IST 2001 CONFERENCE
FINAL REPORT

3 – 5 December, 2001
Düsseldorf, Germany

Technologies Serving People

Contents

Summary

The theme of the IST 2001 event held in Düsseldorf, Germany was *Technologies Serving People*. And the global message emerging from the conference was that it is no good having technology if it frightens people. For Information and Communication Technologies to have a broad effect there is a need to look for ways to help citizens use technology. In the words of Erkki Liikanen, European Commissioner for Enterprise and the Information Society, "technology is important but the needs of citizens must be addressed."

The Challenges of Technologies Serving People

Technologies serving people does not just mean using Information and Communications Technologies in applications such as healthcare, or to provide environmental information, or to develop new generations of mobile devices and services, and so forth. Important as these new developments are, fundamental to technologies serving people is the notion of dealing with barriers, such as, for example, bandwidth constraints and human interfaces. Applications and their development also need to be human- rather than technology-centred. Applications must be easy to use, cheap and accessible by all. The Information Society must also deliver content and services in the language of peoples' choice. Content must also be customised to local context and culture.

There is a need to discover why people have difficulties in using information technologies and to ensure that everyone can participate. The digital divide must be overcome and citizens' information technology skills should be strengthened to help deliver the improvements in quality of life that the Information Society promises.

One thread running through the conference was that of ambient intelligence. This is defined as a combination of ubiquitous computing, ubiquitous communications and intelligent interfaces. The mouse and keyboard are now seen as belonging to a dated paradigm. The future lies with more natural interfaces that make use of other human senses and capabilities. The most profound technologies are those that disappear. The aim should be therefore, to weave Information Society Technologies into the fabric of everyday life until they are indistinguishable from it.

A clear message from the conference is that information technology exists for society, for work and for growth, not just for its own sake. Achieving a situation where technologies serve people requires research effort. To create Information Society Technologies that serve people and which are accessible by all, it is necessary to develop technology with such a policy objective in mind. Technology and policy are therefore related. Whilst it is inevitable that policy will at times react to new technology developments, technologies serving people requires that technology developments be driven by appropriate policies.

The IST 2001 event demonstrated the many ways that technologies are being developed, within the IST Programme, to serve people. The challenges that will need to be pursued within the next Framework Programme to continue this work were also considered.

Ensuring Inclusiveness

The problem of the digital divide was addressed during the conference. Surveys show a wide variation in peoples' usage of the Internet according to factors such as age, level of final education, and location (urban versus rural). Initial work on indicators, characterise the digital divide in terms of four dimensions: gender, age, education, and income. The key risk groups are women, the elderly, low education, and low-income. Available data permit initial indices for each of these, the key measure being the variation between the risk group and the population average. For gender the variation is relatively minor: the index for women in the European Union (EU) is around 80 percent of that for the population as a whole. But for other groups the differences are much more marked. In 2000 the indices were: 54 percent for those in the lowest quartile income group; 39 percent for the elderly (a decrease from 1997); and 28 percent for those who left formal education at or before age 15. Overall the figures suggest that the digital divide in Europe has been virtually static over the last four years, despite concerted efforts to close the gap at national and EU levels.

It was noted that studies show that disabled people are less likely to have computers or access to the Internet than the general population. Disabled people have a wide variety of difficulties accessing information and communication, such as reading and writing problems, hearing impairments, reduced hand or arm movement, etc. Today's European and Global policies follow the general principles of participation and equality, which require that access to information, and the technologies providing information, should become basic human rights for all people. Technology must be available, affordable, accessible and usable.

European standardisation work, in particular those on Information and Communication Technology standards, must now address the needs of disabled and elderly people. Elderly and disabled people should be considered very early in the planning stage, so goods and services can be adapted to the needs of the many millions of citizens who fall within these categories.

The needs of disabled people should become a mainstream issue, but there are some dangers to be avoided. Disability is individual, and it should never be forgotten that forms of support will be diverse, some being appropriate only for a small number of people. The risk of creating a theoretical dimension to disability, where people imagine they can conquer with a *big* solution, should be avoided. The quantity of work needed is large and the Sixth Framework Programme should not address the issues under an umbrella topic such as health. The goal must be to remove the obstacles to participation in society encountered by the millions of citizens who have disabilities.

Creating Intelligent and Realistic Interfaces

Human computer interaction was discussed during the conference. The need to provide better means of access for the disabled and the elderly, coupled with the requirement to create more intelligent interfaces are just two of the drivers for developments in this field. New developments in interaction will also provide the basis of new types of systems with innovative and beneficial capabilities, for example in the field of telemedicine.

Information and Communication Technology product interfaces still need to be adapted to human needs rather than force human behaviour to adapt to the system's demands. Human

interfaces in the mobile industry should be transparent and support seamless services focused on consumer needs to provide personalised information services. Building such solutions is not easy, and using the wrong interface technology will almost certainly lead to product failure in the marketplace.

To move beyond today's multimedia applications, there is a need to establish a fully immersive context for such experiences, which gives the impression of actually *being there*, something that is referred to as *Presence*. Creating a sense of presence is an area where further research is needed. The human brain and senses provide this experience of presence in terms of colours, sounds, movement, texture, feelings etc. A more advanced human-centred interaction with systems would provide users with a sense of being there, close to if not equivalent to the experience of actual presence. Creating this sense of presence remains a major challenge and has led to the development of new interdisciplinary research, combining cognitive and haptic (sense of touch) perception with multimedia design and advanced communications. This research is directed at developing a better understanding of how a real sense of presence can be achieved. It involves learning and discovering what is going on when people use their senses to understand and interpret their surrounding environment and when they interact with objects in that environment.

New Perspectives on Security

The issue of security formed an important part of the conference. The increasing importance of security means that trust and confidence technologies need to be improved to provide confidentiality, data protection and privacy. The discussions on security covered a broad spectrum. The security challenges addressed include those associated with the deployment of electronic signature and authentication infrastructure, rights and asset management technologies, the grid, mobile agents, and anonymity technologies. In addition however, the terrorist attacks in the United States on September 11 have brought another major security related issue to the fore, that of security and protection of critical infrastructures such as communications networks.

The September 11 attack on the World Trade Centre in New York changed the whole concept of security. It is now clear that there are people and organisations that are capable and willing to inflict large-scale damage on infrastructure. As a result, increased emphasis is now being placed in both Europe and the United States on addressing this issue, and on both sides of the Atlantic collaboration on these matters is recognised as important and worthwhile.

R&D collaboration is seen as essential, as the technologies – and their associated risks – are global and continue to develop at a ferocious rate. Indeed, lessons can be learned and shared across as well as within sectors. Collaboration on Science and Technology policy is also essential. Owing to the difficulty of confronting the problems and risks with such limited resources, a transatlantic pooling of resources would appear to be essential. This is especially the case given the events of September and the subsequent global counter-terrorism push, which has an obvious critical infrastructure protection angle. The new efforts being made in critical infrastructure protection within the United States and Europe will continue to develop. These will increasingly have an international element. In the future, dependability will be a priority for R&D agendas.

Future and Emerging Technologies

As is befitting of a conference that provides a showcase for developments in European Information Society technologies, future and emerging technologies were also addressed.

Developments taking place with the IST Programme on next generation wireless systems (or fourth generation (4G) systems) were presented during the conference. Mobile communications technologies require long lead times to develop and deploy. This means that is necessary to start planning now for the wireless world of 2010. Wireless and mobile technologies for the emerging wireless world were addressed with presentations of perspectives from each of the three main markets: United States, Japan and Europe.

Spectrum licensing was identified as a key challenge. The underlying technological issues will need to be resolved by around 2005 in time for the World Radio Conference in 2006 which is expected to identify the spectrum for 4G. Public-private collaborations and partnerships have an important role to play and is already a key feature of efforts in Europe, the United States and Japan.

Discussions took place about nanotechnologies and what will happen when the physical limits of silicon technology have been reached. Nanomaterials also appear to have significant application potential beyond the semiconductor industry, for example, in the aerospace industry where there is an interest in using nanotechnologies to create drag free materials.

The cost of developing nanomaterials was discussed. In the semiconductor industry the development of new generations of silicon technology is paid for from the profits generated by earlier generations of technology. This raised the issue of how the development of nanotechnology would be funded. The key here lies in the fact that many different industries are interested in the technology and what needs to happen is that these different contributors should work together. The important point about nanotechnology is that it is relevant to industry in general and is not just an issue for the semiconductor industry.

Future developments in computer technology were also addressed. In particular, development of computers and algorithms, using the operation and architecture of the human brain as a source of design inspiration, was considered. The aim is to develop computers that are good at undertaking tasks that are currently poorly performed by computers but done with great ease by people or other creatures. Another interest driving research in this field is the development of better understandings of how the brain works. In particular how the brain carries out computations and information processing.

Developments such as the Semantic Web, Internet Protocol Version Six (Ipv6), and all optical networks were also addressed during the conference.

Conclusions

Just over 2000 people attended the IST 2001 event in Düsseldorf. Topics addressed during the conference ranged from dependability of infrastructures such as the telecommunications networks to healthcare, from e-finance to nanotechnologies.

Conference delegates were exposed to a wide range of views about, and demonstration of different ways in which the concept of *Technologies Serving People* is being applied within in the IST Programme. The future challenges for Europe in this area were clearly identified, challenges which will no doubt be taken up and addressed in the next Framework Programme.

Research and Development in Information Society Technologies is essential not only for the IT sector, but for all industries. It is also important for addressing major societal challenges and for supporting all science and research fields. It is a major component of the European Union's global policy towards achieving a knowledge-based society.

Preface

The main issues addressed during the IST 2001 conference sessions are presented in this report, along with the session conclusions. An independent team of six rapporteurs attended the event and prepared the reports on the conference sessions. The rapporteurs that prepared the reports on the IST 2001 conference sessions were:

Salah Al-Chalabi, Chaltel Ltd.,United Kingdom
Maarten Botterman, RAND Europe, The Netherlands
John Buckley, United Kindom
Berthold Daum, bdaum Industriekommunikation, Germany
Paul Kidd, Cheshire Henbury, United Kingdom
Mike Sharp, MS Consulting, United Kingdom

Three colleagues from RAND Europe assisted Maarten Botterman with his work: Ingrid Geesink, Han de Vries and Kevin O'Brien.

Paul T. Kidd (Cheshire Henbury) edited the final version of the report.

The opinions expressed in the report do not necessarily represent the views of the European Commission.

Paul T. Kidd
Cheshire Henbury
December 2001

Technologies Serving People: Political Priorities and Goals

The main drivers for change are technology, regulation, competition and the needs of society. Together they will support the emergence of an Information Society serving the needs of all Europe's citizens and contributing to the new global economy. This plenary session addressed the core themes of the conference and illustrated the contribution made by European initiatives to the Information Society. Commissioner Liikanen chaired the session.

Main Issues Raised

Professor John O'Reilly, Chief Executive of the United Kingdom Engineering and Physical Sciences Research Council, addressed the long-term vision of new technologies in his talk entitled *IST: Shannon, Mammon and Beyond*. Building on the contributions of the fathers of Information Theory (Shannon), telephony (Alexander Graham Bell), wireless (Marconi) and antennas (Yagi), Professor O'Reilly identified major areas for future communications research. He stressed that future research will be large scale and interdisciplinary, with electronics and communications engineers working closely with, say, perceptual psychologists and bio-technologists. Engineers and scientists need to embrace change, *look over the fence* and be prepared to work with life scientists on innovative projects funded by biotechnology programmes. Some examples include genomics, electronic chip implants, perception and context sensitive systems, and odour detection (e-nose on a chip) leading a *Neural Network*.

Standards will still be needed to ensure the interoperability of communication systems. Innovation will also be needed to ensure that technological breakthroughs are exploited commercially for the benefit of customers and end-users. He concluded by saying, "technology provides solutions but the perception of their benefits determines their acceptance by the consumer. Technology and innovation should narrow the gap between the *haves* and the *have-nots*."

Over the past decade, changes in telecommunications regulations have had a major impact on both the prices and the quality of telecommunication services in Europe. This has benefited customers but the full impact of regulation in the important area of *broadband access* is not yet clear. Professor O'Reilly stressed the importance of a coherent regulatory framework to support the introduction of the Information Society Technologies to serve all Europeans.

Dr. Alfred Tacke started his talk on the *Impact of Information Society Technologies on Industry and Trade* by emphasising the role of the Information Society in building the new economy. The Internet remains fundamental, developing change to our economic environment in spite of the sharp decline in hi-tech stock prices in 2001. In Germany the ICT sector has grown by between four and a half percent and 10.9 percent in each of the last four years, has created 75,000 new jobs in 2000 and is expected to grow by two percent in 2002. In addition, six million new connections are added to Internet every month.

Dr. Tacke identified five main trends in the digital economy. First, the old economy is relying increasingly on the new economy to improve production efficiency and return-on-investment.

Second, the growth in mobile commerce will increase to facilitate m-commerce, entertainment, e-learning, and personalised services. Third, there is the increasing demand for broadband services using Universal Mobile Telecommunications System (UMTS), Digital Subscriber Loop (DSL), broadband cable, satellite, wireless local loop and powerline. He emphasised that European policy should ensure fair competitive conditions for establishing innovative infrastructures, but that regulation of prices and technologies should only be introduced when necessary. Fourth, the increasing importance of security means that trust and confidence technologies need to be improved to provide confidentiality, data protection and privacy. The final trend is more widespread e-government and e-democracy as a result of the modernisation and digitalisation of administrative processes. The main challenges facing the introduction of the e-society are meeting customer expectations and enabling all citizens to participate in and to reap the benefits of the new economy

Mr. Lindqvist addressed the issues of accessibility in his presentation. He explained that the goal of an international disability policy was to remove the obstacles to participation in society encountered by the millions of citizens who have disabilities. Accessibility is an important issue for industry and governments and Information and Communication Technologies (ICT) is an area of crucial importance. The market is large enough for industry to create suitable products, because European legislation and regulatory frameworks prohibit discrimination. He also pointed out that what is essential for a few people often benefits everybody else, adding that, "today we see everyday technology applications that are socially motivated rather than the result of advances in technology. User pull is gradually replacing technology push. We have come to realise that technology should support and serve people." However, studies still show that disabled people are less likely to have computers or access to the Internet than the general population.

Disabled people have a wide variety of difficulties accessing information and communication, such as reading and writing problems, hearing impairments, reduced hand or arm movement, etc. Today's European and Global policies follow the general principles of participation and equality, which require that access to information, and the technologies providing information, should become basic human rights for all people. Technology must be available, affordable, accessible and usable.

The United Nations Standard Rules on the Equalisation of Opportunities for Persons with Disabilities provide an important platform for improvement. Within the framework of the *eEurope* 2002 Action Plan, a review is being made of legislation in Member States to ensure conformity to these accessibility principles. In addition, the European Directive on equal access to employment, based on Article 13 of the Amsterdam Treaty, should be implemented in national legislation during the next few years. The principle of *Inclusive Design* or *Design for All*, supports equal and full participation. Several international organisations, such as the European Institute for Design and Disability (EIDD), the European Disability Forum (EDF) and the Web Accessibility Initiative (WAI), are working on inclusive designs. All European standardisation work, in particular those on ICT standards, should now address the needs of disabled and elderly people.

The European Commission has recently recommended that Member States provide accessible public web sites using the WAI international guidelines. In October 2001, the Council of Europe adopted a resolution that recommends drawing up national strategies to ensure that people with disabilities benefit from the opportunities of new technologies. He concluded by saying that there is a need to make the Information Society accessible and flexible from the

start and that people should be provided with suitable equipment, knowledge and skills. Elderly and disabled people should be considered very early in the planning stage, so goods and services can be adapted to the needs of the many millions of citizens who fall within these categories.

Dr. Millán Vázquez de Miguel spoke about *How Extremadura sees its future as part of the emerging Information Society* or the *The regional dimension of the European Research Area and IST - Extremadura Approach*. His presentation described the application of regional Research and Development policy in the Extremadura region of Spain. This involves a new framework for co-operation between individuals, the private sector and public authorities in the areas of governance, subsidiarity, and territorialisation. In the area of governance it has resulted in a regional plan for research, development and innovation, bringing together more than 100 public and private entities to implement three strategic objectives: Technological Literacy; Developing Entrepreneurial Capacity; and Developing E-content for the Regional Intranet. It has also led to the establishment of an Extremadura Intranet involving more than 1400 public and private entities supporting Open Source Software.

In the area of subsidiarity there have been several initiatives supporting the *e-Europe* Action Plan, including: E-learning; Go Digital; and E-inclusion. In the area of territorialisation there is the Information Society in Extremadura II R+D+I Plan. This plan has several thematic areas and general priorities that cover developing services for citizens, enterprises and administrations.

In conclusion, the cohesion of research needs a global approach and the participation of all society. Regional networking is essential to achieve the Lisbon objetive. It is worth pointing out that less developed regions are not mere importer of technologies.

Conclusions and Future Directions

The main issues and conclusions that emerged from this session were:

- Creation and management of complex interdisciplinary research and development programme in an ever-changing world.
- Narrow the digital divide between the *haves* and the *have-nots*.
- Create a reliable regulatory, self-regulatory and technological framework.
- Play a pioneering role in disseminating best practice.
- Provide project financing and good practice.
- Encourage public-private partnerships.
- Encourage industry to create and offer innovative, competitive products and services.
- Encourage industry to create innovative jobs and modernisation of labour relations.
- Design for all and an inclusive Information Society.
- Co-ordinate regional and international research for the benefit of all participants.
- Encourage Open Source Software.
- Support the creation of technical standards for the inclusive Information Society.

Additional Information

Estimated number of people attending this session: 1000

Session Chair:

Erkki Liikanen, European Commissioner for Enterprise and the Information Society

Speakers:

John O'Reilly, Chief Executive of the Engineering and Physical Sciences Research Council, United Kingdom.
Alfred Tacke, Administrative State Secretary in the Federal Ministry of Economics and Technology, Germany
Bengt Lindvist, Special rapporteur on disability of the Commission for Social Developments, United Nations
Louis Millán Vázquez de Miguel, Minister of Education, Science and Technology Regional Government of Extramadura, Spain

Commission Contact:

Nicholas Heenan (Nicholas.Heenan@cec.eu.int)

Co-operation and Ownership in the Information Society

Intellectual property (IP) in the digital world, where national economies are becoming increasingly knowledge-based, yet where copying is easier than ever and piracy a major threat, is a fundamental issue. Two speakers, Tim Hubbard from the Human Genome project and Alessandra Silvestro from AOL Time Warner Europe, explored issues of authors' rights, ownership, co-operation and digital protection systems.

There are two views on content ownership. On the one hand, some people see a world in which content is managed through an information and media industry, backed up with digital protection systems. The other view is of a world where information is a common resource, freely available to all. Session chair Mike Holderness contrasted free information with free beer, "they are not the same," he said. Whatever peoples' views, authors' rights remain very important, and information can be free only when there is a strong personal right for the author to be recognised as the source of the information.

Tim Hubbard explained how the vast databases generated under the Human Genome project needed to be freely available for global research, noting that the value of this information grows with the number of people who have access to it and so have appreciated, commented and annotated it. Patent protection serves only to obstruct research and human progress.

Alessandra Silvestro noted that there would be no DVD industry without ownership rights backed up by content scrambling systems (CSS). Sometimes there are reasonable grounds for copying and shared access, for example in libraries and educational institutions. There is a balance between fundamental rights and authors' prerogative. The law needs to ensure that circumvention of protection is always illegal apart from very limited circumstances.

Main Issues Raised

Tim Hubbard explored the appropriateness of the traditional view that academic science is always open, while anything with serious application becomes *commercial* and goes under a juggernaut of IP protection. The Human Genome project has deposited its results in the public domain daily under the 1996 Bermuda Rules. This project has shown that publicly funded research can deliver results as efficiently as privately funded research. Wondering why a commercial organisation might want the results it funds published in this way, Mr. Hubbard noted that wide access allowed a researcher to get access to work done elsewhere and to profit from other people's ideas. He went on to explain the ENSEMBL project is aiming at open source code not only for the data but also software, where a relational database and object model make possible customised applications of the data. The Distributed Annotation System (DAS) permits ideas from around the world to be captured and co-ordinated.

In contrast, the Breast Cancer gene patents held by a company (Myriad) obstruct research. Furthermore, they entrench an expensive test costing 990 euro, and block cheaper alternatives. The United States has compulsory licensing provisions, and Mr. Hubbard believed that the European Union (EU) ought to be more aggressive with these.

Alessandro Silvestro noted the threat posed to digital content by copying and piracy, quoting that in Germany last year, sales of CDs had fallen by 13 percent while those of blank writeable CDs had rocketed! She noted that ownership is essential but does not have to be selfish, that there can be co-operation between interested parties and that standards of protection may be voluntary or mandated. The legal principle should be that while non-signers cannot be bound to protection, no-one may be allowed to circumvent protection nor manipulate copyright protection management information.

The DeCSS case was the first test of anti-circumvention law in the United States, and dealt with the tension between free speech and copyright protection. DeCSS is a program that circumvents Content Scrambling System (CSS) protection, and links to it have been posted on web sites. The judgement has asserted that while linking is not in its self illegal, knowingly linking to illegal material is against the law.

Conclusions and Future Directions

It appears that Intellectual Property Rights will remain very important in an increasingly de-materialised economy. The following principles emerged in the session:

- Patent protection should be used to protect the author, but *not* negatively just to block the use of information.
- Protection may be necessary to keep information in the public domain.
- Protection systems should not be mandatory, but where they are used, circumvention or manipulation of copyright management data should almost always be illegal.
- Proper royalties are a preferable to blank media levies as a means of compensation. Copy protection systems should eliminate the need for levies.

Additional Information

Estimated number of people attending this session: 100

Session Chair:
Mike Holderness, Freelance journalist, and member of the Information Society Forum

Speakers:
Tim Hubbard, Head of Human Genome Analysis, The Sanger Centre, United Kingdom
Alessandra Silvestro, Vice-President Legal Affairs, AOL Time-Warner Europe, Belgium

Commission Contact:
Philippe Aigrain (Philippe.Aigrain@cec.eu.int)

Towards an Inclusive Information Society

European success in becoming *the most competitive and dynamic knowledge-based economy in the world by 2010* depends crucially on an ability to provide *access for all*. *Inclusiveness* is a term widely used in the Information Society debate but seldom elaborated. This session examined the nature of the digital divide, how it could be measured, and ways in which it could be ameliorated.

There are many definitions of the digital divide. OECD defines it as "*…the gap between individuals, households, business and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies (ICTs) and to their use of the internet for a wide variety of activities."* The key point is that it embraces both access and use.

In economic and social terms, the digital divide is of significance in three respects. First, employability – basic ICT skills are an indispensable requirement for a growing number of jobs. Second, equal participation of citizens in the Information Society. Not having access to ICT or skills will increasingly be a disadvantage in day-to-day life, in on-line banking and ticket booking for instance. Third, looking at demand side economics, off-liners and non ICT–literate parts of the population are unlikely to be e-consumers, and so will act as a break on the growth of the e-economy as a whole.

Evidence from media research (the so-called *knowledge gap theory*) shows that segments of the population with higher socio-economic status tend to acquire information at a faster rate than those of lower social status. The result is that the gap in knowledge between these segments tends to increase rather than decrease. Hence, closing the digital divide will require specific measures – people are unlikely to catch-up of their own accord.

Main Issues Raised

A useful starting point is to ask which groups need to be integrated. Detlev Samland noted that the European Commission's Communication on *eEurope* implied the main target groups were the elderly and the disabled. But this is only one aspect. Surveys show a wide variation in peoples' usage of the Internet according to factors such as age, level of final education, and location (urban versus rural). Taking a wider view, around 60 percent of the world's population has never even made a telephone call. The ratio of personal computers to people is around one to two in the United States, compared to one to 200 in less developed countries.

Identification of relevant *at risk* groups was also emphasised by Werner Korte. Initial work on indicators, characterise the digital divide in terms of four dimensions: gender, age, education, and income. The key risk groups are women, the elderly, low education, and low-income. Available data permit initial indices for each of these, the key measure being the variation between the risk group and the population average. For gender the variation is relatively minor: the index for women in the European Union (EU) is around 80 percent of that for the population as a whole. But for other groups the differences are much more marked. In 2000 the indices were: 54 percent for those in the lowest quartile income group; 39 percent for the elderly (a decrease from 1997); and 28 percent for those who left formal education at or

before age 15. Overall the figures suggest that the digital divide in Europe has been virtually static over the last four years, despite concerted efforts to close the gap at national and EU levels.

The implications of these findings are not yet clear. According to diffusion theory, the gap between the risk group and population average will increase at first and then decrease once the risk group has entered the take-off period. But as Mr. Korte noted, "diffusion theory may not apply or the cycles may be too long for the lag to be socially sustainable."

Another aspect that warrants attention is the implications of flexible work practices. The nature of work is changing fundamentally in terms of time, place, contractual arrangements, and skill sets. The net result is changes in the adaptability of work arrangements, which can vary significantly from country to country. Werner Korte characterised EU countries into three groups. Fast movers (Finland, Sweden, and the United Kingdom) are highly adaptable with dynamic labour markets. A second group of *circumspect followers* (Denmark, Germany, Ireland, and The Netherlands) attempt to combine positive aspects from the past and the future. Finally, *the sedentaries* (France, Italy and Spain) are slow movers who risk falling behind the rest of the EU in their labour market practices. These initial results should be interpreted with care, however, because data on labour market adaptability is scarce and many aspects can still not be measured adequately.

