

# Knowledge Economy



**IST-enabled change in  
organisations and work**

**I**ST is changing the nature of organisations and markets fundamentally. With the rise of e-business, organisations of all types and sizes are having to reassess how they function, and how they can best serve their customers in the new digital economy.

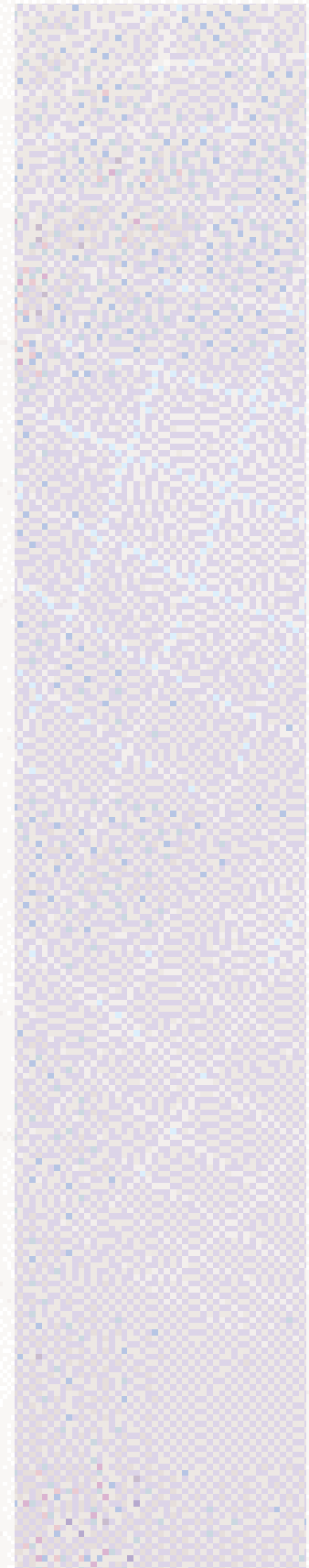
These changes take many forms. At one level, enterprises are having to rethink their internal operations and processes, and turn themselves into “smart organisations”. These are knowledge-driven, adaptable and inter-networked, with the agility to create and exploit the opportunities offered by the new economy.

Relationships with customers and suppliers are changing too. From agriculture to manufacturing to services, companies are having to re-examine their position in the market and how they generate and retain value. The impacts are especially significant in “knowledge industries” such as publishing and broadcasting. New business models are emerging, and companies are co-operating within virtual or extended enterprises to meet new market demands. SMEs face particular challenges in adapting to these changes.

The effective management of knowledge and intellectual assets is emerging as a key success factor in the digital economy. With intangible knowledge assets accounting for an increasing proportion of an organisation’s economic value, the capture, application and reuse of those assets is becoming the main source of competitive advantage for knowledge-based organisations. This creates a need for more people-focused approaches to knowledge management, and for smarter ways of handling digital content, especially audio-visual data. The multilingual aspect of new e-services is also an interesting issue.

Public services, too, are having to adapt. Administrations at all levels are seizing the opportunities presented by IST to interact with the public in new and innovative ways. IST enables public agencies to make the delivery of public services more citizen-centric, and to work more closely with the public and with each other. Examples highlighted here include collaborative working in health services, and new approaches to the management of cultural institutions.

Another interesting aspect is the way in which the workplace itself is evolving. Remote or mobile working is becoming the norm, a trend that has profound implications for our use of office space, for city and spatial planning, and for our attitudes to work itself.



# Towards a European e-business space

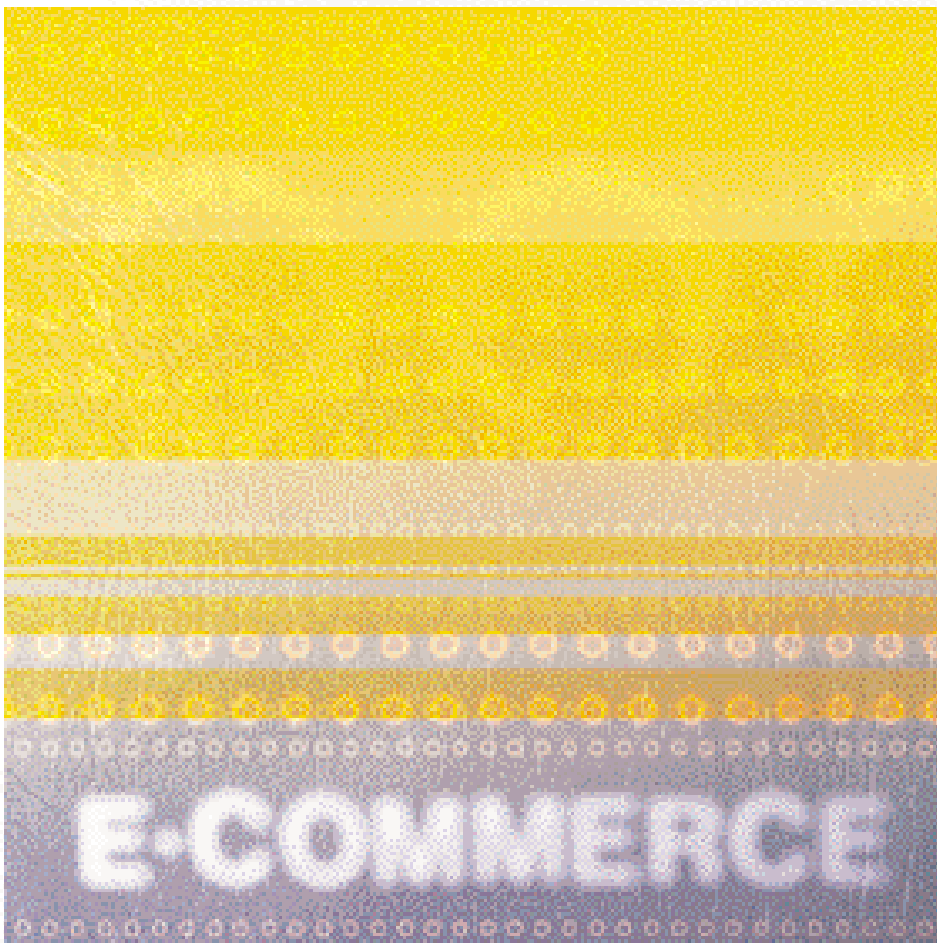
E-commerce is everywhere these days. Businesses of all sizes now see a website as a necessity rather than a novelty, and the ubiquitous “www” features on everything from delivery trucks, to newspaper advertisements, billboards, and even carrier bags. Whereas first generation websites were largely “brochureware” containing quite superficial information, today’s sites are about real commercial transactions. Virtually anything, from motor cars to groceries, and industrial machinery to perfumes, can be purchased online. Meanwhile, many companies are going much further: integrating e-business approaches into all aspects of their internal business processes and external supply chains. By using ICT to transform their relationships with customers, suppliers and partners, they are finding new ways to create value.

With so many e-products and services available within the marketplace, and many more under development by the ICT industry and e-business entrepreneurs, why does the EU support e-commerce research at all? Shouldn’t these developments be left to the market?

The truth is that while e-commerce is already here today, we are still only at the early stages of the digital revolution affecting business. Existing technologies and solutions on the market, many developed by European suppliers, only scratch the surface of the commercial, organisational and technological transformation companies will face in the future.

The IST Programme focuses on this bigger picture. Beyond stimulating the take-up of e-commerce and e-

work in Europe, it emphasises visionary research and technological development for the medium to long term. With limited resources at its disposal, IST addresses key research challenges and areas where a high multiplier effect can be expected. It targets the major, rather than the incremental, advances needed to ensure that Europe is able to capitalise on the new digital economy.



*The e-business revolution has only just begun*

### **Bridging global e-business**

*E-business is already a vital part of manufacturing. But given the pace of e-business innovation, opportunities for new products and services are continually emerging. BRIDGES is seeking to strengthen co-operation on e-business developments between the EU and US by bringing together research centres, industrial enterprises, projects and programmes on both sides of the Atlantic. Its activities include: the development of roadmaps for e-business; promotion of standards for e-business systems; development of guidelines on e-business education and training; and policy advice to the EC on future EU-US co-operation. The project's Working Group includes representatives from EU and US e-business projects together with external experts.*

In future, business will be conducted in flexible networks of interdependent organisations. These will benefit from collaboration, from a sharing of resources, and from the knowledge created and exchanged within them. Organisations will become adaptive, able to react quickly to change and market opportunities. Collaboration will be key to all business functions, for example in procurement, engineering, design, production, marketing and sales. This will need a fundamentally different business environment: one that is open, frictionless, and consistent throughout Europe. Many important issues remain to be addressed, however, if we are to realise this single European e-business space.

Standardisation is one such issue. For business platforms and systems to interoperate there needs to be a set of coherent and robust standards. Many benefits can be derived from building momentum for standardisation during the course of RTD projects. C-ECOM is a cluster initiative that aims to enhance co-operation among IST projects with interests in e-commerce standards issues. The project is run by the Information Society Standardisation System of the European Committee for Standardisation (CEN/ISSS), and is creating important links between the worlds of R&D and standardisation. By building closer relations between IST project teams, C-ECOM facilitates endorsement by industry, users and other parties, and considerably improves the overall visibility of results.

Further examples are to be found in the IST Programme's support for interoperability which promotes common architectures and approaches within specific industry sectors.

In an emerging area like e-commerce, another role for RTD is in supporting the regulatory process. The EU's regulatory framework in this field is developing rapidly. Each piece of legislation requires a thorough analysis of the technology impact; similarly technology development and its innovative deployment might affect current and future legislation. The IST Programme is one of a number of means that facilitate this two-way flow of information. Promotion of interoperability and standardisation are again important here, as well as co-operation with international initiatives and bodies.

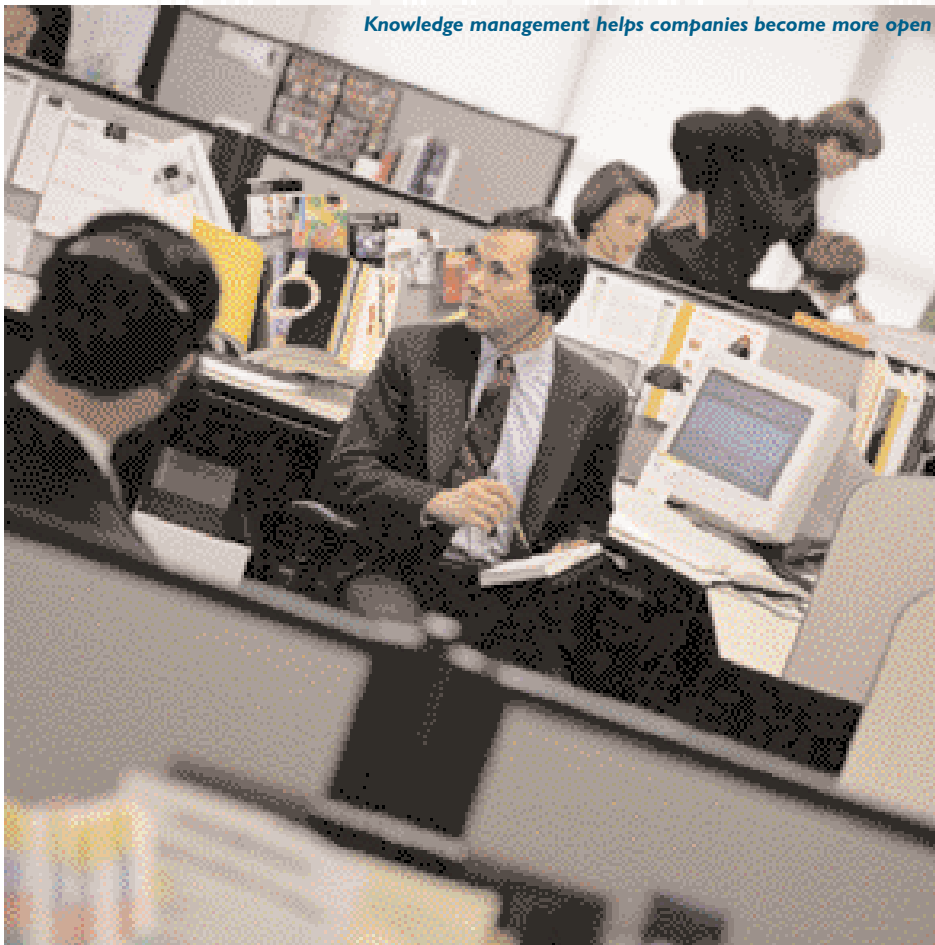
RTD also plays an important role in informing policy development for e-commerce. As well as new insights on established policy questions, such as SMEs and trust and confidence, technology development can lead to fundamentally new policy issues. Recent examples are the effect of peer-to-peer technologies on the content industry (the "Napster issue"), and the impact of open source developments on software markets. To this end, the Programme supports a wide variety of research aimed at monitoring and assessing the socio-economic impacts of new technologies, working practices and business models.

IST Action Lines:	IST-2002 II IST-2002 II.1.1	New methods of work and electronic commerce Exploratory high risk/long term research
Project References:	BRIDGES C-ECOM	IST-1999-14038 <a href="http://www.bridges-eu.org">www.bridges-eu.org</a> IST-1999-14108 <a href="http://www.cenorm.be/iss/ projects/c-ecom/">www.cenorm.be/iss/ projects/c-ecom/</a>
Commission Contacts:	Bror Salmelin	<a href="mailto:bror.salmelin@cec.eu.int">bror.salmelin@cec.eu.int</a>
Web:	<a href="http://www.cordis.lu/ist/ka2">www.cordis.lu/ist/ka2</a>	

# The power of sharing

**A**s markets become increasingly competitive, successful organisations will be those with the most open, communicative, creative and collaborative environments. Employees and collaborators alike will seek out environments where new ideas flourish and innovative solutions are co-created. Thus the ability to capture, apply and reuse knowledge is critical to the innovation capabilities of individuals and organisations, and to the EU's aim of becoming the most competitive knowledge economy by 2010.

methodologies, and new and improved business processes to enable knowledge sharing, communication and collaboration. Such experiences take account of organisations in all their complexity. Learning to share is key. The seeds for innovation are often to be found in the most unlikely places. But we only discover these through interactions with others: through conversations, web chats, e-mail, conferences etc. Hence employees have to be prepared to share knowledge across functions, disciplines and organisational boundaries.



*Knowledge management helps companies become more open*

As yet relatively few European organisations have embraced KM effectively – those that have tend to be the most forward-thinking or have the biggest budgets. The challenge, essentially, is to support KM throughout its whole adoption cycle, and to develop adequate technologies to support it. Obviously, the first steps are to raise awareness and interest. This should then lead to an initial installation allowing people to

Knowledge management (KM) allows organisations to manage these vital knowledge assets so as support innovation and growth. KM is far more than simply the management of information. Enabled by technology, it requires major cultural and organisational change driven by the recognition of the critical nature of knowledge to business success. Successful experiences of KM within business settings emphasize “softer” issues such as human and cultural aspects, personal motivations, change management

discover the change brought by KM. Users will gradually become convinced about the value of the new models and start to use them. Once the system has been utilised long enough to prove its benefit, they will then feel confident to recommend similar approaches to others. Eventually, as users recognise the advantages of KM, they start to internalise knowledge sharing within their personal working habits, and ultimately within corporate routines.



### Practising what they preach

*Sharing knowledge and information does not come easily – even for knowledge professionals. The European Knowledge Management Forum is helping to overcome these barriers by building a pan-European community of KM practitioners and experts.*

*The Forum aims to strengthen the KM community in Europe and to identify and promote the principles of KM and its use in solving business problems. It contributes to standardisation, analyses KM trends, and develops strategic visions and roadmaps. It also links European centres of expertise and special interest groups and provides a focus for international collaboration.*

*With over 2500 individual members and 110 corporate members, the KM Forum is rapidly becoming one of the best known KM websites in Europe. The forum hosts numerous physical and virtual meetings to bring together researchers and practitioners. A regular summer school is also organised, which this year was held in Nice. Future activities will focus on a number of themes such as: how to persuade organisations to take-up KM; how to motivate knowledge workers; and how to introduce communities of practice.*

In the standardisation area, the IST Programme is working with CEN to develop a European Guide to Good Practice in Knowledge Management. The work focuses specifically on softer areas of KM which could be the subject of common approaches and identification of good practices. The main output will be a set of guidelines for companies, notably SMEs, on how to implement KM successfully and the benefits to be gained.

Overall the IST Programme has a portfolio of around 40 projects concerned with organisational knowledge management. Three new projects aim to prepare

roadmaps for future research activities in this area under FP6. VISION will provide a strategic roadmap towards next-generation organisational KM. The overall approach will target context- and location-sensitive solutions for the acquisition, sharing, trading and delivery of knowledge to support workers, business innovation and entrepreneurship. Also concerned with context-aware environments, COCONET is developing a roadmap for KM within collaborative, next-generation business networks. ROCKET focuses on future developments in organisational learning relevant to engineers and knowledge workers.

### Optimising innovation management

*The product development process involves both the reuse of existing knowledge and the creation of new knowledge (innovation). Finding the optimal balance between these two aspects represents a major challenge. NIMCUBE has developed such a methodology for R&D management. Using a set of metrics and a series of supporting software tools, companies are able to quantify and structure their R&D knowledge and assess the balance between “new-use” and “innovation”. The system also includes an assessment tool and a universally-applicable reference infrastructure. The approach has been documented in a recent book “From Knowledge to Value: Unfolding the Innovation Cube” which can be ordered from the project website.*

IST Action Lines:	IST-2001 II.1.2 IST-2002 II.1.2	Knowledge management Strategic roadmaps for applied research	
Project References:	COCONET KM FORUM NIMCUBE ROCKET VISION	IST-2001-37460 IST-2000-26393 IST-1999-11926 IST-2001-38245 IST-2001-38513	<a href="http://www.telin.nl/CSCW/coconet/ENindex.htm">www.telin.nl/CSCW/coconet/ENindex.htm</a> <a href="http://www.knowledgeboard.com">www.knowledgeboard.com</a> <a href="http://www.nimcube.com">www.nimcube.com</a>
Commission Contacts:	Agnes Bradier Paul Hearn Anne Jubert	<a href="mailto:agnes.bradier@cec.eu.int">agnes.bradier@cec.eu.int</a> <a href="mailto:paul.hearn@cec.eu.int">paul.hearn@cec.eu.int</a> <a href="mailto:anne.jubert@cec.eu.int">anne.jubert@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka2/al12.htm">www.cordis.lu/ist/ka2/al12.htm</a> <a href="http://www.knowledgeboard.com">www.knowledgeboard.com</a>		

# Open source comes of age

Open source software has emerged as one of the most intriguing phenomena of the information society. Since its birth in the 1980s, the free/open source software (F/OSS) movement has grown steadily, to the point where it is now an established feature of the mainstream software market. One particularly important market is e-government: European administrations spend around \_6.6 billion per year on IT, and a recent survey for the Commission suggests considerable savings could be made by them sharing OS resources. Some public authorities in the EU are already specifying F/OSS for new software projects because of its flexibility, transparency and cost advantages.

The IST Programme has been an active player in support of innovation in this area. A significant set of projects is funded and these are informally clustered. In 2001, a dedicated call on free software development resulted in a series of new projects on e-government and e-security, areas where open source is recognised as making significant contributions in improving trust, confidentiality and security.

ASWAD, for instance, will develop an intelligent workflow for public administrations. The project will integrate existing free software tools to build a groupware system with built-in workflow management and intelligent personal assistants. Open Evidence produces technology for creating and validating evidence of electronic documents, based on technologies for digital signatures, key management, and time stamping. EUPKI aims to specify, implement and test an operational open source version of PKI.

Other projects focus on enhancing functionality and reuse of open source. AMOS targets a methodology and tool to automate the reuse of OS code, so as to significantly reduce the work necessary to match and assemble components to implement a desired functionality. PUBLICVOICEXML is trialling an OS implementation of the VoiceXML standard, and AGNULA co-ordinates the development of a GNU/Linux distribution for audio.

## Open source medical imaging

*Medical image analysis is an established research field as well as a multi-billion dollar industry. However, the lack of a shared software research environment limits the reuse of algorithms by other groups, minimises the achievement of long-term objectives and inhibits the uptake of techniques by commercial organisations. OSMIA is trialling an open source medical image analysis system. The work includes the setting up of distribution and contribution channels around the software, establishing a user community, and the development of an appropriate licensing framework.*

Free and open source will continue to play a key role in the development of future software systems and services. For instance, the eEurope 2005 Action Plan calls for an interoperability framework based on open standards and encourages the use of F/OSS. In its recent report on software, ISTAG urged that the use of OS licensing should be stimulated for all software generated in the IST Programme and in FP6. However, F/OSS is essentially a business model rather than a technology, and in future such developments will be addressed under individual technology and application domains rather than through a separate action line.

IST Action Lines:	IST-2001 IV.3.3 IST-2002 IV.3.1	Free software development: towards critical mass Composability and dynamic adaptability in software, systems and services	
Project References:	AGNULA AMOS ASWAD EUPKI OPENEVIDENCE OSMIA PUBLICVOICEXML	IST-2001-34879 IST-2001-34717 IST-2001-35176 IST-2001-34340 IST-2001-35174 IST-2001-34512 IST-2001-34546	<a href="http://www.agnula.org">www.agnula.org</a> <a href="http://www.amosproject.org">www.amosproject.org</a> <a href="http://www.dkfi.de/aswad">www.dkfi.de/aswad</a> <a href="http://www.eupki.org">www.eupki.org</a> <a href="http://www.openevidence.org">www.openevidence.org</a> <a href="http://www.tina-vision.net">www.tina-vision.net</a> <a href="http://www.publicvoicexml.org">www.publicvoicexml.org</a>
Commission Contacts:	Jacques Bus Philippe Aigrain	<a href="mailto:jacques.bus@cec.eu.int">jacques.bus@cec.eu.int</a> <a href="mailto:philippe.aigrain@cec.eu.int">philippe.aigrain@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka4/tess">www.cordis.lu/ist/ka4/tess</a>		

# The web of Babel

One does not have to spend much time on the internet to realise that it is currently dominated by English language content and services. This largely reflects the prevalence of English in key areas, such as science and technology, business, and youth culture, which also tend to be enthusiastic internet users. The situation is changing rapidly, however. With the web becoming a mainstream medium around the world, non-English content is growing exponentially and is expected to overtake English within the next few years.

The emergence of the multilingual web brings new problems, however. The key issue is how we maintain the utility of the web in an environment where information and services are available in very many languages. Automated translation systems which are able to translate between one language and another are already quite well developed. But situations involving a multiplicity of languages are much more complex. Data will have to be collected and handled in a variety of languages, with or without translation, and be delivered through many different channels and media. As well as interactions with human users, there is also an issue about how we ensure effective communication between automated devices and services which are themselves language-enabled.

The IST Programme's initiative on the Multilingual Web aims towards significant advances in the multilingual internet for individuals and enterprises by improving the production and use of multilingual information over fixed and mobile networks. The work addresses both technology showcases and longer term research efforts with identifiable short term spin offs. Priorities include collaborative environments for the design, authoring and publishing of multilingual documents; automated translation, gathering and abstraction of web content; and personalised information delivery through multi-channel services.

A series of projects have been launched following calls under WP2000 and WP2001. For instance, IMPACT is evaluating the impact of a multilingual web-based customer relationship management (CRM) system on the business processes of an international service supplier. MIETTA-II aims to provide a unique system for setting up multi-lingual information portals, incorporating several HLT applications like information extraction, multilingual natural language generation, automatic classification, text mining, and cross-lingual information retrieval.



ORIENTEL is exploring the potential of multilingual communication services for the Mediterranean and the Middle East, and in particular aiming to tackle the linguistic peculiarities of these growth areas. And PEKING will produce an automatic system for cross-lingual knowledge management, including three working prototypes in English, Spanish, Italian or Dutch.

IST Action Lines:

IST-2001 III.3.1

Multilingual web

Project References:

IMPACT  
MIETTA-II  
ORIENTAL  
PEKING

IST-2000-30110

IST-2000-30161

IST-2000-28373

IST-2000-25338

[www.mietta.info](http://www.mietta.info)

[www.orientel.org](http://www.orientel.org)

[www.interpeking.com](http://www.interpeking.com)

Commission Contacts:

Giovanni Varile

[giovanni.varile@cec.eu.int](mailto:giovanni.varile@cec.eu.int)

Web:

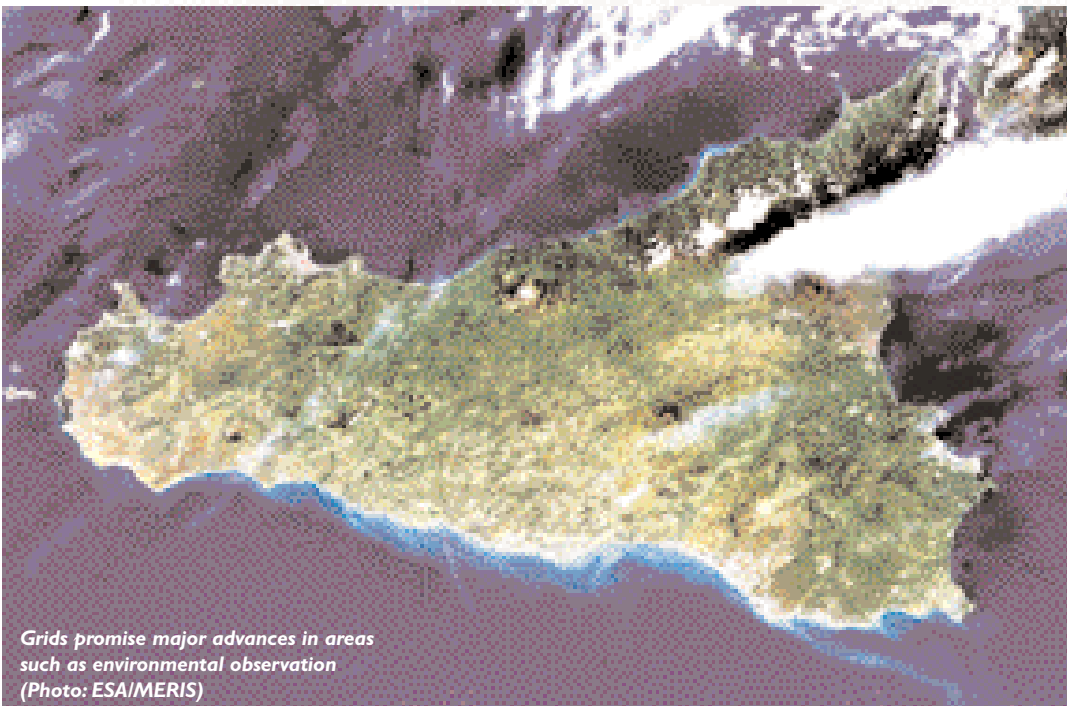
[www.hltcentral.org](http://www.hltcentral.org)



# Grids for Europe

**D**espite the rapid increases in processing power, computer technology is finding it increasingly difficult to keep pace with users' requirements. In science, for example, researchers are seeking to apply computer models to solve ever-more complex problems. This is not simply a matter of number-crunching. Often very large datasets (of the order of terabytes) need to be shared or accessed on a collaborative basis by members of the research community working at different locations. Thus, the issues relate not just to information processing but also to how the data is stored and how to visualise and manipulate the results.

While grid research originally focused on optimising data- and computationally-intensive tasks, attention is shifting to how such systems can be managed and used. The grid community now thinks in terms of a three-tier model. At the lowest level is a "data-grid" comprising computing, storage, and network resources. On top of this sits an "information grid" comprising resource management services. And at the highest level is the "knowledge grid" comprising resource-intensive applications. Furthermore, many aspects of these layers are domain-specific (for example, physics needs different functionality to biology). Hence the grid research space is becoming ever wider, with increasing overlap into



Grids represent a radically new approach to computing. The principle is to decentralise computing resources by using a high-speed network to link supercomputers, databases, computer systems and, of course, users in a kind of worldwide virtual laboratory. By enabling an effective sharing of resources with reliable, co-ordinated cheap access, grids will open the way to new forms of global collaboration. Potential applications are wide ranging, from distributed modelling for pharmaceutical design to distributed data analysis for high energy physics and collaborative industrial design. Enabling infrastructure includes advanced networks, directory services, and authentication and authorisation services.

areas such as trust and security, web services, information visualisation, and the semantic web.

Within the IST Programme, work to support emerging grid technologies is undertaken in close co-operation with national grid projects and wider international efforts. Activities focus on developing and integrating the intermediate software (or middleware) and validating these technologies. A series of testbeds are also supported that aim to enable a wide range of academic and industrial users to share information and computer infrastructure in real time. The Programme has a portfolio of 19 projects in this area, representing total EU funding of around €50 M.

## A European voice for grids

*Standards will be central to the future evolution of grids, but activities in this area are embryonic. GRIDSTART is a support measure that aims to maximise the impact of EU-funded grid and related activities. It acts as a broker, identifying synergies between projects, helping to consolidate grid technical advances, and stimulating their early take-up by industry and business. It also coordinates European inputs into the Global Grid Forum, a grids standards body, so ensuring a strong voice for the EU in shaping future developments.*

The work addresses a variety of issues necessary to ensure the wider deployment of grid technology. One priority is the development of data-grids and meta-data schemes. Another issue is the integration of data-resources at the knowledge level, through ontology-based methods and Semantic Web concepts. Grid functionality is being integrated into web services through the Open Grid Service Architecture (OGSA) concept. Other projects focus on extending grids into new application domains, such as medicine, biotechnology, education, and industrial simulation.

Most initial work on grid concepts, and many contemporary grid applications, is motivated by the particular demands of advanced science and engineering. However, it is clear that grids will also have applicability in the business world. Since grid infrastructures and technologies enable coordinated sharing of resources across geographical and organisational boundaries, they have significant implications for the sort of virtual organisations we see emerging in business today. In the business environment, grids could offer added value by enabling the creation of complex applications out of an assortment of web-services. They could also lower investment costs and development cycles through scalable and interoperable systems, and support new business models and standards. Hence, grid technology could eventually become a key enabler for collaboration within the new “e-economy”.

This evolution towards grids for business (and general users), which will be a key element of work under FP6, requires greater emphasis on the grid knowledge layer, so as to support more intelligent and complex commercial processes. For grid technology to become a utility, it will also be necessary to provide access to a broad range of end-user systems through office and home environments and wireless devices. Over time, grid functionality will become a standard technology layer delivered over the internet.

Grids has been identified as a priority for the Sixth Framework Programme and the available budget is expected to be increased significantly. The work will continue to complement and add value to national and international efforts, and a network of Grid Centres will be created to support this expertise throughout Europe. Terabit-scale distributed facilities will be created as the basis for a common infrastructure serving a broad range of research disciplines. Interconnection to major grid-based test-beds and experiments in Europe and other regions will be promoted. Access devices and user-friendly interfaces will be developed. And interoperability and open architectures will remain key themes.

### IST Action Lines:

IST-2002 VII.1.2  
IST-2002 V.1.9

Advanced experimental infrastructures

CPA 9: Grid test technologies and their applications

### Project References:

GRIDSTART

IST-2001-34808

[www.gridstart.org](http://www.gridstart.org)

### Commission Contacts:

Kyriakos Baxevandis

[kyriakos.baxevandis@cec.eu.int](mailto:kyriakos.baxevandis@cec.eu.int)

### Web:

[www.cordis.lu/ist/rn](http://www.cordis.lu/ist/rn)  
[www.gridstart.org](http://www.gridstart.org)

# Putting self-learning to work

**A**s the world of work becomes ever more complex and portfolio careers become the norm, barriers between work and learning are disappearing. Employees are moving in and out of work and between working tasks in a world where skills, disciplines and jobs mutate rapidly. Increasingly, organisations require a flexible workforce with broad competencies rather than workers trained in a specific but limited skill set. Thus, the emphasis is shifting from job-related training to career-related self-development.



*Individuals are having to manage their own self-development*

As individuals take greater responsibility for their own professional development they will need to access work-related learning opportunities throughout their lives. People will be looking to learn where, when and how they need to – at the office, in the factory, on the road. Such learning will be self-determined, tailored and specific to their skill needs, but at the same time will bring the benefits of collaborative, team-based

approaches. Thus, we have to think in terms of flexible individual learning solutions available on a ubiquitous basis and with complete mobility.

Actions will have to address the needs of organisations for a flexible workforce with multiple competencies, rather than just training workers in specific skills. The acquisition of knowledge and competencies goes beyond the transmission of set skills and procedures.

This raises many complex issues, such as how to model and structure knowledge; the relation of knowledge and knowledge structures to particular types of content; and the cultural context of knowledge. A major challenge will be to use emerging technologies to develop the soft skills (which frequently depend on tacit knowledge) that have high value to employers. Portfolio skill-sets can make it difficult for individuals to express their full abilities, and so risks wasting talent. Intellectual capital management systems, such as electronic CV's and CV databases with an inbuilt model for expressing competence and achievement, will be a great help here.

Twenty-four projects, including 7 trials, are being supported under the action lines on Self Learning for Work (WVP2001) and On-the-Job-Training for SME's (WVP2000). Some investigate generic learning methods and enabling technology. Others concentrate on real trials, addressing either a particular skill-set or a specific industry. Many of the trials build on commercial products or prototypes, in some cases from earlier RTD projects.

For instance, ELSA serves the automotive industry by setting up e-learning portals through which material from various SME course providers may be reached. Materials feature on-line courses, course management, tutoring and expert support. CBLPET is delivering computer-based masters level courses for the petroleum engineering industry, and will compare the

### SME management training

*For employers, one of the key issues with online training is its effectiveness compared to other training modes. GAMBIT is evaluating the effectiveness of online training in delivering appropriate on-the-job training for SME managers. Following an initial consultation involving 20 target end-users, an analysis of already existing market research was undertaken, allowing a comparison between online and conventional training methods.*

*Existing training material and publications are being converted into online modules covering aspects such as human resources management, small business finance and marketing. These are being trialled by a cohort of 40 SME managers from the UK and Ireland. The results will be widely disseminated through clustering and other activities.*

learning effectiveness of the new medium with current paper-based delivery. SLIM-VRT concentrates on self-training in the maritime industry, and is developing a European CV database module to help protect intellectual capital. And ICIS is trialling a system for skills development in the IT sector.

INTRASERV intends to customise an existing web-based training platform to build a brokerage service and trial a whole solution for management of SME training. The project will produce a set of leaning objects. LIP is creating an integrated system of e-learning elements that facilitates a complete contextualisation of the learning process for users.

With an RTD focus, DIOGENE is developing a solution to support CV generation and searching, and web services for handling learning objects. The web-based platform will combine metadata, ontologies and fuzzy learner modelling. ALFANET targets the integration of individuals' characteristics with an adaptive learning

process, and hopes to generate standards for e-learning adaptive interactivity. VirRAD will create a readily-accessible virtual environment for the radiopharmacy community, where they can meet to learn, exchange views, and discuss best practice. And KNOWLABORATION aims to support learning communities in organisations and assist inter-organisational networks.

Not only must individuals develop their skills, but organisations, large and small, also have to develop new competencies if they are to survive. They can only do this if their workers and managers learn, and learn together. Of course, not all of us work in large organisations, and the SME sector has much to gain from virtual learning communities spanning different companies. Thus, use of ICT to support virtual community learning will be an important theme within the Sixth Framework. Preparatory investigations in this area are being made by TIME2LEARN, which will produce a roadmap for e-training.

#### IST Action Lines:

#### Project References:

Project References:	ALFANET	IST-2001-33288	<a href="http://www.rtd.softwareag.es/alfanet">www.rtd.softwareag.es/alfanet</a>
	CBLPET	IST-2000-28520	<a href="http://www.ltc.hw.ac.uk/cblpet/">www.ltc.hw.ac.uk/cblpet/</a>
	DIOGENE	IST-2001-33358	<a href="http://www.diogene.org">www.diogene.org</a>
	ELSA	IST-2000-29340	<a href="http://elsa.clepa.com">elsa.clepa.com</a>
	GAMBIT	IST-2000-28275	<a href="http://www.mygambit.info">www.mygambit.info</a>
	ICIS	IST-2000-29323	<a href="http://www.eidosis.com/icis/progetto/">www.eidosis.com/icis/progetto/</a>
	INTRASERV	IST-2000-29377	<a href="http://www.intraserv.org">www.intraserv.org</a>
	KNOWLABORATION	IST-2001-32505	<a href="http://www.knowlaboration.net">www.knowlaboration.net</a>
	LIP	IST-2001-32518	
	SLIM-VRT	IST-2001-33184	
	TIME2LEARN	IST-2001-38263	
	VIRRAD	IST-2001-32291	

#### Commission Contacts:

#### Web:

Elena Coello [elena.coello@cec.eu.int](mailto:elena.coello@cec.eu.int)  
[www.cordis.lu/ist/ka3/education](http://www.cordis.lu/ist/ka3/education)  
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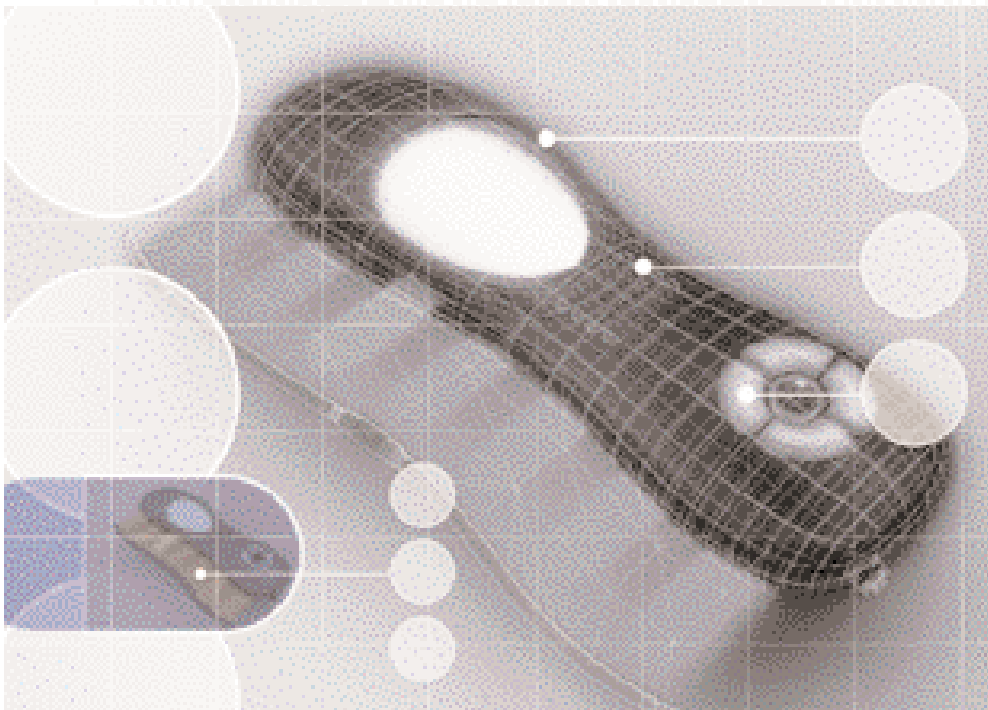


# Gaining knowledge from multimedia

**W**e live increasingly in a multimedia world. Today, the majority of digital information is generated not as text but in forms such as audio, video and pictures. By their very nature, pixels, voxels and acoustic signals do not lend themselves to automated searching. Hence, significant effort is being devoted to finding ways to process multimedia information based on its content (semantics) rather than on words or labels. In this approach, known as content-based multimedia indexing (CBMI), the emphasis is in the automatic creation of index information - metadata - in digital form.

searching and profiling of multimedia objects even in moving video are key elements. Target applications include multimedia database retrieval, monitoring of TV and radio broadcasts, intuitive retrieval of video and music, analysis or restoration of audio-visual archives, and access to museum and digital library collections.

Industrial product design is an increasingly important application domain. Today, 3D graphics design plays a major role in many industries (engineering, furniture, toys etc). However graphics are basically just groups of pixels. Current 3D modelling techniques do not exploit the possibilities to capture knowledge about



*Knowledge technologies will make 3D models smarter*

This only half solves the problem, however, since we then have to interpret the indexed information in a meaningful way. The metadata needs to be actionable – i.e. directly processable by a computer programme – so that the object (image, sound, video clip) can be located, retrieved, filtered and manipulated easily. Thus, methods for analysing and describing multimedia objects and representing the knowledge they contain (generally referred to as knowledge modelling) is an emerging area of research.

The IST Programme has a portfolio of around 40 projects which address CBMI and knowledge modelling as part of their work. Audio-visual metadata schemes, such as MPEG-4 and –7, which allow

the products and how they are made and used. Embedding this sort of information would help optimise the design process and enable designers and manufacturers to offer added value services, for example automatically calculating the cost of different components. Potential applications include: interactive 3D catalogues on CD or over the internet; interior design and virtual furnishing tools; interactive and/or animated assembly instructions; electronic maintenance manuals; and product design and quick prototyping applications.

InDiCo will implement new tools for the production, archival, search and filtering of multimedia content from conferences and seminars. The system

### Intelligent product models

*SpacemantiX aims to enhance the usefulness and user-friendliness of 3D-enabled tools for selecting, configuring, and arranging 3D product items in commercial applications, such as product catalogues. The spatial 3D model of a part/product will be combined with semantic information, both traditional product data and 3D-related data, e.g. assembly instructions. This will enable the direct manipulation of the 3D model in such a way that a part 'knows' where it can be used and how it may be 'plugged' together with others.*

*Modelling such 'natural' constraints within the 3D data sets will enable the user to manipulate the 3D models in a natural and easy way. For example, a model of a table could include the knowledge that it stands on the floor with its legs reaching exactly down to that floor and that it can carry objects up to a certain weight. The model could also 'know' that it is - or is not - also made for outdoor use. Interactive tools will make use of such knowledge. For instance, they could restrict the user-intended movement of the model to 'legal' positions (e.g. indoor areas) in the virtual space, or generate warnings if a product is used in an unintended way (e.g. the table is placed upside down).*

complements that already running in the realm of preprint archives and academic journals, and will further contribute to digital exchange and knowledge sharing in the research community. It will be demonstrated by an experimental evaluation within the high energy physics community, and could be extended to other fields of research and even outside the academic world.

New ways of interfacing with knowledge will be a key focus of research in Knowledge Technologies under FP6. Themes will include: semantic-based navigation and browsing, semantic search engines with support for advanced query construction; semantic web portals and collaboration support; user profiling/personalisation; and knowledge visualisation. In certain cases this will involve enriching established research fields with the benefits of new knowledge-based approaches.

In preparation for FP6, two roadmap projects relevant to knowledge modelling have recently been launched. INNOVANET is looking at future research needs for innovation and knowledge discovery - so-called "innovation engineering" that supports the processing of information and knowledge resources in a 'mechanised' way. NEMIS is looking at future developments in text mining as a means to help people gain insight, understand and interpret large quantities of (mainly) semi-structured and unstructured data. The results could provide a basis for improving future generations of search engines.

IST Action Lines:	IST-2001 III.4	Information access, filtering, analysis and handling	
Project References:	INDICO	IST-2001-34306	indico.sissa.it
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Commission Contacts:	Franco Mastroddi	franco.mastroddi@cec.eu.int	
Web:	www.cordis.lu/ist/iaf/home.html		
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# Smart collaboration

**T**oday's market environment is more turbulent than ever before. Globalisation and the trend towards more knowledge-intensive products and services require firms to collaborate more closely and more extensively. To succeed, firms, and in particular SMEs, need to be able to quickly set up and operate new alliances and partnerships as circumstances require. This dynamic partnering has to be timely, cost-efficient and seamless.

As firms respond to these changing conditions we are seeing the rise of new types of inter-networked collaborative organisations. These so-called smart or virtual organisations (SOs/VOs) have three distinguishing characteristics. Firstly, they are committed to building collaborative partnerships which encourage and promote the clash of ideas. Innovation and customer focus are recognised as key success factors. Secondly, they are able to respond positively and adequately to change and uncertainty. Thirdly, they identify and exploit new opportunities by leveraging intangible resources, such as information, knowledge, relationships, brands, and innovative and collaborative intelligence. To survive and prosper in the new economy, European companies have to embrace the SO philosophy.

The IST Programme's Smart Organisations cluster comprises around 40 RTD projects looking at issues in this domain. These cover the various stages of the SO lifecycle, from its creation, through to operation, evolution and eventually, once its purpose has been fulfilled, to dissolution. From a technical perspective, the projects cover five thematic areas: legal issues and frameworks; reference models and architectures; platforms to support business collaboration; business processes and functions; and socio-economic research.

An independent assessment concluded recently that the portfolio represented "a strong EU research asset" and that the on-going RTD activities showed a "strong European commitment to the future development of this field". Furthermore, the research involves a good balance of industry and academic involvement.

As projects launched earlier in the Programme reach maturity, the emphasis during 2001/02 has been on consolidation of the RTD activities. To this end, a series of accompanying measures have been launched aimed at strengthening the European community of SO researchers and practitioners, and reinforcing Europe's overall RTD capabilities. One of the key measures is VOSTER, a clustering activity that collects, analyses and synthesises results from a number of RTD projects (see box). Another support measure is CE-NET. This is a forum for information exchange and community-building on concurrent enterprising, a relatively new concept representing the convergence of concurrent engineering and virtual enterprises.

THINK CREATIVE is a network of experts on emerging smart organisations that is generating a common vision of the future and advising on future RTD strategies in this area. ALIVE is a working group on legal issues in SOs that is working to define a roadmap for a relevant legal framework. The UEML working group aims to create a European consensus on a common enterprise modelling language. The membership includes industrial and academic organisations.

Looking to the future under FP6, attention focuses on four main research priorities, each of which is being addressed by an initial roadmapping activity launched under WP 2002.

## Building the European SO community

*VOSTER is a clustering activity that aims to collect, analyse and synthesise results from the IST Programme's substantial research effort on SOs/VOs. The project is defining VO-related concepts, types, characteristics and indicators, and also identifying and recommending useful approaches for modelling VOs. Relevant technologies, standards and infrastructures are also being assessed. VO approaches are being actively promoted to European industry and a VO Interest Group has recently been established to facilitate this engagement. In addition, the project will produce research roadmaps which could inform research activities to be conducted within FP6.*



*Business today relies on collaboration*

Firstly, there is a need to research new organisational forms to support collaboration and innovation. The focus is on new organisational paradigms and models that are more human-centred and adaptive. VOMAP aims to define a roadmap towards a strategic European initiative in this area, supporting the emerging virtual organisations and VO communities of practice. The work is being undertaken in collaboration with a large VO industry network.

A second area of interest is advanced business models within collaborative networked organisations. The emphasis here is on the innovative processes across organisations and the associated applications and services. Project COMPANION is analysing the future of collaborative commerce, focusing on collaborative applications and the role of ERP systems in value-creating networks.

Holistic product/service concepts constitute a third pillar. This is concerned with developing, managing and delivering “extended products” involving value-added features such as e-customisation, novel delivery concepts, intelligent services and e-maintenance. VIP-ROAM is developing a vision on virtual product creation technologies and methodologies, and defining a strategic roadmap for RTD activities for the next 5-10 years.

The fourth aspect relates to the interoperability of business applications. For firms to be able to work together as networks of enterprises, a common technical framework is required. Research should focus on infrastructures to support technical, semantic and service interoperability of business applications and seamless interoperation both between and within enterprises. IDEAS has formed a Working Group to elaborate a strategic roadmap on interoperability in enterprise applications and software.

**IST Action Lines:**

IST-2001 II.2.2  
IST-2002 II.1.2

**Smart organisations**

Strategic roadmaps for applied research

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**Commission Contacts:**

Jöel Bacquet

[joel.bacquet@cec.eu.int](mailto:joel.bacquet@cec.eu.int)

**Web:**

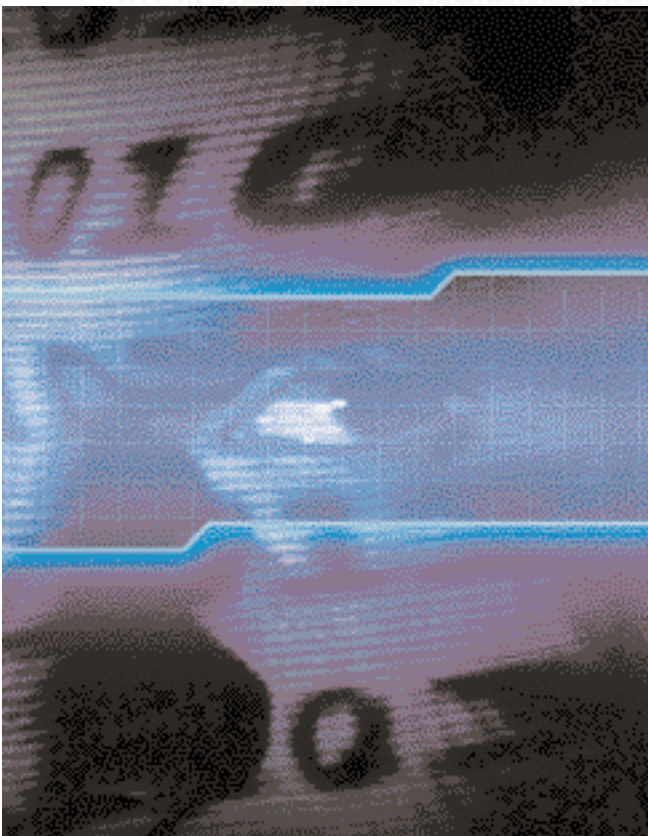
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# New knowledge spaces

In less than ten years the World Wide Web has evolved into a vast information, communication and transaction space, with features that differ greatly from those of traditional media. In the commercial world, the web represents a new global platform for advertising, selling and trading. But its phenomenal success also owes much to its utility as a tool for managing and providing access to an ever-growing body of documents and other information. This digital content is no longer confined to text but can be almost anything: the latest financial data, MP3 audio, images from Earth observation satellites, pictures of a family gathering.

However, the current-day web is having difficulty keeping up with this explosion of digital content, making it increasingly difficult to access and utilise information in ways that add value in our daily lives. For this to happen we need to let computers take the strain by making content more understandable to machines. Over recent years the concept of the Semantic Web has emerged to describe developments which aim to make content more machine-understandable. By enabling the context (semantics) of content to be interpreted, the Semantic Web will bring structure to the web, creating an environment where users will be able to automate sophisticated tasks through software agents.



Digital content calls for new ways of handling data

For content of whatever form to be machine-understandable it must be bound (in terms of being attached, pointing) to some formal description of itself (often referred to as metadata). Furthermore, by providing this data we enrich the value of the web itself, so that it becomes a “web of knowledge”. As well as the knowledge understandable to humans (such as recipes, reports, graphs, still and moving images), it will contain meta-knowledge about the digital content itself (e.g. “picture X contains a man in a blue shirt”). This meta-knowledge will make all the other forms of knowledge (and occasionally nonsense!) more accessible and usable.

But how do we create this meta-knowledge? In view of the vast amounts of content already out there and constantly being produced, manual creation is just not feasible: the task has to be automated. The emerging field of knowledge technologies is concerned with the addition, automatically or interactively, of explicit

## Europe's Semantic Web

W3C's Semantic Web Advanced Development (SWAD) activity plays a key role in the evolution of the Semantic Web. It supports education and outreach to developers, organisations and content creators; open source implementation and testing, and pre-consensus technology development to drive and inform the creation of new Semantic Web standards.

Lead by W3C, IST's SWAD-Europe project will extend this work in Europe, providing targeted research, demonstrations and outreach to ensure SW technologies move into the mainstream of networked computing. The project aims to provide a distinctly European focus for Semantic Web development efforts, targeting practical steps towards the deployment of the Semantic Web in Europe.

semantics to content, services and processes to produce knowledge representations. It draws on a broad range of computer science disciplines as well as the cognitive sciences.

Research issues relating to the addition of semantics to content (and services) as a basis for new knowledge spaces are addressed under the IST Programme's action line on the Semantic Web. The Programme has a portfolio of around 20 projects in this area, most of which were launched following a call in 2001. Several of these target the provision of a general formal framework for dealing with the semantics of distributed digital content, while others are concerned with specific tools for generating and acting upon the semantic descriptors. The overall aim here is help build critical mass. Commercial interests will be reluctant to add semantics to content and services if no tools are available to exploit it. And the development of tools will not pay off if there is little semantically-enriched content to work on.

The need to make content semantics explicit is a dominant theme. Several of the projects focus on ontology learning and emergent semantics in peer-to-peer networks (SWAP, GRACE, MOSES). Ontology-based metadata are also considered through semantic annotations (ESPERONTO), through image analysis (SCULPTEUR), and through the extraction of domain-specific metadata (SPIRIT, WISPER). Other projects emphasise more system-mediated human-to-human interaction.

