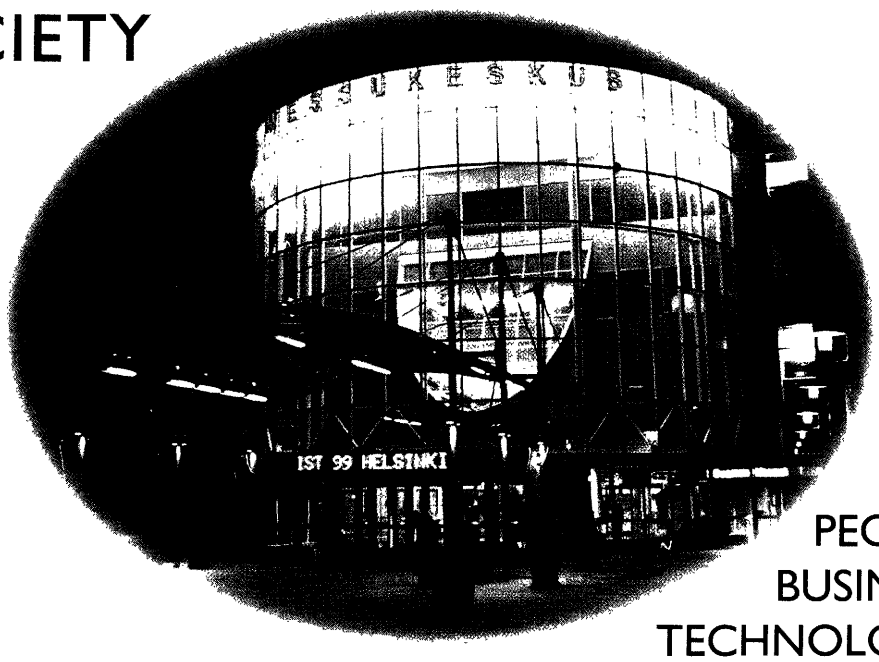
IST 99 HELSINKI

INFORMATION SOCIETY TECHNOLOGIES CONFERENCE 1999 IN HELSINKI

FINAL REPORT

22 - 24 November 1999

EXPLORING THE INFORMATION SOCIETY



PEOPLE
BUSINESS
TECHNOLOGY

Conference and exhibition organised by:

EUROPEAN COMMISSION
Information Society
Directorate-General

Finnish National Technology Agency
TEKES

FOREWORD

It is my honour to hereby present you the final report of the IST 99 Conference. The conference was held last November in Helsinki and jointly organised by the European Commission and Tekes, the National Technology Agency of Finland. The final report summarises the main conclusions from the conference and provides independent observations by external rapporteurs on the conference sessions and workshops. I expect that the report will provide valuable guidance for future work in the Information Society.

The IST 99 conference set out to provide a meeting place for jointly exploring the road towards the future Information Society, for building new partnerships, and for renewing our commitment to realise an Information Society that brings benefits to all.

The most advanced policy and technology developments for the Information Society were subject of intense debate at the conference. While at was not the intention to reach definite conclusions there was a clear impression of progress and growing understanding.

A number of new international collaborations have been launched including the Global Cities Dialogue, the EU-US dependability initiative and the Euro-Latin American IS Initiative. No doubt there is also a concrete follow-up to the many personal contacts and to the investment opportunities that were presented at IST 99.

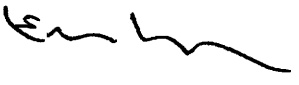
The European Commission is committed to bringing the benefits of the Information Society within reach of all Europeans. In particular I mentioned at the conference the eEurope initiative. Its ambitious and concrete targets were presented in full extent by President Prodi last December (see also http://www.ispo.cec.be/eeurope-initiative.htm).

I think we succeeded in achieving the objectives of the conference, as also shown by a survey conducted among the participants (91% rated the conference good or excellent). IST 99 provided a unique meeting place for the Information Society community with over 3200 participants of which more than one-third from outside the EU.

I can also highly recommend the IST 99 Website, www.ist99.fi, where the full proceedings of the conference have been made available as well as the survey of participants' opinions about the conference.

I trust you will find the report interesting reading and I look forward to your suggestions for future work in making the Information Society a reality for all in Europe.

Sincerely,



Erkki Liikanen
Member of the Commission

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SUMMARY

IST 99 was Europe's largest information society conference in 1999, with over 3200 delegates from business, research, politics and public administration, of whom one-third were from outside the European Union. IST 99 featured 200 speakers in 40 sessions and workshops, with an exhibition of over 100 stands.

The topics addressed at this conference ranged from Internet policy to next-generation microprocessor technologies, from the future of networking to the contribution of children in the information society.

From this wide range of topics and the variety of participants and interests some main trends and themes could be observed in the inter-related categories of economy, society, policy and technology. These observations, as reported in this summary and the attached individual session reports, are intended to contribute to the shaping of our future information society policies and programmes.

Policy

The leitmotiv of IST 99 was the interplay of technology and policy. Participants showed keen interest in the sessions that addressed the revision of the telecommunications regulatory framework as driven by rapid technology developments; the mix of regulation and self-regulation and technology required to manage Internet domain names or to combat cybercrime; and the challenge of convergence and governance in the digital age.

The technology-policy theme is extremely challenging: the subject matter is difficult and multi-disciplinary; example (partial) solutions are only just emerging in a few areas; interests are often opposing, as was visible at the conference. Yet the theme is at the core of how we want the future society to look. Therefore it should not disappear quickly from the agenda and we should assess progress in these matters at next year's conference again.
The debate on convergence presented a variety of views and approaches, depending on the background of the presenters: telecommunications operator, media company, internet start-up, regulatory authority and so on. While there is not yet a common shared vision there is agreement that the future convergence policy needs an integrated approach with respect for diversity. A number of policy principles for this have been formulated in the Commission's Convergence Green Paper.