Will access alone be sufficient to participate in the Information Society? Is the digital divide an access divide or a knowledge divide? The speakers agreed that inclusiveness has to be considered in wider terms than just access. Mr. Samland identified the key factors as being: appropriate, user-friendly technologies; relevant, easy-to-find content; and the utility of the services offered. Technology should not burden peoples' lives further but should integrate easily into their routines. Governments have a key role to play here, Mr. Samland asserted. In Nordrhein-Westfalen, for example, the government has analysed 100 life situations and is already offering on-line solutions for 15 of them, such as registering a birth or marriage, applying for a driving licence, or enrolling for kindergarten. But for many others the legal base is not yet available. Much more needs to be done to foster the development of appropriate content and services.

Axel Plathe argued that, together with equitable access, multilingualism was a particularly important factor in ensuring the universality of the Information Society. Technically it is possible to ensure that any language can be used and understood in cyberspace and that high quality, locally and nationally produced content is available and easily accessible. "What is needed," said Mr. Plathe, "is the political will and the social and cultural awareness of the importance of multilingualism. There is also a need for a consensus to be reached rapidly on publication, dissemination and rights management in the electronic environment."

The potential of ICT-based projects as motors for economic and social development in less developed countries was emphasised by Gerardo Zepeda-Bermúdez. Under the Comunitech project rural communities in Honduras have been provided with access to personal computers and the Internet (via satellite). The communities are so remote that horses were used to transport the equipment! Uses of the technology include a teaching aid in local schools, a health centre to maintain medical records, and provision of training for local farmers and enterprises. The communities concerned have been highly receptive. In schools, for example, a much higher proportion of pupils is staying on to further their education. Based on these positive experiences, the new government in Honduras plans to rollout the programme across

the country, the aim being to provide access for two and a half million people (40 percent of the total population) within four years. It is intended as a starting point for an integrated, nationwide development programme that will also include attracting investment from high technology industries.

Conclusions and Future Directions

The *digital divide* is an imprecise term that needs to be used with caution. While there are clearly disparities between social groups in their use of ICTs, the issue is more complicated than simply access to or even aptitude for technology. Greater efforts are needed to characterise the problem, and in particular the extent to which divides between individuals, businesses and regions are interrelated.

Indicators have a key role to play here. Initial work on indicators has provided useful results but more sophisticated and wide-ranging indicators are needed, for instance to measure the quality (rather than quantity) of ICT usage. A series of new IST projects aim to fill this gap and results are expected over the next one to two years. As well as statistical indicators, empirical investigation can also yield important insights. For instance, the IST SeniorWatch project involves user panels on the ICT needs of elderly people.

Policy-makers should aim for a more holistic approach. Rather than focusing on just a few key issues, such as access and technical skills, there is a need to consider overall capacities. In education, for example, nearly 90 percent of European schools have access to the Internet but teachers are not qualified to exploit the new resources effectively. Digital literacy is becoming a prerequisite for economic and social engagement, and lack of it will be a limiting factor in many areas of life.

Finally, the Honduras example emphasises the importance of leadership. In introducing ICT, as in many areas of innovation, communities need local champions who can be catalysts for more wide-ranging action. Identifying and supporting such people should be a key objective for Information Society programmes.

Additional Information

Estimated number of people attending this session: 250

Session Chair:
Vicente Parajon-Collada, European Commission

Speakers:
Werner B. Korte, Director, empirica GmbH, Germany
Axel Plathe, Programme Specialist, Information Society Division, UNESCO
Detlev Samland, Senior Consultant, ECC Public Affairs
Gerardo Zepeda-Bermúdez, Director, Fundacion Cristo del Picacho

Commission Contact:
Marco Marsella (marco.marsella@cec.eu.int)

Always On… Yet Wireless

Wireless technology and cell phones have become ubiquitous. Like any other technology that is applied on a mass basis, further development of that technology is influenced by forces such as public concerns about the impact of the technology, as well as by the economic needs of a large industry sector. At a time of transition from second generation (2G) wireless networks (GSM – Global System for Mobile Communications) to third generation (3G) networks (UTMS – Universal Mobile Telecommunications System), it is appropriate to consider the impact of wireless technology on everybody's life. The session chair, Imelda Mary Read, in her opening remarks, asked, “what does this technology mean to my family, to my community, and for the future of our children?”

Main Issues Raised

In comparison to GSM, the new generation of wireless networks based on UTMS will improve the personalisation of services, introduce data services, and integrate data services with voice services, explained the first speaker, Giovano Colombo. Based on this new technology, a new value chain is emerging: terminal, service control, network, and content provider. At the delivery end is the terminal, a handheld device such as mobile phone or Personal Digital Assistant (PDA). Service control is based on radio communication, while network services are based on Internet Protocol (IP) backbones. Finally, at the far end are the content providers. While 2G networks combine the roles of service control, network, and content provider, these roles will be de-coupled with the introduction of 3G networks. UTMS allows the integration of voice services with data services and the potential to offer Internet based data services on mobile devices. Thus free access to the Internet and the mediation between Internet formats (Hypertext Mark-up Language – HTML) and mobile formats (Wireless Application Protocol (WAP) and Wireless Mark-up Language (WML)) becomes an issue. Users will not accept being locked into the narrow network of a single operator.

Important for end users is the transparency between different administration contexts such as GSM, personal computers, UMTS terminals, and bank transactions. Additional services can be added on a personalised basis. "The de-coupling of the various network levels makes it possible that any application, in principle, is able to run on top of any transport network,” said Mr. Colombo.

Also the transparency for roaming is improved with UTMS. General Packet Radio Service (GPRS) already makes use of IP networking technology. However, UTMS will use IP protocols in a wider sense allowing multimedia applications, call control, session control, and roaming over diverse networks such as Wireless Local Area Networks (LANs), GPRS networks, and Satellite networks, provided that the necessary security mechanism are provided. This requires the implementation of the Internet Protocol Version Six (IPv6) standard. The tracking of movement of the mobile terminal will still however be based on GSM.

Annegret Groebel reported on the German regulation efforts for the third generation network operators (3G Regulation Framework). The goal is to achieve coverage of 50 percent of the population, or eight and a half percent of the area of the Federal Republic of Germany by

2005. Operators may offer roaming, however, this is not enforced. The regulators trust that market forces will generate roaming solutions where it is appropriate.

Owing to the current pressure felt by many operators (debt burden, technical difficulties, marketing difficulties, and competition from Wireless LANs), regulators have allowed a limited co-operation between operators. The main goal, however, is that operators maintain their independence and functional control (control of the network). To share physical infrastructure such as sites, masts, antennas, cables, and combiners is allowed. What is not allowed is to trade frequencies, to share the core networks, or to share customer databases. Experiences between the national regulators are exchanged in the Independent Regulators Group, an international group of national regulators for the telecommunications industry, founded in 1997 in Paris. Most national regulators, it appears have similar guidelines in place for 3G mobile networks, although some differences exist in the details.

Simon Corell spoke about the possibilities of using mobile devices for security critical applications such as encrypted data transmission and digital signatures. Security technology for mobile devices can be incorporated into Subscriber Identity Modules (SIM) cards. Smart Trust's SIM application toolkit allows operators to change security critical applications easily on the fly. SIM cards with end-to-end encryption using common algorithms are already on the market. Certified keys can be used by handsets, PDAs, smart cards, etc. for digital signature. "Most handheld sets sold in 1999 could handle this sort of applications," said Mr. Corell. Some operators have already rolled out this type of technology. Telenor in Norway, for example, has smart cards with RSA algorithm processors for on-board key generation; Denmark based Sonofon in co-operation with 17 banks provide a mobile Internet banking solution; and Vodafon allow signing forms from mobile devices. "Mobile and secure handsets, will be one of the most efficient and effective and nice to use solutions especially when you are on the move," said Mr. Corell.

Michael Milligan addressed the health and safety concerns associated with the use of mobile phones. "Health and safety issues have been around for several years," said Mr. Milligan. "The question is, how does the industry address these issues?"

Leading manufacturers such as Alcatel, Ericson, Mitsubishi Electric, Motorola, Nokia, Panasonic, Philips, Siemens, and Sony have jointly established the Mobile Manufacturers Forum (MMF). The MMF (http://www.mmfai.org) was formed to jointly fund research projects addressing the World Health Organisation's Research Agenda. "Confidence in the safety of our products is founded in scientific evidence," said Mr. Milligan.

So far, all studies have reached a similar conclusion that radio frequency exposure within the limits of the guidelines does not cause health hazards. However, research goes on as there are still knowledge gaps, and the research databases must be improved. Evidence suggests that biological effects caused by radio frequency do not depend on frequency and modulation. This simplifies research efforts and allows extending the research results to future generations of mobile networks.

"Mobile phones are designed, built and tested to comply with the appropriate radio frequency exposure standards," said Mr. Milligan. However, this is not always made clear to the public, so information dissemination must be improved. This has to occur on several levels in an easily understandable form. More sophisticated formats are also needed. The dissemination of

information originated by independent bodies is essential. Manufacturers within the MMF have committed themselves to provide information about radiation levels for all new models.

It is, of course, not only the handsets that give rise to health worries. Similar public concerns apply to base station antennas. " About 75 percent of the people in The Netherlands have mobile phones," said Laurens Schrijnen. There are five operators, resulting in five different networks. In The Netherlands there are severe restrictions in place for new antennas – every new antenna needs a building permit.

Thus, a national antenna policy is required in the Netherlands. According to democratic practice in The Netherlands, the Dutch Antenna Policy is based on interactive policy making and requires the consensus of all concerned parties such as municipalities and counties, mobile and broadcast operators, manufacturers and consumers, environmental lobby groups, and eight government departments. The goal is to create sufficient space for the deployment of antenna masts within the framework of public health, environment, and safety.

Mr. Schrijnen said that there are four working groups:

- The deregulation group, working on topics such as antenna building permits, maps showing all antennas, visual camouflage, consent of neighbourhoods, exposure limits, antenna register, and site sharing rules.
- The spatial planning group, working on guidelines for governmental sites, design contests for *the nicest mast*, site sharing, and monuments.
- The communication group, forming the National Antenna Information Centre. Here, clients such as municipalities, counties, cities, and operators find questions and answers on technical aspects, health and safety, environment, and regulation. The centre operates the Antenna Register, and is responsible for press campaigns, too.
- The research group, working on topics such as co-operation between operators and municipalities, international comparisons, calculation methods for exposure limits, research on alleged complaints, and epidemiological research.

Conclusions and Future Directions

Scientific evidence, compliance to standards, information policy, and dialogue with consumers and citizens are essential preconditions for implementing a new generation of mobile networks. At the same time, a defined amount of de-regulation and a transparent and profitable business model is required to enable network operators to perform this transition.

Additional Information

Estimated number of people attending this session: 400

Session Chair:
Imelda Mary Read, Member of the European Parliament

Speakers:
Giovani Colombo, Vice-President, Research and Innovation, Telecom Italia Lab, Italy
Annegret Groebel, Regulatory Authority of Telecommunications and Posts, Germany
Simon Corell, Director of Industry Relations, Smart Trust, Sweden
Michael Miligan, Mobile Manufacturers Forum, Belgium

Laurens Schrijnen, Project manager of the implementation of the National Antenna Policy, Ministry of Transport, The Netherlands

Commission Contact:

Bartoleme.Arroyo-Fernandez (Bartoleme.Arroyo-Fernandez@cec.eu.int)

Enabling Trust: Meeting New Security Challenges

The subject of the presentations and discussions was new security challenges in a world with rapidly changing technologies. It is necessary to ensure sufficient trust and confidence to enable further business development. The session addressed security challenges including those associated with the deployment of electronic signature and authentication infrastructure, rights and asset management technologies, the grid, mobile agents, and anonymity technologies. Günther Horn from Siemens chaired the session.

Main Issues Raised

Peter Menzner, the Sales Director in the Public and Health Sector of Deutsche Post E-business, discussed the role of *Security and E-signature*. He stated that "his company's aim was to design, develop and enable trust." Mr. Menzner outlined the progress of e-signature legislation in Germany over the past years, including the May 2000 Signature Act, and the introduction of Article 126a into the German Public (Basic) Law, which states that e-signatures are as legally-binding as paper signatures. Mr. Menzner also highlighted the October 2001 introduction of the common standard for electronic standards and signatures in Germany. Deutsche Post E-business has been instrumental in pushing forward the smart card market for Germany, covering every aspect of daily life that involves the requirement of identification.

The second speaker, Michel Riguidel, Professor and Head of the Computer Science and Network Department of the Ecole Nationale Supérieure des Télécommunications (ENST), addressed *New Security Paradigms in Mobile Computing and Networking*. The presentation provided a global overview of modern security issues in the future communication networks, as well as presenting a prospective viewpoint of Internet and mobile security. Describing the limitations of current communication security in the rising multimedia communication age, he outlined the need for more complex and yet subtle security mechanisms and policies.

Professor Riguidel posited that, as a starting-point, it was necessary to move to change previously held points-of-view on security in order to be able to solve security issues of this new world. "In the 21st Century," he said, "we are influenced too much by the Internet, GSM and the like. We must remember in this mobile world that we must trace the history of these objects, as computing sciences and networking are rapidly going to become historical sciences as we move to secure this world."

One of the solutions to these security, privacy and trust concerns that Michel Riguidel saw was the use of cryptography which could bind the structures of this new society, proving that *someone was here today, doing things this way*. Professor Riguidel also said, "following the terrorist attacks of 11 September, we must take into account the fact that, as part of this networked world, the different costs and values associated with these attacks cannot be assessed in the same manner as previous destructive damage. This will have an impact in the future on trust and privacy considerations."

To assess how to deal with the new ways that access-control functions are much more fluid (for example, ambient networks with objects and subjects are moving all the time, without physical connections in many instances), intelligence must be implemented everywhere into this new society and new technology, including in-side the networks. To this end, networks have to have a better throughput. In addition, mobility does not only imply a *nomadic people*, but also includes mobile things *on* the Internet, such as constantly-moving intangible agents which come close to the users through such things as caches, liquid software, and downloadable applications (to name a few).

Michel Riguidel concluded by discussing how the old OSI model based around client-services and bilateral relationships between people is disappearing, along with the *classic security situation of trusted cryptography*. In today's mobile world, relationships are both open and closed, with *historical witnesses* to exist everywhere, monitoring today's traces or *fingerprint*s (yesterday's *footprints*) and authenticating them to the new world. In this world, it is essential to distinguish between the security of the *contents* and the security of the *container*. It is also very important to secure the infrastructure, binding the contents with the container and how they interact; much of this can be obtained through an audit function, recording the trajectories of transactions and the like. With the trend toward configurable, mobile infrastructures, new threats arising from this dynamism are emerging. Solutions to these vulnerabilities often lie in designing new intermediation services to manage the interfaces between telecommunications operators, users and service-providers, offering security protocols yet to be invented.

Ultimately, from users' perspectives, people must define their own security policy for comfort. Finally, moving beyond the digital to the quantum, including a new model of security with photons and semantics, it is essential (as the Internet Protocol and Extensible Mark-up Language bus continue to develop) to ensure that an interoperability is reached which will aid in securing this mobile society.

The third speaker, Hubert Gottshalk of Deutsche Telecom, discussed *Enabling Trust: Meeting the New Security Challenge (Security Issues of the Infrastructure)*. Mr. Gottshalk began by stating "the focus of network security is reducing risk not establishing trust and with this in mind, public key infrastructure (PKI) product offerings designed for the market of digital signature initiatives are of limited use."

Outlining that security is not just in the networks but in the management of the networks – an essential appreciation after 11 September and the concomitant disasters it caused – he asked whether "trust is all we need for network security or are there other concepts?"

The speaker discussed the evolution of the X400 protocol and the rise of PKI as a *déjà vu* of X400. He said, "while laws such as the 1997 Signature Law in Germany pushed this idea forward, in 2001 we are still waiting for official infrastructures and killer applications which will fully ensure trust." At present, there is limited use of smart cards, and PKI is both cumbersome to use and difficult to deploy. He wondered, "what has to happen to avoid the death of PKI?" Perhaps the answer lies in an integrated trust management and risk management approach for PKI. Mr. Gottshalk concluded, by saying "one should not wait for all the exact conditions to be in place for PKI, but should build upon and use PKI in the interim to force this through."

The final speaker was Helena Lindskog of Ericsson Infotech, who discussed *Towards Self-Determination in Mobile Internet*. New services for the mobile Internet environment, while providing new means to improve peoples' lives also must be safe for the end-users; privacy-enhancing technologies are needed, as well as means to retrieve the user's consent for data processing and collection in a user-friendly way, when this is needed.

Outlining Ericsson's view on privacy, Mrs. Lindskog said, "wireless application protocol has only just started. The *always with you* Information Society is slowly-but-surely developing. Following all the hype and anti-hype, in the end, there are lots of feature that will emerge but perhaps not at the speed first anticipated."

Mrs. Lindskog saw the close future as involving mobile electronic transactions (MET) in which a user carries a device (preferably Bluetooth enabled) which connects all of their world to the Internet (laptop, synchronised devices), as well as being used for payments and transactions and home use (garage-doors, etc). While already tested in Finland successfully, it will be another year before full services are available elsewhere. The problems presented, however, are its limitations (screen size, limited input, and portability concerns), and inherent risks (unsolicited e-mails, use of prohibited materials, and tracking people through data collection). The opportunities it offers, however, include privacy-enhancing technologies such as anonymisation, using pseudonyms, unobservability and unlinkability.

At the moment, the P3P Agreement (prompted by the World Wide Web Consortium), where service-provider stores a reference policy or usage file prior to allowing or offering access to specific pages, would appear to be one of the ways forward for MET. While several issues remain unanswered or unresolved – such as usability, profiling versus privacy, security versus privacy, and new privacy-enhancing technologies – Helena Lindskog concluded, stating that "privacy must not be proprietary and these technologies are all aimed at developing trust."

Conclusions and Future Directions

This session covered a number of central issues relating to the usefulness to the citizen-user of new and emerging technologies – such as mobile networking, smart cards, PKI, and other elements – while discussing the problems and risks associated with these technologies. The presenters generally gave a rosy view of the availability and benefit of such technologies to the user. However, they cautioned that this reliability can be taken too far, and that current concepts of security based on now, outdated understandings of the technology, will need to evolve and change shape to match on-going changes. In the future, users will need to ensure, often at the same time, their privacy as well as *marking their presence* at a particular point and location for auditing purposes. Technologies will have to evolve with these needs which will ensure trust by the user-consumer in the Information Society.

Additional Information

Estimated number of people attending this session: 70

Session Chair:
Günther Horn, Siemens, Germany

Speakers:

Peter Menzner, Deutsche Post, Germany
Michel Riguidel, ENST, France
Helena Lindskog, Ericsson Infotech, Sweden
Hubert Gottschalk, Deutsche Telekom AG, Germany

Commission Contact:

Alain Jaume (Alain.Jaume@cec.eu.int)

IPv6: Addressing Mobility and the Internet

The new Internet Protocol Version Six (IPv6) provides more addressing space, better security and many other advantages over the current Internet Protocol Version Four (IPv4). These are necessities for the growth of mobile, third generation (3G) multimedia communications, and Europe must seize leadership and press ahead. To this end, the European Commission has set up the IPv6 Task Force, which will present its action plan to the spring Council Meeting at Barcelona in March 2002. Erkki Liikanen, European Commissioner for Enterprise and Information Society, said, "the European Council at its meeting in Lisbon on March 2000, set the objective for Europe to become the most competitive and dynamic knowledge-based economy in the world."

The session:

- Addressed the advantages of IPv6.
- Demonstrated its importance to mobile communications and to Europe.
- Outlined the work of the newly formed Internet Protocol Version Six Task Force (IPv6TF).
- Provided some examples of work in progress and some pointers to future work.

Main Issues Raised

IPv6 provides the following advantages over IPv4:

- Virtually infinite addressing space (compared with three billion for IPv4).
- Security.
- Quality-of-service management.
- Extensibility.
- Stability.
- Scalability.
- Faster and cheaper routing.

IPv6 is absolutely critical for the development of mobile interactive, messaging and conversational multimedia services. Highlighting the pressing shortage of addresses, Erkki Liikanen reminded the audience that the Massachusetts Institute of Technology (MIT) currently had more IPv4 addresses than the whole of China! He went on to note that the European Commission was funding research and development projects relating to IPv6 to the tune of 38 million euro, and investing 17 million euro in pan-European IPv6 platforms.

Håkan Eriksson thought that early 3G mobile services would have three main components: messaging, browsing, and positioning. He demonstrated interesting multimedia applications. Comparing different air interface characteristics, he argued that 3G mobile services would integrate the use of WCDMA, EDGE and CDMA-2000 with WLAN and Bluetooth in their respective domains of the wide area, local hotspots and in the home.

On the subject of a roadmap for mobile 3G services, Bosco Fernandes underlined the need for affordable services anytime, anywhere, in a user-friendly and access-independent form. Though IPv4 might well serve initial needs up to about four million terminals, performance and interoperability problems caused by servers and address translation will require a soft and gradual change over to IPv6. He made clear that naming and addressing would have to support features taken for granted in the traditional telephone numbering world, such as portability, caller identification, directories and personal numbering. In conclusion, he observed that:

- RIPE should ensure that addresses are cheaply available.
- Mobile interconnection directives may need revision.
- Application tool kits will be very important.

Ger van den Broek discussed applications in some depth. He said that there would be plenty of standards working together across heterogeneous networks, and this would call for a lot of work after the IPv6TF had presented its key findings. Devices had to be easy to use (*plug and play*), making IPv6's multi-homing, neighbourhood discovery and auto-configuration properties very important. Applications would be person-centric, interactive and definitely beyond the computer, often using hand-held, wearable and small-sensor devices.

Joachim Claus of Deutsche Telekom stressed the need for a non-interrupting and customer-transparent transition to IPv6. He emphasised the standardisation and trials initiatives in which his company was participating, underlining the need for stakeholder education and the raising of migration issues in all kinds of forums and consortia. Of the best applications for early trials, he identified middleware, peer-to-peer applications, person-centric multimedia applications, location-aware transport applications, and remote home control.

Tero Ojanperä set out a roadmap for the transition from IPv4 to IPv6:

- Starting at phase one with dual stack terminals and IPv6 islands.
- Moving to a phase two with tunnelling (IPv6 packets encapsulated under IPv4).
- Finally a phase three with IPv6 dominating. There might still be IPv4 islands, though protocol and address translation would have disappeared from mobile networks.

Conclusions and Future Directions

Latif Ladid presented the recommendations, summarised below, of the IPv6 Task Force:

- Internet Service Providers to take a lead and offer IPv6 services.
- 3G operators together, to develop guidelines and best practices for using IPv6.
- 3G industry to be requested to contribute to 3GPP to accelerate the development of IPv6 specifications for 3G communications.
- Integration of IPv6 in Europe's national Research and Education Networks.
- Introduction of IPv6-based systems in cars, aircraft, freight-transport vehicles and their infrastructures.
- Manufacturers recommended to make household electronic devices IPv6-ready.

- To enable IPv6-based m-commerce.
- To introduce an EU-led intensive training program for IPv6.
- The Task Force for a maximum of 3 years to co-ordinate European efforts on IPv6 and to conduct studies, develop guidelines and launch awareness campaigns.
- To work closely with standards and awareness groups (ISOC, IETF, 3GPP, UMTS Forum, IPv6 Forum, ETSI, Eurescom, ETNO, GSM Association and so on).

The numbering issue represents a challenge for the co-ordination of policy between national environments and the global situation. The International Telecommunications Union will address this.

Additional Information

Estimated number of people attending this session: 550

Session Chair:
Latif Ladid, President, IPv6 Forum, Luxembourg

Speakers:
Erkki Liikanen, European Commissioner for Enterprise and the Information Society
Håkan Eriksson, Vice President, Telefon AB LM Ericsson, Sweden
Bosco Fernandes, Vice President of Strategic Industry Relations & Standards, Siemens AGICM N BO, Germany
Joachim Claus, Senior Vice President, Innovation Management, Deutsche Telekom AG, Germany
Ger van den Broek, Philips Research, Information & Software Technology, The Netherlands
Tero Ojanperä, Vice President, Nokia Networks, Finland

Commission Contact:
Pascal Drabik (Pascal.Drabik@cec.eu.int)

The Ultimate Audio Visual Experience

To move beyond today's multimedia applications, there is a need to establish a fully immersive context for such experiences, which gives the impression of actually *being there*. This *Ultimate Experience* requires enhanced interactivity and advanced user interfaces, involving multi-sensory data collection for continuous acquisition and tracking of events. A true-to-life experience also requires powerful knowledge management systems, together with high-quality visualisation technologies using three-dimensional (3D), virtual reality, mixed reality and immersive displays. These reach beyond mere information, and can be seen as the ultimate audio-visual experience.

This session presented some of the latest research aimed at inventing the next generation of digital experiences and exploring how such audio-visual media will affect interactivity, the Internet, creativity, the arts and human behaviour in general. The speakers addressed rich media, new forms of interactivity, immersion, telepresence and ambient intelligence – the key ingredients that take us from information to experience. They also gave glimpses of future immersive audio-visual experience in several real life scenarios. Professor Benayoun highlighted these points in his introduction to the session.

