of the WebSphere e-business applications, a SIP-based VoIP system, an AccessGrid conferencing tool and IPv4-IPv6 gateway, a QoS-enabled audio streaming tool that supports both WiFi and GPRS networks, and a media-streaming application supporting MIP multicast. In addition, a mobile IPv6 router for use in emergency service applications was successfully demonstrated.

The third and final 6NET Workshop was held on 11-12 May during the GARR Conference_05 in Pisa, Italy. This well-attended event included presentations on network architecture, security, mobility and multicasting, as well as demonstrations of the IPv6 applications being developed by 6NET.

6NET organised its third IPv6 network management tutorial on 2-3 March in Belgrade, Serbia and Montenegro.

The event was targeted at network administrators in southeast Europe, and provided practical hands-on training on various aspects of IPv6 deployment and management. Similar workshops will continue to be held under the auspices of the 6DISS project.

The experience gained during the project had earlier been turned into a number 'cookbooks' for network administrators. These were updated and they were all compiled into a complete deployment guide, which was published in both hard-copy and electronic book formats. The latter can be downloaded from the 6NET website.

6NET actively contributed to the IETF throughout the lifetime of the project, in particular to the ipv6, v6ops, multi6 and dhc working groups. In the final months of the project, six submitted Internet Drafts reached RFC status, indicating the importance of the contributions to the standardisation process. The project had earlier produced the IPv6 guidelines for the GGF specifications.

TERENA was responsible for leading the work package on dissemination and exploitation of results. This included the operation and maintenance of the project Web server, and the opportunity was taken to introduce IPv6 support on all TERENA servers. It also included production of informational material and organisation of workshops. Although 6NET has now concluded, many of the IPv6 dissemination, training and support activities will continue in the 6DISS project.

www.6net.org

> 6LINK

TERENA was a partner in the 6LINK project, which facilitated collaboration, in the form of the IPv6 Cluster, between IPv6-related projects that were co-funded by the European Union. The project was co-ordinated by BT Exact and involved Consulintel, Motorola, Telscom, T-Systems Nova, Universidad Carlos III de Madrid, Universidad Politécnica de Madrid, University College London and the University of Southampton as well as DANTE and TERENA. The project started on 1 March 2002 and was completed on 31 March 2005.

www.6link.org

> 6DISS

TERENA is a partner and work package leader in the 6DISS project, which started in April 2005 and will be completed by the end of September 2007. 6DISS is a project in the 6th Framework Programme to provide IPv6 training and knowledge transfer to research networks in developing regions. The project also aims to establish contacts with networking personnel and organisations in these regions in order to encourage co-operation and possible future participation in European R&D activities. The co-ordinator of the project is Martel GmbH (Switzerland), and the other project partners are Cisco Systems, Renater, GRNET, University College London, the University of Southampton, FCCN, Alcatel and TERENA.

6DISS builds on the IPv6 deployment experiences of the 6NET and Euro6IX projects and the GÉANT network, and specifically targets the Asia-Pacific, Caribbean, Central Asian, Latin American, Mediterranean, southeast European, southern African and sub-Saharan African regions. IPv6 training workshops will be organised in each region during the lifetime of the project, with follow-up support being made available. In addition, the project will provide specialist training for instructors and engineers at locations in Europe, develop e-learning material for online distribution and exchange deployment experiences with research networks in China and India.

The first training workshop was held on 22-23 August in Taipei, Taiwan. This event attracted approximately 50 participants from several countries in the Asia-Pacific region, including government policy-makers as well as network specialists.

The second training workshop was held on 19-20 September in Port Elizabeth, South Africa. This workshop was held in conjunction with the DITCHE Techie Event organised by TENET, the South African national

research and education networking organisation. It attracted approximately 25 participants drawn mainly from the academic networking community, but also from commercial Internet Service Providers.

> 6DISS was a co-organiser of the IPv6 workshop, AfriNIC-3 in Cairo, Egypt.

Towards the end of the year, the project started development of IPv6 e-learning material. This will use an interactive multimedia format that can easily be customised to suit particular requirements, and will be made freely available early in 2006.

TERENA will organise the 6DISS training workshop in Latin America in co-operation with CLARA. This is likely to take place mid 2006, and will provide the opportunity to foster contacts between the European and Latin American research networking communities. In addition, TERENA is responsible for the provision of the project website and mailing lists, and for distributing course material and workshop proceedings via alternative methods to locations where Internet connectivity is poor.

www.6diss.org

> SCAMPI

TERENA was the co-ordinating partner of the SCAMPI project, which was very successfully concluded at the end of March 2005. SCAMPI was a three-year project in the 5th Framework Programme of the European Union to develop a low-cost scalable monitoring platform for the Internet. The other partners were CESNET and Masaryk University Brno (Czech Republic), FORTH and FORTHnet (Greece), IMEC (Belgium), Leiden University (Netherlands), NETikos (Italy) and UNINETT (Norway).

The project developed the COMBO range of programmable PCI-based adapters that are capable of monitoring Internet connections at speeds of up to 10 Gb/s. A variety of cards are available that support different interfaces and can run under both Linux and NetBSD. CESNET plans to further develop this range of cards, and is evaluating the establishment of a start-up company with a view to possible commercial exploitation.

The Monitoring Application Programming Interface (MAPI) software was developed to process network flows, while presenting applications with a standardised API. This was designed to support the COMBO range of hardware, but can easily be implemented on other hardware (e.g. Endace DAG and Intel IXP) and software (e.g. Berkeley Packet Filters) solutions. It offers a variety of interfaces that applications can take advantage of, which include its own built-in functions, as well as support for third-party add-ons such as SNMP clients and libpcap. MAPI has been released as open-source software, and is available from UNINETT's MAPI website.

A flow-based reporting application (Stager) was also developed, which allows network statistics collected from the MAPI or other sources to be aggregated and turned into reports. This Web-based software will continue to be maintained by UNINETT, and is freely available.

In addition, the project developed a kernel enhancement for Linux (FastRing) that creates a socket (PF_Ring) optimised for packet capture. This greatly improves performance, and allows high-speed monitoring without the need for specialised equipment. The technology was subsequently licensed by Endace, a global leader in hardware acceleration technology.

Other activities included the development of a denial-of-service warning system based on detection of anomalous network traffic, and an intrusion detection application that uses signatures to detect malicious network payloads. Initial demonstrators were produced, and this work continues in the LOBSTER project.

SCAMPI was originally due to finish on 30 September 2005, but the project was extended to allow new chip technologies to be utilised in higher-speed COMBO cards. The hardware designs can be downloaded from CESNET's Liberouter website.

www.ist-scampi.org

> TRANSITS

The TRANSITS project started in July 2002 and was concluded at the end of September 2005. The project, which was funded by the European Union as part of the 5th Framework Programme, provided training to staff members of new Computer Security Incident Response Teams (CSIRTs) and to new staff members of existing CSIRTs. The project partners were TERENA and UKERNA.