The new approach in increasingly liberalised and converging communications markets is to reduce regulation and rely more upon competition policy, as exemplified by the Commission's work in the Telecommunications Review. Ongoing liberalisation including increasing competition in the local loop is to make the information society better affordable and thereby accessible for all.

A clear policy imperative emerged related to the speed at which Europe can act in regulation and self-regulation for the information society. In an environment in which whole new commercial phenomena can arise in under a year the traditional ways of policy making are no longer adequate.

The strong international participation in IST 99 confirmed the important role of the information society in supporting and advancing international co-operation policies, for example towards accession countries.

Economy

Many discussions focused on the economy of the information society. In this 'new economy' the emphasis is increasingly on intangibles such as digital information products, services, knowledge and skills. New views are emerging about value and value creation, signalling a paradigm shift in the way business is being done and is being valued. These include the willingness to contribute to the 'cooking pot' of the new economy as long as one assumes that there will be a fair return in the long run for everyone. This is exemplified by the open source software movement which was prominently present at IST 99, as well as by other parts of the intangible econo-

my such as new electronic commerce business models in digital content and virtual communities. These are approaches that are now further explored and encouraged in the Information Society Technologies work programme for 2000.

Another view on value and valuation came from the investment world, which was strongly involved in the IST 99 Investment Forum. The US has consistently been investing about two and a half times more than the EU in intangibles. This happens, in particular, in intellectual capital (people and intellectual property rights) as well as in innovation potential of the industrial structures and in brands. Stock markets reward the value of these intangibles even if book value does not reflect this. The US experience is a strong indicator for Europe to invest in skills, innovation, RTD, and market development for the information society.

At an international conference such as IST 99 it is no surprise that globalisation of the economy featured prominently, amongst others in the 'global versus local' debate. As global traders take over local markets in many respects, local traders have to redefine their markets. It was stated that a region that presents a development strategy which recognises the global dimension gains credibility and becomes locally attractive. In this sense the trend in the economy is from local to global, rather than local opposed to global.

Many other themes related to the economy were discussed, of which sustainability is highlighted here. Economic growth is needed in order to enable investment in a more sustainable world. The information society, by creating value in intangibles, can indeed lead to economic growth without increasing the burden on the environment. However, this does not happen automatically. Better understanding the relationship between sustainable development and the information society calls for interdisciplinary research.

Society

Commissioner Liikanen announced at IST 99 a new initiative, 'eEurope – an Information Society for All'. This sets out to achieve wide-spread participation, broad take-up and inclusiveness in the information society, which were also key themes at IST 99. One session concluded that, despite all recent progress, 60% of citizens still are not convinced that they can benefit from information society technologies in their daily life and business. Therefore the emphasis needs to be on increasing the understanding of what is going on and how to act in one's own situation. Moreover, we need to learn how to learn, reflecting the move towards a continuous learning culture. In this way we can maintain the value of society's investment in people and skills and enable currently excluded people to participate in the information society.

With increased mobility, increased networking as well as new ways of working and new lifestyles are being enabled. People are seeking to create a 'multiple-win' situation, for them as individual, for their family, for their organisation or company, and for the society.

It was shown at the conference how inclusiveness can be enhanced by community interaction for which the Internet provides new opportunities. Communities have members with rights and obligations and go beyond economic value. Community building in the information society creates new opportunities for example for people with special needs and abilities.

Specific attention was given to the role of children in the information society, as they are becoming active participants and shapers of their own future world.

Technology

Networking was everywhere in IST 99. Moreover, it was stated that in the near future 'everything is mobile'. The vision is that the future 'ambient' networks will connect people and connect things everywhere and at every moment in time. This will lead to new paradigms for network management, for services and applications, and for the way we live and work.

With the first licenses for third generation mobile networks (3G) being issued in

Europe at the time of the conference and the next generation networks (4G) already around the corner there is scope for co-ordinated RTD within the IST programme aimed at the new services and applications. Both operators and (new) service providers should be involved to test the technology and business models and to articulate the paradigm shift that is implied by 'everything is mobile'.

It is likely that the future networks will enable many applications to flourish. The analogy is with electricity, which is ubiquitous today but has no longer a single killer application. The set of opportunities is rich, enabled by emerging technologies and standards such as UMTS and WAP. The applications need to become sources of convenience rather than exposing the users to the complexity of the future ubiquitous and ambient networks. It was argued that to master the complexity a wide variety of players and disciplines are needed: technology, architecture, business models, industrial design, sociology, ethnography and so on.

Emerging information society technologies also support the trend towards more dynamic behaviour in communication and collaboration, in business, in work and even in personal lifestyle:

- Future networks will have to deal with more frequent node disconnection and transient network membership. They will be more fluid and temporary networks rather than the rather static and predefined networks of today.

- The future economy will be characterised by more dynamic business relationships for which new technologies are needed that can mediate and broker such relationships and which provide trust and confidence in an increasingly dynamic, open, international and multi-cultural environment.

- Future work relationships will be more flexible, with more people selecting the companies they wish to work for at any moment in time to develop their own career and improve their employability rather than being satisfied with being in employment. People will more often choose to work in a team spanning several enterprises rather than within a single company department.

- Future work settings will be much more on-the-road and at home rather than in the traditional office. Work technologies will be needed to support such dynamic contracting, team work, mobility and the co-existence of work and non-work.

With increased dynamics, increased mobility, increased globalisation, language technologies become ever more important. Language technologies are needed to mediate international electronic commerce and to create even better usable mobile communications. They are also essential to boost the local information society enabling the 6700 world languages to thrive rather than be threatened by extinction. This has already proven to be an area that is suited par excellence for international collaboration.

