

T H E D I G I T A L

THE DIGITAL SOCIETY



To realise the true potential of the Information Society, the benefits of IST need to be accessible to everyone, irrespective of age, gender, social status, or special needs. The development of user-centred IST applications and infrastructures for general and public services is essential to the realisation of a digital society.

One manifestation of this is in the use of IST applications to deliver services in more personalised and interactive ways. In areas such as culture, education and entertainment, for example, IST provides users with access to resources and services through rich, interactive experiences. This trend is especially significant in education, where from the kindergarten to the university IST is fundamentally changing the nature of learning.

IST also helps achieve more efficient use of public infrastructure and environmental resources, and so realise a more sustainable development.

Key applications include improving environmental management, optimising the use of transport networks and multi-modal transport services, and more effective management of environmental emergencies. A relatively recent but extremely important application is in improving the clearance of anti-personnel landmines.

While the applications are varied, they are underpinned by a set of common enabling technologies and approaches that improve the accessibility of IST applications for the digital society. Prominent amongst these are: natural and multi-modal interfaces; virtual and augmented reality environments; distributed computing and applications; mobile and wireless communications; spatially-referenced data; and technologies for trust, security and confidence. The development of application-specific platforms based on interoperability and open standards is another recurring theme.



S O C I E T Y

Better by design

As people we are all different. Yet regardless of our physical, sensory or mental ability, we should all be able to access and use ICT products and services. Developers, designers, manufacturers and others involved in ICT must take account of this diversity in the design process.

"Design-for-all" is an approach to creating products, services and systems which are designed to be usable by as broad a range of the population as possible. By ensuring that the requirements of the widest possible range of users are taken into account at the earliest stages of design, the number of potential users is maximised and products and services will be easier for everyone to use. Design-for-all seeks to ensure that products are flexible enough to be used directly, without assistive devices or modifications, by people with the widest range of abilities and circumstances as is practical with current knowledge and technologies. In some cases designs will also be compatible with the assistive technology products that might be used by those who cannot access or use the products or services directly.

Almost without exception, features added to a product to accommodate individuals with reduced abilities have proven beneficial to users in general. In many cases more people without a disability find the features useful than the original target audience. The captioning of TV programmes, for example, was originally introduced for people with a hearing impairment but is also used by those with another mother tongue, by children learning to read and by adults developing their literacy skills. Applications using speech recognition technology have benefits for anyone unable to use a keyboard, whether because of tetraplegia or because they are driving a car.

Talking packaging

Bar code technology is well established but is presently used by retailers and supermarkets for their benefit alone. IST's PACKAGE project aims to demonstrate that older people and those with disabilities can also benefit from this technology. The use of bar codes is being extended from point-of-sale to point-of-use for a variety of food, drink and detergent products.

An intelligent opening device called Helping Hand will be able to read the bar codes on consumer packaging and match this against a specially developed database called ED-MaPP. The device will identify the package, speak its contents and provide a warning of unsuitable ingredients. It will also be able to open specially developed screw-tops. At the end of the project the ED-MaPP database will be made available on the internet for use in tomorrow's smart homes.

Design-for-All brings benefits for industry too. Accessibility factors are an increasing factor in the competitiveness of ICT products on world markets. By increasing ease of use and convenience within product ranges, the potential pool of users is expanded, thus increasing suppliers' profitability.

Computer products for people with special needs, developed under TAP project Homebrain



Further info	IST-1999 CPA3	Design-for-all for an inclusive information society
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	www.cordis.lu/ist/cpt/1999cpa.htm	

Supporting emergency management

Despite all the comforts of modern life we still live at nature's mercy. Although less exposed than some regions of the world, Europe is at risk from natural disasters such as severe weather, earthquakes, floods and landslides. There are also risks of our own making, such as chemical spills and industrial accidents.

By its very nature emergency management is highly pressurised. Life and death decisions have to be taken at short notice, more often than not on the basis of inadequate information. Even if data is available it can be difficult for people to analyse quickly enough to feed back into the decision process. In such situations information and communication technologies can literally save lives.

Continuing an interest begun under earlier programmes, the IST Programme supports RTD into

environmental risks and emergency management systems. IST's activities aim to ensure a wide availability of efficient and affordable risk and emergency management systems and to stimulate their take-up by civil protection authorities and other end-users. It also aims to "close the loop" with EU and national legislation and to increase citizen's awareness of environmental risks.

Research focuses on the development of intelligent, mobile and networked sensors and systems for real-time data collection. Tools for real-time command and control, as well as integration of data from a range of sources are also being investigated and are expected to lead to warning systems and information to citizens.

A Standard European Methodology For Natural Hazards Management is being developed under the FORMIDABLE project. A standardised, inter-operable system that can be used by European civil protection authorities will be tested in field trials in Italy and Spain.

Other projects target specific risk management applications. FORFAIT, for example, will demonstrate a decision support system to assist civil protection agencies in optimising the management of forest fires. ROBOSENSE is developing a low-cost robotic system for inspecting a building's ability to withstand earthquakes. In the light of catastrophic flood events in Southern and Central Europe, OSIRIS is analysing approaches to flood crisis management in large river basins, and in particular ways to improve information dissemination to citizens. GEOWARN is applying data visualisation techniques to early warning of volcanic and seismic activity.

Remote sensing for oil spills

Oil spills regularly pollute Europe's coasts and maritime waters. The integration of data from aircraft and satellite sensors is an important aspect of any effort to abate such pollution damages. The RAPSODI project is developing an airborne remote sensing system dedicated to oil spills based on synthetic aperture radar (SAR). The project involves close co-operation between signal processing and pollution remediation experts and builds on previous work under the Telematics project AMED. The RAPSODI prototype will be tested in real-life conditions and, in the event of an oil spill occurring, in a real emergency situation.

Further info	IST-2000 1.4.1	Intelligent environmental management, risk and emergency systems
IST Action Lines:		IST-1999 11679
Project References:	FORMIDABLE	IST-1999 10649
	FORFAIT	IST-1999 12310
	GEOWARN	IST-1999 11598
	OSIRIS	IST-1999 12290
	RAPSODI	IST-1999 11976
	ROBOSENSE	
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Doctors in miniature

Microsystems technology (MST) has enabled rapid advances in biomedical devices such as pacemakers, hearing aids, catheter systems and instruments for minimally invasive surgery. Alongside these well known applications, an entire new range of devices is now emerging, made possible by the miniaturisation and high level integration capabilities afforded by microsystems. Leading examples include neural prosthetics to restore or replace functions of the human nervous system, and microdevices for telemetric in-vivo monitoring and drug delivery systems.

The Esprit project MICROMEDES addressed a microsystem for controlled medical drug release. Treating pain, spasticity and cancer (chemotherapy) all require continuous drug treatment. Such drug delivery systems, extra-corporeal or implanted, offer dosage reductions of ten times or more compared to traditional medicines, helping in addition to reduce side effects. In future, treatments for neural disorders and Alzheimer's disease are expected to be available; these will require systems that can monitor the drugs' effects with sensors. Therefore, future developments will focus on closed loop systems, consisting of implantable sensors, powered by telemetry, and an extra-corporeal processing unit, which the user can use to adjust the dose.