The TRANSITS course materials were originally developed by volunteers from TF-CSIRT, and they have been maintained and continually updated as part of the TRANSITS project. The course consists of five modules: technical issues, vulnerabilities, organisational issues, operational issues and legal issues.

During the lifetime of the TRANSITS project, seven training workshops were organised. These events offered an intensive programme of two full days, with trainees working in two parallel groups of about twelve persons each. The lecturers at every workshop were experienced members of the European CSIRT community; the high tutor/trainee ratio allowed for intensive interaction. At every event, TERENA staff took care of logistics and technical support. The TRANSITS budget included a small fund to partly reimburse the cost of participation of trainees from economically less prosperous countries in Europe.

> Participants of the training workshop in Chantilly

The sixth and seventh TRANSITS workshops took place in the first half of 2005. The first of these was held on 17-18 February in Chantilly-Gouvieux near Paris, France. It was attended by 22 trainees from thirteen countries in Europe, representing nineteen different organisations, including national research and education networking organisations, universities and research institutes, commercial companies and government bodies. Lecturers were Andrew Cormack (UKERNA), Klaus Möller (DFN-CERT), Claudia Natanson (Diageo), David Parker (UNIRAS) and Jacques Schuurman (SURFnet-CERT).

> Trainees at the workshop in Vienna

The seventh training workshop was organised with support from FCCN at Carcavelos near Lisbon, Portugal on 28-29 April. Because this was the last opportunity for CSIRT staff members to attend a training course with financial support from the European Union, the number of participants was raised to thirty. Portugal was well represented with twelve trainees; other participants came from ten different European countries, and from the research and education, business and government sectors. Tutors were Andrew Cormack, Jan Meijer (SURFnet-CERT), Klaus Möller and Don Stikvoort (S-CURE).

The end of the TRANSITS project produced some impressive statistics. In seven workshops, TRANSITS has trained 153 persons from 32 countries in and around Europe. Almost 40% of them were staff members of research networking organisations and almost 30% were employed by research and education institutions, while commercial companies and government institutions accounted for slightly more than 15% each. In total, nine experienced

> Participants in the first joint TERENA-FIRST training workshop

members of the CSIRT community contributed as lecturers to the various workshops.

Permission has been given to members of the European CSIRT community to use the TRANSITS materials for training courses at a national or regional level. This resulted in a further 107 people being trained during the lifetime of the project.

In June 2004, the TRANSITS consortium and FIRST, the worldwide association of CSIRTs, agreed that FIRST would use the TRANSITS materials at continental training workshops outside Europe. To prepare for these, 'Train the Trainers' events were organised at the FIRST conferences in Budapest in June 2004 and in Singapore in June 2005. Following a first continental workshop in Rio de Janeiro in November 2004, FIRST organised three more continental training events during 2005: on 22-23 March in Guilin, China, on 29 August – 2 September in Seoul, Korea, and on 1-2 October in Buenos Aires, Argentina.

It was part of the TRANSITS project that a suitable framework should be created for the maintenance of the course materials and the delivery of further training courses after the end of the project. In the summer, TERENA and FIRST.Org, Inc., the legal entity representing FIRST, signed a memorandum of understanding to guarantee this continuity.

The FIRST Secretariat, a function provided by Don Stikvoort of S-CURE in the Netherlands, will enlist the assistance of volunteer experts from the international CSIRT community who will regularly provide updates of the TRANSITS course materials. The FIRST Secretariat will act as the final editor of the updates, integrating the contributions from the volunteers and guarding the completeness and consistency of the materials as a whole.

FIRST also takes responsibility for organising at least three training courses per year outside Europe, which will cover all five core subjects of the TRANSITS materials. At least one of these training workshops will be held in Central or South America, and at least one of them will be held in the Asia-Pacific region.

TERENA and FIRST jointly take responsibility for organising at least two training workshops per year in Europe. The logistic organisation of these training courses, including the selection of venue and financial arrangements, will be handled by the TERENA Secretariat, while the FIRST Secretariat will take care of the programme of the workshops, including inviting the lecturers.

The first CSIRT training course that was jointly organised by TERENA and FIRST took place on 21-22 November in Vienna. The event was sponsored by ISPA, the Austrian association of Internet Service Providers. The workshop was attended by 28 trainees from sixteen European countries, and from the academic, business and government sectors. Tutors were Andrew Cormack, Ulrich Kiermayr (ACOnet CERT), Jan Meijer, Klaus Möller and Don Stikvoort.

Throughout the year, the training materials were regularly updated. Towards the end of the year, a major revision of the module on technical issues was produced by Renato Ettisberger and Serge Droz from SWITCH.

www.ist-transits.org

> MOME

TERENA participates in the MOME project, a co-ordination action that is funded by the European Commission as part of 6th Framework Programme. The project offers a platform for the exchange of knowledge and tools, and for co-ordinating activities in the field of IP monitoring and measurement between projects in the Framework Programmes and with other European organisations. The MOME project started in January 2004 and will be completed at the end of March 2006. The project consortium, which consists of eight partners, is led by Salzburg Research.

TERENA leads the dissemination work package of the project. This work includes the development and maintenance of the project website, as well as the development of a Web-based project management system.

The objectives of the MOME project include evaluation of the interoperability of different active and passive measurement components, tools and interfaces, collection of measurement data of different tools, conversion and storage of them into a common format, and dissemination of the collected measurement data to the community via an easy-to-use Web-based interface to enable statistical data analysis.

The project is organised in two main phases. While the first year was dedicated to gathering information about projects and tools as well as infrastructure set-up, the second year was mainly a period for data collection and analysis. Although MOME is a co-ordination action, some technical work is included in this project, namely the creation and maintenance of databases for monitoring and measurement tools and measurement data, including their access interfaces.

The second MOME workshop was held on 14-15 March in Warsaw and was attended by 70 participants from twelve countries. On 7 June, MOME organised a session at the TERENA Networking Conference in Poznań. This was a panel session to trigger discussions about the future of network monitoring.

MOME Interoperability and MOME Standardisation events were held in July in Paris, before the 63rd IETF meeting. The MOME Interoperability event brought together researchers and developers to discuss network protocols like IPFIX, NSIS and NETCONF. The goal of the event was to clarify ambiguities and misinterpretations in the currently developing protocol standards and their implementations. In addition to this event, MOME organised a distributed OWAMP testing event at the end of the year.

The goal of the MOME Standardisation event was to encourage, co-ordinate and plan the standardisation activities within European projects in the monitoring and measurements area. The event featured six presentations from invited key researchers in the monitoring and measurements area of the IETF as well as from MOME partners.

www.ist-mome.org

> EGEE

The EGEE project has the aim to develop an international computing Grid infrastructure that provides scientists and researchers with access to major computing resources 24 hours-a-day, independent of their geographic location. EGEE is a two-year project, which started in April 2004. In April 2006, it will be succeeded by EGEE II, which is essentially a continuation but with some adjustments to partners and activities.