Exciting new areas were explored at IST 99. In particular interdisciplinary research was being addressed, not only in the sense mentioned above to understand the interaction between policies and technologies, but also between technology areas. Biological sciences provide promising new insights for information and communication technology, in areas such as neurocomputing. Biological metaphors such as evolution and self-organisation are being applied in such different areas as complex networked systems and electronic business in the emerging digital economy.

Results

The concrete results of IST99 may not always be visible to the organisers, the European Commission and Tekes, the Finnish National Technology Agency, but undoubtedly there is a concrete follow-up to the many contacts that participants have been able to establish, to the investment opportunities that have been explored in particular at the Investment Forum, and at the exhibition and to the policy and research insights gained at the conference.

A number of international collaborations have been launched, including the Global Cities Dialogue, the EU-US dependability reliability initiative and the Euro-Latin American IS initiative.

During the conference the three EISTP main prizes were awarded from 25 finalists competing for the highest honour in the IST area in Europe. The conference also resulted in this final report, which is intended to provide guidance for future work in the information society, as well as in a wealth of presentations available at the IST 99 Website www.ist99.fi.

Conclusions

The conference was considered to be of a high quality: 91% of participants considered the program and exhibition to be good to excellent. As a three-day event it offered plenty of room for contacts between participants, which was their number one reason to participate. This year's conference was particularly impressive in showcasing the future of networking, mobility, and e-commerce. International co-operation was also a central theme of IST 99. Many sessions explored opportunities for joint projects, in collaboration of the EU with the USA, Canada, Australia, CEEC, NIS, Latin-America, and others. With one-third of all participants being from outside of the EU the IST conference has established itself as a truly international conference.

It was striking how much sensitivity and discussion there was to improve our understanding of the interplay of all factors that need to come together to realise the information society of the future: technology, policy, new business models, new ways of working, international co-operation, and so on.

The conference clearly demonstrated Europe's confidence in its capabilities to shape the future 'information society for all'. The commitment to this objective and the urgency to act was underscored by politicians and business people alike. In that respect the opening session set the scene. As Commissioner Liikanen said in his speech, announcing the eEurope initiative: "the time has come to accelerate the transition to the new economy. Failing to do so now will compromise Europe's future".

IST 2000 will be a good opportunity to take stock of the achievements and address new challenges, some of which we do not even know of today. At the same time it is the challenge to do even better than IST 99, in terms of increasing overall participation, meeting the high quality standards that participants expect, creating more visibility for the public at large, making the conference even more international, and providing even more opportunities for partnership building.

Robert Verrue, Director-General
European Commission
Information Society Directorate-General

IST 99 FINAL REPORT
Individual Session and Workshop Reports

Approach

The main issues and conclusions of the IST 99 conference sessions and workshops are highlighted in the independent expert rapporteurs' reports that are attached. Each report is preceded by an introduction to the contents of the session/workshop, as provided by the session organisers which were in most cases Commission staff.

In a few cases the session report has been drafted by the session organiser due to the unavailability of a rapporteur to assist the session.

Opinions expressed in the reports are those of the individual authors, and do not necessarily represent the views of the European Commission.

The overall coordination of this final report was jointly undertaken by Maarten Botterman, of RAND Europe, and Paul Timmers, assisted by Marika Lautso, both of the European Commission, Directorate-General Information Society.

Rapporteurs

Andrew Bud, Communications Systems Associates Ltd, abud@iee.org.
Paul Drath, Monica Schofield, SingleImage Ltd, singleimage@compuserve.com.
Raghu Kolli, Meru Research B.V., kolli@meru.nl.
Maarten Botterman, RAND Europe, m.botterman@randeurope.org.

Opening Plenary

The IST 99 conference, "Exploring the Information Society" was the 1999 conference in Europe of the information society community. It was a unique meeting place for business people, researchers, and politicians from all over the world.

IST 99 opened a window on the future of the information society in terms of technologies and applications, the legal and regulatory framework, visionary scenarios of how people will live in the future, emerging job opportunities, how business will be competitive, and how governments will serve citizens. It addresses the relationships between all these elements and how they can support each other.

Realising the information society for the benefit of all requires involvement and dialogue of all key players and joint action, balancing vision and realism. Participating in the IST 99 conference offered the opportunity to jointly explore visions and actions, based on the most recent insights and innovative developments, and to build new partnerships to realise the information society of the 21st century.

The opening session set the tone for the conference. High level speakers from the public and private sector were invited to present their visions on the shape of our future society, and recommended actions to take, both as Europeans and with partners world-wide.

Main issues raised

Martti Mäenpää suggested that the Finnish experience could show how an economy can be transformed through electronics and digital trade. However, it also shows the weaknesses of West European attitudes towards investment, which is still risk adverse.

Erika Mann stressed the positive impact which the liberalisation of the telecoms market had brought about, but at the same time raised the question as to whether the current mergers will mean state monopolies will be replaced by private quasi monopolies. She reflected an optimistic view of Europe's abilities in competing globally in this domain.

Erkki Tuomioja again reflected on the importance of IT to the Finnish economy, which otherwise traditionally focussed on wood and metals. Nevertheless, there remains a large discrepancy between the annual growth of IT producers at 10% and non-IT producers at 0.5 %.

Jorma Ollila presented Nokia's view of the market growth of communication devices predicting that more handsets than PCs will be connected to the Internet by the end of 2004.

Erriki Liikanen stressed the drivers which European policy makers need to push to ensure Europe maximises the opportunities available and announced initiatives of the European Commission to review telecom legislation and to promote the information society for the benefit of all.