Under the IST Programme, the continuation of EUROPRACTICE-MST, the EU initiative promoting access to MST, maintains a strong interest in medical and biomedical applications. The Europractice MST Service helps potential users take their application requirements from concept to manufacture, by providing easy access to design, prototyping and manufacturing facilities. The service comprises design clusters, offering design and prototyping services; manufacturing clusters, offering proven processes in manufacturing, packaging and testing; and competence centres, offering application support and evaluation of new product concepts.



The implantable infusion pump developed under Esprit project Micromedes

IST's PAMELA project aims to develop a more efficient system for monitoring patients diagnosed with prostate cancer by measuring the prostate specific antigen (PSA) level in the blood. The new, fully automated instrument will be used to deliver, in real time, reproducible values for PSA per millilitre of blood, measured at the level of nanograms. This will allow both the doctor and the patient to be updated in real time about the progress of the healing process. The bio-sensor contains the PSA recognising probes and a transducer converts the probe's recognition reaction into an electrical signal, proportional to the concentration of PSA present. The work involves optimisation of all elements and interfaces and combining them into an integrated device that can meet the necessary clinical specifications. The new technology could have a significant impact in related areas of immuno-diagnostic testing and, being of a generic nature, could be adapted to other clinical analyses.

Access to biomedical devices expertise

INTECS is a Competence Centre for Biomedical Devices that continues the work of a previous Europractice centre called MEDICS. INTECS provides access to information services and technological know-how on biomedical microdevices for European device manufacturers, scientists and clinicians. Information services include an extended biomedical database covering European biomedical and microsystem providers, products, services and co-operation partners.

As with other competence centres, INTECS supports users on feasibility assessment, concept evaluation and design. Other services comprise person-to-person assistance in identifying co-operation partners and technology providers, and guidance on the availability of components and product-related solutions. In addition, the centre supports the dissemination of information on microelectrode-, micro-probe- and telemetry systems to the scientific and clinical communities.

The current understanding of how the nervous system functions is based on numerous observations of the behaviour of single units or a small ensemble of units correlated to some external stimulation or behavioural event. However, the processing power of the nervous system lies in its network and interconnections. Thus, the key to understanding the nervous system is to make simultaneous observations of the activity of numerous cells. VSAMUEL is developing such a system for the neuroscience research community, based on silicon microelectrode arrays for acquiring signals from nervous tissue in-vivo. Advanced micro-structuring is being used to design and fabricate probes, together with easy-to-use connectors, multi-channel signal amplifiers and a high-throughput data acquisition system.

MICROTRANS will provide the medical community with an innovative way for reliable monitoring of organs due for transplantation. The viability assessment of those organs by means of a specially developed microsystem would expand the number of available grafts and their potential beneficiaries. It would also enable the monitoring of organ behaviour, both during the transport and during the initial post-operative period. The work involves the design, characterisation and testing of a bio-sensing system for in-situ monitoring of the organ tissue. Parameters, like tissue impedance, pH, K⁺ concentration and temperature will act as initial prognosis tools for the organ viability.

Further info IST Action Lines: Project References:

IST-2000 IV.7.3
INTECS
MICROMEDES
MICROTRANS
PAMELA
VSAMUEL

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www.cordis.lu/ist/ka4/supermic/index.htm
www.europractice.com

Microsystems
IST-1999 13368
Esprit 8902
IST-1999 13478
IST-1999-13047
IST-1999 10073
www.imec.be/PAMELA

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School of tomorrow

The school plays an essential role in the education of younger generations. An obvious aspect of this is provision of the knowledge and skills necessary to make them active citizens of the Information Society, expressed by some experts through the concept of digital literacy. However, to be able to cope with a scenario of almost continuous change, these skills go beyond the traditional acquisition of information about facts and techniques, giving greater emphasis to the higher level cognitive activities (e.g. autonomy, creativity, problem-solving, team work).

The societal changes seen over recent decades also demand the ability to support more differentiated groups of learners, providing the teacher with the means to take better account of their individual needs. This diversity goes beyond the physical limits of the classroom, promoting a more inclusive view of the school and bringing together children irrespective of their geographic location.

The ubiquitous presence of information and communication technologies (ICTs) is also at the origin of new forms of interaction and expression, leading to the emergence of what has been referred to as the "culture of interactivity". This evolution challenges the typical communication processes of the classical classroom. It calls for more innovative learning materials that combine

pedagogical effectiveness with easy-to-use mechanisms supporting interaction between learners, tutors and other peer groups. Enquiry into the cognitive mechanisms associated with the use of ICT in schools, and development of the tools supporting more effective pedagogical approaches, started in the latter stages of FP4, particularly through the Education Multimedia Task Force. A number of projects aimed to bring together the main actors of the school and to support the gradual introduction of ICT in the teaching and learning of various disciplines.

Among these projects, a special mention should be given to the European Multimedia School Network (EUN), a virtual teachers' college for the professional development of teachers, with extensive learning resources for pupils in European schools. This network of more than 500 schools covers all the EU member states, Iceland, Norway and Switzerland. These schools act as a test bed, providing best practice and good examples. They support other European schools wishing to employ multimedia telematics, offering them appropriate tools to both ease and speed up the transformation process.

Other key projects focusing on the development of multimedia resources for primary and secondary schools included EURODELPHES, MEDI-AKIDS, PEDACTICE and VES. In all cases great attention was given to teachers, since their active involvement is critical in making multimedia telematics into useful pedagogical tools supporting the learning process. This perspective was emphasised particularly in REPRESENTATION, which conducted a systematic analysis of the pedagogic aspects of multimedia use in schools and their impact in the design of new products.



IS tools enable teachers to take better account of individuals' learning needs

Other projects focused on the development of learning resources addressing the specific needs of language learning (FABULA, MALTED, VIRLAN, VALASPI), the LOGO language (NETLOGO) and environmental aspects (PLANET).

The concern with a more inclusive school is also present in projects such as FLEX or ISLIL. The Flexible Learning Environment Experiment (FLEX) takes into account the needs of commu-

nities (e.g. circus, fairground and canal families) for which travelling is simply part of their everyday professional lives. In the Integrated System for Long Distance Intercultural Learning (ISLIL) pupils have the possibility of creating, assembling and consulting new intercultural products with the help of the teacher, raising their awareness and sensitisation to the issues of cultural diversity.

The PARLEUNET project provides an example of how ICT can be used to facilitate a better understanding of political institutions (the European Parliament) by students in secondary schools, promoting the concept of EU citizenship.

Within the IST Programme, this work is being pursued with a new group of projects exploiting the more recent advances of technology in the areas of virtual reality and on-line collaboration in the school context. These include several concerned with the development of virtual labs, a tool of great value in the teaching of scientific disciplines. A more in-depth analysis of the pedagogical and cognitive issues associated to the use of these novel technological tools is also the focus of some of the new projects. Another aspect being covered is the need to provide schools with more effective ICT platforms that are easier to manage and more adequate to their specific environment and constraints.

It is expected that the results of this research will contribute to better understanding of how ICT can be used to promote the development of the high level cognitive abilities required by the Information Society.

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IST-2000 III.2.1
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Accessing European cultural heritage

Libraries, museums and archives are our collective memory. Their collections record how individuals, communities and institutions have shaped our society and our culture, reflecting the imagination, skills and learning of previous generations. They are our legacy to the future and we have an obligation not only to preserve their collections but also to enrich them with contributions from our own time. The Information Society presents cultural institutions with unparalleled opportunities to engage with their communities, but also presents tremendous challenges.