The project is one of the largest of its kind, with a budget of more than 46 million euro, of which almost 32 million is contributed by the European Commission as part of the 6th Framework Programme. The project brings together experts from over 30 countries, has 70 contracting partners and over 30 non-contracting participants, divided into 12 geographical federations. The core of the project is divided into eleven different activities: five Networking Activities, two Service Activities and four Joint Research Activities.

The project initially focused on two well-defined pilot application areas: high-energy physics and biomedical science. There are currently more than ten different biomedical applications and nine high-energy physics applications running on the EGEE production service. Since the beginning of the project, EGEE has also established

a much broader range of applications across a wide field including earth sciences, astro-particle physics, computational chemistry and geophysics. Recently, fusion science has been added to this list through an agreement with the International Thermonuclear Experimental Reactor project.

For any Grid computing effort, middleware is a crucial component. Originally, EGEE used middleware based on work from its predecessor, the European DataGrid project. In parallel, EGEE has developed and re-engineered most of this middleware stack into a new middleware solution called gLite, with components being deployed on the production service as they become available. The gLite stack combines low-level core middleware with a range of higher-level services.

TERENA's involvement in EGEE has been as activity leader for the Networking Activity on Dissemination and Outreach. Part of the success of EGEE depended on raising awareness of the project and attracting interest, and ultimately participation, from a range of scientific disciplines, the academic community, business and governments. TERENA has worked closely with the EGEE Project Office based at CERN and the other 29 dissemination and outreach partners across Europe to promote EGEE to the widest possible audience.

TERENA is responsible for the production of eleven formal EGEE deliverables. One of TERENA's main deliverables was a dissemination plan and communications strategy for the whole project. The first plan was written in June 2004 and it was further revised in December 2004 and June 2005. The plan identifies the roles and responsibilities of the dissemination partners, potential audiences, key messages, methods of communication to be utilised as well as success criteria. Every six months TERENA compiles and writes a dissemination progress report to highlight the achievements of the dissemination partners against the metrics outlined in the dissemination plan.

> The fourth EGEE conference was held in Pisa in October

A range of publicity material has been written, designed and published, including a series of twenty fact sheets about key aspects of EGEE. An EGEE brochure, aimed predominantly at executives and politicians, was produced by CERN in July. Other publicity material includes EGEE business cards, EGEE stickers and an EGEE video. An EGEE newsletter is produced on a bi-monthly basis by the Project Office.

TERENA operates and maintains the EGEE public website, which is continually updated to reflect any developments in the project. The website has a number of features whereby members of the public can ask questions, subscribe to an EGEE mailing list and download publicity material. There is also an EGEE technical website with sections about each activity; TERENA operates and maintains the dissemination pages on this site. Here project partners can easily download the templates for a range of publicity material as well as the EGEE logos.

Media relations has played a key role in raising the profile of EGEE. To date, 125 news releases have be written by TERENA, CERN and the local partners, resulting in 282 press cuttings, nine television interviews and five radio interviews about EGEE worldwide. All news releases are available from the public website.

TERENA is also responsible for co-ordinating two EGEE conferences each year. The third EGEE Conference was held in Athens on 18-22 April 2005, hosted by GRNET. The fourth EGEE Conference was held in Pisa on 24-28 October 2005 and hosted by INFN. The attendance at EGEE conferences has been growing steadily, with 461 delegates at the final conference in Pisa.

www.eu-egee.org

> LOBSTER

LOBSTER aims to design and deploy a pilot European infrastructure for accurate Internet traffic monitoring. The LOBSTER project, which is part of the European Union's 6th Framework Programme started in October 2004 and will continue until the end of December 2006. The project is co-ordinated by FORTH, the Foundation for Research and Technology - Hellas.

The main goal of the LOBSTER project is to deploy a pilot advanced European Internet traffic monitoring infrastructure based on passive monitoring sensors at speeds starting from 2.5 Gb/s, and possibly up to 10 Gb/s. Passive monitoring at such high speeds significantly stresses the computational, communication and storage capabilities of the underlying monitoring sensor and poses several interesting research challenges.

The LOBSTER project is a successor of the SCAMPI project, where some of these challenges have been met by designing and developing an advanced Internet passive monitoring system that combines novel hardware and software components. The LOBSTER project develops applications enabled by the availability of the passive network traffic monitoring infrastructure, realises the appropriate data-anonymising tools that will prohibit unauthorised tampering with the original traffic data, and focuses on other important related issues.

The first LOBSTER workshop was held on 7 June in conjunction with the TERENA Networking Conference in Poznań. The first session of the workshop was devoted to an overview of the LOBSTER project and issues of interest for national research and education networking organisations. The second session outlined technological advances in network monitoring. The purpose of the workshop was to present recent results and ongoing efforts from the research community in the area of passive network traffic monitoring with full packet inspection. The workshop addressed both hardware and software challenges related to individual passive traffic sensors as well as large-scale passive monitoring infrastructures, including monitoring applications. The event demonstrated the added value of passive network monitoring for network administrators and practitioners. The workshop was also interesting for researchers because it presented the research issues that are still open in this area.

TERENA is responsible for the dissemination activities in the LOBSTER project. The work includes the development and maintenance of the project website, as well as the development of a Web-based project management system. TERENA, together with other partners, is promoting collaboration with other communities and forums, for example, Internet2, the IETF and the TERENA task forces TF-NGN and TF-CSIRT.

www.ist-lobster.org

> NoAH

The NoAH project, which started in April 2005, is three-year project to gather and analyse information about the nature of Internet cyber attacks. NoAH will also develop an experimental early-warning infrastructure so that appropriate countermeasures may be taken.

The project is co-ordinated by FORTH (Greece) and the other project partners are Vrije Universiteit Amsterdam (Netherlands), FORTHnet and Virtual Trip (Greece), DFN-CERT (Germany), ETH Zürich (Switzerland), Alcatel and TERENA. The total budget of the project is approximately 2.4 million euro, of which almost 60% will be funded by the Research Infrastructures Programme of the EU's 6th Framework Programme.

NoAH is based on the principle of honeypots. Honeypots are hosts specifically set up on a network to appear to offer useful resources; however, these hosts have no production value and can therefore be used to lure attackers in order to analyse their methods and behaviour. Moreover, if honeypots are able to share the information they collect, it might be possible to identify widespread or systematic attacks at an early stage so that appropriate defensive measures may be taken.

The objectives of the project are to design and install a state-of-the-art infrastructure of honeypots, and develop

techniques for the automatic identification of cyber attacks. Mechanisms to distribute this information to firewalls and other containment systems will also be investigated.

This honeypot infrastructure will initially be operated as a one-year pilot in order to demonstrate the effectiveness of distributed security monitoring systems. In addition, data will be compiled on the type and nature of attacks in order to examine trends, refine security models and support Internet-related research efforts in general.

NoAH comprises five work packages, which focus on, respectively, requirements analysis and review of current technology, design of system architecture, implementation of infrastructure, demonstration and pilot operation, and dissemination. TERENA contributes primarily to the last work package, but also supports the first work package and the work on demonstration and pilot operation.