Main Issues Raised

Dr. Ralf Schäfer gave a presentation entitled *Immersive tele-conferencing – a key application for the next generation Internet*. In general, he said, presence can either be classified as *physical* or *social* but their intersection, *co-presence,* would be the main subject of his talk.

Video-conferencing is developing but all current systems are weak on eye contact, have a restricted field of vision, lack social presence, and offer limited support for natural human-centred communication. He then described an ideal virtual room meeting where the participants have the impression of being both physically and socially present in a shared environment that suggests proximity, enabling a higher degree of cultural interaction and encouraging effective collaboration. This *tele-cubicle* technology, which uses one wall of the meeting room as an interactive screen, is more developed in the United States. The immersive environment can include either local or remote participants. It uses very large displays together with four cameras and requires very powerful image processing.

He presented simulated results of 3D signal processing (an animation of a man moving his arms and head), which showed that there are still some technical problems, such as occlusion, to be addressed. He also showed a mock-up of the IST project VIRTUE using MPEG-4 coding together with a 3D rendering algorithm and a trimedia shared board. The system uses colour segmentation techniques to record the meeting room environment ahead of the meeting. A good telepresence experience can be achieved with a one mega bits per second (Mbit/s) connection to each person, and an industry standard personal computer can be used as the terminal.

Dr. Demiris gave a presentation entitled *Next generation set-top boxes for personalised interactivity in sports broadcasting*. He started by addressing fundamental questions such as: Why Interactivity? How do to achieve it? Why Personalisation? He identified sports

broadcasting as the main application area. He then covered the activities of the IST project PISTE (IST-11172) which will provide authoring tools for interactive content based on MPEG-4 players MPEG-7 encoded meta-data.

A video demonstration of the system showed a sport meeting with interactive coverage of the high jump event. The real-time picture can be supplemented with text information about the performance of the various athletes in the covered event as well as past events. The system can also deliver several minutes of replays. Dr. Demris also showed how to compose and create a 3D scene for an event and add a three dimensional figure to the scene. The viewer can influence the scene and the preferences of more than one viewer can be included. The system also allows the broadcaster to influence the views and introduce 3D coverage using several cameras. The project has also developed mathematical tools to analyse the two-dimensional (2D) and 3D pictures from the different cameras. The current system uses satellite receivers and personal computers, because set-top boxes are still expensive and less powerful in terms of computing capabilities.

Mr. Aart introduced the concepts of and technologies for ambient intelligence in a talk entitled *Ambient Intelligence for a true audio-visual experience*. He demonstrated the concept of ambient intelligence by extrapolating a drawing of a girl named Metelda into to a real-life girl who could control her environment through sensors and intelligent electronics embedded in her house, toys, etc.

Ambient intelligence is really about delivering what people want, when they want it and where they want it. It is also about making the entire system intelligent enough to recognise people and what they are doing, so that it can deliver content and services that are personalised to individual needs and preferences. It is a combination of ubiquitous computing and intelligent social interfaces. Ubiquitous computing was introduced by Mark Weiser in 1988 when he dreamt of swarms of embedded microprocessor chips. Intelligent social interfaces were introduced by Nass and Reevs in 1996 and include: media equation, multi-modal, personalised, emotions and experience (fourth economy).

Mr. Aart showed a video of an Indonesian family with a girl interacting with a holographic wall and women adjusting the lighting and colours in their house to suit their tastes. Similar concepts can be applied in the playroom where a child can interact with a screen board to communicate with friends and objects. The networked home of the future will consist of clusters of embedded devices with a user interface that is an extension of our natural speech and movements, through touch panels, heat and weight sensors and intelligent cameras that track eyeball movements.

The vision of ambient intelligence is: embedded, personalised, adaptive, and anticipatory. It involves the convergence of consumer and electronics using different modalities (graphics, tokens, speech) conveying emotions and enhance social interactions. Three-dimensional audio and video experience will make ambient intelligence environments come alive.

The final presentation from Professor Benyoun included a video, which he produced in 1995, entitled *Le tunnel sous l'Atlantique*. The video shows a journey through a virtual world of tunnels under the Atlantic. It includes artistic objects that can be added to the scenes. Users can interact with this virtual tunnel environment to create their own interesting and comfortable worlds. Professor Benyoun also showed an interactive world where people were walking through a virtual reality environment (in this case a Second World War scene) and

taking pictures of their virtual experience. He called this environment *Situation Art*. He concluded by saying that the environment is adaptive and will change to become less predictable and repetitive.

Conclusions and Future Directions

The main conclusions of this session were:

- Tele-immersion is a killer application.
- Immersion videoconferencing is a challenging field.
- Interactivity is the media gateway to the modern home, and it is the medium for accessing information.
- Ambient intelligence may be the next paradigm for consumer electronics.
- The vision of ambient intelligence is: embedded, personalised, adaptive, and anticipatory. It involves the convergence of consumer and electronics using different modalities

Additional Information

Estimated number of people attending this session: 170

Session Chair:
Maurice Benayoun, Z-A Production, France

Speakers:
Ralf Schäfer, Heinrich Herz Institute, Germany
Thanos Demiris, Intracom SA, Greece
Emile Aarts, Philips Research, The Netherlands
Maurice Benayoun, Z-A Production, France

Commission Contact:
Eric Badique (Eric.Badique@cec.eu.int)

E-finance: The Quiet Revolution

The session chair, David Birch, in his opening remarks characterised the state of European payment systems by quoting a striking example. “To send a brick from the United Kingdom to Germany by mail is faster and cheaper than to arrange for payment of the same.”

Main Issues Raised

The first speaker, Charles Goldfinger, gave an overview of the current status of e-banking. Currently, the overall market share of e-commerce transactions is about two percent. Internet banking, in contrast, has a market share of six to eight percent, and Internet based securities trading of about 20 percent. It is expected that e-banking will reach a market share of 50 percent within two or three years.

Internet securities trade had a fast start and a hard landing. Pure Internet play has been successful (E-Trade) but some companies now face serious problems. Internet banking had a slow start but has made steady progress (Nordea, Bradesco). “There is no salvation road outside the click and mortar model,” said Mr. Goldfinger. Cyber-finance has the highest concentration in Korea. Also countries like Brazil are very advanced. The first wave of e-payment has died down. Although e-commerce has taken off better than anticipated, there is not a homogenous payment infrastructure. E-payment has turned out not to be a killer application. Start-up companies such as Digicash, Kleline, Cybercash, SET, etc. have perished. It is consumer behaviour and attitude that decides about success, and not technological wizardry. There is also limited room for newcomers. Banks have an advantage because of their existing branch infrastructure. The second wave of e-payment is characterised by a diversity of approaches. In the business-to-consumer area where there is loyalty to existing institutions, peer-to-peer concepts (Paypal), and Electronic Bill Presentment and Payment (EBPP) are used. The wholesale system relies on SWIFTNET as a core initiative.

Certain claims of Internet technology, it has been learnt, do not fully hold:

- Cost reduction – While the costs of individual transactions were reduced dramatically, marketing costs have gone up. Each new customer costs approximately 200 United States Dollars.
- Easy to implement – Private web pages are easy to implement, but industrial strength applications are even more complex.
- Revolutionary impact – What actually happened was more like system evolution.
- Disintermediation – Cutting out the middleman did not become generally true. As use of the Internet increases the number of relationships grows exponentially, and the need for intermediation rises.

E-finance is currently only at the beginning. The boundaries between finance and technology are blurring, and so are the boundaries between the Internet and transaction oriented systems, and consequently between financial institutions and technology providers. Essential is the integration of different technologies such as Internet, mobile networks, and smart cards. “All finance is becoming e-finance,” said Mr. Goldfinger.

The next speaker, John Bullard, started with a quotation (Ford Motor Company, to its 200,000 suppliers). “By 2002, if you don't trade with us electronically, you don't trade with us!” About 220 billion United States Dollars are spent on payment costs every year, with five percent of the average turnover being cost of payment. In the United Kingdom about one percent of the Gross Domestic Product goes into payment costs. While on-line services could reduce these costs, the lack of security and trust is still the main deterrent. In an on-line environment, in particular, the establishment of trust is essential. However, in an environment without geographical limits this is difficult. Legal jurisdiction stops at country or regional borders. National regulations and standards vary, and there is a question of who will underwrite the risks associated with on-line trading. John Bullard emphasized the role of banks. “We may not all like our banks, but fundamentally we trust them.” As an industry the banking sector has a track record of 300 years and is highly regulated.

Trust is needed at each step of the commerce value chain. The traditional approach has been to issue certifications for payment and performance separately. Someone who the supplier trusts ensures the payment and, vice versa, with someone the customer trusts ensuring that the supplier performs. The new approach is to assure the identity of each involved party by a separate trusted party. Identrus (http://www.identrus.com) acts as such an authority. Identrus is a *Regulated Financial Organisation* recognised and accepted by regulators around the globe including the European Commission.

On the top-level, identities are issued to financial institutions. On the second level, identities are issued to businesses, and on the third level identities are issued to authorised employees. The procedural model for performing real-time on-line validation and identity assurance is based on the credit card model, with Identrus as the certifying authority, and the other roles taken by the buyer's bank, the buyer, the seller's bank, and the seller.

Currently, 53 banks world-wide have signed up with Identrus, with 109 participants in Europe, the United States, Asia, and Australia already in production. The coverage averages between 19 percent and 72 percent depending on the country.

The *Eleanor* scheme, designed and developed by 15 Identrus banks, provides a protocol by which banks can offer conditional and guaranteed real-time e-payment services to their corporate customers.

Matti Karvonen reported on the efforts of his bank in e-banking. Nordea has evolved from a series of mergers within the Scandinavian area and is by now the largest financial group in Scandinavia, the Baltic States and Poland, with approximately 233 billion euro in total assets. Currently, Nordea has just over two and a half million Internet customers (growing at 20 percent per annum) accounting to seven million log-ons per month (growing at 45 percent per annum). About eight million bill payments are processed on-line, two thirds of all equity trades, over 40 percent of all fund investments in Finland, and over 25 percent of all consumer credits in Finland.

Mr. Karvonen emphasized that, “although the hype has disappeared, e-business is continuing and will change the world.” He quoted business futurist Alvin Toffler who said, “anyone who thinks the New Economy is over because of the *dotcom* crash is either defining it too narrowly or being naïve. This is like saying the Industrial Revolution was over because some London textile plants shut down in the 1830s.”

Nordea started as early as 1982 with automated telephone banking, moved into personal computer (PC) based home banking in 1984, into Internet banking by 1996, SMS banking by 1997, and WAP banking by 1999.

Compared to relationship based banking which is characterised by integrated services, high share of wallet, better sales margins, and product cross-selling, Internet banking is characterised by a higher volume, cost leadership, and allowing others to sell (co-branding). Relationship based banking is directed at existing customers while Internet banking is focused on new customers.

According to Mr. Karvonen, "it is essential that customers are allowed to select channels such as branch network, call centre, and e-banking based on their needs." Mr. Karvonen's advice is, "start early, continue in small steps, and learn by doing. Latecomers tend to panic and to make big mistakes. Be customer driven, not technology driven. Offer solutions instead of latest technology, follow mainstream industry standards, keep it simple, and do not ask your customer to install new software or hardware."

Recruiting should enable the whole organisation for transformation. Other product areas will be affected, too, and branch offices must be able to sell the new services.

A question was raised about the reason why banks should be inclined to reduce costs on payments and thus loose some of the 220 billion United States Dollars that are spent on payment services. There was a feeling that this might be a question for regulation. Matti Karvonen answered, saying that payment processing is profitable but that it is only a small segment of overall business. Charles Goldfinger mentioned that French banks cover only 40 percent of the cost of payment processing. The session chair, David Birch, suggested that more competition was needed and not regulation. Charles Goldfinger replied that competition is a relative term. Regulation is accepted, in fact it is very strict. John Bullard added that more competition might motivate franchise institutions to search for solutions that provide more value to the customer.

A question was asked why the banks are involved at all. It might be possible to bypass them. John Bullard replied that Identrus is only in the business of issuing identities, not providing end-user solutions, and that current solutions use the strength of the existing infrastructure.

Standardisation was discussed. This seems only to happen on a national basis and the question of how this was going to change was addressed. Matti Karvonen said that industry standards such as MasterCard and Visa do exist. Charles Goldfinger said that there is a European Committee for banking standards, however, this committee involves banks only, but not merchants. Nothing has been happening, however, within the last 12 years with international banking standards.

Conclusions and Future Directions

E-finance has the highest market penetration of all e-commerce services. Practically all of these services rely on the existing structures, banks with their regional branches and on the three global networks: SWIFT, MasterCard, and Visa. This is the basis for the future. Global

identity certificates will further facility business-to-business real-time transactions. In the consumer market, customer orientation is the key to successful business.

Additional Information

Estimated number of people attending this session: 350

Session Chair:
David Birch, Managing Director, Hyperion Consulting, United Kingdom

Speakers:
Charles Goldfinger, CEO, Global Electronic Finance Management, S.A. Belgium
John Bullard, Senior VP Marketing, Identrus LLC, United Kingdom
Matti Karvonen, First Vice President, Nodea, Finland

Commission Contact:
Philippe Lefebvre (Phillippe.Lefebvre@cec.eu.int)

Reality and Our Sense of Presence

Presence is concerned with the *sense of being there*. The human brain and senses provide this experience of presence in terms of colours, sounds, movement, texture, feelings etc.

Achieving an Information Society with access for all requires the development of more natural ways of interacting with computer and information technology systems. This for example, will help to eliminate barriers that arise from difficulties that people experience in using current interaction devices such as screens and keyboards. New developments in interaction will also provide the basis of new types of systems with innovative and beneficial capabilities, for example in the field of telemedicine.

A more advanced human-centred interaction with systems would provide users with a sense of being there, close to if not equivalent to the experience of actual presence. Creating this sense of presence remains a major challenge and has led to the development of new interdisciplinary research, combining cognitive and haptic (sense of touch) perception with multimedia design and advanced communications. This research is directed at developing a better understanding of how a real sense of presence can be achieved. It involves learning and discovering what is going on when people use their senses to understand and interpret their surrounding environment and when they interact with objects in that environment.

Main Issues Raised

Professor Miriam Reiner introduced the session and said that the main issue to be addressed was what sensory input was needed for someone to feel as if they were present in an environment.

The session speakers addressed a number of different aspects of Presence – sense of touch, vision and sound.

Miriam Reiner presented some results of research undertaken to discover what sensory touch information was important in identifying objects such as lumps in medical diagnostic situations. Early results indicate that there is a kind of touch language learnt by surgeons that represents embodied knowledge. This is knowledge that is not represented in symbolic form but which is acquired by people through experience and which links patterns of touch with interpretations. This knowledge relies upon different types of sensory input – visual, auditory, olfactory, taste, haptics, or the integration of part or all of these.

Anya Hurlbert and Richard Solomon both talked about vision and the perception of colour.

Anya Hurlbert's presentation centred on the notion that although colour is in our heads and is a product of our senses and brain, and hence is seen differently by people, it does nevertheless represent real physical properties. Fundamental to creating a better representation of colour is to understand the physical effects and to model these correctly. She pointed out that micro level surface characteristics are important and these need to be incorporated into models. Context is also important as the colour seen by an observer depends on previously seen colours as well as surrounding colours.

Richard Solomon discussed the requirements for creating pictures that were perceived by viewers as real. He pointed out that few people regarded television pictures as real. It was however possible to design and construct cameras and viewing systems where people perceive the image as real. Such designs are based on understandings of vision and how the eye and brain operate, understandings which show that current technologies such as television cameras have been designed based on the wrong assumptions.

John Watkinson and Davide Rocchesso spoke about hearing and the perception of sound.

John Watkinson discussed the limitations of the current generation of (traditional) loudspeakers used in many devices (hi-fi, radio etc.). He mentioned that these were designed based on frequency response and ignored the spatial and time dimensions of sound. Any sound-producing object generates sound in three dimensions and this noise resonates with the surrounding environment to create the sound that people hear. Traditional loudspeakers produce sound that is unidirectional and they provide poor reproduction of sounds such as church bells and pianos. The speaker then demonstrated a new design for loudspeakers that more faithfully reproduce such sounds. These new designs provide multidirectional capabilities and thus create resonance with surrounding objects.

Davide Rocchesso spoke about sound models for objects producing sounds. His focus was on discovering how sound models could enhance a sense of presence. He demonstrated the differences between models and actual sounds. His main conclusion was that understanding the physics was important for realistic synthesis of a sound but even more important for abstracting and generalising the sound of an object. He introduced the concept of sound cartoons, similar in notion to children's visual cartoons, which do not provide a fully realistic reproduction. He said, “presence is not necessarily realism, but fidelity in interaction.” His message was that sound cartoons were relatively inexpensive to produce and could compensate for deficiencies of visual displays and haptic devices.

The speakers' presentations were then followed by questions from the audience.

A question was raised about the need for the new research field of Presence. Richard Solomon responded by pointing out that there were a number of application areas where a good sense of presence was needed. The first of these was telemedicine, were doctors and surgeons were undertaking diagnostics and performing operations at a distance from the patient. The second was presentation of scientific results where improved pictures could provide better communication to the audience. The third was military. In some battlefield situations the limitations of present devices meant that it was still necessary to risk human life by sending in soldiers to collect information. Improvements in sensors and displays to provide a realistic presence would help to reduce the need to use people to collect information in dangerous situations. Improvement of archives was also an important potential application. He also said, “the research is valuable in its own right as it will lead to a better understanding of humans and animals and their interactions with the environment.”

Miriam Reiner said, “a better technology would provide systems that resonate with the way that people think and operate in the real world.” She continued, “to achieve this state however it is necessary to understand more about the signals from the environment that people use to form judgements and to decide upon situations.” It is clear at the moment that this information

is missing and a better fit between people and computer systems can only be achieved from developing this sort of understanding.

John Watkinson mentioned that people should use their intellect to improve the world. He said, "Presence research could ultimately lead to the development of technologies that would help to reduce the need to travel which would have a positive environmental impact." He also said, "the history of human endeavour was a story of discovery of new knowledge and the development of new ideas, not one of preserving norms and accepted thinking."

A question was raised about the timeframe for the development of next generation Presence technologies. Richard Solomon mentioned that improved systems could be built with today's off-the-shelf components and technologies. The real problem was deciding upon the design parameters, and this was why basic research into Presence was needed so that a better understanding could be achieved.

Anya Hurbert mentioned that there was a need to store as much information as possible. Current systems might not be able to use such information but the capabilities of future generations of technologies are unknown and they might be able to use this information and could only do so if it was captured and stored. Image storage should not be constrained and determined by the requirements of our current technologies. Other speakers agreed with this point.

This issue was reinforced by Richard Solomon, who said, "we need to store more information than the human eye can actually see. The old idea of less is better because it is cheaper is no longer valid."

Conclusions and Future Directions

Improvements in understanding of basic aspects of the way human senses work and how they provide meaningful information will ultimately help with the creation of more natural means of interacting with systems. Thus, research in the field of Presence is not just about abstract study, but potentially an important enabler of an inclusive Information Society, providing a means of access suitable for all. These understandings are also expected to lead to information systems innovation, proving new devices and services for European society and its peoples.

Research into Presence is still at an early stage however. Much more needs to be done to understand the different aspects of the senses involved – such as vision, hearing, and touch. Early results indicate that there are deficiencies in current models and theories and in some cases our current technologies have been designed based on the wrong assumptions. New insights into human senses and how they operate are leading to new technologies and new systems that are already enhancing the *sense of being there*. Many of these new system are however large and expensive and much work will need to be done in the future on cost and size reduction in order to make them more widely available.

Additional Information

Estimated number of people attending this session: 200

Session Chair:
Professor Miriam Reiner, Stanford University, United States

Speakers:
Professor Miriam Reiner, Stanford University, United States
Dr. Anya Hurlbert, University of Newcastle-upon-Tyne, United Kingdom
Richard Solomon, University of Pennsylvania, United States
John Watkinson, Celtic Audio Limited, United Kingdom
Professor Davide Rocchesso, University of Verona, Italy

Commission Contact:
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Small Businesses Thriving on IT

Technologies serve entrepreneurs by opening up new business opportunities and markets. However, there are challenges in the take-up of Information and Communication Technologies (ICTs) and in their use. The session focused on how small and medium-sized enterprises (SMEs) are overcoming these challenges and the role of public policy initiatives.

Introducing the session, Hannelore Kraft noted that a broad range of initiatives already exists at regional, national and European levels. It was important to ask how far all these programmes were meeting the requirements and expectations of SMEs. For example, which programmes are best at reaching SMEs?

Main Issues Raised

Studies show that around two-thirds of European SMEs have access to the Internet. While Internet penetration has grown rapidly over the last few years, the range of uses is still fairly narrow. Geert Eggermont spoke about a survey undertaken in 2000 by his organisation, UNIZO. This study focused on SMEs in Flanders, and showed that the main uses of the Internet were still e-mail (used regularly by 75 percent of SMEs) and searching for information on the World Wide Web (used regularly by 55 percent). Other activities were much less popular. Around 35 percent of SMEs used Internet banking, and only around 10 percent used the Internet for buying or selling. These results are broadly in line with other surveys at national and European Union (EU) levels.

Sylvie Feindt reported on field research looking at business-to-business (B2B) e-commerce in SME value chain relationships. Focusing primarily on the textile industry, the research showed clear links between SMEs' ranking in the value chain and their use of ICT. Companies have started to link up with suppliers or customers through ICT, and there is a tendency to co-operate more intensively with fewer partners. While the majority of interactions are still limited to e-mail, some are much more highly integrated through systems such as vendor-managed inventories, on-line ordering systems, and on-line logistics. "The level of automation was surprising," commented Ms. Feindt. "Some large companies had relatively little automation, whereas some SMEs had a lot," she said. The reason, she concluded, was that upgrading does not happen systematically but depends on commercial drivers and thus very different levels of sophistication co-exist within the same industry.

The nature of the obstacles for SMEs is well characterised and was confirmed by the recent Flemish study *SMEs in the Digital Delta*, cited by Mr. Eggermont. Key obstacles are lack of awareness of the possibilities of ICT for their business; lack of knowledge and competence; a concern about security and legal issues; and access to finance and relevant skills.

These barriers should be the main focus for support measures by government and industry associations. In Flanders, for example, UNIZO works extensively with SMEs in providing information on the opportunities available through e-commerce and in establishing and maximising their web presence. Its website provides a portal for local SMEs on key issues, with the news, useful links and tools being especially popular. The European Union's *GoDigital* initiative is enabling UNIZO to develop these services further through SME

Internet Clubs. These are small discussion groups of 15 to 20 companies that enable SME managers to exchange experiences and obtain guidance from experts in developing their e-business plans.

The commercial viability of such services is open to question, however. In response to a question from the floor, Mr. Eggermont conceded that SMEs are reluctant to pay for such services. Hence they need to be subsidised by the public sector or provided by business organisations as part of some wider package of membership benefits.

Anno Jordan of Parsytec emphasised the importance of information technology (IT) in enabling a business to grow flexibly in response to market requirements. Parsytec supplies surface inspection solutions for the steel industry based on sophisticated computer vision technology and has invested heavily in R&D over recent years. Now it is moving from a *technology enthusiasts* stage towards mainstream market deployment. This intermediate step, which Mr. Jordan called *the chasm*, was typical of the position faced by companies in high technology markets. Such a situation is characterised by an increasing proliferation of products and services; a high dependency on market cycles within the target industries; and increasing complexity from building a world-wide sales and service organisation. This required the company to shift its focus from technology development to maximising the returns on the investments made. Effective use of IT was essential in achieving this. Parsytec had opted for web-based approaches rather than one based on standard proprietary solutions because it was quicker and cheaper to implement. The system had already brought major benefits in terms of customer service and accessibility of management information.

EU-funded research programmes provide important opportunities for SMEs in developing IT-based innovations. Justin Meadows noted that SMEs are frequently the source of highly innovative ideas but lack the resources to undertake the research needed to take them to market. EU programmes can be an effective way for SMEs to overcome this barrier but there are dangers from being a little fish in a big pond. In particular, SMEs have to be prepared to share ownership. "SMEs start off owning 100 percent of their own idea," he said. "This goes down to 20 percent or less when they become part of a consortium with bigger players. It could drop to less than five percent when the big guys decide there is something worth exploiting." The answer, according to Mr. Meadows, is for SMEs to ensure their contributions are properly recognised and to define an exploitation agreement at an early stage.

Effective exploitation of the results of R&D projects is especially difficult. Participants should use the funding allocated for this to support *real* sales and marketing, so as to establish reference sites, rather than waste it on activities such as conferences and academic papers. To make an impact at European level, SMEs need strong partners with European reach. They should also treat the project as part of their core business, rather than a marginal activity, and ensure that they can live with the project's onerous payment profile. Project management is burdensome and probably best left to others but SMEs should ensure they retain a key quality assurance role.

Tom Sheedy of Enterprise Ireland said that an EU proposal might seem a daunting prospect for SMEs. He asked, "why is it worthwhile and what are the criteria for applying?" In reply, Justin Meadows said the IST Programme was a way for SMEs to access funding which they would not be able to access otherwise. Companies should recognise there are costs and obstacles but also advantages – no need to give away equity, for example.

While agreeing about the benefits of EU funding, Anno Jordan stressed it was only suitable for companies at particular stages of development. EU funding is fine for the technology enthusiasts' stage but is not responsive enough for companies in the chasm. Parsytec had used EU programmes extensively in the early phase of product development but now needed to move much more quickly.