Perhaps the most fundamental challenge is in users' expectations of cultural institutions. Increasingly, users want resources presented in terms of their own interests and needs, rather than according to a curator's own criteria. As the volume and variety of resources grow, users will

be looking not only to be directed to resources but to be supported in their selection, aggregation and use. They will expect the resources to tell a story and to interact with them. And they will expect to be able to reuse and repackage materials in different contexts. In short, the user's environment will become much more interactive and dynamic.

This points to major changes in the way in which cultural institutions operate. In the future, libraries, museums and other institutes will not only be places where people visit but also providers of services within a networked European cultural space. These services will include the aggregation, filtering and selection of cultural content for both virtual visitors and automated services. Users will interact with these services through various channels, including digital library services, learning environments, virtual exhibitions and games. Thus, cultural institutions are creators of content as well as custodians of historical assets. Their relationships with users are no longer passive but active.

The business models needed to succeed in this new networked, service-orientated environment will depend, in part, on the co-evolution of technologies, markets and organisations. Opportunities for many new types of services are likely to emerge, some on a commercial basis, such as brokerage or mediation to provide a single point of entry to distributed collections. Other services can be envisaged offering authentication or copyright protection; rating of a collection's content; or long-term archiving facilities.

The old and the new: IST helps make cultural institutions more interactive and user-friendly



Preservation has always been a key aspect of cultural institutions' role. Technologies such as virtual reality can make a significant contribution here, allowing the public to access and interact with historical artefacts in ways they could never do with the real thing, while keeping the artefacts themselves safely protected. But as well as digital representations of physical objects, an increasing amount of cultural resources are born digital. Documents such as web pages, discussion lists, bulletin boards only exist in a digital space. As the digital culture takes hold, this will be increasingly true for other artefacts such as diaries, photographs, films, music etc. These digital artefacts too need to be organised and documented so that they will be accessible and become part of the cultural record.

Large institutions do not have a monopoly of cultural resources. Local and regional museums and libraries, community groups and even individuals are also custodians of important cultural collections, often of a highly specialist nature. These, too, need to be connected into the European cultural space. This "heritage for all" approach calls for the involvement of a wide cross-section of local communities and their citizens in making the best use of community archives for leisure, education or personal expression.

The EU Programme aims to support the transition to a service-oriented, multimedia environment and the creation of this European cultural space. The work focuses, in particular, on specifications and standards which will permit interoperability across different cultural organisations and technical platforms. This includes, for example, new data models and architectures, meta-data directories, trust infrastructures and business models.

One priority is integrated access to distributed collections and the development of interactive digital services. Improvements in the functionality and management of very large-scale repositories of digital data are also being supported. Preservation of and access to multimedia content is also a key interest, both for original digital resources and digital surrogates of physical materials.

Networking European culture

CULTIVATE is a pan-European network for the Digital Cultural Heritage community including IT staff, information professionals, researchers, managers, policy makers, libraries, museums, archives, galleries, non-profit making organisations etc. The network raises awareness of the EU Programme for the development and use of cultural heritage applications. It provides a range of services at European level as well as individual support for proposers at national level. CULTIVATE also assists dissemination and communication by networking European and national authorities with professional organisations and institutions.

Further info EU Action Lines:

IST-2000 III.1.4

IST-2000 III.1.5

Project References: Commission Contacts: Web:

CULTIVATE-EU
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Access to digital collections of cultural and scientific content
Trials on new access modes to cultural and scientific content
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Intelligent environmental management

Timely access to high-quality information is critical to our ability to safeguard the environment. Information and communication technologies (ICTs) present opportunities for more detailed data on environmental conditions, better control of pollution and waste, and more efficient management of natural resources. They also offer prospects to improve decision-making processes and increase public participation in environmental issues. In short, ICTs will be key building blocks for putting the sustainable development principle into action.

Building on work under previous Framework Programmes, the IST Programme continues to support the development of environmental ICT applications. In common with other activities under Key Action 1, the emphasis is on a citizen-centred approach with significant support for standardisation, interoperability and market stimulation. Activities are co-ordinated with other EU programmes and actors, such as DG-Environment, DG-Research, the European Environment Agency and the Joint Research Centre (JRC).

One important emphasis is on new tools, integrated systems and services for environmental monitoring, using techniques such as remote sensing, GIS, advanced data mining and decision support systems. IWICOS, for example, is developing a marine information system that will provide a single point of entry to data products covering meteorology, sea ice and oceanography. The system will combine satellite, weather, ice and ocean data and will transmit via the internet or other communication channels. APNEE aims to disseminate information on air quality through media such as mobile phones, multimedia electronic displays and the internet. The additional functionality is being added to existing air quality management systems in European cities.

Logging on to air quality

Under EU law every member state has been required to set up a network of air monitoring stations. But the cost of these fixed monitoring stations and the length of time needed to process the data limit the speed and quality of information disseminated to the public. The INTAIRNET project aims to provide the EU with a cost-effective air monitoring network capable of meeting the air quality requirements of 2005. A network of microstations will use sensitive gas sensors to provide near real-time measurements of a series of air pollutants. The information will be communicated back by GSM and disseminated to the public via the internet. The system should also help local authorities to manage local air quality more effectively.

Environmental applications utilise a broad range of IST technologies and techniques



The development of intelligent sensors and detectors for environmental monitoring is also a priority. BLUEWATER, for example, is developing a system for monitoring water pollution based on computerised video cameras and advanced image analysis. The solution will permit constant monitoring and give early warning of pollution incidents and is expected to be cheap, fast and reliable.

New business models for value-added environmental services is another area of interest. MERMAID is developing an internet-based data broker capable of cataloguing, storing and retrieving distributed environmental datasets. INTERACT is creating an interactive system for envi-

ronmental protection authorities for use in environmental permitting procedures.

Compatible standards are an essential factor in exchanging environmental data. COASTBASE and EDEN-IW are developing search and retrieval systems that will enable users to access distributed environmental information sources through a single virtual interface.

Over the medium to long term, environmental applications will continue to become more ICT-intensive. Technologies such as remote sensing and miniature micro-electrical mechanical systems (MEMS) will enable data to be collected quickly and cheaply anytime, anywhere. Data will be fed back for analysis over fixed broadband networks and wireless networks (including satellite), with the analysis itself increasingly dependent on developments in portable and mobile computing devices, intelligent agents and GIS. Users will be able to access data with ubiquity and engage in new ways, through technologies such as advanced displays and data visualisation.

Shopping for marine environmental data

Over the past decade various national, European and international programmes have generated an enormous amount of data on marine environmental conditions. However, relatively little of this has found its way through to potential end-users, such as search and rescue organisations or marine protection agencies. MERMAID will be a virtual shop window for environmental data providers and users. Based on existing standards, the system will provide near real-time access to major international datasets. Users will be able to search the data archive, purchase the data online and then download it for direct use.

Further info

IST Action Lines: IST-2000 I.4.1

Project References:

APNEE
BLUEWATER
COASTBASE
EDEN-IW
INTERACT
INTAIRNET
IWICOS
MERMAID

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www.cordis.lu/ist/ka1/environment/home.html

Intelligent environmental management, risk and emergency systems

IST-1999 11517
IST-1999 10388
IST-1999 11406
IST-1999 10151
IST-1999 11372
IST-1999 12615
IST-1999 11129
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Consensus-building for education and training

Telematics and multimedia-based applications and tools are widely seen as offering important benefits for learning and training. But consensus on the nature of the benefits, and how users can maximise their potential, tends inevitably to lag behind the technological and scientific developments. Researchers alone cannot decide on the applicability or usefulness of their innovations: this requires a consensus view expressed in terms of technical standards, social regulations or conventions.