Another theme is the development of tools to act upon explicit semantics, whether by software agents or by humans. Interests here focus on services, their description and discovery, and on other service-related operations. SWWS for instance looks at the implementation of a fully-fledged web service modelling framework. MONET will offer mathematical solvers and SEWASIE concentrates on semantic search and inferencing. Other projects are concerned with various aspects of knowledge modelling and visualisation (see p.36).

Increasingly, Semantic Web technologies are recognised as being complementary to the development of grids, the large-scale distributed systems that enable the sharing of high performance computing and other resources via high-speed networks. The Semantic Web will rely on grid techniques to render its content meaningful to software agents. On the other hand, to make full use of the available resources and services (i.e. to turn "data" into "knowledge"), grids will require the formal framework of a Semantic Web. These linkages and other aspects of Semantic Web technology will be pursued further under the Knowledge Technology activity in FP6.

IST Action Lines:	IST-2001 III.4.1 IST-2002 V.1.9	Semantic Web technologies CPA9: Grid technologies and their applications
Project References:	ESPERONTO GRACE MONET MOSES SCULPTEUR SEWASIE SPIRIT SWAP SWAD-EUROPE SWWS WISPER	IST-2001-34373 IST-2001-38100 IST-2001-34145 IST-2001-37244 IST-2001-35372 IST-2001-34825 IST-2001-35047 IST-2001-34103 IST-2001-34732 IST-2001-37134 IST-2001-34407
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Commission Contacts:	Franco Mastroddi Hans-Georg Stork	franco.mastroddi@cec.eu.int hans-georg.stork@cec.eu.int
Web:	www.cordis.lu/ist/ka3/iaf/index.htm	

# Content made easy

**I**n the information economy, people are not willing to adapt their habits to the choices made by the publisher. They want to be able to access information, entertainment and education in the form that best suits them. This may be on paper, on DVD or over the internet. The information may be static

*Content providers need easier ways to publish on different platforms*



or contain moving images. The user may like interactivity or a pre-customised format or a specific language. And he or she might be using a sophisticated wideband terminal, a simple kiosk, or a wireless mobile device. There is, therefore, a strong need for the adaptation of published content to different platforms and media, and content creators must be ready and able to respond to these requirements.

The dissemination of digital content may, if subject to monopolistic control, become a constraint on the growth of a market should it exclude market entry by new players. Cross-media realisation is not only a matter of enabling the market for growth, but also liberating it from forms of market power that might otherwise impoverish the supply of information.

The IST Programme is supporting a variety of approaches to the cross-media publishing issue. Good quality, high productivity content authoring tools facilitate the capture of primary content in a format that can be rendered by back-end software into different output media. In other cases, this may not be realisable, and so automated or computer-assisted conversion of finished content may be the best approach. A hybrid approach might involve the conversion of finished material into an intermediate form that is

## **New approaches for academic publishing**

*Academic publishing is moving rapidly towards a cross-platform approach. FIGARO is developing a networked platform for the dissemination of academic papers and journals. In many fields, especially science, technology and medicine, electronic publication will soon have completely displaced paper publication. Although some electronic products are little more than digitised print versions, the medium will evolve into navigable "information objects" with capability for searching, browsing and comment attachment.*

*The consolidating academic publishing industry often uses global dissemination platforms with high subscriptions, reducing the information accessible to many libraries. By contrast, FIGARO's federated open framework, which supports interoperable text archives, is much more accessible. It comprises a shared workflow model, while legal and economic agreements with contributing parties are aimed at collaborative virtual working user communities. Work at the authorisation and authentication layer is directed to streamlining the review process.*

friendly to adaptation processes. Multi-format adaptation of content is not the only issue, however. Systems of copyright protection and ownership rights have often been administered separately for different media, while a harmonised system of author identity and rights management is necessary in a cross-platform world.

EDUCAT is developing a toolset for the creation of educational content. Aimed at originators without software development skills, it will be usable, and its end products accessible, either on the desktop computer or over the internet. The system is based on a simple visual programming language and reusable software components. After laboratory assessment, user groups in the tertiary education sector in six countries will try it on real education products.

CATI is taking a fresh look at the problem of translating technical documentation into different languages. Although language translation is available on the internet, it is often of poor quality, more suited to information acquisition than dissemination. CATI is examining the usefulness of "Controlled English", a simplified (and disciplined) form of English from which it is easier to produce good quality translations. The project examines the benefits of this approach and provides a framework for dissemination and commercial exploitation.

A fresh approach to the automation of cartoon production is targeted by NEWS. The most popular product on the market today is based on bit-map patterns, whereas NEWS aims to animate from

vector representations of characters, which should better preserve the unique artistic identity of each character. Images will be input through a pressure-sensitive slate which captures the flexibility of paper and saves the artist from having to draw and scan image material.

INTERPARTY tackles the issue of digital rights management. It provides an infrastructure for the recording of creators' identities in a Directory of Parties. These identities are used in a number of contexts for discovery of ownership, negotiation of agreements and compliance. Present systems are linked to a particular use, such as licensing societies or libraries, and do not have the comprehensive applicability that will be needed for digital content. Besides requiring a database, the INTERPARTY directory will need processes for identification, authentication, dispute resolution, and disciplines to ensure security of access and privacy of personal information.

Within the Sixth Framework Programme, key issues to be tackled are likely to include consumer agreements, interactivity and interactive advertising, cross-platform audio-visual portals and services, and tools for cross-media authoring, production and delivery. The adaptation of technical and business networks to handle content management and cross-media delivery are likely to be addressed. The cross-media issues of rights and protection will also remain prominent topics.

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Web:

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CATI  
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INTERPARTY  
NEWS

Pascal Jacques

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# Intelligent building

The building and construction industry is one of Europe's largest employers. It is increasingly high tech and relies on continuous innovation and state-of-the-art knowledge management. It stands to reap major efficiency gains from techniques such as e-commerce, online ordering, delivery scheduling, project management and flexible team working, and must meet new challenges for the sustainable use of resources.

However, the sector faces major barriers to change. It is highly fragmented, and has to deal with an enormous range of products, services and environments. There is need to share data between many organisations, and high-speed wireless communications are of particular importance on many sites. In such a fragmented industry, effective implementation will be key to increasing competitiveness. As major clients of the construction sector, public authorities could play a key role in speeding the implementation of ICT and new working practices. Co-operation and cultural change are therefore critical success factors.

The IST Programme supports a series of projects that aim to bring the benefits of ICT to the construction sector. Activities include: collecting and consolidating scenarios to build requirements and reference models; analysing the state-of-the-art in standards, technologies and products; and promoting ICT infrastructures and organisational best practices. A cluster initiative, ICCI, has been formed to exchange information between EU and national projects and to ensure coherent dissemination throughout Europe.

DIVERCITY is developing a virtual workspace covering the processes of client briefing, design review and execution management. E-CONSTRUCT has recognised that low bandwidth, poor security and information structure are problems to be tackled to make the internet more useful in this sector. It is developing a customised version of XML, bcXML, to handle the semantic requirements of information exchange for supply and execution management. ISTforCE targets a novel user-centred services platform that will support multiple projects with logistics and workflow management, legal commitment mechanisms, electronic signatures and language interoperability. OSMOS is specifying, building and trialling a set of added-value internet services. These aim at low-cost entry tools for teamwork and virtual project partnerships, giving, for example, shared data access.

SABARECO is developing a multi-project reporting and control tool to support resource planning, project management and horizontal actions support. This will use satellite communications between sites and headquarters. E-COGNOS aims to provide the whole sector with flexible, scalable and open web-based solutions for knowledge management. Construction is also one of the sectors targeted by GLOBEMEN in identifying IT infrastructures and related tools to support globally-distributed and dynamically-networked operations.

A new roadmap project, ROADCON, is investigating future research needs, with a view to activities under FP6.

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### Project References:

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### Commission Contacts:

John Nolan

### Web:

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[john.nolan@cec.eu.int](mailto:john.nolan@cec.eu.int)

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# Made to measure

Europe's clothing and textiles industry faces stiff competition, often from lower cost producers in other countries. While European producers are unlikely to counter this threat by competing on price alone, there is an opportunity to compete on quality and innovation. ICT may help by making it possible to create personalised products, and to bring exciting made-to-measure products within the reach of the middle-income, discerning customer.

The IST Programme has several projects covering the full lifecycle of the clothing and textiles industry. A cluster initiative, E-T CLUSTER, promotes a dialogue between these projects for seamless integration of 3D scanning, computer-aided design (CAD) and avatar technologies. Results are being disseminated to the fashion and retail communities by a website and discussion forums, while proposals to standards bodies are envisaged.

E-TAILOR is building the European anthropometric database, a collection of 3D body scans of 100 000 individuals. As well as providing better data for clothes design, this will also make possible the effective creation of virtual people – know as “human avatars” – that can be used for realistic virtual fashion shows. Animation will make possible the virtual store, where people “try on” different styles on the screen. The made-to-measure trade will be assisted by intelligent pattern alteration software, able to vary standard designs for the individual. Results have already attracted the interest of a major clothing manufacturer.

A related project, FASHIONME, targets the matching of the right avatar to the individual customer, and is prototyping a virtual fitting room. The easiest way to generate the avatar is to select the nearest standard

model from the database, then to personalise the garment. Alternatively, a customised garment could be produced using a 3D scanning booth in specially equipped shops.

Solutions for supplying individually made clothing are being developed by CUTTING EDGE. It builds on existing technology that allows data to be sent directly onto fabric production. The product will allow in-store management from a central database of drawings in a standard format management system. Supply chain and production order management implementation will be a key to the making of customised

Aiming to overcome some of the obstacles to broad adoption of B2C e-commerce by SME fashion retailers, FASHION ONLINE will benchmark current practices and deploy 10 pilots in 4 countries implementing novel internet technologies for clothing products description. And MYFASHION.EU will investigate customised production of tailor-made fashion products combining inputs from various supply networks. Building on the cluster results to date, TEX-MAP is a strategic roadmap activity which seeks to define the key themes for future research.



IST is transforming the fashion industry

## IST Action Lines:

### Project References:

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### Web:

IST-2001 II.3

CUTTING EDGE

E-T CLUSTER

E-TAILOR

FASHION ONLINE

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TEX-MAP

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[carlo.lombardi@cec.eu.int](mailto:carlo.lombardi@cec.eu.int)

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# Future workplaces

**T**he advent of the new economy, with its emphasis on exploiting intellectual assets, challenges many of our conventional views on work. Knowledge workers no longer need to be bound within a particular office building. Communications technologies, wired and wireless, take work into new settings such as the street, train, café and home. The nature of work is changing too. Spaces designed to support the work processes of the industrial age fail to provide the stimulating environment needed by today's knowledge workers. The adoption of alternative environments, from marketplaces to coffee shops, offers fresh opportunities for urban renewal.

Already over 50% of the EU workforce uses the internet or some other form of IT in their jobs. This

figure looks set to increase in future, as more and more organisations, both public and private, recognise the benefits of new IST application and services. It is clear that information and knowledge-based jobs will provide much of the growth sought in the Lisbon agenda, which aims to establish the EU as the most competitive and dynamic knowledge-based economy, capable of sustained economic growth and greater social cohesion.

Workplace enhancement technology is not only about improving the productivity of knowledge and other workers. It has a key role to play in social inclusion. It offers the opportunity to participate to those in rural, isolated and less-favoured regions. On-the-move and at-home communication technologies bring the virtual



*Knowledge workers  
need flexible  
environments*

## **Work in call centres**

*Call centres, one of the first working environments born of the information age, employ more than a million people in Europe. Two IST projects address the technical and human aspects of call centres in an effort to better understanding their implications.*

*ANGELO has created and proven in service a prototype set of support tools. These include a broadband IP network and a number of software tools to improve operator effectiveness. These anticipate operator needs and increase productivity and reduce stress.*

*With the involvement of leading trade unions, TOSCA has examined working conditions in call centres from a social point of view. Taking a large sample of centres in various countries, it has built a functional analysis of the work and a catalogue of the types of jobs performed. The report will increase the quality of work across Europe.*

### Is it practical?

*Quality of life is all very well, but do distributed workforces really deliver productivity? UNITE aims to ensure that they do. Its vision is of a shared virtual workplace, customised for teamwork, that seamlessly integrates the resources that team members use to perform their work, whether they are on company premises, at home, or on the move.*

*At the user level, team members will experience a complete view of the project team in which they are working. For instance, they will be able to see whether a meeting is taking place, who is present and whether or not a person is available for discussion. And at the service level, existing tools will be aggregated into project-specific and context-sensitive user services, such as unified messaging, conferencing, and security policies. UNITE's open platform will provide a framework for integrating a variety of software components (existing and future) and for linking the devices and physical workplaces used by team members.*

workplace to the most convenient place. For many, this will provide the gateway to a more productive and higher quality working life. For the elderly, disabled, disadvantaged or those with care responsibilities in particular, it offers a new route into the labour market. The IST Programme's activities in this area take an holistic view of the modern working environment, addressing far more than simply new desktop ICT tools.

HUMANTEC is a thematic network bringing together universities, design centres, producers of technology and furniture manufacturers to take a complete view of the modern office. It is addressing issues of comfort, safety, ergonomics, environmental sustainability and quality of working life. Another key project, SANE, concentrates not on the "office" as such but on location-independent workplace design. It targets compatibility between separated working environments, exploiting remote computing and ubiquitous fixed and mobile communications. New ICT tools to support this approach are being specified, developed and evaluated.

Two recent projects aim to consolidate the work done to date. E-LOCUS is a cluster initiative enabling workplace researchers to exchange information and forge links where appropriate. The road mapping activity FUTURE WORKSPACES is preparing a vision for collaborative engineering workspaces after 2010, taking account of business, human factors and technology aspects. Its output will be a vision document and a prioritised set of indicative research areas.

In the Sixth Framework Programme, workplace research is likely to focus on new workplace designs, technologies to facilitate creativity and collaboration, resource-use efficiency and extending work opportunities to all communities. This may include research into new broadband, wireless and wearable interfaces and their integration. Additionally, office equipment, furniture design, human psychology and interpersonal interactions will be targeted. The processes of handling knowledge itself will also be addressed as a basis for new technologies for knowledge sharing and interpretation.

IST Action Lines:	IST-2001 II.2.1	Intelligent workplaces for all	
Project References:	ANGELO E-LOCUS FUTURE WORKSPACES HUMANTEC SANE TOSCA UNITE	IST-1999-11696 IST-2001-38790 IST-2001-38346 IST-2000-31046 IST-2000-25257 IST-1999-12646 IST-2000-25436	<a href="http://www.angelo-project.net">www.angelo-project.net</a>  <a href="http://www.humantec.it">www.humantec.it</a> <a href="http://www.saneproject.com">www.saneproject.com</a> <a href="http://www.toscallcentres.net">www.toscallcentres.net</a> <a href="http://www.unite-project.org">www.unite-project.org</a>
Commission Contacts:	Peter Johnston David Guedj Teresa de Martino	<a href="mailto:peter.johnston@cec.eu.int">peter.johnston@cec.eu.int</a> <a href="mailto:david.guedj@cec.eu.int">david.guedj@cec.eu.int</a> <a href="mailto:teresa.de_martino@cec.eu.int">teresa.de_martino@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka2/intelligentsustainwplaces.htm">www.cordis.lu/ist/ka2/intelligentsustainwplaces.htm</a>		



# Setting the multimedia standard

Standards are crucial building blocks for the Information Society. They allow products and services from different providers to work together, giving consumers wider choice while assuring them that systems are technically compatible. Standards also have benefits for industry, minimising the risks that an innovation is heading towards a technological “dead end”. In short, standardisation provides a level playing field.

MPEG-2 Layer 3 (MP3) for audio coding is a case in point. MPEG-4 is poised to have the same effect on video distribution, opening the way to new means of service delivery for third generation mobile services, interactive TV services, e-cinema, and audiovisual streaming.

Over recent years, European research has made substantial contributions to these efforts. In ACTS alone under FP4 funding of around €20m was allocated for activities related to MPEG-4 and MPEG-

*IST audiovisual projects at IBC 2001, Amsterdam*



With the rapid growth in multimedia data, international standards in relation to multimedia representation and coding are especially important. Activities here are led by the Moving Picture Experts Group (MPEG), a working group of the International Standardisation Organisation (ISO). MPEG has developed a family of standards for compression, decompression, processing and coded representation of moving pictures, audio and combined media. MPEG standards are widely accepted and in some cases provide drivers for entirely new forms of entertainment and business models.

7. For instance, the ACTS project MOMUSYS established one of the two reference versions for MPEG-4. European RTD also led to significant progress in processor architecture, giving European manufacturers the means to compete for the next generation of multimedia hardware platforms for mobile and home-based applications. And European participants were prime movers in the setting up of the MPEG-4 Industry Forum, which promotes use of this new standard among application developers, service providers, content creators and end users.

This strong engagement has continued under FP5, with clusters providing a means for coordinating projects' contribution to standardisation bodies. In addition to MPEG, relevant groups include Web3D, IETF, AFNOR, DVB, and TV-Anytime. The impact on standardisation – European open standards adopted worldwide – and the opportunity to link to the regulatory evolution is a strong motivation for industry to co-operate in European collaborative projects and to cross boundaries of expertise and industrial interests.

Early European support played a crucial role in establishing the DVB standard for digital television (see box). Under FP5 the emphasis has been on reinforcing DVB-MHP as the platform of choice for advanced interactive services. Contributions from IST projects have included the first prototypes of TV using large storage (MyTV), internet access (OPENISE, SAMBITS), and object-oriented image coding (SoNG). Interactive programmes necessitate the use of metadata (MPEG-7) and agent technology (FIPA). Relevant contributions here have been made by MyTV, SAMBITS and SoNG. Finally, the easy distribution of AV material through the networks necessitates the development of strong IPR protection methods. Project OCCAMM has

demonstrated the technology of OPIMA and contributes to the MPEG-21 standard.

Important contributions have also been made by projects in the area of mixed realities and new imaging technologies. ENREVI has developed a 2D profile for augmented reality within MPEG-4, and INTERFACE has developed semantic descriptors for faces based on MPEG-7 Version 2. Art.LIVE participates in the Real Time Systems Group of FIPA, (Foundation for Intelligent Programmable Agents), an open standardisation forum for middleware.

In a European and increasingly global framework, issues of interoperability, extensibility, backward compatibility and migration path are essential. Under FP6, European RTD projects should continue to play a key role in terms of consensus building, standard setting as well as contributions to regulatory frameworks. Experiences to date have been extremely positive and the constituency already active in this area has existed for nearly a decade. It is essential to exploit this basis and to ensure continuity and evolution.

### **First mover advantage ensures success of DVB**

*DVB (Digital Video Broadcasting) standards have been adopted for digital TV transmission by broadcasters across all EU Member States. The DVB specifications have also become ETSI standards and ITU recommendations.*

*Since 1990, the EU has invested more than €400m in research related to digital TV, including key elements such as the MPEG video compression system, and the COFDM modulation used in the DVB's terrestrial transmission system. At the same time, a light regulatory framework has been followed. The result has been that broadcasters have enthusiastically embraced DVB standards, not just in Europe but all over the world. Although only launched in 1996, European DTV services already reach millions of households, who enjoy not just television but a whole range of innovative services such as home banking, interactive advertising and internet.*

*Without EU research projects, many of the elements that DVB put into its specifications would not have existed – and none of the other steps could have followed. EU programmes have ensured that key technologies were available when they were needed. This helped DVB to secure an advantage by specifying its systems far ahead of market lift-off. Instead of being late, Europe moved into the lead in DTV.*

IST Action Lines:

Commission Contacts:

Web:

IST-2002 IV.6.1

Carlos Morais Pires

[www.cordis.lu/ist/ka4/vision](http://www.cordis.lu/ist/ka4/vision)

Networked audio-visual systems and services

[carlos.morais-pires@cec.eu.int](mailto:carlos.morais-pires@cec.eu.int)

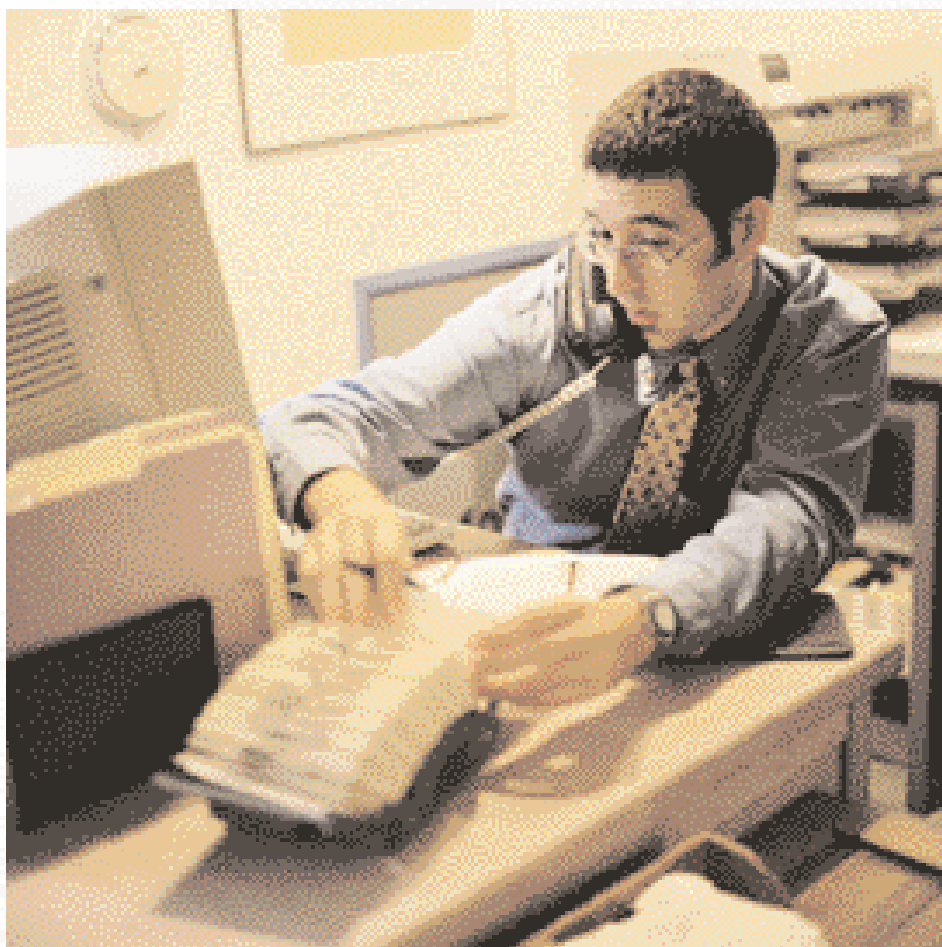
# Helping SMEs make the e-transition

**S**mall and medium-sized enterprises (SMEs) are essential to the European economy. They are the main source of new jobs and play a key role in enabling Europe to compete in world markets. Information and communication technologies (ICTs), and particularly e-business, offer many opportunities for SMEs to grow and prosper. While some are embracing change very successfully, for the most part European SMEs find the opportunities presented by ICTs difficult to grasp.

The obstacles are well documented. They include lack of technical and management skills in SMEs, lack of appropriate e-business solutions, the high cost of ownership of ICT equipment, concerns about security and privacy, and complex regulatory frameworks for e-commerce. Most significantly of all, many SMEs are not yet convinced of the appropriateness of e-business for their particular circumstances. They are seeking highly specific

information on which to build a business case, and so make informed and realistic investment decisions. SMEs need to harness technology to play to their strengths – specialisation and flexibility – and to allow them to collaborate effectively with others.

In April 2001, the European Commission launched the GoDigital initiative as part of the eEurope 2002 Action Plan. The initiative supports actions to raise awareness and spread best practice on e-commerce among European SMEs. It offers a platform for ideas, complementing and building on the experiences gained from regional and national e-business programmes. RTD has an important part to play here, primarily in generating real life business cases based on novel technologies, solutions and business practices. RTD also informs future policy development for SMEs.



*SMEs need help in benefiting from IST*

The IST Programme complements and contributes to GoDigital through various forms of take-up actions. Trials for SME users and suppliers promote the adaptation and introduction of leading-edge technology in industrial and service applications and its joint evaluation by suppliers and users. Best practice actions promote improvements in business practices, processes and operations through introducing SME users to methods and technologies that are proven but not yet widely deployed. Demonstration projects are designed to prove the viability of new technologies offering economic advantages but which are not yet commercialised directly.

Under FP5 around 70 IST take-up projects were launched. These involve directly hundreds of SMEs throughout Europe together with many catalysts – local or regional organisations that work with SMEs to facilitate the change process.

The relationship between the IST take-up projects and GoDigital was recently evaluated by independent experts. The assessment concluded that although many of the projects pre-date the GoDigital initiative, the portfolio has a strong synergy with GoDigital objectives. The IST projects are generating a diverse set of showcases – examples of successful practice that are disseminated through national and regional initiatives under the GoDigital umbrella. They are also creating a broad range of products and services that offer further tangible benefits to SMEs. By making the experience from SME take-up projects widely accessible, the IST Programme is making a significant contribution to the success of eEurope GoDigital.

Looking to the future, the challenge is to facilitate the transition of SMEs to the knowledge economy, and in particular to find means to support partnering and collaboration. Instead of focusing on the early adopters, the emphasis of take-up activities needs to

shift towards wider exploitation by the “early majority”, and towards more advanced e-business solutions for the long-term. With around 19 million SMEs in the EU (and a further 10 million in the Newly Associated States), the scale of this take-up challenge is immense. Success will only be achieved through the close involvement of actors at local and regional levels. SMEs do not operate in isolation, but rather as part of a regional ‘business ecosystems’ comprising other SMEs, larger enterprises, local authorities and business intermediaries. Hence, this regional dimension to e-business will receive high priority in future, under both eEurope 2005 and FP6.

The eEurope 2005 Action Plan identifies the need to promote “a dynamic e-business environment”. A comprehensive set of actions is proposed in relation to legislation, e-skills, interoperability, and trust and confidence, with specific reference to SMEs. Key measures include a European e-business support network, fostering of clusters of online SMEs, sharing of good practice, and promotion of guidelines and standards.

While the two programmes have different time horizons, SME-related actions under FP6 will continue to inform and support this process. One priority could be the creation of a pan-European network of centres of excellence. This could foster the creation, growth and clustering of nodes/hubs of SMEs, and support the deployment of ICT in their activities, giving them the opportunity to compete at inter-regional and international levels. The promotion of innovative e-business models and the transfer of knowledge through appropriate training frameworks should also be encouraged. And there is a need for constituency building and scenarios on ‘eSMEs’, to identify SME-specific needs in terms of development, technologies and ICT knowledge (skills and competences).

IST Action Lines:	IST-2001 II.1.5	High impact take-up, dissemination and training
	IST-2001 II.1.6	Large-scale demonstrators
	IST-2001 V.1.1.1	CPA 11: Regional and sectoral pilot actions and demonstrations for the digital economy
	IST-2002 II.1.3	Addressing eEurope and eEurope+ objectives
Commission Contacts:	Frank Cunningham <a href="mailto:frank.cunningham@cec.eu.int">frank.cunningham@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka2">www.cordis.lu/ist/ka2</a> <a href="http://europa.eu.int/information_society/topics/ebusiness/godigital/index_en.htm">http://europa.eu.int/information_society/topics/ebusiness/godigital/index_en.htm</a>	



# The digital studio

**B**roadcasting is going digital. Not only is digital transmission bringing new services into the home, digital technologies are also being used increasingly throughout the audio-visual production process. For instance, digital techniques are already widely used in editing and post-production processing. The success of Hollywood films such as

help broadcasters and programme makers exploit the vast untapped potential of the digital television platform.

The new MPEG-4 and MPEG-7 standards are central to these trends. These are open standards for audio-visual and multimedia content being developed by the



Digital technologies are being used throughout broadcasting

Toy Story and Jurassic Park are well-known examples of post-production of 3D animation and special effects. The next step is to automate the other stages in the broadcasting production chain, such as content production, content processing and even live broadcasts. In particular, new tools are needed to

Moving Picture Experts Group (MPEG), an industry forum. The MPEG-4 and MPEG-7 standards allow audio-visual media to be described and indexed by their contents – what is in a film scene for example. This object-based approach will enable broadcasters and other audiovisual industries much more flexibility

## Creative tools for iTV

*At present, interactive TV content tends to be limited to sports and entertainment, and especially game shows. Current content – such as advertisements mixed into running shows, or links inserted into pre-recorded music videos - provides little value-added for the audience. TV journalists and editors need new tools that allow them to plan, organise and realise a new generation of iTV events in a creative way.*

*MECITY plans to create a novel form of interactive content for TV, ultimately leading to a new digital expression. It will develop an authoring platform and tools to develop non-linear iTV stories, as well as tools for intelligent search and retrieval of digital content. To demonstrate the tools a prototype iTV production will be created and shown in an iTV testbed.*

### Digital solutions for live production

*In the broadcasting industry, the use of high-speed networks and servers in a post-production environment is increasing. However, these are not generally used in real-time production environments due to problems of quality and reliability. In live productions, equipment such as cameras are controlled by separate stand-alone devices that have no network capabilities. The production chain is like an island that is separated from the studio network. Output is either a live feed to the broadcast network or content on a storage device, mostly tape based.*

*NUGGETS is aiming to introduce digital network technologies into the programme production part of the broadcast chain. Central to the research is the development of a bi-directional network architecture based upon file manipulation. This will allow, for example, not only picture information to be sent from camera to on-air signal, but also for the camera operator to receive instructions through the intercom or for a picture to be inserted into the camera viewfinder for better positioning. The network will be used for live production and will have characteristics compatible with both in-house and public networks.*

to index, search, track and retrieve multimedia content. The new standards provide a consistent set of descriptions that can be used throughout the lifecycle of content, including the production phase. This means that once produced, content can be reused easily across many different media, such as TV broadcast, interactive DVD, internet streaming, and games.

At present the promise of interactive TV is not being realised because there is no standard platform for programme development. Each broadcaster operates a different platform, based on proprietary tools, that requires content creators to rewrite iTV applications many times over. This is stifling both innovative iTV content and advertising revenue, and hence holding back growth of the medium. Two new projects address this problem. EDiCT aims to unify the production and broadcast workflow for interactive television and convert it to open standards, and MECiTV targets new content creation tools for the iTV platform (see box).

SMARTCAST addresses the transformation of broadcast programme makers into providers of “smart” content for broadband networks. It is developing platforms to enable AV content providers to efficiently adapt their production processes and organisational structure to the emerging broadband internet market. The production tools, which are based on MPEG-4, support delivery of broadband media via multiple platforms such as satellite, DSL, cable modem and wireless networks. This enables service providers to adopt a POPE (produce once, publish everywhere) production model, enabling material to be viewed on various devices differing in interactivity and form factor (e.g. PC, iTV, PDA). Following participation in the IST Euro-China event in April 2002, consortium partners have signed an agreement with a Chinese company to supply the web platform developed in the project.

IST Action Lines:	IST-2001 II.3 IST-2001 III.1	Management systems for suppliers and consumers Interactive publishing, digital content and cultural heritage
Project References:	EDiCT MECiTV NUGGETS SMARTCAST	IST-2001-35142 IST-2001-37330 IST-2001-34526 IST-2000-26261 <a href="http://www.smartcast.tv">www.smartcast.tv</a>
Commission Contacts:	Yves Rene de Cotret (KA II) Pascal Jacques (KA III)	<a href="mailto:yves.rene-de-cotret@cec.eu.int">yves.rene-de-cotret@cec.eu.int</a> <a href="mailto:pascal.jacques@cec.eu.int">pascal.jacques@cec.eu.int</a>
Web:	<a href="http://www.cordis.lu/ist/ka2">www.cordis.lu/ist/ka2</a> <a href="http://www.cordis.lu/ist/ka3/iep">www.cordis.lu/ist/ka3/iep</a> <a href="http://www.elpub.org">www.elpub.org</a>	

# Joined-up healthcare

**H**ealth services, like other organisations, have to embrace the opportunities presented by the e-revolution. Within many hospitals, standardised patient medical records already assist the exchange of

information between specialist departments. Frequently, hospitals have to work with other health agencies as well, necessitating the sharing of clinical information between different organisations and specialties. Increasingly, this collaboration extends beyond the traditional care environments into the home itself.



Patients are coming to expect a single point of entry to healthcare services that cuts across institutional boundaries. The “virtual hospital” should enable healthcare services to be provided to the patient as promptly and as locally as possible, while supporting the collaboration of healthcare professionals throughout the care episode. This implies an optimal mobilisation of healthcare resources, for instance by sharing the results of diagnostic tests irrespective of where they are produced, or sharing the best expertise irrespective of geographical location. Effective collaboration, therefore, requires standardised means of collecting, transmitting and storing data, and interoperable technical solutions.

*IST plays an increasing role in day-to-day medical practice*

## Health and mobility

Mobile devices are of increasing importance in healthcare, and many IST projects are exploiting them. For instance, MEMO will build a business model for the adoption of mobile devices in healthcare, create guidelines for interoperability and devise evaluation methods. A web portal will provide secure communication for doctors and also public information, laying the foundations for future developments.

New value-added healthcare services based on 2.5 and 3G technologies are targeted by MOBIHEALTH. Sensors and actuators will continuously measure and transmit a patient's vital constants with audio and video information to health service providers and brokers. This will combine improved patient quality of life with new services in the areas of health promotion, disease prevention, diagnosis, remote assistance, state monitoring (e.g. for sports) and clinical research. The system will also support fast and reliable remote assistance at the scene of accidents, by allowing paramedics to transmit vital information from the accident site.

Changing practices in health management are recognised in the eEurope 2005 Action Plan. Its action on e-health urges Member States to develop, by the end of 2005, health information networks between points of care (hospitals, laboratories and homes) with broadband connectivity where relevant. Further action on electronic health cards is also envisaged. At the Barcelona Council earlier this year it was agreed that these should replace paper-based systems for obtaining treatment in other Member States and the Commission is expected to bring forward a proposal soon. This will support a common approach to patient identifiers, health record architecture, medical emergency data and secure access to personal health information.

Under the IST Programme, RTD on collaborative healthcare aims to enable patients and healthcare professionals to co-operate and share patient and other health-related data, whether from the surgery, hospital, patient's home or accident site. With a medium to long-term perspective, it aims to create a more efficient and secure health knowledge "info-structure", enabling health professionals to interact with a wide range of medical and other health-related systems. The work takes into account advances in sensor technologies, interfaces and intelligent agents, virtual reality and simulation, and fixed and wireless communication technologies.

For example, CHILDCARE is developing a collaborative healthcare platform to improve the quality of children's homecare. The system will enable collaboration between paediatricians, other medical professionals and citizens using teleconference solutions and added value services. E-CARE will introduce new practices in health monitoring in a range of scenarios where patients live a relatively normal life but require constant monitoring of their state of health. Doctors will be able to remotely

track patients' vital parameters using communication devices assisted by an intelligent infrastructure.

The microscope is one of the oldest pieces of medical equipment. E-SCOPE is aiming to make fully digital microscopes available for routine diagnostic practice. Their images will be fully compatible with standards for medical imaging, archiving and communication, also enabling the certification and accreditation procedures set up by the diagnostic pathology community. Also concerned with new health devices, IVP focuses on development and evaluation of a miniaturised video probe system. To be used in diagnosis and therapy, its applications include colonoscopy, gastroscopy and post-operative intracorporeal control after abdominal surgery.

#### **Soft-copy screening programmes**

*Every year millions of women have film-based mammograms in the European screening programmes. The new digital mammography and soft-copy reading technologies addressed in SCREEN-TRIAL will impact on the radiologists' reviewing process and the medical quality. Soft-copy reading enables the use of computer-aided detection, patient e-records and digital image communication, and is a key to the integration of Europe's screening programmes under the EC's e-health initiative.*

The Sixth Framework Programme will continue towards the vision of a 'Health Knowledge Infostructure', a network of interactive and secure medical and health systems allowing timely interaction with various distributed, medical and other health-related databanks. It may involve decision support research (including collaborative research among the bio-informatics, neuro-informatics, and health informatics sectors), and continuous training of health professionals.

IST Action Lines:	IST-2002 I.1.2	Systems for health professionals: creating a “Health knowledge info-structure”		
Project References:	CHILDCARE	IST-2001-33383	<a href="http://www.childcare-eu.com">www.childcare-eu.com</a>	
	E-CARE	IST-2001-33261		
	E-SCOPE	IST-2001-33294		<a href="http://e-scope.vitamib.com">e-scope.vitamib.com</a>
	IVP	IST-2001-35169		<a href="http://ivp.ims-chips.de">ivp.ims-chips.de</a>
	MEMO	IST-2001-35495		<a href="http://www.med-mobile.org">www.med-mobile.org</a>
	MOBIHEALTH	IST-2001-36006		<a href="http://www.mobihealth.org">www.mobihealth.org</a>
	SCREEN-TRIAL	IST-2001-33439		
Commission Contacts:	Luciano Beolchi	<a href="mailto:luciano.beolchi@cec.eu.int">luciano.beolchi@cec.eu.int</a>		
Web:	<a href="http://www.cordis.lu/ist/ka1/health">www.cordis.lu/ist/ka1/health</a>			



# New media, new opportunity

Europe has a vast reservoir of creative energy, enjoys a rich cultural heritage and possesses leading artistic and creative industries and institutions. It has the potential to generate compelling material appealing to all ages and cultural groupings, exploiting to the hilt both traditional outlets and the new opportunities opened by digital technologies such as the internet. Knowledge-based products will be at the heart of the future information, entertainment and education industries, and it is vital that Europe be able to make the most of its assets.

At present, the European audio-visual market is fragmented, both on the supply side (many different

information providers) and the demand side (different cultures and end-user sectors). This diversity, including linguistic diversity, provides rich resources for the EU's audio-visual industry, but it also hinders the sector in exploiting the benefits of IST. We need to know much more about the impacts of audio-visual content, and the related technologies, on the organisations and markets in which they are used.

The IST Programme supports a variety of projects that connect practising creative artists and media industry practitioners with academic and technology partners to undertake well-founded research into practical techniques for the realisation of digital content. Research alone is not sufficient, however:

the industry needs to be aware of and to act upon the results and knowledge being produced. A series of support actions launched over the last two years are helping to ensure the potential is realised. By seeing examples of current best practice in many forms, formats and applications, media companies will be able to perceive opportunities in a fresh light and form connections with other players where necessary to seize new business possibilities.

The gap between research and the adoption of new ideas by industry and investors still represents a major obstacle to the success of EU-funded research. ADOPT-IT is providing a service to RTD projects in the area of digital content



## Strategies for multimedia

*MUDIA was a research study which investigated future evolution scenarios in the news and media industries. A series of detailed reports have been produced providing insights into current trends in the European and worldwide media industries. These include a set of predictive scenarios to illustrate the long-term consequences of the imminent change to fully digital, multimedia production conditions for both content providers and information consumers. Overall, the findings provide European media companies with a framework to evaluate their strategies, an informed reference point for innovation, access to key data and better insights into the preconditions for success.*

*The reports clearly show the extent to which the new digital technologies are revolutionising the media industry. Historically the industry has been heavily “top down”, with relatively few content providers and thousands or millions of consumers. New media will be much more horizontal, and consumers will be able to have their say. Contributors will be more numerous and varied. Media will have new delivery modes, and the marketplace will consist of more and different outlets. Creators will need to consider not only the message, but also the format and the delivery technology. Creative artists will need to develop an awareness of the value chain and business process in a way they may not have done before. MUDIA has helped show companies roadmaps for change, and the novel patterns of work organisation they will need to consider.*

and multimedia to ensure that news of developments and best practice is widely disseminated. Initial activities will focus on a selection of about 20 good practice examples in the management, distribution and publishing of multimedia content. Its awareness-raising campaign will include the definition of a communications strategy, the creation and management of a mailing list database, the launch of a showcase website and the production of a promotional kit with DVD and printed and interactive material.

The industry for providing web hosting services is likely to be crucial in enabling SMEs and content creators without large technical resources to operate in the electronic marketplace. The web-hosting market is evolving rapidly, though its potential has been the subject of unrealistic expectations. WEBHOSTS is conducting a socio-economic study of the web hosting market. A business model and best practice analysis for maximum SME assistance is being developed based on results from a wide-ranging survey.

The enlargement of the EU offers great opportunities in the the ICT and multimedia sectors. ACTeN is actively surveying the market for new technology requirements, and includes partners from the e-content industries in Central and Eastern Europe and the Newly Associated States. This work, transmitted through presentations and knowledge transfer events, is expected to provide a major stimulus to the Sixth Framework Programme. The European Academy of Digital Media (EADiM), a professional association with members in twenty European countries, is a key partner in the project. EADiM is the organiser of the EuroPrix awards for best practice in e-content creation. Since their launch in 1998, around 500 multimedia products are entered for the contest each year, representing a participation of over 1,800 companies.

### IST Action Lines:

IST-2001 III.1.1  
IST-2002 III.5.1  
IST-2002 III.5.2

### Project References:

ACTeN  
ADOPT-IT  
MUDIA  
WEBHOSTS

### Commission Contacts:

Pascal Jacques

### Web:

[www.cordis.lu/ist/ka3/ieip/](http://www.cordis.lu/ist/ka3/ieip/)  
[www.elpub.org](http://www.elpub.org)

### Publishing digital content

KA3 specific support measures

Preparing for future research activities

IST-2001-38240

[www.acten.org](http://www.acten.org)

IST-2001-35183

[www.adopt-it.info](http://www.adopt-it.info)

IST-2000-25400

[www.mudia.org](http://www.mudia.org)

IST-2000-31038

[www.web-hosts.org](http://www.web-hosts.org)

[pascal.jacques@cec.eu.int](mailto:pascal.jacques@cec.eu.int)

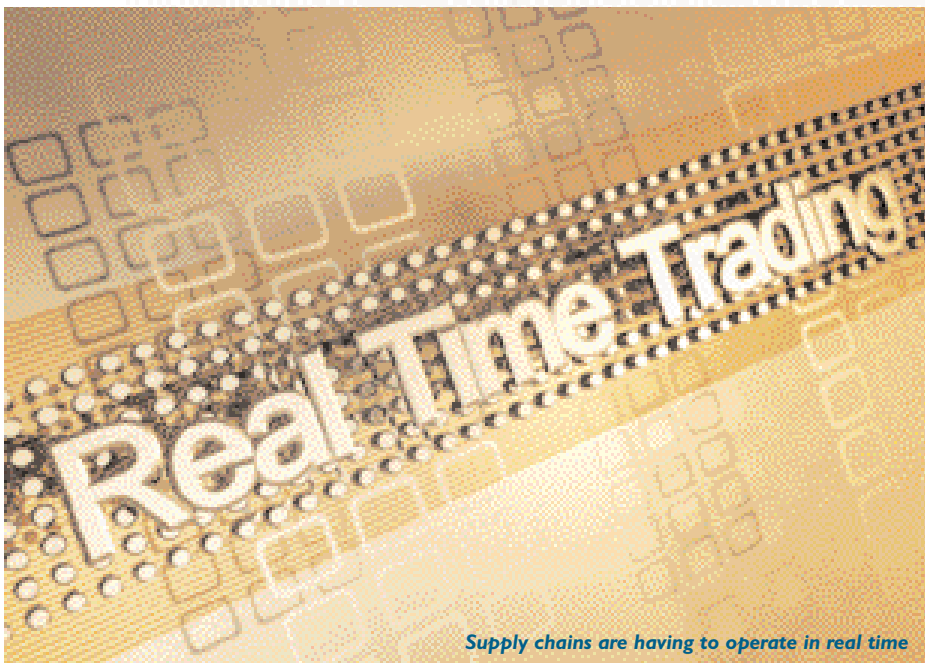
# Connecting the supply chain

**A**s technology advances and living standards rise, our entire philosophy of industry and production is changing. While before we may have been content with a limited range of commodity items brought to us by vertically integrated companies, today we are demanding a wide choice of differentiated and customised products. On the one hand, this gives SMEs a greater part to play in “variety” production; but it also makes value and supply chains much more complicated.

though these will be more and more necessary for rapid product innovation.

Increasingly, manufacturers are enhancing products with added-value services as part of the customer offering. They have to sell benefits, not boxes. An “extended product” is a package that combines a product with services and enhancements that improve marketability. The customer proposition may subsist more in the benefits of the value-added elements than

the physical product itself. Enhancements can incorporate tangible features that make the product more intelligent, customised or user-friendly, including embedded features like maintenance. Other aspects, such as services, engineering or software, are intangible and make the offering more information or knowledge intensive.



To satisfy the demand for richer product ranges, companies possessing different expertise must collaborate. In the past, when companies have formed productive partnerships with others, they have often reached long-term agreements to obtain favourable conditions. These relations become rigid, however, preventing the full benefits of open competition. They deny the possibility of really flexible value chains, even

On the logistics side of the supply chain, the freight sector is growing strongly but the capacity of infrastructure is limited and EU enlargement is likely to exacerbate current problems. Outsourcing of logistics is now common practice, as producers employ specialist solution providers. This sector needs to optimise its efficiency by employing the best technology available, for example positioning systems and smart tags.

## The supplier constellation approach

*Companies are increasingly recognising the benefits of flexible value chains. Instead of having a set of rigid relationships, a company can play in a constellation of possible suppliers, and select whichever virtual combinations are most suited to meeting a particular need at a particular time.*

*The INDIA project aims to support this concept. It is developing an internet-based software suite, the Constellation Driver (CD), which will assist companies to find suppliers, specify tasks and generate the necessary commercial agreements. The CD platform will incorporate the latest natural language, artificial intelligence and information retrieval techniques. The CD prototype will be tried first by consortium members, then by other companies in France and Germany.*

### The future for e-logistics

*BPR-LOGISTICS is aiming to produce a strategic roadmap for logistics and supply-chain management. It will provide a focus for collaboration between projects (national as well as EU-funded) and explore future and emerging research topics. The outputs will be an assessment of the impact of the e-economy on logistics and supply chain management activities, and recommendations for future RTD activities under the Sixth Framework Programme.*

EXPIDE is a clustering activity for IST projects with interests in these emerging areas. With strong involvement from the e- and m-commerce sectors, the project is building a community of researchers across Europe and in particular provides a forum for exchange of information for related IST projects. Activities focus on new business processes in dynamic enterprises as they relate to value chains and extended products, including analyses of trends, development of strategic visions, and definition of roadmaps. Opportunities for future RTD collaboration and for dissemination of results are also addressed. Another cluster project, TRANSACT, focuses on trends, technologies and information dissemination in electronic trading systems, transaction management, brokerage and negotiation.

SMEs stand to benefit from e-business logistics and supply chain support, but are at a disadvantage when compared with large companies since they cannot afford long learning curves or complex system initiation strategies. MEDIATE-SME is investigating a

“packaged” methodology and set of building-block tools that may save an SME up to 40% of introduction costs and 80% of business risk. The solution will take the form of a component library that supports logistical business processes in SMEs. E-POWER is creating a set of regional technology centres throughout Europe to facilitate the take-up of e-business and e-working practices by engineering and manufacturing SMEs. Two conferences, a website and portal will help disseminate the output of this work.

SMARTISAN is producing a generic e-business solution to enable SMEs to join today's digital commerce revolution. It will offer an XML-based service covering, among other aspects, market mediation, synchronising of extended wholesale and retail deliveries, and participation of customers and suppliers. A feature called the Virtual Artisan allows accumulated knowledge to be captured and used to support the customer relationship management (CRM) process. The work includes a roadmap for SMEs' choices of e-commerce methods, tools and architectures.

IST Action Lines:	IST-2001 II.3.1 IST-2002 II.1.2	Dynamic value constellations Strategic roadmaps for applied research	
Project References:	BPR-LOGISTICS CITRO DISTRICT EMIRES E-POWER EXPIDE INDIA MEDIAT-SME SMARTISAN TRANSACT	IST-2001-38477 IST-2001-32521 IST-1999-11247 IST-2001-32591 IST-2000-29343 IST-1999-29105 IST-2000-28413 IST-1999-11570 IST-2000-26267 IST-2000-26311	<a href="http://www.bpr-logistics.trans.aueb.gr">www.bpr-logistics.trans.aueb.gr</a> <a href="http://www.citrotrans.com">www.citrotrans.com</a> <a href="http://www.brunel.ac.uk/depts/math/research/maprog">www.brunel.ac.uk/depts/math/research/maprog</a> <a href="http://www.e-power.eu">www.e-power.eu</a> <a href="http://www.expide.org">www.expide.org</a> <a href="http://www.indiaproject.net">www.indiaproject.net</a> <a href="http://www.cbt.es/mediat-sme">www.cbt.es/mediat-sme</a> <a href="http://www.alfamicro.pt/smartisan">www.alfamicro.pt/smartisan</a> <a href="http://www.eu-commerce.org">www.eu-commerce.org</a>
Commission Contacts:	Costas Paleologos	constantin.paleologos@cec.eu.int	
Web:	<a href="http://www.cordis.lu/ist/ka2/logistics.htm">www.cordis.lu/ist/ka2/logistics.htm</a> <a href="http://www.bpr-logistics.trans.aueb.gr">www.bpr-logistics.trans.aueb.gr</a>		



# Citizen-friendly government

**I**n the Information Society the roles of government and public administration are multi-faceted. They function as lawmaker, regulator and enabler. They provide information and services to individuals and businesses, and they are customers. The key challenge is for government to function, and be seen to function, as a single enterprise, regardless of borders and “levels” of government. Looking to the longer term, we need to work towards a vision of integrated government across Europe in which administrations, citizens and businesses are able to interact seamlessly. This requires a secure, easy-to-access infrastructure through which to deliver improved, high-value public services.

Several important principles follow from this. Firstly, services must address the needs of the citizen. When people interact with government they want to do so in ways that relate to their view of the world. Systems of access to government must be service-orientated, rather than structured by technology or organisational boundaries. Secondly, government and its services need to be more accessible. All services that can be delivered electronically should be accessible over the internet, mobile phones, digital TV, call centres, PCs as well as conventional means. These services must be readily interoperable, one with another and with e-business and m-business infrastructures. Social inclusion is a priority, so services must be readily usable by all, including minorities and those with disability or special needs. Finally, it is essential to make better use of information. Government’s knowledge, information and data are valuable public assets.

Adoption of the latest technologies, strategies and practices will be essential in improving public services, making them more efficient, productive, affordable and easier to use. Community research under the IST Programme focuses on developing new, specialised services incorporating the latest technology and best practice, rather than on front-ending or automating

old-generation systems. Current research includes trials as a means of obtaining real-life experience. Platforms embody technologies to help branches of government adopt best practice, and be learning organisations that enable their people to develop as they respond to organisational, process and cultural changes for the information age.

For instance, EUROVET TRIAL is developing a database application for the notification of animals and herd registration. This will provide new tools for movement control and health surveillance, contributing to protection against fraud, defence against spread of disease, and better health management data. CLIPCARD targets a potentially standard smart card system for traffic violation offences, replacing current paper slips. These tickets are expected to speed up payment and collection, and to help gather information on stolen vehicles.

SAMPLE is trying to tackle the delays associated with customs clearance of mail and parcels imported into and exported from Community countries. It is developing a support system that will simplify accounting, consolidate procedures and predict workloads. And at the e-commerce/e-government interface, EBR-ON aims to provide common access to European registers of companies and businesses. A new system should improve access to the company registers in 13 countries based on harmonised technology, efficiency and market need for the data.

Citizen digital identity systems could bring about great improvements in efficiency and end-user facilities provided they are appropriately linked with e-government and e-commerce systems, always respecting citizens’ privacy rights, of course. EUCLID, supporting the eEurope “Public Identity” trailblazer, is seeking consensus on requirements for reading, verification and data interchange.

## Information at your fingertips

*A lot of time is wasted and frustration caused when someone contacts a government department, only to find that the person handling the enquiry cannot find the right information. MAP is aiming to develop an intelligent, knowledge-based application that will listen to the dialogue, anticipate the relevant information, and bring it onto the computer screen. This system runs in the background while the dialogue proceeds. It will be self-learning, able to sense the way government employees access and use information and respond accordingly.*

Much valuable experience has been accumulated in e-government solutions, and greater efforts are needed to diffuse these best practices within government so as to help managers, administrators and specialists to learn and develop. VISUAL ADMIN is developing a

generic portal for access to government back-office systems based on high standards of user-friendliness, and having adaptation for display on mobile terminal platforms. A knowledge-based system to simplify the development of online transaction services is being investigated by SMARTGOV. KIWI focuses on a knowledge management system tailored to public administrations, designed to help with employee development, personal creativity, learning and team building. And E-FORUM provides an internet-based forum for sharing information about future needs, best practices and methods of delivery.



*Technology can make public services more citizen-friendly*

Sixth Framework projects in this area are likely to emphasise co-operative relationships between government and business. Aspects covered will include road mapping, models of governance, and interoperability with evolving e-commerce and m-commerce systems, including new 3G platforms. Systems are likely, ideally, to be based on generic technologies and modular in nature, permitting the composition and self-customisation of individual applications.