Initial activities have focused on identifying the requirements for the NoAH infrastructure. To this end, a survey on security issues was circulated to research networking organisations, Internet Service Providers, CSIRTs and to network security personnel in other organisations, so that different opinions, needs and expectations could be evaluated. More than fifty responses were received from a wide variety of organisations, and these were used to help develop the design brief and usage policies. The responses also revealed that the most common concerns were viruses and worms, and that intrusion attacks including spamming were a serious problem, while denial-of-service attacks and traffic sniffing were significant. Most respondents felt honeypots would be useful in warning of this type of attack, and nearly half had utilised them previously.

www.fp6-noah.org

> SEEFIRE

TERENA is the co-ordinator of the SEEFIRE project, a Specific Support Action funded by the European Commission in the 6th Framework Programme to study the opportunity for the acquisition of (dark) fibre networks by national research and education networking organisations in southeast European countries, in particular: Albania, Bosnia and Herzegovina, Bulgaria, the Former Yugoslav Republic of Macedonia, Greece, Hungary, Romania, and Serbia and Montenegro. The SEEFIRE project partners are the national research and education networking organisations in these countries as well as CESNET, DANTE and TERENA. SEEFIRE is a one-year project, which started on 1 March 2005.

The connectivity of national research networks in Europe and the GÉANT backbone has traditionally been based on individual point-to-point circuits leased from telecommunications operators. The SEEREN network was based on connectivity service contracts with these operators, which expired at the end of 2004. With a contribution from the GN2 project, some of those connections have been extended into 2005. Without the financial support of the European Commission, national research networking organisations in the region could not afford these services. For the next generation of this network to be self-sustainable, more affordable alternatives need to be explored, such as the acquisition of their own optical fibre infrastructure.

The recent progress in technology for optical transmission at high speed has made the deployment of owned or leased fibre networks a reality for research networks. SEEFIRE takes the first step in the direction of a cost-effective Gigabit network in southeast Europe, connecting researchers and universities in the region with other research users in Europe and worldwide. In doing so, the project will contribute to reducing the digital divide that affects several countries in southeast Europe, due in part to past political and economic circumstances.

The SEEFIRE project builds on the success of the SEEREN project in preparing for the next generation of networks for research and education in southeast Europe. The goals of SEEFIRE are to establish a benchmark of existing and potentially available optical fibre for research networks in the region, and to make an analysis of the technical options available for the deployment of dark fibre and the management of optical transmission by the relevant national research networking organisations. The project reports on economic aspects and regulations, and it disseminates information to increase awareness about dark-fibre

deployment both at technical and at policy-making level.

During 2005, the SEEFIRE project has carried out a number of studies regarding the availability of optical fibre in the countries concerned, the technological and economic aspects of deploying customer-controlled (dark) fibre and lighting fibre by national research networking organisations (optical transmission), as well as the regulatory and legal issues related to fibre ownership.

The results of the survey of fibre availability have been stored in a fibre-footprint database, which is available to project partners but not to the general public. All other results are publicly available on the SEEFIRE project website. Four reports have been published in 2005 that are of particular interest; they describe dark-fibre installation and long-term acquisition experiences in southeast Europe, NREN-empowered dark-fibre transmission technologies, support for deployment of customer-empowered fibre infrastructure, and the regulatory and legal framework for the support of dark-fibre infrastructure in southeast Europe. Two more reports will be published at the end of the project in February 2006: a report about the economic model for the acquisition and operation of dark-fibre networks in southeast Europe, and a white paper that is a strategic report on southeast European fibre-infrastructure for research and education.

SEEFIRE organised a technical workshop in Sofia on 14-15 July, which was attended by representatives from national research and education networking organisations in southeast Europe, the European Commission and industry. A panel discussion provided a forum to explain that research networks are interested in acquiring dark fibre as the only cost-effective means of developing their networks. This would also allow national research networking organisations in the region to bring their networks to the same level as other European research and education networks. It was also demonstrated that research networks are not in competition with telecommunications operators or Internet Service Providers. Participants learned about the experiences of others in acquiring dark fibre, both within the southeast European region and in other European countries, as well as in the United States.

www.seefire.org

> SEEREN2

The SEEREN2 project aims to create the next generation of the southeast European segment of the GÉANT2 network, and make leading-edge technologies and services available to the entire research and education communities and all sectors in southeast Europe. The objective is to ease the digital divide that still separates most of the southeast European countries from the rest of the continent.

SEEREN2 follows up on the success of the SEEREN project, which ended in December 2004. SEEREN2 is led by GRNET; the project started on 1 October 2005 and will be concluded at the end of March 2008. SEEREN2 is a Specific Support Action, co-funded by the European Commission with an amount of approximately 2.5 million euro.

The goals of the project are to provide international connectivity to the national research networks of Serbia and Montenegro, the Former Yugoslav Republic of Macedonia, Bosnia and Herzegovina, and Albania. In the first three months of the project, the procurement of network connectivity was carried out, targeting traditional, leased-capacity services ranging from an absolute minimum of 2 Mb/s up to 155 Mb/s, but also including dark fibre as an option. On top of connectivity and basic network operation services, the project is looking at the testing and deployment of advanced services, to be gradually introduced on the network infrastructure that was procured in the project. These range from networking services, including IPv6 and IPv6 multicast, to network management and performance monitoring, as well as security services and user-level services such as IP telephony, videoconferencing and mobility (eduroam).

TERENA is the project partner leading the work package on training, dissemination and communication. The primary targets of the project's dissemination strategy are stakeholders of national research networks in southeast Europe, including managers and engineers users and government officials responsible for funding research networks.

www.seeren.org

)- Services

)- Trusted Introducer

The Trusted Introducer (TI) offers an accreditation scheme that assists in building a web of trust between Computer Security Incident Response Teams (CSIRTs). The Trusted Introducer collects detailed information about CSIRTs, and when a CSIRT meets certain criteria it can be accredited. Information about accredited CSIRTs and about other known CSIRTs is published on the TI website. The information is checked on a regular basis to ensure that accredited CSIRTs still fulfil the criteria for accreditation. The service does not provide a form of certification, but the scrutiny by the Trusted Introducer gives accredited CSIRTs sufficient status for other CSIRTs to build their trust on.

The TI service is provided on the basis of a contract between S-CURE and TERENA by a team that is led by Don Stikvoort (S-CURE) and Klaus-Peter Kossakowski (PRESECURE Consulting). TERENA pays S-CURE monthly amounts for the service provision; these amounts are re-charged by TERENA to the accredited CSIRTs.

A TI Review Board reviews the operations of the Trusted Introducer and addresses any special issues that may arise. The Review Board consists of Gorazd Božič (ex officio as chairman of TF-CSIRT), Karel Vietsch (TERENA representative) and three members elected by the accredited CSIRTs as their representatives. During 2005, the elected members were Jimmy Arvidsson (TeliaSonera, from 15 September), Jacques Schuurman (SURFnet), Marco Thorbrügge (DFN-CERT, until 15 September) and Wilfried Wöber (ACOnet). The Review Board met back-to-back to the meetings of TF-CSIRT.