Conclusions and Future Directions

The session provided conclusions on small business and IT in three key areas: value chain relationships; support initiatives; and the role of SMEs within the Sixth Framework Programme.

While the penetration of ICT within SMEs is increasing, the scope of usage remains relatively limited. The future of business lies in collaboration and ICT is an important means of facilitating this. Companies need to step up their investment and to integrate IT more readily into their business processes to retain their position within the value chain. As the textile industry examples show, ICT also provides SMEs with opportunities to develop entirely new relationships and processes, either individually or collectively as part of virtual organisations. The prerequisite for SMEs is the recognition of how to add value within their sector.

Regarding support initiatives, the requirements are at three levels. First, SMEs need help in accessing hardware and software solutions that are appropriate for their needs. Second, they need help in aspects such as security and legal issues, which surveys suggest are still disincentives to more widespread take-up of B2B e-commerce. Third, they need access to skills training not just on technical aspects but on business aspects too. Networks, such as UNIZO's SME Internet Clubs, and industry clusters, such as those found in the textile industry, are important channels for spreading good practice.

The IST Programme within Framework Programme V has been a huge success story for SMEs. Over 60 percent of contracts involve at least one SME, around 25 percent of all contractors are SMEs and they account for a similar proportion of the overall funding. The move to larger integrated projects in the Sixth Framework Programme could jeopardise this and specific measures may be needed. In addition SMEs should prepare for the Sixth Framework Programme by strengthening their existing networks.

Additional Information

Estimated number of people attending this session: 350

Session Chair:

Hannelore Kraft, Minister of Federal and European Affairs, Nordrhein-Westfalen, Germany

Speakers:

Geert Eggermont, Project Manager, UNIZO, Belgium
Sylvie Feindt, Director, Sylvie Feindt Consulting
Anno Jordan, Managing Director, Parsytec AG
Justin Meadows, Director, C International Ltd., United Kingdom

Commission Contact:

Timo Hallantie (timo.hallantie@cec.eu.int)

E-health: Improving Prevention and Treatment of Disease

The session chair, Denise Silber of Basil Strategies, noted that the work on e-health within the IST programme was not yet widely known among the external community in Europe and globally. Modern Information and Communication Technologies (ICT) are now capable of providing systematic support for the prevention, treatment and care of patients, whilst they are at home. This is leading to a paradigm shift in both the organisation and the priorities of health systems. Presentations in the session examined the consequences of e-health on people's quality of life, on economics, employment and on society generally.

Main Issues Raised

David Ingram of University College London addressed the *Continuity of care in regional settings*. His contribution drew on his experience as a member of the London Health Modernisation Board, where he had seen the impact that could be achieved by good but small teams. One striking statistic is that mental ill health costs London at least five billion Pounds Sterling per year. He was confident, however, that the cultural and scientific changes, which he had seen during the last 35 years, would continue to improve the provision of healthcare.

Websites such as www.virtuall.org combine electronic based learning with practical development programmes for better mental health for London and provides the community with better access to health information. An example is the accessible publishing of Genetic Information to provide information for patients and families about haemoglobin disorder (Thalassaemia – www.chime.ucl.ac.uk/APoGI) where timely screening can significantly improve the lives of patients. He emphasised that there is a need to link the science to the community and this requires a good infrastructure.

Thanks to European Union programmes some health records, such as Electro Cardio Graphs (ECGs), are now well kept. However inter-working and interoperability are ongoing problems. International standards for healthcare systems are now beginning to emerge but much remains to be done. He cited the OpenEHR Foundation (www.openEHR.org) as an example of an international initiative supporting Open Source software. He emphasised that integrated approaches to information management together with coherent and cost effective systems are needed to achieve true continuity among patients and carers and across organisations, services, professions and industry.

The government has a role to play in delivering public services in new and electronic ways, to be more convenient, more joined-up, more responsive and more personalised. There is a need to work locally and to think globally and to remember the importance of security and confidentiality in managing medical records.

Jürgen Sembritzki, of the Zentrum für Telematik im Gesundheitwesen, described his project on the development of a health telematics platform. He summarised the main benefits of telematics systems, “health telematics provides the basis for an effective medical care by secure and trustworthy communication,” he said.

The relevant system components are electronic patient records, electronic physicians' reports, and an identification card (ID) for health professionals. The main problem is the absence of a standardised platform for these components, although Extensible Mark-up language (XML) is emerging as a common protocol for data interfaces that will allow seamless communications between all the players involved in the care of a patient.

The project will use smart cards, which will be introduced throughout Germany in 2002, as ID cards for doctors. The smart card infrastructure will use open standards to provide secure identification, confidentiality and data transmission. The system specification has been finalised and pilots will start shortly. The implementation will start with a countrywide *nucleus*, which will gradually be extended and used to test information technology systems and components for conformity with established standards.

The system will provide secure communications between patients, physicians, hospitals, pharmacies, insurance companies, institutions, and professional authorisation organisations. The infrastructure will inter-work with different hardware components, such as smart cards, card terminals, mobile devices (for example, home monitoring) and software implementing open interfaces. It will also provide a migration path from legacy to open systems. Conforming systems will be certified as being able to inter-operate with the open platform.

It will be important to build consensus among all the stakeholders, at national and international levels, including institutes, industry associations and professional bodies. A major objective of the project is to implement a reference platform based on open standards, which will help establish international standards for health telematics and avoid the development of isolated solutions. The project will establish a contact office and hotline, along with an Internet based database of information about relevant healthcare standards. It will also play an active role in national, European and international standards making bodies.

Dr. Mariusz Duplaga of the University of Krakow started his presentation by quoting two proverbs. "Take two aspirins and log-on in the morning," he said and, "medical advances only change why, when and where we die, and, until we die, how healthy are we and how much we spend."

His presentation dealt with remote telemonitoring systems for patients with chronic conditions. Such systems were potentially very valuable, as chronic diseases are a growing problem and accounting for 70 percent of healthcare expenditure in the United States and Europe. Even relatively simple measures that help patients to monitor their condition can have a major impact, although there is now a growing range of devices for remotely monitoring patients over telecommunication links. Such systems can incorporate the latest clinical guidelines, provide automatic diagnoses and medical prescriptions, and identify early signs of incidents that might need medical intervention.

The latest monitoring devices include smart sockets (detecting circulation problems), smart bandages (detecting bacterial growth) and smart shirts with embedded sensors. Future *smart homes* could have sensors that track the occupants and monitor their vital signs. Over the last few years, home monitoring systems have been successfully used to support the care of patients with hypertension, diabetes, asthma and chronic heart disease. Dr. Duplaga described the *Severe Asthma Monitoring System* a continuous monitoring network, which is currently being tested in five regions of Poland. Patients access the system via personal computers and the Internet or by mobile phones. The system connects reference centres, local hospitals,

primary care physicians, and other health professionals. It can also trace the course of the disease and generate alarm messages in the form of e-mails or short message service texts. The system is expected to increase the patients' quality of life, whilst reducing the cost of their medical care (fewer home visits, less time in hospital etc.).

Denise Silber concluded the session with a presentation entitled *E-health: where are we - first or second generation?* She characterised first generation medical Internet initiatives as poorly targeted ventures with flawed business models and little understanding of the needs of professionals. Today's second generation services aim to establish on-line communities providing knowledge, support and compliance to standards. They not only offer the prospect of improved diagnostics and treatment but make it possible for the patient to be actively involved in the process. This involvement challenges the doctor's status and may have profound effects on healthcare over the next 10 years. Surveys in North America, Europe and Brazil show that *Internet empowered* patients are already asking for specific drugs and are more likely to challenge the treatment suggested by doctors.

Although the number of people seeking on-line health information is growing rapidly, the first generation of medical Internet ventures failed because, like most *dotcom* organisations, they had flawed business models and poorly designed products, and underestimated the cost of creating trusted brands. Several trust certification services emerged but there was no recognised co-ordinating body or global standards. Nevertheless, a survey has shown that most Primary Care Physicians would use the Internet if it provided quicker, cheaper and better medical care or a better archiving system or both.

Second generation medical Internet services will only be successful if they provide customised services that are practical, simple and support dialogue between peers and experts in addition to simple information provision. They should reduce medical error, improve diagnosis, link specialists with remote patients, and provide continuing education. They could also build communities of patients with similar illnesses, and support commercially available devices for remote diagnosis. However Ms. Silber concluded by asking some questions. "How can we move from pilots to large scale implementation? Should the priority be improved longevity in the developed world, or simple survival in the developing world?" Cheaper (or even free) computers and Internet connections were needed if the *digital divide* was to be overcome. She concluded that, for e-health to succeed, long-term commitment is needed, along with mixed public and private sector funding.

Conclusions and Future Directions

To improve systems interoperability, standards are needed to ensure inter-working between the various components of healthcare systems. Because of their nature, healthcare systems need to pay particular attention to confidence, trust and reliability. However, cost and user acceptability is also important, from the viewpoints of both the healthcare professionals and the patients themselves. More care needs to be taken in capturing the users' requirements when designing future systems. E-health also has interesting implications for the relationship between the patient and healthcare professionals. It will therefore be important to build consensus among all the stakeholders. Finally it is important that health-related IST projects work together and maximise the benefits of participation in a European programme.

Additional Information

Estimated number of people attending this session: 47

Session Chair:
Denise Silber, e-consultant, Basil Strategies, France

Speakers:
David Ingram, CHIME University College London, United Kingdom
Jürgen Sembritzki, Zentrum für Telematik im Gesundheitwesen, Germany
Mariusz Duplaga, Collegium medicum, Jagellonian, University of Krakow, Poland
Denise Silber, e-consultant, Basil Strategies, France

Commission Contact:
Sigurd Von-Ingersleben (Sigurd.Von-Ingersleben@cec.eu.int)

EU-US Collaboration on Dependability in the Information Society

All businesses and social infrastructures are becoming increasingly dependent on communication networks and information systems, including the Internet. This all takes place in a global setting. Opportunities for joint initiatives between Europe and the United States on dependability and infrastructure interdependency analysis were explored in this session.

"We are living in a violent world with attacks happening," said the session chair, Hans Ottosson. "These attacks include the high profile ones like the September 11 tragedy, as well as the less obvious ones like those that attempt to ruin our computers and spread a disease to the computers of our colleagues and friends." He started the session with a further remark: "We need the Information Society for a number of reasons, but should ensure protection against these attempts, before the threats grow beyond our control."

Main Issues Raised

Norman Neureiter, Science and Technology Advisor to the United States Secretary of State, outlined the history of European Union and United States (EU-US) co-operation on issues relating to dependability. He discussed how four years ago, a special task force on critical infrastructure protection was created for EU-US co-operation, which identified areas in which technical solutions to emerging threats and vulnerabilities could be developed and facilitated. Since then, there have been numerous examples of co-operation across the Atlantic. The events of 11 September make it painfully clear that there is a need to address critical infrastructure protection issues as one part of protecting the world from terrorism. Thus, it is extremely important that the EU-US task force continue to develop solutions to these challenges.

He explained how the Bush Administration has implemented new critical infrastructure protection initiative, starting with Executive Order (EO) 13231 on *Critical Infrastructure Protection in the Information Age* (October), establishing the President's Critical Infrastructure Protection Board, which recommended policies and co-ordinated programmes that are part of critical infrastructure protection (CIP) efforts. This was followed by a second Executive Order establishing the Office of Homeland Security and the Homeland Security Council. These are charged with the development of a comprehensive national strategy for critical infrastructure protection, including measures to protect, defend against and respond to such attacks, and to co-ordinating resources from dozens of agencies across government.

The Office of Science and Technology Policy chairs the R&D component of these efforts. More than twenty agencies participate in this committee to ensure the trustworthiness and resilience of the United States' critical infrastructures, as well as developing new technologies to support the overall mission of CIP.

Overall, Norman Neureiter stated that, "efforts to implement an effective critical infrastructure protection strategy will only work if both government and the private-sector work together." On 30 September, Bush established the President's Council of Advisors on S&T (PCAST), originally established by President George Bush Senior in 1991.

One of the biggest problems that they have already highlighted, according to the speaker, is the lack of resources that the government can draw from educational facilities in terms of current students studying in these areas. For example, out of around 35,000 students currently involved in computer-design and related studies in the United States, less than 100 of these are interested in security and critical infrastructure protection issues – a very worrying statistic. It is clear that this number needs to be far larger for cyber-security. For the time being, this shortage of people makes international collaboration even more of an imperative. "We all face the same problems, and these issues demand international co-operation and collaboration. We cannot solve the global challenges in one country, but need to do it together," he said. It is also clear that partnerships with industry are essential, as they own and operate most of the critical national infrastructures.

Mark LeBlanc, the United States Department of State Special Advisor for CIP S&T, took the podium next to back up much of what Dr. Neureiter had stated. Outlining some of the priorities in EO 13231, particularly with regard to R&D/S&T, Dr. LeBlanc discussed the Interagency Working Group on Technologies established in the United States for road-mapping cyber- and physical threats, as well as interdependencies. As a result of PDD-63, the Working Group was expanded to provide support for the national co-ordinator (Richard Clarke). This committee now oversees threats and vulnerabilities in these new technologies.

Dr. LeBlanc outlined the daunting challenges facing the United States Government, as the technology invented throughout the United States economy is undergoing a continuous and fundamental transformation. The committee works to identify vulnerabilities in each sector, existing R&D priorities, and gaps between *the ideal and real* in existing research. This is developed into an R&D agenda both within government and industry. The committee has come up with priorities in R&D, including infrastructures interdependency research (under physical, cyber/electronic, geographic, logical & financial); education and training of personnel in CIP and CIP R&D; threat, vulnerability and risk assessment studies; system protection and insurance; reconstitution of damaged systems; and Intrusion Detection and monitoring.

Dr. LeBlanc concluded with an examination of how to move forward by developing new technologies to defend and lessen against the effects of cascading and cross-sector failures, as well as new methodologies for testing techniques. It is essential to have EU-US collaboration in this regard. It is clear that problems (money, resources and time constraints) are shared on both sides of the Atlantic. Working together results in a situation where there is an effect almost as though the funding has been doubled. There is such a small community of experts, with ideas in both places, that these should be pulled together to ensure faster solutions and responses to threats.

Jean-Claude Laprie, the Director LAAS – CNRS, reported on the EU-US Research and Development Workshop which took place in Düsseldorf, from the first to the second of December. Setting the scene in terms of Dependability and Security, it was clear that national issues cannot be addressed only nationally. This was partly owing to the fact that the emergence of networked and embedded systems go far beyond computers and networks that exist today. There are clear essential infrastructures interdependencies.

New topics of research have to be pursued and extended, including:

- Terminology (support for clear thinking and communication; transatlantic harmonisation of dependability/security concepts and language; and convergence of dependability and security concepts and languages).
- Large-scale networked embedded systems involving people (pervasive computing; trustworthy, dynamic, complex information sharing).
- Socio-technological issues in global computer-based systems.
- Reliability and security in future computational grids.
- Malicious and accidental fault-tolerance (including model-based adaptation).
- Maintenance of critical systems by non-trusted organisations.
- Dependability and security engineering (creation by abstraction and analysis of multi-level models of large systems, composition, validation of systems with regard to the specification of methods to quantify whether and to what extent a particular design meets the specification dependability certification).
- Modelling of interdependent utilities (energy, telecommunications, etc.), and the impact of economics on infrastructures assurance.

It is also clear that a gap exists in metrology, that is, a widely accepted basis for data collection and measurements of accidental and malicious events. In exploiting measurement trends for substantiating current and future research both current gaps and expected future threats need to be taken further into account. Whilst some collaboration mechanisms exist – there are numerous success stories from a scientific or technical viewpoint in the absence of joint policy (such as MAFTIA/OASIS or Embedded & Hybrid Systems Research) – more is required, especially in terms of joint actions and projects and programme models, and developing funding frameworks.

Excellent moves forward are being made in the field of education curricula – such as the extension of the United States National Colloquium on Information Systems Security Education (NCISSE) and the development of a *virtual university*.

Jean-Claude Laprie concluded by briefly outlining France's position on critical infrastructure protection. In summation, this includes approaches towards robust infrastructures and infrastructures responsive to catastrophic failures, the implementation of wide-area response measurements and simulation techniques, and finally an appreciation of deregulation in industrialised and emerging countries.

Following this presentation, Angelo Invernizzi, a Senior Advisor to the President of CESI in Italy, made a presentation on the *Vulnerabilities and Dependability of the Electric System*. He said, "the electric system is the most crucial infrastructure, as electricity supply is vital to economic and social life, and many other infrastructures such as transportation, healthcare systems, and information and communication." Mr. Invernizzi outlined how the electricity market is changing in compliance with EU directive 96/92c and the growth of national and cross-border energy transactions, both of which will require an open, flexible and distributed Information and Communication Technology (ICT) infrastructure so as to make possible data exchange among European operators.

It is clear that the electrical system and the ICT infrastructure are becoming increasingly interdependent. Electric systems will rely more and more on open communication networks and off-the-shelf systems. In order to ensure both dependability and survivability, it is necessary to have trust in the system's capacity to provide the service it is designed for, as

well as its capability to fulfil its mission in the presence of attacks, failures and accidents. In this sense, R&D priorities include survivability analysis methodologies based on modelling and simulation, self-healing architectures and technologies, and infrastructures testing. Methods to guarantee *dependability* and *survivability* should be adapted to open, interdependent and multi-jurisdictional infrastructures.

There is a growing need for cross- and intra-sector information sharing to help define organisational and technical standards. Mr. Invernizzi concluded that, as the electric system structure and the relevant design and operation criteria are already based on common standards, the same factors could help co-ordinate R&D programmes at an international level.

The final presentation was given by Rosalie Zobel, a Director in the European Commission's IST Programme, responsible for Key Action II, New Methods of Work and Electronic Commerce. She stated, "the EU is working towards the set of parameters laid-out at Lisbon in 2000 – to become the strongest knowledge-based economy in the world by 2010." Dr. Zobel outlined a strategy based on the single market, a single currency, and the European Research Area (ERA), all supported by the *eEurope* initiative. When developing policy in these areas, the Commission has a coherent strategy in three different domains:

- S&T in which the current and next Framework Programme demonstrate interaction and co-ordination of national initiatives throughout Europe, as well as enhancing EU competitiveness through e-commerce and industry links across Europe.
- Dependability, which underpins all new e-economy applications – the Information Society will not survive if people do not have dependable infrastructures supporting them, as well as trust and confidence in those infrastructures.
- The protection of investments and assets which is a matter that is becoming increasingly important to the EU.

Two committees (IST Advisory Committee and ISTC) underpin this work.

Dr. Zobel discussed how the *eEurope* initiative has pushed *secure networks and smart cards* to improve the overall security of on-line transactions, as well as the direction of improving the security of information infrastructures and combating computer-related crime (EU COM(2000)890). At the moment, EU policy is based upon the 2001 Stockholm conclusions. These were continuing to move things forward, even before the September terrorist attacks. At the moment, the Commission is preparing a framework decision on *combating serious attacks against information systems*. New proposed Actions include awareness raising, EWIS (CERT co-ordination), technology support, the legal framework, security in government use, and international co-operation.

Specific to the question of EU-US collaboration, there currently exists: the S&T Agreement; the Joint Task Force on RTD for CIP including the European Commission-United States Joint Consultative Group since 1998: the EC-USA Workshop of Dependability Experts (held in Venice during 1999): the Joint Thematic Workshops (on CIP and Information Assurance and Security in 2000 and 2001): conference sessions (IST1999, ISW2000, IC-DSN2000, IST2001); the Joint Session on CIP as part of the second EU-US conference on *New Vistas for Transatlantic S&T Collaboration* (held in June 1999); and the collaborative workshops held in Helsinki 1999 and Düsseldorf 2001.

Dr. Zobel concluded by stating, "for the future of EU-US collaboration, both sides have identified dependability as a political and R&D priority, as well as the requirement for a global dependability dialogue to create awareness, exploit synergies, and move towards closer co-operation." There will be continued R&D collaboration with the United States through Framework Programme V and broader initiatives will be possible in Framework Programme VI. For Framework Programme VI, IST is a major priority with dependability, trust and confidence of growing importance. Within Framework Programme VI, new instruments are being developed including integrated projects, Networks of Excellence, the implementation of Article 169 to allow joint work and co-ordination of national programmes, and, finally, more emphasis on international co-operation.

Conclusions and Future Directions

From all the speakers, it was clear that a number of priorities exist in terms of EU-US collaboration. First, R&D collaboration is essential, as the technologies – and their associated risks – are global and continue to develop at a ferocious rate. Indeed, lessons can be learned and shared across as well as within sectors. Second, collaboration on Science and Technology policy is also essential. Third, owing to the difficulty of confronting the problems and risks with such limited resources, a transatlantic pooling of resources would appear to be essential. This is especially the case – as outlined by a number of speakers – given the events of September and the subsequent global counter-terrorism push, which has an obvious critical infrastructure protection angle. Fourth, it was made clear by the first two speakers that the new efforts being made in critical infrastructure protection within the United States government will continue to develop. These will increasingly have an international element. In the future, dependability will be a priority for R&D agendas, with programmes launched by both sides.

Additional Information

Estimated number of people attending this session: 150

Session Chair:
Hans Ottosson, Managing Director, CRIS, Sweden.

Speakers:
Norman Neureiter, Science and Technology Advisor to the Secretary of State, United States Department of State
Rosalie Zobel, Director Information Society, European Commission
Marc Leblanc, United States Department of State
Jean Claude Laprie, LAAS-CNRS, France
Angelo Invernizzi, CESI, Italy

Commission Contact:
Andrea Servida (Andrea.Servida@cec.eu.int)

Mobile Killer Applications

The mobile phone has become the world's predominant contact medium. New generations of mobile networks, providing *always on* fast access services, are being deployed world-wide. The advent of mobile multimedia also raises the issue of content provision in mobile networks and what type of services could possibly become mobile killer applications.

In her opening remarks, the session chair, Ms. Diaz i Romero, noted that mobile content was a crucial feature of next generation mobile networks. "Whereas second generation (2G) mobile was optimised for voice communication, third generation (3G) mobile are being designed to support data services at high rates," she said. "To exploit this broadband capacity in a mobile context it is necessary to consider which areas seem well suited to service provision in a wireless environment."

Some indications of what the future market for mobile services might be like can be gained by looking at experiences in Japan where the 3G i-Mode service was introduced in the early part of 2001. Around 70 percent of i-Mode subscribers are under 35 and 35 percent are under 25. I-Mode sites receive over one and a half billion visits per week and on average each subscriber downloads 748 Kbytes per month, with 90 percent accessing more than 10 sites per day. Entertainment, such as downloading music and micro-movies, accounts for around 50 percent of usage. Other popular applications are on-line news and information, and live ticketing. Both subscriptions and data traffic are growing rapidly and DoCoMo predicts that by 2005 the i-Mode component will account for around 50 percent of the average subscriber's bill.

Main Issues Raised

A key point, addressed by several of the speakers, was whether it made sense to talk in terms of *killer applications*. There was a consensus that there would be no single killer application for mobile networks, but rather a plethora of services packaged to meet the requirements of specific users in particular situations. As Max Kopijn commented, "communication itself is the killer application – the need to stay in touch with those closest to us, our family, friends and work colleagues." Veli-Pekka Niitamo agreed, "in vertical markets such as education, killer applications do not exist. What consumers want are solutions combining a broad range of applications and services. Realising this will be an evolutionary process."

Johan Hjelm said that killer applications were convenient and fun. To be successful a service needed either to be convenient or to be fun, and preferably both. Wireless Application Protocol (WAP) was a case in point. Users had not been receptive to the technology because the vast majority of the services offered were boring and inconvenient. The few WAP services that were engaging and accessible *had* been successful. The message was clear said Mr. Hjelm, "do not be boring!" Max Kopijn agreed but cautioned against drawing too close a comparison between WAP and next generation services. "WAP was not a service," he said, "but a set of traffic regulations. What use are traffic regulations on a bumpy road? The situation on the Universal Mobile Telecommunications System (UMTS) freeway will be very different."

Another aspect of mobile services is that they enable people to use their time more effectively. Over the last few years people have been turning dead time into working time through developments such as telecommuting. With the mobile Internet there is the opportunity to turn dead time into leisure time, for example by surfing on the train and booking tickets from the car. "Users want time to be either useful or fun," exclaimed Johan Hjelm. "Mobile services help them turn dead time into useful time," he said.

The timeframe of users' decisions is also a significant factor. People choose their access platform according to the timeframe of that particular decision. Surfing on a personal computer is fine for services of a long-term nature, such as finding careers information or accessing e-learning, but information needed on a minute-by-minute basis, such as travel, weather, restaurant bookings, is best accessed through a mobile platform.

Gianfranco Manes emphasised the importance of characterising user needs and of recognising that these will vary significantly from one situation to another. Users will expect services to be tailored according to their personal profile and to be accessible through simple, easy-to-use interfaces. Other key requirements are ubiquitous access (*anytime, anywhere*), seamless integration between mobile and native devices, and the ability to efficiently retrieve content according to location and other criteria.

