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2006|07

THE JANET REPORT

2006|07

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Foreword

Supporting UK competitiveness and learning by delivering information and communication technology services to enable research and education.

For the UK to remain competitive in the global knowledge economy, a flexible and resilient information and communications infrastructure is essential. JANET is a world class network, employing the latest optical technology, and has become a mission critical asset for teachers, learners, administrators, researchers, indeed all involved in education, training and research. It offers a reliable and secure means of communication, providing access not just to the Internet but also to a range of application and advice services. Nevertheless, as the volume of traffic on JANET grows, and with the constant emergence of new technologies, the network needs to be continually updated to meet the current and future requirements of over 18 million users.
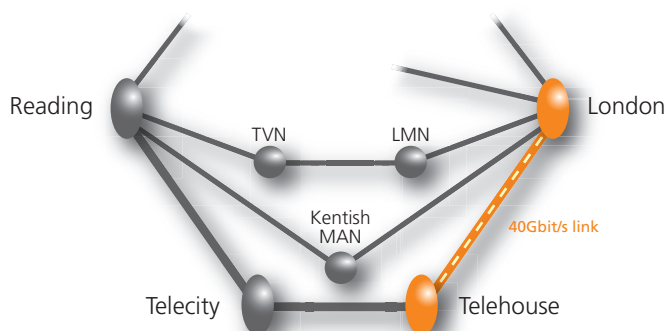
Interaction with users from all sectors of the education and research community enables JANET(UK) to respond effectively as needs change in a rapidly evolving technological landscape. This has enabled government education and research strategies to become reality. JANET(UK) will continue to push the boundaries of network engineering, and explore ways in which the network can reach beyond the traditional classroom, research laboratory or lecture theatre setting.

At the heart of JANET(UK)'s strategy is a strong development and delivery relationship with commercial partners. The fulfilment of this strategic approach has meant that JANET can provide significant value and is an exemplar of a successful shared service, a form of delivery being adopted increasingly across the public sector. JANET(UK) will use its expertise and experience to guide future policy and strategy in this area.

This report records the activities of JANET(UK) during 2006-7. In the summer of 2007 our trading name was changed from UKERNA to create a stronger and more unified brand which can be trusted to deliver. We have also moved into new offices, at Lumen House on the Harwell Science and Innovation Campus, Oxfordshire, locating our headquarters at one of the UK's premier research sites and providing us with facilities which will enable us to continue to meet the expectations of our JANET customers.

Tim Marshall
Chief Executive Officer

The successful operation of any network is dependent on its underlying infrastructure and the way it has been engineered to support the needs of its users and applications. With the completion of the commissioning of the SuperJANET5 infrastructure, JANET users now have access to leading-edge network services for learning, teaching and research.

Trial of 40Gbit/s channel operation on JANET

In order to ensure that the underlying JANET network service is able to meet any novel demands of new applications, a broad range of network engineering development projects are underway.

Looking towards the future, trials of 40Gbit/s channel operation have been carried out on the busiest part of the network, the link between Telehouse® and the London backbone node. JANET is the first European National Research and Education Network to install this technology, which is a cost-effective means of increasing bandwidth and hence capacity.

Authentication and Authorisation

In partnership with JISC and Becta, JANET(UK) has implemented the UK Access Management Federation, which provides a single solution to online access management for the UK education and research sectors. The federation uses standards-based Shibboleth software, which means that there is no tie-in to a single provider. By allowing users to authenticate at their home organisation, and hence protecting their privacy, the new system will permit a range of access management options not available until now, such as the use of the same username and password for internal and external resources, a reduction in the number of user accounts to administer and the ability for organisations to collaborate more effectively by sharing access to specific resources.

The UK Access Management Federation

FOR EDUCATION AND RESEARCH

**http://www.ukfederation.org.uk**

IPv6

Interest in IPv6 among the JANET community has been increasing, reflected in a growing use of the tunnel facilities provided on the network. IPv4/IPv6 dual stack has been in place on the JANET backbone since 2003, and a range of IPv6-related activities have been held to encourage regional and site network operators to become familiar with the deployment and operation of IPv6 services within their networks. Support and guidance has been provided via a series of IPv6 hands-on workshops and the production of a range of documents, including procurement guidance, to regional and campus network operators. IPv6 unicast is now to be introduced formally into the JANET Service Level Agreement in a phased approach.