**IST Action Lines:**

IST-2001 I.3

Administrations

**Project References:**

CLIPCARD

IST-2001-32148

[www.clipcard.fr](http://www.clipcard.fr)

EBR-ON

IST-2001-32260

[www.ebr.org](http://www.ebr.org)

E-FORUM

IST-2000-29213

[www.eforum.eu.net](http://www.eforum.eu.net)

EUCLID

IST-2001-32731

EUROVET TRIAL

IST-2001-32357

[www.e-blana.com](http://www.e-blana.com)

KIWI

IST-2001-35247

[www.ist-kiwi.org](http://www.ist-kiwi.org)

MAP

IST-2001-34001

SAMPLE

IST-1999-10744

[www.sample.ipc.be](http://www.sample.ipc.be)

SMARTGOV

IST-2001-35399

[www.smartgov-project.org](http://www.smartgov-project.org)

VISUAL ADMIN

IST-2000-28248

[www.visual-admin.net](http://www.visual-admin.net)

**Commission Contacts:**

Valentine Reilly

[valentine.reilly@cec.eu.int](mailto:valentine.reilly@cec.eu.int)

**Web:**

[www.cordis.lu/ist/ka1/administrations/home.html](http://www.cordis.lu/ist/ka1/administrations/home.html)

# Advancing agri-business

**T**he food production, distribution and retailing sector touches all our lives on a daily basis and is probably the oldest industrial and work activity known to humankind. It is a major source of employment. In retailing alone, food and drink accounts for 43% of a European retail sector that comprises 4 million businesses and employs 15 million people. The industry is changing rapidly. In many countries, the number of small and independent retailers is falling while supermarkets and hypermarkets become larger and account for an increasing market share.

The food industries are traditional industries that have considerable scope for adding ICT to their business models. By so doing, they may improve considerably customer satisfaction, the quality of the customer experience and supply chain efficiency. By adapting to digital business methods, small retailers may be able to achieve the efficiencies and offer the distinctively personal customer marketing values that will enable them to survive and prosper.

The agri-food business is one of several industry-focused clusters within the IST Programme's Key



Europe's agri-food sector is grasping the e-revolution

## Shopping at the supermarket of the future

*Imagine a situation where food items have a smart product identification tag on them instead of today's barcodes. Suppose now that the supermarket trolley has a device that reads these as the goods are placed in it, and updates the store computer item by item. Visualise that your refrigerator and other storage areas at home also have similar readers. The last link in the chain is your supermarket identity card, by which the supermarket can associate your purchases with you. This is the scenario envisaged by MYGROCER.*

*When you go shopping, you "log" your card into the trolley and the screen springs to life, reminding you of your regular shopping list. It may advertise some new items or special offers it thinks you will like. It can display an interactive store map if you need help finding anything. It knows, from the messages the computer has received from your home sensors, which items you need to replenish. There is no need to join a queue to pay. The trolley reader knows exactly what you have bought, and will charge your account by an e-commerce payment.*

*The underlying technology for these functionalities includes smart code readers, embedded devices in trolleys (carts) and shopping places and WAP protocols for mobile communications.*

Action II, New Methods of Work and Electronic Commerce. Projects here are exploring innovative business models for e-business for the food and agriculture sectors that aid value creation. They also aim to advance the delivery of highly customised products and services in response to globalisation and changing market demands.

For instance, DISTRICT is developing a new business model and toolset for the small food and drink retailer. This will provide value chain integration tools for transport, internal and external logistics, user profiling, demand management, management of buying groups and finally distribution management and route scheduling, including for home delivery. These innovative technologies will help small retailers remain competitive in the e-commerce era.

In the consumer area, VIRTUAL-WINERY integrates a user-friendly web-based application for the on-line ordering and delivery of wine for the high-end European consumer base. And MYGROCER targets tools for shopping list and card management, home and store inventory management, store navigation and personal and location-based promotions (see box).

Other aspects of the food industry value chain are also addressed. E-CANNED is demonstrating the advantage of e-commerce for food cannery companies by creating a virtual mall for selling their products via the internet, while CHAINFEED is developing process modelling tools applied to animal feed production. A system to improve the collection of food safety data and monitor compliance with food safety regulations is targeted by SAFES. It will integrate a prototype system for real-time data collection with standard web browsers.

With a view to the Sixth Framework Programme, a new roadmap project, AFORO, aims for a vision and work plan to transform agriculture and food industries into digital companies. The team will integrate, refine and validate the knowledge of its partners to test the feasibility of new e-business and e-work technologies. The output will be research priorities with a five to ten year timeframe and a five-year action plan.

### Flowers on demand

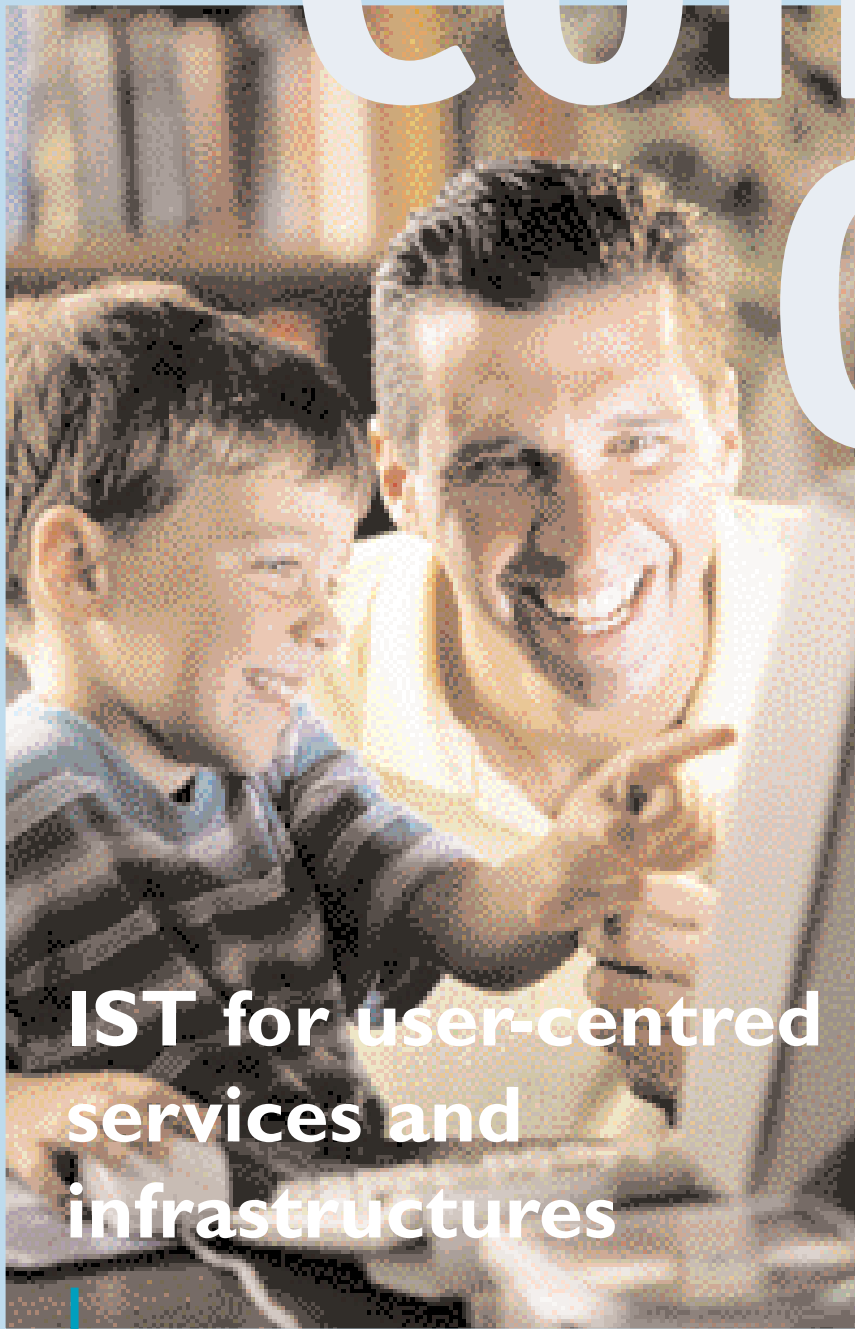
*E-FLORA is adapting novel e-commerce approaches for the needs of horticultural SMEs. The tools provide support for logistical management of perishable items, last minute ordering, bioenvironmental conditions, supply chain management, handling of surplus produce and dealer-client support.*

*The customer-facing aspects of the system include an ordering tool, dynamic administration of the catalogue and the products displayed on the company website, decision support, and aftersales information and support. It is being trialled in a flower-growing company.*

IST Action Lines:	IST-2001 II.3 IST-2002 II.1.2	Management systems for suppliers and consumers Strategic roadmaps for applied research
Project References:	AFORO CHAINFEED DISTRICT E-CANNED E-FLORA MYGROCER SAFES VIRTUAL-WINERY	IST-2001-37258 IST-1999-10625 IST-1999-11247 IST-1999-20185 IST-1999-21058 IST-2000-26239 IST-1999-20842 IST-1999-12665  pilot.nuigalway.ie/chainfeed www.brunel.ac.uk/depts/math/research/maprog/ www.anfaco.es/ecanned www.exodus.gr/e-flora www.eltrun.aueb.gr/mygrocer  www.finca-allende.com/virtualwinery/index.htm
Commission Contacts:	Oluf Nielsen Constantin Paleologos	oluf.nielsen@cec.eu.int constantin.paleologos@cec.eu.int
Web:	www.cordis.lu/ist/ka2/food.htm	



# Connecting Communities



**IST for user-centred  
services and  
infrastructures**

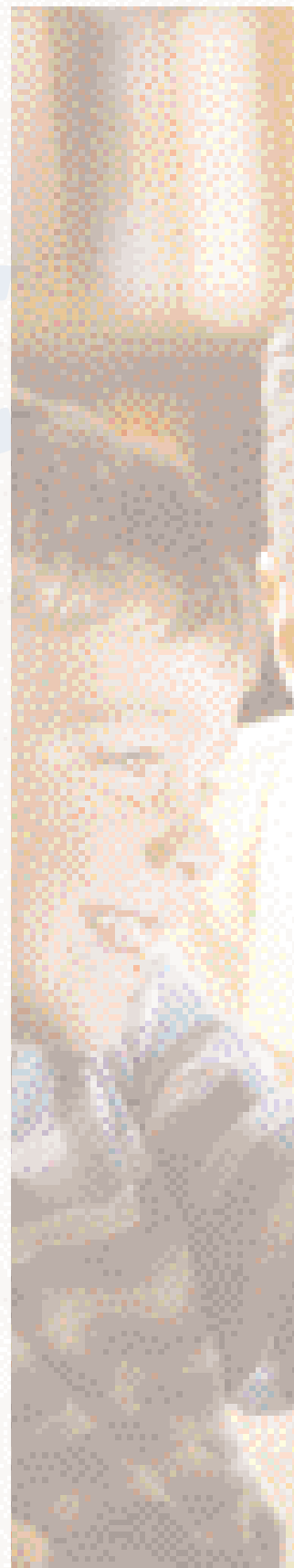
# nities

**T**o 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 healthcare, culture, education, government and tourism, IST is enabling user-friendly access to a wide range of resources and services. This trend is especially significant in education, where from the kindergarten to the university IST is fundamentally changing the nature of learning.

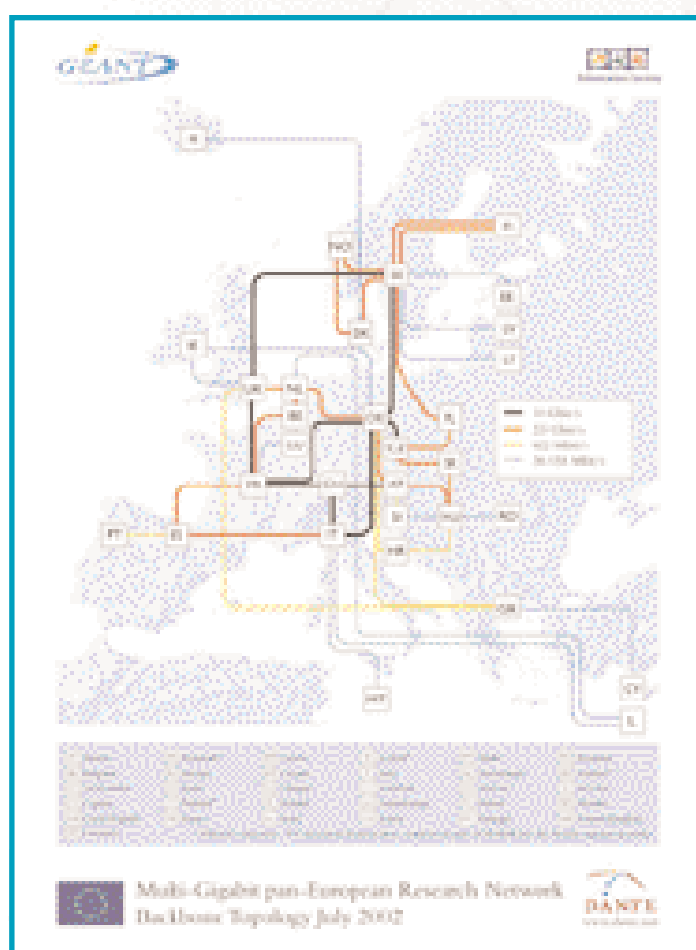
IST also helps achieve more efficient use of public infrastructure and environmental resources, and so contributes to sustainable development. Key applications include improving environmental management, optimising the use of transport networks and multi-modal transport services, and more effective management of environmental emergencies. A niche, 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 connected 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.



# Towards global networks

Scientific research is increasingly reliant on electronic networks. Researchers use such networks not only to communicate with their fellow scientists but also to access resources such as very large data collections, scientific experiments and high performance computing. These developments – sometimes referred to as “e-science” – are fundamentally changing the way researchers work, enabling them to access and manipulate data in new ways and allowing research itself to be much more productive.



**GÉANT - Europe's world-beating research network**

In Europe, the highly robust infrastructure needed to support future research networking and the evolution towards grids is being provided by a new world-class high-speed network called GÉANT. This very high performance, pan-European network service interconnects Europe's national research and education networks (NRENs) at multiple gigabit speeds. With a backbone throughput of 10Gb/s - a sixteen-fold increase in capacity since 2000 - GÉANT

is undoubtedly the world's fastest research network. Together with associated upgrades in the NRENs, these developments allow European researchers to benefit from a world-leading research network infrastructure.

GÉANT has been fully operational since 1st December 2001. Interconnecting over 3000 research and education organisations in more than 30 countries, GÉANT supports the development activities of the European research and education community, including new advanced applications and the exploitation of new networking capabilities. It serves a dual role, providing not only an infrastructure to support researchers but also a platform for network research itself. For the latter, it will be used as a testbed to introduce such technologies as quality of service, virtual private networking, multicast, network security and IPv6 into operational services.

In technical terms, the network is based on a multigigabit/s (Gb/s) resilient core, exploiting dense wavelength division multiplexing (DWDM) optical technology. Over the four year roll-out period, the project roadmap envisages that capacity will increase through the provision of additional wavelengths in the fibre-optic network. The overall capacity will increase rapidly and is expected to be of the order of 100Gb/s by 2004.

With research co-operation increasingly undertaken at a global scale, an important element of GÉANT is the development of connectivity with equivalent research networks in other regions. Connectivity with existing networks in North America (such as Abilene, Esnet and CANARIE) and in Asia-Pacific (such as SINET, KOREN and SingAREN) are being consolidated. For instance, following a memorandum of understanding signed earlier this year, three dedicated 2.5Gb/s links have been established between the EU and North American research networks. For Asian countries, the newly-established Trans-Eurasia Information

Network (TEIN) provides a direct link between the EU and Asia-Pacific (i.e. not routed via the US). EUMEDCONNECT, part of the EUMEDIS initiative, aims to enhance research connectivity within the Mediterranean region, and is expected to establish a direct connection to GÉANT by the beginning of 2003. And in support to @LIS, the EU-Latin American Information Society initiative, IST's CAESAR project is investigating a direct connection between GÉANT and similar research networks in Latin-America. Linkages with Russia, the Balkans and Caucasian countries are also being pursued or reinforced.

While these bilateral agreements are making some progress, it is apparent that a global dialogue is needed. The European Commission is playing an active role here and is a founding partner of the Global Terabit Research Network (GTRN). Launched at a meeting in Brussels in May 2002, GTRN is an international partnership to establish a global backbone comparable in speed and reliability to the national and multinational research networks. The initial partnership between Europe and North America was formalised earlier in the year. This is

now being extended to Asia-Pacific through connection to Japan and Korea. China and other countries in the Asia-Pacific are expected to connect in due course. Similarly, Latin-American research networks will associate themselves to this global initiative.

Member States and the European Parliament have recognised the value and strategic importance of recent improvements in research infrastructure. In the Sixth Framework Programme, a total of €300 M has been allocated for topics related to research networks, a doubling of the budget compared to FP5. Reflecting their capital-intensive nature, the majority of these activities will be undertaken through the Research Infrastructures priority within the Specific Programme on Structuring the ERA. The work will be driven by four inter-linked objectives: reinforcement of the network infrastructure to the 100Gb/s level and beyond; further contributions to improving global connectivity; support for high performance grids; and the promotion of large-scale experimentation on next generation networks.

### Connectivity for a purpose

*With high-speed networks becoming strategically important to the European research and education communities, it is essential to ensure that future developments reflect users' needs. A new project, SERENATE, will provide inputs for decision-makers on policy initiatives necessary to keep European research networking at the forefront of worldwide development, and enhance the competitiveness of the European Research Area.*

*Specifically, SERENATE is developing cost-estimates for the networking scenarios outlined in the eEurope Action Plan, which envisages evolution towards speeds of 100Gb/s and beyond. The strategic development of such "superfast" networks is being assessed, looking into the technical, organisational and financial aspects, the market conditions and the regulatory environment. Inputs are being obtained through a series of stakeholder workshops.*

#### IST Action Lines:

IST-2002 VII.1.1  
IST-2002 VII.1.2

Extending the reach of Research Networks  
Advanced experimental infrastructures

#### Project References:

CAESAR  
GÉANT  
SERENATE

IST-2001-35412  
IST-2000-26417  
IST-2001-34925

[www.dante.org/caesar](http://www.dante.org/caesar)  
[www.dante.org/geant](http://www.dante.org/geant)  
[www.serenate.org](http://www.serenate.org)

#### Commission Contacts:

Mario Campolargo  
Bernhard Fabianek

[mario.campolargo@cec.eu.int](mailto:mario.campolargo@cec.eu.int)  
[bernhard.fabianek@cec.eu.int](mailto:bernhard.fabianek@cec.eu.int)

#### Web:

[www.cordis.lu/ist/rn](http://www.cordis.lu/ist/rn)  
[www.dante.org](http://www.dante.org)

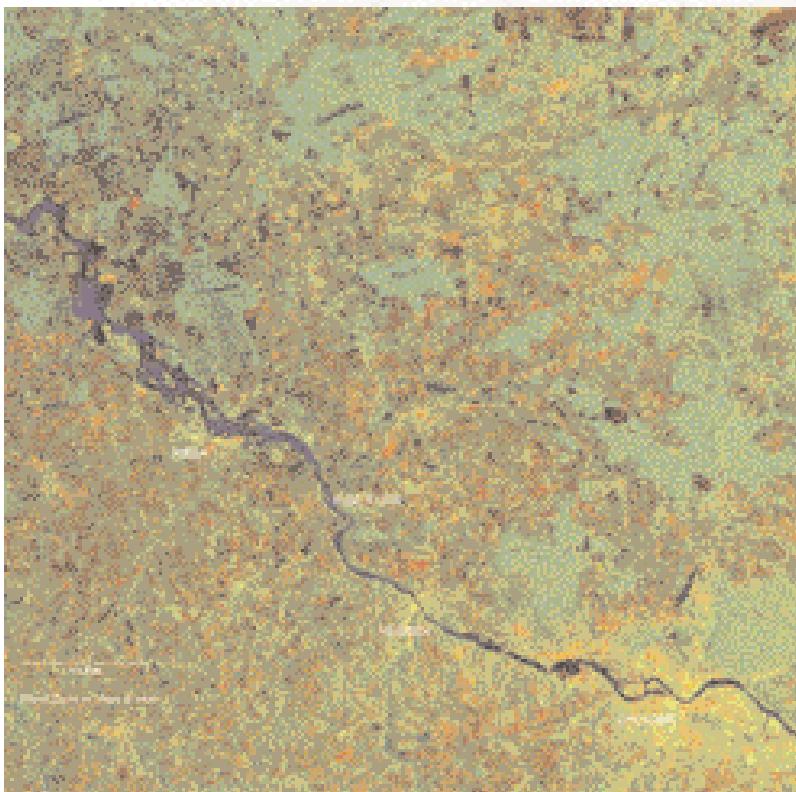


# Effective emergency management

**D**espite 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, industrial accidents and forest fires.

By its very nature emergency management is highly pressurised. Life and death decisions have to be taken at short notice, often on the basis of inadequate

With current emergency management systems, actions are often planned and executed with a limited understanding of the size and severity of the event, which hampers the authorities in promoting appropriate measures. Furthermore, even if the magnitude of the event is adequately recognised, the totality of information available from various sources may be only partially utilised. Smart approaches using ICT, such as land use maps generated from satellite images, forest fire propagation models, and hand-held personal assistants for rescuers, can significantly improve the way the situation is managed.



Flooding on the River Elbe, Aug 2002 (Photo: ESA)

Work under the IST Programme aims 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 citizens’ awareness of environmental risks.

Generally, a unified approach to emergency management has been missing at the European level. Each civil protection authority operates within a local, regional and national context, but emergencies do not respect administrative boundaries. Open access to European information

information. Even if data is available it can be difficult for people to analyse quickly enough to feed into the decision process. In such situations information and communication technologies can save lives.

resources, guidelines and methodology can add greatly to prediction and effective management. Consequently, a number of IST projects target standardisation and interoperability. FORMIDABLE, for

## Holding back the flood

*OSIRIS is analysing organisational structures and procedures for coherent flood crisis management. All stages of flood risk management are taken into account, from preventive measures, action planning, monitoring and forecasting, to warning, attenuation measures, crisis management and post-event monitoring. The project utilises a combination of knowledge management tools and communication systems, such as wireless devices, street display panels, public terminals and websites, aiming to increase citizens’ awareness and participation.*

instance, is developing a standard European methodology for data access and natural hazard management for use by civil protection authorities across Europe. This and an interoperable support system prototype are being tested in field trials in Italy and Spain. Meanwhile, CLIFF is performing a critical analysis of past and on-going flood and fire projects to identify guidelines, recommendations and possible strategies for standardisation of disaster management. Actor workshops were held in February 2001 and June 2002.

Also concerned with standardised tools, EGERIS aims to provide regional and national authorities with effective ICT support for emergencies in the preparedness and response phases. The project focuses particularly on telecoms, the weak link in the management chain. Systems are being developed for open IP communications, handheld communications and vehicle-mounted information centres. These will host a full range of communication, information and decision-making functions. The pilot trial covers four sites.

RISK FORCE is gathering actors from IST projects and national institutions to develop a shared European protocol for natural risk management, service specifications and implementation plans. European agencies are being invited to sign a Memorandum of Understanding on the use of these standards, which deal with all phases from prevention to post-crisis management.

Our societies are threatened not only by natural or technological catastrophes but also by civil security risks, such as political terrorism. Hence, work on risk management under the Sixth Framework Programme will take an holistic approach, aiming to apply ICT to prevent or mitigate a wide range of risks and security situations. In addition to RTD, support will be provided for standards, training, take-up activities by public bodies and the development of service provider networks. Further support is anticipated for the Global Monitoring for Environment and Security (GMES), a joint initiative of the EU and the European Space Agency (ESA).

### A view from above

*Satellite observation of earth events can be an invaluable tool in the prediction, containment, control and decision support for various kinds of natural disaster. However, satellite images are not always easy to interpret. For example, it can take a week to achieve accurate geo-referencing of the locations shown in a satellite picture, which is far too long in a flood or forest fire emergency.*

*EOLES aims to improve the effectiveness of space observation data for meteorological and environmental early warning and decision support. It will concentrate on internet delivery of large satellite images, efficient geo-referencing within three hours, and object-oriented image enhancement techniques. These will help people to spot key features for crisis management.*

IST Action Lines:	IST-2002 I.4.1	Intelligent systems and services for civilian and environmental crisis management	
Project References:	CLIFF	IST-1999-14104	<a href="http://styx.esrin.esa.it/cliff">styx.esrin.esa.it/cliff</a>
	EGERIS	IST-2000-28345	
	EOLES	IST-1999-57450	
	FORMIDABLE	IST-1999-11679	<a href="http://www.formidable-project.org">www.formidable-project.org</a>
	OSIRIS	IST-1999-11598	<a href="http://www.ist-osiris.org">www.ist-osiris.org</a>
Commission Contacts:	RISKFORCE	IST-2001-37203	
	Guy Weets	<a href="mailto:guy.weets@cec.eu.int">guy.weets@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka1/environment/home.html">www.cordis.lu/ist/ka1/environment/home.html</a>		
	<a href="http://gmes.jrc.it">http://gmes.jrc.it</a> (GMES)		

# Connected tourists

**T**he emergence of the e-economy is revolutionising Europe's tourism industry. The key to this new development is information, which has the power to enrich all stages of the travel experience. ICT can help the tourist choose a destination, find (and book) the transport and reserve accommodation. ICT can also help them decide what to do and where to visit, and give route information with points of interest. These changes extend far beyond simple e-commerce, and go to the core of the industry's business processes. All involved have to rethink their products, business models and marketing channels. Operators such as hotels, restaurants, travel agencies, car rental companies, visitor attractions and tourist offices are re-examining their customer relationships.

Many are seeking co-operation with partners and establishing networks of alliances.

Each service provider must face the challenge of packaging information so that it is accessible, reliable and up-to-date. Historically, the sector's information management has been based on large centralised systems, mainly for air transport, car rentals or hotel chains. At first there was little direct customer access, although more recently front-end web portals for business-to-consumer (B2C) transactions have been added. In the near future, the main activities will be not only B2B and B2C, but also service-to-service as virtual networks of specialised enterprises emerge offering value-added ICT-based services.



Tourism offers many opportunities for IST services

Tourism RTD under the IST Programme aims toward tourism information systems based on open standards and protocols. The work covers a broad spectrum of services based on interoperable ICT-intensive components and systems. Customisable interfaces for accessing relevant information and services in a mobile context are supported. Another key emphasis is on innovative business models and systems to support the tourism value chain. Applications include booking and reservation, trip planning and guidance supported by 3D reconstruction and e-commerce brokering.

## Climb every mountain

Although some people may take to the mountains to get away from it all, hikers and mountaineers could benefit from a variety of mobile communication and navigation services. PARAMOUNT (as well as TOURSERV) is investigating the delivery of such services via GSM or UMTS and linked with satellite navigation and geographical information systems. Services will include map download, positional information, places of interest, routing and guidance, 3D visualisation, weather forecasts, avalanche prediction and safety tracking. The application will be trialled in Alpine and Pyrenean mountain regions where there is sufficient mobile signal coverage.



Platform integration and harmonisation are features of a number of the RTD projects in this sector. DAFNE is a take-up action to downstream the results of the FETISH network, a Europe-wide infrastructure integrating a wide range of tourism applications, resources and processes. HARMONISE will deliver tools and protocols reconciling the semantics of the different existing tourism related standards. ESTIA is addressing a B2C platform for the tourist industry by creating added value services that are accessible from mobile devices. These will include personalised travel information, brokerage platforms, virtual tourist trails for targeted market segments. E-TOUR aims at mobile access to integrated multimedia tourism resources, sent via the internet to PDAs.

Like several of the projects EUREAUWEB targets a specific tourist domain, in this case Europe's waterways. A portable audio-visual device will give access to context-sensitive multimedia information, the EurEauMap. A waterways web portal will offer data resources for downloading before and during a trip, such as places of interest, restaurants, service points, wildlife and activity data.

The integration of e-commerce solutions with tourist information features in a number of trials. CAPITALS ITTS addresses travel and tourist services in cities and is being trialled in five European capitals. Data from many local sources, such as traffic and coach parking information, will be integrated in a single platform. M-TOGUIDE will develop and trial a multi-network GPRS/UMTS-based platform delivering personalised tourism information and services through a PDA.

## Where am I?

*The vision of anytime-anywhere access to information services is dependent on the ability to sense the context in which the information is being used. This requires establishing a link between the current location and the user's personal profile.*

*AMBIESENSE is exploring the innovative concept of "context tags". These are wireless markers that may be placed in various places such as in buildings, furniture, restaurants or vehicles. Their purpose is to make themselves known to the tourist's PDA and so establish a well-defined context that can then be tied to data resources and intelligent agents in a tourist information system. This concept will be tried in the city of Seville and at an international airport.*

Research within the Sixth Framework Programme will continue to focus on making tourism systems more useful and user-friendly, in particular through the multi-channel distribution of knowledge and value added services. This will require open frameworks, distributed architectures, common semantics, knowledge sharing, and the emergence of new business models. Research may also address information mining and decision-making processes. Progress will be needed in interactive mobile, wearable, multi-sensorial and multilingual devices and interfaces, virtual reality and location-aware user profiling. Solutions for people with special should also be addressed.

IST Action Lines:	IST-2001 I.5.3	Ambient intelligence application systems for mobile users and travel/tourism businesses	
	IST-2001 I.5.4	Best practice and trials in transport and tourism	
Project References:	AMBIESENSE	IST-2001-34244	<a href="http://www.ambiesense.com">www.ambiesense.com</a>
	CAPITALS ITTS	IST-2000-30038	<a href="http://www.eu-capitals.net/">www.eu-capitals.net/</a>
	DAFNE	IST-2000-35113	<a href="http://fetish.t-6.it">fetish.t-6.it</a>
	ESTIA	IST-1999-20962	<a href="http://estia.sema.es">estia.sema.es</a>
	E-TOUR	IST-1999-20447	<a href="http://www.elios.dibe.unige.it/etour">www.elios.dibe.unige.it/etour</a>
	EUREAUWEB	IST-2001-34182	<a href="http://www.eureauweb.co.uk">www.eureauweb.co.uk</a>
	FETISH	IST-1999-13015	<a href="http://fetish.t-6.it">fetish.t-6.it</a>
	HARMONISE	IST-2000-29329	<a href="http://www.harmonise.org">www.harmonise.org</a>
	M-TOGUIDE	IST-2001-36004	<a href="http://www.mtoguide.org">www.mtoguide.org</a>
	PARAMOUNT	IST-2000-30158	<a href="http://www.paramount-tours.com">www.paramount-tours.com</a>
Commission Contacts:	TOURSERV	IST-1999-20414	<a href="http://www.tourserv.com">www.tourserv.com</a>
	Brice Lepape	<a href="mailto:brice.lepape@cec.eu.int">brice.lepape@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka1/trans_tourism/home.html">www.cordis.lu/ist/ka1/trans_tourism/home.html</a>		



# Natural interaction

**D**espite the efforts of designers and engineers over many years, most people still find ICT applications, devices and services complex. As users, either we waste time in trying to get the service or device to function as intended or, more likely, we give up altogether. Only the most enthusiastic or technically-aware are prepared to invest the time and effort into getting the most out of the system. We still have a long way to go to make applications truly “user friendly”.

It is now widely agreed that future systems will have to take user behaviour into account, based on awareness of how people communicate and interact, and what they want to do and achieve. We need to design systems that are easier and more intuitive to use. As well as the usual keyboard, this means an ability to recognise and respond to actions such as touch, pointing, speech, gesture and expression. These so-called multimodal interfaces offer the prospect of making machines, systems and services much more productive. In particular, speech, being the most natural means of human interaction, is likely to be one of the most important modalities in future systems.

Natural interactivity is a key theme under the IST Programme’s RTD in Human Language Technologies (HLT). The research aims to enhance the naturalness of human-computer interactions and the effectiveness of interpersonal communications. Areas covered include multilingual input-output with speech, language, multi-modal interaction and technology-mediated communication between people. Key issues are the performance, reliability and scalability of embedded speech and language technologies for applications in the home, e-work and on the move. HLT now has a portfolio of around 50 projects concerned with natural and multi-modal communication across a wide range of scenarios.

Among the most recent projects, NICE will demonstrate natural, interactive access for edutainment applications. Marrying professional computer games technologies with advanced speech recognition technology, the project will develop systems able to recognise the speech and spoken linguistic behaviour of children and adolescents. The system will be applied to enable fun and experientially-rich communication between the users and virtual historical and literary characters.

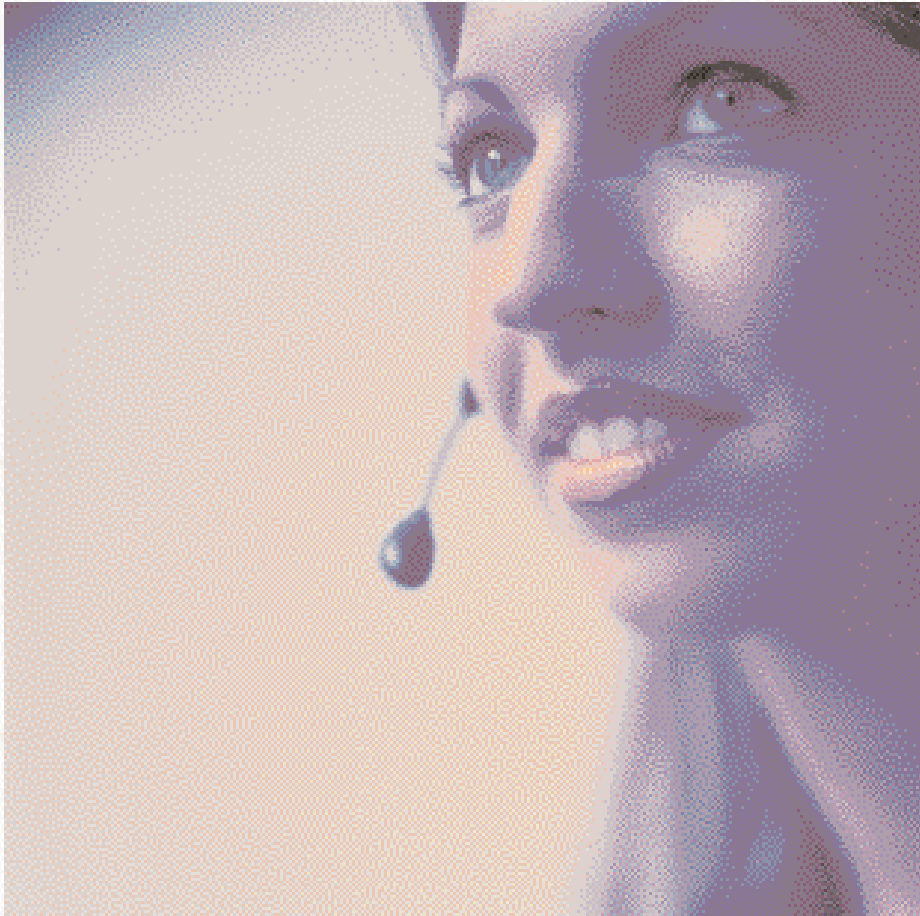
FAME targets new tools for human-human communication integrating speech, vision and dialogue. The project will construct an “information butler” – an intelligent agent able to facilitate communication between people at separate locations and from different cultures, working on solving a common problem. This agent will be context-aware and able to blend information from both electronic and physical channels. The result will be a demonstration of integrated computer-enhanced human-to-human communication, with a public demonstration planned for the Barcelona Cultural Fair in 2004.

Natural interaction modes will remain central to future work on new, more user-friendly interfaces. Priorities under FP6 will be threefold. Firstly, understanding the user, in particular his expectations and behaviour in relation to the mobile applications and services which will be made possible by the new interaction and communication technologies. Secondly, developing enabling technologies, such as speech recognition in adverse conditions, vision, gesture and touching, on which new interactive systems can be built. Thirdly, exploring new interaction paradigms, such as the use of avatars, conversational interfaces, and all-senses communication.

## Multilingual e-commerce services

*Businesses must strive to find innovative and cost-effective channels in order to reach out and attract customers. While much has been achieved in today's e-commerce systems, in most solutions the face-to-face interaction that provides customers with a sense of comfort and security is missing.*

*NESPOLE! is addressing this problem by integrating automatic speech-to-speech translation in e-commerce and e-service environments. Using standard communication protocols, multilingual features and functions are being combined with existing videoconferencing software such as Microsoft Net Meeting. The resulting speech-to-speech translation systems will be demonstrated in two showcases, in a travel agent and a technical helpdesk.*



Future systems will make greater use of speech interaction

### The emotional computer

Generally in human behaviour two modes of interaction can be distinguished: firstly, the transmission of explicit messages about specific topics; and secondly, implicitly transmitted messages about the speaker. While significant linguistics and language technologies have been committed to understanding the first explicit behaviour, the second area is less well researched. A new project, ERMIS, aims to develop a prototype system for human-computer interaction that can interpret its users' attitudes or emotional states, e.g. activation/interest, boredom and anger, in terms of their speech and/or their facial expression and gestures.

A number of techniques are used to interpret the user's emotional state including speech analysis, robust speech recognition, facial expression analysis, and hybrid, neurofuzzy techniques. A major application area of this technology is in synthetic agents, which can communicate with humans in a natural way, thus permitting the development of sophisticated human-like interfaces between humans and computers in a host of online applications. Call/information centres and next generation PC interfaces have been selected to test the performance of the ERMIS system.

#### IST Action Lines:

IST-2001 III.3.2  
IST-2001 V.1.2

Natural and multilingual interactivity  
CPA2: Multimodal and multisensorial dialogue modes

#### Project References:

ERMIS  
FAME  
NESPOLE!  
NICE

IST-2000-29319  
IST-2000-28323  
IST-1999-11562  
IST-2001-35293

[www.image.ntua.gr/ermis/](http://www.image.ntua.gr/ermis/)  
[www.fame-project.org](http://www.fame-project.org)  
[nespole.itc.it](http://nespole.itc.it)  
[www.niceproject.com](http://www.niceproject.com)

#### Commission Contacts:

Giovanni Varile

[giovanni.varile@cec.eu.int](mailto:giovanni.varile@cec.eu.int)

#### Web:

[www.hltcentral.org](http://www.hltcentral.org)  
[www.cordis.lu/ist/cpt/cpa2.htm](http://www.cordis.lu/ist/cpt/cpa2.htm)

# The intelligent transport network

**T**ravel delays and congestion are common features of day-to-day life in Europe. The direct costs to EU Member States are more than €120 billion per year and a further €160 billion a year may be attributed to road accidents. With environmental impacts taken into consideration, the true costs are even higher. Over 1.5 billion people travel by air each year and annual passenger growth averages 6-7%, with the result that Europe's airports and airways are becoming ever more congested. At the same time, the share of more environment-friendly traffic modes, such as sea and rail, continues to decline.

whole and encourage balanced use of services. For instance, travel and traffic management services can tell road users what is happening ahead so that they can plan their journeys 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.



Within the IST Programme, RTD on intelligent transport infrastructures addresses all transport modes and EU policy priorities. Work focuses on improved efficiency through traveller information, congestion control, demand management and innovative network optimisation tools. Enhanced safety is also addressed through aspects such as traffic control,

Research in IST has a significant role to play in optimising the use of transport networks. Effective use of IST can improve their quality and efficiency, and enhance their capacity without requiring major investment in new infrastructure. It can also help rationalise energy use and reduce environmental pollution. By making multi-modal transport easier, IST can improve the efficiency of transport structures as a

incident and emergency management systems and driver assistance. Open systems and architectures and standardisation initiatives aim towards the interoperability of different systems.

For instance, PRIME addresses the detection and management of incidents on motorways. Its aims are to predict incidents as an input to traffic management,

## Safe tunnels

*Safety in road and rail tunnels is a major concern in Europe. SAFE TUNNEL is developing a system for trial in the Frejus area that aims to reduce HGV incidents by 40% and fire incidents by 50%. It combines vehicle-borne sensors and infrastructure-based support technologies.*

*Also concerned with tunnel safety, SIRTAKI is developing an advanced tunnel management system featuring real-time decision support and a knowledge bank of past events. Trials in France, Germany, Italy and Spain aim to improve safety and to lessen the stress on the people involved when tunnel incidents do happen.*

detect and verify incidents and finally support integrated management strategies. The methods are being verified using simulation and on-line data. EYE-IN-THE-SKY focuses on the management of large events and crises by means of surveillance and providing a secondary communication infrastructure from an airship. A fusion of data from the airship, static sensors, vehicles and geographical information systems will support traffic monitoring, fleet management and security. A trial will take place in Athens in 2004.

Intelligent transport systems depend on accurate sensing of traffic conditions. Modern research favours video-sensing techniques over the older loop-sensing methods, though it is still important to evaluate the relative merits of various techniques. This is the work of RHYTHM, which is evaluating methods of state estimation, queue tail tracking, travel time estimation and traffic ramp metering. The final objective is to deliver two enhanced algorithm prototypes. It has long been known that co-ordinated control of traffic flow can improve journey times through congested areas. SMART NETS is developing and testing in three

European cities a traffic-responsive urban control strategy, which may constitute a breakthrough. Designed for saturation conditions where other systems perform poorly, this may lead to savings of about 40% compared with decentralised control and may offer advantages over other commonly deployed systems.

OMNI targets an intermediate middleware layer in transport management systems that will isolate applications from the specific details of sensors. This will help transport authorities get value for money from legacy systems when they upgrade their transport management. SMITH is a dissemination project that provides a showcase for suppliers of new intelligent transport products.

Research on transport networks in FP6 is likely to focus on an open telematics framework for end-to-end service delivery, in-vehicle communications systems, open communications platforms, vehicle-to-vehicle and vehicle-to-infrastructure communications, and precision positioning technologies.

### Shipping guidance and control

*Over 90% of the EU's external trade is sea-borne, as is some 30% of intra-Community traffic. Ships operate in more congested waters, with higher speeds and with much stricter requirements to timeliness and cost of operation.*

*Several IST projects are addressing the needs of the shipping sector. IPPA combines vessel traffic services (VTS), satellite positioning, electronic nautical charts (ENC), automatic identification system (AIS), internet and mobile communication in order to develop an advanced system that aids pilotage of vessels in confined and restricted waters. And ITEA-DS is aiming to develop new ways and tools for integration and fusion of data onboard and onshore for safer and more efficient ship operations.*

IST Action Lines:	IST-2001 I.5.2 IST-2001 I.5.4 IST-2002 I.5.1	Integrated vehicle infrastructure systems Best practice and trials in transport and tourism Systems for mobility: take-up and clustering activities
Project References:	EYE IN THE SKY IPPA ITEA-DS OMNI PRIME RHYTHM SAFE TUNNEL SIRTAKI SMART NETS SMITH TRANS-3	IST-2000-29531 IST-1999-20569 IST-1999-20254 IST-1999-11250 IST-1999-13036 IST-2000-29427 IST-2000-28099 IST-2000-28303 IST-2000-28090 IST-1999-12340 IST-1999-20385  www.ippa.qinetiq.com www.portauthority.li.it/itea-ds.htm www.omniproject.net www.prime-project.gr www.ist-rhythm.com www.crfproject-eu.org www.sirtakiproject.com www.smart-nets.napier.ac.uk www.smithtitos.com www.rapp.ch/div/trans3/index.htm
Commission Contacts:	David Callahan	david.callahan@cec.eu.int
Web:	www.cordis.lu/ist/ka1/trans_tourism/home.html	



# Digital past, digital future

**F**or many European archives, libraries and museums being digital is no longer an option but a reality. With conventional resources being digitised and others being “born digital”, cultural institutions are having to take care of both analogue and digital collections. The conversion of all sorts of cultural contents into bits and bytes opens up opportunities for reaching traditional and new audiences in ways that were unimaginable a decade ago. But the integration and management of new digital technologies in the cultural sector also presents substantial challenges. They affect the very core of how cultural institutions operate.

This new context for cultural and memory institutions is addressed under several of the IST Programme’s projects on digital cultural heritage. The work focuses on technical and organisational issues regarding distributed collections and very large-scale digital repositories. This includes content management and long-term preservation. Models for future virtual collections and guidelines for integrating real and virtual objects and collections are also emphasised.

To help decision-makers in the cultural heritage sector to build and exploit the emerging digital landscape, the Programme commissioned a major foresight study



## Your personal guide

*Archaeology is not always thought of as being at the cutting edge of technological research, but developments in ICT present the discipline with important opportunities. For instance, ARCHEOGUIDE offers a new approach for interpreting and visualising material in historic buildings or archaeological sites based on augmented reality.*

*Visitors are provided with a see-through head-mounted display which receives audio-visual information, via a mobile tracking system, that helps them to explore the site. The information presented reflects the user’s position and orientation within the site, and is also personalised to take account of the visitor and tour profiles. Demonstrators have been developed for three mobile platforms based on a laptop computer, pen-tablet computer and PDA. Other system components include a GPS receiver, digital camera and head-mounted display. It has been demonstrated and evaluated on site in ancient Olympia in Greece.*

looking at trends in the European cultural heritage sector over the next five years. The resulting report, entitled *Technological Landscapes for Tomorrow's Cultural Economy* (known as the DigiCULT Report), provides a strategic roadmap for future developments.

The study presents an in-depth analysis of the technologies, organisational models, cultural services and applications as well as user demand in European archives, libraries and museums. It highlights the surrounding legal and policy framework against which these developments are taking place. And it draws conclusions and provides recommendations on measures to be taken to exploit the opportunities and to overcome current technological, organisational and legal barriers. The study drew on inputs from more than 180 international experts, both practitioners and policy-makers, from Europe, the United States, Canada and Australia. They shared their opinions on future trends in the cultural heritage sector through interviews, workshops and an online Delphi survey.

The DigiCULT report carries important messages in four key areas. Firstly, it highlights the need for a comprehensive cultural heritage policy. This should go beyond simply the digitisation of analogue resources to include wider issues of cultural expression and the participation of small and under-resourced institutions in the cultural digital economy. A second issue is

organisational change. Introduction of ICT can create many tensions for cultural institutions, but at present many lack a clear strategy with regard to their business processes or the type of strategic partnerships and alliances they may need. Exploitation is another area where cultural institutions are under pressure, and some see the increasing economic imperative as a threat to their mission. They have to find the appropriate business models, and in particular learn to manage the risks. Fourthly, cultural institutions have to get to grips with technology. Key issues here include embracing the use of rich, highly interactive environments, digitisation, integration and technical obsolescence, and the need to preserve digital resources for the long term.

The results of the study are being widely disseminated and provide a sound basis for activities in digital cultural heritage under the Sixth Framework Programme. To further consolidate the findings DIGICULT-FORUM has been launched. This is a pool of 50 culture and technology experts who meet on a regular basis to discuss technological trends and related issues affecting the future of the European cultural heritage sector. Accompanied by further technology watch studies, the Forum will facilitate and stimulate cross-sector, cross-border co-operation between practitioners, policy-makers and ICT supply industries.

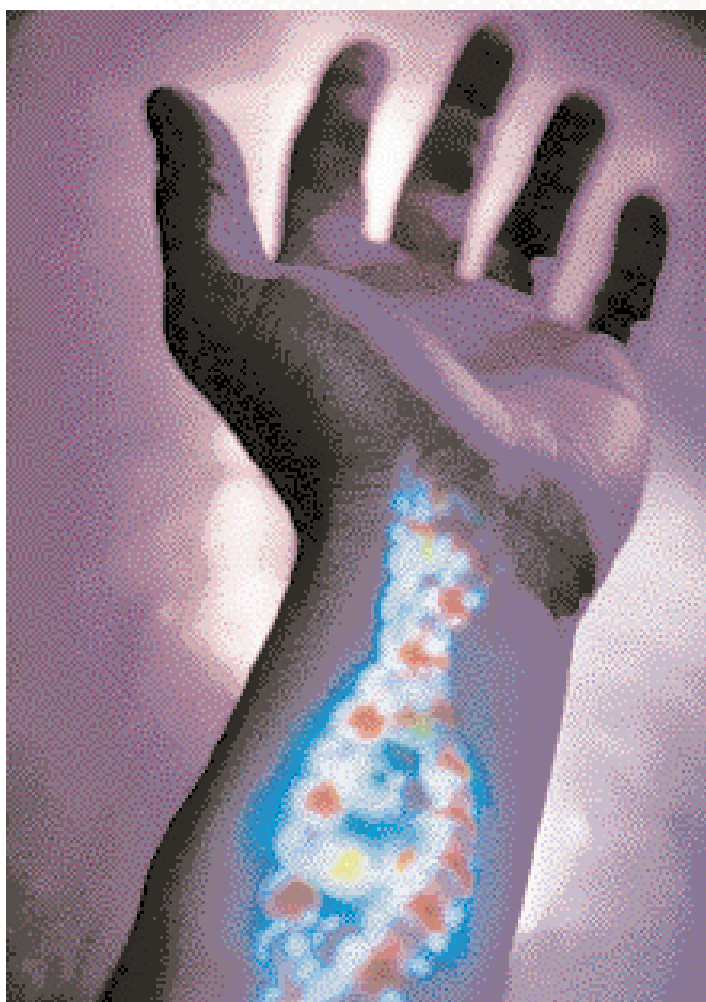
### This way for the tour

*There was a time when a museum or library was a physical location. You had to visit the building to access its collections or experience its artefacts. This is no longer the case. TOURBOT has developed an interactive tour guide robot able to provide individual access to a museum's exhibits over the internet. TOURBOT's "avatars" operate as the user's personal guide in the museum by accepting commands over the web that direct it to move in its workspace and visit specific exhibits. The robots enable a more effective use of exhibition space, greater interactivity, and can be particularly advantageous for people with restricted mobility. The system is also able to guide on-site museum visitors.*

IST Action Lines:	IST-2001 III.1 IST-2001 III.1.3	Interactive publishing, digital content and cultural heritage Next generation digital collections	
Project References:	ARCHEOGUIDE DIGICULT-FORUM TOURBOT	IST-1999-11306 IST-2001-34898 IST-1999-12643	archeoguide.intranet.gr www.digicult.info www.ics.forth.gr/tourbot
Commission Contacts:	Bernard Smith	bernard.smith@cec.eu.int	
Web:	www.cordis.lu/ist/ka3/digicult www.digicult.info		

# Improved healthcare delivery

**I**n healthcare, the work of medical practitioners at all levels is becoming more information intensive as sophisticated medical equipment and computer applications are more widely used. At the same time, demands on healthcare budgets are increasing in the face of medical and scientific advances, an ageing population and changing patient expectations. Digital technologies are becoming more important in health management both at individual practitioner level and at national and regional level. They offer the potential to



*Genomics is leading to a revolution in healthcare*

reduce administrative costs, to deliver healthcare services at a distance, and to avoid unnecessary duplication in examinations. In addition, individual citizens are increasingly using the internet to obtain medical information.

The European Union has supported research and development in IT for healthcare for more than 10

years. Over this period EU RTD has contributed significantly to advancing health telematics throughout Europe, helping to develop not just specific applications but the underlying infrastructures needed for new solutions to be taken up throughout the European health community. Examples of successes include integrated regional health information networks, standardised electronic health records, reliable and effective systems for telemedicine (teleconsultation and home telemonitoring), as well as personal systems for citizens to support and manage their health status.

Whereas in the past health-related RTD focused on solutions for particular professional groups, such as general practitioners, surgeons, pharmacists etc., in future the emphasis will be in interconnecting these different constituencies within a "health knowledge infostructure". This vision of knowledge for health goes far beyond simply linking up professional users. It means putting in place systems and services to meet the needs of patients, to ensure they receive the best possible quality of care, and of citizens, to ensure they are able to stay healthy and to protect their general well-being. Such approaches must be backed by the highest standards of privacy, security and ethics. Furthermore, given the huge advances being made in biotechnology in being able to decode our genes, links between health informatics and bioinformatics is likely to be a key feature of future health systems.

In the meantime, diffusion of the substantial expertise already accumulated in e-health technologies through to the user community remains a key challenge. The IST Programme supports a variety of actions to promote the uptake of health telematics applications by healthcare providers and administrations. Best practice actions aim to validate existing e-health solutions in a real-world setting, while trials involve large-scale demonstrations with clear European impact.

For ICT to help improve health delivery systems, the health community needs comprehensive and reliable information on healthcare models. All the players recognise this need as crucial, but such information is not always accessible. HIN-EUROPE will build an online repository of generic data and information to help all players develop new models of healthcare employing ICT.

The convergence of medicine and genomics is giving rise to molecular medicine. This new area promises the development of new diagnostic and therapeutic solutions personalised to the genetic traits of patients. The twin disciplines of bioinformatics, the application of informatics in the processing of genetic information, and medical informatics, the application of informatics in the processing of health information, are beginning to interact. The core of the BIOINFOMED project is to study common areas of interest between these disciplines, identify opportunities for collaboration and explore areas of potential synergy.