Conclusions and Future Directions

European strengths in the IT sector are reflected in the national strengths of Finland. As in Finland, the liberalisation of the European telecoms market and the ability to develop and exploit the whole spectrum of telecoms technologies have in the short span of five years transformed IT business development dramatically. Key drivers for future growth will be universal internet access and further reduction in connection charges. By 2004 Nokia predicts that more handsets than PCs will be connected to the internet enabling access to datanet services to be available to all in any place.

Finland is not only a European success story in the IT sector, but also an example of how the commitment of government policies over the past 10-15 years towards

R&D, training and education has brought about a transformation of an economy. Today, the electronics and telecoms sector is equal in importance to the traditional mainstays of the Finnish economy, wood and metals. Nokia and Linux were born in Helsinki, and today Finland is a leader in Europe with respect to e-commerce.

To remain at the forefront of developments, Europe needs to develop a more competitive culture. While Europe may lead in the development of basic technologies and have on the whole more universal access to higher education providing exceptional opportunities for study, many Europeans such as Linus Thorvalds, developer of Linux, exploit their talent in Silicon Valley where they perceive the access to capital and equal minded competition to be better. Europeans must become more prepared to take risks.

Europe needs to pool resources and to devise a common strategy to ensure the benefits are translated into jobs, growth and improvements to quality of life. The challenge for decision-makers is to ensure Europe has the necessary skills, the appropriate education and school system and investment in R&D.

There needs to be concerted investment in the complete R&D cycle, in innovation and in diversifying economic structures. Developments need to centre on the user and policies need to encourage broad take-up. Europe's strength in mobile communications and digital broadcasting could propel her into the lead for global e-commerce. These should be priorities for research.

To take advantage of the new e-economy opportunities it was stated that we must build on the key resources of this economy which are information and knowledge. A major effort has to be made to accelerate this transition. To achieve this, Europe needs an initiative with immediate and significant impact, based on a collaborative effort involving Member States and industry.

To meet this challenge the Commission is planning to launch a new initiative, "eEurope". The objective is to bring everyone in Europe – every citizen, every company, every administration – on-line, and this as soon as possible. The initiative will focus on:

- Cheaper and faster Internet access.
- Promoting digital literacy of Europeans
- More effective capital markets, in particular as regards venture capital.
- A public sector which takes more advantage of digital technologies.

Europe is at a threshold and must move quickly or doors will be closed.

Rapporteurs: Monica Schofield & Paul Drath

Speakers:

- Martti Mäenpää (FI), Director General, National Technology Agency Tekes, Finland: A Flying Start for Europe in the Digital Era
- Erika Mann, Member of the European Parliament
- Erkki Tuomioja (FI), Minister of Trade and Industry, Finland: Why we use ICT – the Challenge for European Companies
- Jorma Ollila (FI), Chairman of the Board and CEO, Nokia
- Erkki Liikanen , Member of the European Commission for Enterprise and Information Society
- Conference Announcements: Guy Hoeberechts, Event Manager, European Commission Information Society Directorate General

Commission Contact:

Paul Timmers (Paul.Timmers@cec.eu.int)

Children Shaping the Future

As the fable of the Emperor's new clothes aptly captures, children are often recognised for their audacious innocence. How can we tap into their way of thinking and seeing so as to help redress issues common to us all? In what way can young people be a contributing force in helping us shape the information society? Given that contributions from children cannot always be treated in traditional ways, how can this be done in a way that is meaningful to both children and the adults involved?

The session was not just about children and IT, which is a very broad topic. Rather, it tried to go beyond that to see how can we make a 'better IT world' by listening to children's 'voices' about this subject. How to do this is a specific topic with many open questions? A number of speakers touched on topics such as:

- Listening to the unheard voices of children.
- Tapping into creativity: children's contribution to design and designers.
- Ways in which young people can influence TV and new media production.
- Kids' summits and what can be learnt from these.
- Children as co-creators in the development of new IT-based tools .

Speakers illustrated these topics with material drawn from practical experience. Following individual presentations, a panel discussion explored specific ways in which young people could help us shape the information society.

Main issues raised

Children need to be involved in the role of users, testors, informants and design partners in development of IT products (Druin)

Children's products need to relate to their world of excitement, storytelling, shoulder-shoulder collaboration and embedded into their natural surroundings - blocks, stuffed animals, floor tops. The focus should be on enabling children to create their own content reflecting confidence, ownership, identity and personal growth.

Children have no voice in what is handed out to them by TV media today. Digital technology provides children the means to produce some of their own programs (Home)

The UN has recognised the rights of children on their own media. Adults can no longer be overprotective about children. The media industry cannot push programmes to children anymore. It is time to listen to children, respect them and treat them as intelligent and more than equal.

Nothing is by web alone when dealing with the vast majority of marginalised children in parts of the world (Cassel)

Vast majorities of children in the world have no computer nor access to web. When connecting these communities, we have to create for the lowest denominator so as to include everyone. The access barriers are numerous and children are increasingly vocal about ethics and their rights.

Companies make products that sell. There is no money for companies to make content tools for children (Discussion)

The driver of development for children's products is the vast commercial opportunities. Who sets the agenda for children? Adults do not follow-up children's projects which raise lot of expectations Adults have a responsibility for children. Children cannot be expected to take care of their own development through technology means.

Conclusions and Future Directions

There are loose efforts going on to involve children actively in the IST. The European Commission has initiated the Experimental Schools program to explore how IT can help young pre-school children to learn in innovative environments. The University of Maryland hands out partnership contracts to children to take part in their development projects. During the Children's World Summit 1998 in London, participating children produced an eye opening documentary on adults at the conference which makes many squirm in their seats. In the Junior Summit 1998 (in which 1000 children from 139 countries participated) the children practically rebelled against the adult organisers and over took the conference. They went further after the conference raising funds, making a representation to UN and issuing passports to adults to enter their web community. Seeing some of the examples, it is clear that children of today are growing past the passive consumption model faster than their age.