Network Access

There is an increasing need for access to JANET beyond the classroom and computer lab, which requires the implementation of new technologies which are less dependent on temporal and spatial limitations. As one aspect of this, JANET(UK) is exploring the potential of Local Loop Unbundling for 'last mile' access, which offers the possibility of large savings over more traditional approaches to primary connectivity.

The growing number of participants in the JANET Roaming service reflects the expanding interest in the use of wireless networks. JANET(UK) has undertaken a survey to provide a baseline snapshot of the penetration of the technology and its breadth of applications, and reveal patterns of uptake or modes of use that can guide future development activities. Trials are being planned to investigate both the mobile IP and location awareness aspects of this technology, while the JANET Wireless Technology Advisory Service has been launched to provide unbiased expert advice on a wide range of wireless technologies and their implementation.
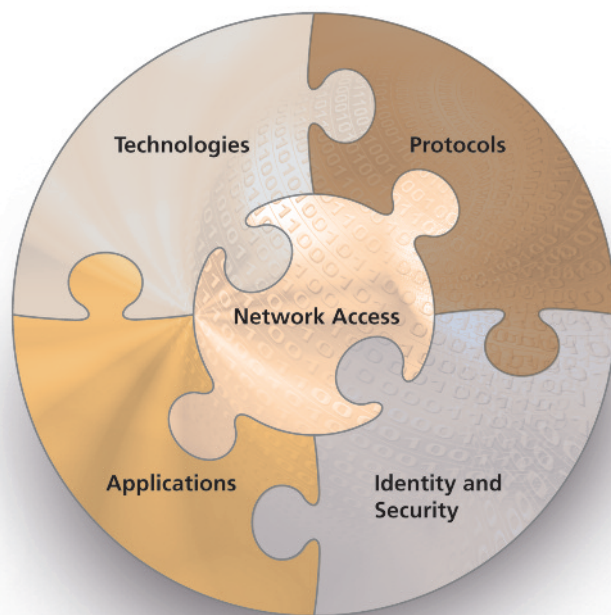
*The network access approach
links edge technologies*

Reliability, Resilience and Security

JANET's reliability, resilience and security are of vital importance to our customers, as information technology becomes an increasingly mission-critical resource.

Reliability and Resilience

The JANET network continues to be stable and reliable, and able to handle the increasing volumes of traffic traversing the network to the links with global transit providers who provide external connectivity to the wider Internet.

Security

An agreement between TERENA and GlobalSign™ enables JANET(UK) to offer a Server Certificate Service to JANET customers, which has been in considerable demand as a result of the launch of the UK Access Management Federation. Every federation resource provider and every identity provider requires its own certificate, and potentially the demand could reach more than a thousand server certificates. These certificates cryptographically validate the DNS name of the server on which they are installed: they are effectively a signed statement issued by a trusted and registered third party and can be used for all other web-based services such as e-mail, VLEs (Virtual Learning Environments) and MLEs (Managed Learning Environments). As well as providing an electronic means of proving the identity of a server, a server certificate can be used to encrypt sensitive information such as usernames and passwords so they cannot be read or modified as they pass across the network. By using server certificates you are assuring others that their communications with you are secure and that in effect the server is who it says it is.

JANET(UK) continues to provide advice on regulatory and policy issues to the JANET community and other bodies, including government consultations such as the House of Lords Committee on Science and Technology enquiry into personal internet safety.