Health-related IST research in the Sixth Framework Programme will support the evolution towards more knowledge-intensive healthcare systems. Activities are

likely to focus on intelligent systems to support health professionals, to provide patients with personalised healthcare and information, and to stimulate health promotion and disease prevention in the general population. These are likely to bring about quantum leaps in medical therapies and support the efficiency and effectiveness of future health delivery systems. There is also the possibility to promote e-inclusion here through technologies that are essentially empowering and barrier-free. Such knowledge and communication systems could be constantly available, portable, and even wearable, so that they can be accessed in people's homes, on the move, in the workplace or in public settings.

Common technology themes are likely to include mobile networks and systems capable of delivering personalised health information, status and care on the move and in various remote locations. Such personalisation might be based on genetics, habits, environmental issues, background and education. Strong and active collaboration among professionals is implied.

### Sharing experiences in healthcare

*IFG is the organiser of the European Health Forum Gastein (EHFG) which provides a platform for discussion for the various stakeholders in the field of public health and healthcare. The Forum has become a unique annual event bringing together representatives of health agencies, practitioners, patients, and the healthcare industry to debate key health issues. Integrating various national, regional and European perspectives, the forum facilitates the exchange of views and experience among key actors and experts. It provides a framework for developing European health policy while recognising the importance of national and regional decision-making bodies.*

IST Action Lines:	IST-2002 I.1.2	Systems for health professionals: creating a "Health knowledge info-structure"
Project References:	BIOINFOMED HIN-EUROPE IFG	IST-2001-35024 IST-2000-31127 IST-2001-92502
Commission Contacts:	Ilias Iakovidis	ilias.iakovidis@cec.eu.int
Web:	www.cordis.lu/ist/ka1/health	



# Diffusing the landmine legacy

**A**nti-personnel landmines (APLs) are an horrific feature of modern warfare. Cheap to produce and easy to deploy, landmines have been planted in their millions in conflicts around the world. Once planted, landmines can be difficult to detect and retain the potential to maim and kill for many years. Apart from the personal suffering, they also block the progress of economic reconstruction and development of the whole society. Around 60 countries are known to be affected, with the total contaminated area estimated to be one million square kilometres. Over recent years they have become a problem for Europe too. All too often warring parties leave the locations of mine fields undocumented, and even where locations are known mines can be disturbed by flooding or other environmental factors.

Present clearance techniques are painstakingly slow and, with tens of millions of mines to be tackled, there is an urgent need for reliable solutions that can speed up mine clearance. Current detectors have high false alarm rates, limited ability to detect small low-metal content APLs, and poor performance in certain environments (such as mineralised soils). As well as the location and clearance of individual mines, accurate delineation of the affected area (“area reduction”) is critically important, allowing agencies to intensify their efforts on clearly defined areas which are known to contain mines. While high-level aerial photography is not effective for detecting APLs, a more promising approach is to use low-flying unmanned aerial vehicles equipped with multiple sensors to define the limits of the mined area.

Building on earlier work started under Esprit, demining RTD under the IST Programme aims primarily to strengthen and support EU policies and operational

efforts under the Stability Pact of 1999. Through innovative RTD projects, IST expects to increase the efficiency of equipment for mine action programmes in South Eastern Europe and improve European know-how in developing specific tools for area reduction and mine clearance. Some of the work is applicable not only to environmental demining, but also to more general civil security applications such as the detection of explosives.

Initial work focused on combining existing sensors into detection systems through the use of advanced signal processing methods, software and hardware. Particular advances have been made in the use of low-cost high-performance computing systems, and new algorithms for complex signal processing such as for ground-penetrating radar (GPR).

The emphasis has now shifted to the development of new sensors and sensor arrays. The aim is to increase detection and reduce false-alarm rates by combining different sensors reacting to different physical or electromagnetic characteristics of buried objects. This is achieved by combining data from several types of sensors, known as multi-sensor data fusion. Projects in this area are aiming to integrate conventional sensors, such as metal detectors (MD), GPR, radiometers and infrared (IR) sensors, and to improve the processing and interpretation of data from such multi-sensor systems through the development of new algorithms. Concurrently, some new sensors are being developed which aim at detecting minute traces of explosives rather than mines themselves.

Two projects are yielding promising results in relation to area reduction. ARC targets surveying by an unmanned aerial vehicle (UAV, in this case a small helicopter), loaded with optical, infrared and other

## Community building for European demining

*European demining expertise is highly fragmented, a factor which constitutes a major barrier to the new technological solutions. EUDEM2 is an EC co-funded support project involved in networking, technology watch and community building. It aims to strengthen the EU's current knowledge base about humanitarian demining through surveys of the current state-of-the-art and analyses of future research needs, and by providing relevant information to demining researchers. Contact is being made with many experts by way of workshops and interviews with key actors, to obtain information about current capabilities and impediments to progress. The project's website provides a portal for European demining information and expertise.*

sensors. This system, which links novel image analysis with data fusion and a geographical information system, is in extensive trials and should make for effective targeting of affected areas. SMART concentrates on powerful ways of analysing collected data. This includes data from aerial surveys, but also land cover classification, and detected anomalies in land cover or appearance. During trials this is compared with “ground truth” data, that is data collected by mine clearance by existing methods. This system does not aim for automatic detection but to give maximum support for computer-aided interpretation by human operators. It will transform raw data into metadata, and combine expert data with context data.

The European Union is committed to the elimination of APLs by 2010. This is a challenging goal and its realisation depends on de-miners having new tools and equipment. Key areas for research under FP6 will include area reduction (through technologies both to detect the presence and the absence of APLs), improved sensing and analysis technologies, and novel techniques (e.g.explosive vapour detection). Improved co-ordination and co-operation within the European demining community, including SMEs with leading-edge technologies, will be crucial.



Manual demining, such as here in Cambodia, is painstaking work

IST Action Lines:	IST-2000 I.4.2	Data fusion and smart sensor technologies for humanitarian demining
Project References:	ARC	IST-2000-25300
	BULRUSH	IST-2000-26419
	CLEARFAST	IST-2000-25173
	EUDEM2	IST-2000-29220
	SMART	IST-2000-25044
Commission Contacts:	Russell Gasser	<a href="mailto:russell.gasser@cec.eu.int">russell.gasser@cec.eu.int</a>
Web:	<a href="http://www.eudem.vub.ac.be">www.eudem.vub.ac.be</a>	
	<a href="http://eu-mine-actions.jrc.cec.eu.int/demining.asp">http://eu-mine-actions.jrc.cec.eu.int/demining.asp</a>	

# E-democracy for all

Falling participation in the electoral process is an issue across the developed world. While the reasons for this are still hotly debated, the clear downward trend raises serious concerns for all those who believe in the democratic process. People's busy lifestyles imply that electoral and consultative processes need to be made more citizen-friendly. Forcing people to reorganise their day to be in a particular place at a particular time is a disincentive to participation.

By recasting the connection between the people and their government, electronic government can help revitalise democracy. E-government links people not just to each other and the e-commerce marketplace but also to the public marketplace of ideas and debate, and puts ownership of government back in the hands of the people. In reshaping our attitudes to government, IST presents important opportunities

not just for better government services but also for more direct involvement in participatory democracy. As people become accustomed to the advantages of online communication in the commercial marketplace, they will expect the same of government services, including the ability to communicate directly with their elected representatives.

For these e-democracy models to work, they need to be both inclusive and active. Inclusive means that they are open to all on an equitable basis – an issue that is much more complicated than merely providing universal access to computers. Active means opportunities for citizens to participate and influence all aspects of decision-making,



E-voting is becoming a reality

## The road to e-democracy

To help focus the research work in this domain a project cluster has been set up. The cluster aims at stimulating co-operation and synergies between all IST projects with interests in increased participation of citizens in democratic matters. In addition, it provides a platform for the exchange of ideas between all related European and international projects on e-democracy. In this way an early start towards the implementation of the European Research Area will be made and a bridge to the new instruments of the 6th Framework Programme. Already the cluster has managed to attract many experts in the field who are associated with private and public organisations at European and international levels.

These activities are facilitated through the support project EVE. This contributes by consolidating the knowledge base that is being acquired in the areas of technology, the industrial environment and foreseeable evolutions. It also contributes through project co-ordination and establishing links to relevant European and international activities. Creating awareness is vital for the mainstreaming of this work into society. Here EVE has created a Centre for the Assessment of International Practice in e-democracy (CAIN), a body that will continue after termination of the project. This is addressing standardisation issues, and grappling with the legal constraints to e-voting and e-democracy approaches.

rather than simply ratifying decisions made by others. This in turn shifts the focus to “e-citizenship” and the policies and structures needed for online democracy to work as a process.

Among the projects in this area, E-POLL is aiming to apply new IST developments to the voting process. The European Virtual Ballot Network is being set up as a framework defining the components of the electronic vote process (e.g. voting lists, virtual polling stations, vote collection systems, voters’ identification devices) and the information flow between the actors involved. Voter authentication is performed by combining biometric recognition (a fingerprint reader) with a voter smart card. Trials have already been performed successfully during three elections in France and Italy. Use of 3G mobile (UMTS) devices is being investigated as a further means of delocalising voting booths.

A common platform for the storage and exchange of European justice information is being investigated by E-COURT. This will include regulations, verdicts and court activity, and is aimed at availability, where confidentially permits, to expert and ordinary citizens via a web portal. Justice institutions in different

countries will be able to share information, which will contribute to harmonisation of justice management among Member States. The platform will add value to the information, such as indexing, multilingual translation and multi-media material. It will include facilities for the acquisition and synchronisation of audio, video and textual data; advanced information retrieval; database management; workflow management and security management.

Many hurdles still remain before we are likely to see internet voting on a public scale. The processes, not necessarily a simple evolution and automation of traditional voting methods, need to gain acceptance by all actors (citizens and politicians). Suitable technology and processes have to be found, trialled and confirmed in service. Impact assessment on democratic institutions and the political process will be very important, since surprising or unexpected results will have the power to obstruct good government and cause premature loss of confidence in e-democracy. These and other aspects will be addressed under the Sixth Framework Programme, with a view to the widespread introduction of e-voting across the EU by around 2010.

IST Action Lines:	IST-2001 I.3	Administrations	
Project References:	E-COURT	IST-2000-28199	laplace.intrasoft-intl.com/e-court
	E-POLL	IST-1999-21109	www.e-poll-project.net
	EVE	IST-2001-33008	www.eve.cnrs.fr
Commission Contacts:	Antonis Galetsas	antonis.galetsas@cec.eu.int	
Web	www.cordis.lu/ist/ka1/administrations/home.html		
	www.eve.cnrs.fr		

# Enabling e-inclusion

**W**orldwide there are more than 750 million people with disabilities, 37 million of whom live in Europe, while the number of older Europeans is steadily increasing. New technologies offer significant opportunities for people with special needs, helping them to overcome the isolation of the past. Through the web they are able to access information, distance education, workplace interaction, electronic commerce, and participate in society at large. If thoughtfully applied, IST can give people with special needs a social and economic freedom they have not had before.

The key issue here is equality of access. As more and more government services and important public information become available online, ensuring access to public websites for all citizens is as important as ensuring access to public buildings. This does not mean treating people with special needs differently, however. Experience shows that consideration of usability requirements from the beginning of the design process can often make new technologies easier for everyone to use. This “design-for-all” (or universal design) approach brings great benefits usually at little extra cost.

In general, the majority of mass-market technologies, applications and services have been developed without due regard for the requirements of disabled and older persons. As a result, these groups risk social exclusion due to a range of technical barriers they face when using ICT. However, in recent years researchers have also begun to address how mainstream technologies, such as graphical user interfaces, the internet, smart cards and mobile telephony, might be made accessible to the disabled and elderly.

The Web Accessibility Initiative (WAI) guidelines, created by the W3C with the support of the European Commission, provide a voluntary mechanism for public information providers and website builders to conform to a set of informal rules on designing and structuring websites. The WAI guidelines have been widely endorsed by industry, research, governments and disability organisations. They form a key part of the Commission’s Communication *eEurope 2002: Accessibility of Public Web Sites and their Content*, which was adopted in September 2001 and has subsequently been endorsed by the European Parliament. Implementation of the WAI is being supported through the WAI-TIES project, while the IDCNET network addresses the development of a model design-for-all curriculum for ICT products, systems and services.

In the eEurope 2005 Action Plan e-inclusion is recognised as a key horizontal dimension of great social importance. Multi-platform access to services, broadband, 3G mobile systems and interactive TV will provide new opportunities for inclusion, but also challenges in terms of accessibility. Hence, best practices regarding e-inclusion and accessibility for people with special needs are likely to receive high priority within the evolving FP6 activities.

IST Action Lines:	IST-2002 I.2	Persons with special needs, including the disabled and the elderly
Project References:	IDCNET WAI-TIES	IST-2001-38786 IST-2001-38471
Commission Contacts:	Inmaculada Placencia-Porrero	inmaculada.placencia-porrero@cec.eu.int
Web:	<a href="http://www.cordis.lu/ist/ka1/special_needs/home.html">www.cordis.lu/ist/ka1/special_needs/home.html</a>	



# Educational IST for all

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 and technologies for education and training.

eEurope 2002 placed a strong emphasis on measures to improve take-up of IST in educational contexts, an approach which is reiterated in the latest initiative eEurope 2005. PROMETEUS, an EU-wide forum for e-enabled learning, is a key instrument here. Launched in 1999 with backing from the EC, PROMETEUS enables players in education and training to identify common issues for the further development of ICT-based learning services and the provision of multimedia access to education and training in Europe. More than 500 organisations have joined the forum, and more than 1,800 people are currently involved in it. The outcomes include guidelines, recommendations, best practice handbooks and contributions to the CEN/ISSS standards on learning technologies.

Research and development also has an important role to play in opening up more innovative and efficient ways of learning. To fully realise the potential of research and ensure the results have a meaningful impact on education and training practices, RTD projects need to be complemented by other measures. These include community-building and other horizontal activities promoting a wide dissemination of project results, the use of innovative tools, and the assimilation of the new concepts by individuals and organisations.

LCCN supports the Learning Citizen in its clustering and dissemination activities, while EUN VALNET supports projects in the school sector in their validation and evaluation activities. K2 is hosting knowledge-sharing events, preparing information packs and building a web site. LEARN is disseminating results from EU RTD projects among learners and university students. A series of learning modules explain complex themes through easy multimedia presentations tailored to younger audiences and in all 11 EU languages. L-CHANGE is a constantly updated observatory on market and technological trends in ICT for education. The project also promotes collaboration between IST projects and other EU-funded programmes, (such as ADAPT, LEONARDO, SOCRATES), and raises awareness of educational ICT among the public. PROACTE maintains the main web service for all the IST education projects, and undertakes other promotional activities.

SEN-IST-NET is a thematic network on special educational needs (SEN) for children, young people and adults, which brings together IST researchers, practitioners and policymakers in the field. A series of special interest groups address topics such as SEN research, SEN-related ICT developments, assistive technologies, user groups, and case studies. The networking and dissemination activities are supported by a website, complying with widely accepted accessibility guidelines.

## IST Action Lines:

### Project References:

### Commission Contacts:

### Web:

IST-2001 III.2

EUN VALNET

K2

L-CHANGE

LEARN

LCCN

PROACTE

SEN-IST-NET

Alma Cardi

[www.cordis.lu/ist/ka3/education](http://www.cordis.lu/ist/ka3/education)

[www.proacte.com](http://www.proacte.com)

[www.prometeus.org](http://www.prometeus.org)

## Education and training

IST-2000-14025

IST-2000-25017

IST-2000-26226

IST-1999-12371

IST-2001-33539

IST-1999-12292

IST-2000-26449

[alma.cardi@cec.eu.int](mailto:alma.cardi@cec.eu.int)

[www.eun.org](http://www.eun.org)

[www.know-2.org](http://www.know-2.org)

[www.dbcons.com/learn](http://www.dbcons.com/learn)

[www.learningcitizen.org](http://www.learningcitizen.org)

[www.proacte.com](http://www.proacte.com)

[www.senist.net](http://www.senist.net)

# Preserving Europe's film heritage

Europe was a pioneer of film and cinema. For over one hundred years European film-makers have used this powerful medium both as a form of cultural expression and a valuable historical record. Furthermore, this record is not confined to Europe, since the archives of European broadcasters encapsulate the social and cultural history of most of the world from the early 20th century onwards. At a time when broadcasting and multimedia publishing is growing rapidly, there is insatiable demand for such high quality audiovisual material.

Many of the film archives are in poor condition, however, and these priceless assets are in danger of being lost forever. Fragile old films are fading and crumbling, and records, audio and videotapes are becoming damaged and unplayable. All broadcast materials made before the 1980s are vulnerable. The problem is compounded because equipment to play the recordings (on vinyl, tape and videotape) is now also ageing or obsolete. It is essential that this valuable heritage is preserved.

Organisations dealing with film heritage face challenges similar to those of other "memory institutions", such as libraries, museums and galleries. They have to deal with physical restoration and cleaning of the assets, and in some cases to digitise them and preserve the digital forms. They also have to build new models and services around these digital archives and to handle IPR and copyright issues. But film heritage also presents unique problems due to the volume and scale of the assets and the need to sustain them over time.

The IST Programme supports a number of projects that are seeking to apply new technologies for accessing and preserving European film heritage. The

cost-effectiveness of digitisation in the internal workflow of film archives is a key issue, together with the development of business models for repurposing and reuse of archival films. Rights management models are also addressed, as well as copyright and rights issues in different national contexts. In addition, improvements in access to European films are considered, especially those from the first half of the 20<sup>th</sup> century.

For instance, PRESTO targets cost reduction in the archival process and aims to reduce preservation costs by at least 30%. This is to be achieved through automating specific labour-intensive bottlenecks in preservation processes, by developing efficient metadata handling, and by identifying and using the most sustainable and cost-effective new technologies. Ways to minimise future maintenance costs while maximising commercial and public access to the archives are also being sought.

A digital archiving system for the management, access and distribution of audiovisual material is being demonstrated by AMICITIA. The system will serve the needs of professional users in terms of quality, flexibility, usability etc, but will also allow easy public access. Also concerned with access, ECHO is creating a digital library service for documentary films belonging to large national audiovisual archives. Based on an open architecture and reusable software approaches, the system will provide direct access to historical collections over the web. Business scenarios for repurposing and reuse of the materials, e.g. for education and entertainment, are also being developed.

A web-based collaborative work environment for archivists, researchers and end-users concerned with

## Cost-effective video restoration

*The level of exploitation of moving picture archives is currently limited by the high cost and lengthy processing time required to restore the material to meet the expectations of film-makers and viewers. Hence, efficient and cost-effective restoration is essential to the large-scale exploitation of television archives, as well as being a necessary step to guarantee their preservation.*

*BRAVA is developing a solution to speed up the restoration process based on new algorithms capable of analysing the image in detail. The system is intended to replace many of the current manual video and film restoration processes by providing real-time processing of a wide range of defects. To meet the needs of professional archive restorers, it incorporates many automated features to provide restoration at or close to real-time operation.*



*Queen Victoria's funeral, Feb 1901, one of the first historical events to be captured on film*

digitised cultural material is being implemented by COLLATE. The repository focuses on historic film documentation, including censorship files, photos and film fragments. Users take an active part in evaluating sources and adding valuable information. Technical features, such as watermarking and task-based interfaces, enable high standards in content indexing and management to be maintained.

Projects from content-related action lines also contribute to this domain. A new project, RACINE-S is researching digital techniques and tools for use in film restoration. The solution will enable film makers and restorers to generate new, synthetic sequences of images and sounds, based on data extracted from existing sequences, to a level of realism and quality that

at least matches the best existing methods for film-making. SPEED-FX is researching a very high resolution, real-time solution for the post-production of film and video. The work involves the development of an open, real-time and scalable low-cost platform, which will incorporate new techniques for image processing and content-based multimedia indexing. The solution reflects the rapid movement towards an e-cinema approach, based on all-digital masters, within the current-day film industry.

Future requirements in this area are being investigated under a new project FIRST, which will produce an RTD roadmap for activities relating to film heritage.

IST Action Lines:	IST-2001 III.1.1 IST-2001 III.1.3	Publishing digital content Next generation digital collections	
Project References:	AMICITIA BRAVA COLLATE ECHO FIRST PRESTO RACINE-S SPEED-FX	IST-1999-20215 IST-1999-11628 IST-1999-20882 IST-1999-11994 IST-2001-38256 IST-1999-20013 IST-2001-33717 IST-2001-34337	<a href="http://www.amicitia.project.de">www.amicitia.project.de</a> <a href="http://brava.ina.fr">brava.ina.fr</a> <a href="http://www.collate.de">www.collate.de</a> <a href="http://pc-erato2.iei.pi.cnr.it/echo">pc-erato2.iei.pi.cnr.it/echo</a> <a href="mailto:presto.joanneum.ac.at">presto.joanneum.ac.at</a> <a href="http://www.pandora-int.com">www.pandora-int.com</a>
Commission Contacts:	Bernard Smith Pascal Jacques	<a href="mailto:bernard.smith@cec.eu.int">bernard.smith@cec.eu.int</a> <a href="mailto:pascal.jacques@cec.eu.int">pascal.jacques@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka3/digicult/filmher.htm">www.cordis.lu/ist/ka3/digicult/filmher.htm</a> <a href="http://www.cordis.lu/ist/ka3/iep">www.cordis.lu/ist/ka3/iep</a>		

# Information for the environment

**A**ccess to and exploitation of high-quality information is critical to our ability to safeguard the environment. However, there is a paradox here in that many environmental theories, assumptions, models, and conclusions are currently based on very limited amounts of data. The implication is clear: environmental data sources must be better identified and exploited.

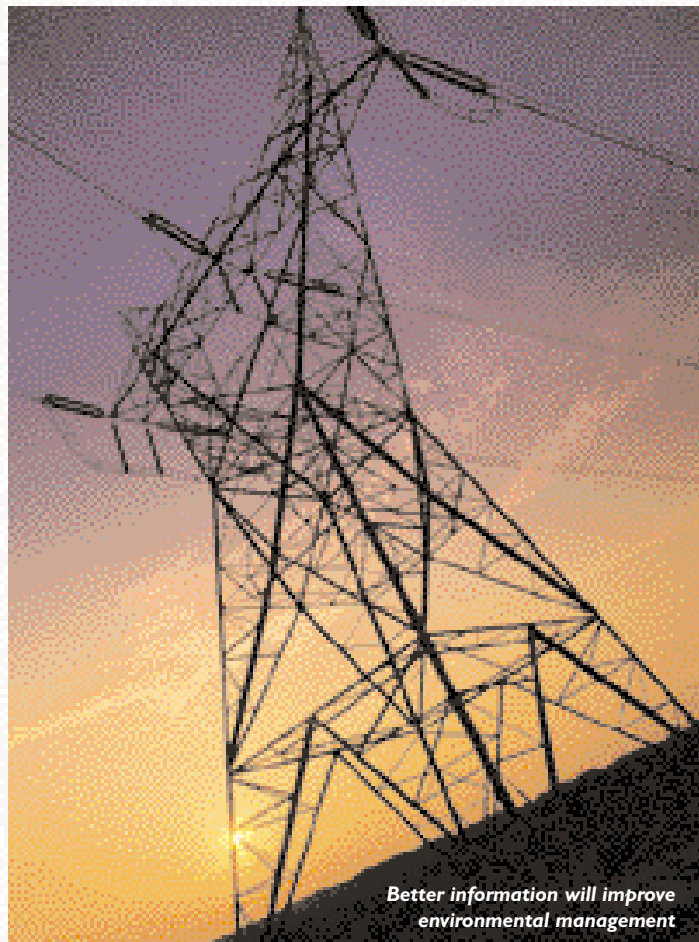
ICT presents many opportunities for the delivery of new environmental information services on, for example, air, water, waste or soil quality. These will enable better control of pollution and waste, and more efficient management of natural resources. They also offer prospects for improving decision-making processes and increasing public participation in environmental issues. In short, ISTs will provide key building blocks for putting the sustainable development principle into action.

RTD on environmental applications under the IST Programme focuses on a citizen-centred approach with significant support for standardisation, interoperability and market stimulation. The main technical emphasis is on new tools, integrated systems and services for environmental monitoring, using techniques such as remote sensing, geographic information systems (GIS) and advanced data mining and decision support systems. Such data should provide a solid basis for assessment, planning, and public information. This will help information policy to move from “trust me” to “show me”, and the ultimate purpose of “involve me”.

No matter how much environmental data is available, it is of limited use if stored in disparate formats on disconnected systems. Many of the projects, therefore, are addressing the collection and integration of varied information on distributed, interoperable platforms. Search and retrieval tools will enable the data to be accessed from different institutions and for different applications. TEASE, an accompanying measure,

provides the “glue” here, bringing together environmental data platforms from many sectors. It is developing middleware and network technologies to enable collaborative team working. This integration will provide valuable support to GMES (Global Monitoring for Environment and Security), a joint initiative between the EU and ESA.

COASTBASE developed middleware to provide an internet-accessible, Europe-wide database of coastal and marine data. Accessible at different levels of government, these information resources contribute to environmental assessment and policy development. The results are being taken up in a follow-on action, EuroSION, sponsored by DG-Environment. A new project, DISMAR, aims for a marine information system combining both physical and biochemical models with observed data from aircraft, ships, satellites, buoys and ferry boxes. Using database technology from SODA (see box), data fusion and internet-hosted GIS, the system will help pollution crises by prevention, mitigation and recovery.





### Reading the ripples

Existing methods for the monitoring of waterborne pollutants are confined to spot-sampling and laboratory-based chemical analysis. This method has drawbacks, however, being slow, expensive and localised. BLUEWATER is developing a system for monitoring water pollution based on surface surveillance.

Pollutants in water have a damping effect on the water surface. The wave signatures associated with each damping effect are monitored through a network of radio-linked pole-mounted cameras, and the resulting images are subject to advanced computerised analysis. By comparing the surface signature of a wave with that in ambient water, it is possible to detect suspended solids at concentrations of 100 mg/litre, and pollutants such as hydrocarbons and algal blooms at 1 to 8 mg/m<sup>2</sup>.

The BLUEWATER solution, which is currently being trialled at several sites, will permit constant monitoring and give early warning of pollution incidents. Being cheap, fast and reliable, it is expected to be of great interest to authorities responsible for pollution control at sea, beaches and waterways.

FOREMMS, undergoing trial in Finland, Italy and Poland, is an environmental monitoring and management system for forests. Multi-scale data from field sensors, airborne sensors and satellites will be integrated for use on a regional, national or international level. Spatio-temporal (4D) views of the data will be available. The solution might provide the basis for a standard European-scale scheme for the collection and analysis of forest environmental parameters.

ODIN is a middleware solution providing real-time geo-spatial information for citizens, tourists and SMEs about environment and weather through mobile devices. The application is currently under trial in Norway, Italy and Ireland.

For FP6, the key challenge for environmental IST is to move from traditional monitoring tools to more ambitious end-to-end service delivery development. This should include key IST components for decision-support and knowledge management for industry and public agencies. More efficient management tools are also needed, capable of addressing all scales from very localised areas to large geographic or morphologic regions. And for environmental IST to be viable, aspects such as standardisation and business models should be addressed.

### Solar radiation

Solar radiation data is not as complete as we would like. It often concentrates on the energy falling on extensive, flat areas, and often accumulated over long periods. SODA aims to collect data for many types of surface using a smart network linking diverse monitoring sources. A prototype service will deliver the information through innovative temporally and spatially structured views of the data. This may evolve into a commercial service after dissemination of the results.

IST Action Lines:	IST-2002 I.4	Environment	
Project References:	BLUEWATER	IST-1999-10388	<a href="http://www.bmtech.co.uk/bluewater">www.bmtech.co.uk/bluewater</a>
	COASTBASE	IST-1999-11406	<a href="http://europa.eu.int/comm/environment/iczm/home.htm">europa.eu.int/comm/environment/iczm/home.htm</a>
	DISMAR	IST-2001-37657	<a href="http://www.nersc.no">www.nersc.no</a>
	FOREMMS	IST-1999-11228	<a href="http://www.nr.no/foremms">www.nr.no/foremms</a>
	ODIN	IST-1999-10498	
	SODA	IST-1999-12245	<a href="http://www.armines.org">www.armines.org</a>
	TEASE	IST-2000-29397	
Commission Contacts:	Pascal Collotte	<a href="mailto:pascal.collotte@cec.eu.int">pascal.collotte@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka1/environment/home.html">www.cordis.lu/ist/ka1/environment/home.html</a> <a href="http://gmes.jrc.it">http://gmes.jrc.it</a> (GMES)		

# Towards sustainable development

**I**t is widely recognised that the current pace of world population and economic growth cannot be sustained. The combination of resource exhaustion and pollution threaten widespread degradation of our physical environment. The gross inequality of wealth distribution, where 20% of the world's population consumes 80% of its resources, is also unsustainable because of the tensions and threats it raises for global security. We need to address both the absolute increases in resource consumption and the relative inequalities between the developed and developing worlds.



*IST can help make development more sustainable*

This does not mean, however, to abandon growth. Rather we have to make the changes necessary for more sustainable ways of life. Future growth will have to be differential growth: as much as needed to sustain employment in developed economies, and at higher levels to improve quality of life in poorer regions. And we have to achieve this growth without a

corresponding increase in the load on the environment. Production must become more efficient, and we must consume fewer physical resources. In other words, we must move towards a de-materialised economy.

ICT has an essential role to play here. It can dematerialise many transfers of goods and services altogether. In activities where physical resource consumption cannot be eliminated, ICT can make them more efficient, for example by saving travel to work. A knowledge economy, where increasing value resides in intellectual and cultural assets, provides hope of growth without extra burden on the environment. It offers a way for poorer peoples to participate in trade.

But ICT also has its risks. Investment in ICT does not automatically lead to efficiency. It may deepen the “digital divide” between rich and poor. We do not yet have paperless offices (rather we use more paper), and the global internet encourages some of us to travel more. Global communications may threaten diverse cultures, but can also provide them with visibility on the world stage. Solving the holistic triangle of growth, equity and sustainability will require much thought and effort.

At the Göthenburg Summit in June 2001, EU leaders agreed a strategy on sustainable development which is closely linked to the Lisbon objectives to create a competitive knowledge-based economy. The strategy calls for resource-efficient growth, based on improved resource productivity in areas such as manufacturing, transport, energy and the built environment. A prominent role for corporate social responsibility (CSR) is also emphasised.

The IST Programme has a small portfolio of projects on SD-IST linkages that aim to better understand the problems and build scenarios and visions. Aspects being addressed include macro-level analysis and modelling of SD-IST interactions, micro-level investigations and case studies, and the use of ICT to support corporate social responsibility.

### Mapping a sustainable future

*A series of new roadmap projects are investigating the linkages between sustainable development and the information society and setting the agenda for future research under the Sixth Framework Programme.*

*SASKIA is setting up networks of stakeholder constituencies to discover ways of unlocking the power of IST RTD to address sustainability issues. Building on the "Landing Place 2030" vision scenarios, it expects to develop implementation models for actors in the field. G-NIKE is examining the interaction between ICT and "growth nodes", the industry communities driving regional and inter-regional growth. It will ask what are the conditions (rules) for sustainable growth, and locate the policy levels where the rules are managed. INTEL CITY is conducting consultations with stakeholders from urban planning, property development, utilities, transport and other areas. Together, they will explore user needs and expectations for sustainable urban living.*

*In the area of CSR, NESKEY focuses on the disclosure of information about corporate environmental, social and economic performance to aid decision-making. It will quantify macro and micro intangible factors, so permitting an evaluation of the risks and opportunities inherent in the "soft" values of companies.*

For instance, DIGITAL EUROPE is focusing on the crucial roles that e-commerce and e-work can play in user-friendly, socially inclusive, environmentally sustainable business. Led by a prominent environmental think-tank, the project is constructing case studies in eight industry sectors. It will locate and quantify the real dematerialisation opportunities, and make recommendations for all levels of government. TERRA 2000 is developing mid- to long-term scenarios for the knowledge economy in Europe, including consequences for society and sustainable development, based on inputs from leading experts.

A new project, SUSTEL, is seeking to fill the gap in the empirical evidence on the effectiveness of teleworking. Through 30 longitudinal case studies, it

will assess the impact of teleworking and develop an integrated assessment tool. The final output will be a guidance document for sustainable teleworking.

In the area of CSR, VIP has developed voluntary industry codes of practice. Representatives from large international companies participated in setting guidelines for fair competition and the shaping of a humane global information society. Focusing on company ethics, the project proposed codes of conduct for cross-border working, and built a knowledge base of existing codes of practice.

IST Action Lines:	IST-2001 II.1.1 IST-2002 II.1.2	Socio-economic analysis in eWork and eBusiness Strategic roadmaps for applied research
Project References:	DIGITAL EUROPE G-NIKE INTEL CITY NESKEY SASKIA / ASSIST SUSTEL TERRA 2000 VIP	IST-2000-28606 IST-2001-38068 IST-2001-37373 IST-2001-39080 IST-2001-38184 IST-2001-33228 IST-2000-26332 IST-2000-25463 <a href="http://www.digital-eu.org">www.digital-eu.org</a> <a href="http://www.eppa.com">www.eppa.com</a> <a href="http://www.immaterialisation.org">www.immaterialisation.org</a> <a href="http://www.sustel.org">www.sustel.org</a> <a href="http://www.terra-2000.org">www.terra-2000.org</a> <a href="http://www.unomondo.org">www.unomondo.org</a>
Commission Contacts:	Peter Johnston Pierrick Fillon-Ashida John Nolan	<a href="mailto:peter.johnston@cec.eu.int">peter.johnston@cec.eu.int</a> <a href="mailto:pierrick.fillon-ashida@cec.eu.int">pierrick.fillon-ashida@cec.eu.int</a> <a href="mailto:john.nolan@cec.eu.int">john.nolan@cec.eu.int</a>
Web:	<a href="http://www.cordis.lu/ist/ka2">www.cordis.lu/ist/ka2</a>	

# Learning institutions

**T**he role of schools and universities in educating younger generations has never been more important than it is today. In the information society, future citizens will have to deal with complex rules and to cope with continuous change in their private and professional lives. We have to provide young people with the knowledge and skills to handle these situations. On the one hand, this means equipping them with the technical skills necessary to engage with the new technologies, so that they have a

high level of “digital literacy”. But it also places greater emphasis on the higher level cognitive activities, such as creativity, problem-solving, and team work.

For universities the challenges are even more demanding. With higher education now a global market and knowledge transfer increasingly seen as the key driver of wealth creation, European higher education institutions are under growing pressure to develop competitive curricula. They also face a major new challenge, as knowledge providers in individuals’ life-long learning.



*E-learning is becoming a central part of education*

## **Construct your own courses**

*UNIVERSAL is investigating the feasibility of an open exchange system for academic course units. The aim is to develop a brokerage platform, based on common models and standards, which will enable lecturers to enrich their curricula with remotely sourced units. Different classes of course units will be covered including live, person-to-person units and packaged, person-machine units. The system will be compatible with a variety of current business models including open universities. Students will benefit from a wider choice of course units and from virtual mobility based on mutual recognition.*



Tomorrow's schools and universities will be very different from those of today: increasingly virtual institutions serving a much wider client base. Curricula will be produced collaboratively from distributed educational resources, and flexibly managed and delivered to learners worldwide. The boundaries between academic education and vocational training will become increasingly blurred as learners access personalised and flexible learning services, available as and when they want them, as part of a continuum of lifelong learning. Students will no longer be confined to one curriculum but will be able to build their own using course material drawn from multiple institutions.

Following calls in 1999 and 2000, the IST Programme launched a series of projects which aim to improve the quality and accessibility of learning at school and university levels by exploiting the latest technological advances. The projects combine multidisciplinary research on the development of new applications and demonstrations with a comprehensive pedagogical and socio-economic evaluation. The work builds on and consolidates on-going national initiatives, and supports the eEurope goals for personalised lifelong learning.

Several projects focus on personalised course delivery. LEDA, for example, is developing a networked system to support postgraduate education in the field of digital media. Based on database-middleware communication, personalised learning environments will be generated, enabling students to articulate critical steps in their development and publish their research and project outcomes. The project is generating an international knowledge base on digital media production processes, methods and techniques, which will be used by universities and industry to access research results and learning materials interactively.

User-friendly brokerage systems for university courses are also an emerging area. CUBER is developing a system to support individuals and corporations in finding a three-dimensional match in courses between vocational demands, academic offers and individual learning conditions. Using brokering middleware, it will integrate European universities within a virtual network through a common knowledge base of standardised course descriptions.

### Collaborative learning for schools

*Computer-supported collaborative learning (CSCL) is set to play an increasingly important role in education. ITCOLE is developing a new web-based environment for collaborative learning and knowledge building in schools. Following a review of current CSCL tools, ITCOLE is preparing a foundation for new generation learning models and tools. Utilising an open source approach, its working prototype will contain a shared workspace, synchronous and asynchronous collaboration, awareness tools and tutoring products.*

*Large-scale evaluation of the methods and tools in real schools across Europe will allow further refinement and alignment with local practices. The final task will be to disseminate the results as widely as possible, establishing local centres of expertise in web-based CSCL.*

IST Action Lines:

IST-2001 III.2

Education and training

Project References:

CUBER  
ITCOLE  
LEDA  
UNIVERSAL

IST-1999-10737  
IST-2000-26249  
IST-1999-10567  
IST-1999-11747

[www.cuber.net](http://www.cuber.net)  
[www.euro-cscl.org](http://www.euro-cscl.org)  
[www.ledanet.org](http://www.ledanet.org)  
[www.ist-universal.org](http://www.ist-universal.org)

Commission Contacts:

Carlos Oliveira  
Wim Jansen

[carlos.oliveira@cec.eu.int](mailto:carlos.oliveira@cec.eu.int)  
[wim.jansen@cec.eu.int](mailto:wim.jansen@cec.eu.int)

Web:

[www.cordis.lu/ist/ka3/education](http://www.cordis.lu/ist/ka3/education)  
[www.proacte.com](http://www.proacte.com)

# Capturing community memory

**D**igitisation is a key staging post for Europe to be able to exploit its rich cultural and scientific resources in the new digital world. Digitisation contributes to the conservation and preservation of heritage and scientific resources. It also creates new educational opportunities and can be used to encourage tourism. It provides a rich basis for the development of new content and services, a key policy objective under eEurope 2005. And, not least, digitisation offers citizens improved access to their local and community heritage.

In April 2001 experts from Member States met in Lund, Sweden to review efforts in this field. They noted that while considerable effort is invested in digitisation projects and campaigns across Europe, these activities are heavily fragmented, solutions are often inherently obsolescent and based on uncertainty about choices of contents, standards and methodologies. There is, therefore, an urgent need for guidelines, standards and awareness of what is going on in other countries.

The meeting resulted in a series of recommendations, now referred to as the Lund Principles, for improving

coordination of digitisation programmes across Member States. These were subsequently translated into a set of comprehensive actions known as the Lund Action Plan. Implementation of the Action Plan is being supported through MINERVA, a network of European ministries from the EU and other countries. The network provides national representatives with a forum for open discussion on the harmonisation of digitisation policies and for the exchange of best practices. A list of recommendations to support the adoption of a common policy is also being prepared together with an information and training programme. At practitioner level, further support for digital preservation is provided by ERPANET (see box).



*Our cultural records are going digital*

### Access to digital preservation

*Within the cultural sector there is a lack of awareness about how to handle existing digital preservation and how to plan effectively for the future. Knowledge and skills are fragmented and there is no coherent research agenda. The ERPANET network provides a platform for co-operation, collaboration and exchange of results and experience in the preservation of digital objects.*

*The network brings together memory organisations (museums, libraries and archives), research institutions, ICT industry, public organisations, and entertainment and creative industries. Activities include awareness raising and the organisation of workshops and training seminars. An enquiry and advisory service on preservation issues, practice and technology is being set-up. The network will build an online community and develop a suite of tools, guidelines and case studies. It will also stimulate awareness about user needs among software producers, and encourage the development of standards in this area.*

As well as managing digital assets over time, we have to consider how to create them in a way that ensures digital inclusion. IST's Heritage for All action line aimed to support communities in being able to document, share, access and preserve community heritage and collective memory in digital form. The initiative was conceived to encourage participation by smaller scale cultural and memory institutions, as well as to initiate citizen-, rather than technology-driven projects. It focused on the enhancement of local and regional cultural resources by developing digital archives to document past and present social history and cultural expression for the use of the widest possible range of individuals and groups of citizens.

The selected projects encouraged, to a greater or lesser extent, active participation of diverse online citizen communities in producing an evolving digital record of their culture. For instance, CHIMER is researching models for children in disadvantaged areas to contribute to a better understanding of the cultural assets of their regions making use of mobile technologies. COINE aims to create interoperable web-based environments hospitable to local cultural activity, while CIPHER concentrates on local themes typical of particular regions such as Nordic story-

telling or the shared heritage of Central Europe. All three projects open up opportunities for ordinary people from all walks of life to document their own record of regional heritage across Europe. Focusing on a specific period in our recent history, MEMORIAL aims to create a digital personal records archive covering the Holocaust.

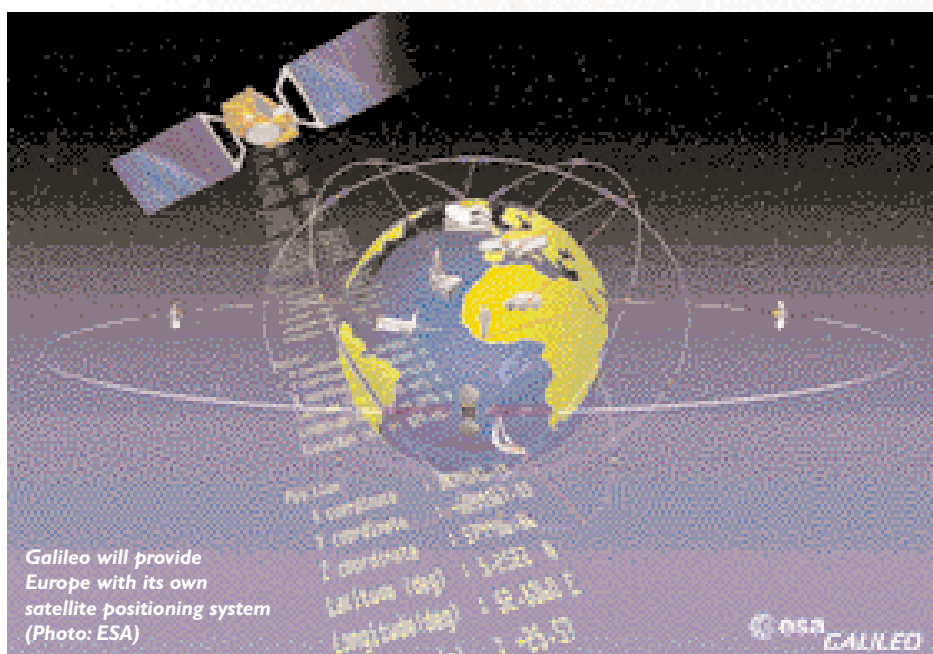
Cultural organisations tend to be risk averse, and before investing in new techniques and business models seek sound information on which to build a business case. Following a call in 2000, IST launched a series of 25 trial actions to encourage take-up of results and stimulate the implementation of innovative products and services. These should help to create momentum for innovation in cultural institutions. A support measure, TRIS, brings these projects together to exchange experiences, develop common approaches and share good practice. It is helping the projects to produce viable and standardised solutions. It is also assisting them in exploitation towards complementary subject areas (e.g. education) and to extend their reach in European markets. The TRIS website provides news about progress and results, and links to each of the projects.

IST Action Lines:	IST-2001 III.1.2	Heritage for all	
Project References:	CHIMER	IST-2001-32695	<a href="http://www.chimer.org">www.chimer.org</a>
	CIPHER	IST-2001-32559	<a href="http://www.cipherweb.org">www.cipherweb.org</a>
	COINE	IST-2001-32258	<a href="http://www.coine.org">www.coine.org</a>
	ERPANET	IST-2001-32706	<a href="http://www.erpanet.org">www.erpanet.org</a>
	MINERVA	IST-2001-35461	
	TRIS	IST-2001-33010	<a href="http://www.trisweb.org">www.trisweb.org</a>
Commission Contacts:	Bernard Smith	<a href="mailto:bernard.smith@cec.eu.int">bernard.smith@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka3/digicult">www.cordis.lu/ist/ka3/digicult</a>		

# Exploiting geodata

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.

The European Commission has affirmed the importance of GI on a number of occasions. It forms a centrepiece of the Green Paper on Public Sector Information in the Information Society, for example. GI is also a key feature of the e-Europe 2002 Action Plan, especially in the actions on online government, citizens' environmental awareness and intelligent transport systems. In addition, various studies undertaken for the Commission have emphasised the key role of public sector users in stimulating the market for GI in Europe.



RTD that contributes to this goal is supported under a number of IST Programme action lines, including a Cross-Programme Action on Geographic Information. 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

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.

concerning the robustness and stability of new GI applications. The integration of GI systems with telecommunications, navigation and positioning systems, including exploitation of the EU's Global Navigation Satellite System (GNSS), is also addressed.

Efforts towards a European Geographic Information Strategy (EGIS) are being supported under GINIE. To achieve this effectively, close and active collaboration is

## Common data, common access

*Much spatial data is held on application-specific platforms that do not work well together. BRIDGE-IT is targeting geo-server technologies allowing for seamless, efficient content collection and multi-source integration and dissemination, independently of proprietary GIS technology and services.*

*A new modular system architecture will address data and metadata access, content integration, real-time and time reference management, internet access and formatting for portable and other devices. The system will be piloted in three scenarios: a flexible system in a remote rural region (Hautes-Pyrénées); a traffic management and information system in Flanders; and local government works and estate management applications in Germany and the UK.*



necessary between industry, the research community, and the various local, national and international bodies. These three constituencies are represented respectively within GINIE by the Joint Research Centre (EC-JRC), the Open GIS Consortium Europe (OGCE), and the European Umbrella Organisation for GI (EUROGI). As well as defining the overall strategy, GINIE prepares reports and case studies, organises conferences and workshops, and participates in European and international working groups. Now established as the main European contact point on GI systems, GINIE represents the EU in the Global Spatial Data Infrastructure Conference (GSDI), a global forum on GI issues.

Among recent projects, GEOPIE targets autonomous workflow systems from Earth image capture to geographical feature extraction. It is developing both a new sensor design, overcoming known hurdles in current products, and image processing technology based on the CORBA standard. In trials it will support portals for preventing avalanches and floods, and for promoting tourism.

REGEO will link existing regional GI sources in rural regions with an e-community portal. The system will

have an open interface to other platforms, and feature spatial data content with advanced presentation and visualisation technologies. A customised tourism application will be trialled in four locations. NATURE-GIS is a thematic network aiming at guidelines for the capture and use of GIS in environmentally protected areas.

The environment is an important application for GI and several new projects aim to enhance its use in this domain. GIMMI is addressing information requirements in pesticide impact assessment, where data has to be shared between a variety of locations and users. The problems are of distributed data interoperability, capture and management of temporal knowledge, and the integration of legacy systems. I-MARQ is gathering real time information on coastal water quality via a dynamic GIS trial. This must solve the problems of real-time monitoring from heterogeneous sensor sources, and integration of real-time data. A system to track the geographic origins of food at all stages from production to distribution is being developed under GEOTRACEAGRI. It will determine the correct classifications and indicators, and construct referencing systems for geographic traceability.

### Mapping the territory

*In the countries of South-East Europe an appropriate infrastructure for the exploitation of geodata services is still lacking. GISEE aims to remedy this situation by strengthening the spatial data infrastructure in eight countries of the region: Albania, Bosnia-Herzegovina, Bulgaria, Croatia, Macedonia, Romania, Turkey and Yugoslavia. The work focuses on policies, organisational remits, data, technologies, standards and delivery mechanisms. An analysis will find both obstacles to and favourable conditions for GIS technology, resulting in proposals, a roadmap and policy recommendations*

IST Action Lines:	IST-2001 I.1.4 IST-2001 V.1.3	Best practice and trials in environmental management CPA3: Use of geographic information	
Project References:	BRIDGE-IT	IST-2001-34386	<a href="http://www.bridge-it.info">www.bridge-it.info</a>
	GEOPIE	IST-1999-57456	<a href="http://www.geopie.com">www.geopie.com</a>
	GEOTRACEAGRI	IST-2001-34281	<a href="http://www.geotraceagri.net">www.geotraceagri.net</a>
	GIMMI	IST-2001-34245	
	GINIE	IST-2000-29493	<a href="http://www.ec-gis.org/ginie">www.ec-gis.org/ginie</a>
	GISEE	IST-2001-37994	
	I-MARQ	IST-2001-34039	
	NATURE-GIS	IST-2001-34641	<a href="http://www.gisig.it/Nature_GIS/">www.gisig.it/Nature_GIS/</a>
	REGEO	IST-2001-32336	
Commission Contacts:	Pascal Jacques (CPA 3)	<a href="mailto:pascal.jacques@cec.eu.int">pascal.jacques@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/cpt/cpa3.htm">www.cordis.lu/ist/cpt/cpa3.htm</a> <a href="http://www.ec-gis.org">www.ec-gis.org</a> <a href="http://www.eurogi.org">www.eurogi.org</a>		

# Best practices in information security

**D**eveloped societies are becoming increasingly dependent on communication networks and information systems. As more and more economic and societal activities move into the e-space, so critical business and social processes are becoming more vulnerable to accidental or malicious failures of information systems. The infrastructures of modern life, such as banking and finance, healthcare, energy, transportation, and others, rely on ICT and are mutually dependent. These vulnerabilities will increase in future, as we move towards mobile and embedded devices that are linked into always-on communications networks.

This interdependence between information networks raises serious concern about the safe and secure operation of complex ICT systems, and about the potential consequences of disruptions cascading from one system to another. Thus, the dependable and predictable behaviour of the information infrastructure is coming to be recognised as a key challenge for the future development of the information society. In particular, it is of central importance in ensuring the trust and confidence necessary for the growth of e-business and e-government services.

The dependability of information infrastructures was identified as a priority issue under the eEurope 2002 Action Plan and specific measures were proposed to stimulate a dialogue in this domain. These included the development of a European Early Warning & Information System (EWIS) and improving co-operation amongst national computer emergency response teams (CERTs). Both sets of measures are being supported through projects launched under the IST Programme.

Initial steps in this respect were taken through the Dependability Development Support Initiative (DDSI), an IST measure to support the development of dependability policies across Europe. DDSI sets up networks of interest and provides baseline data to inform policy development by European institutions and by stakeholders in the public and private sectors. In October 2001 DDSI, together with the Joint Research Centre, convened a workshop to help scope EWIS issues and potential solutions. The workshop brought together a wide range of stakeholders and led to recommendations that formed the basis for a subsequent EWIS roadmap (see box). DDSI is also leading a dialogue on dependability issues with the equivalent community in the US.

A series of recent projects support eEurope's objectives in relation to CERTs. The EISPP (European Information Security Program) project aims to provide European SMEs with trustworthy IT security services. A European network of CERT expertise is being created which will stimulate private-public co-operation on prevention. ECSIRT.NET, a trial, focuses on the deployment of new techniques and practices to improve co-operation between CERTs. The system will enable CERTs to exchange incident-related data in a standard format and to easily collect and share incident statistics. A third project, TRANSITS, is addressing the shortage of skilled CERT personnel. Specialist training courses are being provided to train new employees in the organisational, operational, technical, market and legal issues involved in providing CERT services.