A number of issues emerged that need to be addressed to make children active participants of IST :

- New methodologies for involving children need to be created simultaneously while creating new products
- We need to move gradually from 'interactive text books' (where children play with content created by adults) to 'expressive media' (where children create their emotions, stories in their own creative way).
- Children's physical world needs to be augmented in addition to creating cyberspaces
- Children make content that is direct, clear and often uncomfortable to adults. How can adults cope with this?
- Children are increasingly dependent on the safe world and community around them. It is not possible to reach them always directly through web.
- Language is a barrier among global children community.
- Less than 10% of the audience (15 of 150) ever worked with children in their projects
- Children's explosion is happening in the developing countries. India and China will account for more than half of global children.
- Children also deserve compensation for their effort in the development process. Can children get EC evaluator contracts ?
- Shipping computers to children in developing countries may turn them into digital sweat shops.
- Children do not have experience to see and make complex decisions. It is the responsibility of adults.
- Children should not be discriminated against because of their age. They are individual people like everyone.

Rapporteur: Raghu Kolli

Speakers:

Introduction by: Simon Bensasson, Head of Unit, Future and Emerging Technologies, European Commission, Information Society Directorate General

Moderator: Walter Van de Velde (B), Starlab Research Laboratories, Belgium

- Alison Druin (USA), University of Maryland, part-time visiting professor at KTH, Stockholm
- Carla Rinaldi (I), Reggio Emiglia Schools
- Anna Home (UK), Director of the Childrens' Film and Television Foundation
- Justine Cassell (USA), MIT Media Lab, director of the 'Junior Summit'

Commission Contact:

Jakub Wejchert (Jakub.Wejchert@cec.eu.int)

Global versus local: the digital regional economy

Does globalisation lead to localisation? Large trans-national companies try to learn to behave as local citizens everywhere, local SMEs try to learn to operate in global markets. Local and regional economies are a source of innovative activity (e.g. tacit knowledge, cultural environments), but competitiveness has to be global. Information, intangible assets and services move globally fast but people as human capital and skills are location-bound.

Unleashing the potential of European diversity and transforming its regions into a birth place of global competitors require a pluralism of regional infrastructures, applications and services. Scalability of applications and services, accessibility and affordability make it possible for both global and regional digital economies to develop.

What lessons from practical experience do we have today? What policies for the growth of digital regional economies do we need? Can Europe combine global leadership with local adaptation? Can we create an inclusive information society, for business and citizens, within the multi-lingual, multi-cultural Europe? Virtual regions, global regions, "Silicon Valleys" everywhere?

This session debated the local phase of the global digital economy and explored promising actions and policies at regional, national and European level.

Main issues raised

The changing economy: global now affecting local

Within this rapidly changing economy, developments are much faster in some areas than in others. This difference in speed involves risks, which need to be addressed. Regions that fall behind will be falling behind even further, in the future, unless action is taken to prevent this. Global traders will take over local markets in many respects, local trades have to redefine their markets.

How can local areas profit from the global market?

IST now allows sparsely populated and remote areas like Lapland or the Western Isles to create conditions that allow people to stay and live there, whilst having access to university education and IS work. NB: this does require locally good quality infrastructure. Local Australian farmers are now selling wheat to Egypt without leaving the countryside. But this doesn't come easy. Technology will go where markets are: the main cities. To get good infrastructure at the country side extra efforts are needed. In many rural and remote areas the tele-center has become the hearth of the local hub of the Internet. They have proven to have extended the technology usage and provide access to schools in the local community.

The stimulus of the local economy leads to global interest, as a locally organised Jazz festival demonstrated by attracting more then 7000 (US) visitors for on-line participation via a web cast.

What is the role of government?

Governments have a responsibility towards longer term developments, and those com-

munity interests that are going beyond the direct interest of the individual. There are different ways in which governments can act: by legislation (but this is hard to do well in such a rapidly changing environment), by leading by example (become a main user and good practice example, themselves), or by positive action. The latter can be done in public and private partnerships: this collaboration between public and private sector is more necessary than ever, since both government skills and private sector skills are needed.
Focal points are:

- How to eliminate social exclusion
- Ensuring (affordable) access

Regional policy has become increasingly relevant. Local governments should consider the following:

- A region needs to present a development strategy to be globally present, in order to be locally attractive
- Firms need to communicate with the global market, in order to remain competitive
- To retain people in a region, the region needs to be connected with the global economy
- Support comes from national IS strategies: it provides a source of funding and transfer of experience
- Partnerships become possible with areas that otherwise would not have been developed

An example: Canada introduces secure email for all citizens. A Webcard is provided to Canadian households to facilitate buying on-line. The government aims to become a model user of information technology and the internet. The goal is to be known around the world as THE government most connected to their citizens.

Conclusions and Future Directions

The shift in the economy is from local to global, rather than local versus global. Old markets now have to be share with global players, but new markets must be globally available. Local activity is still very much valued, since it depends for a large part on local knowledge: but not all the way, and at any cost. The development of the digital regional economy has become a priority.