Server Certificate Service

http://www.ja.net/services/scs

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International Traffic

Peak traffic across GÉANT2
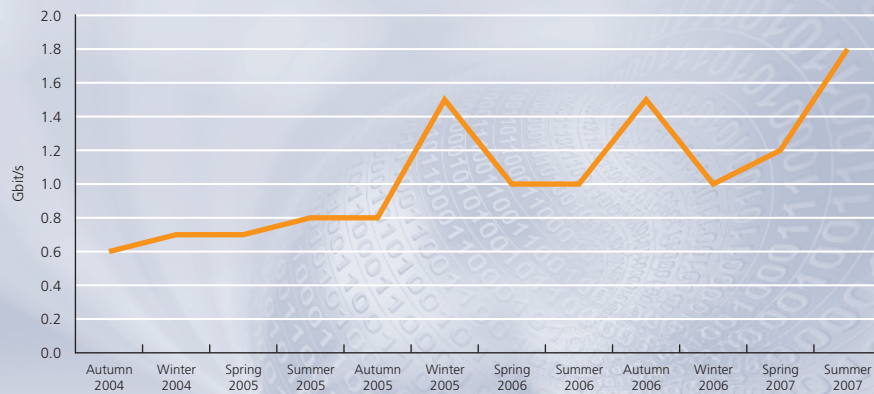
Peak traffic across over connections to the global internet
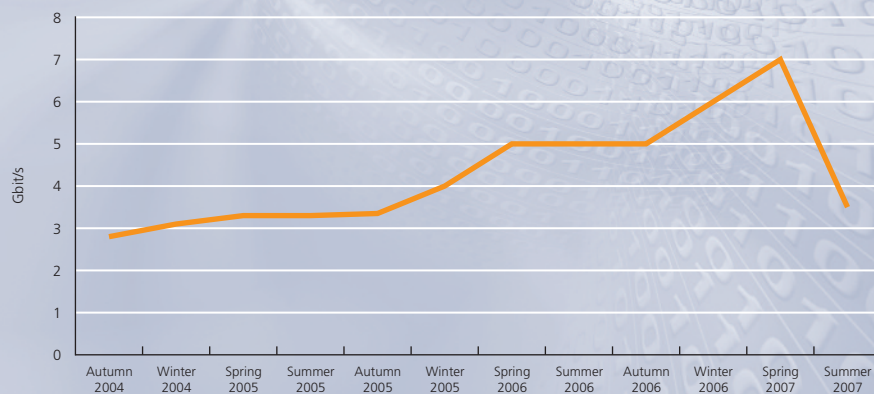
CSIRT
(Computer Security Incident Response Team)
http://www.ja.net/csirt

JANET CSIRT takes a proactive stance towards malicious activity across the JANET core, and the promotion of good practice among the JANET community helps to reduce the effect of threats from the Internet at large. Problems with web site defacement and e-mail abuse continue to cause concern however, although they can usually be dealt with rapidly. The JANET CSIRT conference provides a valuable forum for the sharing of information and discussion about security issues.
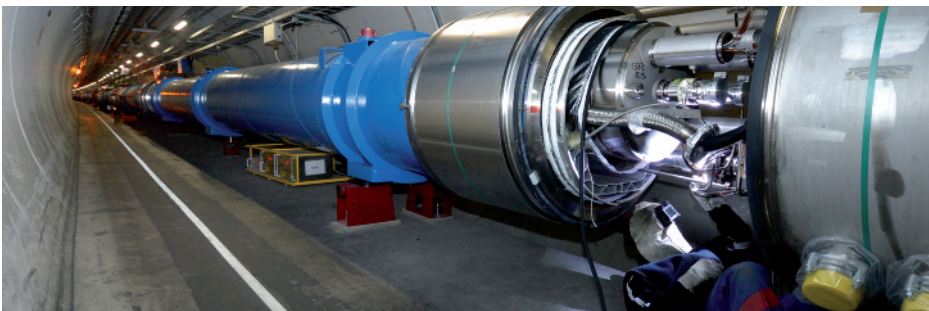
Supporting Research

The research sector is a major user community on JANET and is one of the main drivers for the development and evolution of the network. Dedicated network capacity is provided to support exciting and cutting edge science and research projects.