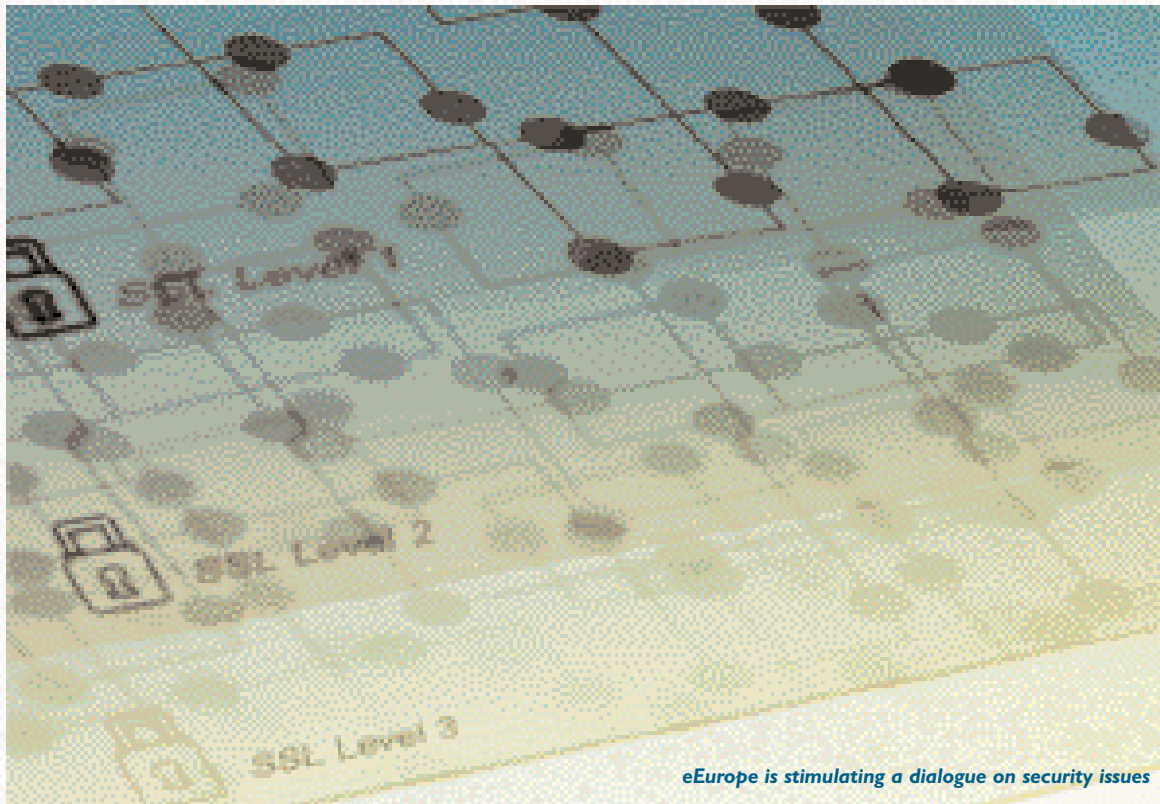
For the future, it is clear that we need to better understand, model and control the interdependencies among large-scale systems and infrastructures. Key

## Early warning on information risks

*Activity undertaken by DDSI has elaborated a basis for a roadmap for a European Warning & Information System (EWIS).*

*The aim of EWIS should be to ensure that an appropriate level of security information is available to all users of information systems in the EU. The information required consists of: warnings and alerts, threat assessments, helpdesk services, and educational products. Rather than the creation of large, co-ordinating superstructures, the EWIS model should comprise a programme of activities including: a small centre to facilitate networking, analysis and best practice guidance; an enhanced dissemination network; and information channels based upon the needs of target audiences.*

*Further information is available on the EWIS Forum website: <http://ewis.jrc.it>*



*eEurope is stimulating a dialogue on security issues*

challenges include the dependability issues related to networks' increasing bandwidth and latency; the growing demand for dependability at acceptable cost; and supporting the paradigm shift from "resist to attack" to "survive and adapt". The necessary approaches embrace a broad range of technologies, both hardware and software.

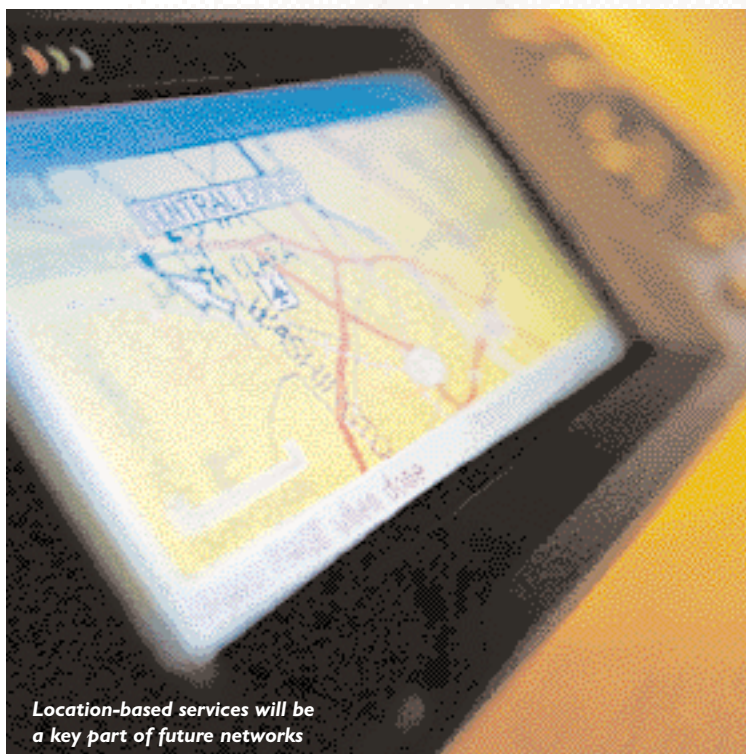
To help define the future strategy in greater detail, a series of roadmapping activities have recently been launched. PAMPAS is developing a roadmap for future

mobile systems and services focusing on security, privacy and identity management requirements. ACIP considers cascading and feedback effects in highly complex, networked systems and will produce a roadmap for their further modelling and assessment. A strategic roadmap for applied research in the area of privacy and identity management is targeted by RAPID. Based on inputs from these other projects, AMSD will develop an overall dependability roadmap that considers dependability in an holistic way, as well as a detailed roadmap for dependable embedded systems.

IST Action Lines:	IST-2001 II.4.1 IST-2001 V.1.4 IST-2002 II.1.2	Trust in information infrastructures CPA4: Towards dependable and survivable systems and infrastructures Strategic roadmaps for applied research
Project References:	ACIP AMSD DDSI ECSIRT.NET EISPP PAMPAS RAPID TRANSITS	IST-2001-37257 IST-2001-37553 IST-2000-29202 IST-2001-37558 IST-2001-35200 IST-2001-37763 IST-2001-38310 IST-2001-39118
Commission Contacts:	Andrea Servida	andrea.servida@cec.eu.int
Web:	<a href="http://deppy.jrc.it">http://deppy.jrc.it</a> <a href="http://www.ddsi.org">www.ddsi.org</a>	

# Pinpointing the location

**T**he requirement to know where things are, where they are in relation to other things, and where we and other people are in relation to them, is a fundamental human need. The existence of so many products aimed at meeting this need, from maps and street directories to compasses, chronometers and satellite navigation receivers, is testimony to both the persistence of the requirement and its economic value.



*Location-based services will be a key part of future networks*

From the operators' point of view, mobile telephony is inherently about location. Knowing where mobile devices are, at least to the level of granularity needed to route calls, is currently one of the core technical competencies of every mobile network operator. Base station triangulation techniques considerably refine this granularity with suitably (though not expensively) upgraded mobile terminals, while systems working in conjunction with navigation and positioning satellites have even greater positional resolution. Location-based services (LBS) build upon these competencies, and upon the technical infrastructure used to provide them, to offer greater functionality to end-users.

Location-based services can assist safety, location of goods and vehicles, and consumer facilities such as, "Where is the nearest Chinese restaurant?". Given a

great array of opportunities and benefits, market forecasts anticipate overwhelming demand for LBS, with a predicted 80% of mobile users subscribing to such services by 2005. For operators, clear regulatory provisions and the availability of fully-proofed location platforms are essential prerequisites for deployment.

IST projects are addressing the development of innovative location-based services, positioning systems, platforms and protocols in various contexts. Some target underlying technology, whereas others focus on middleware application platforms and end-user applications and services.

With a technology focus, HELINET is investigating the design aspects of high-altitude long endurance (HALE) unmanned, solar-powered platforms in the stratosphere. These will have applications for environmental surveillance and telecommunications generally, as well as for localisation. GAUSS is targeting enhanced LBS for road and inland waterway applications using GPS/GNSS positioning and S-CDMA/UMTS mobile systems. GLORIA is optimising GNSS/Loran-C receivers for use in road and rail applications. Looking beyond 3G, UCAN is developing a physical RF

layer and self-organising MAC layer for an ultra wideband services demonstrator. And RIU253 is examining the technical issues involved in adapting the wired internet to mobile situations. Emphasising 3G and W-LAN air interfaces, it will address key interoperability issues and make inputs to standards bodies.

OPIUM targets an open platform for UMTS middleware. It aims to support new wireless services interconnected, pan-European GPRS and UMTS networks. Trials and an evaluation period will result in inputs to standards. Location and orientation-sensitive information for next generation mobile devices are being developed by LOVEUS, with trials promoting tourism and other industries. AGORA is addressing a generic location referencing system that relates to



### An independent platform for LBS services

*An integrated service platform for LBS would allow technology problems to be solved once and for all, allowing new applications to enter the market without re-inventing the wheel each time. POLOS will build and evaluate the kernel of a LBS service management platform. The platform will cover a full range of issues such as service specification, development, creation, deployment, provision and management. The architecture will be applicable to GSM, GPRS and UMTS networks, and will capitalise on Open Service Architecture (OSA) components, giving reusability and independence from mobile, LBS and terminal technologies. The project will also adapt process models from business to propose and support a process structure for organisations specialising in the provision of LBS.*

features and co-ordinate systems but is independent of various map referencing systems.

Following the success of the LOCUS project in contributing to legislation for the European Emergency Call Service ("112"), E-MERGE is aiming to extend this to a pan-European 112 service ("X-112"). It is investigating the technical, organisational and commercial frameworks needed to develop common specifications for the emergency call and its handling, including cross-border and language issues.

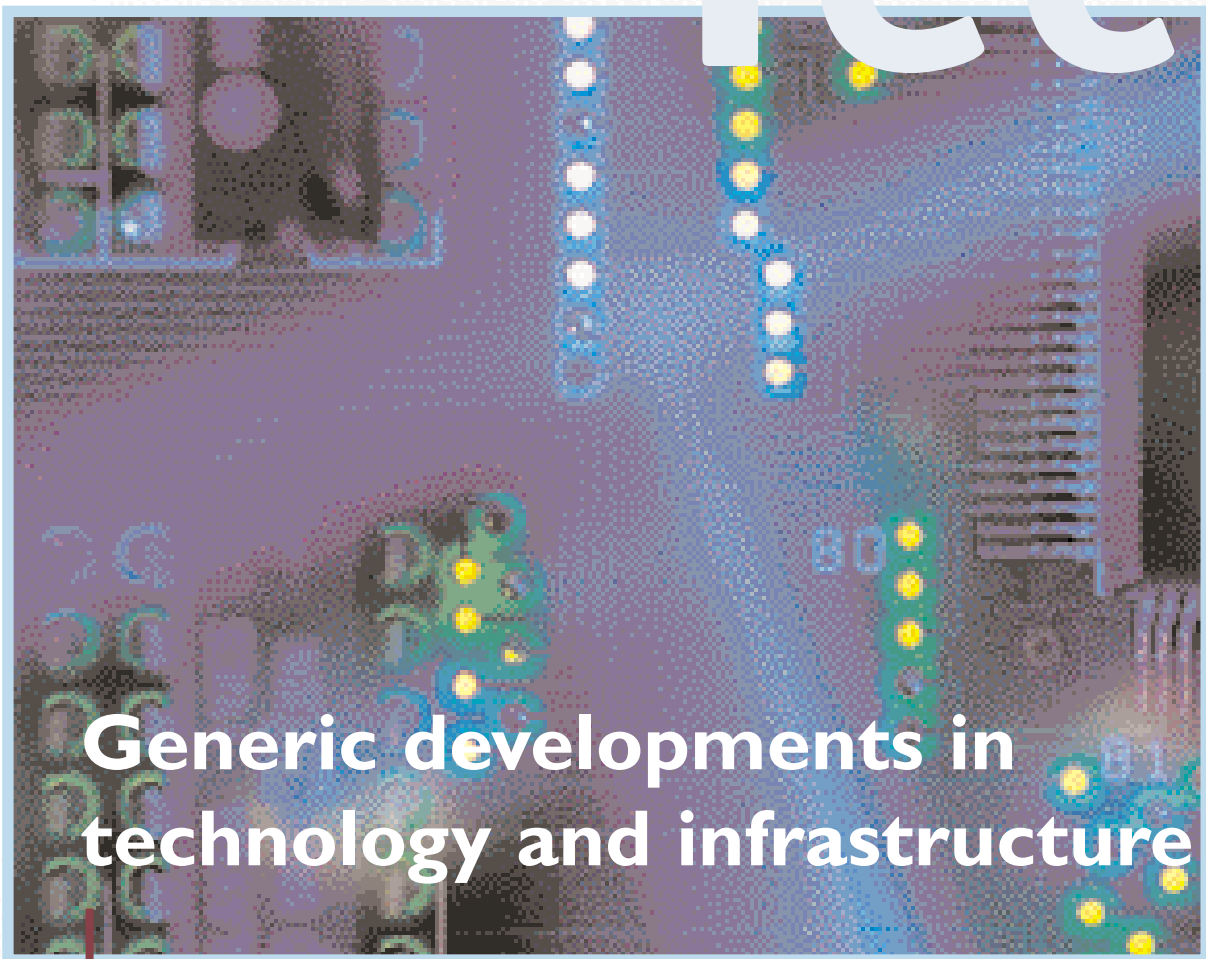
LBS projects are supported by the LOBSTER cluster. The cluster promotes the exchange of information and experience, bridging across technological, service and regulatory issues. Specifically, activities focus on stimulating the pan-European deployment of LBS, promoting innovative positioning techniques relevant to mobile wireless personal communications, and identifying new positioning concepts and technologies for LBS beyond 3G.

The cluster has identified various key directions relevant to future RTD. Barriers to LBS are quality of service and service reconfigurability, and these are likely to be themes for the Sixth Framework Programme. There are plenty of avenues for standardisation within LBS, one being "discovery", or the way an application or terminal senses what services the current network environment supports.

LBS is expected to play a major role in the development of third and fourth generation mobile services, since future services will need to adapt to the user's context, of which location is an important parameter. Hence future research is expected to focus heavily on user needs. This will help generate a roadmap, taking into account social factors and barriers to take-up. Given the desirability of multi-context, ubiquitously available services ("anything, anywhere"), integration, interoperability and middleware are also likely to emerge as key themes.

IST Action Lines:	IST-2002 I.5.1 IST-2002 IV.5  IST-2002 V.1.14	Systems for mobility: take-up and clustering activities Mobile and personal communications and systems, including satellite-related systems and services CPA14: Mobile applications and services
Project References:	AGORA GAUSS GLORIA EMERGE HELINET LOCUS LOVEUS OPIUM POLOS RIU253 UCAN	IST-1999-20457 IST-1999-20532 IST-1999-20600 IST-2001-34061 IST-1999-11214 IST-1999-14093 IST-2001-30155 IST-2001-36063 IST-2001-35283 IST-2001-36510 IST-2001-32170
		<a href="http://www.ertico.com/activiti/projects/agora/agora.htm">www.ertico.com/activiti/projects/agora/agora.htm</a> <a href="http://galileo.cs.telespazio.it/gauss/">galileo.cs.telespazio.it/gauss/</a> <a href="http://www.eu-gloria.org">www.eu-gloria.org</a> <a href="http://www.ertico.com/activiti/projects/e_merge/e_merge.htm">www.ertico.com/activiti/projects/e_merge/e_merge.htm</a> <a href="http://www.elec.york.ac.uk/comms/haps.html">www.elec.york.ac.uk/comms/haps.html</a> <a href="http://www.telematica.de/locus">www.telematica.de/locus</a> <a href="http://loveus.intranet.gr">loveus.intranet.gr</a> <a href="http://www.ist-opium.org">www.ist-opium.org</a> <a href="http://www.polos.org">www.polos.org</a> <a href="http://berja.upc.es/riu253">berja.upc.es/riu253</a> <a href="http://www.ucan.biz">www.ucan.biz</a>
Commission Contacts:	Jean-Louis Lavroff	<a href="mailto:jean-louis.lavroff@cec.eu.int">jean-louis.lavroff@cec.eu.int</a>
Web:	<a href="http://www.cordis.lu/ist/ka4/mobile/proclu/c/lobster.htm">www.cordis.lu/ist/ka4/mobile/proclu/c/lobster.htm</a>	

# Enabling Technology



**Generic developments in  
technology and infrastructure**

The IST Programme is working towards a vision of the future that places the needs of the user, whether at home, at work, at leisure or on the move, at the centre of IST development. Underpinning this vision is a set of key technologies that will provide the main building blocks for this user-centred approach.

One of the most important phenomena here is network convergence. The explosive growth of the internet and of mobile and multimedia services demand new approaches to network technologies. Key issues include reconfigurability, mobile systems beyond 3G, optical networking technologies, and satellite systems. Increasingly, networks will be all IP-based, reflecting the convergence of fixed, mobile and wireless technologies around internet standards.

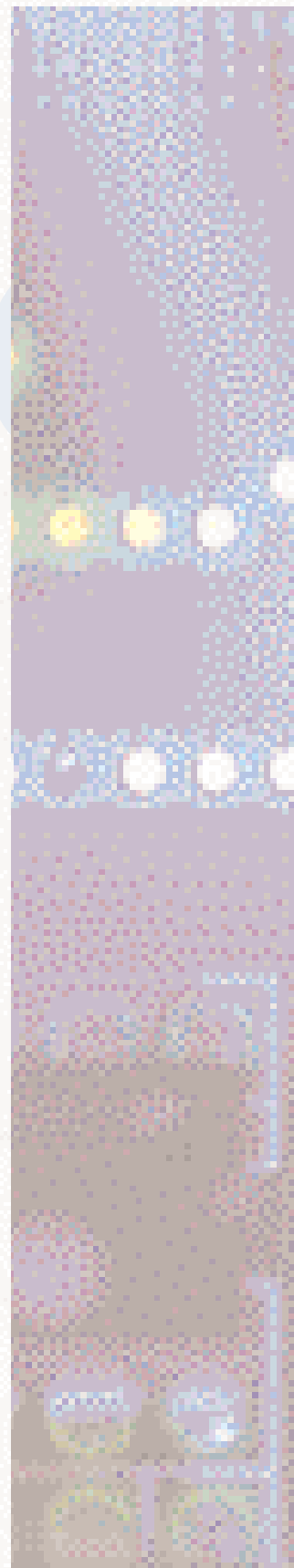
Multimodal and multilingual interfaces is another key technology cluster. People will find IST applications easier to use if the interfaces through which they access them are more natural and intuitive. Technologies such as speech and gesture recognition, simulation, visualisation, displays, and virtual and augmented reality are important in this respect.

In software, new paradigms are emerging aimed at improving the flexibility of both the development process and the resulting IST applications. These include continuing developments in distributed systems and middleware, component-based architectures and service engineering, and open source software.

Trust, confidence and security is a general requirement for all technologies, applications and services. Developments here focus on technologies and applications to support information security, privacy, digital rights, and the dependability of systems and infrastructures.

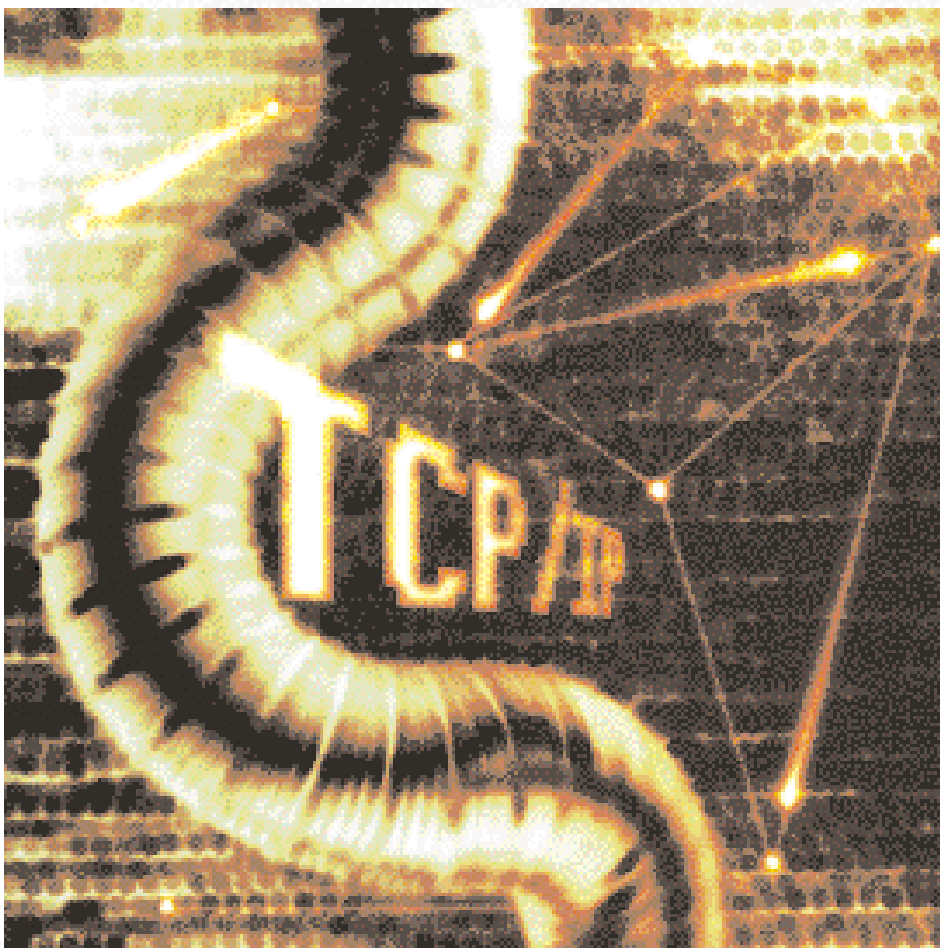
Embedded intelligence is another key theme. Continuing the trend of the last forty years, microprocessors will continue to become smaller and more powerful. In addition to data processing functions, sensing, actuating and storage capabilities are being added to microdevices to produce hugely powerful and versatile microsystems. These technologies, together with related developments in embedded software, are being integrated within an increasing array of “smart” devices and products to enhance their functionality and performance.

While there is much scope for further integration of processor technologies, there are signs we are approaching the end of the electronic age. Extensive effort is already being devoted to alternative technologies, such as opto-electronics, nano-technologies and, for the longer term, quantum computing and bio-computing.



# New protocol, new services

Within the IST Programme, many projects are addressing IPv6 in various contexts. Eight projects focus on fixed networks (6INIT, LONG, AQUILA, SEQUIN, GCAP, NGNLab, 6QM, 6POWER). A further eight focus on the interconnection and convergence of different radio access platforms (DRiVE, WINE GLASS, MOBY DICK, MIND/BRAIN, SUITED, WINE, 6WINIT, 6HOP), and another addresses the interconnection between fixed and wireless platforms (NETGATE). A new project, SATIP6, addresses issues in broadband satellite communication, including the eventual evolution towards IPv6.



*IPv6 will enable many new services*

The new generation internet protocol IPv6 addresses these shortcomings. With its expanded addressing capabilities, from 32-bit to 128-bit, IPv6 can provide some billions of addresses per square metre of Earth surface. This allows multiple addresses per interface, multiple interfaces per host and multiple hosts per person. Other important characteristics of IPv6 are

its ability to support auto-configuration, security and various classes of services, so enabling the labelling and prioritising of services which can then be charged accordingly. It also offers more efficient packet routing and “end-to-end” security and privacy. For network and service providers, faster subscriber growth through new personalised services and easier maintenance will lead to lower costs and more revenue. Thus, the new protocol has many advantages over its predecessor.

IPv6 will take time to materialise because applications will not arrive instantly. However, it is essential to

prepare the relevant technologies now, and encourage industry to get involved with this process. Implementation will have to allow for backward compatibility. After a first phase, starting with dual-standard terminals and IPv6 “islands” in a sea of IPv4, the second phase will use IPv4 “tunnelling”, that is IPv6 within IPv4 envelopes. In the final stage, IPv6 would dominate (with some IPv4 islands left), protocol and address translation would largely have disappeared, and seamless interworking

between heterogeneous wireless access networks would have arrived.

Within the IST Programme, many projects are addressing IPv6 in various contexts. Eight projects focus on fixed networks (6INIT, LONG, AQUILA, SEQUIN, GCAP, NGNLab, 6QM, 6POWER). A



## Europe in the vanguard

*Strong political support is ensuring that Europe is at the forefront of the future internet. In June 2002 the Member States adopted a series of conclusions on the transition to IPv6, reinforcing an earlier commitment made at the European Council in March. Vital to this has been the input of the IPv6 Task Force, launched in 2001, comprising senior representatives of European ISPs, telecoms operators, equipment supply industries, and key application sectors. The Task Force had by January 2002 prepared four working group reports and a common report.*

*The Task Force's work is being continued through the thematic network, IPv6TF-SC, with a new emphasis on dissemination and take-up. In this second phase, the Task Force will develop a strategy for the introduction of IPv6, with a focus on European initiatives. The target is to play an instrumental role in the deployment and co-ordination of the introduction of IPv6 in Europe on a large-scale by 2005 and beyond. It deals with IPv6 network co-operation aspects especially for new services and new developments towards 4G. More information can be found on the Task Force website: [www.ipv6tf.org](http://www.ipv6tf.org).*

further eight focus on the interconnection and convergence of different radio access platforms (DRiVE, WINE GLASS, MOBY DICK, MIND/BRAIN, SUITED, WINE, 6WINIT, 6HOP), and another addresses the interconnection between fixed and wireless platforms (NETGATE). A new project, SATIP6, addresses issues in broadband satellite communication, including the eventual evolution towards IPv6.

Euro6IX and 6NET offer large-scale pan-European IPv6 platforms for testing services related or using IPv6 and involving either European telecom operators or research networks. The Next Generation Networks Initiative (NGN-I) will produce a roadmap

towards the next generation networks in which the migration to IPv6 is one of the key issues. Another recent project, EUROV6, will provide practical demonstrations of IPv6 applications (see box).

The IPv6 Cluster, supported by the project 6LINK, brings together IPv6-related projects across the IST Programme and beyond. It is helping to foster a common view of the status of IPv6 development and to locate the most important issues for IPv6 deployment in Europe. Activities include the publication of books and reports, and a resource centre on IPv6-enabled applications and standards. The cluster also provides a focus for European contributions to standardisation bodies.

## A showcase for IPv6

*The European IPv6 Showcase, EUROV6, aims to raise awareness about the IPv6 protocol. It provides a forum for sponsors (operators, manufacturers, service providers) to test their devices and systems and bring their applications to the attention of potential user communities. A series of permanent demonstrators are being set up in Brussels and at other centres around Europe, providing an effective showcase of IPv6 networks, services and applications. The project will also create a portable package of applications and services, together with documentation and installation tips.*

### IST Action Lines:

IST-2001 V.1.6  
IST-2002 IV.2.3  
IST-2002 IV.5.2  
IST-2002 VII.1.2

### Commission Contacts:

Pascal Drabik (RN)  
Jose-Joaquim Fernandes (E4)  
Pertti Jauhiainen (E1)

### Web:

[www.ipv6tf.org](http://www.ipv6tf.org)  
[www.6link.org](http://www.6link.org)

### CPA6: Next generation networks

Networks and technologies for distributed services and applications  
Validation of wireless and mobile systems and technologies  
Research Networks: Advanced experimental infrastructures

[pascal.drabik@cec.eu.int](mailto:pascal.drabik@cec.eu.int)

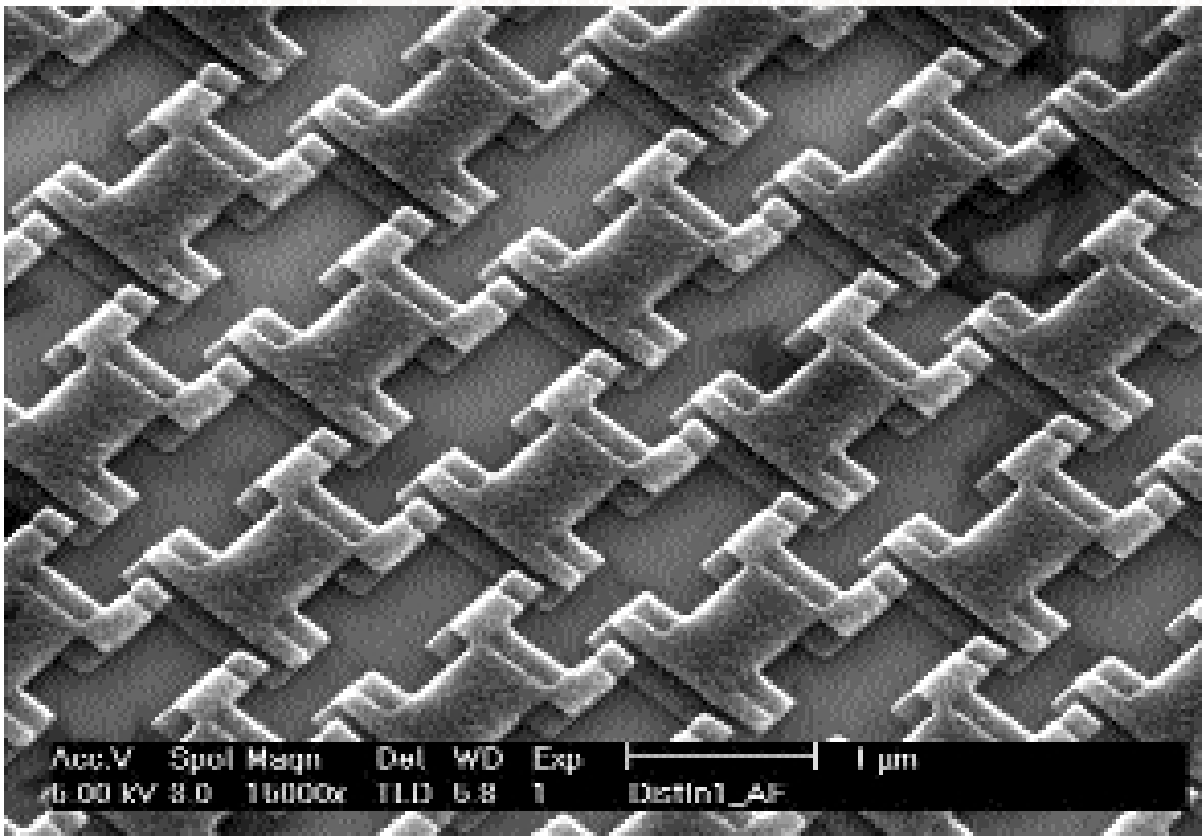
[jose-joaquim.fernandes@cec.eu.int](mailto:jose-joaquim.fernandes@cec.eu.int)

[pertti.jauhiainen@cec.eu.int](mailto:pertti.jauhiainen@cec.eu.int)

# Quantum dreams

**F**ew areas of science are as impenetrable to the layman as quantum mechanics. This is partly because the quantum view of the world is so totally at odds with our everyday experiences. Phenomena such as teleportation – the transfer of quantum objects from one place to another without sending the objects themselves – seem to owe more to science fiction than to real world science.

Progress in this field over the last decade, both in theory and experiments, has been rapid, to the point where radically new information and communication technology based on quantum phenomena are becoming a real possibility. Many questions still remain, however. Can quantum computers be made that scale up and are cost-effective? What problems would they be able to solve? What other applications can be envisaged for quantum systems? Considerable



*SEM picture of a Josephson junction array, a potential circuit for quantum computing (Photo: Delft Technical University)*

Over recent years, however, scientists have recognised that quantum mechanics opens wholly new prospects for processing and transmitting information. Quantum approaches could revolutionise the way we handle, transfer and even define information, leading perhaps to one of the most important breakthroughs in computing and communications since the emergence of the digital computer 60 years ago. The science involved is so close to fundamentals that completely new, as yet unthought of, ideas and applications will almost certainly emerge.

additional research and development is needed, both to open up new avenues and to bring the technology potential to fruition.

The Quantum Information Processing and Communications (QIPC) initiative, part of the IST Programme's Future and Emerging Technologies action, aims to pull together European expertise in the field to provide focus and build critical mass. It addresses the development of novel systems and techniques for information processing, transmission and security that exploit the properties of quantum

### Supporting Europe's QIPC community

*QUIPROCONE is a network of excellence for research on quantum information processing and communications. The network provides a framework for coordination of QIPC research activity across Europe. As well as supporting the EU-funded collaborative RTD projects, the network has strong links with national research activities and with industry. It enables broad dissemination of the latest information, news and developments, and both organises and participates in a wide range of scientific conferences and workshops. A roadmap on future developments in this field is also being prepared. To inform this process, a series of working groups have been set up, dealing with issues such as: cryptography and communication; decoherence control and stability; qubit and entanglement manipulation; input/output in quantum systems; and new concepts of quantum information.*

mechanical operations. The launch of the QIPC initiative followed an 18-month preparation phase which involved the key European “fathers” of quantum computing and involved a major public event where more than 100 scientists contributed to shaping its long-term objectives. The field is strongly interdisciplinary and draws together researchers from areas such as nuclear physics, computer science, semiconductor engineering, quantum optics, and mathematics.

Following a call under IST's 1999 Work Programme, 12 projects were launched looking at various aspects of quantum systems, together with a support network, QUIPROCONE (see box). A further 12 projects are expected to be launched by the end of the year, following a call under WP2002.

The key research objective is the development of an elementary scalable quantum processor, which is likely to be an important step towards large-scale quantum computing. Other aspects addressed by the projects include quantum algorithms – the “software” needed to tackle practical problems; the stability of quantum systems; and mechanisms to store and retrieve information from quantum systems and to read back the results.

The scientific achievements resulting from this joint research effort are already substantial. To date, QIPC projects have resulted in over 200 refereed papers in high quality scientific journals, as well as many

conference presentations and posters. Another notable feature is the close collaboration between experimentalists and theorists. Although some of the underlying issues are theoretical, others require experimentation at large-scale physics facilities and/or applied research in the laboratory (on nano-scale solid state devices, for example). The ready flow of information between projects, disciplines and research groups is helping to keep Europe at the forefront of this fast-moving field.

One of the most promising applications is in quantum communications and cryptography. The ability to use quantum systems to transmit information at the laboratory scale is well demonstrated. But scaling these quantum communications protocols over long distances and demonstrating their compatibility with the telecoms infrastructure, such as optical fibres, is a highly demanding task. Earlier this year, a record exchange of “quantum keys” over 23.4km between mountain tops in southern Germany was demonstrated. This is just the latest in a series of breakthroughs by IST projects across the QIPC field.

Building the devices necessary to demonstrate the underlying concepts also represents a substantial technological challenge. Here the researchers are seeking to develop single-photon sources, entangled-pair sources and single-photon detectors. Realising such components is likely to prove as challenging as the quantum processors themselves.

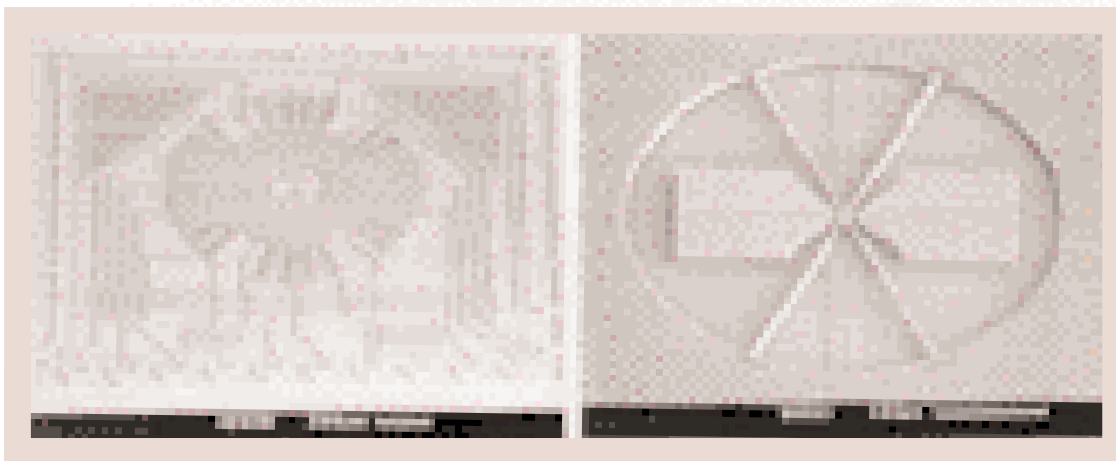
IST Action Lines:	IST-2002 VI.2.1	Quantum information processing and communication
Project References:	QUIPROCONE	IST-2000-29064
Commission Contacts:	Pierpaolo Malinverni	pierpaolo.malinverni@cec.eu.int
Web:	<a href="http://www.cordis.lu/ist/fetqipc.htm">www.cordis.lu/ist/fetqipc.htm</a> <a href="http://www.quiprocone.org">www.quiprocone.org</a>	

# Making the most of microsystems

**M**icrosystems – miniaturised systems comprising a wide range of mechanical, electronic, optical and other components – are of increasing importance across a wide range of industry sectors. Current applications include DNA chips, drug delivery systems, smart cards, accelerometers for automotive air bags, and inkjet printer heads.

established and either have already shown good results or are close to promised achievements.

A smart two-dimensional barcode reader based on micro-mirror devices is targeted by MIRAGE. Microelectronics, microsystems, optical beam forming and focusing techniques, mechanics and packaging techniques are combined with software techniques for



*Accelerometers are one example of microsystems*

During the course of the Fifth Framework Programme, microsystems RTD has evolved from the development of single, and rather isolated, sensors, actuators and microsystems to more integrated complex systems merging multidisciplinary technologies, system integration aspects, control techniques, connectivity and interface specificities. Over the later phases of the IST Programme, in particular, the emphasis of the various projects has shifted from development of process technologies, device design and single chip or device packaging, towards complete system design and packaging techniques, and integration of more complex functionalities. A representative sample of projects showing the changing approach is mentioned below. Some of these have just started, others are more

barcode reading and image scanning. This complete mechano-optical system could replace existing barcode scanners and post stamp reading systems.

CMOSSens and SAGAS are both developing gas sensor systems based upon microsystem technologies, for residual oil analysis and “electronic nose” applications, and industrial exhaust gas analysis and detection respectively. In addition to the more conventional sensor and microsystem developments, both projects involve research and exploration of extensive software and mathematical analysis methods for differentiation and detection of various gas mixtures. Methods for the remote calculation, storage, control and feedback of the measured signals are also key elements.

## **Microsystems for safety and security**

*Numerous applications in daily life, such as safety and security surveillance, traffic and transport management, require more affordable, more robust and more accurate sensors. MISSY is addressing these needs by developing a microsystem for fast and robust 3D image acquisition. The system will be based on CMOS photosensitive circuits, infrared laser illumination and an innovative time of flight measurement method. It will be flexible, optimised for high volume applications, highly miniaturised and support network communications. Potential applications include security surveillance or remote observations of people in hospitals or recovering at home.*



A recently started project that integrates flexible shutters at chip level in optical microsystems to an IR spectrometer is MEMBIRS. By means of an array of micromechanical microshutters, a light beam is split into its components that are detected by sensor arrays. These technologies are being combined with complex optical packaging, optical techniques, electronic circuitry for steering and control, and software for spectrometric analysis of light.

In the medical domain, SALIWELL is developing a technology to obviate medical, psychological and social privations due to insufficient saliva production. The leading-edge technology integrates a self-correcting electronic saliva stimulating system in a dental implant. The work integrates micro-sensors and micro-actuators with software, interactive interfaces, building on physio-chemical, mechanical, medical, dental and other disciplines. It provides an excellent model for future integrated projects.

Also for healthcare, TUBA is trying to develop implantable medical devices to assist patients with a “drop foot” syndrome. The device combines a micro-fabricated inertial system, a planar RF transmitter/receiver and a micro-sensor to determine the relative position of the receiver form. Again the multidisciplinary approach – application of mechanical knowledge to the medical field – is illustrative of the approach to be followed under FP6.

For the future, the challenge is to more fully embrace the multidisciplinary approach necessary to realise the full potential of microsystems from both technology and application perspectives. The new FP6 instruments (integrated projects and networks of excellence) will be used to attack this broader picture, addressing the long term research needs and helping to build critical mass for Europe in key areas.

### Really useful smart cards

*FORMAT is developing an innovative smart card technology for multi-application cards with more user-friendly interfaces. It targets in particular multi-application card markets where more complex cards will efficiently challenge multiple card solutions. Multi-function smart cards will support interactivity between users and card applications, increase ease-of-use, strengthen security and trust, and facilitate large deployment of card applications thanks to higher user acceptance. These are key objectives of the e-Europe Smart Card Charter.*

*The work involves the validation of a card technology that supports a number of functions on ISO standard cards, and validation of the economics of multi-function card manufacture.*

IST Action Lines:	IST-2002 IV.7.2	Integration of sensors and actuators for increased intelligence, interaction and networking
	IST-2002 V.1.1.10	CPA10: Sensor technologies and applications
Project References:	CMOSSens	IST-1999-10579
	FORMAT	IST-2002-30121
	MEMBIRS	IST-2001-35150
	MIRAGE	IST-1999-10109
	MISSY	IST-2000-28174
	SAGAS	EP 28114
	SALIWELL	IST-2001-37409
	TUBA	IST-2001-32750
Commission Contacts:	Marcel Hugen	marcel.hugen@cec.eu.int
Web:	www.cordis.lu/ist/ka4/supermic/index.htm	

# Smart antennas

**A**ntennas are essential to the functioning of wireless communication systems. Adaptive antenna technology addresses the threefold goals of obtaining greater range, gaining extra capacity and reducing interference levels within a given radio system. In former RACE and ACTS projects the concept has been proven to impart extra capacity in cellular networks.

Two principles underlie this technology. Beam steering, the sending of correlated signals from multiple antennas, permits directional control of the signal, so gaining frequency re-use and interference control. Diversity, the receiving of uncorrelated signals at different aeriels, accomplishes capacity gain and interference rejection. Examples are space and polarisation diversity. Diversity has received a lot of attention recently, with the use of multiple antenna diversity at both transmitter and receiver. These techniques are known as MIMO, "multiple outputs multiple inputs".

Several IST projects are investigating antenna technology issues and an Adaptive Antenna cluster has been formed to consolidate results, exploit synergy and stimulate information sharing. These techniques are thought to be key to the successful commercial exploitation of third generation (3G) mobile technology, while they might be applicable to the optimisation of earlier systems and are clearly relevant to systems beyond 3G. Adaptive control of antennas provides a means of dynamically configuring radio systems and networks. As such, it is of major interest as a means for achieving the flexibility necessary for service and system interoperability in future mobile networks.

SATURN involves a theoretical and experimental study of advanced MIMO diversity using cross-polarised antennas for UMTS and HIPERLAN systems. It hopes to obtain extra capacity especially where channels are fading, and also to develop improved techniques for determining the location of a terminal. ASILUM is investigating interference mitigation techniques for GSM systems, and will compare various proposed methods by computer simulation. ESCORT is characterising the propagation environment encountered when using GSM in urban public transport systems. Here, the tunnels result in signal reception over unusual multiple paths. Special diversity and space-time coding algorithms are being developed to provide more reliable communication for transport control systems.

I-METRA continues the work of an earlier project (METRA) in seeing how close theoretical capacity limits may be approached with adaptable antennas at both terminal and base station. FITNESS aims to achieve link level and system level reconfigurability using smart antennas for systems beyond 3G. Its investigations address UMTS and HIPERLAN 2 systems, and contribute to standards bodies. OBANET targets coverage area management for fixed and mobile services in the 40 GHz band. It will use novel photonic (optical) technology for delivering signals to the beam-forming antennas.

IST Action Lines:	IST-2002 IV.5	Mobile and personal communications and systems, including satellite-related systems and services	
Project References:	ASILUM	IST-1999-10741	<a href="http://www.ist-asilum.org">www.ist-asilum.org</a>
	ESCORT	IST-1999-20006	<a href="http://www.ceit.es/escort">www.ceit.es/escort</a>
	FITNESS	IST-2000-30116	<a href="http://www.ist-fitness.org">www.ist-fitness.org</a>
	I-METRA	IST-2000-30148	<a href="http://www.ist-imetra.org">www.ist-imetra.org</a>
	METRA	IST-1999-11729	<a href="http://www.ist-metra.org">www.ist-metra.org</a>
	OBANET	IST-2000-25390	<a href="http://www.ist-obanet.upv.es">www.ist-obanet.upv.es</a>
	SATURN	IST-1999-10322	<a href="http://www.ist-saturn.org">www.ist-saturn.org</a>
Commission Contacts:	Fabrizio Sestini	<a href="mailto:fabrizio.sestini@cec.eu.int">fabrizio.sestini@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka4/mobile/proclu/c/adaptantennas.htm">www.cordis.lu/ist/ka4/mobile/proclu/c/adaptantennas.htm</a>		

# Building blocks for learning technology

**I**nformation and communication technologies (ICTs) are now widely used in education and training, enabling the implementation of new approaches to learning (e.g. distance learning, sharing of course materials, virtual laboratories). While there are many practical benefits in the use of ICT, the production of learning content is expensive. At the same time new learning requirements are emerging, with a shift towards personalised learning services flexibly delivered. Thus, more cost-effective learning environments are required based on open standards and reusable learning objects.

Building on earlier work, the IST Programme's initiative on Open Platforms and Tools for Personalised Learning aims to develop open architectures for education and training applications and services. The work focuses on the development and validation of reusable components, and is closely linked to component software engineering. New tools and processes are being developed for producing and maintaining reusable learning objects at different levels of detail ("granularity"). Tools and processes for locating and sharing learning objects are also addressed, including solutions for operational issues such as intellectual property rights, accreditation and payments. Another area of interest is the assembly and maintenance of new types of flexible learning environments based on reusable learning objects.

A total of 22 projects are supported including 6 trials. The main development areas include: learning object manipulation (metadata generators and retrieval systems); learning object authoring systems; security and trust infrastructures (APIs, smartcards); knowledge repositories; and language translation. The results feed

into longer term research on advanced learning environments and innovative pedagogical approaches. In addition, active contributions are being made to international standardisation activities and to European best practice.

KOD, a key project in this area, was concerned with adaptive learning environments for personalised learning. The idea behind the KOD system is the generation of personal learning paths (knowledge routes), which are generated and updated based on the learner's personal profile (background, interests, skills etc.). These enable educators to learn about students' needs and provide users with a full spectrum of instructional and informative data tailored to their needs and prior knowledge. The recently completed project delivered a set of software tools and components, together with a reference manual and user guidelines, and full documentation and analysis of the methodology.

EASEL, also recently completed, explored technologies to offer course constructors an environment in which they can readily combine existing learning objects to create new online courses. The work involved the development of an XML metadata repository for storing descriptions of learning objects, assessment modules for interrogating objects, a web-based search gateway and a construction kit. The project worked closely with industry initiatives on learning object methodologies, such as W3C, Dublin Core and IEEE LOM.

IST Action Lines:	IST-2001 III.2	Education and training	
Project References:	EASEL	IST-1999 10051	<a href="http://www.fdggroup.com/easel">www.fdggroup.com/easel</a>
	KOD	IST-1999-12503	<a href="http://www.kodweb.org">www.kodweb.org</a>
Commission Contacts:	Jans Jürgen Westhoff <a href="mailto:hans-juergen.westhoff@cec.eu.int">hans-juergen.westhoff@cec.eu.int</a>		
Web:	<a href="http://www.cordis.lu/ist/ka3/education">www.cordis.lu/ist/ka3/education</a> <a href="http://www.proacte.com">www.proacte.com</a>		

# Composing software

As software applications grow in size and pervade all domains, there is a growing need to reduce development time and costs, while maintaining or increasing quality and performance. Such demands will increase in future, since the ambient intelligence vision relies on the inclusion of software components for nearly all devices. Hence, we need to find ways to improve the productivity of software development without compromising on reliability.

While component-based software engineering (CBSE) and extensive reuse are considered key techniques, over recent years attention has been shifting from the components themselves towards the architectures within which they are used.

The efficiency of component-based systems depends on the system architecture, since this determines the extent to which components can be interchanged and reused. Effective development environments will require reasoning at the architectural level on issues such as composability, quality, scalability, reliability and dependability, which are best addressed at the design stage. Research in this field includes formal specifications and modelling. Attention is also moving to real-time aspects, self-correction and self-adaptation, as well as software systems that are able to evolve and reconfigure themselves dynamically.

The IST Programme supports a broad portfolio of work on composability in software. This focuses on

the design and development of flexible, reusable and evolvable software systems through the development of models, tools and notations to describe and compare them. Semantic descriptions of the functionality of, and interactions between, software components are also addressed.



Software is essential to modern organisations

## Innovation in component-based software

Component-based software engineering is an approach to software systems development based around the reuse of existing general-purpose software components. System implementation involves integrating these components within some framework. Although there are overlaps in partners and informal communications between research initiatives throughout Europe, the CBSE community could benefit from a more systematic approach to information interchange.

CBSEnet is a thematic network which provides a European-wide forum for the exchange of information between researchers and developers working in the field. The network also facilitates the transfer of R&D results to early adopters of new CBSE technologies and methods in industry, and provides a channel for informing researchers on industry's research needs.



Attempts over recent years to use generic techniques to analyse, describe and design any kind of software architecture have proved largely unsuccessful. A more realistic approach has been to use architectural styles that concentrate on describing aspects relevant to a specific domain and provide specific techniques to analyse the problems associated with that domain. This is the approach taken in CARTs, the selected domain being time-critical applications. A computer-aided architectural analysis tool is being developed supporting a real-time component-based architectural style. The results will enable equipment manufacturers to specify, design and evaluate real-time embedded software architectures built around components.

The product families approach aims to optimise the benefits obtained with reusability and component-based applications by restricting them to limited domains. CONIPF is defining and validating a configuration methodology for product families in industrial applications, with the aim of maximising the

reuse of available generic software components. Also concerned with modular approaches, MASTER aims at providing automation for the adoption of OMG's Model Driven Architecture (MDA) for modelling complex software system families, focusing specifically on air traffic management. MODA-TEL is developing an MDA for telecommunication system development and operation. And BANKSEC is developing an assembly environment for secure banking applications using a component-based approach.

While CBSE is becoming mainstream for conventional applications, components can be difficult to deploy in embedded systems because of non-functional requirements. PECOS seeks to enable CBSE for embedded systems by defining a meta-model as well as a repository for components that reflects non-functional requirements. These additional features are integrated in a composition environment. An ultralight component environment allows the composed application to be run on the embedded system.

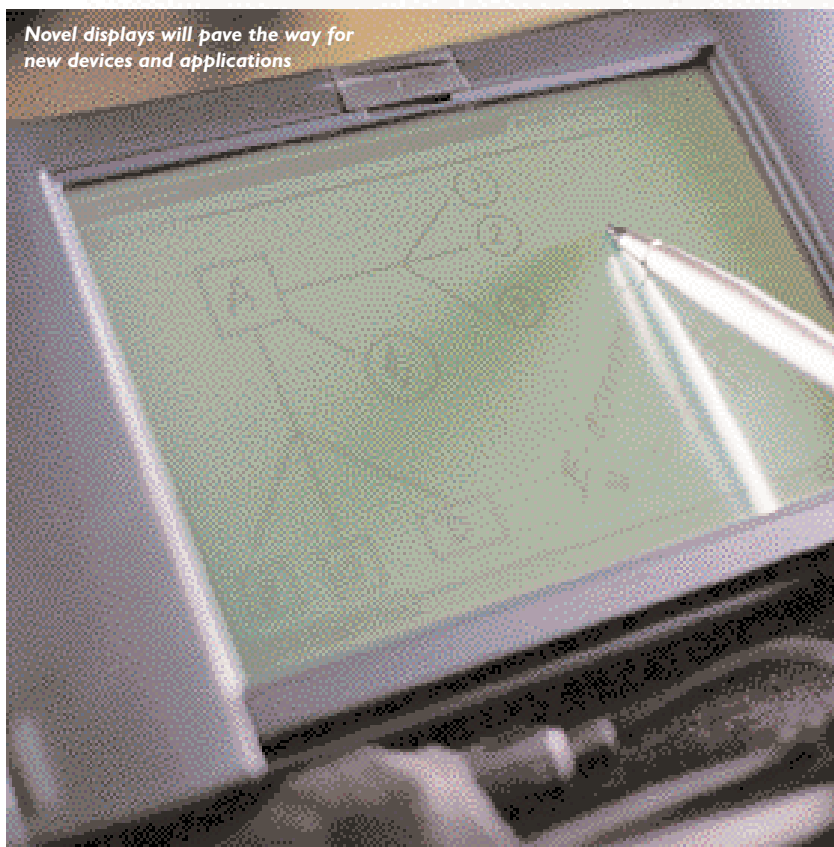
### Dependability in P2P architectures

*Peer-to-peer (P2P) computing, which eliminates the need for servers and leverages computing capabilities, is a promising architecture that is expected to expand significantly over the next few years. P2P ARCHITECT aims to enable software developers to build dependable software systems conforming to a P2P architecture. This will be achieved by defining and implementing a methodology and supporting tool for ensuring conformity to dependability requirements at an architectural level. The system will be validated in a series of real-life implementations involving P2P environments.*

IST Action Lines:	IST-2001 IV.3.1 IST-2002 IV.3.1	Software architecture Composability and dynamic adaptability in software, systems and services
Project References:	BANKSEC CARTS CBSENET CONIPF MASTER MODA-TEL P2P ARCHITECT PECOS	IST-1999-20711 IST-1999-20608 IST-2001-35485 IST-2001-34438 IST-2001-34600 IST-2001-37785 IST-2001-32708 IST-1999-20398 <a href="http://www.tcpsi.es/carts">www.tcpsi.es/carts</a> <a href="http://www.atc.gr/p2p_architect">www.atc.gr/p2p_architect</a> <a href="http://www.pecos-project.org">www.pecos-project.org</a>
Commission Contacts:	Jacques Bus Michel Lacroix	<a href="mailto:jacques.bus@cec.eu.int">jacques.bus@cec.eu.int</a> <a href="mailto:michel.lacroix@cec.eu.int">michel.lacroix@cec.eu.int</a>
Web:	<a href="http://www.cordis.lu/ist/ka4/tesss">www.cordis.lu/ist/ka4/tesss</a>	

# Advanced portable displays

Display technologies are essential for accessing and transmitting information because most system to end-user information transfer occurs visually. Users will access the next generation of networked applications and services through intelligent, accessible interfaces, to which displays are increasingly contributing. Current solutions only partly satisfy their respective market needs, however, and often limit system design and usability. Hence, new approaches for displays are constantly being proposed and, in contrast to silicon, no single technology is able to fulfil all applications.