In such a context the European Commission promotes several initiatives to create a critical mass of "resources" able to support, guide, stimulate and disseminate both knowledge and innovation in the education and training world. Such initiatives anticipated needs expressed in the eEurope Action Plan, endorsed in June 2000 by the European Council in Feira: "to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion".

A knowledge-based economy will be a powerful engine for growth, competitiveness and jobs capable of improving citizens' quality of life and environment. But to offer European youth and workers equal opportunities within the upcoming knowledge-based society requires a consensus on innovative tools, methodologies, technologies etc for education and training.

Anticipating that view, the European Commission has supported the PROMETEUS initiative. PROMETEUS is an open forum that bridges the gap between research and actual use of learning technologies, content and services in European education and training. Launched in March 1999, the initiative already has over 500 members, including trainers and educators, educational authorities, researchers, content producers and service providers.

PROMETEUS develops guidelines and best practice handbooks, as well as recommendations which are submitted to national and EU authorities and international standards bodies. Eleven special interest groups have also been established in areas such as: interoperability and reusability of educational media; best practices in higher education; learning environments for primary and secondary schools; and broadcast-based learning.

Consensus building also led the Commission to promote the European Multimedia School Network (EUN), a virtual teachers' college for the professional development of teachers with extensive learning resources for pupils in European schools. Set-up under the Education Multimedia Task Force in FP4, EUN is a network of networks in the EU member states, Iceland, Norway and Switzerland working for the development and validation of multimedia tools and services and offering access to high quality information and services of European interest. The participating schools act as a test bed, providing best practice and good examples while being key animators of the European School Network. They provide support to other European schools wishing to employ multimedia telematics, offering them appropriate tools to both ease and speed up the transformation process.



Consensus on educational IST helps ensure opportunities are open for all

Standardisation plays a strategic role in consensus building. The European Commission provides a strong contribution here through the CEN/ISSS workshop on learning technologies and the IEEE standards group.

Consensus-building is essential to ensure that a critical mass of learning systems, services and contents can be established in a cost-effective way. It helps to respect Europe's culture and linguistic diversity in the global context, to benchmark learning innovation at European level and to disseminate good practice related to learning technologies. This is an important contribution to help move Europe forward through strategic investments in learning.

New activities encompassing dissemination are being launched under IST. The LEARN project promotes the dissemination of IST activities to European learners and, more specifically, is setting-up an educational multilingual on-line service for schools, universities, open learning centres including science museums, for learners all over Europe.

The PROACTE project provides a structured dissemination activity, consolidating the results of IST's RTD projects and disseminating them to a wide audience of professionals and decision-makers in the education and training world.

Further info
IST Action Lines:
Project References:

Commission Contacts:

IST-2000 III.2
PROMETEUS
European Multimedia
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PROACTE
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Harnessing the power of language

Language is one of our most powerful and flexible means of communication, central to the expression and exchange of human knowledge. But with its subtle features and complex structures, language is also extremely difficult to master and exploit. Human language technologies (HLT) research is seeking to harness the power of language to make information products and services readily available and easy to use.

Given its cultural and linguistic diversity, language technologies have long been regarded as a priority in Europe. Maintaining, and profiting from, this rich mix of cultural identities is a key goal for the European Information Society. To realise this, citizens and consumers must be able to access information and services, both private and public, in the language of their choice.

Language technologies are also central to the notion of seamless, intelligent services. As the services themselves become ubiquitous and more complex, users will be looking for more natural forms of interaction. Human language technologies offer the prospect of natural interfaces for the next generation of applications and systems, that make the technology itself fade into the background.

Language-enabled applications are already embedded in a wide range of products and services and their use will increase rapidly in the future. One key application is in the information infrastructure itself, in areas such as universal voice telephony, messaging and conference services, and network information services.

Language technologies will also feature in information appliances, such as telephones, personal digital assistants, desktop computers and an array of new multimedia devices. Business applications include electronic commerce, knowledge management, corporate publishing, and localisation of information and services. There will also be important applications in on-line publishing and the public and voluntary sectors.

Support for human language technologies

A series of IST actions aim to ensure that Europe stays at the forefront in the research and application of HLTs. The CLASS project fosters value-added collaboration between HLT projects in key areas so as to improve the delivery, visibility and impact of RTD results. ELSNET builds on an existing Esprit network involving over 130 key academic and industrial players in HLT research across Europe. ISLE involves co-operation with US researchers in the area of HLT standards. And HOPE aims to stimulate the market for HLT applications by raising awareness and creating communities of interest.

HLT research covers a wide range of computer-based tools and techniques that aim to enrich Information Society applications with language functionalities. It is grounded in software engineering but also draws on a substantial research effort in mathematics, linguistics and, increasingly, the neurosciences and psychology. Key technologies include automatic machine translation, speech recognition, speech synthesis, speaker verification, semantic analysis and information extraction.

A voice-operated driver information system developed under TAP project VODIS



Within the IST Programme, HLT research is directed to overcoming linguistic barriers by enabling interpersonal communication through the use of technology. RTD aims to improve the functionality, usability and acceptability of future information products and services. It also aims to ensure, within the context of a multilingual society, that knowledge is accessible and manageable, and that linguistic and cultural diversity are preserved.

Characteristically, HLTs are embedded in systems. Multilinguality, the ability to access services in the language of the user's choice, is potentially a feature of any system. For example, speech recognition and synthesis may be used in building automated call centres. Semantic analysis is an essential component of effective search engines. Speaker verification can be used in the interface to secure telematics services.

IST's work on multilinguality focuses on building multilingual intelligence into business processes, communication services, information appliances and public services. The ALERT project, for example, is designing a system to automatically monitor media sources, such as newspapers and TV, that brings together state-of-the-art speech recognition with audio-visual presentation and indexing technologies. LIMBER is developing multilingual tools, based on metadata, to enable social scientists to access huge national data archives. M-PIRO is concerned with multilingual information systems which will allow museum visitors to interact with objects in a highly personalised way. And NAMIC is a system that will customise and distribute multilingual news services.

Multi-lingual e-commerce

Cost-effective interchange between languages is critical to the growth of global business and electronic commerce. MKBEEM is investigating a multi-lingual mediation service for e-commerce. End-users will formulate requests in their native language, which will be automatically translated and interpreted. These will then be passed to the content or service providers, who will formulate their offers in their native language, which are automatically translated before being sent back to the user. The system, which is based on a series of knowledge bases and HLT tools, will also support contract negotiation.

Further info		
IST Action Lines:	IST-2000 III.3.3	Multilingual communication services and appliances
	IST-2000 CPA2	User-friendliness, human factors, multi-lingual and multimodal dialogue modes
Project References:	ALERT	IST-1999 10354
	CLASS	IST-1999
	ELSNET-3	IST-1999 12127
	HOPE	IST-1999 12595
	ISLE	IST-1999 10647
	LIMBER	IST-1999 11748
	M-PIRO	IST-1999 10982
	MKBEEM	IST-1999 10589
	NAMIC	IST-1999 12392
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	www.cordis.lu/ist/cpt/2000cpa2.htm	

Time travellers

Virtual environments really bring cultural objects to life. Instead of having an explanatory text detached from the object, virtual reality (VR) environments allow the user to interact with the object directly within authentic historical surroundings. It is as if the user has travelled back in time and is actually participating in this historical world.