Research Links

A dedicated 10Gbit/s path has been commissioned between the STFC's Rutherford Appleton Laboratory and CERN, the European Organisation for Nuclear Research in Geneva. The path runs across JANET and GÉANT2, connecting the data processing centres at the

*Completing magnet interconnection on the last sector of the Large Hadron Collider at CERN.
Image © CERN*

two sites, and will be used to distribute data from the experiments at the LHC (Large Hadron Collider) which is due to come into operation next year. This is the first example of the use of such a high-capacity dedicated link, but the JANET backbone has been engineered to make provision of these services straightforward and cost-effective, and it is expected that more will be implemented next year. There is already interest from the Radio Astronomy and High Performance Computing communities, which are both involved in national and international scientific collaboration requiring dedicated high-capacity connections between their facilities.

Measurement and Monitoring

There is considerable interest among the network research community in gaining access to network traffic information from JANET, on both performance and status. Consequently, one of the high-level goals for SuperJANET5 was to increase the visibility of the network by making performance and traffic information available to the wider community. The system which measures traffic across the JANET network, JANET Netsight, is in the process of being upgraded. Netsight gathers data on the availability of JANET-connected organisations and graphs it for viewing on a web page. The new system will enhance the features available, provide more granular measurements and allow flexibility to add additional measurements as and when required. In addition, two of the core routers in Reading and London will be configured to enable the attachment of monitoring systems which can gather IP network traffic. This is a significant new step and should enable research projects to undertake interesting work to the benefit of the current and future JANET networks.

Optical Networking

JANET(UK) has established a five year optical development programme, which aims to utilise the current JANET infrastructure in order to investigate mechanisms to improve the management and delivery of network capacity wherever it is needed and to examine developments in optical networking technologies and network architectures to inform the approach to future JANET network services. In order to understand the requirements and technologies further a broad range of projects will be established under this programme, extending from transmission and switching technologies to usability issues with a linking theme of control and management. JANET Lightpath is a centrally managed service which will help support large research projects on the JANET network by providing end-to-end connectivity. It includes the UKLight service for fine-grained circuit provision and extends it to include whole wavelengths across the JANET optical transmission infrastructure.
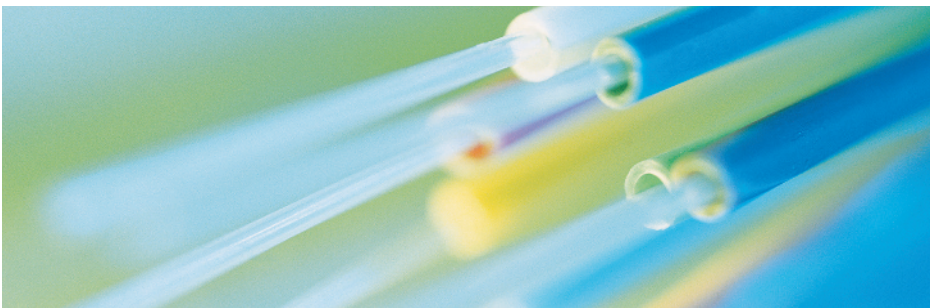
Grids

There are currently over 80 Access Grid nodes based in the UK. These support collaboration in areas such as management and research meetings, teaching, seminars, and performance art. These collaborations are enhanced using features of the Access Grid such as its ability to support large multi-site sessions and focusing on the human factors of remote collaboration such as multiple views and support for collaborative applications. The Access Grid Booking Service has been developed to help users make more effective use of grid facilities. The service will automatically assign a virtual venue for the session and distribute vital organisation and technical information to all participating sites.

JANET Lightpath

http://www.ja.net/lightpath

- provides dedicated network capacity for large volumes of data or delay sensitive data

- can be extended internationally by connection to GÉANT2 to reach other National Research and Education Networks in Europe

- connections to North America and other international networks are also possible via an exchange facility in StarLight in Chicago.

Videoconferencing

http://www.ja.net/video

Videoconferencing is becoming increasingly popular among all sectors of the JANET community. The JANET Videoconferencing Service (JVCS) helps to promote effective use of the technology and increasing automation has been introduced to deal with the growing volume of interest. The JANET Video Technology Advisory Service provides advice on relevant products and their implementation.

In the schools sector, the delivery of AS and A2 Level tutorials and teaching via distance learning has grown significantly over the past eighteen months. This increases access to courses in non-mainstream subjects, including Film Studies, Law, Latin, Psychology and Critical Thinking.