In its early phase, Internet mainly focused on urban communities for its commercial applications. It is now beginning to move to the rural areas. Most information provided locally, is from sources far removed from the local community. Many people that are on-line today are looking for local products, but they are not available. For the next phase of Internet development a new model is needed to make the Internet-world more useful for the citizen:

(1) Give citizens maximum control and provide info at the local level:
(2) Focus on content;
(3) Provision of government services;
(4) Growth of local business via electronic commerce
(5) Customisable secure personal portals

Attractiveness of services is key; improving the context is needed. Technology moves fast, but knowledge goes slow and culture follows knowledge. Main conclusion: local information will become of key importance, which offers new opportunities. Positive action by public authorities can enhance these opportunities. The role of government is to ensure access to good quality infrastructures in all areas, for all people, and to respond to needs in education.

Rapporteur: Maarten Botterman
Speakers: Chairperson: Dr Roberto Carneiro (PT), President, Grupo Forum

- Christos Folias, MEP, Member of the INDU Committee of the European Parliament: Trade and technology as global drivers of local economies
- Hannele Pokka (FI), Governor of the Province of Lapland, ex-Minister of Justice : The Lapland route to the digital economy
- David Reid (CA), Regional Manager Community Access - Industry Canada : Canadian regions on the move
- Owen Evans (UK), Policy co-ordinator, British Telecom Wales: Building the Welsh Economy on global digital infrastructures
- Ken Young (AUS), Community Information Victoria Inc.: Regional Australia in the Internet age
- Robert Shotton, European Commission - DG Regional Policy

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Europe on the move

New intelligent, ubiquitous wirelessSee Ambient; Mobility services allow the European citizen on the move to have seamless interactive access to multimedia information to support of his transport, business and leisure needs. The session "Europe on the Move" addressed these new services and applications, and the wireless visions of the future.

Main issues raised

Automotive journey support services
Two speakers addressed the opportunities for services aimed at vehicle drivers. These would be personalised and highly context dependent. Such services exist to a limited degree today, but are based on in-car intelligent systems. New mobile services will make possible low cost, pay-per-use off-board dynamic services. The vision is for turn-by-turn route guidance, directly updated to take account for current traffic conditions, using both visual and verbal interactions with the driver. Compared to existing solutions, these will be cheaper, more flexible and no longer tethered to the car. New billing models will have to be developed for this kind of micro-information, with a tendency to value-based pricing. Mobile operators clearly have an advantage because their existing billing systems are well suited to this kind of service.

On-the-move applications should be aimed at the mass market
All speakers agreed that future new mobile services will be spawned in the mass market rather than the business market. At a top level, it was suggested that the added value of mobile will be to bring virtual consumer services into contact with real-time life. This will apply to areas such as e-commerce and games, as well as to transport information services. In each case, a mass market target will be necessary to drive the development of exciting services.

The role of a national framework architecture
One speaker pointed out that in an area such as driver services, complete solutions require the coordination of many information sources, infra-structure authorities, owners of technical infrastructure and regulators. In such an environment, it is difficult for market forces alone to create the coordinated conditions necessary for a service to blossom. The solution is to develop a national reference framework within which independent elements may be created. Up until now, in the driver services area, only Finland has produced such a framework.

Understanding of feedback effects is essential
Contributors from the floor highlighted the importance of considering the effect of mobile, dynamic driver support services on mass driver behaviour, and the consequences of such feedback. It was agreed that thought should be given to the effects that might occur once penetration of such services exceeded 10%. Policy issues were raised by such ideas as only providing really effective route advice to avoid congestion to subscribers buying a premium level of service.

Conclusions and Future Directions

It is difficult to draw many strong conclusions from this session. Perhaps the two clearest may reflect the points raised above, as follows:

The virtues of National Framework Architectures were strongly argued and convincing. Equally, the limited investment in such initiatives was also clear, and the need to do so at an EU level, rather than national level, is obvious. There would seem to be a strong argument for the Commission to review the scope for co-ordinated RTD on a common framework within which 3G driver support services could be implemented, engaging national

road management authorities, garages, car manufacturers and mobile operators.

The contributors to the session had many questions but few answers on the issue of feedback loop behaviour. Issues of environmental, political and transport policy are raised by considerations of how masses of people will respond to high quality congestion information and advice. Comparisons with the air-traffic control regime were raised, implying regulatory control over scarce road space. Both academic research and policy study would seem to be required here.

Rapporteur: Andrew Bud

Speakers:

Chairperson: Prof. Yrjö Neuvo (FI), Member of the Group Executive Board, Senior Vice President, Product Creation, Nokia Mobile Phones

- Mark C. Hoogenboom (NL), Senior Technology Consultant, CAP Gemini: From Mobility to Infomobility
- Morten Heuing (D), Product Marketing, TEGARON Telematics GmbH: Navigation to the Guidance
- Kevin Duffey (UK) Chairman, Global Mobile Commerce Forum and Group Telecoms Director, Logical Plc: Mobile e-commerce
- Prof. Yrjö Neuvo (FI), Member of the Group Executive Board, Senior Vice President, Product Creation, Nokia Mobile Phones: Wireless Visions

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(3)

Net Learning

The progress of the information society has a profound effect on the development of a new learning culture. Learning is dependent on context and on appropriate and timely access to knowledge. Multimedia and telematics based tools, content and services are widely considered as potential central ingredients for evolving new ways and means of learning.

The IST 99 Net Learning session presented key challenges and success factors for the new ways of networked learning, based on information and communication technologies. The objective was to contribute to bridging the gap between research and actual use of learning technologies, content and services in both companies, organisations and private life, in both education, training and lifelong learning in general.

Avenues were indicated for us to become an active collaboration partners in the Net Learning domain, for example through key European initiatives: PROMETEUS - PROmoting Multimedia access to Education and Training in EUropean Society - A Partnership for a Common Approach to the Production and Delivery of Learning Technologies, Content and Services, and CEN/ISSS Workshop on Learning Technologies.