The fragility of historical objects is a constant concern for museum curators, especially where an exhibition involves the transport of objects from several different collections. VR environments allow the use of fragile objects without the risk that they will be damaged, either through transport or through contact with users. As virtual reality platforms become more widespread, it should be possible to hold virtual exhibitions, bringing together objects from different museums, even though the objects themselves need never travel.

Virtual landscapes also offer important opportunities to experiment with new forms of instruction and learning. Increasingly, this learning will be through the genre of "edutainment", utilising the power of the VR environment to actively engage users rather than just passively feeding them information.

Within the IST Programme, virtual environments are seen as an important means of improving access to scientific and cultural heritage. The technological focus is on rich representations, powerful immersive features such as 3D visualisation, real-time virtual object manipulation, and group interactivity.

The ASH project, for example, is developing a virtual reality environment that allows users to

Living in the Renaissance

RENAISSANCE is creating an innovative genre of video game which will teach players about history. The interface will be a 3D reconstruction of a Renaissance court with accurate representations of historical settings, palaces, costumes and characters. Users will learn about this fascinating period of European history simply by playing the role of a courtier, living in the court and directly experiencing the social conventions. The 3D game will be played over the internet and will be a portal to a virtual internet community. Intelligent agents will constantly check players' actions against historical conventions and define the consequences of their behaviour in the historical social structure.

explore European historical resources relating to space exploration. CHARISMATIC is designing a virtual theatre, populated by avatars or virtual humans, that will enable audiences to experience cultural environments in highly interactive and entertaining ways. TOURBOT is developing an interactive tour guide that will enable users to navigate museum exhibits over the internet. And VAKHUM aims to improve the human representations used in VR environments.

Augmented reality (AR) also has applications in cultural heritage, especially in historical buildings and sites. ARCHEOGUIDE, for instance, is incorporating AR in an advanced information system for visitors to archeological sites. Visitors will be provided with a see-through head-mounted display which will receive audio-visual information, via a mobile tracking system, that will help them explore the site.

Further info IST Action Lines:	IST-2000 III.1.5	Trials on new access modes to cultural and scientific content Virtual representations of cultural and scientific objects
	IST-2000 III.1.6	
Project References:	ARCHEOGUIDE	IST-1999 11306
	ASH	IST-1999-10859
	CHARISMATIC	IST-1999 11090
	RENAISSANCE	IST-1999 12163
	TOURBOT	IST-1999 12643
	VAKHUM	IST-1999 10954
Commission Contacts: Web:	Bernard Smith	renaissance.iridon.com
	www.cordis.lu/ist/ka3/digicult	www.ics.forth.gr/tourbot www.ulb.ac.be/project/vakhum

Protecting authors' rights

One of the downsides of the information revolution is the ease with which digitised content can be copied and misused. Broadcasters, record companies and multimedia publishers spend millions of euros per year trying to stop illegal use, manipulation and sale of copyrighted content. Consequently, copyright owners are losing significant revenue through lost royalties. Appropriate safeguards for intellectual property rights (IPR) are essential for the creation of the content-based businesses and services on which the Information Society depends.

Legal measures, such as the draft Directive on copyright and related rights in the information society, are helping to establish a level playing field for copyright protection in the new digital environment. Technological approaches to IPR management also have an important part to play. They can enable information owners to keep closer control over information released and ensure that correct payment is received for information used.

Technical safeguards for IPR are meant to enable and not restrict access to information, respecting both the users freedom of choice and the marketing strategies of the information providers. They are embedded into so-called "electronic copyright management systems" (ECMS) or "electronic rights management systems" (ERMS). ECMS/ERMS provide electronic protection for copyright material together with a framework for controlled access, payment of royalties, transfer of rights to copyright material on the basis of commercial transactions and tracking usage over time. Such systems are planned to include technologies for identifying protected digital material (watermarking) and controlling lawful usage by professional or private users.

IPR management is addressed within the IST Programme in the context of technologies and solutions for promoting trust and confidence. The work includes the development and validation of new protocols and business models for trustful rights management. CERTIMARK, for example, focuses on certification for watermarking techniques. A suite of tools for benchmarking watermarking technologies is being designed and, based on this suite, a certification process for watermarking algorithms will be set up.

Under WP 2000, a new focus is the protection of IPR in users' own personal data. This covers technologies that empower users to consciously and effectively manage their personal intellectual property rights and assets. This includes solutions that enable anonymous or pseudonymous access to applications and services, for example by minimising the generation of personal data.

Secure collaboration for multimedia producers

There is currently no secure environment for authors and producers where they can collaborate in developing, co-producing and selling films, TV programmes and multimedia titles. IST's Crea Net project is creating a collaborative and secure environment for European authors and independent producers. A network of local centres, called Crea Centres, will offer support for complying with local laws, regulations and uses. This will be complemented by an international distribution hub which will provide a channel for international collaboration and co-production, as well as undertake promotion worldwide.

Further info IST Action Lines:	IST-2000 II.4.1	Technology building blocks for trust and security IST-1999 10987 IST-1999 10871
Project References:	CERTIMARK CREA NET	
Commission Contacts: Web:	Dominique Gonthier	dominique.gonthier@cec.eu.int
	www.ispo.cec.be/istka2/c4 www.ispo.cec.be/ecommerce/clusters/ipr.html	

Tackling the legacy of landmines

Anti-personnel landmines (APLs) are one of the most horrific features of modern warfare. Cheap to produce and easy to deploy, landmines have been planted in their millions in conflicts around the world. Over recent years they have become a problem for Europe too. Once planted landmines are difficult to detect and retain the potential to maim and kill for many years. Often the warring parties deliberately leave the locations of mine fields undocumented and even where locations are known mines can be disturbed by weather or environmental factors.

Present clearance techniques are painstakingly slow and, with tens of millions of mines to be dealt with, there is an urgent need for reliable solutions that can speed up mine clearance. Current detectors have very high false alarm rates, a limited ability to detect small non-metal and low-metal APLs, and poor performance in certain environments (such as ferrous soils).

Building on earlier work started under Esprit, demining RTD under the IST Programme aims primarily to strengthen and support operational efforts under the Stability Pact of 1999. Through innovative RTD projects, IST expects to significantly increase the efficiency of equipment for mine action programmes in South Eastern Europe and improve European know-how in developing specific tools for mine clearance.

Detector-on-a-chip

DEMINE is improving existing surface penetrating radar (SPR) detectors in terms of detection and false alarms, cost and weight. The improvements are being sought through a revolutionary system-on-a-chip solution using high speed digital technology. Another new feature is multi-dimensional signal processing and classification which exploits the novel features of the radar. Other innovations include the use of multi-static and multi-polarisation techniques for the antenna array, and a dynamic positioning measurement system. The work is expected to lead to a practicable and affordable prototype product based on SPR technology.

Recent work has focused on improving existing sensor systems through the use of advanced signal processing methods, software and hardware. Particular advances have been made in the use of low-cost, light-weight, high-performance computing systems, and new algorithms for the processing of ground-penetrating radar (GPR). One of the most promising avenues to increase detection and reduce false-alarm rates is to combine different sensors reacting to different physical characteristics of buried objects. This is achieved by combining data from several different sensors, known as multi-sensor data fusion. Projects in this area are aiming to integrate conventional sensors, such as metal detectors, GPR, radiometers and infrared sensors. Later, further advanced sensors may be added, such as vapour detectors, neutron activation probes, gas sensor or nuclear quadripolar resonance.