The central issue here is interoperability. As Max Kopijn noted, "what good is a car if you cannot put gasoline in it? Or you can put gasoline in but cannot pay for it? That is what interoperability means in this context," he said. Leaving aside the technical challenges, the most intractable issues are in terms of the wireless Internet supply chain. "At present," said Mr. Kopijn, "no-one feels responsible for end-to-end service, and reliability across the supply chain is poor." He continued, "over the next few years 30 to 40 percent of the market will shift to the content providers. Network operators are trying to introduce a *walled garden* approach. But consumers will not wait and they prefer trusted brands." Network operators must recognise that it will be impossible for them to own the whole value chain and they should be more open to partnerships.

Interoperability will also be a major factor driving home networks. Mike Barnard explained that with an increasing proportion of homes having multiple personal computers, TV set-top boxes and other information appliances, there is a growing requirement for plug-and-play solutions to interconnect different devices. Wires, the existing solution, are attractive in that they are cheap, simple and reliable. To achieve widespread acceptance wireless networks must be at least as good, if not better, in each of these respects plus exploit the key advantage of wireless: mobility.

Mobility enables devices to be context-sensitive (that is, to detect proximity or location or both) and to establish multiple connections between networks. It also enables *remote* control of home appliances (that is, from outside the home) or, working the other way, allows users to access resources within the home (data, audio, video etc.) from remote locations. The result, said Dr. Barnard, will be that mobile and home wireless will be mutually reinforcing. "Mobile enhances the wireless home, and the wireless home enhances mobile," he said.

Ms. Diaz asked the panel to elaborate on whether broadband was an essential requirement for mobile killer applications. Johan Hjelm felt broadband was not a critical requirement. The key factors were convenience and fun. Dr. Barnard agreed, noting that in the context of home networks control functions require very little bandwidth. Max Kopijn said users wanted action

and colour. But this did not necessarily require broadband. The new MPEG4 standard, for example, allows video broadcasts to be delivered on an ordinary Personal Digital Assistant (PDA). Mr. Niitamo disagreed, "broadband will be essential for simultaneous services for vertical applications, such as m-learning," he said. Professor Manes noted that interactivity does demand broadband but that the capabilities of the access device were also an important factor.

Conclusions and Future Directions

The success of future mobile services depends to a large extent on the ability of service providers to meet user needs, something that Mr. Hjelm noted in the title of his presentation, *Content is not king – users are*. Early experiences from Japan suggest that mobile data services will be extremely popular in Europe provided they are marketed correctly. The formula for success appears to be to package the services in a way that is fun, convenient and allows users to optimise use of their time. Following these simple rules, any number of services could become *mobile killer applications.*

The nature of mobile content will be very different from that found today. Providing location-dependent information means personalising the content to a greater degree than is possible or reasonable on the fixed Internet, and literally impossible in traditional media. To achieve this there is a need to move away from document-based approaches towards database-driven services delivered through a variety of channels and access devices. This will bring pressures on privacy, digital rights management and services billing models. Initial models for dealing with these aspects, termed *web services*, are currently being considered by the World Wide Web Consortium (W3C).

Another key aspect will be relationships within the mobile Internet value chain. Just as the fixed internet has forced companies to change the way they are organised, the mobile internet will drive further changes in processes and business models, and bring opportunities for new types of intermediaries. Forums are needed that bring together the different actors within this m-commerce supply chain and which create a greater understanding of the interactions involved.

Finally, it should be recognise there are likely to be social consequences. The ability to send and receive multimedia content across mobile networks will lead to people publishing for people and provide a powerful medium for community-based communication.

Additional Information

Estimated number of people attending this session: 560

Session Chair:

Pilar Diaz i Romero, Member of the Catalonian Parliament, Spain

Speakers:

Mike Barnard, Philips Research Laboratories, United Kingdom
Johan Hjelm, Ericsson Research, Japan
Max E. Kopjin, Vice President Technology, ATOBE Mobile Solutions, The Netherlands
Gianfranco Manes, Head of Microelectronics Laboratory, University of Florence, Italy
Veli-Pekka Niitamo, Director, Nokia Strategic Resourcing, Finland

Commission Contact:

Bartolome Arroyo-Fernandez (bartolome.arroyo-fernandez@cec.eu.int)

Culture and Community Building

In the Information Society cultural heritage remains one of Society's main assets, and technology offers new ways of accessing and sharing this heritage. But there is more: digital technology also enables new forms of art, in a digital form. This session chaired by Alice Grant focused on this aspect. Interesting topics about the need to develop innovative opportunities, innovation, collaboration, access and policy regarding cultural heritage were discussed from various perspectives by a series of speakers with very different backgrounds.

Main Issues Raised

Technological Landscapes for Tomorrow's Cultural Economy was the title under which the first speaker, Andrew Cameron, presented his vision. He stressed that the cultural heritage (CH) sector is an important building block in the knowledge-society – in terms of collecting and archiving resources, providing content and learning material for education. The challenges he posed were how the value, not only monetary, but also cultural of CH institutions can be maximised, and what is necessary to unlock the value of the resources these institutions are taking care of. He also highlighted the increasing value of the new tools and the role of intermediaries for bridging the technology gap, which remains a main concern limiting the potential of artists wanting to experiment in the domain.

By presenting the results of the DigiCULT study, a project aimed at gaining the expert's perspective on the present situation of the CH sector, the speaker explained how the value of cultural heritage could be expanded and unlocked, also by using new tools. CH services need to include all kind of skills and technical know-how, and this requires smart integration of new techniques.

In a demonstration of digital art Emmanuel 'Maa' Beriet showed how innovation can bring cultural heritage alive, and how this would provoke and stimulate ideas. Working for the Nibelungen Museum in Worms, Germany, he was one of the developers of real-time interactive software. This software is used to revive a song from the middle ages, a myth that is very important in the city of Worms. Using several projectors, personal computers and single user navigation, a virtual tour with all kinds of virtual objects and elements of the myth is provided. The *museum* is an interactive guided audio experience. Providing a transparent room gives a sensation of diving into this experience.

After his astonishing presentation Berriet provided a background on the political value of the project and the technology used. From a commercial point of view, the goal of the project is to attract tourists to the city of Worms – as many visitors as possible!

Lyn Elliot Sherwood introduced the Canadian Heritage Information Network (CHIN), whose mission is to *engage audiences of all ages in Canada's diverse heritage through a dynamic Internet service freely available to the public in French and English*. The core partnership consists of collaboration between Canadian museums and CHIN, and includes a branded collection of high-quality content and features, brought together with a *Virtual Museum* hub and a search engine.

The reasons for collaboration is that in the competition for attention, while much content is hidden in databases and thus creating a visibility problem, the effort required to reach key markets allowing to achieve a critical mass of content, marketing a whole range of interests, is very high. And yet this is a necessity to ensure adding value to content, ready to use in curricula, and sustaining the effort.

An increasingly broad definition of community and partnerships is a crucial step towards opening the minds for such an effort. Expanding the connections, for example between other museums, government, information distributors and the audience, is necessary. “If we want to add value, we need to reach a much broader group,” she said.

Patrick O'Keefe, a consultant and author based in Paris, addressed the issue of intellectual property rights (IPR) and copyright. “Copyright, access and culture are inextricably mixed in the current situation,” he said, “but they are uneasy bedfellows.” There is an ever-increasing emphasis on the right of the public to have access to its cultural heritage, and all kind of resolutions or conventions (by UNESCO for example) support this view. But these instruments have been concerned basically with physical access (like to a monument or an object) while virtual access has not really been considered. Problems with providing access also depend on what those who are providing it want to do with it. When the intention is to keep control of what is on the Internet or to have financial return on investment, then copying can be a major threat.

The extent of copying (pirating) of material on the Internet is unknown but widespread. In a way it can be seen as new ways of looking at our culture. How to regulate this is a challenge with many grey areas yet to be defined.

Seamus Ross argued that in the cultural landscape, cultural heritage is intellectual capital – it is an asset. The aim is improvement in the joy of life of the citizens and formation of a foundation for creative industries. Creativity is the leading asset for business development in the coming years. Training children to be creative is therefore boosting business opportunities.

In the cultural heritage landscape a fragmentation exists between effort and practice. Also there is limited technical knowledge in the cultural sector. Looking at the work presently supported by DG INFSOC it is clear that a tremendous effort is necessary to exploit the cultural heritage better. Digitisation of our current heritage is an important factor in this.

With regards to policies on technical standards the sepaker argued that IPR issues related to cultural and scientific content must be approached, Member State-by-Member State and case-by-case. However, help is needed at European Union (EU) level. Most Member States recognise their lack of long-term preservation strategies and the need for action. Experts at the Lund meeting of EU experts in April 2000 year identified the main digitisation needs. The objective of the meeting was *to optimise the value and to develop shared visions of European content*. The meeting:

- Examined benchmarking as support to improving policies and programmes.
- Undertook identification of standards and of guidelines in support of good practice and interoperability.
- Developed the Brussels Quality Framework – approaches to identify quality criteria for (web) sites providing access to cultural resources.

- Highlighted the importance of national programmes and support for training and skills.

Following the series of presentations the session chair raised the issue of two-way communications. An issue in on-going communications is that, the content of this communication would become the property of that community. It is not clear what effect this would have on the privacy of the participating individual.

Conclusions and Future Directions

It is becoming clear that various actions should be taken towards the future. All speakers highlighted important directions and concerns for the future. Andrew Cameron concluded that political action is needed in order to stimulate investments in (human) capacity instead of equipment and in establishment of training and support centres. The latter should be brought *on-board* in CH projects (visibility) and be stimulated towards co-operation with larger institutions.

From the point of view of innovation Emmanuael Maa Berriet concluded that, "it is more important to feel there than to be there," underlining the emotional part of the technology. Also, there has to be equilibrium between technology and content, in which creativity is very powerful. "In order to preserve we must create! Let's not forget our dream."

Lyn Elliot Sherwood stressed the need for holistic organisational approaches as a key to success. New partnership models and skills are needed, and information management strategies are required that support multiple partnerships and communication modes, learning from evolving business models and multiple measures for success.

Copyright has become an old system, according to Patrick O'Keefe. He argued that it has provided benefits to authors for many years, but now attempts have been made to expand its scope to cover many new areas where there are issues involving creation and dissemination. This may well be driving the concepts of copyright too far. Its proper role and that of any other systems of protection need further study particularly in relation to ensuring access to culture in a new era.

The session chair, Alice Grant, concluded that there is a need for strategies and policies in order to ensure visibility, collaboration, representation of diverse sources, consistency of description, long term access, and tapping educational potential, which all should be aimed at enhancing the quality of life of citizens.

Additional Information

Estimated number of people attending this session: 50

Session Chair:
Alice Grant, Alice Grant Consulting, United Kingdom

Speakers:
Alice Grant, Alice Grant Consulting, United Kingdom
Andrew Cameron, Maplehurst, Canada
Emmanuael Maa Berriet, Le Graine, France

Lyn Eliot Sherwood, Canadian Heritage Information Network, Canada
Patrick O'Keefe, Consultant, France
Seamus Ross, Humanities Advanced Technology and Information institute, University of Glasgow, United Kingdom

Commission Contact:
Axel Szauer (Axel.Szauer@cec.eu.int)

E-accessibility for All: Barrier-free Use of Technology

Access to information is now recognised as a basic human right. Since e-government and on-line public services will be soon available, it is most important that people with cognitive impairments be included. Yet modern technology is in many cases making life harder for the disabled, for example Microsoft Windows operating system and human-computer interface, public transport automation, automatic tellers and smart cards. This session explored various issues of e-accessibility.

Main Issues Raised

Carlo Velasco noted that access provision for people with impairments can have spin-offs for all when unusual means of operation were called for, such as hand-free operation. He drew attention to the European Accessibility Guidelines for web content, authoring tools and user agents, and the work being undertaken to extend these.

Maureen Piggot gave a detailed exposition of cognitive impairments, noting that everyone will suffer temporarily (for example when tired). Many people will face impairments as they grow older. Her presentation showed various forms of specific support, including:

- Visual representations for abstract concepts.
- Planning support for personal organisation.
- Albums, prompts and prompt sequences for memory support.
- Alternative formats for information, for example colours for days of the week.
- Simplified operation for common devices.
- Monitoring, prompting and alerting for personal safety.
- Smart homes.
- Multimedia profiling to capture the preferences of people with impaired communication.

She showed and discussed case studies, orthotic systems and *smart home* technology. Forms of support, she observed, needed to be sustainable (that is, not too expensive). They also needed to take into account issues of privacy and user determination, issues that could deter the use of support technology. Questioning whether Europe needed stronger regulatory policy, she cited examples of products where features required in the United States had been removed from European versions, as regulations in Europe were less demanding.

Cristina Rodríguez-Porrero described in considerable detail various European and Spanish standardisation initiatives, noting that the Action Plan *eEurope* 2002 had important objectives to ensure accessibility for all. She said, “it is essential that the principles of design for all, accessibility and assistive technology are applied in all the standardisation process.” Standards often fail to take into account the needs of disabled people, while organisations representing disabled people are not always well equipped to contribute to standardisation.

Nonetheless, “elderly and disability aspects must become an integral part of the ordinary standardisation works,” she said.

Rodolfo Cattani opened his presentation by stressing the importance of assistive technology to empower people by reducing their dependence on others. Taking account of this matter during product design stages was invariably cheaper than retrofitting specialist provision.
“Attention,” he said, “may be required to the European Copyright Directive. This is aimed primarily at the needs of publishers, and this often made it very hard to get works into different formats for the disabled.”

Echoing the commitment of the Lisbon summit to make the needs of disabled people a mainstream issue, Rodolfo also sensed some dangers to be avoided. Disability is individual, and it should never be forgotten that forms of support will be diverse, some being appropriate only for a small number of people. The risk of creating a theoretical dimension to disability, where people imagine they can conquer with a *big* solution, should be avoided. He said, “the quantity of work needed is large and the Sixth Framework should not address the issues under an umbrella topic such as health.”

The question of the funding of disability support arose in open discussion. There is a real problem of non-uniformity across Europe. Some countries provide disability aids free, while others do not. Some do not even exempt them from value added tax. A non-discrimination requirement will not, on its own, be strong enough to bring about harmonised good practice.

Conclusions and Future Directions

The main conclusion was that disability deserves a much higher profile than it now has. In particular, a great deal can be achieved by taking disability into account from the start in standards processes. The power of Information Society technologies, for example the World Wide Web, is their universality. Access by everyone regardless of disability is an essential aspect. Therefore:

- Disability needs to be recognised as a stronger theme.
- The standardisation process has a crucial role to play.

Additional Information

Estimated number of people attending this session: 75

Session Chair:

Helen Petrie, Professor of Human Computer Interaction, CHCID, City University, London, United Kingdom

Speakers:

Carlos Velasco, GMD German National Research Centre for Information, Germany
Maureen Piggot, MENCAP, United Kingdom
Cristina Rodríguez-Porrero, Director of the National Centre for Personal Autonomy and Technical Aids (CEAPAT), IMSERSO, Ministry of Labour and Social Affairs, Spain
Rodolfo Cattani, European Blind Union, Union Italiana Ciechi, Rome, Italy

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Humane Interfaces

New digital services are supported by sophisticated interface technology, which should make them a natural and intuitive experience for everybody. The letter *e* in the word *humane* emphasises the need to develop user-centric interfaces and systems. This session tried to bridge the gap between the technologies for distributed e-services and the human-computer interactions needed to deliver them to the consumer. An existing technology is the voice portal. Third and fourth generation mobile and wearable devices will use multi-modal interactive technology. The session also covered longer-term research in computer assisted multilingual human-human interactions, which will lead to more realism and reduce linguistic barriers between people.

Main Issues Raised

Opening the session, Dr. Nieminen pointed out that some systems, such as cars, have stopped changing significantly because they now meet most of their users' needs. However Information and Communication Technology (ICT) product interfaces still need to be adapted to human needs rather than force human behaviour to adapt to the system's demands. Humane interfaces in the mobile industry should be transparent and support seamless services focused on consumer needs to provide personalised information services. Building such solutions is not easy, and using the wrong interface technology will almost certainly lead to product failure in the marketplace.

Dr. Boy then presented an *overview of the new interface and interaction paradigms and how they bridge the gap with consumer needs*. Dr. Boy introduced a methodology used in the aerospace industry to analyse the interaction between users, the task to be performed and the required artefact. This methodology leads to a prototype, which can be tested to determine the limitations of the design. It is usually easier to change technology than human habits or culture, although new artefacts can sometimes lead to social changes. Ideally computers should be an invisible part of the infrastructure, and manufacturers need new approaches to make this happen. However, human-centred design costs money and suitable human-computer interfaces will take time to develop.

It is inevitable that new digital systems for experts will be more complex and require better humane interfaces. New digital services for reading and writing will need new tools, such as annotation that can be used with e-mail, chat rooms etc. One of the most important stages in design is user feedback, which can be supported by knowledge management. Another application area is new digital services for engineering professionals in large companies with complex processes. Acceptability of a product normally depends on humane product development, cost, and product integration. Integration is one of the most important issues to be addressed in product design and acceptability. The main directions for R&D on humane interfaces are:

- Beyond the desktop (procedural interfaces), for example interactivity.
- Augmented cognition, especially for complex systems.
- Promote human-centred interfaces.

- Appliances and invisible computing.

Dr. Coppo gave a presentation entitled *Voice portals: The human voice as a mean of accessing Information*. He started by introducing a new spin-off company developing a global speech technology platform, which offers voice-activated services. The human voice is the most natural and intuitive user-friendly interface. Voice synthesis technology has improved considerably over the last decade. The systems can now generate voices in any language. However, no system can yet convey the emotions of the speaker or the intonation of his voice within a specific context.

Voice-based and voice-activated services have the advantage that they can be reached by telephone from anywhere on the globe. Voice activated technology will make it possible for future third generation mobile devices to support multi-modal interfaces. Such technologies will be used for novel services like booking medical appointments over the telephone. These services can now be offered over the Internet via a personal computer, a mobile device or a normal telephone.

The platform is based on open industry standards such as Hypertext Mark-up Language (HTML), Wireless Mark-up Language (WML) and Voice Extensible Mark-up Language (VXML). A voice portal supports services such as messaging, e-mail reader, form filling, personal assistant, location and positioning information, billing enquiries, chat rooms, conference calling and personal profiling. The services provide content, such as yellow pages, train timetables, flight arrival and departure times, stock quotes and trading, shopping, sports stores, restaurants, movie listings, traffic reports, lottery, horoscopes, weather, soap opera updates, news.

He then presented a case study of the Italian voice portal *Dimmi Tutto* (Tell me Everything) which is part of the Info412 service – a new brand of automatic directory services. *DimmiTutto* is available to wireline residential customers, 24 hours a day, seven days a week, and will be extended to mobile customers and other operators in 2002. The key functionality is the identification of caller location and the completion of calls to the nearest outlet of the service providers (cinema, pharmacy etc.).

He also then introduced the IST project SPOTLIGHT *Spoken Natural Language Application for e-Commerce* and the project TARSU, which uses data on the electronic version of the Italian identity card to build a more extensive personal records database. The information is collected using a voice-activated system with a personal voice signature.

Finally he described the IST project ANGELO, which aims to improve the quality of work in call centres by reducing stress and fatigue through the use of innovative human-machine communication. The system uses ambient and biometric sensors to determine the stress level of an operator. The biosensors measure physiological parameters – such as heartbeat, perspiration, eye movements, respiratory rate, etc. Other sensors measure the environmental conditions – such as air quality, temperature, humidity, noise level, light. This information is then used by a feedback system to reduce the stress level of individual operators by adjusting their work rate, requesting help from colleagues, switching on ventilation systems, increasing the air conditioning, etc. The ANGELO system effectively manages the interaction between the customer and the operator. Trials have shown that the biometric and ambient sensing helps reduce stress and also reduces the average time taken per call.

The final presentation of the session was given by Professor Alex Waibel and was entitled *A longer-term view of computer enhanced interpersonal communication across cultures and languages* or *Perceptual Aware Cross Lingual Human Interfaces*. Professor Waibel started by pointing out that most current computers still utilise the point and click interface. There is a requirement to now move towards third generation pervasive computing, where computers provide services in the background – like a butler.

An example of such services is dialogue between people speaking different languages via a translation machine. This scenario is addressed by the IST project NESPOLE, which is developing speech-to-speech translation for supporting e-commerce and negotiation services. There is also the LingWear project on wearable devices. Another area of research is the use of computers in analysing complicated situations where they monitor human-human interactions. This calls for computers to become more context sensitive. Another area of research is speech recognition where some phenomena are not yet fully understood. These include the use of such systems outside the environments in which they were trained. Professor Waibel also described the IST project FAME, which is addressing issues associated with language processing and translation.

He concluded by discussing the problem of summarising spoken dialogues and the development of *Meeting Browsers* that could automatically produce summaries of meetings. Such tasks would require computers to detect, recognise and process emotions and social interactions between people. People tracking and the analysis of body position, gestures, eye movements and facial expressions are other areas where further long-term research is required.

Conclusions and Future Directions

The main conclusions of this session were:

- More emphasis needs to be directed towards real applications of technology to solve real problems to make life easier.
- Human-machine interfaces are very important, but equally important will be human-human machine assisted interfaces.
- Future sensors will be multi-modal and support multi-lingual interfaces and fitness for purpose.

Additional Information

Estimated number of people attending this session: 150

Session Chair:
Hannu Nieminen, Head, Nokia Research Centre, Visual Communications Laboratory, Finland

Speakers:
Guy Boy, Director, Eurisco, France
Paolo Coppo, VP Business Development, Loquendo S.p.A., Italy
Alex Waibel, Director, CMU Interactive Systems Laboratory, United States

Commission Contact:

Giovanni Varile (Giovanni.Varile@cec.eu.int)

Innovate Now!

Richard Duggan, the session chair, opened the session by asserting that “innovation is fun.” He then provided a more formal definition of innovation, “the successful exploitation of ideas,” he said. He differentiated innovation from creativity or invention. Innovation is a holistic process, in which a chain of activities leads to the successful exploitation of ideas and inventions, and the outcome is only as successful as the weakest link in the chain. Innovation needs both good input ideas and strong functional teams. Inventors focus on the brilliance and strength of their ideas and often pay too little attention to the supporting activities needed to transform them into innovations. A recent study identified four distinct aspects of the innovation process:

- Creativity, that is the source of the ideas.
- A receptive climate that can find value in the new ideas.
- Creative cross-functional team working to develop the ideas into a feasible proposal.
- An effective innovation process to minimise the chances of failure.

Main Issues Raised

The first presentation, by Richard McDermott, was called *Intimacy & Exposure: The Role of Communities of Practice in Innovation.* He started his talk by describing a community of practice known as the *Turbodudes.* This is an inter-disciplinary group of geo-scientists, which meets every week to discuss the best ways to drill wells. Although they share common interests, they cross boundaries and use their meetings to develop trust and to support each other in solving problems.

It is often useful to combine a community of practice with a team that has well defined objectives. There are distinct differences between communities of practice, teams and networks in that community members help each other, share a common interest and passion, think together, respect each other's experience and develop craft intimacy. An important feature of communities of practice is that they are loosely structured groups with a fluid membership that can move across departmental boundaries. Another aspect of communities of practice is that they can also be a vehicle for sharing ideas with other companies, as they are essentially networks of people.

An example is a group of business analysts and consultants from different industries within Hewlett Packard, who get together by telephone to solve common problems and exchange ideas. They have already succeeded in reducing their time to innovation by two thirds. Another example is the World Bank, which has invited some of its customers to share their experiences of networking to solve common problems. Schlumberger and Daimler-Benz also use communities of practice to bring engineers and marketing people together to share experience and resolve common problems.

These communities of practice have semi-formal structures with a leader to hold them together, but they grow organically. They are seen as important vehicles for sharing ideas.

Edna Pasher gave a presentation entitled *The NIMCube Story: How to balance Reuse and Innovation*. She explained that NIMCube started at a management meeting in ECI, an Israeli telecommunications company, where they realised they were *re-inventing the wheel*. As a result, they developed a re-use programme, initially based on a directory of experts, which shared the experience of these experts to avoid developing the same thing twice. They also created the relevant tools, such as forms and templates, to support the process. In addition, they computerised the R&D records to provide rapid access to information and encourage extensive re-use of designs. This led to shorter development times, better products and elimination of waste.

The value of the *community of experts* was clear and the experience was then repeated in another Israeli company called ILTAM, which was also attempting to follow a re-use strategy. The team realised that their system could benefit companies all over the world. They also realised that it would be interesting to extend the approach from re-use to the more fundamental and interesting problem of innovation. The result was the IST project, NIMCube, on Innovation Management and Measurement Methodology.

NIMCube attempts to address the issue of how much effort should be invested in using existing knowledge and how much should be invested in new knowledge. The project has demonstrated that that re-use plus invention and exploitation coupled with ecology can lead to major improvements in performance. The results of the project have been formalised as a performance enhancement innovation process.

Ms. Pasher also described *Innovation Labs: a trip to the future* – a project with partners from Europe, Israel and the United States. An Innovation Lab is an organisational, cultural and physical space for prototyping new ways to work, enhancing internal innovation, identifying very long range opportunities and threats, encouraging wild thinking, and exploring multiple perspectives. It aims to recreate the *Silicon Valley experience* inside a company.

Attractive Innovation Labs should have clear visions, methodologies, networks, processes, tools, energy and actions, and fun. In addition to the Innovation Lab there should be an *Innovation Fund* to commercialise the results. She described the creation of an Innovation Lab to speed up the development of the tools needed for innovation. This drew on experience gained from visits to Innovation Labs such as the Skandia Future Centre, Ericsson Foresight, Sydkraft Innovision, the Denmark Future Centre, the Rocky Mountain Institute, Army after Next, and the Israel Future Ranch.