Main issues raised

We need to break barriers between sources of knowledge and adapt a mix of learning technologies - on the job, just-in-time, always accessible embedded into the workflow process (Kyyrö)
We need to accept individual learning needs and offer customised educational products to suit a specific situation in a flexible manner. Learners need not browse. Relevant material comes to them.

Learning is a social artefact that requires alignment in different contexts: learning (education), practice (workplace) and interests (leisure) (Figueriedo)
People learn through different ways and in different settings: by being told, by observing and by accessing resources and by doing together. Too much focus on content production alienates the context of learning.

Standardisation to describe learning objects metadata, educational resources, lifecycle etc. facilitates search and re-use (Duval)
There is no real impact of R&D on Educational Technologies. Because of lack of support of plug and play infra structure, the technology base disappears shortly after development. Standardisation helps developers to connect to resources and enables end-users to work with a variety of systems.

The effectiveness of distance learning methods in teaching is not proven (discussion)
Some people work longer while others have no jobs. Policy needs correction ? (discussion)
The US is impacting Europe. When the economy consistently grew, unemployment fell. The growth of the economy is limited by availability of workforce.

Conclusions and Future Directions

The need for a learning culture was emphasised by the fact that a new IST call for proposals is expected in February 2000 for research projects covering key issues such as changing job profiles, advanced training systems, school of tomorrow and learning citizen. Key issues that emerged are :

- Corporate learning extends and includes the customer
- Learners are non-homogeneous
- Each net educational product needs to be customised
- Content needs to be related strongly to a context
- Activity rich, interaction rich, culturally rich social environments over networks facilitate learning
- Universities would not want to lock in to a proprietary educational systems from vendors

Rapporteur: Raghu Kolli

Speakers:

Chairperson: Luis Rodríguez-Roselló, Head of Unit, Multimedia Applications for Education and Training, IST Programme, European Commission, Information Society Directorate General

- Olli-Pekka Heinonen (FI), Minister of Transport and Communications, former Minister of Education, (teleworking from Rauma, Finland) Net Learning in the Finnish and European Knowledge Society
- Albert A. Angehrn (CH), Professor; Director, Centre for Advanced Learning Technologies; INSEAD - Institut Européen d'Administration des Affaires / The European Institute of Business Administration Net Learning: Pitfalls and Research Questions
- Juhani Kyyrö (FI), Product Manager, Valmet Virtual Learning Center, Metso Corporation: New Ways of Corporate Virtual Learning
- António Dias de Figueiredo (PT), Professor, Universidade de Coimbra; PROMETEUS Steering Committee Member and Chair of PROMETEUS SIG: Organisational and Co-operative Learning;
- Organisations and Learning Technologies: How to Make them Meet? – The Ultimate Alignment Imperative
- Erik Duval (B), Professor, Katholieke Universiteit Leuven; Chair of CEN/ISSS Workshop on Learning Technologies; PROMETEUS Steering Committee Member; What are Learning Technology Standards, and Why should we, Europeans, Care?

Commission Contact:

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Making Technology Work in Europe

What's the point of developing all these new information society technologies and applications, if Europeans do not use them?
Well, some do, but many, are either unaware, reluctant, or passive.
This session showed us why this is the case. It revealed interest of Europeans in information societies, technologies, services, and applications, and the fascinating market potential for those that matter!
It also showed successful examples of the information society reaching out to people and businesses. The first part discussed the best dissemination initiatives for making information society technologies work for SMEs, in the second half we were guided through the prototype of a 3D virtual visitSee 3D to the EU.

Main issues raised

What interest do European people have in the Information Society?
The Eurobarometer service, which surveys nearly 15.000 households, annually measures the progress of the Information Society (IS), mainly by measuring uptake of a set of specific IS technologies. This data shows a continuous growing interest, and a willingness to pay for on-line services. All data is presented at www.ispo.cec.be.

Successful examples of dissemination activities:
Several European projects were presented. These included:

- ESIS includes reports on regulatory developments, IS promotional actions, alternative networks, technology indicators, www indicators, statistical reports, who's who. www.ispo.cec.be/esis
- GIP global inventory project should provide a one stop shop for national and international inventories of projects, studies and other activities relevant to the promotion and further development of knowledge and understanding of the IS
- EU IS Best Practices Gallery: umbrella initiative for emerging IS best practice initiatives: both a showcase and living, dynamic organisation: should become a sustainable information society best practice initiative.
- BOURBON provided bandwidth to SMEs: experience has shown the importance to have SMEs involved in the design phase of the services (Participatory design method). Benefit for technology partners involved in the project were: a better understanding of SME needs and wants, their business models, and the opportunity to pilot scalable network solutions for SMEs. It has successfully demonstrated the impact of broadband technologies on competitiveness of SMEs.
- The project KITE focused on the success SMEs could have in electronic commerce. SMEs operating on the Internet should start to focus upon differentiation. Cost leadership is not a viable strategy. It is more important to focus at critical success factors: Content, convenience, control, interaction, community price sensitivity,

brand image commitment, partnership, process improvement, integration. In this technology is not a critical success factor in itself, but used in support of achieving the other critical success factors (http://kite.tsa.de)

3D prototype for a virtual visit to Europe
At the end of the session the prototype for a 3D presentation of European Institutions was demonstrated. It is the intention to incorporate this as part of the official EUROPA site. The guided visit through Europa made by the project CITYCOM will include 10 institutions, 11 languages. It is currently being tested by users on 4 institutions.

Conclusions and Future Directions

After presentation of the results of recent Eurobarometer surveys the chairman concluded that 60% of citizens still need to be convinced that they can benefit from IS technologies in their daily lives and business.