The last few years have seen the emergence of flat panel displays (FPDs) of increasing size and performance, and light portable projectors in the office. FPDs are already key components of many systems and are set to challenge the traditional CRT in market value in the coming years. The consumer TV market is still largely untapped, however, with several technologies competing. For portable devices, displays which combine crisp visual appearance with low power consumption and video capabilities have yet to emerge. Furthermore, the visual coupling to high content pictures with small form factors is not solved, and the

usability of the portable systems remains limited. The emergence of large area "plastic" electronics integrated with flexible displays and sensors could open up new application possibilities like e-paper, wearable devices, and complete flat and thin terminals.

The IST Programme has around 17 projects concerned with advanced displays and sensors. The main focus is on improving the usability of portable devices; and adding value to existing display technologies through the development of new materials, processes and components including their system integration with

sensors/actuators. Innovative concepts for high performance applications like large-scale projection and immersive virtual reality and augmented reality applications are also addressed. Thin flexible displays for smart cards, electronic paper, visualisation and wearable computers are another key interest. As in previous programmes, there are close links to basic research on new materials, which in FP5 is being undertaken under the Growth Programme.

Among the most recent projects, FLEXled targets further developments in flexible substrate technologies. New types of flexible displays for mobile

consumer devices are being developed based on polymer light emitting diodes (PLED). Passive matrix displays (up to 320x240 pixels) on flexible substrates will be made, with an expected lifetime greater than 10 000 hrs. Addressing all aspects necessary for a successful demonstration of the flexible display concept, the work is expected to pave the way for new applications (e.g. e-paper, smart cards, wearable displays) and manufacturing approaches.

A novel display interface that is fully wearable and portable is being investigated by MULTIPLEYE.

### Low-cost systems for large-screen TV

*LCOS (Liquid Crystal On Silicon) microcircuit is a promising technology for the large-screen TV and home cinema markets. But today's solutions are based on expensive 3-LCOS or digital micromirror concepts. The LCOS4LCOS project aims at making a breakthrough by demonstrating the technical and economical feasibility of the 1-LCOS concept. A completely new LCOS component is being developed with an innovative pixel architecture combined with the latest LC materials. Dedicated optical architectures are being designed to validate the concept for consumer TV applications. Cost and marketing studies are also being undertaken to demonstrate how this technology can fit with market requirements.*

Potential applications include vision enhancement and navigation in driving, specialised computer-assisted operations (surgeons, assembly workers), office applications, entertainment, and vision enhancement for the visually impaired. Among other elements, the system will comprise an optical module, a miniaturised inertial system (based on MEMS technology) for tracking head position and orientation, and CMOS camera.

WALORI will demonstrate the feasibility of an ultra-compact, low-cost camera module including CMOS image sensor, image processing and built-in lens. The work focuses on new optical concepts allowing a thin optical system to be directly bonded on image sensor silicon wafer and able to meet at least the same optical performance as current macro imaging systems. The approach promises a real breakthrough in high volume telecom and multimedia applications in terms of integration and compactness, sensor detectivity, image quality, and manufacturability.

Research into displays, sensors and modules as components to support audio-visual terminals will continue under FP6. Improving the usability of portable terminals will be one priority. Particular issues here include higher visual quality and lower power displays; and new concepts for visual coupling,

sensing and feedback. Endurance, form factor and flexibility for smart-cards, e-paper and wearable terminals will be addressed. And the emergence of organic displays and electronics will be investigated as the basis for a new class of thin, flexible and very cost-effective terminals.

In large-area electronics major efforts are needed to advance electronic performance, to find appropriate substrates able to stand processing temperature and guarantee operational stability even when flexible, and to demonstrate the possibility for very low cost or even customised manufacturing. Important issues include integration with existing technologies (sensors, interconnects, MEMS, batteries), and system optimisation, with a view to demonstrating the feasibility of flat and slim wearable communication devices.

IST Action Lines:	IST-2001 IV.6.1	Advanced displays and sensors
Project References:	FLEXLED	IST-2001-34215
	LCOS4LCOS	IST-2001-34591
	MULTIPLEYE	IST-2001-35108
	WALORI	IST-2001-35366
Commission Contacts:	Marc Boukerche	marc.boukerche@cec.eu.int
Web:	www.cordis.lu/ist/ka4/vision	

# Breaking through the wall

**M**iniaturisation has enabled impressive increases in the performance of modern electronic equipment. This is a consequence of Moore's Law, the observation that the processing power of integrated circuits (ICs) doubles every 18 months. However, we are reaching a stage where further downscaling becomes increasingly problematic. Physical limits, such as quantum effects, and technological bottlenecks, such as lithography, material reliability and power dissipation, threaten to put a brickwall in the way of future development and bring Moore's miniaturisation ride to an end.

To ensure a synchronised development, the global semiconductor industry has developed the International Technology Roadmap for Semiconductors (ITRS), setting out the perspective through to 2016. From the 130nm technology now entering production, the industry expects to proceed to feature sizes of 90nm by 2004, 65nm by 2007, and to 32-22nm by 2013-2016. Realising this requires efforts on many fronts, including further optimisation of processes to achieve very small gate sizes, development of new materials and optimisation of existing materials, and novel approaches to architectures and circuit design.

The IST Programme has made major contributions towards these international efforts. A series of projects – HUNT, ARTEMIS, IMPACT, NESTOR – are making steady progress in this area and provide every confidence that the ITRS goals will be achieved (see box).

Simulation of the fabrication of semiconductor devices has generally been accepted by industry to be very important to the optimisation and development of new devices. However, the predictive models used tend to fall behind and continual effort is required to maintain the accuracy necessary for industrial applications. FRENDECH is developing front-end simulation models for silicon and silicon-germanium devices, focusing on ion implantation, diffusion and oxidation.

New gate material is another challenging area of investigation. As transistors become smaller, insulators with higher dielectric constant than conventional silicon dioxide are required to reduce leakage currents. HIKE is developing modelling and simulation tools of the growth of high-k dielectric oxides (e.g. hafnium and zirconium oxides). The work aims at helping development engineers to better tailor film growth and improve their understanding of deposition mechanisms. Also focusing on high constant materials, TOPS has investigated the photodeposition of tantalum pentoxide on silicon. INVEST is integrating in CMOS other complex metal oxides, grown by molecular beam epitaxy, with even higher dielectric constants.

In the area of new and emerging devices, ADAMANT is studying novel storage mechanisms for future generations of standalone and embedded non-volatile memories (NVMs). The work addresses the 100nm Flash Technology node and prepares for the 80nm generation. Embedded NVMs based on SBT ferroelectric materials are being developed by FLEUR.

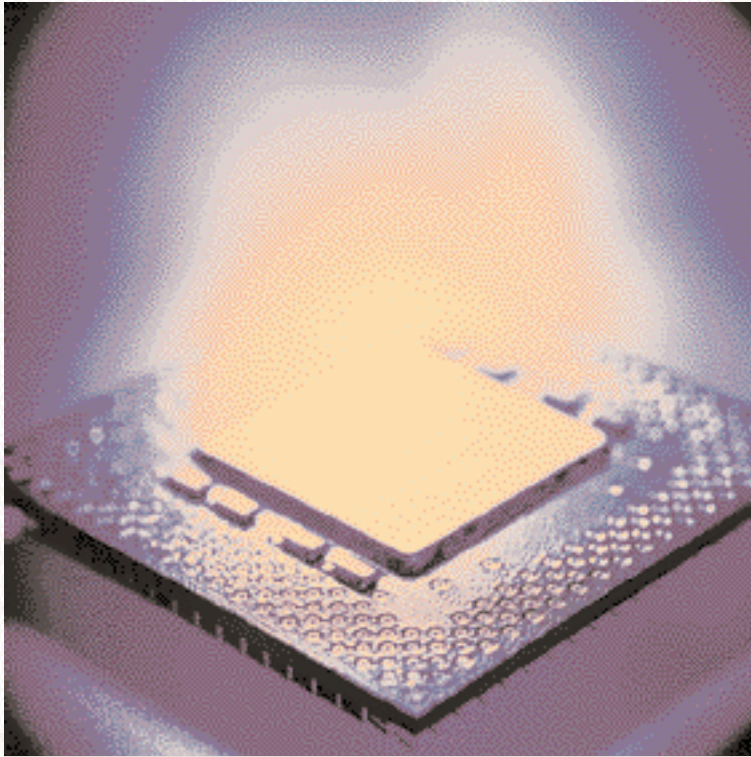
## Following Moore's road

*HUNT addressed the development and evaluation of the main process steps and modules for 100nm CMOS technology. Activities focused on the investigation and optimisation of the gate dielectric, and on specific basic transistor building blocks. The advances made will significantly improve the transistor architecture, both for the 100nm technology and for future technologies. The main industrial partners expect to transfer the results to ramp-up their 90nm technology by the end of 2002.*

*A follow-on project, ARTEMIS, aims to extend the results towards the 65nm node. It targets physical gate lengths from 45nm down to 25nm, in line with the ITRS roadmap. Another IST project, IMPACT, is using HUNT's baseline 100nm CMOS technology as the starting point for further optimisation of RF performance for wireless applications. The results have also been fed into the MEDEA+ T201 project, dedicated to the overall integration (front-end and back-end) of the 100nm generation CMOS technology.*

*Realisation of 65nm node technology will require the introduction of devices with gate lengths in the 25nm range by 2007. A new IST project, NESTOR, will provide a first assessment of three new multi-gate architectures for such devices that are potentially scalable down to the 10nm range.*





*The future of microelectronics depends on further advances in process technology*

The project aims to integrate them in a single chip with CMOS logic for smart card and RFID applications. And with a longer term horizon, FORUM FIB aims to demonstrate a new generation of nano-crystal memories for potential mass fabrication and full compatibility with CMOS technology.

Other projects are addressing key challenges following the wafer fabrication stage (so-called back-end processes). For instance, ULISSE concentrates on critical aspects of interconnects, in particular the use of ultra-low k materials to reduce parasitic capacitances. And MULSIC is developing a software package for the simulation of interconnect fabrication processes and characteristics, so as to optimise circuit design.

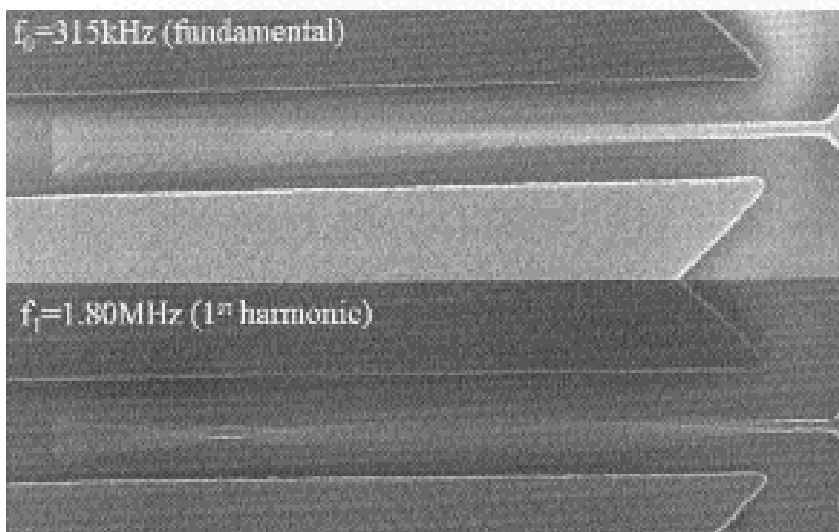
Given the current rates of progress, within the timescale of FP6 we can expect to realise microprocessors with more than 1 billion transistors (now about 100 million), and memory with capacities of more than 10 gigabits (versus 512 Mb now). Thus, future work will continue to push the limits towards 32nm node requirements for mainstream CMOS,

through efforts on lithography, dielectrics, metrology, controls, and new materials, as well as environmental health and safety. In addition, work will continue towards 22nm node and below (corresponding to physical gate sizes below 10nm), focusing on pushing the limits of CMOS and on looking for alternative nanoscale fabrication technologies.

IST Action Lines:	IST-2002 IV.8.2	Microelectronics technologies – processes, equipment and devices	
Project References:	ADAMANT	IST-2001-34234	<a href="http://www-leti.cea.fr/programmes/adamantproject">www-leti.cea.fr/programmes/adamantproject</a>
	ARTEMIS	IST-2001-34404	<a href="http://www.imec.be/artemis">www.imec.be/artemis</a>
	FLEUR	IST-2000-30153	<a href="http://www.imec.be/fleur">www.imec.be/fleur</a>
	FORUM FIB	IST-2000-29573	
	FRENDTECH	IST-2000-30129	<a href="http://www.iis-b.fhg.de/en/arb_geb/frendtech.html">www.iis-b.fhg.de/en/arb_geb/frendtech.html</a>
	INVEST	IST-2000-28495	<a href="http://www.ims.demokritos.gr/invest">www.ims.demokritos.gr/invest</a>
	HIKE	IST-2000-29295	<a href="http://www.nmrc.ie/projects/hike">www.nmrc.ie/projects/hike</a>
	HUNT	IST-1999-11599	<a href="http://www.imec.be/hunt">www.imec.be/hunt</a>
	IMPACT	IST-2000-30016	<a href="http://www.imec.be/impact">www.imec.be/impact</a>
	MULSIC	IST-2000-30133	<a href="http://www.iis-b.fhg.de/en/arb_geb/mulsic.html">www.iis-b.fhg.de/en/arb_geb/mulsic.html</a>
	NESTOR	IST-2001-37114	
	TOPS	IST-1999-10541	<a href="http://www.nmrc.ie/projects/tops">www.nmrc.ie/projects/tops</a>
	ULISSE	IST-2000-30043	<a href="http://www-leti.cea.fr/programmes/ulisseproject">www-leti.cea.fr/programmes/ulisseproject</a>
Commission Contacts:	Georg Kelm Bernard Netange	<a href="mailto:georg.kelm@cec.eu.int">georg.kelm@cec.eu.int</a> <a href="mailto:bernard.netange@cec.eu.int">bernard.netange@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka4/mel">www.cordis.lu/ist/ka4/mel</a>		

# A small new world

**N**anotechnology - the ability to engineer devices and processes at the molecular level – is set to be the dominant industry of the 21st century. Exploitation of nano-scale phenomena, processes and structures promises further breakthroughs in miniaturisation, as well as adding new functionality in terms of sensing and actuating capabilities. These developments will enable products and systems to become more portable, intelligent and powerful. They will facilitate the creation of new machines, new production processes and new applications and services – things that can only just be imagined and things that have yet to be imagined at all.



A swinging cantilever developed under project NANOMASS

The Nanotechnology Information Devices (NID) initiative, part of IST's Future and Emerging Technologies (FET) action, supports innovative research for information processing systems operating at the nano-scale. Its scope covers any

research field that could contribute in shaping future visions for information processing nano-systems, from quantum electronics to nano-mechanics and biology. The field is inherently interdisciplinary and draws on expertise from a broad range of disciplines. Following calls in 1999 and 2001, the IST Programme now has a portfolio of around 30 projects.

The work addresses three main aspects. Firstly, the development of novel architectures and designs for information processing systems that can be implemented at the nano-scale. A second area of interest is novel devices, at the level of logic gates,

memory cells or other elementary components. Key concerns here are scalability, power consumption and the interfacing of the nanoscale devices to the macroscopic world. Thirdly, NID is developing tools and techniques for fabricating structures with critical dimensions below 10nm and integrating them within robust systems. Again fabrication, scalability and cost, in terms of throughput, are important issues. Novel approaches such as self-

organisation and self-assembly or hybrid systems are also covered.

A key interest is in novel devices and systems operating at the atomic or molecular scale (molecular

## Molecular interconnects for nanotechnology

*Microelectronic systems have many highly interconnected components. Future manufacturing methods for nano-devices on the molecular scale will need to deliver at least the same level of interconnection using a compatible process. Ribo-nucleic acid (RNA) folds to form simple tertiary structures. Since the folded structure of a given sequence of RNA can be predicted, sequences that fold into desirable branched nanoelectronic structures can be made.*

*MINT is investigating families of structures that can link up to form tessellated ensembles and multiply connected structures. These structures will be used to position electronic materials for devices, and electrical characterisation will be undertaken. The project is also studying pattern transfer to conventional electronic substrate to demonstrate sub-10nm lithography.*

computing). Carbon nanotubes (CNTs), due to their unique electrical and mechanical properties, are emerging as one of the best candidates here. At the interface of electronics and chemistry, SATURN is studying the growth, nanomanipulation and electronic properties of single wall CNTs with a particular emphasis on junctions. The objective is to demonstrate the applicability of CNTs for the fabrication of electronic devices. Also in molecular computing, the DNA-Based Electronics project is exploring the electronic properties of DNA and its potential for future information processing. And MINT is investigating RNA as a basis for molecular scale interconnects (see box).

In the area of fabrication, NANOLITH is addressing key problems in parallel e-beam lithography, the preferred approach for realising feature sizes at 45nm and below. NANOCOLD aims to develop atom lithography nanotechnologies based on the deposition of individual atoms focused by laser light for the production of nanostructures in the 10nm range. And ESCHER is investigating the chemical preparation of coated nano-crystals as self-assembling

building blocks for active electronic components.

Several of the most recent projects focus on silicon-compatible devices beyond CMOS, such as hybrid systems integrating magnetic, superconducting device concepts and other effects with a silicon interface. For instance, NANOMASS II continues an earlier project to develop technologies for the combination of CMOS circuitry with a variety of nano-scale sensors. The work focuses on innovative approaches to nanolithography. NEAR is investigating nanoscale electronic elements and circuits for operation at room temperature. The devices, primarily wave-guide and point-contact devices, will be defined by a single layer nanolithography, and will be integrated in applications such as logic ports and RF circuitry. NANOMAG is aiming to prepare highly magnetic, air-stable nanocrystalline materials for data storage and imaging applications.

Work in this area is being consolidated by PHANTOMSNET, a network of around 160 research groups comprising 1300 researchers.

### New approaches for microwave communications

*Most long-range telecommunication systems are based on microwave links including high power transmitters on ground stations and on satellites. As present frequency bands become saturated, manufacturers are looking for new low-cost amplifiers able to operate at higher frequencies. Cold cathodes using carbon nanotubes are considered as an ideal starting point. CANVAD aims to demonstrate the use of CNT-based cold cathodes (as an alternative to today's hot thermionic cathodes) as a basis for a new generation of high frequency (30-100 GHz) compact and low-cost vacuum microwave amplifiers.*

IST Action Lines:	IST-2001 VI.2.1	Nanotechnology information devices
Project References:	CANVAD	IST-2001-33566
	DNA-BASED ELECTRONICS	IST-1999-13099
	ESCHER	IST-2001-33287
	MINT	IST-2001-32152
	NANOCOLD	IST-2001-32264
	NANOLITH	IST-1999-11806
	NANOMAG	IST-2001-33546
	NANOMASS II	IST-2001-33068
	NEAR	IST-2001-32300
	SATURN	IST-1999-10593
Commission Contacts:	Ramón Compañó	ramon.compano@cec.eu.int
Web:	<a href="http://www.cordis.lu/ist/fetnid.htm">www.cordis.lu/ist/fetnid.htm</a> <a href="http://www.phantomsnet.com">www.phantomsnet.com</a>	



# Inspired by nature

Since time began man has sought inspiration in the design and organisation of the natural world. Hundreds of years ago inventors such as Leonardo da Vinci were seeking to mimic the graceful simplicity of natural systems. While humans will never fly like birds, as these inventors imagined, we still have



Biological systems offer opportunities to learn from nature  
(Image: Jean Solé)

much to learn from the animal world as we move towards computer systems and devices that are ever more complex. Such developments are likely to be especially fruitful for bio-nanotechnology, offering important insights into how to build micromachines that are able to sense and adapt to changes in their environment.

IST's Future and Emerging Technologies action has launched a series of initiatives to explore the interface between information technology and the bio- and neuro-sciences. A first interdisciplinary initiative on Neuroinformatics ("artefacts that live and grow") was launched in 2000, followed in 2001 by a second initiative on Life-like Perception Systems (LPS). A total of 24 projects have been funded, each of between 2-4 years duration, with a total EU commitment of €38.2 million. These include three projects received through FET's Open Scheme, such as NEUROBIT (see box), which are trying to directly interface neurones and silicon devices.

The LPS initiative focuses on perception-response systems that are inspired by the sophistication of solutions adopted in living systems. "Perception" here refers to sensorial, cognitive and control aspects, covering vision, hearing or any other ways in which a biological organism interacts with the environment. Involving more than mere sensing, it is the process through which sensorimotor signals are integrated to form internal representations of the sensory world. Such systems would extend the capabilities of machines or be used to augment the human senses.

The selected projects follow a broad range of approaches, reflecting the rich diversity of ideas and thinking in this area. BIOLOCH, for instance, aims at understanding perception and locomotion of animals crawling in wet and slippery conditions. CICADA studies the mechanoreceptor hairs of a cricket and its response to predators as a basis for new forms of

## Learning from crickets

*Insects are marvels of nature, with bodies that are well adapted to a wide variety of tasks. The construction of these tiny structures could hold many lessons for our efforts to build micro-scale machines. Combining a broad range of expertise from sensory ecology to microtechnology, CICADA aims to transfer knowledge of insects' reaction mechanisms to the development of highly integrated artificial life-like miniature systems based on MEMS and bio-electronic technologies.*

*The project concentrates particularly on predatory-sensing behaviour in crickets. Crickets have a huge number of mechanoreceptor hairs which they use to detect the presence of predators through changes in air currents. The degree of information redundancy from many hairs and the minimal configuration in crickets will be used to inform the design of large arrays of MEMS sensors. A miniature demonstrator will also be built.*



MEMS devices (see box). CIRCE takes inspiration from the amazing echo-location mechanisms used by bats. A multidisciplinary team is studying the sonar of bats with the aim of constructing a similarly precise, miniature echo-location system. This could provide the basis for a new generation of sensors and transducers.

Two further projects cover problems related to the construction of neuroprostheses. ROSANA focuses on different ways of stimulating sensorial receptors equivalent to natural stimuli and studies the representation of such stimuli in the central nervous system. CYBERHAND aims at the construction of an artificial hand capable of producing a natural feeling of touch and grip.

Other aspects addressed by projects include: multimodal learning in humanoid robots (MIRRORBOT); the study of chaotic dynamics for neural representation (APEREST); and robots mimicking human and animal behaviours (SPIKEFORCE). Interesting approaches were also suggested to bio-inspired sensor systems

(SENSEMAKER), and novel architectures for categorisation of vision tasks (CAVIAR).

Current projects in this area are being supported by a new thematic network activity, NEURO-IT NET.

For the Sixth Framework Programme, interest focuses on systems “beyond robotics”. While traditional approaches to robotics, such as machine vision and AI, have achieved some success, it is apparent that real breakthroughs will depend on new, more open-ended approaches. For instance, how do we extend the capacities of robot entities to “evolve” in complex 3D environments? The proposed initiative would build on previous work with additional emphasis on integration and systems research. Potential research topics include: “robot ecologies” – teams of autonomous robotic agents exhibiting collective behaviour and intelligence; robotic companions – cognitive robots whose “purpose in life” would be to serve humans; and hybrid bionic systems, which interface information systems with the human nervous system.

### The artificial brain

*Functional plasticity is incomparably greater in the brain than in any artificial system. In particular, the brain's ability to learn from previous experience is a major challenge for understanding the underlying principles and operations, and a necessary step toward implementing such principles in physical devices. NEUROBIT is taking advantage of these unique learning properties to control the sensorimotor behaviour of an artificial body moving in a changing environment. Portions of living mammalian nervous tissue, kept alive in vitro, will be connected to a mechanical robot. The resulting hybrid system will be “trained” to control the robot in real-time. The work is expected to open up new opportunities for using engineered neurobiological units to process information.*

IST Action Lines:	IST-2000 VI.2.2 IST-2001 VI.2.3	Neuroinformatics for “living” artefacts Life-like perception systems
Project References:	APEREST BIOLOCH CAVIAR CICADA CIRCE CYBERHAND  MIRRORBOT NEUROBIT NEURO-IT NET ROSANA SENSEMAKER SPIKEFORCE	IST-2001-34893 IST-2001-34181 IST-2001-34124 IST-2001-34718 IST-2001-35144 IST-2001-35094  IST-2001-35282 IST-2001-33564 IST-2001-35498 IST-2001-34892 IST-2001-34712 IST-2001-35271
Commission Contacts:	Jacques Lacombe Pekka Karp	<a href="mailto:jacques.lacombe@cec.eu.int">jacques.lacombe@cec.eu.int</a> <a href="mailto:pekka.karp@cec.eu.int">pekka.karp@cec.eu.int</a>
Web:	<a href="http://www.cordis.lu/ist/fetni.htm">www.cordis.lu/ist/fetni.htm</a> <a href="http://www.cordis.lu/ist/fetbi.htm">www.cordis.lu/ist/fetbi.htm</a>	
		<a href="http://www-arts.sssup.it/research/projects/CyberHand/default.htm">www-arts.sssup.it/research/projects/CyberHand/default.htm</a> <a href="http://www.his.sunderland.ac.uk/mirrorbot/">www.his.sunderland.ac.uk/mirrorbot/</a>

# Maintaining leadership in smart card

**T**he smart card is emerging as a key building block of the information society in general, and of the electronic marketplace in particular. As a safe and tamper-resistant token, it brings secure access to voice and data networks and provides users with confidence when accessing online services, in both private and professional environments. Smart cards are now deployed in hundreds of million units, in various applications, including banking, mobile phones, health administration, and pay-TV.

Europe enjoys technological leadership in this area, being home to more 90% of the worldwide smart card industry. But to maintain this leadership, Europe must continue to invest in research and development and to support wider deployment in existing and new applications.

The eEurope Smart Card initiative, launched in 2000, has already generated a momentum in the specification of common requirements in environments where added-value features of the smart card are expected. This initiative, recognised and supported by over 250 organisations worldwide and by the European Commission and Member States, is open to all. A draft set of Smart Card Common Specifications has recently been issued and a final version is expected to be published by the end of 2002. These address strategic aspects such as identification, authentication, certification and security.

The IST Programme has funded around 70 projects related to smart cards, representing a total budget of €190 million, of which €108 million is being funded by the Programme. Technological development (R&D, demonstrators or a combination of the two) accounts for 65% of the projects, while 15% look at take-up

(trials and best practices), and the remaining 15% are concerned with prospective and consensus-building (accompanying measures and thematic networks).

Projects are drawn from across the IST Programme. Seven projects directly support eEurope Smart Cards, through the activities of the working groups established under the initiative. Fifteen projects address generic technology issues: such as the integration of USB interfaces (SMART\_USB, USB\_CRYPT, FULL SPEED); a specification for a secure smart card reader (EMBEDDED FINREAD, TRUSTED FINREAD); and security within wireless networks (SHAMAN, T2R). A further six are concerned with radio frequency identification, both in components (FLEX-SI, PALOMAR, MISENEMOCLESS) and applications (LAUREL, TRITON, PARCELCALL).

Seven projects concentrate on methodologies and development tools, on aspects such as formal verification of security (SECSAFE, MATISSE, VERIFICARD); common software platforms (ISOPI); production (PATRIA) and generic modularity both in the terminals (CAPTIN) and the card (FORMAT). Thirteen projects are developing future building blocks in areas such as biometrics (U-FACE, BANCA, BEE, FINGER-CARD, S-TRAVEL), and electronic signatures, public key infrastructure or crypto (CHALLENGE, DIGISEC, NESSIE, LA MER, eEPOCH, STORK). Finally, 24 projects are looking at implementing solutions relying on smartcards in applications as diverse as: e-business (SIDCOM, E-TAILOR, HIPSCAN), transport and tourism (TRIANGLE, C-TRAVEL, TELEPAY), healthcare (MEDITRAV, MOBI\_DEV, RESHEN), and e-government (SMARTCITIES, FASME, E-POLL, TRUE-VOTE, E-VOTE).

## A European future for smart cards

*RESET is developing an agenda for future European research on smart cards. The RESET thematic network is investigating the RTD needs corresponding to current and expected technology gaps identified by the smart card industry and key industrial users. The resulting roadmaps on secure devices and platforms will be widely disseminated so as to ensure strong feedback from relevant stakeholders. As well as providing a basis for European RTD beyond FP5, these roadmaps will constitute a reference for research activities under national and international RTD programmes and for R&D in industry. Representing a large part of the European smart card industry and research community, the network also provides a focus for future industrial and research collaborations.*



Smart cards are an enabler for a wide range of services

Looking to the future, it is apparent that the scope of technology areas will become larger, due to the extended limits of environments where smart card added-value features will be required. Next generation smart cards need to be enhanced to take account of drivers such as mobility, interactivity and connectivity, in both physical and virtual worlds. As a day-to-day device securely handling users' credentials and/or consumers' profiles, the card will emerge as an essential component in many information and communication systems. Key applications are likely to

be in providing secure access to open networks, enhanced electronic signature in e-government, e-business, secure transactions and micro-payments, trusted data management in mobile networks, digital rights management, and privacy management.

In preparation for FP6, in May 2001 the Commission convened a consultation meeting on research needs for the medium to long term. Entitled *Research for the Smart Card of 2010*, the meeting affirmed that significant investments are needed to ensure Europe maintains its current technological and industrial leadership in smart card

technology. Key domains are chip and card design, secure embedded software, manufacturing technology, and development of smart card applications. Further roadmapping activities have subsequently been launched to define research needs in greater detail (see box). As well as reflecting developments in technology, future RTD must also take account of various socio-economic factors relating to smart card production and use.

IST Action Lines:

IST-2001 V.I.5  
IST-2002 II.I.2

Commission Contacts:

Gérard Galler  
Tiziana Arcarese

Web:

[www.cordis.lu/ist/ka2/smartcards.html](http://www.cordis.lu/ist/ka2/smartcards.html)  
[www.cordis.lu/ist/cpt/cpa5.htm](http://www.cordis.lu/ist/cpt/cpa5.htm)  
<http://eeurope-smartcards.org>  
Compendium of Projects on Smart Cards:  
[ftp://ftp.cordis.lu/pub/ist/docs/cpa5compendium-final-april02.pdf](http://ftp.cordis.lu/pub/ist/docs/cpa5compendium-final-april02.pdf)

CPA5: Smart cards

Strategic roadmaps for applied research

[gerard.galler@cec.eu.int](mailto:gerard.galler@cec.eu.int)  
[tiziana.arcarese@cec.eu.int](mailto:tiziana.arcarese@cec.eu.int)

# Innovation in end-user services

**I**n the “always on” information society that is now emerging, users will have access to a whole variety of services through new types of personal devices connected to information/service infrastructures. Some of the devices will take over the role of conventional every-day objects (maps, books, diaries, cameras, etc.) by combining and adding value. Others

include global positioning systems, mobile networks, micro-payment services, geographical information systems, web-based services etc.

In the past, service engineering was concerned predominantly with connectivity issues, such as ensuring that networks provide the necessary



*Operators need tools to easily create and deploy e-services*

will allow users to access new types of intelligent, value-added services, made possible by the innovative combination of existing and emerging technologies, like mobile internet and geographical information systems.

From the service engineering point of view, the introduction of new end-user services into networks and appliances presents major challenges, however. Whereas users are looking for seamless services with a high level of functionality, the underlying components are derived from many different infrastructures. These

resources (bandwidth and other elements of quality of service) to run an application. As new services are introduced, delivered through different devices and infrastructures, the emphasis is shifting to the creation, discovery and composition of new as well as available services in order to integrate their functionality within user-friendly devices and applications.

The IST Programme's work on service engineering aims to prepare the ground for new types of end-user service economies where innovative players (including

## **Service creation for seamless networks**

*The ability to deliver cost-effective services is key to the successful introduction of third generation networks. The industry identified the need for a 3G operations support systems (OSS) platform as essential to ensuring cost effectiveness. However, present day platforms are unable to support the range and complexity of networked services.*

*ALBATROSS will specify such an OSS architecture. It will also develop a set of OSS building blocks to support the rapid service creation, provisioning and delivery of end-user enabled services. The project has access to two UMTS service platforms that will enable it to validate its results through realistic trials. A key objective is to ensure that the ALBATROSS approach builds on the results of past and existing EU project results and on the work of standards bodies.*



### Device independent access to services

*One of the challenges faced when providing access to services through a variety of mobile devices is ensuring that the user interface is adapted to the characteristics of each device. CONSENSUS aims to overcome the time-consuming process of manually adapting user interfaces to various mobile devices, leading to faster deployment and wider availability of mobile services. It will develop building blocks for an automatic adaptation process that considers usability constraints for the targeted devices, by including application knowledge into the adaptation process. This will lead to the definition of an open standard Renderer Independent Markup Language and the tools to apply it.*

emerging service SMEs, but also telecoms operators, or even individuals) have the software infrastructure and tools to easily create and deploy new types of e-services. This includes supporting the appearance of "plug and play" service components, which provide bits and pieces of functionality, together with service reference models, which describe and manage how those functional components fit and work together.

Recent projects in this area focus in particular on service interoperability and service creation within heterogeneous environments. NOMAD is concerned with service discovery over homogeneous and heterogeneous networks. ALBATROSS is developing building blocks to support the rapid creation, provisioning and delivery of services in 3G networks (see box). ADAPT will produce an open source platform for creation and management of composite services.

Other projects target more general aspects of service creation and deployment. CONSENSUS focuses on adaptability for mobile applications, simplifying the task of presenting the same application through a variety of different mobile devices (see box). POLOS is

developing a service creation environment for location-based services together with a platform for deploying and provisioning such services. The platform will be customisable to a wide spectrum of business domains, such as emergency services, fleet management, medical tele-monitoring, and automotive assistance. ACE-GIS is producing tools to support the development, deployment, discovery and composition of distributed web-services, with particular emphasis on the combination of geographical information and e-commerce services.

Two new projects aim to produce strategic roadmaps for this area in anticipation of FP6. MIDAS focuses on middleware for composable and dynamically adaptable services in the context of large-scale systems where quality of service issues such as fault-tolerance, timeliness, security and survivability are important. FIN TECH studies technologies relating to composability and dynamic adaptability focussing on service engineering and related technologies (agents, peer-to-peer technologies) in the context of the financial services and banking industries.

IST Action Lines:	IST-2001 IV.1.1 IST-2001 IV.1.2 IST-2001 IV.3.2 IST-2002 IV.3.1	Design of networked embedded systems Multiservice networks – middleware for seamless access to services Functionality models and building blocks for end-user services Composability and dynamic adaptability in software, systems and services
Project References:	ACE-GIS ADAPT ALBATROSS CONSENSUS FIN-TECH MIDAS NOMAD POLOS	IST-2001-37724 IST-2001-37126 IST-2001-34780 IST-2001-32407 IST-2001-37949 IST-2001-37610 IST-2001-33292 IST-2001-35283  www.consensus-online.org  www.oteconsult.gr/nomad www.polos.org
Commission Contacts:	Jacques Bus Peter Diry	jacques.bus@cec.eu.int peter.diry@cec.eu.int
Web:	www.cordis.lu/ist/ka4/tesss	

# The photonics gateway

**P**hotonics, the science and engineering of systems based on the generation, manipulation and harnessing of photons, offers a real departure from the established electron-based technologies. In telecoms, photonic technologies are already widely deployed in the optical fibre networks which make up the core of modern communication infrastructures.



Optical technologies are the key to ultra-broadband networks

The challenge now is to further increase the bandwidth of these core networks, and to extend the use of fibre in the access network. In addition, there are many opportunities for optical technologies beyond the telecoms sector; in applications such as healthcare, sensing, environment, and lighting.

In optical networks data is transmitted at set wavelengths and the capacity of an optical fibre can be increased by using more than one wavelength (colour). With this approach, known as wavelength division multiplexing (WDM), each wavelength carries an electrically-modulated data stream, without interference, multiplying the total amount of data transmitted. Recent technological advances have moved key WDM building blocks, such as optical amplifiers and WDM transmitters, to commercial deployment. Next generation systems, known as dense wavelength division multiplexing (DWDM), will utilise as many as 100 different wavelengths in a single fibre. Data requirements are increasing rapidly, however, and the latest predictions suggest the number of wavelengths will need to increase sharply to 500 by 2005, and 1000 by 2010 (giving a total capacity of 10 terabit/s for a single fibre).

The IST Programme's activities on optoelectronics aim to strengthen the position of photonics as a pervasive enabler of IS applications and services. The further development of optical, opto-electronic and photonic materials and functional components, devices and systems is a key focus. In addition, support is provided for research in generic and applied technologies and their exploitation in ICT and other application areas. Under FP5, 24 projects have been funded, divided in broad terms between optical sources and optical devices.

In the area of optical sources, TUNVIC has demonstrated a micromechanical tunable VCSEL, as the basis for a MEMS-scale tunable laser source for WDM applications. Other projects focus on aspects such as: quantum dot lasers; long-wavelength GaAs arrays; resonant cavity LEDs; ultra-short pulse sources; and high-power/brightness sources.

## New lasers for cancer treatment

Reliable high-brightness laser diodes and optical modules that will improve transmission efficiency in small diameter fibres are being developed under ULTRABRIGHT. A high power quantum dot laser (operating at 980nm) with output power of 3.8W has been demonstrated. The lasers show very good high temperature properties and thus overcome a crucial drawback of existing devices. As well as increasing the power and brightness of laser sources used in WDM networks, the results will also be applied to photodynamic therapy, an advanced cancer treatment.

### High-performance optical amplifiers

*The rapid development of optical telecommunications fosters a strong demand for inexpensive components for metropolitan networks. SINERGIA is addressing issues related to manufacturing and cost/performance for optical amplifiers. It intends to realise a high-performance, low-cost waveguide amplifier from silica or other specific glass co-doped with erbium (Er) and silicon (Si) nanocrystals.*

*Specifically, the project is striving to exploit recent observations of significant (greater than 100-fold) enhancements in characteristic emissions of Er<sup>3+</sup> in such materials. Using methods compatible with both Si technology and industrial implementation, it is endeavouring to optimise the conditions, to explore the systems and to identify the most viable approach to achieve the best material for a commercial amplifier.*

Two early projects have produced valuable breakthroughs in relation to photonic crystals. PICCO has demonstrated a waveguide with a loss of 2dB/100µm, a world best for a device of this type. New etching technology is expected to further reduce the losses by an order of magnitude or more. Fabrication processes using silicon-on-insulator (SOI) are also being addressed. A related project, PCIC, has produced the world's smallest ever laser with a cavity length of just 12µm.

Other areas being supported in opto-components include: polymer/organic components; non-linear glasses; optical interconnects; and fibres and plastic optical fibres.

Recent projects reflect the increasing interest in nano-technologies in the optical domain with a view to nanophotonic devices. For instance, FUNLIGHT will investigate functional nanoscale materials and devices for light emission, for high brightness display applications. ISOLASER will develop an optical isolator monolithically integrated with a solid state laser. And pioneering the area of microwave photonics, LABELS

will investigate the use of optical techniques to process microwave signals. Use of polymer materials as an alternative to semiconductors is also being pursued.

For FP6 the key challenge will be to capture the opportunity presented by photonic technologies for widespread broadband deployment – low-cost access for all at capacities of 1 Gb/s or better. The priorities here are threefold. Firstly, further progress on components for all-optical networks, storage and processing devices. This should aim towards the manufacture of low-cost packageable components for a wide range of material systems with supporting manufacturing platforms, and to the integration of multiple functions on a photonic chip. Secondly, new optical sensors and sensor arrays based on solid state light sources and their deployment in imaging systems and other devices. Thirdly, the integration of active and passive optical functions with mainstream silicon technologies within “photonic integrated circuits”. Material systems such as GaAs, InP, polymers, organics will be especially important here.

#### IST Action Lines:

IST-2002 IV.8.3

Optical and opto-electronic technologies

#### Project References:

FUNLIGHT

IST-2001-38195

[www.ist-optimist.org](http://www.ist-optimist.org)

ISOLASER

IST-2001-37854

[www.ist-optimist.org](http://www.ist-optimist.org)

LABELS

IST-2001-37435

[www.ist-optimist.org](http://www.ist-optimist.org)

PICCO

IST-1999-10361

[www.intec.rug.ac.be/picco](http://www.intec.rug.ac.be/picco)

PCIC

IST-1999-11239

[pmc.polytechnique.fr/PCIC](http://pmc.polytechnique.fr/PCIC)

SINERGIA

IST-2000-29650

[www.ain.es/sinergia](http://www.ain.es/sinergia)

TERAVISION

IST-1999-10154

[teravision.org](http://teravision.org)

ULTRABRIGHT

IST-1999-10356

[www.ist-optimist.org](http://www.ist-optimist.org)

#### Commission Contacts:

Henri Rajbenbach

[henri.rajbenbach@cec.eu.int](mailto:henri.rajbenbach@cec.eu.int)

Ronan Burgess

[ronan.burgess@cec.eu.int](mailto:ronan.burgess@cec.eu.int)

#### Web:

[www.cordis.lu/ist/ka4/mel/index.htm](http://www.cordis.lu/ist/ka4/mel/index.htm)

[www.ist-optimist.org](http://www.ist-optimist.org)



# Success through microsystems

**M**icrosystems are now widely recognised as being a critical driver of innovation in a wide range of applications. From consumer goods to industrial equipment and medical devices, microsystems - miniaturised systems comprising several functions such as sensors, signal processors and actuators - are key to making products smaller, cheaper, smarter and more reliable. As well as making existing products more user-friendly, they also open up many possibilities for new products and systems with greater added value. Existing examples include DNA chips, drug delivery systems, smart cards, accelerometers for automotive airbags, and inkjet printer heads.

Despite its many advantages, however, companies still face many barriers in accessing microsystem technology (MST). It involves new approaches to design and testing, access to specialised fabrication facilities, and specialist skills. Access can be costly and time-consuming. The Europractice MST Service helps to address these issues.

Launched in 1995, the Service aims to stimulate and assist the wider take-up of MSTs by European industry. It helps reduce the perceived risks and costs associated with these technologies by offering potential users a range of services, reducing their entry costs and providing a clear route to system manufacturing and product supply. The initiative offers a complete service, from idea to product including: contract research; feasibility and proof-of-concept studies; prototyping and low volume production; access to large-scale industrial manufacturing facilities; custom design; software; and training. Customers are given access to a wide range of technologies for design and manufacture through a network of Competence Centres, Design Houses and Manufacturing Clusters.

The Europractice MST Service is having a significant impact on the take-up of MSTs in Europe. During 2000/01, more than 2000 organisations were contacted. Of these, 47% were SMEs and around 35% were new to microsystems. Some 1100 quotations for research, design, prototype production or other services were generated and around 700 orders received, representing a value of €58M. Given the public funding of around €12M during this period, a return on investment ratio of nearly 5 was achieved. In terms of applications, the emphasis was on medical (25% of order value), instrumentation (24%), and telecoms (21%). Customers' main interests were to realise prototypes (32% of the total turnover) and to manufacture products (16%). The other significant need was to carry out feasibility studies with the help of competence centres (26% by value).

Many of the organisations involved in Europractice projects have detected new business opportunities. Since 1996, the Service has contributed to the formation of at least 14 companies and the creation of more than 300 jobs in Europe. Altogether these start-ups have raised over €60M from private investors. This is more than 15 times the amount of EU funding for these projects over this period. Further start-ups are being generated as a result of the latest phase.

The Europractice Service has recently been renewed for a further three years (through to 2004), while at the same time widening its scope to include non-silicon technologies, such as GaAs, glass and polymers. Activities in Central and Eastern Europe have also been reinforced.

Another indicator of the increasing maturity of MST in Europe is Nexus. Originally established under Esprit as a support measure for microsystems, the organisation

## Skills development

*The future development of micro- and nano-technologies is critically dependent on the availability of engineers with appropriate skills. A European training initiative in microsystems and microelectronics was started in 1996. EUROTRAINING now offers access to a comprehensive range of advanced courses and has established an online course directory and a high-calibre quality label system. Special attention is now being devoted to the multidisciplinary micro-nano integration issues and distance learning. A European MST Master programme is also in preparation. A new action, REASON, aims to address skills issues in Central and Eastern Europe.*





*Biomedical implants is one area that will benefit from MST*

has recently become a self-funded association representing some 400 MST companies, universities, and research institutes within Europe.

Looking to the future, it is apparent that microsystems and micro-nano-technologies and their implementation within successful products will be vital to maintaining Europe's competitiveness. Consequently, these technologies are given a high priority in the Sixth

Framework Programme, both in the context of IST and more generally. Nano-technology and nanoscience form a separate action within FP6 (Thematic Priority 3); nanoelectronics and the implementation and integration of micro- and nanosystems are key activities under the IST Priority.

IST activities will focus on interconnect technology and system integration, aiming to improve the cost-efficiency, performance and functionality of micro- and nanosystems for IST-based systems and services. While addressing key technology issues, the work is also expected to have a strong application perspective. For example,

application-focused integrated projects may be supported in areas such as implantable bio-devices, environmental monitoring, optical communications, and intelligent navigation and information systems for transport. As currently, structural activities aimed at stimulating take-up and creating a critical mass of European users and support facilities will remain a high priority.

IST Action Lines:	IST-2001 IV.7.3	Subsystems and microsystems – take-up measures
Project References:	EUROTRAINING REASON	IST-2001-37348 IST-2000-30193
Commission Contacts:	Dirk Beernaert Gisèle Roesems-Kerremans	dirk.beernaert@cec.eu.int gisele.roesems@cec.eu.int
Web	www.europractice.com www.cordis.lu/ist/ka4/supermic/index.htm	

# Embedded everywhere

In sectors such as finance, transport, telecommunications and industrial control the performance of IST applications is critical for reasons of safety, security and reliability. Increasingly such systems are required to operate in real time and rely on embedded hardware and software. Real-time approaches are required in embedded "mobile" applications too, such as automotive control systems. Whether as part of a networked infrastructure or as components in products, embedded systems are essential building blocks in enabling our surroundings to become more intelligent and responsive.



*Real-time control systems represent a major challenge*

Within the IST Programme, activities in this area focus on the requirements of distributed sensing, decision making, scheduling and control systems operating under real-time conditions. The work addresses new models, methodologies and tools that are able to meet the stringent requirements of real-time systems (e.g. regarding robustness and fault tolerance). Composable systems, which permit the reuse of generic components, are a key focus. Standardised platforms and architectures are also being investigated, as well as novel design methodologies and algorithms.

One priority is advanced control systems, including so-called hybrid systems which have to cope with discontinuities and significant dynamic elements. The automatic braking system used in cars is one example: here the control system has to switch very

rapidly but also detect and respond to the vehicle's dynamics as it moves along the road. Other instances of hybrid systems include process control in the pharmaceutical industry, where the process requirements are much more demanding than in normal chemical manufacturing, or new models for the next generation of air traffic management.

Projects launched in the last IST calls address a number of novel topics and solutions. For instance HYBRIDGE and CC deal with stochastic hybrid systems, while RECSYS, AMETIST, RISE, FIRST and

OCERA concern systematic design methodologies for embedded systems. COMETS and ADVOCATE II apply advanced controls to sophisticated uninhabited space and underwater vehicles.

Embedded systems is a challenging and emerging area. A new project (network), ARTIST, aims to co-ordinate the EU's RTD efforts in advanced real-time systems so as to

improve awareness among academics and industry. The work programme comprises three closely-related actions, respectively on hard real-time systems, component-based design and development, and adaptive real-time systems for quality-of-service management. Roadmaps for future research are also being produced. The project is helping to support EMSOFT, a major networking event for the embedded systems community.

Vision systems are another priority, in particular the development of robust cognitive vision systems capable of acquiring and using knowledge for decision-making. The challenge here is to recognise and integrate a large number of objects and visual cues, and then to reason and learn from this information in a way that is meaningful for real-world decisions. Novel architectures and computational frameworks are

## International collaboration in advanced systems

*The further development of real-time embedded systems and control systems is of fundamental significance. Since 2000, the IST Programme has developed strong relations with the US in this area, notably through the National Science Foundation and DARPA, the US defence research agency.*

*As well as a continuous dialogue at policy level, a series of joint events have been held and collaborations between the two RTD communities are being encouraged. At project level, these contacts have included liaison with NSF's Hybrid and Embedded Systems (HES) programme and DARPA-sponsored projects on model-based embedded (MOBIES) and networked embedded (NEST) systems. Other joint EU-US activities include support for the Hybrid Systems Conference 2002, an IST-NSF workshop on hybrid systems at IFAC 2002 in Barcelona, and the annual EMSOFT meeting.*

*IST has recently launched COLUMBUS, a transatlantic research project focussing on the design of embedded controllers for safety-critical systems. A first collaboration with Korea on embedded systems R&D has also been initiated.*

required that permit adaptive, real-time responses. Approaches for achieving cognition, such as temporal reasoning and incremental learning, are also needed. There is an interesting link of cognitive systems to both knowledge and the control aspects of complex systems. Such interplay and synergies are expected to be addressed within FP6.

Current projects are also tackling these problems. For instance, COGVIS is investigating methods to enable objects and events to be identified according to a recalled "memory". The system "understands" in the sense that it is able to recognise and categorise through association. It also "knows" in that it uses a memory as a basis for information representation and maintenance, and is able to learn new tasks. A

prototype will be built which will be able to interpret user actions and perform simple tasks, such as fetching and delivering objects in real-life situations.

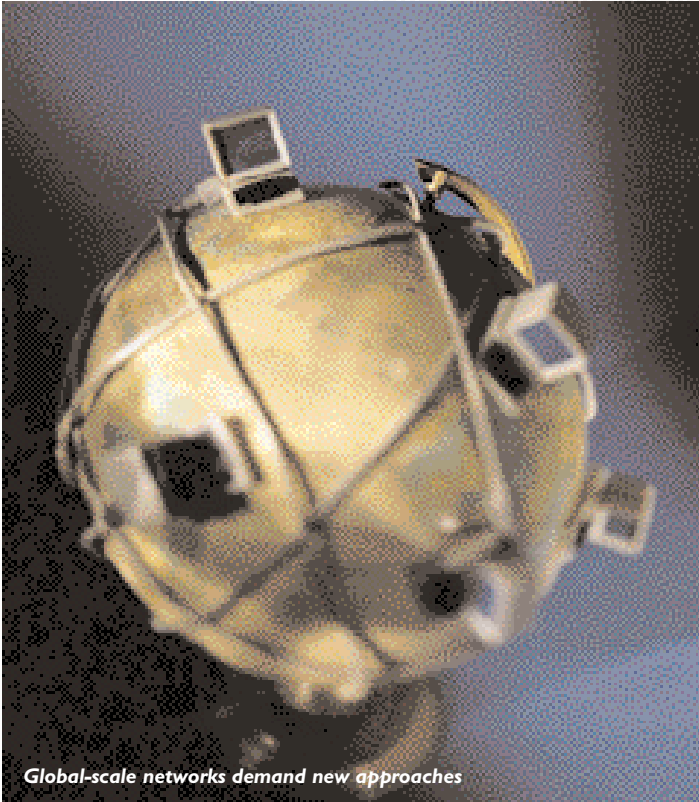
Also dealing with cognitive vision, COGVISYS will build a self-adaptive vision system that is able to reason from an explicit knowledge base. Demonstrators will translate visual information into textual description for applications such as traffic surveillance, sign language interpretation, and video annotation. The work involves improvements in cue extraction and integration, development of categorisation techniques, and collaboration with the AI community on the explicit representation of knowledge.