The assembly of representatives of accredited CSIRTs also met at every TF-CSIRT meeting. Their meetings are very useful to build out the collaboration between the accredited CSIRTs and to lay the foundation for new components of the TI service. Following discussions in 2004, three new service components were added at the start of 2005: statistics gathering and dissemination, re-encrypting secure mail gateway, and out-of-band alerting. In their May meeting, the accredited CSIRTs made some suggestions for relatively small additional features that could be provided by the Trusted Introducer. These were prepared in the remainder of the year.

www.trusted-introducer.nl

-/ Memberships and Liaisons

-/ ENPG and European Commission

The European Networking Policy Group (ENPG) is the forum where civil servants from European countries meet to exchange information and co-ordinate their policies for (the funding of) research networking. TERENA has permanent observer status. On the basis of a contract with the JISC, TERENA also hosts the ENPG website and mailing lists.

The ENPG had three meetings in 2005, on 14-15 February in The Hague, on 16-17 June in Bratislava, and on 8-9 December in Nottingham. In every meeting, a representative of DANTE gave an update on GÉANT2 and a representative from the European Commission presented the latest developments in European policies and funding plans in the area of research networking and Grids. In the February meeting, Karel Vietsch presented recent developments in the TERENA activities.

The meeting in The Hague also heard presentations from SURFnet on the new SURFnet6 network and on GLIF. The June meeting received a presentation on academic and research networking in the Slovak Republic. It also had an in-depth discussion about the financial and policy complexities of cross-border dark-fibre connections. In Nottingham, there were presentations on the new SuperJANET5 network, on ESFRI and on cyber-infrastructure policies in the United States.

ENPG Secretary John Martin retired in July. At the end of the year, Malcolm Read (JISC) was succeeded as chairman of the ENPG by the Danish representative, Jan Windmüller.

The members of the TERENA Executive Committee and the TERENA Secretariat staff maintain regular contacts with the European Commission services on a number of policy issues, in particular, in relation to the Framework Programmes.

On 11 April, the Commission organised a workshop in Brussels under the theme: "Research Networking: Where do we go next?". The meeting was attended by invited representatives from the research networking organisations in the EU member states, as well as from TERENA, DANTE, the ENPG, the eInfrastructure Reflection Group and the Policy Committee of the GN2 project. TERENA's Karel Vietsch was asked to act as the rapporteur of the event. The meeting was asked to give its views on the development of research and education networking in the period 2007-2013, the expected lifetime of the 7th Framework Programme.

The meeting emphasised first of all the speed of developments in research networking, and hence the uncertainties when trying to look eight years ahead. Consequently, EU policies in this field should be flexible and adaptable, and the same holds for the funding and policy instruments to be deployed in the 7th Framework Programme. After the revolutionary changes that mark the transition from GÉANT to GÉANT2, it was not expected that the technology and architecture for the

successor network after 2008 would be significantly different again. However, cross-border fibre was mentioned as a development that needs further investigation.

The workshop felt that the overall objective for the support for research networking in the 7th Framework Programme should be that all researchers, teachers and students receive the bandwidth and the services that they need. There are a number of issues when pursuing this goal: the necessary move of research networking organisations towards service provision, the bottlenecks in network and service provision caused by the digital divide between countries, the lack of network facilities in remote areas, and end-to-end and campus issues.

www.enpg.org
http://europa.eu.int/information_society/

-/ DANTE

DANTE is a limited-liability company and a not-for-profit organisation, based in Cambridge, England. Its mission is to plan, build and operate pan-European networks for research and education. Many national research and education networking organisations in Europe are shareholders of DANTE.

The two sister organisations TERENA and DANTE collaborate intensively. This manifests itself particularly in the GN2 project, where each of the organisations is responsible for a number of the project activities. TERENA's President and Secretary General are members of the Executive Committee of the GN2 project, and the latter is also an observer in the DANTE Board of Directors. Throughout the year, TERENA and DANTE have also collaborated in a number of other projects, such as 6NET, SEEFIRE and SEEREN2, which are reported on elsewhere in this Annual Report.

In 2005, the preparations and subsequent rollout of the new GÉANT2 network have been the most demanding task in DANTE's work portfolio. In the successful tendering process it soon became clear that in its first phase the backbone will already encompass a 'dark-fibre cloud' connecting a very large number of the participating countries. GÉANT2 will deploy a hybrid IP-optical network architecture that seamlessly combines a switched and a routed infrastructure by using the most appropriate technologies. The actual rollout of the network, which required very careful planning, started by the middle of 2005 and is expected to cover a one-year period. GÉANT2 was officially launched at a ceremonial and well-organised event in Luxembourg on 14-15 June.

DANTE is also the leader of a number of EU-funded projects that aim to promote network connectivity for research in other world regions: ALICE (Latin America), EUMEDCONNECT (the Mediterranean region) and TEIN2 (East Asia). The ALICE and EUMEDCONNECT projects were both extended, until April and July 2007, respectively. TEIN2 is complemented by the new ORIENT project, which will connect several of China's academic networks, headed by CERNET, with GÉANT2.

www.dante.net

-/ Intercontinental Collaboration

The CCIRN (Co-ordinating Committee for Intercontinental Research Networking) is the forum where representatives of research networking organisations meet on a multilateral basis to discuss issues of common interest. The European delegation to the annual CCIRN meetings is designated by the TERENA Executive Committee.

This year's CCIRN meeting was organised and hosted by TERENA in Poznań on 4-5 June. Setting a new tradition, the programme of the meeting focused on a small number of topics, so that more in-depth discussions became possible. The topics chosen for this year were hybrid IP-optical networking, deployment of IPv6, and intercontinental collaboration on PR and information dissemination.

A main agenda item was a discussion on the future and the positioning of the CCIRN. The history of the Committee goes back almost twenty years, and during this period the environment of intercontinental collaboration in research networking has changed substantially. In recent years, strong and stable continental collaborative organisations have emerged: TERENA in Europe, Internet2 and CANARIE in North America, APAN in the Asia-Pacific region and CLARA in Latin America. It was agreed to position the CCIRN as the meeting forum of these continental organisations. A corresponding revision of the terms of reference of the CCIRN will be discussed in next year's meeting. In line with this reorganisation, the chairmanship of the North American delegation was transferred from the National Science Foundation to Internet2.

TERENA also liaises with its counterparts in other world regions on a bilateral basis. TERENA Secretariat staff members participated in the Internet2 Member Meetings in Arlington, Virginia on 2-4 May and in Philadelphia on 19-22 September.

www.ccirn.org

-/ Internet Society

The Internet Society is a professional membership organisation that aims to provide leadership in addressing issues that confront the future of the Internet. It is the organisational home for groups responsible for Internet infrastructure standards, including the IETF and the IAB. TERENA was one of the original charter members of the Internet Society. It remains a supportive member of the organisation, especially because of the Society's role for the IETF and the IAB, which TERENA considers to be the reason for existence of the Internet Society.