More museums and galleries are now registering with JVCS so that they can reach schools, and JANET is working closely with the National Museums of England, Northern Ireland, Scotland and Wales, the Museums, Libraries and Archives Council in England and their counterpart CyMAL in Wales to raise awareness of the potential of videoconferencing in the cultural sector.

The National Maritime Museum and the Royal Observatory, Greenwich are a prime example of what is possible. They offer a wide variety of National Curriculum-focused sessions for schools, where the museum's subject specialists encourage students to learn through interpretation of items in their impressive collection, and actors help to recreate a sense of the past.

There is now also significantly greater potential for collaboration between universities, colleges and schools. Liaison officers at universities are starting to use videoconferencing to provide schools with access to virtual Open Days. Many universities and colleges are also able to provide expertise in a variety of curriculum extension topics. For example the Cambridge Motivate team, based at Cambridge University, has been delivering sessions on mathematics and science to schools via JVCS for over 10 years.

Voice

http://www.ja.net/development/voip

Voice over IP and IP telephony are strategically important areas that JANET-connected organisations cannot ignore and the use of IP networks to carry voice traffic is becoming more commonplace. To support organisations in their deployment of this technology, the JANET Voice Advisory Service was launched to provide independent advice and guidance on all aspects of voice technologies. This will be achieved through the publication of reports and case studies, product reviews and a help-desk facility supported by experts from the JANET community.

A voice collaboration pilot, JANET Talk, is also under development. The service will allow users from within the JANET community to collaborate using voice, instant messaging, and potentially other features such as shared whiteboards, slides and desktops. At the heart of the new service will be a directory that will allow subscribed users to locate other users of the service. This directory is expected to be searchable not only by name/nickname and location data, but also by extended information such as research or educational interest areas or job titles. The challenges of delivering voice across JANET are not

insignificant. However, with the maturing of standards and architectures for Voice over IP networks it is possible to build a service that is largely vendor neutral.

Delivery of Media-rich Content

The mixed use of network-based film, audio, images and text is widespread across the JANET community as a whole, not only as a tool for teaching and learning, but also as a communications medium, a resource for research, and a medium by which the day-to-day business of JANET-connected organisations is conducted.

There are a number of content providers in various guises within the JANET community. These include several data centres and repositories, such as EDINA, JORUM and MIMAS, who all play an important role in providing access to centrally-stored and rights-cleared content. These services are based on simple searchable access and download. The future will more than likely also see on-demand television-type services playing a key part in the way that content is used within the JANET community.

There has been a significant increase in JANET-connected organisations making use of IPTV (IP Television) technologies which provides a more flexible delivery medium than is currently offered using traditional coaxial television cabling. In late 2006, JANET(UK) signed an agreement with Inuk Networks that enables Inuk to deliver an IPTV service to student halls of residence. The service, called FreewireTV, provides a number of services including the full range of UK free-to-air channels.

JANET txt

http://www.ja.net/services/janet-txt

- JANET txt will be available to any organisation receiving JANET services, and offers an adaptable service to the various education and research sectors which make up the JANET community. Schools can use it to keep parents informed, while it is employed for a range of purposes by universities and colleges: mobile learning, exam results, changes of lecture venues or times, library book returns, student counselling, ticket bookings and even as alarms to get students out of bed in the mornings.

Venues Registered with JVCS
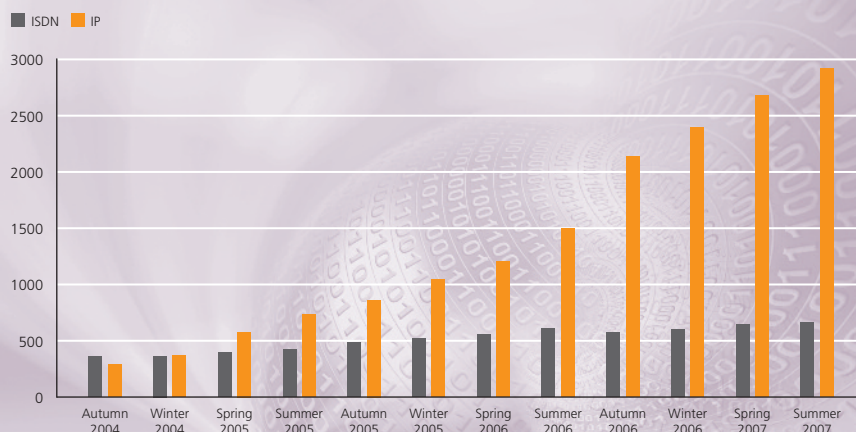
JANET's remit has widened greatly since its inception, and it now connects customers from all sectors of the UK education and research communities, from schools to research councils, further and higher education organisations, personal and community development centres and specialist colleges.