The processing and interpretation of data from multi-sensor systems is another area of interest. By allowing more accurate identification of mines, data fusion should reduce the number of false alarms significantly. Other research focuses on how the data is presented to and used by the operator, so that the man-machine interface does not become a bottleneck as the amount of data increases.

Advanced techniques such as neutron activation focus on chemical characteristics rather than shape. One set of approaches relies on refining sensors to detect the presence of chemical explosives. Others aim to improve the possibilities of detection by increasing emissions from the explosive. Both avenues seem promising. As well as R&D, various support actions are undertaken. Networking actions aim to improve awareness, communication and collaboration between researchers involved in demining. Other measures allow researchers to access independent test facilities to evaluate and validate their systems and equipment.

Unfortunate as it is that the market exists, demining is a significant business opportunity with large areas in SE Europe and worldwide needing to be surveyed, cleared of mines and rehabilitated. The technologies developed are also likely to have spin-offs in other markets, such as airport and building security, systems for cable and pipe positioning in urban areas, and military applications as armies worldwide upgrade their equipment.



New solutions can speed up mine clearance

HOPE for demining

HOPE, an Esprit project, is developing a handheld mine detector weighing less than 7.5kg and costing less than Euro 12,000. The equipment is based on a multi-sensor system: a metal detector for identifying metallic objects, a GPR for identifying metallic and dielectric objects and microwave radiometer for indicating flushed mines. The equipment will be able to detect plastic and minimum metal mines at depths 30% greater than present devices and should reduce the false alarm rate by more than 50%.

Further info		
IST Action Lines:	IST-2000 I.4.2	Data fusion and smart sensor technologies for humanitarian demining
Project References:	DEMINE HOPE	Esprit 29902 Esprit 29870
Commission Contacts:	Wolfgang Boch	wolfgang.boch@cec.eu.int
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Building integrated public transport

Since the Rio Environmental Summit, most European governments have adopted policies designed to discourage private car usage. Planning policies represent one approach, encouraging the location of new development near established urban centres. Transport policies also have important contributions to make. People are unlikely to abandon their cars willingly unless public transport alternatives are reliable and convenient.

Intelligent transport systems (ITS) present opportunities for technical and organisational solutions that can improve the appeal and efficiency of public transport, making it much more accessible and appealing. Passenger information systems can provide users with accurate, up-to-date information with which to plan, or vary, their journeys. These include real-time on-board systems as well as at bus stops, travel termini, and demand-responsive services in low-demand regions. There are also strong synergies with systems to promote information on tourism.

Often passengers rely on more than one transport mode to complete their journey. Intermodal information and payment systems will enable users to access information on various transport services from the same terminals, both fixed and hand-held portable devices using mobile communications. With integrated ticketing and payment solutions, using smart card technology for example, travellers will require only a single transaction to complete their journey.

Targeting cross-border regions and metropolitan areas with transport bottlenecks, IST's ISCOM project is demonstrating electronic timetable information and associated mobility centres in

Sharing data for multi-modal transport

To encourage travellers to make use of different modes of transport, the switch from one means of transport to another has to be smooth and easy. This requires reliable and efficient communication between the different transport operators, so as to ensure the overall quality, reliability and timeliness of the transport service. The TRIDENT project is establishing mechanisms for sharing and exchanging common and reusable data between different travel services. Work focuses mainly on the development of common specifications supporting an object-oriented approach, based primarily on Java and CORBA. The specifications and resulting prototypes will be tested in field trials involving different transport modes in five European regions.

four European regions. Services will include dial-a-ride shuttles, shared ride taxis and car pools for hourly or daily rent. They will be available to users directly, via terminals, internet, DAB and WAP, and through operator-staffed mobility centres.

PEPTRAN is developing a navigation system to guide users around a city, walking and using public transport. The software is being implemented on both a hand-held device and an existing car navigation system. FETISH is specifying a distributed network for tourism information services. Using a distributed computing platform, the project will provide access to a critical mass of value-added tourism services which appears to the user as a single system.

Further info IST Action Lines:

IST-2000 I.5.4

Intelligent systems for improved tourism and travel services

Project References:

FETISH
ISCOM
PEPTRAN
TRIDENT

IST-1999 13015
IST-1999 11425
IST-1999 10391
IST-1999 10076

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Geo-data for all

Much of the content for future multimedia services will be based on data referenced to particular geographical locations. Geographical information (GI) is already used in a variety of applications, principally by governments and enterprises. Current uses include urban planning, public administration and environmental protection. In the future, spatially-referenced real-time data will be available to all and will become a common feature of our daily lives.

Today, geographical information is manipulated with very specialised and sophisticated tools, used by trained experts for specific purposes. Few people have hands-on access to GI through the applications they use everyday. Future tools and platforms will be able to accommodate the spatial and temporal features of GI to provide users with customised information services, available anywhere, at anytime, and in any language. Such services will be based on spatially-refer-

enced data derived from both terrestrial and satellite resources, integrated with traditional ground-based geographical information, global positioning and telecommunication systems.

The European GI community faces major challenges in developing the tools, datasets and methods necessary to integrate GI into the Information Society. Common challenges, encountered across the numerous GI markets, include lack of generic technology platforms and common standards, leading to difficulties in accessing data and interoperability between systems. In some markets, lack of comprehensive, pan-European datasets is also an issue.

The European Commission has set out its position in GI 2000: Towards a European Policy Framework for Geographic Information. The vision is of a European Geographical Information Infrastructure based on large-scale, distributed collections of geo-spatial data and services. In particular, the paper emphasized the role of public sector users in stimulating the market for GI in Europe. GI is also a key feature of the e-Europe initiative, especially in the actions on intelligent transport systems.

The IST Programme supports RTD that contributes to the technology base needed to help make geographical information accessible to all. The emphasis is on new models, metaphors, concepts and applications which promote the general accessibility, user-friendliness and acceptability of GI. The work includes testbeds of GI platforms, and trials concerning the robustness and stability of new GI applications. The integration of GI systems with telecommunications, navigation and positioning systems, including exploitation of the Global Navigation Satellite System (GNSS), is also addressed.

Building a European GI infrastructure

ETEMII is a network of excellence for GI that brings together key actors, including users, to build a consensus for a European GI Infrastructure. ETETMII clusters European RTD projects working on GI issues, providing feedback on user needs to standards bodies and raising awareness on the benefits of standards. Key issues addressed include reference data, data access policy, standards and interoperability. Information on GI systems and approaches is disseminated to decision-makers, citizens and SMEs so as to ensure data is accessible to all. It also provides a focus for European representation in the various international forums which are considering GI at global level.

Further info IST Action Lines:

IST-2000 I.5
IST-2000 III.1

IST-2000 V.1.3 CPA3

Project References: Commission Contacts:

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Transport and tourism
Interactive publishing, digital content and cultural heritage
Ubiquitous and intelligent info-mobility and geo-information systems
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Optimising transport networks

Europe's transport infrastructure is under severe strain. Greater mobility within Europe, combined with increased worldwide trade and travel as a result of globalisation, are increasing demand on all forms of transport network. Motorways, urban roads, railways, airspace and waterways all face similar problems of congestion and under capacity. But adding to this infrastructure is hugely expensive and, bearing in mind the environmental considerations, highly contentious.