IST Action Lines:	IST-2001 IV.1.1 IST-2002 IV.2.1 IST-2002 IV.2.2	Design of networked embedded systems Cognitive vision systems Advanced control systems	
Project References:	ADVOCATE II AMETIST ARTIST CC COGVIS COGVISYS COLUMBUS COMETS FIRST HYBRIDGE OCERA RECSYS RISE	IST-2001-34508 IST-2001-35304 IST-2001-34820 IST-2001-33520 IST-2000-29375 IST-2000-29404 IST-2001-38314 IST-2001-34304 IST-2001-34140 IST-2001-32460 IST-2001-35102 IST-2001-37170 IST-2001-38117	<a href="http://www.advocate-2.com">www.advocate-2.com</a>  <a href="http://www.systemes-critiques.org/ARTIST/">www.systemes-critiques.org/ARTIST/</a> <a href="http://www.dii.unisi.it/~hybrid/cc">www.dii.unisi.it/~hybrid/cc</a> <a href="http://cogvis.nada.kth.se">cogvis.nada.kth.se</a>  <a href="http://www.comets-uavs.org">www.comets-uavs.org</a>  <a href="http://www.nlr.nl/public/hosted-sites/hybridge">www.nlr.nl/public/hosted-sites/hybridge</a> <a href="http://www.ocera.org">www.ocera.org</a>
Commission Contacts:	Alkis Konstantellos	<a href="mailto:alkis.konstantellos@cec.eu.int">alkis.konstantellos@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka4/ipcn/home.html">www.cordis.lu/ist/ka4/ipcn/home.html</a>		

# Managing complex networks

**I**n the interconnected world that is now emerging, the objects with which we work are increasingly endowed with communication capabilities. Already, mobile devices allow users to access services and functionalities wherever they are and wherever they are

connectivity and bandwidth change, computational processes and data can migrate, and applications come and go. The availability and responsiveness of active resources at any given point in time are unpredictable and difficult to control. And the scale of the systems is expected to be extremely large, both in number of components and, in some cases, in geographical scope.



Global-scale networks demand new approaches

going. In future, cars and planes will communicate among themselves and with devices in the environment so as to make efficient use of available road and air space. And a whole new class of smart everyday objects (as envisioned, for example, in FET's Disappearing Computer initiative) will provide new levels of mobility and interaction. The result will be a highly complex and dynamic global information infrastructure.

These complex, global systems have new and unique characteristics. Physical devices move around,

The design and management of systems that are able to be dynamically configured in this way poses new challenges for computer science. FET's Global Computing initiative aims to lay the theoretical foundations to underpin these developments. Focusing on large-scale systems of autonomous mobile entities, the goal is to learn how to construct systems that are flexible, dependable, secure, robust and efficient. The work is also expected to be beneficial to the evolution of the grid, the global network of computational resources. Thirteen projects were launched earlier this year following a call under WP2001.

One of the key challenges is to find new approaches to design, modelling and testing in this global computing environment. Current middleware and programming language technologies are totally inadequate here. They tend to support only a limited range of interactions, have a limited view of components and objects, and fail to properly and uniformly support properties such as mobility, predictability, security, and fault-tolerance. They are also not amenable to rigorous investigation for verification, validation and test purposes.

## Architectures for mobility

*Architecture-based approaches have been promoted as a means of controlling the complexity of system construction and evolution. They provide systems with the agility required to operate in turbulent environments and to adapt to changes very quickly. Current architectural concepts and techniques cannot cater for mobility, however. AGILE will develop a new architectural approach to address this problem. Using a uniform mathematical framework, the technique will enable mobility aspects to be modelled explicitly and mapped on the distribution and communication topology made available at physical levels.*



## The global database

*One view of global computing is as a database problem: how to design, build and analyse systems capable of managing large amounts of data. In environments composed of very many mobile entities, the traditional approach of storing data in monolithic database management systems becomes obsolete. This creates the need for new theoretical foundations in all aspects of data management: modelling, storage and querying.*

*DBGlobe adapts a data-centric approach to the design and analysis of dynamic environments of autonomous and mobile entities by considering each entity as a primary data store and a mini-server that protects and encapsulates access to its data. Such networks constitute ad-hoc distributed database systems of unprecedented scale. Besides these "walking" databases of mobile entities, in DBGlobe meta-information and services related to them are maintained in dedicated data stores, called InfoStations, dispersed throughout the stationary network.*

Several projects aim to apply formal methods to overcome these limitations. For instance, MIKADO is defining and prototyping new formal models for the specification and programming of highly distributed and mobile systems. SOCS is proposing computational logic-based techniques for specifying and verifying formal properties of "societies" of interacting computing entities. Methods to analyse the behaviour of distributed mobile systems to ascertain their correct functioning are targeted by PROFUNDIS. DART is developing formalisms for dynamic assembly, reconfiguration and type-checking of complex distributed software systems. And DEGAS aims to combine semi-formal (graphical) and formal methods to create a design environment for wireless applications.

FLAGS aims to provide a unifying scientific framework and a coherent set of design rules for global systems. It takes account of issues such as co-operation and antagonism, stability and fault-tolerance, as well as communication and motion.

New approaches to security within this global infrastructure is another theme. SECURE is investigating a new approach to security founded on the notion of trust. A model is being developed in which trust relationships are established from the record of interaction between entities, and a security mechanism expressed in terms of such trust. MYTHS seeks to develop theories and models based on types as the basis for security in mobile and distributed systems. While MRG aims towards a system of security guarantees for mobile resources.

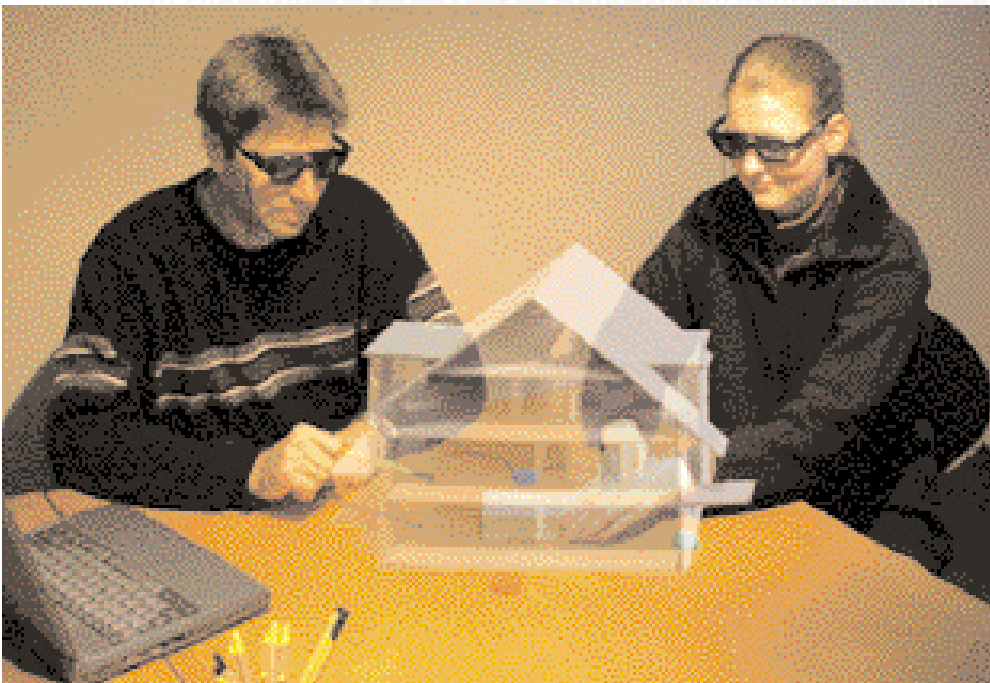
Other aspects within the global computing portfolio include: investigation of peer-to-peer computing models (PEPITO); solutions for critical resource-sharing in complex networks (CRESCCO); and the extension of architecture-based system design approaches to accommodate mobility (AGILE – see box).

IST Action Lines:	IST-2001 VI.2.2	Global computing: co-operation of autonomous and mobile entities in dynamic environments	
Project References:	AGILE	IST-2001-32747	
	CRESCCO	IST-2001-33135	<a href="http://www.ceid.upatras.gr/faculty/kakl/crescco">www.ceid.upatras.gr/faculty/kakl/crescco</a>
	DART	IST-2001-33477	<a href="http://www.disi.unige.it/project/dart">www.disi.unige.it/project/dart</a>
	DBGLOBE	IST-2001-32645	<a href="http://softsys.cs.uoi.gr/dbglobe">http://softsys.cs.uoi.gr/dbglobe</a>
	DEGAS	IST-2001-32072	<a href="http://www.omnys.it/degas">www.omnys.it/degas</a>
	FLAGS	IST-2001-33116	
	MIKADO	IST-2001-32222	
	MRG	IST-2001-33149	<a href="http://www.dcs.ed.ac.uk/home/dts/mrg">www.dcs.ed.ac.uk/home/dts/mrg</a>
	MYTHS	IST-2001-32617	
	PEPITO	IST-2001-33234	<a href="http://www.sics.se/pepito">www.sics.se/pepito</a>
	PROFUNDIS	IST-2001-33100	
	SECURE	IST-2001-32486	
	SOCS	IST-2001-32530	<a href="http://www.lia.deis.unibo.it/research/projects/socs">www.lia.deis.unibo.it/research/projects/socs</a>
Commission Contacts:	David Pearce	<a href="mailto:david.pearce@cec.eu.int">david.pearce@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/fetgc.htm">www.cordis.lu/ist/fetgc.htm</a>		

# Imagineering

**I**mages are an ever-present feature of modern life. Through television, magazines, computer screens and outdoor advertising boards we are constantly exposed to the power of pictures. These images are increasingly sophisticated, integrating and mixing animated computer graphics and high-resolution images of the real world. Consequently, they are increasingly attractive and exciting, enabling us to see things that will never actually exist.

on advanced displays and sensors, and cognitive vision systems (see separate articles). The FET initiative on presence research, which aims towards innovative systems offering “richer” experiences than current media and communication technologies, is also pertinent. Research into “mixed reality” (MR) environments, which aims to bridge the gap between the real and virtual worlds, also makes a major contribution.



*3D environment using see-through display, developed under project ARTHUR*

But this is only the beginning of the image revolution. Looking back in a few years from now, we will probably find today's streamed video appallingly blocky, modern video-conferencing barely realistic, and today's digital still picture cameras ludicrously low resolution. Young people, especially, have come to expect a high-quality visual experience. Imaging technologies will contribute the next step in the development of ICT, providing us with highly visual and interactive systems much like those common in games today. Applications for advanced imaging systems will be widespread, from security surveillance and new reality environments for education and tourism, to new solutions for workplace design and training, and complex problem-solving in science and engineering.

Within the IST Programme, relevant research is addressed through several action lines, including those

The frontier between real and virtual is increasingly blurred. Mixed reality can be thought of as a continuum that includes “conventional” virtual reality, where the emphasis is on bringing to life a virtual world, and augmented reality, where the emphasis is on enhancing real world environments through virtual interfaces. New multi-sensory and immersive 3D environments which allow rich, multisensory experiences are another aspect. Based on developments in computer vision, computer graphics and advanced audio-visual representation and coding techniques, MR will lead to a new generation of visual interfaces which will help move IST beyond the desktop. As well as visualising real world objects, future MR applications will enable users to interact with them to enjoy a rich sensory experience.

The Programme has a portfolio of around 20 projects covering mixed reality and advanced imaging. They address augmented reality, new technology for rich, mixed-media content creation, and advanced interaction mechanisms. Three clusters have been formed focusing on emotional interfaces, metadata, and image analysis, modelling and computer vision.

Among the most recent projects, ATTEST is trying to prove a novel concept for 3D TV broadcasts, covering the complete broadcast chain. For 3D content generation, the work focuses on an innovative 3D camera and 2D-to-3D conversion of existing content. 3D video coding is being developed complying to 2D digital broadcast and streaming internet standards. Novel single and multi-user 3D displays needed to visualise the broadcast are also being investigated.

AMIRE targets the efficient creation and modification of MR applications. A series of methodologies, tools and procedures are being developed that will enable users to efficiently build and exploit MR applications. The system will be demonstrated in a training application for an oil refinery and a museum application. Also concerned with authoring of MR applications, CREATE aims to develop a toolkit for the construction of highly interactive and realistic virtual worlds, for markets such as design, education and cultural heritage. LIFEPLUS is looking into new immersive environments which recreate ancient frescos and historical scenes.

Earlier projects are already producing substantive results. An estimated 40 publications have been submitted to international journals and conferences, and several public demonstrations have been organised including a major presence at the IBC2001 Conference in Amsterdam. In some cases participating companies have already formed commercial partnerships or are

creating new start-ups to exploit results. All projects are monitoring and contributing to standardisation groups such as Web3D, IETF and MPEG.

### Seeing the light

*In current virtual reality systems there is only a very limited set of possibilities to visualise the appearance of different materials and to simulate safety-relevant aspects of design, such as blinding the driver by interior lights in a night-driving situation. REALREFLECT is researching physically correct simulation of light distribution and reflection, as well as an image-based real-time visualisation for synthetic objects with complex reflectance behaviour. This new technology will be integrated into an existing VR-system and tested in different application scenarios, such as the simulation of safety and design aspects in the automotive industry and photorealistic VR simulations in architecture.*

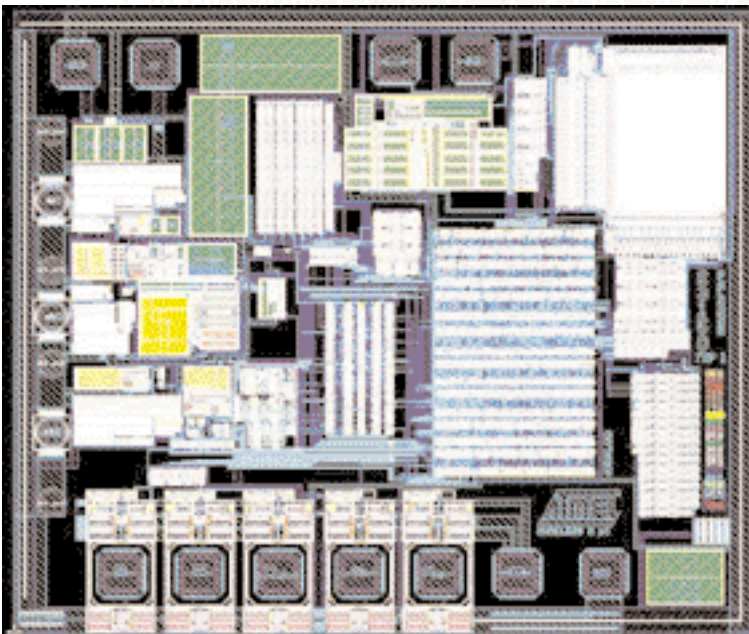
Given their significance as an enabler for IST applications, imaging technologies will continue to be supported under the Sixth Framework Programme. The core technological challenges are expected to remain, i.e. sensors and displays, computer vision, audio-visual data manipulation and storage including computer graphics, and mixed reality and standards. It will be essential to promote synergies between the core technologies and encourage a deeper integration of vision and speech aspects. Work on human/human interaction and human/machine interaction will also be important here, and needs to take account of efforts on language, vision and intelligent information presentation. The realism of the experience, rather than of the image, could become the benchmark for success.

IST Action Lines:	IST-2001 IV.4.2	Mixed realities and new imaging frontiers	
Project References:	AMIRE	IST-2001-34024	<a href="http://www.amire.net">www.amire.net</a>
	ATTEST	IST-2001-34396	<a href="http://www.iti.gr/db.php/en/projects/attest.html">www.iti.gr/db.php/en/projects/attest.html</a>
	CREATE	IST-2001-34231	
	LIFEPLUS	IST-2001-34545	<a href="http://www.miralab.unige.ch/subpages/lifeplus">www.miralab.unige.ch/subpages/lifeplus</a>
	REALREFLECT	IST-2001-34744	<a href="http://cg.cs.uni-bonn.de/project-pages/RealReflect/default.html">cg.cs.uni-bonn.de/project-pages/RealReflect/default.html</a>
Commission Contacts:	Eric Badiqué	<a href="mailto:eric.badique@cec.eu.int">eric.badique@cec.eu.int</a>	
	Remy Bayou	<a href="mailto:remy.bayou@cec.eu.int">remy.bayou@cec.eu.int</a>	
	Jorge Santos	<a href="mailto:jorge.santos@cec.eu.int">jorge.santos@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka4/vision">www.cordis.lu/ist/ka4/vision</a>		

# Bridging the IC design gap

**T**he relentless quest for improved performance in IST applications presents a fundamental challenge for IC designers. While the performance of microprocessors continues to grow at an exponential rate (according to Moore's Law), the demands of innovative applications grow even faster. In wireless communications, for example, the functional complexity in the 3G systems now being introduced is around 100,000 times greater than that in the 1G

electronic system to be integrated on silicon, to form a so-called system-on-a-chip (SoC). Hence the design needs to accommodate a growing diversity of functions, ranging from logic, processor units, memory blocks, analogue circuits, RF components, and also linkages to low level and system software. The integration of optoelectronics (using different materials such as InP, GaAs etc.) represents a further dimension.



RFID solution developed under project PALOMAR

systems introduced in the 1980s, (a growth referred to as Shannon's Law). By contrast, processor power has only increased around 1000-fold over this period. Thus the sophistication of applications is increasing at a much faster rate than processor performance. Another crucial constraint is battery capacity, where further increases are proving very difficult to achieve, dramatically increasing the requirement for low-power circuits.

Furthermore, IC design is increasingly complex. As feature sizes decrease, to 100 nm and below, factors that were previously second order effects, such as noise and quantum effects, come into play. The scale of integration continues to grow, with designs containing up to one billion transistors expected within a few years. This allows more and more parts of an

This drive towards more sophisticated end-user applications and greater design complexity is creating a "design gap", with increases in the desired levels of system functionality far outstripping productivity gains in the system design process. To address these challenges, designers need to assess overall design choices while exploring the design space and investigating new types of architectures. They also require new methods and tools to support system-level design and provide a seamless path from specification right through to implementation. A greater emphasis on the re-use and exchange of intellectual property (IP) and on the use of reconfigurable system blocks is also needed.

Configurable structures allow the use of the same chip for several applications or for the functionality to be adapted during the lifetime of the product. Project ADRIATIC is making good progress towards methodologies and tools for reconfigurable SoCs for applications such as HIPERLAN/2 wireless terminals. A new project, AMDREL, aims to extend this technology further, by developing logic blocks that are reconfigurable dynamically (i.e. during use). Methodologies, tools and IP blocks are being developed and integrated into an SoC development platform. These will be used for the development of wireless communication products including critical parts of a wireless LAN system.

An important input to improve design productivity is the availability of reusable design cores for crucial



parts. ADOC targets innovative reusable ASICs for OFDM-based communications. The cores will be used in a family of integrated circuits based on state-of-the-art OFDM technology, including chipsets for high-speed modems and LAN cards, VDSL, and wireless local loop. Inspired by the success of open source software, ASPIDA aims to deliver and promote a free, open-source IP processor core. The core will be designed, tested and implemented using industrial EDA tools, and will be easily embedded into any open IP system-on-a-chip.

Field programmable gate arrays (FPGAs) were a popular means for developing hardware prototypes. They are now also becoming a solution of choice for small series products. RECONF2 aims to improve the utility of this approach by developing a complete design environment for dynamic reconfigurable FPGAs. The system will give large companies and SMEs the opportunity to develop new, complex and high performance applications.

With systems becoming increasingly complex, new approaches to verification and testability are also needed. SYMBAD is developing a platform for system-level design and verification for hardware and software integrated systems. Incorporating formal verification techniques, the platform will lead to a new methodology in high-level system design offering conformance checking of low-level models with high level specifications. It will be assessed on the design of a reconfigurable SoC for an image processing system. Testability problems for analogue macrocells embedded into SoCs are addressed by TAMES-2. The work focuses on the main industrial requirements, namely improving the test quality while reducing test costs, and the introduction of key concepts of test reuse at SoC, architectural and circuit levels.

### Low-cost, long-range identification tags

*Radio frequency identification devices (RFIDs) could potentially be used in a wide range of applications, such as logistics and stock tracking. Limitations in current RFID systems include high RF power and the short range over which the signal is transmitted. PALOMAR has developed the technology necessary for a cost-effective long-range passive RFID solution.*

*The concept is based on a novel link mechanism in the area of passive UHF RFID systems on a low-power CMOS transponder technology, which combines EEPROM and RF features. The solution works over long-distances (up to 4m at 868 MHz) and makes use of the contactless rewrite possibility of EEPROM. Operating frequencies are in the range 868 MHz to 2.45 GHz, depending on the application and the local RF regulations. The system supports the features described in ISO 18000-6 and has been demonstrated in a pilot implementation for stock tracking in a paper mill.*

IST Action Lines:	IST-2002 IV.8.1	Microelectronics design and IP reuse	
Project References:	ADOC	IST-2001-35358	<a href="http://www.ds2.es/projects/ADOC">www.ds2.es/projects/ADOC</a>
	ADRIATIC	IST-2000-30049	<a href="http://www.imec.be/adriatic">www.imec.be/adriatic</a>
	AMDREL	IST-2001-34379	<a href="http://vlsi.ee.duth.gr/amdrel/">vlsi.ee.duth.gr/amdrel/</a>
	ASPIDA	IST-2001-37796	
	PALOMAR	IST-1999-10339	<a href="http://eu.atmel.com/atmel/randd/prod_palomar.htm">eu.atmel.com/atmel/randd/prod_palomar.htm</a>
	RECONF2	IST-2001-34016	<a href="http://www.reconf.org">www.reconf.org</a>
	SYMBAD	IST-2001-34607	<a href="http://www.symbad.org">www.symbad.org</a>
	TAMES-2	IST-2001-34283	
Commission Contacts:	Philippe Reynaert	<a href="mailto:philippe.reynaert@cec.eu.int">philippe.reynaert@cec.eu.int</a>	
	Markus Korn	<a href="mailto:markus.korn@cec.eu.int">markus.korn@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka4/mel/index.htm">www.cordis.lu/ist/ka4/mel/index.htm</a>		

# Next generation signal processing

**T**he success of mobile phones, multimedia internet, digital TV and similar applications derives from their ability to rapidly process complex information streams. The technology that enables them to do this is known as signal-processing (SP). Over the last decade the performance of SP components has improved dramatically, while prices have dropped and standardisation has promoted wider take-up.

Progress in sensors, displays and actuators are opening new research and application fields for SP. New representation and coding standards are emerging which have the potential to catalyse further developments. A prime example is the MPEG-4 multimedia standard. Decoders have been specified, but exploitation of some of the most novel features (such as object-based coding) requires significant progress in robust image segmentation. The same is true for MPEG-7 and indexing applications for which there is enormous potential. And in the longer term, SP will be crucial to the effective realisation of the computing-everywhere vision ("ambient intelligence"), where intelligent processing capabilities are embedded within a wide range of everyday objects.

Research on digital signal processing (DSP) technologies progresses at three levels. Firstly, there are the underlying processing algorithms, known as codecs. New "killer codecs" are needed to deliver the performance necessary for advanced applications. Research here embraces a wide range of topics including physical modelling, multidimensional filtering, neural networks, wavelets, chaos theory, watermarking and cryptography. The second level is that of devices. The algorithms are implemented in embedded systems with innovative approaches to device technologies

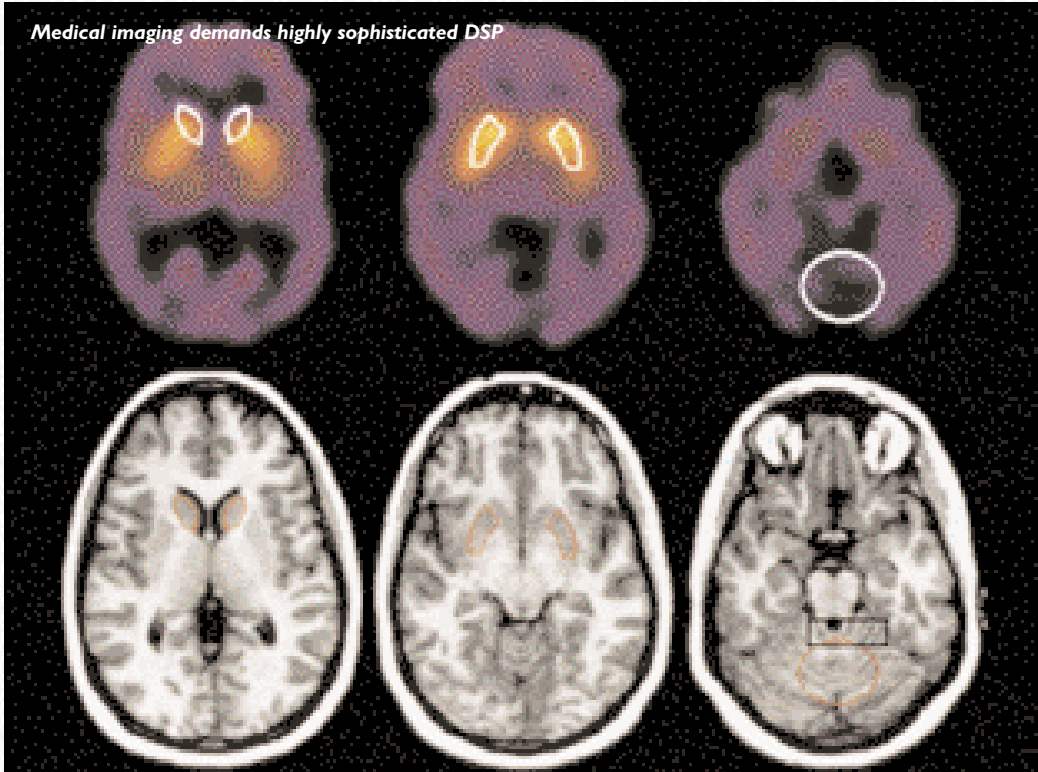
including architectures, systems-on-a-chip and FPGAs. Signal processing functionality is increasingly found in acquisition devices and sensory subsystems such as smart sensors, sensor arrays, conversion devices (analogue/digital conversion) and biometric devices. This new generation of devices are expected to be low power, high performance, reconfigurable and portable with small footprints. Thirdly, the devices have to be engineered into end-user applications. Key areas include biomedical, media, communications, and security.

Signal processing issues are addressed throughout the IST Programme. Around 70 IST projects have an SP component and the Programme already contributes significantly to SP R&D funding across Europe. Examples are to be found in the work on computer vision, restoration, authoring, representation and coding, and processors. Communication, telepresence, multimodal interfaces, watermarking, cryptography, and biometry are also major themes. In addition, significant resources are dedicated to SP-intensive application development in the health, environment and transport sectors.

To complement these activities, and reflect the enabling nature of DSP, a CPA on Advanced Signal Processing Systems and Applications was launched in 2001. This aimed to foster interdisciplinary research and development of high performance applications based on signal processing technology and to speed their implementation. It also aimed to contribute to the ambient intelligence vision by realising advanced embedded systems and by stimulating open approaches to software and hardware technologies. The resulting projects reflected the broad range of research interests in this field.

## Clear speaking for the emergency services

*Users of professional mobile radio communications, such as fire brigades or police forces, operate in particularly harsh acoustic environments. Siren noise, alarms, car engines can result in a real threat to the workers' and citizens' safety. For such users speech clarity is critical, and they are seeking solutions that significantly improve the quality of their communications. ANITA proposes to develop innovative DSP-based solutions for in-car and street applications, where environmental noises are removed in quasi real time (<25 ms). The technical approach includes innovative noise reduction algorithms combined with microphone arrays. Algorithms will be implemented on a PC platform for real-time demonstration and into DSPs for prototyping.*



For instance, the need to transmit sound and audio data across networks of varying bandwidth has led to a clear need for universal sound codecs. Project ARDOR will develop such a codec that adapts to the time-varying characteristics of the input signal, to time-varying network and application constraints and to user-preferred codec attributes. The codec will be based on an architecture consisting of a set of advanced sub-coding strategies, and a control system that allocates rates and signal components to each sub-coder using an innovative perceptual distortion measure.

DASPTOOL targets further developments in digital alias-free signal processing (DASP) technology. It will exploit an innovative method known as hybrid double sampling which represents a significant improvement

over the non-uniform sampling techniques currently used. A new class of algorithms and hardware/software tools and devices based on this sampling will be developed and offered for high-performance direct digital processing of RF and microwave signals at frequencies up to several GHz. Real-time signal processing will also be covered. These DASP tools, including signal pre-processing microprocessor subsystems, will be suitable for a wide range of applications such as reconfigurable telecommunications, data acquisition, test & measurement, instrumentation and similar systems designs.

Other application areas include adaptive 4D processing of digital ultrasound images (ADUMS), and the solution of differential equations for biomedical processes (PLACEBO).

IST Action Lines:	IST-2001 V.1.13	CPA 13: Advanced signal processing systems and applications
Project References:	ADUMS ANITA ARDOR DASPTOOL PLACEBO	IST-2001-34088 IST-2001-34327 IST-2001-34095 IST-2001-34552 IST-2001-35270
Commission Contacts:	Javid Khan	javid.khan@cec.eu.int
Web:	www.cordis.lu/ist/cpt/cpa13.htm	

# Beyond 3G

**D**igital mobile communication is one of the great success stories of recent years, offering people levels of mobility and service in personal communications never before available. In April 2002 the number of mobile users reached one billion worldwide, of which around 80% use digital GSM technology.



*Towards next generation mobile communications*

The next window of opportunity for growth of mobile services will be through the development of true broadband mobile technology, known as Universal Mobile Telecommunications System (UMTS). Part of the so-called third generation (3G) of global mobile systems, UMTS will integrate terrestrial and satellite networks to provide high-quality, high-bandwidth mobile multimedia services anywhere, at any time. With the technical and regulatory frameworks now in place, the first commercial UMTS systems are due to become operational in the EU during 2003. In Europe, the groundwork for UMTS, like GSM before it, owes much to the EU's RTD programmes, which enabled early Europe-wide consensus.

There is a continuing role for EU RTD, through the IST Programme, in preparing the ground for the likely technological and service evolution necessary to realise further generations of mobile communications technology. With UMTS systems nearing commercial service, attention is already shifting to the longer term, paving the way for systems in a 2010 timeframe. The project cluster "Systems beyond 3G" (SB3G) consists of 31 projects and is researching a broad range of issues. In late 2001, the cluster published a report, *A Vision on Systems beyond 3G*, presenting a roadmap for future developments in this area.

A number of projects concentrate on the effective seamless interworking of mobile applications and services over multi-standard wireless networks. Even though some projects base their trial activity on current and third-generation protocols, the architectures and models developed will be essential prerequisites for effective fourth generation deployment.

## **Visions for a wireless future**

*The Wireless World Research Forum (WWRF) is an industry-led forum for strategic research and debate on wireless futures. Launched in December 2000, the initiative aims to formulate visions on strategic future directions in the wireless field, and to identify research needs for mobile and wireless system technologies. Membership is open to all parties with an interest in future mobile systems, and now stands at around 100 from industry, operators and academia.*

*The Forum co-operates closely with the UMTS Forum, ETSI, 3GPP, IETF, ITU and other relevant bodies regarding commercial and standardisation issues arising from research. It is also establishing strong links with similar futures initiatives in Japan and elsewhere. In late 2001, it published a "book of visions" describing key issues, trends and research needs for the wireless world. A major workshop on this was held in 2002.*

*The IST projects WSI and WWRI complement WWRF's activities, supporting the bridging to FP6 in the wireless area. Further details are available at: [www.wireless-world-research.org](http://www.wireless-world-research.org).*



Among the most recent projects, CREDO targets IP service delivery over diverse systems to multimode terminals that select the most appropriate radio technology for the service and their current location. The project will develop the hardware and software architectures for terminals, network and service management systems, and will mount a trial in the demanding environment of the 2004 Athens Olympic Games. EVOLUTE addresses multilevel mobility management and successful context transfer for multimode handoffs in an all-IP network accessed through various indoor and outdoor wireless technologies. Both projects plan substantial contributions to emerging standards.

FLAWS considers the impact of converged multi-standard approaches on terminals, concentrating on multi-band antenna arrays. It is assessing the utility of these techniques by simulating terminal radio architectures, DSP aspects and channel models. The commercial consequences of multiple standards are also being examined. PACWOMAN is looking at the long-term requirements for scalable, secure, low-power terminals operable with personal, community and wide area networks. (PANs, CANs and WANs). These terminals need to be scalable in terms of data rate (100 bit/sec to megabits), cost (throwaway to premium-value) and functionality. They will exploit novel modulation techniques, be operable for about six months between battery charges, and discover their current radio and service environments.

BROADWAY proposes a hybrid dual frequency system called HIPERSHOT. The concept extends and complements existing 5GHz broadband wireless LAN systems in the 60GHz range to provide a new solution to very dense urban deployments and hot spot coverage. Economic analysis of business models for the competitive provision of IP mobile services is being investigated by TONIC. Working with service definitions and traffic flows, it will provide insights into the most competitive routes to fixed broadband access.

For future research under FP6, the guiding vision is to develop the concepts necessary for the next generation of wireless communication systems, to be rolled out beyond 2010. In addition to mobile communications, wireless devices and applications for PANs, CANs and WANs will remain a priority, as well as optimised interworking of different wireless systems in a variety of environments. Tools allowing for friendly development of context-aware applications will also be researched. The problems are multi-faceted and require work on user/service aspects, operator/network aspects, new business models, and regulation and standards.

IST Action Lines:	IST-2002 IV.5.1 IST-2002 IV.5.2	Towards technologies, systems and networks beyond 3G Validation of wireless and mobile systems and technologies	
Project References:	BROADWAY	IST-2001-32686	<a href="http://www.ist-broadway.org">www.ist-broadway.org</a>
	CREDO	IST-2001-33093	<a href="http://www.credo.nal.motlabs.com/">www.credo.nal.motlabs.com/</a>
	EVOLUTE	IST-2001-32449	<a href="http://www.intranet.gr">www.intranet.gr</a>
	FLAWS	IST-2001-32125	<a href="http://www.flows-ist.org">www.flows-ist.org</a>
	PACWOMAN	IST-2001-34157	<a href="http://www.imec.be/pacwoman">www.imec.be/pacwoman</a>
	TONIC	IST-2000-25172	<a href="http://www-nrc.nokia.com/tonic">www-nrc.nokia.com/tonic</a>
	WWRI	IST-2001-37680	
Commission Contacts:	Bartolomé Arroyo-Fernandez		<a href="mailto:bartolome.arroyo-fernandez@cec.eu.int">bartolome.arroyo-fernandez@cec.eu.int</a>
Web:	<a href="http://www.cordis.lu/ist/ka4/mobile/proclu/c/beyond3g.htm">www.cordis.lu/ist/ka4/mobile/proclu/c/beyond3g.htm</a>		

# Future broadband networks

Communication and networking are of strategic importance for Europe. New approaches are needed to cope with the continued strong growth of the internet and the growing demands of

Protocol (IP) standards, and in particular the new IPv6. Developing and deploying network services, i.e. services which operate on the IP layer, needs to be enhanced to allow for a more rapid provisioning of such services.



*The convergence of fixed and mobile networks creates new demands*

mobile and broadband multimedia services. To achieve cost-effective networks and services, further advances are required that allow the (communication) technologies to converge. Interoperability with legacy networks and systems and a migration path from legacy networks to new network technologies are of key concern. Increasingly, these will be all-IP networks, reflecting the convergence of fixed, mobile and wireless technologies and architectures around the Internet

These and related issues are addressed under the IST Programme's work on network integration and management. Activities aim to increase the bandwidth capacity, security, quality and functionality of communications networks and to support seamless service provision within a diverse network environment. The focus is on networks and protocols to support the full range of broadband services and applications, delivered through channels such as the internet, cable networks and mobile networks. Network agility and management are also addressed with an emphasis on active and dynamically re-configurable approaches.

The Next Generation Network Initiative (NGNI) is an IST thematic network that aims to provide a roadmap towards the next generation networks and point the way on future NGN issues. As well as being a focus for NGN expertise and clustering activities within the IST Programme, the initiative benchmarks the results of NGN projects, activities and developments worldwide. It also maintains

close links with international initiatives such as Internet 2, the US Next Generation Internet (NGI) programme, IPv6 Forum, and Optical Internet Forum, and with international standards bodies.

Active networks is a proposed solution for the fast and flexible deployment of new network services. The idea is to enable third parties (end-users, operators, and service providers) to inject application-specific services

## **A roadmap for European photonics research**

*OPTIMIST is a thematic network for IST projects in the areas of photonic technologies and optical networks. The OPTIMIST website facilitates the exchange of information and best practice across IST areas related to photonics, in particular between projects focused on components and basic research, and those concerned with systems. It also leads interaction with industry and with international bodies on research requirements. A 'Photonics Roadmap' is maintained, setting out the development perspective for the medium to long term across the whole field of photonics and optical networking technologies.*

### Assessing the true cost of IP networks

*Internet protocol (IP) is seen as a common technical basis for next generation networks and services. The economic viability of such an approach is unproven, however. TONIC is undertaking a techno-economic evaluation of new communication networks and services to identify economically viable solutions. A business case study approach is being used to assess new broadband and IP service scenarios. The results are key economic indicators such as net present value, internal rate of return and payback period, together with a comprehensive risk analysis.*

(in the form of code) into the network. Applications are thus able to utilise these services to obtain required network support (e.g. in terms of performance) in a way that is network-aware. As such, active networks allow dynamic injection of code as a promising way to realise application-specific service logic, or perform dynamic service provision on demand. Several IST projects focus on active network concepts.

The RTD on next generation network infrastructure has the aim also to foster deployment and early market adoption of open, converged networking infrastructures by supporting industry-driven experimentation and validation activities. These experiments allow testing of usability and user-friendliness on a large scale in terms of both number of users and duration. The emphasis is on novel IP infrastructures that result from the convergence of fixed, mobile and wireless technologies and architectures from a service perspective. Complementary testing of new business models for service provision is also addressed.

All-optical communications networks represent the best means of meeting the bandwidth requirements of future broadband applications and internet services. Empowered by WDM (wavelength division multiplexing) in all-optical networks, the transmission, multiplexing and switching is done completely optically, without performing inefficient opto-electronic conversions, serving the need for flexibility, manageability and quality for end-to-end services.

The importance of a widely available broadband infrastructure is highlighted in the eEurope 2005 Action Plan. In creating this infrastructure throughout Europe, a major challenge is the integration of optical core network technologies with access technologies such as wireless (mobile and fixed), satellite, xDSL, cableTV and a multitude of different protocols (including ATM, Ethernet and IP).

Due to the broad range of technological issues needing to be addressed, projects relevant to optical technologies are found across the IST Programme.

#### IST Action Lines:

IST-2001 V.1.6  
IST-2002 IV.2.3  
IST-2002 IV.2.4

CPA6: Next generation networks  
Networks and technologies for distributed services and applications  
Computing, communications and networks – take-up measures

#### Project References:

NGNI  
OPTIMIST  
TONIC

IST-2000-26418 [www.ngni.org](http://www.ngni.org)  
IST-1999-12501 [www.ist-optimist.org](http://www.ist-optimist.org)  
IST-2000-25172 [www-nrc.nokia.com/tonic](http://www-nrc.nokia.com/tonic)

#### Commission Contacts:

Pertti Jauhiainen [pertti.jauhiainen@cec.eu.int](mailto:pertti.jauhiainen@cec.eu.int)

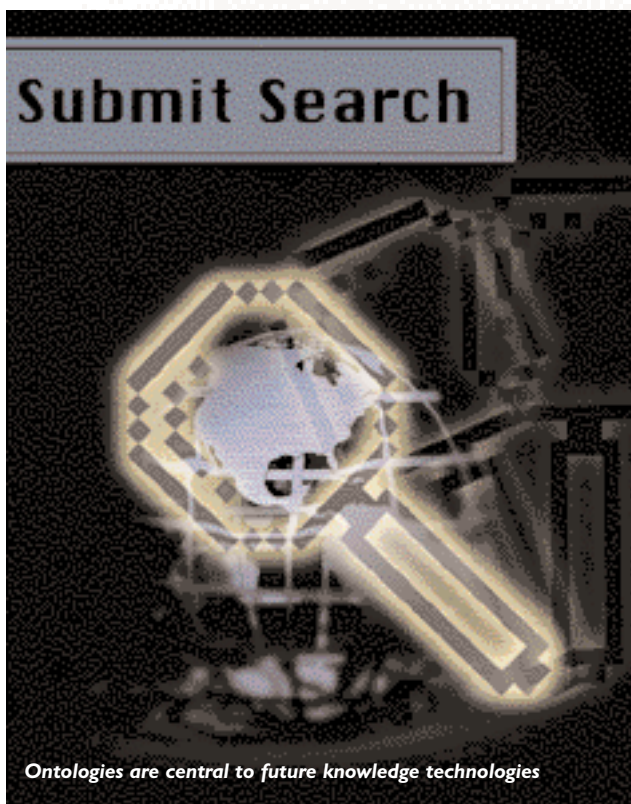
#### Web

[www.cordis.lu/ist/ka4/ipcn](http://www.cordis.lu/ist/ka4/ipcn)  
[www.cordis.lu/ist/cpt/cpa6.htm](http://www.cordis.lu/ist/cpt/cpa6.htm)



# In search of meaning

Existing approaches to information searching and retrieval are highly problematic. Anyone who has ever used a keyword search on a search engine will be only too well aware of the limitations in terms of precision and accuracy. Such approaches usually deliver raw documents, URLs in the case of web search engines, which require significant effort to process and extract the desired information. This burdens the human user and dramatically hampers automated information extraction by agents. Ontologies offer a means to mediate information access and will be key elements in automating the generation, maintenance and processing of all forms of content.



In information management, an ontology is a formal definition of terms and the relationships between them. As a mechanism for representing knowledge, ontologies are of crucial importance for the Semantic Web, the emerging model of information management that aims to make content understandable by machines.

In this context, an ontology is similar to a thesaurus. It includes a controlled vocabulary for a particular

topic, and rules for making explicit relations between terms. For example, the ontology of sailing includes sails and ropes, the different ways of tying ropes, the difference between port and starboard, the expectation that position depends on wind speed, etc. In view of the enormous benefits that will result from improved access to content, in the future virtually every company, university, government agency or individual could be producing web resources linked to ontological data. Thus they will contribute to realising the vision of the "Semantic Web". But for this to happen we need to develop appropriate standards and tools to automate the ontological descriptions.

For these reasons, research on ontologies has now gained a specific role in fields as diverse as knowledge representation, knowledge engineering, qualitative modelling, database design, information systems and database integration, natural language understanding, information retrieval and extraction, object-oriented software, knowledge management and organisation, and agent-based systems. Current applications areas include electronic commerce, enterprise integration, digital libraries, medicine, bioinformatics, geographic information systems, and legal information systems. The key role of ontologies for content-based data interchange is testified by the interest shown by many international standardisation bodies and initiatives, including ISO, ANSI, the W3C, and IEEE.

A key aim of these international efforts is to develop standardised languages in which to express ontologies. IST's ON-TO-KNOWLEDGE project, for instance, contributed OIL, the Ontology Inference Layer/Interchange Language, while a DARPA-supported initiative resulted in DAML, the DARPA Agent Markup Language. Through EU/US collaboration DAML+OIL was agreed, based on the Resources Description Framework (RDF) developed by the W3C. Following the setting up of a W3C Working Group on ontology issues relevant to the Semantic Web in 2001, DAML+OIL has been adopted as the basis for a new web ontology language called OWL.



## Ontologies for business

With over 120 members, the ONTOWEB network brings together the main players in the ontology-related research community in Europe. The network tracks developments in ontology-related fields, organises workshops and special interest groups, and promotes standardisation. It also represents the European ontology community worldwide and in co-operation with related initiatives, such as DAML, in the US.

Earlier this year ONTOWEB published a review of the state-of-the-art in ontology-based applications for business. The report categorised the most mature ontology-based application clusters and examined many practical aspects of ontologies, such as business models, practical hints for organisations building ontologies for the first time, and advice on benchmarks and metrics. Real-life applications include ontology-based techniques for call centres and for document and catalogue searches.

In the knowledge management area, PARMENIDES is investigating novel techniques to semi-automatically build and maintain domain-specific ontologies. ONTOLOGGING is concerned with a distributed approach to ontologies based on W3C and Semantic Web activities, as a means of enhancing the customisation of KM products. And COG looks at corporate ontologies in the context of grids. Most of the IST projects concerned with the Semantic Web also make substantial contributions to advancing ontology-related R&D.

As part of activities promoting best software practices, QUESTION-HOW aims to promote the latest developments on ontologies and other emerging web specifications from the W3C within

European industry. The project is developing state-of-the-art tools to demonstrate the emerging functionality of the new web, and inform European organisations at large about technological developments and trends. IBROW is a brokering service, configuring knowledge components (ontologies and generic algorithms) according to stated specifications of user needs.

CORES brings together major standardisation groups to discuss strategic directions for future development on metadata, as well as various international initiatives that are seeking to build registries which harvest and use vocabularies.

IST Action Lines:	IST-2001 II.1.2 IST-2001 III.4.1 IST-2002 IV.3	Knowledge management Semantic Web technologies Technologies and engineering for software, systems and services
Project References:	COG CORES IBROW ON-TO-KNOWLEDGE ONTO-LOGGING ONTOWEB PARMENIDES QUESTION-HOW	IST-2001-38491 IST-2001-35273 IST-1999-19005 IST-2001-33076 IST-2000-28293 IST-2000-29243 IST-2001-25120 IST-2000-28767
Commission Contacts:	Agnes Bradier (KA II) Hans-Georg Stork (KA III) Vincent Obozinski (KA IV)	agnes.bradier@cec.eu.int hans-georg.stork@cec.eu.int vincent.obozinski@cec.eu.int
Web:	www.cordis.lu/ist/ka3/iaf/index.htm	

# Competitive advantage through micr

**T**he long-term competitive advantage of European industry depends on world class microelectronics research and production facilities and on sufficient skills availability in microelectronics. Specific microelectronics initiatives aim at broadening the range of actors in the “food-chain” who are able to contribute to the advancement of semiconductor technology and those who exploit the results.



*European industry needs to exploit the latest microelectronics technologies*

The Semiconductor Equipment Assessment (SEA) initiative promotes the development in Europe of new or improved production equipment and its

introduction in the production process. It benefits both the equipment suppliers and equipment users in the semiconductor industry by stimulating the rapid take-up of the most advanced processes and techniques originating from research. The close co-operation between the two sides also ensures that the equipment and processes meet industry's leading-edge production requirements. The SEA projects point towards the next generation wafer/mask

processing and/or at 300mm wafer-size requirements. Wafer and device characterisation and metrology equipment is assessed in projects, such as DREAMS, COMBIMEXX, MIDAS; new material films deposition equipment in ACTION, LEPECVD300/3, HALE&RAPID; and photo-mask processing equipment in APHRO and McD'OR. Worldwide dissemination of the SEA projects' results is enhanced by the project SEAD.

Building and maintaining the required research infrastructure involves massive investment. It is very important to provide access to state-of-the-art facilities to as broad a segment of the research community as possible, in particular those who cannot afford it. The EURACCESS initiative aims to ensure that a large variety of European research groups can continue working on advanced microelectronics despite the escalating costs. It is a network of European research infrastructures that provides smaller research teams with access to state-of-the-art equipment and facilities in order to

validate new research ideas and concepts, and to study their industrial feasibility. In particular it promotes research on difficult “road blocks” set out

## **Spreading best practice in skills on low-power design**

*The ability to design low-power circuits and applications is essential for electronics industries aiming to compete in the wireless era. Building upon the results of a previous EU project, MARLOW offers a broad range of support relating to low-power electronic design. The network brings together a range of partners from academia and industry, including SMEs. The services offered to the low-power design community include a web portal, consultancy, and technical workshops. A technology roadmap identifying future research challenges in the field is also being developed.*

in the International Technology Roadmap for Semiconductors (ITRS).

The Europractice IC Service provides low-cost access to design tools and to ASIC prototyping and small volume manufacture. This is particularly important to support academic research and training, which would not be able to obtain this service from the market. It also offers a route from R&D to small-volume production as required by SME's. The initiative has been serving as a broker for such services since 1995 to an impressive number of customers. In 2001, 465 designs were prototyped on multiproject wafer (MPW) runs and a total of 103 small volume projects were booked, resulting in the delivery of 5.5 million components. In addition, the Service became the first fabless broker to offer access to a 0.13 micron MPW service.

The market has responded well, with many established users, design houses and new start-ups using the service to validate new IP developments and products. This enthusiastic take-up of deep sub-micron processes bodes well for the future use of these technologies in Europe. Europractice IC has recently been extended for a further three years, with a view to becoming self-funded by 2006. In line with its strategy to offer a full "one-stop-shop" solution, the service is being further expanded towards system level integration with single and multi-die SoC (system-on-chip) and SiP (system-in-package) solutions.

Trials, which provide pilot demonstrations of emerging technology in specific applications, are also supported. For instance, NEURO is demonstrating the use of a reusable neural network solution as a basis for test equipment for high-speed optical networks. By improving the usability and user-friendliness of a large variety of electronic test and analysis tools, the project will help to improve the competitiveness of the European test equipment industry.

In the highly knowledge-intensive field of micro-electronics, skills shortage is also a major concern. Lack of skilled personnel has reached critical levels and has also become a factor which limits the growth of the industry. The initiatives mentioned above are therefore complemented by training activities. In FP6 such topics will be further addressed as an integral part of the integrated projects and networks of excellence launched in the relevant areas.

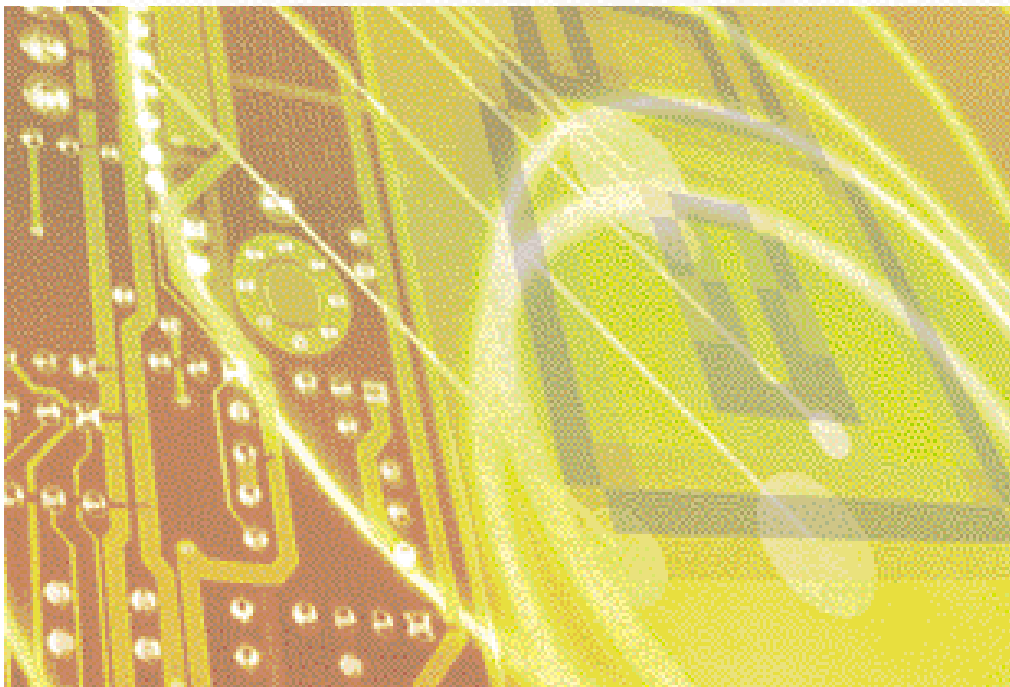
IST Action Lines:	IST-2002 IV.8.1	Microelectronics design and IP re-use - demonstrations, thematic networks, best practice and access actions	
	IST-2002 IV.8.4	Industrial micro- and opto-electronic technologies – take-up measures and assessment actions	
Project References:	EURACCESS	IST-1999-10407	<a href="http://www.imec.be/euraccess">www.imec.be/euraccess</a>
	EUROPRACTICE-IC 2	IST-2001-37510	<a href="http://www.europractice.com">www.europractice.com</a>
	MARLOW	IST-2001-37115	<a href="http://www.esdlpd.dimes.tudelft.nl/Marlow">www.esdlpd.dimes.tudelft.nl/Marlow</a>
	NEURO	IST-1999-20690	
	SEAD	IST-1999-11025	<a href="http://www.sea.rl.ac.uk">www.sea.rl.ac.uk</a>
Commission Contacts:	Patrick Van Hove	<a href="mailto:patrick.van-hove@cec.eu.int">patrick.van-hove@cec.eu.int</a>	
	Georg Kelm	<a href="mailto:georg.kelm@cec.eu.int">georg.kelm@cec.eu.int</a>	
	Michael Hohenbichler	<a href="mailto:michael.hohenbichler@cec.eu.int">michael.hohenbichler@cec.eu.int</a>	
	Bernard Nétange	<a href="mailto:bernard.netange@cec.eu.int">bernard.netange@cec.eu.int</a>	
Web	<a href="http://www.cordis.lu/ist/ka4/mel/index.htm">www.cordis.lu/ist/ka4/mel/index.htm</a>		

# Trust for e-transactions

**B**uilding trust is essential for the development of the information society and e-commerce. As access to the internet diversifies, from PCs to digital TVs, mobile phones, PDAs and very soon cars and even home appliances, people are feeling increasingly concerned about their security and privacy in this electronic world. As digital technologies become more pervasive, our approach to security is changing. No longer is it a matter of “keeping the bad guys out”, but of recognising that trust (and by implication security) is an enabler for all sorts of e-transactions. As well as managing our identities and risks, we need to manage access to applications and, increasingly, to digital assets.