Nigel Crouch explored the question *what makes an organisation innovative*? He started by asking if the audience believed that innovation is important. Not surprisingly the answer was overwhelmingly *yes*. He then asked, "is innovation absolutely critical for survival in difficult times?" The majority answer was again a *yes*. He went on to present the results of a survey conducted in 2000 which showed how dramatically the world had changed. Each day in 2000 more world trade took place than the whole of 1949, more scientific research was conducted than in the whole of 1960, more phone calls were made than in the whole of 1983, and more e-mails were sent than in the whole of 1990. This dramatically illustrates the pace of change and shows that innovation is absolutely essential for survival. "Innovation is all about getting inside the heads of our customers and the people in our organisations," he said.

He examined the experience of excellent companies in the United Kingdom. In general, people in the United Kingdom believe they are very creative. They have invented, amongst

other things, penicillin, microwave technology, and the World Wide Web, but commercial exploitation of such inventions in the United Kingdom has been very weak.

This experience was not unique to the United Kingdom. The Japanese had similar experiences. A study analysing what factors made companies commercially successful highlighted the importance of innovation. Three critical success factors could inspire people, create an innovation process, and connect companies very closely to their markets and customers.

Successful companies create a culture of trust, respect, integrity, openness and fun. They also develop a passion for creating something innovative. But it is not easy. Mr. Crouch cited the example of a *restless* company, which maintains its innovation successes by making sure that the process is maintained especially when they come out with a successful product. They have also a *no-blame* culture that encourages experimentation and failure to achieve success. He quoted a director of a hi-tech company in Cambridge. “It is management failure if someone gets into a position where they make a disastrous mistake. Management is responsible for giving people space but not enough space to kill themselves,” he said.

He observed that successful organisations acknowledge the efforts of their team members. They know that *thank you* is a great motivator. They also provide their teams with a mentor in a senior position who can create the right culture for *making things happen*. The teams need to include *crazy guys* who can think outside the box together with risk takers. Finally, successful teams make a connection to customers, markets and suppliers. He concluded by saying that the answer to the question *how can we innovate better* is, “do not do it unless you have a passion for it.”

Conclusions and Future Directions

An important message from the session was the distinction between invention and innovation. Invention is the inspired generation of ideas, whereas innovation is a holistic process for exploiting ideas. Although innovation is undoubtedly a process, which can be documented and supported by appropriate tools and information systems, it is different in character from most conventional business processes. It involves very flexible teams, which cut across disciplinary, departmental and maybe even company boundaries. Team membership is not precisely defined and may involve anyone with relevant experience on an ad-hoc basis. Companies that manage innovation successfully, create a culture that encourages their innovation *teams* to take risks and learn from their mistakes.

Additional Information

Estimated number of people attending this session: 55

Session Chair:
Richard Duggan, Duggan Creative Innovation Advisors, United Kingdom

Speakers:
Richard McDermott, McDermott and Associates, United States
Edna Pasher, Edna Pasher Ph.D. & Associates, Israel
Nigel Crouch, Senior Industrialist, DTI Future and Innovation Unit, United Kingdom

Commission Contact:

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Roadmaps to All Optical Networks

Currently, the communications industry is in a dire economical situation, characterised by rising costs, insufficient revenues, too many competitors, and excessive debt. In the United Kingdom and Germany, high Universal Mobile Telecommunications System (UTMS) licence fees have heavily affected network operators. A roadmap to all optical networks must take such a scenario into account.

Main Issues Raised

The session chair Paul Lagasse presented the Optimist Network (http://www.ist-optimist.org). Photonics are a major enabler for *ambient intelligence*, putting people into the centre. By 2012, Metro links will connect homes with access speeds of up to one Gbps per customer. Data transfer within these Metro networks will amount to 10 Gbps per wavelength with 100 wavelengths per fibre over a distance of up to 20 kilometres. Businesses will have access to this network in multiples of 10 Gbps.

These Metro links are connected via regional networks (MAN) operating at 10 Gbps per wavelength, 1000 wavelengths per fibre over a distance of up to 200 kilometres. Wide area networks (WAN) will connect Europe operating at 40 Gbps per wavelength and 1000 wavelengths per fibre. Finally, global networks (GN) connect continents with up to 128 wavelengths per fibre and up to 80 Gbps per wavelength.

Fibre capacity has drastically increased in recent years and continues to increase at a significant rate, with Internet Protocol (IP) traffic doubling every year. Challenges that remain are multi-vendor open networks and low cost components allowing for mass access to optical networks. Access is currently the bottleneck. Narrow band, plain old telephone service (POTS) lines dominate; Integrated Services Digital Networks (ISDN) has a small share, and xDSL (DSL **?** Digital Subscriber Loop) has a very small share. Only four percent of users in Europe have wide band access. Even xDSL has a limited lifespan because the demand for bandwidth will soon exceed the technical limits of xDSL. Hybrid Fibre Coax cables do provide sufficient bandwidth, however high lead times and regulation are roadblocks for this technology. By 2006 the market share of xDSL will already decline, and the share of Hybrid Fibre Coax will amount to a third of all accesses. By 2009 this share will already be in decline, giving way to an increasing share of Fibre to the Home (FTTH). Within the next 10 years optical fibre will come closer to the home, especially to multi-dwelling units. The last meters to picocells will still be copper, or increasingly wireless technologies such as wireless local area networks (LAN) or UTMS allowing up to 100 Mbps access speed per picocell. Passive Optical Networks (PONs), covered by the IST project HARMONICS, will allow mass access on an optical basis because of low installation and maintenance costs, and because they are well suited for broadcast.

Other roadblocks are the diverse and fragmented European markets and operators whose investment capabilities have been exhausted by exorbitant UTMS licence fees, especially in the United Kingdom and Germany. A sustainable business model therefore requires customers that are willing to pay for services and the availability of cost-effective payment methods. Interesting is that revenues are lowest for canned content such as music downloads

(0.001 United States Dollars per Mega byte (Mbyte)) but highest for mobile communications, especially for Short Message Service (SMS) with 1000 United States Dollars per Mbyte.

Arpad Bergh related to the current doom-and-gloom situation in the communications industry. This situation is not caused by the technology, which, in fact, advances steadily and predictably, but by the lack of a viable business model. “Every time you go to a meeting you find new hero experiments and there is an increasing gap between what technology can do and what is available to people,” he said.

Within the communications industry the food chain consists of:

- Service providers.
- System and equipment providers.
- Subsystem and component providers.
- Manufacturing industry.
- Research and development.

Currently, service providers face rising demands, rising costs, insufficient revenues, too many competitors, and excessive debt. This situation is propagated down the food chain to system vendors and manufacturers.

Also, regulation has had some influence. In the United States the MFJ, FCC as well as 50 State Regulators control regulation. In 1996, under President Clinton, the telecommunications market was opened for competition. Five years later, after a short gold rush (from 1999 to 2000 there was a tremendous increase in the number of competitive carriers), the industry is now contracting and people are being laid off. Consumers are still waiting for the benefits of competition.

The pricing system is heavily unbalanced. Data traffic accounts for about 90 percent of total traffic, but 43 percent of revenue is generated by voice traffic. As data traffic increases, costs go up and revenue comes down. The cash reserves for expansion are down by as much as 40 percent.

What is needed to consolidate the industry is, according to Arpad Bergh, cost reduction, higher revenues, and the solution of the last mile problem. Fibre backbones are plentiful and provide sufficient capacity, but access to the network is the bottleneck. Also Arpad Bergh sees the high costs for components as a roadblock. Solutions may come by 2004 with tuneable lasers in metro rings, the 10 Gbps Ethernet, better integration, mass production, standards, and modelling and simulation.

Yosuhiko Arakawa gave an overview of the Optical Communication Roadmap Project in Japan. This project was started in 1996, with a second version issued in 1999, and a revised version in 2001. The project defines a timetable that coordinates the technologies for data transmission and routing:

- By 2001, messages will be routed by electronic means. Global IP backbone capacity will be at 10 Gbps per wavelength and 128 wavelengths per fibre, amounting to approximately one Tbps per fibre. Regional IP backbone capacity is in the range one to 10 Gbps per wavelength and 64 to128 wavelengths per fibre. Network access

happens in the range one and a half to 100 Mbps for home users, up to one Gbps for business users, and two Mbps for wireless devices.

- By 2005 tuneable lasers will allow optical wavelength routing with switching times in the milliseconds area. Regional IP backbone capacity will be in the range one to 10 Gbps per wavelength and 512 wavelengths per fibre.
- By 2010, optical burst switching will be introduced for routing, with switching times in the area of microseconds. IP backbone capacity is by 10 Gbps per wavelength and 512 wavelengths per fibre. Network access will happen at 1 Gbps for home users, 10 Gbps for business users, and 100 Mbps for wireless devices.
- By 2015, optical packet switching will be introduced, with switching times in the area of nanoseconds. IP backbone capacity is up to 40 Gbps per wavelength and 1000 wavelengths per fibre. Regional IP backbone capacity is in the range two and a half to 40 Gbps per wavelength and 1000 wavelengths per fibre.

According to Yosuhiko Arakawa, the demand for bandwidth will not so much driven by personal computers (PCs) but by an increase of non-PC devices such as networked home appliances, digital TV and radio, and mobile devices. While the number of PCs in Japan will slowly grow to 25 million units in 2015, non-PC devices will amount to 190 million units by that time, plus an additional 10 million car-based devices.

Some discussion took place concerning whether the lack of content was a roadblock. Arpad Bergh expressed the view that he did not think so. This seems to be rather a chicken and egg problem. Currently, user applications like video walls (videoconferences) are inhibited by prohibitive prices for lines, prices that are enforced by regulation. Lower prices will enable such applications and thus lead to new contents.

Low orbit satellites were discussed. A question arose if these were still a hot topic. Paul Lagasse said they were not. The Iridium project has failed. A viable business model for satellites is difficult with the current coverage of competing wireless services. Global operation of satellite-based communications is not simple owing to a multitude of national regulations. Satellite technology is good for surveillance and broadcasting but is not an option for two-way communication.

A question was asked about the physical limits per fibre. Yosuhiko Arakawa replied that the physical limit is defined by a wavelength of two nanometers. This computes down to approximately 40Gbps per fibre. Paul Lagasse said that physical limits are not the problem. The crucial issue is the cost of components.

Conclusions and Future Directions

The good news is that the Internet has room to grow. However, only a minority of phone subscribers world-wide is currently connected to the Internet. Progress will depend not so much on technology but on a viable business model and regulation framework. Metro and access technology is seen as the next growth opportunity.

Additional Information

Estimated number of people attending this session: 50

Session Chair:
Paul Lagasse, Department of Information Technology, University of Gent, Belgium

Speakers:
Paul Lagasse, Department of Information Technology, University of Gent, Belgium
Arpad Bergh, Optoelectronics Industry Development Association, USA
Yasuhiko Arakawa, University of Tokio, RCAST, IIS, Japan

Commission Contact:
Andrew Houghton (Andrew.Houghton@cec.eu.int)

Software Serving People

Many years ago, computer users programmed their own applications. “Is it now time,” wondered the chairperson, “to go back to the future?” How might it be possible to customise the programming environment for web content and end-user development using powerful environments based on agents? This lively session explored technologies that might help software serve people better, by letting them build, swiftly and simply, the personalised applications they wanted. Both the practicability and the desirability of this were aired.

Alexander Repenning showed a number of examples, including his AgentSheets tool. This provided a user interface, and data templates for people to define their own agents to go to the Internet, fetch information, process it and report in a customised form.

Norbert Streitz took a different view, challenging whether *programming* is now the best paradigm, the right way for people to think about their use of computers. Referring to the late Mark Weiser of Xerox Parc, he said, “the most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.”

Main Issues Raised

Alexander Repenning demonstrated AgentSheets, an authoring tool allowing end-users to build their own interactive content and simulations, and publish them on the Internet. End-user programmable agents bridged the gap between present and relevant information on the Internet. Using voice input and adapted output, for example for personal digital assistants (PDAs), these agents could assist access by disabled people. Agents were exportable, and so shareable and tradable.

Showing a number of simulations, including Lego-bricks, animals in eco-worlds and Java for communities in India, Mr. Repenning showed how useful the flexible programming environment could be in education, in exploring, expressing and sharing concepts. He said, “there is a progression underway, from the *syntactic web*, through the *semantic web* to the *pragmatic web*.” The first, based on Hypertext Mark-up Language (HTML), was wholly author controlled. The second, based on Extensible Mark-up Language (XML), was mostly author-controlled. The third, based on user agents, was user-controlled.

Neil Maiden’s talk took a cautious view, making clear that software design for and by the generality of computer users was a very demanding challenge, requiring much research. The problem was that the abstraction and creative thinking necessary for design are difficult, so end-user design implies a learning process. How, he wondered, might this be achieved? He suggested four research focus areas:

- Learning by example.
- Creative designs through re-use (that is, reasoning by analogy).
- Scenario driven requirements expression.
- More effective design communication methods.

Patrick Girard, looking at computer-aided design (CAD) products, took the view that end-user programming (EUP) is alive, well and with us now. He cited examples such as LIKE, EBP, GIPSE and TEXAO, permitting parametric objects, new object creation and system modification. He reviewed the declarative and procedural approaches to programming, and contrasted variational and constructive methodologies. With the former, the user did not know the solution and used to system to find it; under the latter, the user knew the solution and taught it into the system. He observed that wherever end-user programming is an objective, it must be taken into account early in the application design.

Norbert Streitz questioned whether end-user programming really was a contribution to software serving people. It maintained the position of the computer as the primary artefact, the gateway to cyberspace. Might this be an example of the old tension, the danger of putting technology-driven approaches before human-centred ones? Ought not the computer, he argued, make a mental (and maybe physical) disappearance, becoming the secondary artefact? "We should then be talking about *small artefacts and services serving people,"* he said. "User-centred design should come well before thinking about programming, and in four design spaces: mental, social, informational, and architectural."

During open discussion, the question of safety arose. Any architecture for EUP – and there has to be one – must make clear what could and could not be changed, and by whom. An extreme example is the safety control of a nuclear power plant. Someone commented that educational simulation was hardly serious programming, and should not mask the amount of work to be done for *rea*l EUP. Another rejoined that lifelong learning was a very significant marketplace, not lightly to be ignored.

Conclusions and Future Directions

The discussions that took place in the session considered when, in practice, end-user programming might be a practical reality and when the gap between the user and expert programmer domains would be bridged. Whilst no firm answers emerged, the session did show that:

- For true end-user programming, a lot of work remains to be done.
- Economics and the market may force the pace, because of the scarcity of skilled programmers.

Additional Information

Estimated number of people attending this session: 100

Session Chair:
Debra Logan, Gartner Group, United Kingdom

Speakers:
Alexander Repenning, University of Colorado - Department of Computer Science, United States
Neil Maiden, City University - School of Informatics- The Centre for HCI Design, London, United Kingdom
Patrick Girard, Universités de Poitiers - Génie Physiologique Informatique, France

Norbert Streitz, Head of Division, Fraunhofer IPSI, Darmstadt, Germany

Commission Contact:
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2010: A Wireless Vision

The session chair, João da Silva, in his opening remarks, noted that next generation wireless systems (or fourth generation (4G) systems) were already a hot topic in the IST Programme, with many projects addressing relevant RTD issues. As history has shown, mobile communications technologies require long lead times to develop and deploy. This means that is necessary to start planning now for the wireless world of 2010.

The key opportunity for 4G systems is to be an enabler for truly anytime, anywhere services. For this to happen there is a need for a paradigm shift both in technologies and markets. At a technical level, there is a requirement for a shift toward what Robert Berezdivin called *ultra connectivity* – making wireless work as well and as easy as wireline technologies. This will not be an easy task. In market terms, the shift should be towards services that enable everyone and everything to be always connected. Services will be location-adaptive, personalised and user-centred. Dr. Satoh summarised the vision as: mobile multimedia, anytime, anywhere, anyone, global mobility support, integrated wireless solutions, and customised personal service (MAGIC).

The session addressed wireless and mobile technologies for the emerging wireless world, and included perspectives from each of the three main markets: United States, Japan and Europe.

Main Issues Raised

In charting a path from the present to the future it is helpful to have a roadmap identifying the key technological, regulatory and other challenges, and possible timeframes for their resolution. Two recent reports provide important inputs to the debate in this respect.

The *Book of Visions*, was published in December 2001 by the World Wireless Research Forum (WWRF), an industry-led initiative supported by the IST Programme. It identifies visions and issues in particular areas, sets out technology development and standardisation issues, and summarises contributions from member organisations.

The report *Outlook for Future Mobile Communications Systems*, published by the Japanese Telecommunications Council in June 2001, provides a similar perspective and will provide a basis for Japan's contributions to the International Telecommunications Union (ITU) and for future R&D projects. In addition, relevant work is being undertaken in other frameworks, such as the Internet Protocol Version Six (IPv6) Forum and the Institute of Electrical and Electronic Engineers' (IEEE) 4G Mobile Forum.

Dr. Berezdivin identified four key technological challenges to be overcome for 4G systems. First, there should be seamless integration with other wireless and wireline networks so as to achieve transparency between services and technologies. This necessitated IP-centric networks interconnected through intermediary service-oriented middleware. Transmission rates for 4G networks would be in the region 20 to 100 Mbps compared with two to 10 Mbps for third generation (3G). Second, 4G systems should achieve highly efficient use of spectrum and wireless resources, requiring high performance physical and access layers. Third, the networks should be flexible and adaptive to the wireless environment and to service and user

needs. This could be achieved through approaches such as flexible network and transport layers, adaptable architectures, and software radio. Fourth, 4G networks would be distributed and smart, with intelligence and wireless resources everywhere. This necessitates the dynamic adaptation of services and application resources within Internet-like distributed architectures.

Spectrum efficiency is a particularly important issue. Radio spectrum is a limited resource that could become an obstacle to future development of wireless technologies. The challenge is to enable many more users to access many more services in the same spectrum with very high quality of service. Dr. Satoh estimated that additional spectrum in the range 1.2 to 1.7 Giga Hertz of bandwidth would be required by 2015. Potential technological solutions, identified by Dr. Berezdivin, include dynamic spectrum allocation and spectrum sharing, smart antennas, and adaptive hybrid access techniques.

David Kennedy questioned whether 4G networks would necessarily be based on Internet Protocol. "The biggest challenge," he said, "is finding the post IP protocol (PIPP)." In response to a question from the floor regarding the new IPv6, Mr. Kennedy replied that "IPv6 is today's protocol. It addresses the issues of today but will it be enough in 10 years time?" Bosco Fernandez of Siemens AG commented that an important feature of IPv6 was its management capabilities. Mr. Kennedy agreed that IPv6 was a major improvement but doubted that it was sufficient for the future scenarios being considered.

A key factor influencing future developments will be the rate of traffic growth. Japan's experiences as an early adopter of 3G provide useful indicators here. DoCoMo introduced data based services on the i-Mode platform in 2001 under the brand name Foma. Connection speeds range between 64 Kbps to 384 Kbps and users have multi-call functions as well as facilities to browse using Hypertext Mark-up Language (HTML) and Java. Already around 21 million subscribers use i-Mode in Japan. Around six million subscribers are expected to be using the Foma data service by 2004, by which time it will be accessible to 97 percent of the population. DoCoMo's projections anticipate 81 million users by 2010. However, while the number of subscribers will be saturated, traffic from new data services and terminals will continue to increase.

Presenting results from the WWRF, Werner Mohr characterised the emerging wireless world as a series of multiple spheres one inside the other. At the lowest level is the personal area network, comprising smart clothes and intelligent accessories such as shoes and watches. At the next level is the immediate environment, such as appliances within the networked home, then *partners* such as cars, and so on right up to the highest layer, cyberworld. Mr. Kennedy agreed, noting a proliferation of smart devices such as TVs, digital cameras, household appliances, and even wearable computers. "We have more converging devices, but also more single function devices that are Internet-enabled," he said.

What will be the killer applications for this wireless world? David Kennedy and Werner Mohr both encouraged people to think in terms of millions of killer application rather than just in terms of a single killer application. As Mr. Kennedy noted, "the next generation user is not somebody new. It is the likes of you and me. The killer applications will be whatever people find useful for their particular circumstances."

Regarding future prospects, Yair Sharan from Tel Aviv University noted that the panel was all highly optimistic. Did the difficulties and crises of the last two years affect the outlook for 4G? In reply, Werner Mohr said, "GSM was introduced in 1992 against a similar economic

background. Given the long timeframe, it was right to start planning now for the major changes needed in moving to a truly wireless world."

David Kennedy agreed but also cautioned that there is a need to keep an eye to the economics. More and more bandwidth will not produce more and more revenue. "As operators we do not want to build infinite capacity networks. Just ones big enough to deliver the service users require," he said. To be economic, present estimates suggest that users will need to spend around 100 euro per month on services. Operators should start informing and educating users about the possibilities, and build partnerships across the value chain.

Conclusions and Future Directions

The research agenda for next generation mobile systems is now fairly well defined. Activities within the WWRF and other forums have identified the key technological, regulatory and market issues, and these are now beginning to be addressed through research and other actions. A clear timeframe for the relevant developments has also been set out, with milestones being the World Radio Conferences (WRC) scheduled for 2003 and 2006. The initial research phase for 4G is envisaged to last through to 2005, followed by concept integration, standardisation, and system development, in time for full system deployment from around 2010. Relevant research could be the basis for integrated projects within the Sixth Framework Programme.

Spectrum licensing will be a key challenge. The underlying technological issues will need to be resolved by around 2005 in time for the WRC 2006 which is expected to identify the spectrum for 4G.

Public-private collaborations and partnerships have an important role to play and is already a key feature of efforts in Europe, the United States and Japan. Forums such as the WWRF provide opportunities to consolidate these regional activities into a truly global effort.

Additional Information

Estimated number of people attending this session: 350

Session Chair:
João da Silva, European Commission

Speakers:
Robert Berezdivin, Chief Scientist, Information and Advanced Systems business unit, Raytheon Inc., United States
David Kennedy, Senior Programme Manager, EURESCOM GmbH, Germany
Werner Mohr, Vice President, Siemens AG, Germany
Kohei Satoh, Managing Director, DoCoMo Communications Laboratories Europe GmbH, Germany

Commission Contact:
Bartolome Arroyo-Fernandez (bartolome.arroyo-fernandez@cec.eu.int)

Improving Competitiveness in Traditional Industries

E-business can be and is being exploited to maintain and enhance competitiveness in traditional industries. The session illustrated the successes that are possible when the *old economy* meets the *new economy*. Three speakers from European industries showed examples of:

- A large company that is improving its processes with electronic business.
- A large company that is improving its processes and has developed new revenue streams using information technology.
- A company that has developed an innovative product model using the Internet.

Main Issues Raised

Michel Byvoet, Chief Executive Officer of a Belgian family firm in the clothing business, spoke about his company's investments in a new business (Bivolino) producing made-to-order men's shirts ordered over the Internet, at prices comparable with an off-the-shelf quality product.

The company has invested its own funds in a five-year, one and a half million euro development of a new business process with patented software. The system is now working and serving consumers, and full commercial launch is expected in 2003. Mr. Byvoet explained how the front office and back office software could deliver an order to their manufacturer 3,000 kilometres distant within about 10 minutes of the customer placing the order, and how the shirt would then be ready within 50 minutes. "The biggest problem," said Mr. Byvoet, "has been getting all the firm's workforce to understand their role as a team in the new process." The firm has invested in two and a half months training over three years.

Dr. Thomas Ludwig explained how e-business fitted into a threefold strategy to increase competitiveness at German steel-maker ThyssenKrupp. There were three objectives. These were to:

- Increase the company's service orientation.
- Introduce an e-business practices initiative from February 2000.
- Develop an information technology (IT) business as a strategic revenue stream.

ThyssenKrupp's service business now accounts for 17 percent of group sales, targeted to reach 25 percent in three years time. The service business consists of three strands: life cycle service with ThyssenKrupp products; purchasing and customisation services with third-party products; and pure services. Naturally, the proportionate service revenue varies over ThyssenKrupp's six main divisions, being 50 percent in Elevators, less than this in Steel, Technologies and Automotive, and more in Materials and (obviously) Services.

ThyssenKrupp set up a steering committee and a core team to oversee 140 sector based e-business projects and four synergy teams, these being:

- E-procurement.
- ThyssenKrupp Internet portal.
- Knowledge management.
- Personnel and recruiting.

The total of 140 projects compares with a benchmark average of 93 for the DAX-30 companies in the year 2000. The projects, which cover most business activities, were carefully assessed for development potential and priority, while each profit centre funded its own projects.

The ThyssenKrupp Information Services (TKIS) operation has grown from 250 employees at its foundation in 1994 to 3,200 employees in 2001, turning over 500 million euro in various broadcasting, communications and outsourcing operations. TKIS is now Germany's third largest IT outsourcing operation.

Christian Bleil outlined the strategy for e-business at the German multi-utility company RWE. He defined e-business as web support of any activity across the whole range of the business processes, so highlighting it as an integral part of the company's vision for existing businesses. The company developed an e-business master plan consisting of vision, strategic goals, value chain analysis and organisation. It approached the definition and prioritisation of major projects with both top-down (that is, benchmarking) and bottom-up (that is, internal demand) methods. As at ThyssenKrupp, RWE favoured a decentralised approach where each business was responsible for its own e-business strategy.