Information and communication technologies have a significant role to play in optimising the use of transport networks. Effective use of ICT can improve the quality and efficiency of transport services, and enhance their capacity without requiring major investment in new infrastructure. By facilitating multi-modal transport, ICT can also improve the efficiency of transport structures as a whole, so encouraging balanced use of services.

Travel and traffic management services, for example, can tell road users what is happening ahead so that they can plan their journeys better and choose their route, using technologies such as guidance systems. Tracking systems can help fleet operators to make the most efficient use of their fleet by improving transport reliability, safety and customer services. Similarly, in inter-modal freight transport, intelligent infrastructure can improve both transport network management and terminal operations. Air, rail and waterborne transport face similar challenges in terms of optimal use of existing networks.

Monitoring container movements

Most container terminals operate a Terminal Operating System (TOS). This is a software tool running on standard PCs to record the positioning of containers inside the yard and to plan handling operations. TOSs are usually fed with information collected manually, which is often unreliable or late. This is a major cause of problems and reduces the terminal's effectiveness.

The MOCONT project is implementing a TOS with precise container positioning in the yard. Container locations are gathered in the field using a tracking system that combines a GNSS locator coupled to inertial navigation sensors. This data is integrated with container identification numbers obtained via a visual identification system. A fully working prototype will be tested at an Italian container terminal.

Within the IST Programme, RTD on intelligent transport infrastructures aims to improve the mobility of passengers and freight transport locally and across Europe. Under WP 2000, the work addresses intelligent transport systems supporting logistics and co-operative resources management for the whole transport chain. Management of integrated urban and interurban traffic networks is also a priority, including aspects such as co-ordinated motorway control, management of large-scale events and crises, and management of over-saturated networks and network disruptions. Surveillance and control systems for safe operation of road tunnels and railways are also addressed.

Building on results from FP4 projects, PRIME aims to improve the effectiveness of incident detection and emergency traffic management on motorways and urban networks. Innovative models, sensing systems and management strategies will be used to improve the management of congestion and traffic incidents.



IS solutions can help optimise the use of transport infrastructure

Management of airline disruption

The airline industry experiences growing congestion in the airspace over Europe. Problems are becoming more and more common, and increasingly difficult to solve without causing knock-on problems elsewhere. Management of disruption occurring on the day of operation has therefore become an important issue for airlines. DESCARTES is producing a decision support tool to enable airlines to manage disruptions more effectively.

The project targets a new way of organising the operations control at the airline, letting the organisation become an input to the demands of the decision support tool. The system will ensure airlines encounter fewer delays, lower costs, less unnecessary flying due to disruption, and so provide better service to customers.

PARCELCALL is realising an intelligent, end-to-end tracking and tracing solution for transport and logistics. New network technologies are being combined with advanced sensors and innovative service engineering. Standard mobile phones will be used, anytime and anywhere, to get near real-time tracing information along the complete logistics chain.

A reference architecture and open technology platform for the shipping industry is being developed by ARETOPS. The automated system will link applications such as ship and office management, ship monitoring and control systems, and external information services.

Further info

IST Action Lines:

IST-2000 I.5.1

Project References:

ARETOPS
DESCARTES
MOCONT
PARCELCALL
PRIME

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Intelligent transport infrastructures

IST-1999 11498
IST-1999 14049
IST-1999 10057
IST-1999 10700
IST-1999 13036

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Networking European research

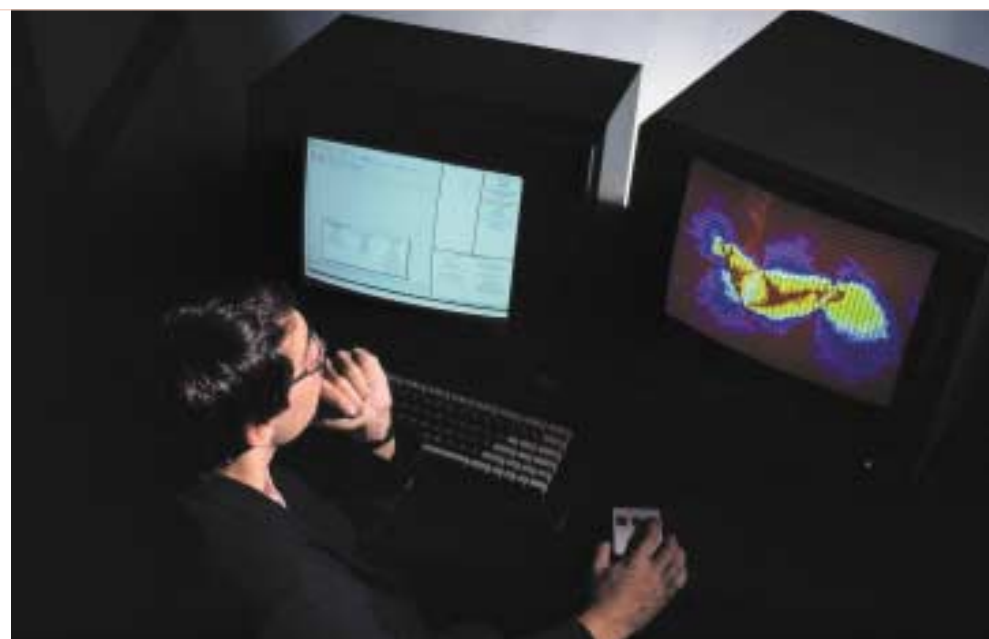
Advances in scientific instrumentation are presenting the global science community with an unprecedented opportunity and challenge. We are on the verge of major leaps forward – mapping the entire human genome, discovering the origin of matter, unravelling the structure and evolution of our Universe, and analysing the variables that influence changes in our environment and climate. The challenge is how we harness and share the vast amounts of data we will increasingly generate and translate it into knowledge and innovation.

Success will depend on developing a radically new IT infrastructure which will enable us to manage and access vast distributed databases. Very high speed and highly robust networks linking a variety of computers (single PCs, high performance computers) and data sources (scientific instruments, digital libraries etc) will be a key part of this infrastructure. A new generation of software and visualisation tools for accessing and manipulating data will also be important elements.

These very high speed, intelligent networks – known as grids – will fundamentally change the way researchers work. They will enable the creation of global virtual laboratories in which scientists can collaborate through multi-media communication in mining, sharing and analysing data. With this enormous computing power at their disposal, scientists will be able to spend more of their time on interpreting data rather than processing it. Major impacts on the productivity of research are expected.

Future European research networking will be provided by a new world-class high-speed network called GEANT, interconnecting the national research networks of 30 countries. GEANT will be the largest pan-European network, offering researchers access to core transmission capacity expected to be in the order of 2.5 Gbit/s to 10 Gbit/s in 2001 (see box). As with the current TEN-155 network, it will be managed by DANTE, a not-for-profit company owned by the national research networks.

Grids technology will help scientists push back the frontiers of knowledge



Europe's gigabit network

The GÉANT network will transform the international network service provided to the European academic and research community by exploiting new developments in telecommunications. It will make available previously unimaginable transmission capacities to support the development and use of new applications as a fundamental tool for international activities including virtual laboratories, centres of excellence and learning institutions.