In 2005, the Internet Society has supported the IETF in its efforts to rationalise and strengthen its administrative activities through the creation, in April, of the IETF Administrative Support Activity. Mid December, the Internet Society and CNRI established the IETF Trust to hold the IETF's intellectual property rights in benefit for the IETF. The Internet Society has also been a central and valued participant in the World Summit on Information Society, receiving significant recognition from many governments and key players.

www.isoc.org

-/ GLIF

GLIF, the Global Lambda Integrated Facility, is an international virtual organisation that promotes the paradigm of lambda networking. The GLIF participants are national research and education networks, consortia and institutions working with lambdas. Participation in GLIF is open to any organisation that subscribes to the GLIF vision and that can contribute to the GLIF activities.

The activities of GLIF are two-fold:

> The GLIF participants jointly make lambdas available as an integrated global facility for use by scientists and projects involved in data-intensive scientific research.

> GLIF brings together leading networking engineers worldwide, who exchange information to learn from each other's experiences, seek to establish best practice, work together to develop, test and implement new lambda networking technologies, middleware and applications, and generally collaborate to bring the technology forward.

GLIF organises one large workshop every year, also known as the Annual Global LambdaGrid Workshop. Much of the GLIF work is undertaken in the GLIF working groups. Most active are the Working Group on Technical Issues and the Control Plane and Grid Integration Middleware Working Group. Increased activity is planned for the Research and Applications Working Group, while the Governance Working Group looks after the overall management of GLIF.

At the annual GLIF workshop in Nottingham in September 2004, TERENA was invited to provide the secretariat support functions for GLIF. The direct costs are covered by a number of GLIF participants, while TERENA itself contributes by covering the indirect cost. Initially, five (combinations of) organisations together committed 50,000 euro as their contribution to the funding of the GLIF Secretariat: CESNET, Internet2 and NLR, JISC / UKERNA, NORDUnet and SURFnet. In the second half of 2005, a number of other sponsors followed their example: AARNet, CANARIE, CERN, Indiana University, Northwestern University, University of California at San Diego, University of Amsterdam, and University of Illinois at Chicago.

As part of the Secretariat work, TERENA staff have created a new GLIF website, which is hosted on a server in the TERENA Secretariat office. Information has been moved from the previous website, the structure of the new website has been expanded with new sections, and more information has been added. The website is regularly updated. The staff have also created closed mailing lists for GLIF participants and for specific GLIF (working) groups. They have contributed to the organisation of the annual GLIF workshop in September, and, most importantly, they provide the secretariat functions for the GLIF working groups.

The fifth annual GLIF workshop was held on 29-30 September on the campus of the University of California San Diego in La Jolla, in conjunction with the iGrid2005 event. The first day was a joint symposium with iGrid2005. The symposium programme had been arranged by the iGrid2005 organisers. It included updates on GLIF in general and on the Technical Issues and Control Plane Working Groups. The four working groups had meetings on the second day in parallel sessions. At the

> The annual GLIF workshop at the University of California San Diego attracted a large attendance

end of that day, participants convened in a plenary session to hear reports about the progress made during the day.

The GLIF Working Group on Technical Issues aims to identify the resources that can be used by GLIF (for example, lambdas and optical exchanges) and to develop a database to facilitate connections and schedule usage. It also aims to define standard terms for usage within GLIF and to facilitate seamless connectivity through the harmonisation of contracting and fault management processes. The group is chaired by Erik-Jan Bos (SURFnet) and René Hatem (CANARIE), and its Secretary is TERENA's Kevin Meynell. The Working Group met twice in 2005: on 13 February in Salt Lake City and on 30 September at the annual GLIF workshop.

The main activity has been to identify GLIF network resources and to document these on the GLIF website along with up-to-date contact information. It was realised that as existing networks grow and others appear, it will be increasingly difficult to co-ordinate all lambdas, interfaces, exchange points, policies and administrative information in the existing ad-hoc fashion. A repository would therefore consolidate resource information in one place and facilitate better co-ordination between the GLIF participants.

There are currently three main approaches to implementing network resource repositories: a monolithic database, adapting the DNS to store network information or using semantic Web technology to create a distributed database maintainable by individual organisations. It was therefore necessary to examine the merits of each of these approaches in order to determine whether a common system could be agreed and whether such a system could be used at the control plane level as well.

Another ongoing activity was the documentation of best practices among the GLIF operators. This included agreeing a standard nomenclature for network resources, since a variety of terms was in use, causing much confusion. It was particularly important to define optical exchanges in the GLIF context, as these are central to the creation of a worldwide integrated optical facility. From this, the concept of GLIF Open Lambda Exchange (GOLE) was adopted. Starting in October, monthly teleconferences were held to improve communication between the GOLE operators.
The requirement for an end-to-end fault management system was also investigated during the year. While the majority of the GLIF constituent networks are not production oriented, it was recognised that there needs to be a centralised mechanism to report and track faults. A standard way of reporting faults needs to be agreed and a ticketing system implemented.

The Control Plane Working Group focuses on the implementation of interfaces and protocols to allow automatic delivery and on-demand provisioning over optimised network paths (belonging to the contributed lambda resources), using optical control-plane technologies. The group is chaired by Gigi Karmous-Edwards (MCNC) and TERENA's Licia Florio is the group's Secretary. The Control Plane Working Group works very closely with the Working Group on Technical Issues, automating the procedures agreed by that group.

Although some control-plane workshops took place in 2004, the Control Plane Working Group was officially established in the beginning of 2005, and it had its first meeting on 30 September at the LambdaGrid Workshop. The meeting discussed possible work items, and agreed on three main issues to be addressed:

> common service definitions, i.e., the characterisation of a service in order to understand if a network is able to support the service;
> how users verify services, i.e., the way that users report about the service received;
> how to start automating today's manual and very labour-intensive processes for establishing end-to-end connections.

Larry Smarr (Calit2) and Maxine Brown (University of Illinois at Chicago) took over the chairmanship of the Research and Applications Working Group at its meeting on 30 September. The Working Group will focus on three areas: user applications, infrastructure and research. The goal to be achieved in the first work area is to generate more users and applications using the GLIF infrastructure. As part of the infrastructure activity it is proposed to interconnect GLIF sites with high-definition videoconferencing and tiled displays. In the third area, roadmaps on various topics will be produced, such as devices, architectures and integration.

www.glif.is

> Financial Report 2005

The financial statements consisting of balance sheet, statement of income and expenditure, and summary cash-flow statement for TERENA for the year 2005 are presented below.