Mr. Bleil summarised the lessons learned as follows:

- E-business is an integral part of the existing business.
- Formulate a vision and define goals.
- Locate the highest potential gains.
- Prioritise activities and focus resources.
- E-business is a programme of culture change.
- Measure and control the financial impact.

During the open discussion, Mr. Bleil gave more details of specific problems that may be encountered when introducing e-business change. One of these is transparency. In an e-business environment a department will be responsible for more than just inputs and outputs, as the progress of transactions may become more visible and more traceable. This can prove uncomfortable for some people.

Conclusions and Future Directions

Common experience has shown that e-business development should be decentralised to separate business divisions. On employee relations and *Mitbestimmung*, ThyssenKrupp's

experience has been that problems are avoided if one can convince employees of the business logic and value of the changes.

Additional Information

Estimated number of people attending this session: 40

Session Chair:

Josef-Albert Beckmann, President, Industrieverband Gesamttextil, Ibena Textilwerke Beckmann GmbH, Bocholt, Germany

Speakers:

Michel Byvoet, CEO, Douelou N.V., Hasselt, Belgium
Dr. Thomas Ludwig, Chairman of the Executive Board, ThyssenKrupp Serv AG, Düsseldorf, Germany
Christian Bleil, Senior Manager Business Development, RWE Com GmbH, Essen, Germany

Commission Contact:

Jorge Gasos (Jorge.Gasos@cec.eu.int)

Towards Neuronal Computers

The human brain has amazing operative performance. It can work very fast, undertake tasks in parallel, adapt to new situations, and deal with the unexpected. It is also fault tolerant. Computers have become very fast and can undertake some computations with great efficiency. However, there are some areas, for example, visual recognition of objects, where the human brain out performs the best computers.

Neuronal computing addresses the development of computers and algorithms using the operation and architecture of the human brain as a source of design inspiration. The aim is to develop computers that are good at undertaking tasks that are currently poorly performed by computers but done with great ease by people or other creatures. Another interest driving research in this field is the development of better understandings of how the brain works. In particular how the brain carries out computations and information processing.

The objectives of the session were to:

- Give an overview of the basics of neurone information processing.
- Summarise the state of the art in understanding information processing in the living world (neurones).
- Explain the directions of research and the main challenges.
- Provide a view on how the research might inspire new computational architectures and implementations.

Main Issues Raised

The session chairman, Rolf Kötter made a few introductory remarks. In particular he stressed the need to understand how the brain works and the benefit of bringing different disciplinary perspectives to bear on this area of research. The issues to be addressed by this research concerned the identification of the algorithms implemented in the brain and the way that neurones actually produce these. He said "knowing how the brain works may be helpful in understanding how to build better computers that have some of those properties that the human brain possesses." He said that the session was organised around presentations from researchers with a background in both computer science and brain research.

Alain Destexhe, gave the first presentation. This was focused on work that he had been undertaking at the neuronal level. His work combines insights from computational modelling and experimental physiology, to understand the operation of neurones. Neurones are in a state of continuous operation, emitting spikes spontaneously and producing background noise. The key conclusion of his research was that the emission of output spikes by neurones to a meaningful input was enhanced by the addition of noise. Without noise, the inputs can be filtered out resulting in no output spike. The presence of noise tends to create sharper outputs.

Simon Thorpe addressed the topic of reverse engineering in biology. This work was concerned with discovering the design principles of the brain in order to design an equivalent solution in software. He stressed the importance of using knowledge from neuroscience,

psychology and computational modelling to achieve this objective. He demonstrated his work in this area, by addressing rapid visual processing, an activity where the brain outperforms computers. He described an approach called spike based neural computing, which is computationally efficient and can be implemented on a personal computer. This approach uses a concept called temporal coding, which basically means that the time taken to generate a spike depends upon the stimulus intensity, with a larger stimulus producing a spike faster than one of lower intensity. One of his important conclusions about the potential of neuronal computing was that it might lead to more natural interfaces for human interactions, which would be better for people as the technology would work in the same way that people operate.

Nigel Goddard spoke about tools to help simulate the brain's operation and to support co-operation between people working in the area. He mentioned that computational models of the brain help with the understanding of information processing taking place in the brain. Software techniques however can provide people with the tools to collect, compare and to analyse information from many different researchers. “Collaboration,” he said, “between different researchers is important. Data from research is distributed and there is a need for tools to support exchange, discussion and comparison of models and data.” He described tools that his team had developed for neural modelling and discrete event simulation. He also described tools for collaboration that would help researchers to share information in a better way.

Igor Aleksander brought an engineering perspective to the session. His main message was that computing implies a digital approach. He mentioned a tool that his team had developed called a Neural Representation Modeller, which provided modelling capabilities on different levels: the digital neural cell; the neural module; and the neural architecture. The architecture of the brain was a key area of interest. He addressed the problem of how people look at and remember faces, presenting an engineering model of visual memory built using neural nets.

In the discussion that followed the presentations, the question of the relevance of this sort of research was raised. Igor Aleksander said that one of the main application areas was in the solution of medical problems and that industrial applications might then spin-off from the medical applications. Many people felt that this was a strange situation as they expected to see medical applications arising as a spin-off from industrial applications. There was agreement that neuronal computing however had the potential to change many things in industry in the longer term.

The question of collaboration was further discussed. One person asked if Networks of Excellence could improve communication and collaboration between the different disciplines and researchers working in the field. Nigel Goddard felt that such networks might make it easier for people to collaborate. However, many people want to do their own research in their own way. The view was also expressed that whilst networks are valuable, there are many people who believe that work is at an early stage, and therefore there is little scope for any standardisation or norms. Simon Thorpe felt that many things needed to be done to push forward the boundaries so collaboration would be helpful. Igor Aleksander said that networking activities were good if they led to good research collaborations.

The question of biological computers was raised. The speakers noted that some work was being undertaken in this area, where analogue VLSI based on neurones had been developed. However Simon Thorpe felt that working with something like a high performance personal computer had advantages since they were rapidly evolving and no special hardware

technologies were required. This latter point meant that more people would be able to undertake work in this field. At the moment Pentium microprocessors are ideal, but ultimately all technologies are potentially interesting.

Conclusions and Future Directions

A lot of further research is needed in the area of neuronal computing. There is an expectation that this research will eventually inspire new computer architectures. There are things that can be learnt from biology that can be transferred to engineering and vice versa. Cross fertilisation between disciplines such as computer scientists and brain researchers is important.

The session showed that there were different ideas about neuronal models. There are also different views about the level of modelling and what constitutes the important units to study in the brain and to take inspiration from. There is a need to work at all levels and also to work across levels. Perhaps this is where most work actually needs to be focused. The important thing was to ensure that there was no particular bias in the research supported in the future and that the different perspectives are allowed to flourish.

Additional Information

Estimated number of people attending this session: 80

Session Chair:

Dr. Rolf Kötter, Centre for Anatomy and Brain Research, Heinrich-Heine-Universität Düsseldorf, Germany

Speakers:

Dr. Rolf Kötter, Centre for Anatomy and Brain Research, Heinrich-Heine-Universität Düsseldorf, Germany
Dr. Alain Destexhe, Unité de Neurosciences Integratives et Computationnelles CNRS Gif-sur-Yvette, France
Dr. Simon Thorpe, Centre de Recherche Cerveau et Cognition CNRS Toulouse, France
Dr. Nigel Goddard, Institute for Adaptive and Neural Computation, University of Edinburgh, United Kingdom
Professor Igor Aleksander, Imperial College of Science Technology and Medicine, United Kingdom

Commission Contact:

Pekka Karp (Pekka.Karp@cec.eu.int)

Complex Systems

Complex systems are the systems of everyday life. Communications networks, the immune system, financial markets, road-traffic networks are all examples of what systems theorists call *complex, adaptive systems*. As John Casti, the session chair, noted in his introduction, "the only place you find simple systems are in textbooks, the real world is one of complex systems."

Complex systems consist of many autonomous and interacting agents, sharing an elaborate collective behaviour that is the result of their interdependent actions and preferences. Complex systems often follow universal patterns that are almost independent of the properties of their individual agents. According to John Casti, "what makes a complex system complex is not its connections or structure but its behaviour. They do things that are unexpected, counter-intuitive and just plain hard-to-understand."

One example is a football game. It comprises a medium number of agents (players) within a defined space (playing field), making decisions on the basis of rules (the rules of the game). The main outcome of the game (the points and goals) are not present within the system itself but are a consequence of interactions between these different elements. In systems terms, it is said that the goals are an *emergent property*. Similarly in a financial system, price is an emergent property from the behaviour of individual market actors.

Such systems are characterised by three key elements that Professor Casti called, "the fingerprints of complexity." First, they comprise a medium size number of agents. The number is not so small that all possible interactions can be calculated, but not so large that statistical aggregation methods can be used. Typically between a few hundred and a few hundred thousand agents are involved. Second, the agents are adaptive. Although their behaviour is determined by rules, they are able to monitor their performance and change the rules to take account of others' behaviour. Third, agents (for example, footballers or brokers) rely on local information. They do not know what others are doing and have to act on imperfect information.

The session was concerned with the use of complex systems as a means of explaining many everyday phenomena.

Main Issues Raised

One key issue is the nature of the investigative process. Although in the natural sciences (physics, astronomy, chemistry etc.) systems can be said to be *complex*, in the sense of being complicated, they always use the same rules. Research in the natural sciences is primarily about understanding the rules. But in everyday systems the rules themselves are changing. Professor Casti drew an analogy with the situation of gamblers in the 17th century. They made many observations and undertook experiments but until the development of probability theory by Pascal, Fermat and others, they had no theoretical framework within which to work. As yet there are no appropriate models and frameworks to help to understand complex, adaptive systems.

In most cases controlled, repeatable experiments are not possible. Hence researchers have to look to new ways of doing research by building detailed computer models. Igor Aleksander presented a demonstration of such an approach. The Neural Representation Modeller is a *meccano set or construction kit* for modelling regions of the brain based on technology developed at Imperial College. Alan Kirman observed that in economics, computer models have also been applied successfully in explaining the self-organisation of markets.

Another important aspect is the relationship between the behaviour of individual actors and the system as a whole, and in particular the role of networks. Interaction among the agents means that aggregate phenomena are intrinsically different from individual behaviour. In economics, for example, Professor Kirman noted that performance at the macro level bears little correlation to the behaviour of actions at the micro level, as standard theory suggests. Standard approaches focus primarily on the price mechanism and take no account of direct interactions between economic agents. In reality such agents exchange information, mimic each other, trade together, and influence each other's expectations. Interaction of this sort helps to explain phenomena such as herding behaviour, information cascades, bubbles, and the emergence of market loyalty, which are difficult to treat with standard economic models.

The case of customer loyalty emphasises the point. Based on a model of the Marseille fish market, it is possible to show that frequent purchasers will lock on to a seller and will cease to shop around, whereas infrequent purchasers fail to develop strong loyalty to any individual seller – a result with important consequences for Internet retailers. Similarly, a model of opinions within a financial market shows that traders follow experts in the short term but market fundamentals in the long term. The system does not converge to equilibrium, but gradually shifts between the two. Markets adopt this self-organising approach because it is more efficient. Such examples also emphasise the heterogeneous nature of individual agents.

Igor Aleksander argued that complexity offered a promising route to understanding consciousness. Here again traditional approaches in science and philosophy have failed to provide adequate explanations. "We know from the history of artificial intelligence that the programmers view of how intelligent systems work is rapidly running out of steam. We need an alternative approach," he said. "We should consider what makes a thing conscious. Is there a theory that will tell us what conditions the machinery of an agent needs to satisfy for us to believe it is a conscious agent?"

According to Professor Aleksander, consciousness can be considered as an emergent property from the architecture of the brain. Starting from a series of axioms regarding the conditions of an agent capable of particular sensory states, it is possible to show that conscious experiences require agents to have a functional support. In living systems these functional supports are states of firing of small groups of neurones. The mechanism for measuring these support functions is called the *j referent*, and in living organisms is found among neural groups that control and monitor muscular activity (eye movement, convergence focus etc.). Evidence for *j-indexed* neurones (also known as motor index neurones) in living conscious organisms is now overwhelming. Such approaches have already helped in the treatment of Parkinson's Disease by explaining the role of dopamine in controlling the motor neurones responsible for movement.

In discussion, a member of the audience asked how complex systems related to chaos theory. Professor Casti noted that the two were quite distinct but frequently confused. Chaos theory is the study of systems whose development is highly sensitive to slight changes in conditions, so

that small events can give rise to strikingly different consequences. It is a wider phenomenon that is often related to complex systems but is not the same. In complex systems the emphasis is on emergent properties as consequences of the adaptive behaviour of individual agents rather than on stochastic events. Professor Kirman agreed. “In economics there was a fad for deterministic systems with chaotic behaviour. In fact chaos is not the most important feature,” he said.

Conclusions and Future Directions

Universal patterns of system behaviour which are apparently independent of the properties of individual agents are observed in many areas of everyday life, as indicated by the wide range of practical examples presented. As networks assume a greater role in economic activity and in society as a whole, the study of complex systems will be key to understanding economic and social phenomena. Moreover, as Professor Aleksander’s presentation showed, complexity theory can provide new insights on challenging scientific problems.

Computer models are key tools in complex systems research. Indeed, the reliance on models as a means for primary investigation rather than as a means of manipulating empirical data represents a paradigm shift in our approach to scientific research. Greater efforts are needed in developing the models and frameworks necessary for scientifically rigorous experiments in a wide range of areas.

Complex systems research is inherently interdisciplinary. Policy-makers should recognise this and ensure appropriate mechanisms to allow exchange of ideas and the development of networks across traditional boundaries. The IST Programme’s Future and Emerging Technologies action already supports several projects and networks in this respect.

Additional Information

Estimated number of people attending this session: 125

Session Chair:
John Casti, Director, Santa Fe Institute, United States

Speakers:
Igor Aleksander, Intelligent and Interactive Systems Research Group, Imperial College, United Kingdom
John Casti, Director, Santa Fe Institute, United States
Alan Kirman, G.R.E.Q.A.M. Ecole des Hautes Etudes en Sciences Sociales, Université d’Aix Marseille, France

Commission Contact:
Ralph Dum (ralph.dum@cec.eu.int)

E-environment: Managing, Monitoring, Mobilising

Mobilising citizens and their representatives to address environmental issues is essential for achieving significant changes in global climate control. Within an Information Society this can only be achieved by a transparent information policy that is based on facts – facts that can only be derived from monitoring the environment on a constant and regular basis.

Main Issues Raised

Pavel Kabat pointed out in his speech a paradox. Global environmental monitoring and modelling resembles an inverse iceberg. " An overwhelming amount of theories, assumptions, models, and conclusions are based on only a very limited amount of available data," he said. The conclusions are clear – data sources must be identified and exploited. This includes data sources for past events. "Sensing the past helps us to understand what the environment is doing," said Professor Kabat.

One example is the long-term study of carbon dioxide in the atmosphere, which provides evidence that the level of this gas in the atmosphere within the last hundred years by far exceeds the levels in earlier epochs. Another example shows that in the mid-Holocene era the Sahara changed from a green zone to an arid zone.

The exploitation of data from present events concentrates on global hot spots, areas that affect not only the regional but also the global climate. Such hot spots are Africa (land degradation by overexploitation), South-East Asia (flooding, change of monsoon rains), Central Asia (dry zones), and the Amazon Basin (loss of rainforests). The Arctic Regions are a test bed with retreating glaciers, increased snowfall, melting sea ice, warming oceans, and thawing soil.

Based on a larger amount of data it has become possible to develop improved models. As an example, Professor Kabat, showed the results of an improved Climate Carbon Cycle Model. Simulation results obtained with this model predict, unfortunately, a higher global warming than indicated with earlier models. "This century will end not with a temperature increase of four degrees but with six or seven degrees," said Professor Kabat.

The tasks that lie ahead in data exploitation include a huge data consolidation effort using data from the last 50 years. The implementation of a consistent regional to global environmental sensing strategy needs to be addressed as does the development of an integrated data-model system for data assimilation to combine ground data (high resolution) with satellite data (low resolution).

Franz Jaskola reported on a new satellite system for environmental observation. Existing satellite systems are limited by optical constraints (clouds). TerraSAR uses radar technology (L-band) to monitor the environment. TerraSAR is part of the Global Monitoring for Environment and Security (GMES) initiative of the European Commission and was approved by the ESA Ministerial Conference in Edinburgh on November 15, 2001.

TerraSAR will be operational by 2006 and will provide environmental data of unprecedented accuracy. For example, it will be possible to distinguish between the different types of forests, calculate biomass, or show the distribution of nitrogen. Such data should provide a solid basis for assessment, planning, and public information. Information policy has to move from the *trust me* to *show me* with the purpose of *involve me*.

Providing public access to environmental data facilitates this move in information policy. Christiane Friedrich gave an overview of the efforts undertaken by her ministry to provide public access to environmental data for citizens of the State of North Rhine-Westphalia, Germany. This required a substantial effort in legislation, administration, and technology. While in the past data was buried in large mainframes, inaccessible to the public, the recent development of technology, and particularly the development of the Internet, have provided the possibility to disseminate such data to the public.

The Directive of the Council of the European Union (EU) *On Free Access to Information about the Environment*, dated June 1990, marks a change in information policy. This directive was transposed into German legislation in the Environment Information Law, which came into effect on July 16, 1994. A new version took effect on August 23, 2001. Based on the Aarhus Convention from June 25, 1998, the EU Directive is currently being revised. "The revised Directive is intended to guarantee that any natural person or legal entity is entitled without special reasons to have access to information held by or for the authorities," said Christiane Friedrich.

Citizens of North Rhine-Westphalia will from the beginning of January 2002, have the comprehensive right to inspect files and all other documents of the authorities. This right includes access to data produced by systems such as the air quality monitoring system (LUQS), the overall data and information system (DIM), the information system for hazardous and environment-relevant substances (IGS), and the meta-information system and environmental data catalogue for North Rhine-Westphalia (UDK-NRW).

Further information services in North Rhine-Westphalia include the Internet database *Good Examples of Sustainable Development*, Internet presentation for environmental education, sustainability strategies, and Agenda 21. Also included are the Internet services for production-integrated environment protection from the NRW Efficiency Agency, and an Internet area with numerous links to organisations in connection with the *One World* policy in North Rhine-Westphalia. "We do not only announce, we also inform," said Christiane Friedrich. Such information channels do not just have a service dimension for citizens but also have a political dimension – feedback from the public influences policymaking.

Wolfgang Teubner gave a systematic overview of information dissemination and communication techniques to citizens. Available channels are e-mail, public terminals (touch screen), web sites on the Internet, information boards and displays. These channels have the advantages of actuality, independence of space and time, availability on demand, and the possibility to combine information with feedback. For example, it is possible to provide up-to-date information about air quality, ozone, or noise. The public can be informed about emergencies and help-lines can be offered. Access to status reports and documents can be provided. Maps can provide Geographic Information System (GIS) based information on soil contamination, noise, etc.

On-line services can simplify and accelerate the processing of permits and applications and can provide information on demand. Public forums and message boards can facilitate public discussions. Feedback channels contribute to the participation of the public in planning processes, and allow continuous opinion polling.

Wolfgang Teubner suggested that it is important for the acceptance of these services by the public that the web environment is of a high quality, and that these services are combined with other web services (one stop shopping). Also, additional communication with citizens is crucial.

One questioner doubted the relevance of satellite data for decision-making. Current satellite technology, it was felt, does not always provide data suitable for early warning systems, for example, in the case of wildfires. Pavel Kabat replied that there are early warning systems in operation but that the stakeholders do not get enough information. Wolfgang Teubner noted that information must be digestible, and that there is a tendency to always ask for more information when decisions must be made. Further discussion concentrated on the need for additional investments in terms of information technology. Franz Jaskola doubted the need for additional hardware as the technical infrastructure is already in place and is used for other purposes, too. The session chair, Wolfgang Boch, mentioned the possibility of eco-balancing. Christiane Friedrich expressed the opinion that, “all this information technology is toxic waste.”

Conclusions and Future Directions

The session chair, Wolfgang Boch, drew three conclusions from the session. First, better data and harmonised data are essential but do not necessarily lead to better information of citizens. Second, it should be evaluated if individuals would be prepared to pay for environmental information if this is of such value. Final, the effect and impact of the dissemination of environmental information given to the public must be taken into account.

Additional Information

Estimated number of people attending this session: 40

Session Chair:

Wolfgang Boch, IST Applications for Environment Protection and Technologies for Humanitarian Demining, European Commission

Speakers:

Professor Pavel Kabat, Wageningen University and Research Center, The Netherlands
Wolfgang Teubner, ICLEI - International Council for Local Environmental Initiatives (http://www.iclei.org), Germany
Franz Jaskolly, inforterra GmbH, Germany
Christiane Friedrich, Deputy Minister in the Ministry for the Environment, Nature Conservancy, Agriculture and Consumer Protection of the State North Rhine-Westphalia, Germany

Commission Contact:

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The Semantic Web: Services Built on Knowledge

The World Wide Web is the product of a vision developed long before the current popularity of the web. The web is a place where people can deposit content and also make links between the content on one web page and the content on other pages, and between the content of one site and the content of another. In its present state the World Wide Web is a very disorganised collection of data, information and knowledge where retrieval is largely a manual process. Phenomenal growth in content on the World Wide Web is partly responsible for the chaotic situation that now prevails.

A new vision of the World Wide Web has recently been formulated. This new vision for the web is referred to as *The Semantic Web*. This is essentially seen as an information resource where there is more structure and it becomes possible to easily extract information and knowledge from content that is globally distributed.

The construction of the Semantic Web requires developments that will enable web content to be better organised and classified, as well as the application of knowledge-based technologies that will help to automate the collection of information and the extraction of knowledge from web content. The intention is to transform the web into an efficient information and knowledge source and to enable the development of value added services based on the web.

Main Issues Raised

Dieter Fensel, the session chair, said that the computer was invented as a device for computation, but it has now become a truly universal machine for it also provide a means of entertainment as well as an entry point to a world wide network of information exchange. He said, “a technology is now needed that supports access to unstructured and heterogeneous distributed information and knowledge sources. This technology is called the Semantic Web.”

Nigel Shadbolt's talk addressed the problem of extracting useful knowledge from information found on the web. He mentioned that everyone was now facing a deluge of data and information. The volume was overwhelming and there was a need to be able to extract useful knowledge from this. He mentioned that there were a number of important issues that needed to be addressed. The first of these was the development of shared vocabularies (also known as ontologies). These would provide the basis of a common understanding of the meaning of words used in different applications. Without such agreed vocabularies the present chaos would continue. He also stressed the importance of trust – knowing that data, information and knowledge derives from reliable sources. This was a major difficulty that would need to be resolved if the vision of value added services based on the Semantic Web were to become a reality. Content also needs to be annotated, preferably by automated means, if knowledge-based services are to be delivered based on web content.

Andreas Persidis, spoke about the Semantic Web as part of a knowledge intensive economy. He stressed that he believed that the distinction between old and new economies was inappropriate. The key issue for him was what kinds of processes added value in a knowledge intensive economy. He referred to something that he called the 'Lego Trend' in industry.

Using simple building blocks it is possible create arbitrarily complex structures, using basic interfaces that are very simple and hence flexible. These Lego type building blocks support a creative, bottom-up approach. These characteristics are the essence of the Semantic Web. He spoke about the devaluation of knowledge that occurs with time, and the need to bring different knowledge together to create new knowledge for competitive advantage. His primary points were that web services will become the nuts and bolts of the knowledge economy and that the Semantic Web movement needs to build on the experiences of Artificial Intelligence and move forward creating transparency in knowledge services.

Daniel Brickley, spoke about the activities initiated by the World Wide Web Consortium (W3C) that are being directed towards the development of the Semantic Web. He spoke about W3C which is a vendor neutral consortium that has been involved in many aspects of the development of the web including ensuring the architectural consistency of the web and the creation of maintenance specifications for web content and services. "The Semantic Web activity," he said, "is based upon evolving the current World Wide Web into something that better supports automation. The key tools for this are ontologies and resource description framework. The aim of W3C is for the semantics of ontologies to be defined by user communities." He continued, saying, "resource description framework provides a generic means of describing resources of any kind. The resource description framework makes use of Extensible Mark-up Language, and it also provides a means of helping to automate aspects of using the web."

The semantic web activity in W3C centres around working and interest groups looking at issues such as resource description framework, development of specifications, and achieving better integration of resource description framework with web services and Extensible Mark-up Language. A web ontology group is working to produce a more sophisticated, richer and expressive language through which user communities can expose the more detailed semantics of their onologies.

A question was raised about the difficulties of creating ontologies as these need to be consensual. It was felt that this was sometimes routine, but sometimes very hard depending on the situation. At the moment there are no good design guidelines for developing onologies. The key issue is capturing the rationale for representing the world in a particular way. The question of how to maintain ontologies in areas where rapid changes and developments are taking place is also a major problem, one for which there is as yet no solutions.

The question of quality of knowledge was raised. How does one ensure the quality of knowledge? Andreas Persidis felt that this was a difficult question to deal with, as there were certainly applications, for example in medicine, where high quality is needed. Ensuring quality on the Semantic Web is a big issue.