Schools

Access to a wide range of educational and cultural content through videoconferencing has become increasingly vital for teaching and learning in schools at all levels. The use of JANET connectivity and services is a major contribution to the overall National Education Network which enables them to do this in a secure environment. It provides the potential for cross sector collaboration, both within the UK and worldwide. The Read Around the Planet event in March 2007 linked 28 UK schools with many others across the globe for a series of language and literature activities.

A number of independent schools have expressed interest in JANET connections, as they become aware that in order to utilise their resources effectively, they need better connectivity than is economically available from commercial leased line services. JANET provides them with a reliable and resilient high-speed Internet connection, but also access to a number of other services and the wider education and research community.

Local Authorities

A recognition of the potential value of e-learning provision and a growing emphasis on Work-based Learning has resulted in a number of local authorities self-funding bandwidth upgrades. JANET provides significant cost savings over existing connectivity arrangements, thus enabling local authorities to continue provision of this increasingly vital resource.

NHS-HE

The project to implement the N3 JANET Gateway has progressed to the stage that hardware has been ordered for the early adopters in the South West, North East and Birmingham. The gateway is to be used for collaboration, teaching and learning, for example by providing fast, robust web access for Virtual Learning Environments. A future development will be to implement IP videoconferencing to enable meetings not involving confidential patient data.

Further Education and Specialist Colleges

The use of new technologies in this sector continues to grow and a JANET connection is seen as a valuable and reliable resource. Regular surveys and personal visits help to ensure that provision is developed in the right direction to meet changing needs. All English Further Education colleges have had bandwidth upgrades to 10Mbit/s funded by the LSC (Learning and Skills Council), which will enable further use of Virtual Learning Environments and online assessment tools.

More specialist colleges have received funding from the LSC as their number of eligible students has increased. The potential benefits of technology to enhance learning for students with disabilities are huge and specialist colleges have been at the forefront of innovation in this area. Examples include providing cooking instructions on CD and MP3 and extending wireless networks to cover horticulture departments and even into polytunnels themselves, so that students can use laptops to update records and identify pests and diseases on the spot.

Self-funded Organisations

The number of self-funded connections has continued to rise, which reflects the value which they provide. A customer satisfaction survey has confirmed that independent organisations are very pleased with the service they receive and would recommend a JANET connection to others. A review of the connectivity infrastructure that enables data communication and web access at the various British Library sites resulted in a proposal for a full resilient network with dual connections at each site running over the JANET backbone. This will meet the needs of a project to digitise 100,000 of the oldest books and documents in the Library's collection and make them available over the web. This project also involves Internet2 in the US and the National Library of Wales, Aberystwyth.

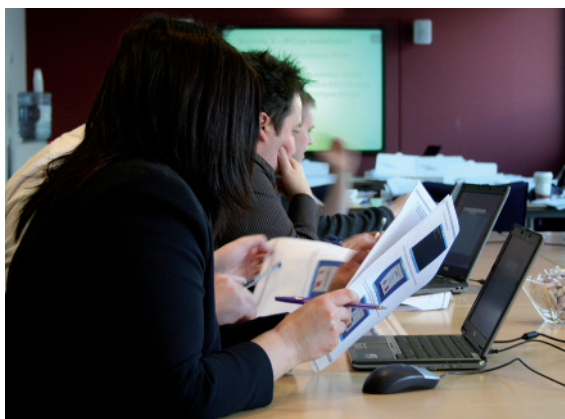| Total New and Upgraded Connections 2006-2007	
HE	9
FE	59
Research Councils	4
PCDL	12
Scottish Executive	2
Self funded	26
Total	112

JANET provides a range of support services to enable its user base of 18 million from all sectors of the education and research communities to make most effective use of the technologies available to them. This is achieved through the JANET website, publications, events and training courses.