> Balance sheet as at 31 December 2005

(in €)

	31-12-2005	31-12-2004
Fixed assets	909	4,318
Current assets		
Accounts receivable	365,448	410,997
Cash in bank and on hand	2,556,691	2,413,725
	2,922,140	2,824,722
Current Liabilities	-1,839,994	-1,789,470
NET CURRENT ASSETS	1,083,055	1,035,252
Deferred Income	-12,000	-12,000
NET ASSETS	1,071,055	1,027,570
Financed by:		
RETAINED EARNINGS	1,071,055	1,027,570

> Statement of Income and Expenditure 2005

(in €)

	budget 2005	2005	2004
INCOME			
Contributions	961,000	956,160	945,875
Projects, workshops and conferences	792,000	1,167,101	886,417
Other income	4,000	3,959	56,277
TOTAL INCOME	1,757,000	2,127,220	1,888,569
DIRECT EXPENDITURE			
Projects, workshops and conferences	-1,128,000	-1,387,444	-937,309
Technical programme	-68,000	-35,727	-48,548
	-1,196,000	-1,423,171	-985,857
INCOME LESS DIRECT EXPENDITURE	561,000	704,049	902,712
INDIRECT EXPENDITURE			
Personnel costs	-409,282	-428,634	-256,632
Other administrative costs	-201,718	-164,598	-432,320
	-611,000	-593,232	-688,952
OPERATING RESULT	-50,000	110,817	213,760
Interest received	45,000	52,374	37,640
Financial expenses	-16,000	-13,259	-2,998
Bad debts written off	-136,000	-106,447	-720
	-107,000	-67,332	33,922
SURPLUS OF INCOME LESS EXPENDITURE	-157,000	43,485	247,682

> Summary Cash Flow Statement

(in €)

	2005	2004
NET RESULT	43,485	247,682
Depreciation charges	3,409	18,674
Investments in fixed assets	0	-7,990
(Increase)/Decrease in accounts receivable	45,548	232,114
Increase/(Decrease) in current liabilities	50,524	591,037
Increase/(Decrease) in long-term liabilities	0	-34,067
NET CASH FLOW	142,966	1,047,450

	Increase/ (Decrease)	2005	2004
Accounts receivable	-45,548	365,448	410,997
Current liabilities	50,524	1,839,994	1,789,470
CASH IN BANK AND ON HAND	142,966	2,556,691	2,413,725

To the executive committee of TERENA,
Auditors' report
In accordance with your instructions we have audited the condensed financial statements of TERENA, Amsterdam, for the year 2005 (as set out on pages 55 to 57). These condensed financial statements have been derived from the financial statements of TERENA for the year 2005. In our auditors' report dated 6 April 2006 we expressed an unqualified opinion on these financial statements. These condensed financial statements are the responsibility of the association's management. Our responsibility is to express an opinion on these condensed financial statements.
In our opinion, these condensed financial statements are consistent, in all material respects, with the financial statements from which they have been derived.
For an understanding of the association's financial position and results and for an adequate understanding of the scope of our audit, the condensed financial statements should be read in conjunction with the financial statements from which the condensed financial statements have been derived and our auditors' report thereon.
6 April 2006,
PricewaterhouseCoopers Accountants N.V.,
J.A. de Rooij RA

TERENA Membership in 2005

(as at 31 December)

> National Members

ACOnet	Austria	Peter Rastl
BELNET	Belgium	Pierre Bruyère
CARNet	Croatia	Zvonimir Stanić
CYNET	Cyprus	Agathoclis Stylianou
CESNET	Czech Republic	Jan Gruntorád
UNI•C	Denmark	Ole Kjærgaard
EENet	Estonia	Mihkel Kraav
CSC	Finland	Leif Laaksonen
Renater	France	Dany Vandromme
DFN	Germany	Klaus Ullmann
GRNET	Greece	Panayiotis Tsanakas
HUNGARNET	Hungary	Lajos Bálint
RHnet	Iceland	Jón Ingi Einarsson
HEAnet	Ireland	John Boland
Consortium GARR	Italy	Enzo Valente
LATNET	Latvia	Janis Kikuts
LITNET	Lithuania	Petras Šulcas
RESTENA	Luxembourg	Antoine Barthel
MARNET	FYRoMacedonia	Margita Kon-Popovska
University of Malta	Malta	Robert Sultana
SURFnet	Netherlands	Kees Neggers
UNINETT	Norway	Petter Kongshaug
PCSS	Poland	Jan Węglarz
FCCN	Portugal	Pedro Veiga
ANSTI/RNC	Romania	Dana Gheorghe
University of Belgrade	Serbia and Montenegro	Zoran Jovanović
SANET	Slovakia	Pavol Horvath
ARNES	Slovenia	Marko Bonač
RED.ES	Spain	Tomás de Miguel
SUNET	Sweden	Arne Sundström
SWITCH	Switzerland	Urs Eppenberger
ULAKB_M	Turkey	Cem Saraç
UKERNA	United Kingdom	Shirley Wood

> International Members

CERN	David Foster
ESA	Stefano Zatti

> Associate Members

3Com Corporation	Angelo Lamme
Cisco Systems	Johan Paardekooper
DANTE	Dai Davies
EMBL	Peter Stoehr
IBM	Brian Carpenter
Juniper Networks	Jean-Marc Uzé
Level 3 Communications	Bart van Aanholt
NORDUnet	René Buch
Teleglobe	Yves Poppe

> Membership Fees

The annual membership fees for National Members are in eight categories, depending on the gross national income of the countries that they represent. A National Member pays the unit fee multiplied by the number of units linked to its category. The membership fees for National Members in categories 1 and 2 are further differentiated according to the per-capita GNI for their countries. National members in categories 1 and 2 that are classified by the World Bank as an 'upper-middle-income economy' receive a reduction in the fee and in the number of votes of 20%. That reduction is 40% if their country is classified as a 'lower-middle-income economy' and 60% if their country is classified as a 'low-income economy'.

International Members have 10 votes and pay the unit fee. Associate Members pay half the unit fee.

The unit fee for 2005 was set at 4,800 euro.

Category	Units	Votes	Country
1	0.2	2	
1	0.3	3	FYRoMacedonia
1	0.4	4	Estonia
1	0.5	5	Malta
2	0.4	4	
2	0.6	6	Serbia and Montenegro
2	0.8	8	Latvia, Lithuania
2	1	10	Cyprus, Iceland
3	2	20	Croatia, Luxembourg, Slovakia, Slovenia
4	4	30	Czech Republic, Hungary, Ireland, Romania
5	6	40	Denmark, Finland, Greece, Iran, Norway, Poland, Portugal, Turkey
6	8	50	Austria, Belgium, Netherlands, Sweden, Switzerland
7	12	60	Spain
8	16	70	France, Germany, Italy, United Kingdom

> TERENA Staff in 2005

> Secretary General	Karel Vietsch
> Chief Technical Officer	John Dyer
> Deputy Chief Technical Officer	Valentino Cavalli
> Project Development Officers	Kevin Meynell
	Licia Florio
	Baiba Kaškina
> Senior IT Support Officers	Alex de Joode (until 31 August)
	Dick Visser
> Senior Webmaster	Jeroen Houben
> Webmaster	Christian Gijtenbeek (from 1 October)
> Chief Administrative Officer	Bert van Pinxteren
> Financial Administrator	Wilma Overdevest
> External Relations Officer	Joanne Barnett
> PR and Conference Officer	Carol de Groot-Crone
> Workshop Organiser / Project Management Assistant	Jim Buddin (from 3 March)
> Workshop Organiser	Aukje Bakker (from 1 September to 30 November)
> Secretaries	Aukje Bakker (until 31 August and from 1 December)
	Pilar Mayorga (from 15 August to 30 November)
> Assistant Bookkeeper	Erkan Mengi (from 8 November)
> SEEFIRE Project Expert	Claire Milne (from 6 April)