Cryptography and related public key infrastructure

(PKI) are key technologies for securing electronic transactions and enhancing personal privacy. IST's PKI Challenge is promoting interoperability amongst a wide range of PKI products, service providers and certification authority services. Showcase demonstrations of PKI-enabled applications are being organised and specifications and best practices promoted within standards bodies. In the RTD area, NESSI has organised an open competition to address the medium to longer-term improvement of cryptographic primitives (see box). And STORK brings together key players from academia and industry to formulate a common research agenda to meet current and future needs in cryptology. The resulting roadmap will be widely disseminated and is expected to provide a basis for further activities under FP6.



Security technologies will help build confidence in the e-economy

## Next generation security

*Crypto algorithms are mathematical formulas used to protect electronic information. They come in many different forms, and to achieve the level of security necessary to support e-commerce, e-government and electronic signatures, new algorithms are needed. NESSIE has achieved international visibility by organising an open competition to find a strong portfolio of new algorithms.*

*A total of 42 submissions were received from cryptographers around the world, including Australia, Korea, Japan and the US, with two-thirds of them being from industry. Researchers inside and outside the NESSIE project subsequently tried to attack these algorithms, attempting to find weaknesses that would compromise their security. In addition, the efficiency of the algorithms (their speed) was also assessed. The initial contenders were first reduced to 24 candidates, and the final portfolio is expected by the end of 2002. These best algorithms will also be submitted to standardisation bodies such as ISO, IETF and IEEE.*



Digital rights management (DRM) is also a key issue. The focus here is on tools and services to support the transfer and management of digital content as commercial assets. The PAIDFAIR trial is introducing a real-time accounting system to protect and measure usage of intellectual property, for scenarios such as music distribution, digital broadcasting, and e-payments. TRADEX is setting up a trial trade exchange for cultural heritage, where buyers and sellers will be able to trade digital representations of cultural objects. Based on technologies such as smart cards, PKI, XML and MPEG-4, the service will enable cultural institutions to set up virtual exhibitions and could provide a basis for a worldwide platform for managing digital object transactions.

Biometrics is a promising area for managing privacy and identity. BIOVISION will produce a roadmap for the successful future deployment of biometrics. Commercial applications over the next 10 years are being investigated using scenario modelling, and future research challenges identified by gap analysis.

Future RTD priorities will continue to focus on the need for trust and confidence in the mobile information society, in particular to support the expected growth of m-commerce. Many hard problems still remain here. For example, we need scalable security policies that enable appropriate and acceptable levels of security for the diverse network environment that is now emerging. Similarly, we have to look at how to define and manage privacy policies so as to permit access to location-sensitive services without intrusion into the user's private life. Two recent projects aim to lay the groundwork for FP6 in this area. RAPID is developing a roadmap for applied research in privacy and identity management. And PAMPAS targets a roadmap for future mobile systems and services, taking account of technologies such as cryptography, PKI, and DRM.

### Spreading best practice on digital signatures

*DIGISEC is investigating the technological and legal issues posed by the large-scale deployment of PKI technologies in a real business context, namely electronic transactions between companies, chambers of commerce and government authorities in Italy.*

*Under this trial, more than 160 000 certificates for digital signatures have been issued together with a further 60 000 for authenticating access to web applications. All certificates are supported by secure smart cards and are being used for various legal purposes, such as the electronic delivery of financial or legal documents with the Italian Business Register. A number of services leveraging the PKI infrastructure are also being offered, such as certified e-mail, repository services, and strong authentication-based access to web applications.*

*The experience gained through the project has been assembled into a best practice guide, and the results are also being disseminated through ChamberSign, the top-level certification authority.*

IST Action Lines:	IST-2001 II.4	Information and network security and other confidence-building technologies
	IST-2002 II.1.2	Strategic roadmaps for applied research
Project References:	BIOVISION	IST-2001-38236
	DIGISEC	IST-1999-20981
	NESSIE	IST-1999-12324
	PAIDFAIR	IST-2000-29616
	PAMPAS	IST-2001-37763
	RAPID	IST-2001-38310
	STORK	IST-2001-38273
	TRADEX	IST-2000-21031
Commission Contacts:	Thierry van der Pyl	thierry.vanderpyl@cec.eu.int
Web:	www.cordis.lu/ist/ka2	
		digisec.infocamere.it
		www.cryptoneessie.org
		www.paidfair.com
		www.tradex-ist.com

# Multimedia by satellite

**D**espite the setbacks of some mobile satellite systems, the satellite industry has continued to expand over recent years. Broadcasting remains the 'success story' of this sector, with 80 million users receiving satellite TV programmes in Europe, either with direct-to-home (DTH) receivers or indirectly after retransmission over cable networks. Satellite systems have also been instrumental in the success of the DVB European standard, first introduced for digital broadcasting via satellite.

*Satellite systems will play a key role in future communications networks*



Beyond broadcasting, satellite communication systems have successfully addressed the new opportunities offered by the rapid development of internet services, with some European operators already dedicating about 50% of their satellite capacity to internet traffic. This trend is expected to continue in the future, with satellite communications becoming an important delivery channel for services such as interactive multimedia, mobile voice and data, and digital audio radio systems. Integration of these systems, i.e. mobile and broadcasting, is also considered as a promising avenue to open up new markets and applications.

The IST Programme's work related to satellite communications is largely consistent with this evolutionary picture anticipated by the industry. IST-sponsored activities do not target space-specific equipment, such as payloads or platform technologies, nor the ground equipment used exclusively in a satellite context. Rather, IST projects take terrestrial systems and networks as a starting point, with a view to validating the related technologies and services in the mixed satellite-terrestrial environment that is likely to emerge in the future. In this context, the vast majority of projects include a satellite and a terrestrial network component, and aim at optimising interoperability within this heterogeneous environment.

## **Co-operation on future satellite communications**

*IST's RTD projects are implemented in the wider political context of establishing closer links with the European Space Agency (ESA), as called for by the Council Resolution of 16th November 2001. In the field of mobile communications, the EC and ESA have jointly launched a Task Force on Advanced Satellite Mobile Systems, the ASMS-TF. This industry-led initiative aims to derive a European vision of the future of mobile systems, from both technological and economic perspectives, and to identify critical standardisation and regulatory issues. It also provides a platform for exchange of information for all projects financed under the IST and the ESA umbrellas.*

*The joint group now has 48 members and 6 working groups, a mature contrast to the fragmented position of a few years ago. Its work has been welcomed by industry and is leading to agreed visions on future technologies and systems. It is currently contributing to the agenda and key topics for FP6, including potential applications and demonstrators for the ESA's new large-capacity satellite, to be launched around 2007.*

Various IST projects are achieving convincing results with demonstrations of satellites linked to terrestrial network and service infrastructures for internet, multimedia and broadcasting services. VIRTUOUS and FUTURE target a heterogeneous platform compatible with terrestrial and satellite UMTS, partly building on previous ESA developments. On a similar issue, SATIN is integrating the best feature of satellite, its inherent broadcasting ability, with terrestrial networks (GPRS or UMTS) to provide a cheap mobile interactive channel. The project thus represents a key contribution to mobile-broadcasting convergence, together with the MODIS project which will further demonstrate satellite L-band capability with an extensive in-car demonstrator. At Ka band, SUITED has a heterogeneous testbed combining a mobile satellite network with a terrestrial GPRS-based network, and has submitted its novel quality-of-service protocol, GRIP, to the IETF. The work on internet by satellite is complemented with SATIP6, whose demonstrator will eventually be connected to the terrestrial 6BONE infrastructure to validate compatibility of IPv6 with satcom systems.

REPOSIT is showing that a DVB-S satellite system can be integrated with terrestrial distribution nodes for heterogeneous services (such as interactive TV, internet, and multimedia applications), while WIRELESS CABIN is studying and trialling communications within an aircraft cabin.

Satellite systems have competitive advantages in the areas of broadcasting, multicasting and geographical reach, and, with the continuously growing traffic for business and consumer services, have a significant contribution to make to wealth creation in the future. The Sixth Framework is likely to identify a co-ordinated European view of the role that advanced mobile satellite communication systems may play in 3G and in systems beyond 3G. Since 2G-compatible satellite systems have experienced a disappointing uptake, the definition of a viable set of system and service strategies will be an early focus. Support to standards activities will remain an important outcome of this work.

### All aboard!

*High-speed trains are natural candidates for satellite communication as they spend much of their time travelling through remote areas. FIFTH is specifying, evaluating and demonstrating a dual-segment satellite and W-LAN data communication system for rail passengers. The users' terminals (laptops, PDAs etc.) communicate primarily via the satellite but will hand over to an on-board W-LAN environment in tunnels and urban environments. The demonstrator will explore issues of mobility management, traffic management and quality-of-service, taking special account of the impairments found in the railway environment, such as proximity to power lines.*

IST Action Lines:	IST-2002 IV.5.1 IST-2002 IV.5.2	Towards technologies, systems and networks beyond 3G Validation of wireless and mobile systems and technologies	
Project References:	FIFTH FUTURE MOBILITY MODIS REPOSIT SATIN SATIP 6 SUITED VIRTUOUS WIRELESS CABIN	IST-2001-39097 IST-2000-25355 IST-2000-25096 IST-2001-34263 IST-2001-34692 IST-2000-25030 IST-2001-34344 IST-1999-10469 IST-1999-10167 IST-2001-37466	<a href="http://www.ebanet.it/future.htm">www.ebanet.it/future.htm</a> <a href="http://www.rose.es/mobility/">www.rose.es/mobility/</a> <a href="http://www.ist-modis.org">www.ist-modis.org</a> <a href="http://www.oteconsult.gr/reposit/index.htm">www.oteconsult.gr/reposit/index.htm</a> <a href="http://www.ee.surrey.ac.uk/satin">www.ee.surrey.ac.uk/satin</a> <a href="http://satip6.tilab.com">satip6.tilab.com</a> <a href="http://www.suited.it">www.suited.it</a> <a href="http://www.ebanet.it/virtuous.htm">www.ebanet.it/virtuous.htm</a> <a href="http://www.wirelesscabin.com">www.wirelesscabin.com</a>
Commission Contacts:	Bernard Barani	<a href="mailto:bernard.barani@cec.eu.int">bernard.barani@cec.eu.int</a>	
Web:	<a href="http://www.cordis.lu/ist/ka4/mobile/index.htm">www.cordis.lu/ist/ka4/mobile/index.htm</a> <a href="http://www.cordis.lu/ist/ka4/mobile/proclu/c/satcom/satcom.htm">www.cordis.lu/ist/ka4/mobile/proclu/c/satcom/satcom.htm</a> (ASMS Task Force)		

# Subsystems for wireless communication

**T**he increasing sophistication of modern wireless and mobile communication systems and devices presents designers with many new challenges. For instance, the trend towards multi-modal mobile terminals able to operate on different interface standards significantly increases the complexity of the radio interface. Developments such as wireless local and personal area networks also create a requirement for specialised components. A reduction in the number of discrete components used in wireless devices would have major advantages in terms of higher functionality and reliability, and reducing size, weight and costs.

Technological advances are enabling many of the high-frequency (HF) components to be integrated within high frequency IC architectures. We are still some way from being able to integrate all of the relevant components within the chip itself, however. And given the “new” areas of the spectrum being opened up for wireless communication, such as the 2GHz band used for personal area networks and the 77GHz band for future generations of car radar systems, this will remain the case for some while to come. Hence, subsystems retain an important role in the functioning of HF systems.

The IST Programme includes a series of projects addressing subsystems in the context of future wireless communications. Subsystems are multi-component assemblies with well-defined functionality and interfaces, often combining active and passive elements and associated software. They constitute the functional blocks of information processing and communication systems and related products and help determine how a component is used in a particular application. Aspects such as manufacturability, reliability, power consumption, thermal performance and miniaturisation are key research issues.

FLEX-SI, for instance, is investigating ultra-thin electronic packaging solutions based on thin flexible Si chips with a thickness  $<50\mu\text{m}$ . Derived from different industrial applications, three ultra-thin packaging technologies are planned: multi-chip module with active component integration into flexible substrates (MCM-L), chip-on-chip and chip-in-paper. The work focuses on the development of wafer thinning, handling and shipping techniques; investigation of the material properties of ultra-thin silicon; and studying the long term behaviour and reliability.

Focusing on broadband terminals, SMACKS aims to reduce the manufacturing cost and time-to-market through improvements in key technologies for the volume production of millimetre-wave transceivers. Solutions are being sought in three areas: new passivation techniques and packages for GaAs MMICs; the integration of passive filtering functions into printed circuit boards; and enhancements to the standard surface assembly processes. These technologies will be integrated and validated in a 0.5W high performance module.

LIPS focuses on interconnects, packaging and sub-system solutions for low-cost millimetre-wave communication and radar applications including consumer products. High-density interconnect (HDI) and bare die attachment technologies are being adapted to operate in the millimetre-wave range. The technologies will be validated for volume production in two demonstrators: a 60GHz Tx/Rx module for the next generation WLAN, and a front-end for a 77GHz automotive collision avoidance radar.

As ICs become larger the number and density of external connections also increases. LIDCAT targets a new production technology for printed circuit boards to handle routing and placement of dense-array packages. FLEXIL aims to develop very advanced flex-

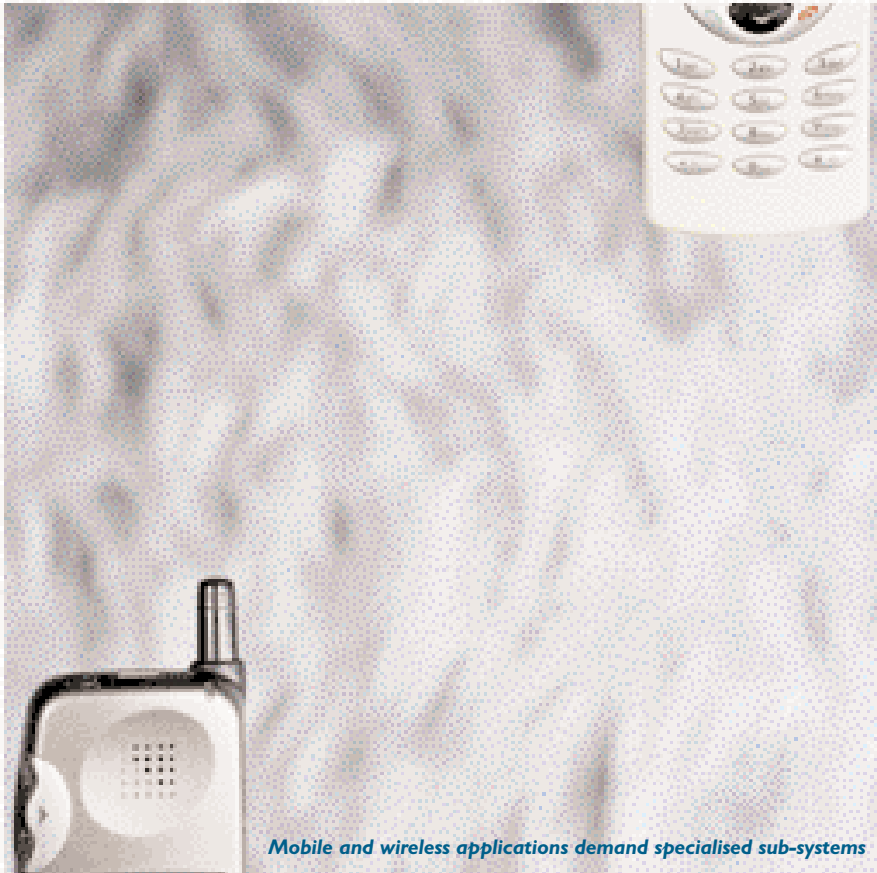
## Integrated antennas for Bluetooth devices

*With Bluetooth functionality now being included in a wide range of products, there is increasing demand to further reduce the size of short-range communication components. BLUEPAC is developing microelectronic packaging solutions for the next generation of Bluetooth-enabled devices. A significant new development will be in the integration of passive components, such as antennae and antenna filters in the ball grid array (BGA) package. This will improve circuit performance as well as reducing size and the number of external components.*



based technologies and related assembly processes to support the manufacture of better flat panel displays and similar devices for applications such as avionics, automotive, smart cards, and telecoms.

Trials of HF subsystems are also supported. MULTI-MODULES is trialling microelectronics and packaging solutions for multi-mode 3G wireless terminals (UMTS/TETRA/TETRAPOL). The technologies concerned - BiCMOS monolithic process, HDI organic substrate, and advanced ceramic and ferrite materials and process – are all candidates for use in radio blocks for wide band terminals. The materials, processes and components are being tested to identify



their respective cost and performances, and to come up with design guidelines for equipment manufacturers.

**Subsystems for next generation broadband devices**

*GALACTIC is addressing innovative solutions for high performance, affordable subsystems for Ka-band equipment. The key technologies are compact multifunctional circuits based on GaAs MMICs, low temperature co-fired ceramics (LTCC) for high-power Ka-band applications, and their integration and packaging. These technologies are expected to provide the basis for a low cost, multi-component high-power Ka subsystem adequate for high volume production. They will be integrated and validated on a Ka-band up-converter transmitter, which is the key building block of various future products for next generation broadband access systems.*

IST Action Lines:	IST-2002 IV.7.1	Microsystems and miniaturised subsystem modules for portable applications
Project References:	BLUEPAC	IST-2001-35246
	FLEX-SI	IST-1999-10205
	FLEXIL	IST-1999-12288
	GALACTIC	IST-2000-30109
	LIDCAT	IST-1999-10852
	LIPS	IST-2000-30128
	MULTI-MODULES	IST-1999-20260
	SMACKS	IST-2000-30060
Commission Contacts:	Francisco Ibanez	francisco.ibanez@cec.eu.int
Web:	<a href="http://www.cordis.lu/ist/ka4/supermic/index.htm">www.cordis.lu/ist/ka4/supermic/index.htm</a>	

# Flexible radio services

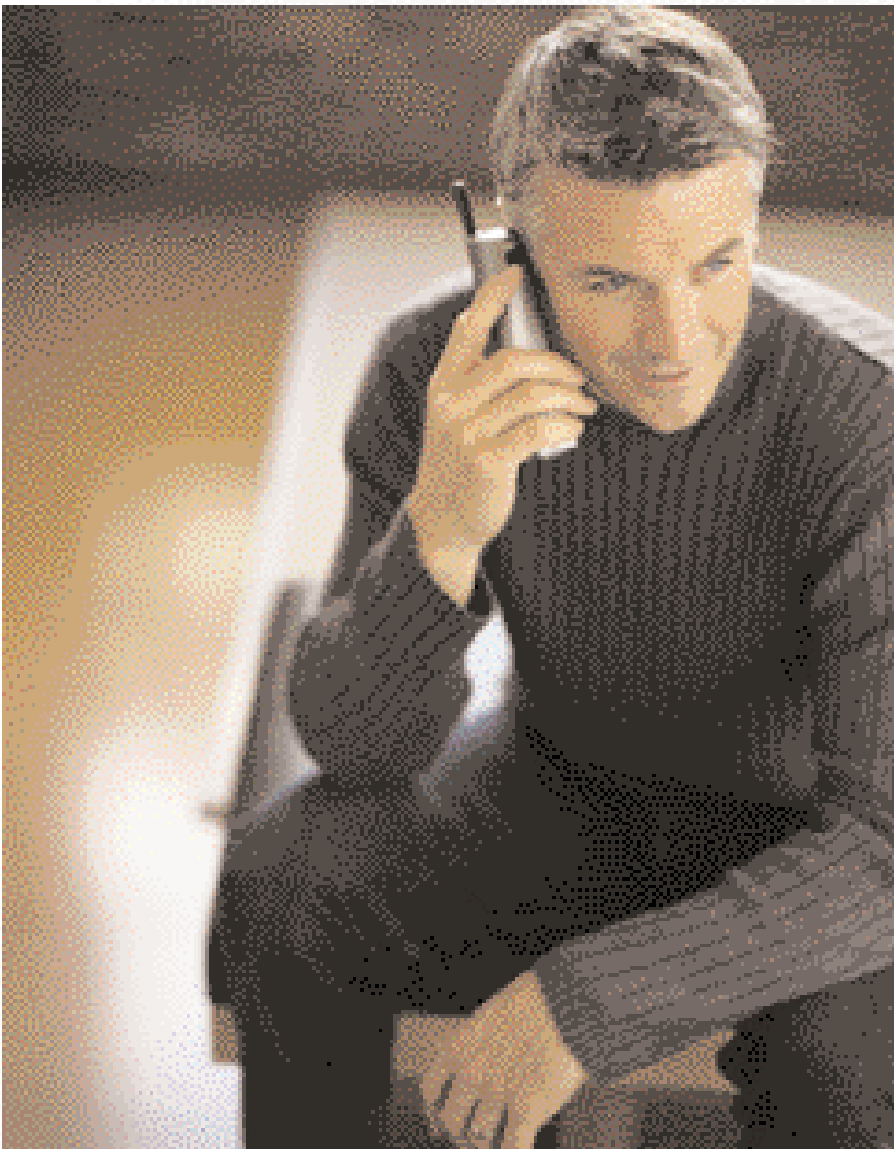
Over recent years, reconfigurable radio systems and networks concepts (also known as software radio or software-defined radio, SDR) have become one of the most important topics of research in mobile and personal communications. SDR promises the capability to allow a single terminal to assume different characteristics (e.g. air-interfaces) on-demand, through software definition. In addition to mobile terminals, the concept applies also to base stations. In this case, mobile and base station transceivers become a generic processing platform capable of implementing the instructions downloaded

to them. This transition from standard-specific to “general purpose” processing architectures brings significant gains in terms of flexibility not only to the network operator but also to the user.

Some see SDR as simply freeing us from standards, as “everything” could be defined at will, without any need for consensus. In Europe, however, the perspective is a broader one, changing not only the way we think about radio systems and networks, but more importantly the way we define and provide the services and adapt the applications that run on top of them. In this context,

the EU’s SDR approach concentrates not only on the terminal side but extends through the network into service creation and application development, delving into the impact on spectrum usage, regulation and standardisation. Instead of settling for defining the terminal in software, we envision reconfiguring on-demand not only the terminal but also the serving network(s) and the services they provide.

In the future, we expect that mobile networks will be completely controlled and dynamically reconfigured by software. They would be capable of dynamically assigning resources to specific users, varying the coding and modulation according to load and quality of service demands, and using different access techni-



*Reconfigurable networks will improve service levels*

ques and frequencies. This ability to reconfigure and adapt on the basis of service demand, network load and user profile will be a key characteristic of next generation mobile networks. Reconfigurability cuts across all types of radio systems, enabling the integration of many systems in the same hardware platform. It also cuts across generations, and should not be conceived just as an implementation of third generation systems, thereby ignoring second generation and potential fourth generation systems, or even the shorter term multi-mode problem.

Reconfigurable radio provides for an integrated approach to what is commonly treated as a series of disjointed problems, and thus enables a level of synergy otherwise unattainable. It provides the user, operator, manufacturer and application developer with a tremendous degree of flexibility without sacrificing efficiency. On the contrary, by fully exploiting all available systems (i.e. using the most appropriate) for each data stream, it will increase spectrum efficiency, allowing eventually for full spectrum sharing. Reconfigurability is expected to play a critical role in maintaining Europe's leadership in the area of mobile wireless communications by increasing flexibility and reducing the costs of deployment, operation and maintenance. It is expected to facilitate enhancements and personalisation, so creating new business opportunities and jobs.

Recent projects within the Reconfigurability Cluster are addressing holistic aspects of reconfigurability, of networks and systems, as well as at the component (terminal and base station) level. SCOUT aims to develop and validate concepts for the operation of reconfigurable networks. This will include reconfiguration at all layers, quality-of-service and spectrum issues, identifying key technologies. Among many specific issues to be tackled are download management, distributed node negotiation, mode switching, radio resource management, procedures and signalling. The consortium includes operators, manufacturers, academia and a regulator.

A key challenge for future wireless services will be the optimised interworking of heterogeneous wireless systems in a variety of environments. These include the "personal", "community" and "wide" area networks. In the Sixth Framework Programme work is likely to concentrate on four major domains, that of the user, the terminal device, the provision of service, and the network. Reconfigurability is horizontal to all these domains and is likely to be further researched with the aim of getting wide acceptance at standardisation level, particularly in network and service concerns. A clear understanding of regulatory and security implications of this technology will probably be sought.

### Smoothing the transition to 3G

*The world of wireless telecommunications is moving towards a new era in which communications will be available anytime, anywhere, in any media at high-data rates. However, the transition of existing cellular systems to wireless communication systems of third generation and beyond seems to be rather difficult. Operators have made enormous investments in 3G licences and setting up next generation systems with the same penetration rates as current GSM networks will be extremely expensive. The coming years will be crucial to the future of telecommunications.*

*CAUTION++ aims to provide a highly innovative and scalable platform that will allow wireless systems of same and different operators to be interconnected. This will enable operators to achieve maximum utilization, increase network performance and share network resources.*

IST Action Lines:	IST-2002 IV.5.1 IST-2002 IV.5.2	Towards technologies, systems and networks beyond 3G Validation of wireless and mobile systems and technologies	
Project References:	CAUTION++ MUMOR SCOUT	IST-2001-38229 IST-2001-34561 IST-2001-34091	 <a href="http://www.mumor.org">www.mumor.org</a> <a href="http://www.ist-scout.org">www.ist-scout.org</a>
Commission Contacts:	Demosthenes Ikononou Jorge Pereira	demosthenes.ikononou@cec.eu.int jorge.pereira@cec.eu.int	
Web:	<a href="http://www.cordis.lu/ist/ka4/mobile/proclu/c/reconfigurability.htm">www.cordis.lu/ist/ka4/mobile/proclu/c/reconfigurability.htm</a>		

# Glossary

**T**his list excludes acronyms relating to specific IST projects and initiatives

3D	three-dimensional	EFC	electronic fee collection
ACTS	Advanced Communications Technologies and Services Programme (of the EU's Fourth Framework Programme)	EIB	European Investment Bank ( <a href="http://www.eib.org">www.eib.org</a> )
ADAS	advanced driver assistance system	ERA	European Research Area
ADSL	asymmetric digital subscriber loop	ESA	European Space Agency ( <a href="http://www.esa.int">www.esa.int</a> )
AL	action line	ETSI	European Telecommunications Standards Institute ( <a href="http://www.etsi.org">www.etsi.org</a> )
ANSI	American National Standards Institute ( <a href="http://www.ansi.org">www.ansi.org</a> )	EU	European Union
API	application programming interface	EWIS	European Early Warning Information System
AR	augmented reality	F/OSS	free/open source software
ASIC	application-specific integrated circuit	FET	Future and Emerging Technologies
ATM	asynchronous transfer mode	FP5	Fifth Framework Programme for Research & Technological Development ( <a href="http://www.cordis.lu">www.cordis.lu</a> )
AV	audio-visual	FP6	Sixth Framework Programme for Research & Technological Development
BPR	business process re-engineering	FPGA	field programmable gate array
CAD/CAM	computer-aided design/computer-aided manufacture	GaAs	gallium arsenic (semiconductor)
CAN	community-area network	Gbit / GB	gigabits / gigabytes (10 <sup>9</sup> )
CBMI	content-based multimedia indexing	GHz	gigahertz
CBSE	component-based software engineering	GIS	geographical information system
CDMA	code division multiple access	GMES	Global Monitoring for Environment and Security ( <a href="http://gmes.jrc.it">http://gmes.jrc.it</a> )
CEN	Comité Européen de Normalisation (European Committee for Standardisation) ( <a href="http://www.cenorm.be">www.cenorm.be</a> )	GNSS	Global Navigation Satellite System
CERT	computer emergency response team	GPR	ground-penetrating radar
CMOS	complementary metal oxide semiconductor	GPRS	general packet radio service
CNT	carbon nanotube	GPS	global positioning system
CORBA	Common Object Request Broker Architecture ( <a href="http://www.corba.org">www.corba.org</a> )	GSM	global system mobile
CPA	Cross-Programme Action	GTRN	Global Terabit Research Network ( <a href="http://www.indiana.edu/~gtrn/">www.indiana.edu/~gtrn/</a> )
CRM	customer relationship management	HDI	high-density interconnect
CSCL	computer-supported collaborative learning	HLT	human language technologies
CSR	corporate social responsibility	HMI	human-machine interface
DAB	digital audio broadcast	HTML	hypertext mark-up language
DAVIC	Digital Audio-Visual Industry Council ( <a href="http://www.davic.org">www.davic.org</a> )	IC	integrated circuit
DG	Directorate-General	ICT	information and communication technologies
DSL	digital subscriber loop	IEEE	Institute of Electrical and Electronic Engineering ( <a href="http://www.ieee.org">www.ieee.org</a> )
DSP	digital signal processing	IEFT	Internet Engineering Task Force ( <a href="http://www.ietf.org">www.ietf.org</a> )
DSRC	direct short-range communications	IMS	Intelligent Manufacturing Systems Initiative ( <a href="http://www.ims.org">www.ims.org</a> )
DTV	digital television	InP	indium phosphorous (semiconductor)
DVB	digital video broadcast	IP	integrated project (in FP6)
DVD	digital video disc	IP	Internet Protocol
DWDM	dense wavelength division multiplexing	IP	intellectual property
EC	European Commission ( <a href="http://www.europa.eu.int/comm">www.europa.eu.int/comm</a> )	IPR	intellectual property rights
		IPv6	Internet Protocol version 6
		IRC	Innovation Relay Centre
		IRTF	Internet Research Task Force ( <a href="http://www.irtf.org">www.irtf.org</a> )



ISDN	integrated services digital network	P2P	peer-to-peer (technology)
ISO	International Standardisation Organisation ( <a href="http://www.iso.org">www.iso.org</a> )	PAN	personal area network
IST	information society technologies	PDA	personal digital assistant
IST	Information Society Technologies Programme ( <a href="http://www.cordis.lu/ist">www.cordis.lu/ist</a> )	PKI	public key encryption
ISTAG	Information Society Technologies Advisory Group	QIPC	quantum information processing and computing
ISTC	Information Society Technologies Committee	QoS	quality of service
ITU	International Telecommunications Union ( <a href="http://www.itu.org">www.itu.org</a> )	RDF	Resource Description Framework (see <a href="http://www.w3.org/RDF/">www.w3.org/RDF/</a> )
JRC	Joint Research Centre ( <a href="http://www.jrc.cec.eu.int">www.jrc.cec.eu.int</a> )	RFID	radio-frequency identification device
KA I	Key Action I: Systems And Services For The Citizen	RN	research network
KA II	Key Action II: New Methods Of Work And Electronic Commerce	RTD	research and technological development
KA III	Key Action III: Multimedia Content And Tools	SCM	supply chain management
KA IV	Key Action IV: Essential Technologies And Infrastructure	SDH	synchronous digital hierarchy
KM	knowledge management	SDR	software defined radio
LBS	location-based services	SEE	South-Eastern Europe
LTCC	low-temperature co-fired ceramic	SiGe	silicon germanium (semiconductor)
Mbit / MB	megabits / megabyte (10 <sup>6</sup> )	SME	small and medium-sized enterprise
MEMS	micro-electromechanical system	SMS	simple messaging service
MHP	Multimedia Home Platform ( <a href="http://www.mhp.org">www.mhp.org</a> )	SO VO	smart organisation / virtual organisation
MHz	megahertz	SOC	system-on-a-chip
MOEMS	micro-optoelectromechanical system	SOI	silicon-on-insulator
MOSFET	metal oxide semiconductor field effect transistor	S-UMTS	satellite-universal mobile telecommunication system
MPEG	Motion Picture Expert Group ( <a href="http://mpeg.telecomitalia.com">http://mpeg.telecomitalia.com</a> )	TAP	Telematics Applications Programme, of the EU's Fourth Framework Programme
MPW	multi-project wafer	Tbit / TB	terabits / terabytes (10 <sup>12</sup> )
MST	microsystem technology	TD-CDMA	time division/code division multiple access
NAS	Newly Associated States	THz	terahertz
NGI	Next Generation Internet initiative ( <a href="http://www.ngi.gov">www.ngi.gov</a> )	TTP	trusted third party
NGN	next generation network	T-UMTS	terrestrial-universal mobile telecommunication system
NID	nanotechnology information device	UMTS	universal mobile telecommunications system
nm	nanometre (10 <sup>-9</sup> m)	URL	universal resource locator
NoE	network of excellence (in FP6)	USB	universal serial bus
NRENs	national research and education networks	VME	virtual mobile environment
NVM	non-volatile memory	VR	virtual reality
OEM	original equipment manufacturer	W3C	Worldwide Web Consortium ( <a href="http://www.w3c.org">www.w3c.org</a> )
OFDM	orthogonal frequency division multiplexing	WAI	Web Accessibility Initiative ( <a href="http://www.w3c.org/wai">www.w3c.org/wai</a> )
OGSA	Open Grid Services Architecture ( <a href="http://www.globus.org/ogsa">www.globus.org/ogsa</a> )	WAP	wireless application protocol
OSGI	Open Services Gateway Initiative ( <a href="http://www.osgi.org">www.osgi.org</a> )	W-CDMA	wideband code division multiple access
OWL	web ontology language (see <a href="http://www.w3.org/2001/sw/WebOnt/">www.w3.org/2001/sw/WebOnt/</a> )	WDM	wavelength division multiplexing
		W-LAN	wide-area local area network
		WP2002 (2001)	IST Work Programme 2002 (or 2001)
		WWW	world-wide web
		XML	extensible mark-up language

# National Contact Points

This list is updated regularly and can be accessed at  
<http://www.cordis.lu/ist/ncps.htm>

## Austria

Dr. Erich Prem  
BIT - Büro für Internationale Forschungs- und  
Technologiekoooperation  
Donaucity Strasse 1  
A-1220 Vienna  
☎ +43 1 581.1616-119  
☎ +43 1 581.1616-16  
✉ [ist@bit.ac.at](mailto:ist@bit.ac.at)  
🌐 <http://www.bit.ac.at/ist.htm>

## Belgium

Ms Claudine Belleflamme  
SSTC / DWTC  
Rue de la Science 8  
B-1000 Bruxelles  
☎ +32 2 238.3569  
☎ +32 2 230.5912  
✉ [bell@belspo.be](mailto:bell@belspo.be)

Mr Karel Goossens  
IWT  
Bischoffsheimlaan 25  
B-1000 Brussel  
☎ +32 2 209.0900  
☎ +32 2 223.1181  
✉ [krg@iwt.be](mailto:krg@iwt.be)  
🌐 <http://www.iwt.be/>

M. Baudoin Jambe  
DGTRE  
Avenue Prince de Liège 7  
B-5100 Jambes  
☎ +32 81 335.671  
☎ +32 81 306.600  
✉ [B.Jambe@mrw.wallonie.be](mailto:B.Jambe@mrw.wallonie.be)  
🌐 <http://mrw.wallonie.be/dgtre/>

## Denmark

Mr Erik Balck Sørensen  
EuroCenter/Erhvervsfremmestyrelsen  
Rådhuspladsen 14  
DK-1550 København V  
☎ +45 3332.7278  
☎ +45 3332.7478  
✉ [ebs@schultz.dk](mailto:ebs@schultz.dk)  
🌐 <http://www.eurocenter.schultz.dk>

Fuldmægtig Jan Corner-Walker  
FIRST, The Danish Research Agency  
Randersgade 60  
DK-2100 København Ø  
☎ +45 3544.6200  
☎ +45 3544.6201  
✉ [jcw@forsk.dk](mailto:jcw@forsk.dk)  
🌐 <http://www.first.dk>

## Finland

Mr Janne Peräjoki  
Technology Development Centre (Tekes)  
P.O. Box 69  
FIN-00101 Helsinki  
☎ +358 10 521.51  
☎ +358 10 521.5906  
✉ [janne.perajoki@tekes.fi](mailto:janne.perajoki@tekes.fi)

## France

Ms Christine Montagut  
CFCE (Centre Français du Commerce Extérieur)  
10, avenue d'Iéna  
F-75783 Paris CEDEX 16  
☎ +33 1 4073.3673  
☎ +33 1 4073.3060  
✉ [christine.montagut@cfce.fr](mailto:christine.montagut@cfce.fr)  
🌐 <http://www.cfce.fr>

## Germany

Mr. Klaus Schütz  
DLR (Deutsches Zentrum für Luft- und Raumfahrt e.V.)  
Linder Höhe  
D-51147 Köln  
☎ +49 2203 601.3400 (IST infoline)  
☎ +49 2203 601.3055  
✉ [eu.ncp@dlr.de](mailto:eu.ncp@dlr.de)  
🌐 <http://www.dlr.de/it-ncp/>

## Greece

Mrs Paraskevi Sachini  
NDC / NHRF (National Documentation Center of the  
National Hellenic Research Foundation)  
Vassileos Konstantinou Ave. 48  
GR-116 35 Athens  
☎ +30 1 727.3906  
☎ +30 1 724.6824  
✉ [ist@ekt.org.gr](mailto:ist@ekt.org.gr)  
🌐 <http://hirc.ekt.gr/rtd/5th/t2/ist.htm>

## Ireland

Mr Tom Sheedy  
Enterprise Ireland  
Glasnevin  
IRL-Dublin 9  
☎ +353 1 808.2000  
☎ +353 1 837.0178  
✉ [tom.sheedy@enterprise-ireland.com](mailto:tom.sheedy@enterprise-ireland.com)  
🌐 <http://www.enterprise-ireland.com/ist/>

## Italy

Dr. Roberto Gagliardi  
Consorzio Pisa Ricerche  
Corso Italia 116  
I-56123 Pisa  
☎ +39 05-0915811  
☎ +39 05-0915823  
✉ r.gagliardi@cpr.it  
🌐 <http://www.meta.cpr.it>

Ms Floriana di Giacomo  
APRE (Agenzia per la Promozione della Ricerca Europea)  
Grattacielo Italia  
Piazza G. Marconi 25  
I-00144 Roma  
☎ +39 06-5911.817  
☎ +39 06-5911.908  
✉ digiacomo@apre.it  
🌐 <http://www.apre.it>

## Luxembourg

Mr Bertrand Dessart  
Luxinnovation GIE.  
National Agency for Innovation & Research  
rue Alcide de Gasperi 7  
L-1615 Luxembourg-Kirchberg  
☎ +352 436.26321  
☎ +352 438.120  
✉ bertrand.dessart@luxinnovation.lu  
🌐 <http://www.luxinnovation.lu>

## The Netherlands

Ir. Bert Van Werkhoven  
EG Liaison/Senter  
PO Box 30732  
NL-2500 GS 's Gravenhage  
☎ +31 70 361.0250  
☎ +31 70 356.2811  
✉ bert.van.werkhoven@egl.nl  
🌐 <http://www.egl.nl>

## Portugal

Dra. Carla Santos  
ICCTI (Instituto de Cooperação Científica e Tecnológica  
Internacional)  
Ministério da Ciência e da Tecnologia  
Rua Castilho, 5 - 4º  
P-1250-066 Lisboa  
☎ +351 1 358.5312  
☎ +351 1 315.4065  
✉ carla.santos@iccti.mct.pt  
🌐 <http://www.iccti.mct.pt>

## Spain

Mr Narciso García Santos  
E.T.S. Ingenieros de Telecomunicacion  
Universidad Politecnica de Madrid  
E-28040 Madrid  
☎ +34 91 336.7353  
☎ +34-91 336.7350  
✉ narciso@gti.ssr.upm.es

Mr Luis Gonzalez Souto  
Centro para el Desarrollo Tecnológico Industrial (CDTI) -  
Departamento de Programas de la Unión Europea  
Calle del Cid, 4  
E-28001 Madrid  
☎ +34 91 581.5547  
☎ +34 91 581.5586  
✉ lgs@cdti.es  
🌐 <http://www.cdti.es>

Mr Anatolio Alonso Pardo  
Secretaría General de Comunicaciones  
Palacio de Comunicaciones - Desp. 425-L  
Pza. de Cibeles, s/n  
E-28071 Madrid  
☎ +34 91 346.1527  
☎ +34 91 521.2723  
✉ anatolio.alonso@sgc.mfom.es  
🌐 <http://www.sgc.mfom.es>

Mr Luis Prieto Cuervo  
D.G. Desarrollo de la Sociedad de la Informacion -  
Desp. 333-G-A  
Ministerio de Ciencia y Tecnologia  
Alcala, 50  
E-28071 Madrid  
☎ +34 91 346 2745  
☎ +34 91 346 2674  
✉ luis.prieto@setsi.mcyt.es  
🌐 <http://www.setsi.mcyt.es/>

## Sweden

Mr Niklas Wingborg  
The Swedish EU-R&D Council (EU/FoU-rådet)  
Regeringsgatan 56  
PO Box 7091  
S-10387 Stockholm  
☎ +46 8 454.6449  
☎ +46 8 454.6451  
✉ niklas@eufou.se  
🌐 <http://www.eufou.se>

## United Kingdom

Mr Peter Walters  
UKISHELP  
PO Box 80  
Hayes  
Middlesex UB3 1XR  
☎ +44 870 606.1515  
☎ +44 20 8848.6660  
✉ ncp@ukishelp.co.uk  
🌐 <http://www.ukishelp.co.uk>

## NCPs in the Associated States

### Bulgaria

Prof Kiril Boyanov  
Bulgarian Academy of Sciences  
25A, Acad. G. Bonchev str.  
BG-1113 Sofia  
☎ +359 2 703.260  
☎ +359 2 707.273/703.260  
✉ boyanov@bgcict.acad.bg

Dr Roumen Nikolov  
Department of IT, FMI  
St. Kliment Ohridski University  
5, James Bouchier Street  
BG-1164 Sofia  
☎ +359 2 656.157  
☎ +359 2 656.157  
✉ roumen@fmi.uni-sofia.bg  
🌐 <http://www-it.fmi.uni-sofia.bg>

### Cyprus

Prof Antonis Kakas  
University of Cyprus  
Kallipoleos 75  
CY-1678 Nicosia  
☎ +357 2 892.230  
☎ +357 2 339.062  
✉ antonis@ucy.ac.cy  
🌐 <http://www.cs.ucy.ac.cy/~istncp/>

Marilena Paraskeva  
Research Promotion Foundation  
P.O. Box 23422  
CY-1683 Nicosia  
☎ +357 2 660.292  
☎ +357 2 666.117  
✉ marilena@research.org.cy  
🌐 <http://www.research.org.cy>

### Czech Republic

Ms Eva Hillerova  
Technology Centre AS CR  
Rozvojova 136  
CZ-165 02 Praha 6  
☎ +420 2 203 90 717  
☎ +420 2 209 22 698  
✉ hillier@tc.cas.cz  
🌐 <http://www.femirc.cas.cz>

### Estonia

Mr. Tarmo Pihl  
Archimedes Foundation  
Komanii 2  
51007 Tartu  
☎ +372 7 300.329  
☎ +372 7 300.336  
✉ tarmo.pihl@femirc.ee  
🌐 <http://www.esis.ee>

### Hungary

Mr Vilmos Bognar  
Ministry of Education, R & D Division  
Szervita Tér 8  
H-1052 Budapest  
☎ +36 1 318.4101  
☎ +36 1 318.4130  
✉ vilmos.bognar@om.gov.hu

### Iceland

Mr Eiríkur Bergmann Einarsson  
Research Liaison Office  
University of Iceland  
Dunhagi 5  
107 Reykjavik  
☎ +354 525.4900  
☎ +354 552.8801  
✉ ee@rthj.hi.is  
🌐 <http://www.rthj.hi.is>

### Israel

Mr. Myer W. Morron  
ISERD  
29, Hamered Street  
IL-61500 Tel Aviv  
☎ +972 3 511.8121 / +972 54 436.110 (Mobile)  
✉ mwm@iserd.org.il  
🌐 <http://www.iserd.org.il/newiserd/ist/>

### Latvia

Dr. Karlis Cerans  
Institute of Mathematics and Computer Science  
University of Latvia  
Raina Bulv. 29  
LV-1459 Riga  
☎ +371 721.3716  
☎ +371 782.0153  
✉ karlis@cclu.lv  
🌐 <http://www.zinatne-5.lv/>

### Liechtenstein

Ms Hermine Haug  
Amt für Volkswirtschaft  
Gerberweg 5  
FL-9490 Vaduz  
☎ +423 236.6871  
☎ +423 236.6889  
✉ hermine.haug@avw.llv.li

### Lithuania

Mr Martynas Bieliunas  
Integrated Information Centre  
Faculty of Communication, Vilnius University  
Universiteto g.3  
2734 Vilnius  
☎ +370 2 366.115  
☎ +370 2 366.104  
✉ martynas.bieliunas@kf.vu.lt



## Malta

Dr. Matthew Montebello  
Office 409, C.S.A.I. Dept.,  
University of Malta,  
Tal-Qroqq, Msida MSD 06  
☎ +356 3290 2132  
☎ +356 320539  
✉ mmont@cs.um.edu.mt  
🌐 <http://www.cs.um.edu.mt/people/staff/mmont.html>

Mr Brian St. John  
MITTS  
Gattard House, National Rd  
Hamrun  
☎ +356 2599.2498  
✉ brian.st-john@magnet.mt

## Norway

Mr Tron Espeli  
The Research Council of Norway  
PO Box 2700 St Hanshaugen  
N-0131 Oslo  
☎ +47 22 03.7313  
☎ +47 22 03.7001  
✉ te@forskningsradet.no  
🌐 <http://www.forskningsradet.no/fag/eu/>

Mr Ole Andreas Flagstad  
The Research Council of Norway  
PO Box 2700 St Hanshaugen  
N-0131 Oslo  
☎ +47 22 03.7195  
☎ +47 22 03.7001  
✉ oaf@forskningsradet.no  
🌐 <http://www.forskningsradet.no/eu/>

Mr Steinar Kvitsand  
The Research Council of Norway  
PO Box 2700 St Hanshaugen  
N-0131 Oslo  
☎ +47 22 03.7000  
☎ +47 22 03.7001  
✉ shk@forskningsradet.no  
🌐 <http://www.forskningsradet.no/eu/>

## Poland

Mr Krzysztof Trojanowski  
Instytut Podstawowych Problemów Techniki PAN  
Ul. Świetokrzyska 21  
PL-00-049 Warszawa  
☎ +48-22 828.7481  
☎ +48-22 828.5370  
✉ pt2@npp.gov.pl  
🌐 [http://www.npp.gov.pl/prog\\_tem\\_2/](http://www.npp.gov.pl/prog_tem_2/)

## Romania

Mr Adrian Pascu  
National Agency for Science, Technology and Innovation -  
European Integration in R&D Programmes  
Office for European Integration in R&D Programmes  
21-25 Mendeleev Street  
RO-70168 Bucharest  
☎ +40 1 210.9275  
☎ +40 1 210.9275  
✉ apascu@mct.ro  
🌐 <http://www.mct.ro>

## Slovak Republic

Mr Ivan Filus  
BIC Bratislava  
Zochova 5  
811 03 Bratislava  
☎ +421 7 5441.7515  
☎ +421 7 5441.7522  
✉ ist@bicba.sk  
🌐 <http://www.femirc.sk/fp5/ist/>

## Slovenia

Dr. Andreja Umek Venturini  
Ministry of Science and Technology  
Trg OF 13  
1000 Ljubljana  
☎ +386 1 478.4668  
☎ +386 1 478.4721  
✉ andreja.umek@mzt.si  
🌐 <http://www.mzt.si/mzt/med/5okvp/ist/index.html>

Dr. Joze Gricar  
University of Maribor  
Faculty of Organisational Sciences  
Kidriceva 55a  
4000 Kranj  
☎ +386 4 237.4220  
☎ +386 4 237.4299  
✉ gricar@uni-lj.si  
🌐 <http://ecom.fov.uni-mb.si/gricar/>

## Switzerland

Dr Patrick Furrer  
Euresearch  
CP 7924  
CH-3001 Bern  
☎ +41 31 380.60044  
☎ +41 31 380.6003  
✉ ist.ncp@euresearch.ch  
🌐 <http://www.euresearch.ch>

# Project Index

In this book there is only room to mention a small cross-section of the projects supported by the IST Programme. Full details on all FP5 projects are available on ISTweb at [www.cordis.lu/ist/projects.htm](http://www.cordis.lu/ist/projects.htm). The site includes a search facility.

## Key:

KA I	= Key Action I
KA II	= Key Action II
KA III	= Key Action III
KA IV	= Key Action IV
CPA	= Cross Programme Actions
FET	= Future and Emerging Technologies
RN	= Research Networks
SM	= IST Supporting Measures

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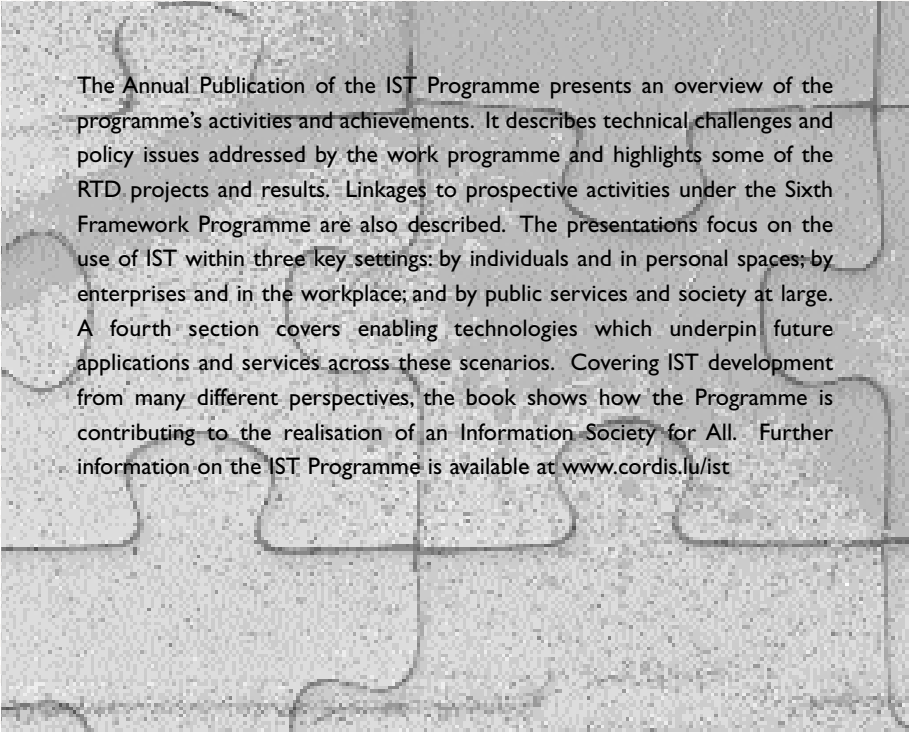
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The Annual Publication of the IST Programme presents an overview of the programme's activities and achievements. It describes technical challenges and policy issues addressed by the work programme and highlights some of the RTD projects and results. Linkages to prospective activities under the Sixth Framework Programme are also described. The presentations focus on the use of IST within three key settings: by individuals and in personal spaces; by enterprises and in the workplace; and by public services and society at large. A fourth section covers enabling technologies which underpin future applications and services across these scenarios. Covering IST development from many different perspectives, the book shows how the Programme is contributing to the realisation of an Information Society for All. Further information on the IST Programme is available at [www.cordis.lu/ist](http://www.cordis.lu/ist)

Information society technologies (IST) are central to the knowledge-based economy. Already, ISTs affect every aspect of how we live, work and play, and they seem set to have an even greater impact in the future. To realise the full potential of the knowledge economy and society, however, the benefits of IST should be accessible to all.

The Information Society Technologies Programme, part of the EU's Fifth Framework Programme for Research and Technological Development, is working towards a vision of the future that puts the user at the centre of IST development. In this vision, the technology is almost invisible as it blends into our everyday environment. People are able to access IST applications and services anywhere and anytime, whatever their age or impairment, and in the form that is most natural for them.

This book presents an overview of the IST Programme at the present time, describing technical challenges and policy issues addressed by the work programme and highlighting some of the recent RTD projects and results. Linkages to prospective activities under the Sixth Framework Programme are also described. It focuses on the use of IST within three key settings: by individuals and in personal spaces; by enterprises and in the workplace; and by public services and society at large. A fourth section covers enabling technologies which underpin future applications and services across these scenarios. Covering IST development from many different perspectives, the book shows how the Programme is contributing to an Information Society that puts people first.

**For further information about  
the IST Programme, please contact:**

IST Information Desk  
European Commission  
Directorate-General Information Society  
Office BU 31 I/19  
B-1049 Brussels  
Belgium  
E-mail: [ist@cec.eu.int](mailto:ist@cec.eu.int)  
tel. +32-2-296 85 96  
Fax +32-2-296 83 88  
<http://www.cordis.lu/ist>



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