JANET Service Desk

The JANET Service Desk is the single point of contact for all enquiries concerning the JANET network and services, including connection requests, fault reports and requests to the advisory services. The Service Desk ensures queries are appropriately assigned, and tracks them to a satisfactory conclusion.

Training

The JANET Training schedule has been revised, in order to ensure that the courses offered continue to meet the needs of the community and reflect growing areas of technology. Two new courses have been introduced and more are under development. Courses are available at various technical levels and cover a wide range of areas, including introductions to JANET and networking, videoconferencing, wireless fundamentals, and security issues such as firewalls, logfiles and security policies. The range of venues for courses has also been increased, with the aim of enabling wider participation.

To increase the opportunities for practical experience on JANET Training courses, a virtual network environment has been developed. This enables course participants to experience real-life situations without affecting production services or jeopardizing the security of their organisational network. This approach reflects the belief that learning is most effective when learners are actively engaged in the process. Work is also underway to implement an online learning

JANET Technical Administration Group

The JANET Technical Administration Group deals with the provision of domain name addresses and the allocation of IP addresses. It also administers the Server Certificate Service and answers queries about the UK Access Management Federation.

Number of Enquiries Received by JSD
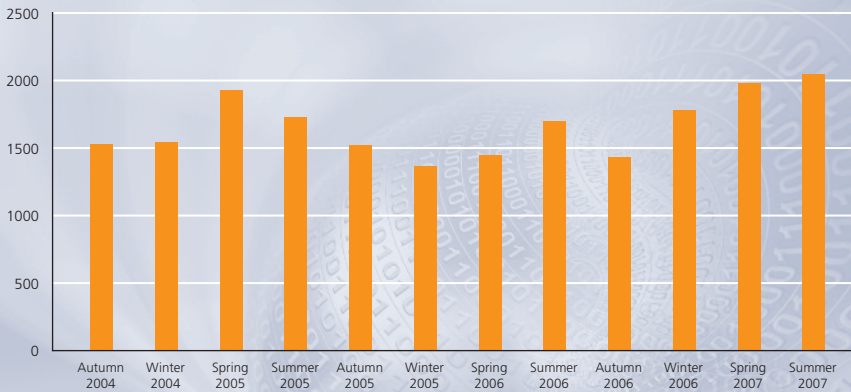
JANET Publications 2006-7

http://www.ja.net/services/publications

Case Studies

- Coleg Harlech Extranet for Distributed Records Management and E-learning Services
- Foxes Academy Multi-site WAN based on EPS9, SHDSL and IP DSLAM
- Deploying IP Telephony on Greenfield Sites
- Brunel University: A Converged Network Running Voice Data and Other Services
- A Case Study of Changes Made to a Nokia/Check Point® Firewall-protected H.323 Gatekeeper/Proxy Topology at Wrexham County Corough Council

Factsheets

- Television Licensing and IP Television Services
- WEP, WPA or Other?
- JANET and Internet Filtering
- Wireless Rogue Suppression
- Guest and Public Access

Technical Guides

- Grid Support
- IPv6 Multicast on JANET
- Firewalls Implementation at JANET-connected Organisations

Other

- Wireless Advisory Group: WEP Strongly Deprecated
- ENUM and e164.ja.net – what is it?
- Different Flavours of VPN

facility which will provide resources and support for collaboration between individuals and organisations in areas relating to network provision.

Events

JANET holds regular events to raise awareness of key issues and new technologies and disseminate vital information to the community. These include the annual Networking Strategy and Strategic Briefing, and the very popular Networkshop. This year's conference was held at the University of Exeter and brought together network specialists from within the JANET community and further afield to discuss current key areas of interest, including wireless technologies, the UK Access Management Federation, IPv6 and security.

JANET is the UK's education and research network, but education and research transcend national boundaries. JANET is a full member of the global education and research networking community, which has the facility to send and receive vast amounts of raw data securely around the world.