> List of Acronyms

6DISS	IPv6 Dissemination and Exploitation
6LINK	IPv6 Projects Linkage Cluster
6NET	Large-Scale International IPv6 Testbed
AA	Authentication and Authorisation
AA-RR	Authentication and Autorisation Requester-Responder
AARNet	Australia's Academic and Research Network
ALICE	América Latina Interconectada Con Europa
APAN	Asia-Pacific Advanced Network
APCERT	Asia Pacific Computer Emergency Response Team
API	Application Programming Interface
ATM	Asynchronous Transfer Mode
Becta	British Educational Communications and Technology Agency
BSD	Berkeley Software Distribution
CA	Certification Authority
Calit2	California Institute for Telecommunications and Information Technology
CAMP	Campus Architectural Middleware Planning
CANARIE	Canadian Network for the Advancement of Research, Industry and Education
CCIRN	Co-ordinating Committee for Intercontinental Research Networking
CDN	Content Delivery Network
CERN	European Laboratory for Particle Physics
CERT	Computer Emergency Response Team
CLARA	Cooperación Latino Americana de Redes Avanzadas
CNRI	Corporation for National Research Initiatives
CNRS	Centre National de Recherche Scientifique
CSIRT	Computer Security Incident Response Team
DAG	Data Acquisition and Generation
DANTE	Delivery of Advanced Network Technology to Europe
dhc	Dynamic Host Configuration
DITCHE	Development of Information Technology Capacity in Higher Education
DNS	Domain Name System
DV	Digital Video
DVTS	Digital Video Transport System
E-CoAT	European Co-operation of Abuse-fighting Teams
eduroam	Education Roaming
EGEE	Enabling Grids for E-sciencE
ENISA	European Network and Information Security Agency
ENPG	European Networking Policy Group
ENUM	Telephone Number Mapping
ESFRI	European Strategy Forum on Research Infrastructures
EU	European Union
EUGridPMA	European Policy Management Authority for Grid Authentication in e-Science
EUNIS	European University Information Systems
Euro6IX	European IPv6 Internet Exchanges Backbone
EuroCAMP	European CAMP
FIRST	Forum of Incident Response and Security Teams

FORTH	Foundation for Research and Technology - Hellas
Gb/s	Gigabits per second
GDS	Global Dialing Scheme
GÉANT	Gigabit European Academic Network Technology
GGF	Global Grid Forum
GLIF	Global Lambda Integrated Facility
GMPLS	Generalised Multi Protocol Label Switching
GN2	Multi-Gigabit European Academic Network
GNI	Gross National Income
GOLE	GLIF Open Lambda Exchange
GPRS	General Packet Radio Service
HD	High Definition
H-TCP	TCP Congestion Control for High Bandwidth-Delay Product Paths
HS-TCP	High-Speed TCP
IAB	Internet Architecture Board
IETF	Internet Engineering Task Force
INFN	Istituto Nazionale di Fisica Nucleare
IP	Internet Protocol
IPFIX	IP Flow Information Export
IPSec	IP Security
IPv4	Internet Protocol version 4
IPv6	Internet Protocol version 6
IRT	Incident Response Team
IT	Information Technology
IXP	Internet Exchange Processor
JISC	Joint Information Systems Committee
LAN	Local Area Network
LCPM	Lifecycle and Portfolio Management
LDAP	Lightweight Directory Access Protocol
libpcap	Library for Packet Capturing
LOBSTER	Large Scale Monitoring of Broadband Internet Infrastructure
MAN	Metropolitan Area Network
MAPI	Monitoring Application Programming Interface
Mb/s	Megabits per second
MIB	Management Information Base
MIP	Mobile Internet Protocol
MIT	Massachusetts Institute of Technology
MOME	Monitoring and Measurement Cluster
MPLS	Multi-Protocol Label Switching
MRD6	IPv6 Multicast Routing Framework
multi6	Site Multihoming in IPv6
NETCONF	Network Configuration
NLR	National LambdaRail
NoAH	A European Network of Affined Honeypots
NREN	National Research and Education Network
NSIS	Next Steps in Signalling
OWAMP	One-Way Active Measurement Protocol
PAPI	Point of Access to Providers of Information
PBX	Private Branch Exchange

PCI	Peripheral Component Interconnect
PKI	Public Key Infrastructure
PR	Public Relations
QoS	Quality of Service
R&D	Research and Development
RADIUS	Remote Authentication Dial-in User Service
RadSec	RADIUS Security
RFC	Request for Comments
RIPE	Réseaux IP Européens
RTIR	Request Tracker Incident Response
SAML	Security Assertions Markup Language
SCAMPI	A Scaleable Monitoring Platform for the Internet
SCHAC	Schema Harmonisation Committee
SDH	Synchronous Digital Hierarchy
SEEFIRE	South-East Europe Fibre Infrastructure for Research and Education
SEEREN	South-Eastern European Research & Education Networking
SEEREN2	South-Eastern European Research & Education Network
SIP	Session Initiation Protocol
SNMP	Simple Network Management Protocol
SSL	Secure Sockets Layer
SSM	Source-Specific Multicast
TACAR	TERENA Academic CA Repository
TCP	Transmission Control Protocol
TEIN2	Trans-Eurasia Information Network
TENET	Tertiary Education Network
TERENA	Trans-European Research and Education Networking Association
TF-CSIRT	Task Force on Collaboration of Security Incident Response Teams
TF-EMC2	Task Force on European Middleware Co-ordination and Collaboration
TF-Mobility	Task Force on Mobility
TF-NGN	Task Force on Next-Generation Networking
TF-PR	Task Force on Public Relations and Information Dissemination
TF-VVC	Task Force on Voice, Video and Collaboration
TI	Trusted Introducer
TRANSITS	Training of Network Security Incident Teams Staff
TTL	Time To Live
UNIRAS	Unified Incident Reporting and Alert Scheme
UREC	Unité Réseaux de CNRS
US	United States
v6ops	IPv6 Operations
VISIT	Videoconferencing In Schools Initiative - TERENA
VoIP	Voice over IP
VPLS	Virtual Private LAN Service
VPN	Virtual Private Network
VRVS	Virtual Room Videoconferencing System
WAN	Wide Area Network
WIDE	Widely Integrated Distributed Environment
WiFi	Wireless Fidelity
WMnet	West Midlands Regional Broadband Consortium
XCP	Explicit Control Protocol

TERENA Secretariat Staff (December 2005)
Front row: Baiba Kaškina, Jim Buddin, Licia Florio, Carol de Groot, John Dyer, Joanne Barnett
Back row: Christian Gijtenbeek, Valentino Cavalli, Dick Visser, Wilma Overdevest, Karel Vietsch, Kevin Meynell, Aukje Bakker, Jeroen Houben, Bert van Pinxteren