Maintenance was discussed. This is often addressed as an afterthought but is in fact a central issue. There is a need to acquire knowledge with a view to future maintenance. There was agreement that not enough attention was paid to this subject.

The issue of dealing with both general and specific knowledge was addressed in the discussion. Nigel Shadbolt said, "one way forward was to create high level abstract ontologies, and then to specialise these to cases. However there is a view that onologies are task dependent and that mapping between ontlogies or merging ontologies is hard. There is

also no single best ontology. It is unlikely that there will be single uniquely accepted ontologies."

Conclusions and Future Directions

The creation of the Semantic Web provides an opportunity for technologies to be used to serve people. Application of technologies offers the potential to make the web easier to use, more user friendly and to automate the extraction of knowledge from the data and information on the web. The challenges that lie ahead include the construction of shared vocabularies, the development of automated means of annotating web content, especially legacy content from current web sites, dealing with the authentication of content (a question of quality and trust) and maintenance of content. A major challenge is using knowledge technologies to create a more automated approach to using the web and extracting knowledge from the vast resource that is the World Wide Web. Ensuring the quality of the knowledge provided is a major issue to be resolved if knowledge-based web services are to be widely accepted.

Additional Information

Estimated number of people attending this session: 120

Session Chair:
Professor Dieter Fensel, Vrije Universiteit Amsterdam, The Netherlands

Speakers:
Professor Dieter Fensel, Vrije Universiteit Amsterdam, The Netherlands
Professor Nigel Shadbolt, University of Southampton, United Kingdom
Dr. Andreas Persidis, Biovista, Greece
Mr. Daniel Brickley, University of Bristol, United Kingdom

Commission Contact:
Franco Mastroddi (Franco.Mastroddi@cec.eu.int)

E-safety – Intelligent Vehicles

"During the short time of this session, statistically more than six people will stop breathing owing to their involvement in a traffic accident, in Europe alone. In 2020, road traffic injuries and fatalities will be the world's third biggest cause of death, up from ninth place in 1990, if we do not do anything about it."

This statement, made by Lars Lind, set the scene for the ongoing efforts of the automotive industry to improve the safety of vehicles via the means of electronics. An ever increasing number of vehicle based computers (currently up to 33 computers per vehicle) provides an ambient intelligence environment for the driver that helps to avoid collisions, limit the impact of collisions if they happen, and assist in cases of emergency. The common philosophy behind these efforts is to leave the driver in control. This requires the development of human-machine interfaces (HMI) that are easy to understand and effective to use. As the session chair, Olivier Mossé, put it, "it is extremely difficult to change the behaviour of everyone."

Safety is not the one and only goal in automotive development. Other goals such as economy and ecology may conflict with safety issues. Finding the optimal compromise between conflicting goals is an ambitious task for engineering disciplines.

Main Issues Raised

E-safety systems can be classified into active systems and passive systems. Active systems help to avoid collisions or start rescue initiatives after a collision while passive systems limit the impact of a collision by protecting the occupants of the vehicle.

The focus of active systems lies in driver awareness and driver workload. André Rault said, "the driver has to be the focus of everything." During the development of human-machine interfaces it must be taken into account that the driver has never been trained to operate these systems, and that the range of drivers is very wide.

Passive systems protect occupants against the impact of collisions. These include restraining systems that act in the moment of a collision such as air bags and seat-belt restraints, but also systems that modify the interior of the vehicle before a collision when immediate impact is discovered by the system.

Research on active safety systems is co-ordinated through the Advanced Driver Assistance Systems in Europe (ADASE II) Programme. ADASE defines a safety architecture, which is organised in layers:

- On the vehicle level there are local systems such as Anti-lock Braking Systems (ABS), Electronic Stabilisation Program (ESP), Brake Assistant System (BAS), but also systems to enable and protect the driver. Such systems include *what you see is what you need* (WYS-WYN) systems that avoid information overload or systems that ensure a fixed and optimal eye position, but also simple systems such as a seat belt reminder.

- The second layer consists of vehicle-to-vehicle systems, such as Adaptive Cruise Control (ACC) measuring the distance between vehicles, or stop-and-go systems that allow cars to follow the vehicle in front automatically. These systems can be based on camera, radar, laser, or vehicle-to-vehicle radio.
- The third layer consists of systems that are environment aware, such as lane departure warning systems (currently used for trucks), speed limit warning systems, night vision systems, advanced front lighting systems, obstacle detection, pedestrians and cyclist detection, immanent impact detection, etc. These systems can be based on cameras, laser, radar, or radio buoys integrated into the environment. Improved Global Positioning System based navigation can inform the driver about speed limits, can make speed and lane suggestions and issue curve warnings. Information can be retrieved from travel and road management to give travel advice, or be exchanged with emergency services in cases of breakdowns or accidents.

It is important that the safety architecture is seen as an integrated part of the vehicle. The need to purchase and operate separate add-on safety gadgets is not acceptable.

The development process for new safety systems takes place in the following phases:

- Traffic accident research and literature study.
- Requirement specification and definition of scenarios.
- Architecture and product development.
- Development of prototypes.
- Laboratory tests.
- Production.
- Market introduction.
- Monitoring of effectiveness.

However, a complete safety architecture not only requires the efforts of car and component manufacturers but also the contributions of all stakeholders such as road traffic authorities, municipalities, police, etc.

The following organisations are involved in programmes for automotive safety:

- EUCAR was established on 27 May 1994, evolving from the previous Joint Research Committee (JRC) of the European motor vehicle manufacturers. Following on from the scientific co-operation carried out by the JRC, EUCAR has begun to foster strategic co-operation in Research & Technological Development (RTD) activities. The members of EUCAR represent the major European motor vehicle manufacturers: BMW Group, DaimlerChrysler, Fiat, Ford Europe, Opel, Porsche, PSA Peugeot-Citroën, Renault, Volkswagen Group, and Volvo.
- ERTICO is a Europe-wide, not-for-profit, public-private partnership for the implementation of Intelligent Transport Systems and Services (ITS). Set up in 1991 on the initiative of the European Commission as well as key members of European ITS industry and national governments, ERTICO is open to any European organisation or international organisation operating substantially in Europe.
- CLEPA is the European umbrella membership organisation for the global Automotive Supply industry. It represents 80 of the world's most prominent suppliers for car parts,

systems and modules. National trade associations and European sector associations from 18 countries represent more than 2,500 companies.

Conclusions and Future Directions

Future research efforts need to be directed towards the development of sensors, improved communication, occupant sensing, adaptive chassis and intelligent vehicle structures, road infrastructure (intelligent road), driver modelling, simulation, fail-safe systems, and design and manufacturing of affordable systems.

Additional Information

Estimated number of people attending this session: 50

Session Chair:
Olivier Mossé, CEO, Ertico, Belgium

Speakers:
Berthold Ulmer, Manager – Research and technology, Daimler-Chrysler, Germany
Dr André Rault, General Secretary, Eucar, Belgium
Lars Lind, Volvo Car Corporation, Sweden
Gianfranco Burzio, Fiat Research Centre, Italy
Gerhardt Pellischek, CLEPA European Association of Automotive Suppliers, Belgium

Commission Contact:
Juhani Jaaskelainen (Juhani.Jaaskelainen@cec.eu.int)

Interdisciplinary Research: When Hard and Soft Sciences Meet

Monica Schofield, who at the last minute stood in for Professor Joyce Tait, chaired the session on Interdisciplinary Research. After addressing the focus of this session – research at the boundary between hard and soft sciences – she emphasised the notion that *technology should work in the real world*. The contributions to this session covered a great variety of topics, ranging from urban sociology to safety studies, from designing new work environments to building very large ships. They have one thing in common – finding an interdisciplinary approach by integrating hard and soft sciences.

Main Issues Raised

Guido Martinotti – who teaches urban sociology – started by discussing how technology, from a historical point of view (*Surfing the Tsunami*), influences the way of life in a city. He observed changes with high impact that come from fast communications and information development. This had already started by the time printing was invented. Today it is the miniaturisation of information. The technology of mobility and the technology of information did not substitute for one another, but combined into new paradigms. For work, the technology has had a major influence, but this is also the case for housing.

After this, the speaker related this trend to some characteristics of the 20th century metropolis. Buildings define the old city, and the new city is defined by its energy use. The 20th century metropolis was designed for the commuter. The shape of the city in a physical sense expresses the city as a place where people sleep, not where things are happening. Mr. Martinotti then gave an excellent example of interdisciplinary research in action. He studied the movement of people in a city (usually a sociological effort) with the use of the Global Positioning System (GPS).

The next speaker was Anne-Sophie Nyssen from the Department of Psychology at the University of Liege. She focused on the need for multi-disciplinary research in studying the relationship between technology, safety and human error. After disasters like Three Mile Island in 1979 in the United States, safety studies were driven by intense interdisciplinary considerations. In the past these studies focused on human error, but Mrs. Nyssen argued that this is a narrow technological oriented view and that reality is more complex. “Complex systems fail because of the combination of small and sometimes latent failures, each individually insufficient to cause an accident,” she argued. “Besides unsafe facts there are other organisational and technological factors that are important.”

She gave examples of multidisciplinary research in this area, like the healthcare sector project. In this study, scenarios and simulation were used to obtain rich results including activity and system analysis, man-machine interaction, and analysis of problem situations and problem solving skills.

The third speaker, Norbert Streitz, was a walking example of an interdisciplinary researcher, with doctorates in both physics and psychology. He is head of division at GMD-IPSI and he discussed an interdisciplinary approach for the design of smart artefacts. In his presentation

Ambient Agoras, he focused on human-computer interaction, activity space and architecture. "Today, computers are primary artefacts, because the computer is an access point to information. However, human-computer interaction is not the goal," he said. He called this the *calm paradigm*. "The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life," he said, "and we should not be directly aware of the computer as a device."

He went on with the presentation of activity space and architecture by noting that there is a shift underway. Activities have become more mobile and work is wherever someone happens to be. This changes the role of buildings, as most activities can be done at any time at any place. Users are still real people interacting with other people and artefacts around them. The real environment has a new role for all activities and is less a space for the individual world, but more for social interaction, for example, informal communication and team co-operation.

Then he gave some examples of the design approach of AMBIENT at IPSI, which can be characterised by human-centred communication and a co-operation landscape – ROOMWARE for Co-operative Buildings and Future Office Dynamics. Another example was called *Ambient Agoras* (agora means marketplace). The goal here was to transform places into social marketplaces of ideas and information (agoras). The design approach was driven by the creation of *bits-of-life* (very small episodes). Then there was the aggregation of scenarios and the building of video mock-ups by making fake movies. The next step was building a functional prototype. Focus groups consisting of people in a working environment looked at the videos. A combination of technical and design studies, a prototype and test-bed evaluation completed the interdisciplinary design process.

The final speaker was Torben Anderssen, Executive Vice-President of Odense Steel Shipyard. He gave an interesting picture of industrial reality in his talk called *Putting Multidisciplinary Work into Industrial Practice*. Although it is very difficult to find anything soft in shipbuilding, and information technology is used everywhere, shipbuilding is a complex and multidisciplinary process. An important area in shipbuilding is system integration. Peoples' motivation and qualification are not in the system and psychology and sociology are very powerful in this manner and can boost productivity.

An issue in the debate following the speeches concerned the funding of long term interdisciplinary research. There was a short debate whether long-term funding really was the issue, or that it was more a question of establishing a tradition. Anne-Sophie Nyssen found it very difficult to find long term funding for this type of research. "It requires entrepreneurial skills from a researcher to continuously find new sources of funding, but it is a risk, and hard extra work," she said. Norbert Streitz added to the discussion. "It seems sometimes that interdisciplinary research is something exotic, but if you look around in the world there is more and more a trend to acknowledge that you need a lot of different people to do something, for example the process of making a movie," he said.

Conclusions and Future Directions

The main conclusion drawn by Guido Martinotti was that more then ever before, people now talk and interact with other people they really do not know. This results in a shift in theoretical, practical, and technical concepts of society and can be described as a development from the traditional movement of *Gemeinschaft* towards *Gesellschaft*: *Vernetzenschaft*. The

consequences for society are not clear yet. This is very much a subject for multidisciplinary research.

According to Anne-Sophie Nyssen future research in the field of safety studies should be characterised by a long-term focus and application of multiple techniques to collect data. Work analysis should include cognitive, context and organisational aspects. User-interactive scenarios should be developed as the basis for shared language and collaboration within the interdisciplinary team, along with feedback for the user and assessment in the field.

Norbert Streitz saw a clear future for *co-operative buildings*, serving the purpose of co-operation and communication, but also being co-operative towards their inhabitants and users via attentive, intuitive and learning interfaces. The human being is in the centre of attention. He challenged the audience to look *inside out* to social space, architectural space, information space and mental space.

From his experience Torben Anderssen concluded that new technology enables people whom otherwise would not be able to do a job any more, to do it with the help of robots and computers. Further integration of technology in the work process may well be possible but does not always lead to further improvement of the working situation, as there are some natural cut-off points. These may well be related with culture and habit. In his observation people are the key in establishing where and how essential contributions can be made.

The final conclusion was that multidisciplinary research is everywhere. In this age where technology has become so closely integrated with the human process, no development can effectively take place without a multidisciplinary approach. Interdisciplinary approaches offer great opportunities to explore new ways of working, studying, living, designing and building, and place the human being in the centre of development.

Additional Information

Estimated number of people attending this session: 75

Session Chair:
Monica Schofield

Speakers:
Guido Martinotti, Universita' degli studi di Milano-Bicocca, Dipartimento di Sociologia, Italy
Anne-Sophie Nyssen, Department of Psychology, Université de Liège
Norbert Streitz, Head of Division, GMD-IPSI, Germany
Torber Anderssen, Executive Vice-President, Odense Steel Shipyard, Denmark

Commission Contact:
Karl-Heinz.Robrock (Karl-Heinz.Robrock@cec.eu.int)

Will Moore's Law Make Your Application Dreams Come True?

Moore's law states that the increase in complexity of microprocessors and other types of semiconductor integrated circuits, will double every 18 months. History shows that so far this has been the case and in fact the observation made by Gordon Moore has become a self-fulfilling prophecy. This doubling in complexity has resulted in a phenomenal growth in the amount of computing power available on a single microprocessor chip. However, the cost of developing these chips and providing production facilities is also growing, and the profits from one generation of chips are needed to finance the development of the next generation.

This session addressed a number of issues surrounding Moore's Law. One of these was the extent to which Moore's Law was driving the development of applications. Another concerned the importance of Moore's Law in different industrial sectors. The question of whether in some sectors there are more important issues other than available computing power was considered. The session also addressed what will come after the microtechnologies of silicon, when it is no longer feasible to reduce the size of a silicon transistor. The session addressed the topic of nanotechnologies, seen by some as the step that eventually lies beyond the micro.

Main Issues Raised

In his opening remarks, the session chair Roger De Keersmaecker, mentioned that the theme of the conference was *Technologies Serving People*. A new era was emerging in which computing was becoming invisible – microprocessors are embedded in many objects and interactions with these devices needs to become more user friendly and less reliant on keyboards and other traditional interaction devices. “Achieving a situation where computers are ubiquitous and interaction is natural and effortless requires a massive research effort,” he said.

Bernard Goffart, spoke about applications centred around broadband residential applications. These applications include home entertainment, home automation and learning. The vision here is one of more applications and communications with silicon technology everywhere and always switched on. Moore's Law appears to be fundamental in achieving this vision, by providing increased computational power for signal processing and applications. The goal is a system on a chip, and one of the main drivers for this is cost reduction. Achieving a system on a chip requires more complexity on chips, in other words Moore's Law is an enabler.

Peter van Staa spoke about applications in the automotive industry. He said that in the automotive sector there were many application specific components, with up to 50 per cent of the electronic content in cars falling within this category. There were also many different types on applications in cars, including motion sensing, ignition, in-car entertainment, navigation, and environment sensing. Many applications have the potential to either improve safety or fuel consumption. However one of the main challenges was reducing warranty costs. Cars represented a harsh physical environment and there was a significant need to reduce component failure. There is a problem referred to as a design gap. Design productivity is increasing more slowly than the complexity and capabilities of the technology. In conclusion,

therefore this speaker felt that Moore's Law was not the main issue in automotive applications, there being other more significant problems to address.

Jürgen Moll, spoke about smart card applications. “Smart cards provide the basis for secure transactions,” he said. Smart card technology provides the personal enabling factor for a networked society. Smart card technology, however, is about three to five years behind the technology that is used in personal computers and other advanced applications. The risk of damage to the smart card electronics means that the usable space on a smart card is limited. There is a need therefore to increase the complexity of the usable space to provide new functionality and better security. Therefore, Moore's Law is relevant, even though the smart card industry is still working with earlier generations of microprocessor technology.

Ayman El-Fatatry, talked about nanotechnologies and what will happen when the physical limits of silicon technology have been reached. He said that the physics were different on the nanoscale. Surface effects predominated over bulk effects and the materials were also less stable. Nevertheless, there was significant application potential, for example in creating drag free materials for aerospace, or carriers for other materials, or super strong materials. He mentioned that there were already companies selling products based on nanotechnology. Manufacture of nanomaterials was a significant challenge, as was the scaling up of processes for mass production.

A question was asked about the use of optical technology in microprocessor chips. Jürgen Moll said, “every relevant technology that can be brought in to use would be used if there was an application for the technology.”

The cost of developing nanomaterials was discussed. The development of new generations of silicon technology is paid for from the profits generated by earlier generations of technology. This raised the issue of how the development of nanotechnology would be funded. Ayman El-Fatatry felt that this was an issue, but that it was not the major problem that had been implied by the question. He said, “many different industries are interested in the technology and what needs to happen is that these different contributors should work together. The important point about nanotechnology is that it is relevant to industry in general and is not just an issue for the semiconductor industry.”

Conclusions and Future Directions

In the area of broadband residential access, the key issues are achieving improved signal processing and development of systems on a chip. System on a chip implies increasing chip complexity and also better design methods, especially at the system level and achieving hardware and software co-design. Moore's Law is therefore important in this area. In the automotive field some of the main challenges are better design methods and improved packaging. For this industry Moore's Law is not the main concern. In the smart card industry Moore's Law is of relevance as there is a need to add more to a limited area on the card. Looking towards the end of Moore's Law, when the physical limits of silicon have been reached, nanotechnologies may provide a way of enabling the continuation of this law. It is likely however that silicon will still be used in conjunction with nanotechnologies. It is certainly the case however, that many applications still need Moore's law, and will continue to do so for some time to come.

Additional Information

Estimated number of people attending this session: 90

Session Chair:

Professor Roger De Keersmaecker, IMEC, Belgium

Speakers:

Professor Roger De Keersmaecker, IMEC, Belgium
Bernard Goffart, Alcatel Microelectronics, Belgium
Dr. Peter van Staa, Robert Bosch GmbH, Germany
Dr Jürgen Moll, Giesecke & Devrient, Germany
Dr Ayman El-Fatatry, BAE Systems Advanced Technology Centre, United Kingdom

Commission Contact:

Ronan Burgess (Ronan.Burgess@cec.eu.int)

The IST Programme in 2002 and Beyond

In the opening session of the conference, Commissioner Erkki Liikanen presented the objectives of the IST programme and the priorities in the Sixth Framework Programme, along with its general context. The closing and final session of the conference addressed the achievements of Framework Programme V over the past year and provided a further insight into its content and the rationale behind this content.

Main Issues Raised

"Most if not all IST areas are at a junction point between (i) a maturing generation of products and services and (ii) a new wave of technology and applications that will bring a breadth of new products and services," according to Peter Zangl, Deputy Director General of DG INFSO. He emphasised that the current wave of transitions or disruptive shifts results in uncertainties and risks but also larger opportunities. As examples he presented the transition from Global System for Mobile Communications (GSM) to Universal Mobile Telecommunications System (UMTS), and the move from Internet Protocol Version Four to Internet Protocol Version Six. He mentioned that there were many other transitions addressed from several perspectives during IST 2001 conference.

Submission of the Commission's proposals for the Framework Programme (February 2001), the Specific Programmes (May 2001) and the rules for participation (September 2001) to the Council and Parliament has been completed. The European Parliament has already voted a series of amendments to the Framework Programme text, amendments that the Commission has already responded to with a modified proposal. If the Research Council reaches a common political position in 2002, a common decision between Parliament and Council will be possible for the end of spring 2002. This would allow the launch Framework Programme VI as planned.

The Commission proposal for IST in Framework Programme VI is based on three main principles:

- A further concentration of the effort so as to build critical mass and contribute significantly to the strengthening of European competitiveness and the building of a knowledge society for all.
- Emphasis on forward looking and high-risk research that fosters creativity and innovation.
- Simpler, more efficient and more flexible implementation mechanisms and practices.

The Programme proposal for IST focuses on three key technology building blocks (communication and computing infrastructures, components and microsystems, knowledge and interface technologies) that will reinforce Europe's strengths and help overcome some critical weaknesses. A fourth research area that addresses societal and business applications that are highly demanding in terms of technology development complements these. As the IST programme in Framework Programme V has three Key Actions that are applications oriented, and one on essential technologies, there is a clear shift in Framework Programme VI towards research in the core technologies rather than applications.

One of the points of worry in the current Programme was that in its first two years, the average time to contract had reached a peak of around 250 days from proposal submission to contract signature. Mr. Zangl expressed the Commissions' commitment, to bring this down to 150 days, as a first step, and to introduce several simplifications. A first pilot during the Sixth Call procedure showed that this would be possible.

For the Sixth Framework Programme Mr. Zangl promised:

- Fewer contract forms.
- Shorter time between Call deadline and start-of-contract.
- Larger autonomy and flexibility to consortia to adapt to technology and market changes.

The IST Advisory Group (ISTAG) advises the IST Programme Management about the future course of the Programme. Its chairman, Angelo Airagi, explained that the context for IST had changed so much in the last year. The financial situation of the IST sector had decreased, and this is now reinforced by a global economic recession. In addition, the September 11 attack on the World Trade Centre in New York changed the whole concept of security. It is now clear that there are people and organisations that are capable and willing to inflict large-scale damage.

The importance of IST for the economy and the whole society remains vital. Information Society Technologies have the potential to address societal challenges and can enhance competitiveness and create new business opportunities. In its nature it affects all other science and research fields.

In order to address the uncertainties for decision-making, ISTAG has emphasised the need for research as an *anti-cyclic* activity in which public support is key, and risk sharing is a necessity. It needs to anticipate, but also to react to change. Scenarios may help with the preparations for uncertain events to come. Following this philosophy, ISTAG has developed the *ambient intelligence* scenarios to assist in selecting the core needs for IST research in their robustness across a wide set of uncertain future developments.

Core elements in this vision are:

- Bringing people to the foreground and putting technologies in the background.
- Almost invisible – present everywhere, embedded in everyday objects.
- Offering natural, intuitive and personalised interactions using all our senses.
- Providing an expanse of applications and services.

Philippe Geyres, a member of ISTAG and Vice President of ST Microelectronics, focused his contribution at microelectronics, this being at the heart of all Information Society developments. He said that Moore's Law (complexity in microelectronics doubles every 18 months) would continue to happen for many years to come.

By continuing investment in the semiconductor industry he predicted that from the 250,000 jobs today, Europe could double this amount in the next 10 years to come. Over the last years Europe has already improved its position on the world market considerably, as now three out

of 10 companies in the semiconductor top 10 firms is European. This was only one out of 10, about 10 years ago. However, Europe has still *only* half of its *fair share* of the semiconductor industry, when taking into account that the market accounts for 22 percent of the world market, but supply is only 11 percent.

Again emphasising the central role of semiconductors in the total electronic equipment industry, he urged political support for further development of the sector. "As microelectronics is core to all new technology, Europe cannot win without a strong microelectronics sector," he said.

Conclusions and Future Directions

The session was concluded by Gerard Comyn, Head of Unit for Workprogramme preparation and cross Programme themes in the IST Programme. He pointed out that today the IST community has its head in Framework Programme VI, but its feet in Framework Programme V. He summarised what remains to be done in Framework Programme V, and what should be done in Framework Programme VI:

- Emphasis in Framework Programme VI on the ambient landscape vision.
- Reduction of "time-to-market" from proposal to contract.
- A first call under Framework Programme VI hopefully by the end of 2002, but more realistically early 2003.

The current Call for proposals is intended to bridge the Framework Programme V activities towards the Framework Programme VI. The call launched on 16 November has 35 Action Lines open, including four specific lines on Framework Programme VI bridging. More information is available on the Cordis web site (http://www.cordis.lu/ist).

The key question relating to the theme of this year's conference, was how to make sure that this next wave of technology development was designed in order to serve people and not to force people to adapt to the technology. The conference sessions have addressed IST through this essential angle.

IST and Framework Programme VI will only succeed if interaction between Commission and community continue. What is at stake is immense. Research and Development in IST is essential not only for the IST industry but for all industries, for addressing major societal challenges and for supporting all science and research fields. It is a major component of the European Union's global policy towards the knowledge-based society.

Additional Information

Estimated number of people attending this session: 250

Session Chair:

Gerard Comyn, Head of Unit for Workprogramme preparation and Cross Programme Themes in the IST Programme

Speakers:

Peter Zangl, Deputy Director of DG Information Society

Angelo Airaghi, Chairman of ISTAG and Vice President of Finmeccanica
Philippe Geyres, Member of ISTAG and Vice President of ST Microelectronics

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