Linking to the World

JANET has a 10Gbit/s connection to the pan-European research and education network GÉANT2, operated by DANTE. As well as linking to 30 NRENs (National Research and Education Networks) in Europe, this also provides access to two US research networks: Abilene and ESnet (Energy Sciences Network). GÉANT2 also provides a link between JANET and TEIN2 (Trans-Eurasia Information Network).

JANET is a project partner in ORIENT, which is working with TEIN2 to connect academic networks in China and Europe, and to upgrade the connection to 2.5Gbit/s, to enable e-Science collaborations in areas including radio astronomy, Grid computing, meteorology, sustainable development and space science.
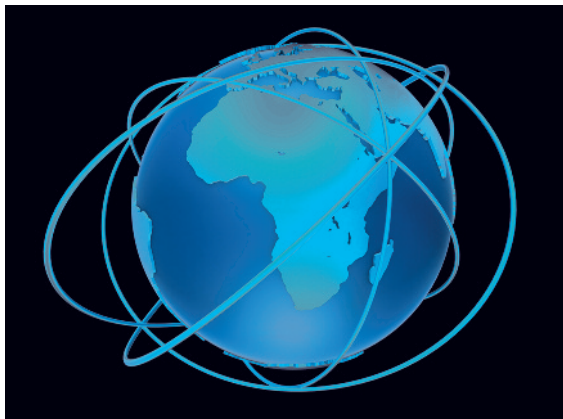
TERENA

JANET representatives regularly attend meetings of TERENA, the Trans-European Research and Education Networking Association, and contribute to various development projects through the TERENA Task Forces, including Mobility (focusing on authentication, authorisation and mobile computing), Next Generation Networking and Public Relations. Work has continued on producing a policy and service framework for eduroam, which allows users from participating organisations to access the Internet at another participant's organisation using access credentials from their home organisation.

The recent upgrade to the JANET backbone has brought with it many opportunities for the delivery of new and enhanced JANET services. The potential of these will continue to be explored during the coming year, to ensure that the network meets the needs of a growing number of users from increasingly diverse sectors of the education and research community.
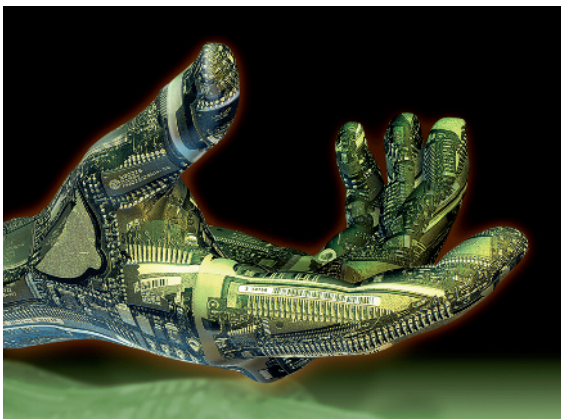
An example of this will be the JANET Lightpath service, which will satisfy the requirements of research groups throughout the UK. The high-capacity dedicated link between the Rutherford Appleton Laboratory and CERN is expected to begin to transmit data, while the implementation of similar links will support other areas of national and international scientific collaboration. Enhancements to the systems which measure and monitor network traffic on JANET will ensure that the bandwidth capability of the network is fully exploited and a wider deployment of 40Gbit/s channels across the backbone is planned for 2008.

These new directions in network engineering will run alongside developments in other areas of technology, enabling more effective delivery of multimedia content and services across IP networks. This will broaden opportunities for both everyday communication and more specific educational collaboration. The coming year will see the pilot of JANET Talk, which harnesses the potential of Voice over IP technology. These new applications need to be underpinned by suitable security and access control measures, which will be facilitated by the growing membership of the UK Access Management Federation.

However, the delivery of these technologies will only be possible by strengthening JANET(UK)'s partnerships with the Regional Network Operators and other national networks such as those which serve schools and the NHS. In addition, the potential for third-party service and content providers to deliver innovative and cost-effective services across JANET will continue to be investigated. The overall aim is to ensure that JANET retains its place among the world's leading national education and research networks.