This very high performance, advanced, pan-European network service will interconnect the services provided by Europe's national research and education networks (NRENs). It will support the development activities of the European research and education community, including new advanced applications and the exploitation of new networking capabilities. GÉANT will create a ubiquitous infrastructure interconnecting the participating NRENs based on shared "core connectivity" operating at gigabit speeds. Initially this will be in parallel with the current TEN-155 infrastructure which it will eventually supercede.

GÉANT will obtain direct access to managed fibre capacity in as many locations as possible. Dedicated fibre capacity will be sought through access to multiple wavelengths on a dedicated pair of fibres, allowing access initially at speeds of either 2.5 Gbit/s or possibly 10 Gbit/s. This approach will enable capacity to be further increased at a later stage to hundreds of Gbit/s via additional hardware investment rather than by leasing more capacity.

Access will be available initially in between six to ten locations. For other locations, SDH capacity at speeds ranging from 34 Mbit/s to 622 Mbit/s will be procured. All countries will have multiple connections where this is economically feasible.

Capacity requirements are increasing dramatically, however. Over the four year roll-out period, the project road map envisages that capacity will increase through the provision of additional wavelengths in the optical elements of the network and that overall capacity will at least double annually. The more aggressive national plans already provide for committed capacities in the order of tens of Gbit/s. Consequently, GÉANT's minimum capacity by the end of its planned lifetime is expected to be of the order of 100 Gbit/s. This goal will be adapted in line with developing national plans. A plan to upgrade the connectivity between Europe and North America and other regional networks is also being established.

Application test-beds, which integrate and validate grids technology in specific applications, are being established in Europe requiring unprecedented effort in resources. Other topics of vital importance to networking in general, and research networks in particular, such as IPv6 and mobile access are being addressed in pan-European test-beds. A terabit test-bed is also being established, making use of the most advanced European terabit router technologies, thus making another significant contribution to the testing of advanced applications, such as the ones required by the most advanced virtual communities worldwide.

Further info
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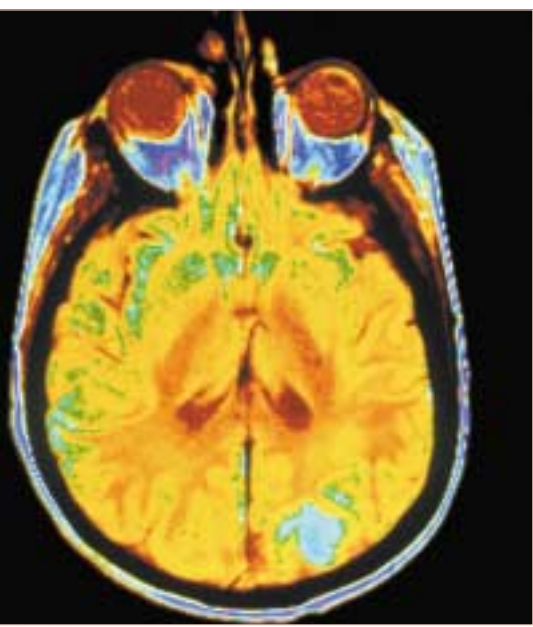
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Advances in medical imaging

Medical imaging is one of the most technology-intensive medical applications. Over recent years, numerous imaging technologies have supplemented and extended the classical X-ray. As well as digital radiography, cross-sectional imaging methods have come into use, such as computer tomography (CT), magnetic resonance imaging (MRI), ultrasound, and emission tomography. In addition, new techniques such as optical imaging and bioelectronic methods are now becoming available. Together with advances in computing, these will make possible imaging during an intervention, for example to assist a surgeon while operating.

The IST Programme is supporting a number of RTD projects involving advanced imaging and augmented or virtual reality for surgery planning and radiotherapy. ADEQUATE, for example, is developing and validating a system for the automatic diagnosis of heart disease using echocardiography. The system will be validated statistically by comparison with human observers and other imaging techniques, such as MR/x-ray angiography. It will be demonstrated clinically in the context of stress echo diagnosis of cardiac ischaemia.

Technology brings new possibilities to medical imaging



Facilitating digital breast screening

The lack of an adequate soft-copy reading environment is a major technological obstacle to the take-up of digital mammography in Europe's breast cancer screening programmes. A soft-copy reading environment that can replace film-based reading in screening programmes is being developed under SCREEN. The resulting prototype should enable an experienced screening radiologist to read one hundred cases per hour.

The project is addressing problems posed by current digital image display technologies and by the heavy emphasis on diagnostic throughput and quality in screening mammography. The R&D work focuses on computer-aided detection and interpretation of lesions; new applications of computer-aided training and workflow management; and intelligent interface design. This includes optimising the basic hardware and software to handle the 50 MB or more of data per case that need to be transferred to the display.

Magnetic resonance imaging has the potential to become a new, non-radiative, high-quality technique for interventional imaging. The clinical demand and benefits are generally agreed, but current systems lack the usability and most of the functionality present in other interventional techniques. AMIT is developing advanced visualisation and tracking solutions which should make minimally invasive MRI a much more accessible technique.

Accelerator-based radiosurgery has been proven as a safe, cost-effective, non-invasive treatment. It has a wider range of applications than con-

ventional surgical or radiation techniques, with fewer complications and a better survival rate. However, specialist staff are required to handle treatment planning and treatment procedures within these installations. While the equipment itself needs to be available locally at the treatment site, planning and set-up can be undertaken remotely using an advanced telematics infrastructure. IST's TELE-PLAN project is designing and developing a distributed environment for outsourcing the complete dosimetric treatment planning procedures.

MI3 is concerned with the next generation of computer-assisted surgery systems for use in dentistry, orthopedics and ENT surgery. The MI3 solution integrates innovative imaging devices, augmented reality technology, and new imaging algorithms and knowledge databases. MITTUG is developing a minimally invasive therapy for treating tumours using 3D ultrasound images rather than computer tomography (CT) scans. The system should decrease waiting time and treatment time, and enable radioactive sources to be placed more accurately.

Other IST projects relating to imaging are DynCT, which is defining a real-time motion visualisation of image sequences for X-ray tomography, and IERAPSI, which aims to provide a novel environment for rehearsing and planning surgical interventions based on advanced imaging methods and virtual reality techniques.

Early diagnosis of skin cancer

Skin cancers can be difficult to detect but early diagnosis is crucial to successful treatment. EDISCIM is developing a prototype system for the early diagnosis of skin cancer based on confocal imaging. Similar to an ultra-sound system, EDISCIM will display the upper layers of the skin to the physician in the form of a virtual vertical biopsy. Images will be captured up to a depth of 1mm and processed in real time. Using a classification of skin types in a knowledge-based system, the physician will be guided in the diagnosis and will be able to transfer images for remote consultation. The system will be validated in clinical trials at dermatology hospitals in Germany and Italy.

Further info		
IST Action Lines:	IST-2000 I.1 IST-2000 IV.6	Health Interfaces making use of the various senses
Project References:	ADEQUATE AMIT DYNCT EDISCIM IERAPSI MI3 MITTUG SCREEN TELEPLAN	IST-1999 10837 IST-1999 11412 IST-1999 10515 IST-1999 10100 IST-1999 12175 www.vmw.org/projects/ierapsi IST-1999 12338 IST-1999 10618 IST-1999 10246 www.mevis.de/MeVis/projects/screen/ IST-1999 11999
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