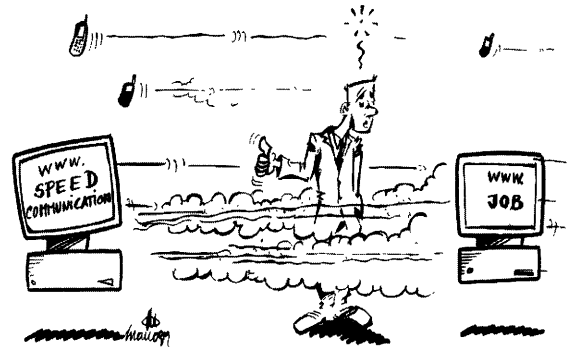
It is the responsibility of the EU to provide:

- Regulatory framework
- Promotion of, and support for, Networks, basic services and ICT applications
- Monitoring and analysing the IS societal and cultural impact
- Promotion of the IS

The focus of promotion is based on the growing belief that the business environment is based on two models: knowledge era and networked economy. Once convinced of benefits of ICT in general, potential actors will start asking questions "what can be done", "who does what"and "who is who". Inventories are needed here. Most of the current inventories suffer from a lack of quality: inventories do supply information, but not often knowledge. Benchmarking and learning from best practices are therefore key activities. Within the abundance of information from many different sources, jumping from site to site is not satisfactory. Comparable data sets would help, including some form of data validation. The European Commission should play a role here.

Prime Minister Tony Blair has said: "Information is the key to the modern age. The new age offers breathtaking opportunities, limited only by the boundaries of our imaginations... but there are also huge risks." To understand what is going on in global context is the key. It is therefore necessary to:

- Demonstrate the potential
- Stimulate co-operation
- Establish networks
- Basis for further work
- Contribute to policy formulation



Rapporteur: Maarten Botterman
Speakers: Chairperson: J. Wenzel, Principal Advisor, European Commission, Information Society Directorate General/ISAC: Introduction

- Dominique Vancrayeynest, Representative of INRA Int. Research Associates:
- The invisible market - Peoples attitudes towards IS Barometer findings
- Louis Lengrand (F), LL&A The Information Sources for Information Society Promotion :
- The ESIS/GIP surveys and Best Practices Gallery
- Martin Boyle (UK), Department of Trade & Industry – G8 pilot projects:
- Lessons and experiences for Europe
- Aimo Maanavilja (FI), HPY and Bourbon Network. Stimulating IS take-up in SMEs :
- The Blueprint for success
- Thierry Klein (F), Citycom: EU Open Door for the Citizen – a 3DV prototype
- A guided tour
- Sylvie Feindt (D), KITE G8 project manager: SMEs guidelines to successful Internet Business
- Marco Villard (A) Cartoon Artist: 'Live' illustration of speeches during session

Commission Contact: Jose Pato (Jose.Pato@cec.eu.int)

Networked Europe
Europe Goes Wireless

After the commercial success of GSM (2nd generation mobile), the basis for the 3rd generation mobile has already been laid in Europe. The Universal Mobile Telecommunications System (UMTS) was conceived nearly a decade ago and now there are concrete plans for deployment in Europe starting in 2002. It is now time to start thinking about the next generation of mobile and wireless networks that will complement GSM and UMTS – ***the 4th generation.***

This session had a forward looking nature and addressed 4th generation technologies, networks and services from the following three perspectives, which are certainly not mutually exclusive, and whose evolution will be market led:

1. 4th generation as a concept that refers to ***bandwidth-on-demand broadband access*** and distribution networks with (a)symmetric bit rates in excess of 2 Mbit/s, including broadband wireless fixed access, broadband wireless local area networks, mobile broadband systems (MBS), interactive broadcasting networks (both terrestrial and satellite based). Within this perspective, it is important to maximise spectral efficiency and to explore new spectrum frontiers to support the anticipated demand.

2. 4th generation as a concept that refers to the ***need to provide seamless services over an increasing number of distinct and heterogeneous, fixed and wireless platforms and networks operating across different frequency bands.*** The concept goes beyond the need to develop systems-on-a-chip that can cover a few frequency bands and different technological parameters. It extends to full network and terminal reconfigurability, where continuous adaptation to the actual carried data streams, traffic load, channel conditions and service environments, takes place. This implies network protocols that adapt dynamically to changing channel conditions; protocols that allow the coexistence of low and high-rate users; congestion-control algorithms for changing channel conditions; etc. The service and applications potential of this perspective will also be discussed.

3. 4th generation as a concept that refers to:
   - the need to ***network, necessarily on an ad hoc basis***, a ***myriad of ultra-low power devices*** (wireless sensors and actuators embedded in appliances as well as in living beings) capable of wirelessly transmitting ***a wide range of data rates*** (10 bit/s - 10 Mbit/s) over ***a wide range of frequencies*** (100kHz-100GHz)
   - other low power (0.1 - 100 mW) equipment, including PDAs, palmtops and laptops, where the available services and applications reconfigure and adapt themselves to the capabilities of the devices available in specific environments.

Main issues raised

Everything is mobile

One clear theme was the evolution of mobile communications as a means of connecting people to a system connecting things. Several speakers expressed a

vision in which household appliances, merchandise and wallets would join the ranks of mobile subscribers, vastly increasing the number of nodes on the mobile network. Such a change would be driven on one hand by the continuing falling cost and increasing power of terminal and infrastructure technology, and on the other by the ubiquity of IP connectivity.

Air Interfaces
It was striking how comparatively little attention was given in the session to new air interfaces. One speaker expressed the view that the increasing legacy of mobile infrastructure investment would drive operators to focus instead on better ways to link and integrate services. Another speculated that a new high-bandwidth air interface might be needed by the year 2010, and noted the opportunities raised by liberation of the analogue TV bands. Great stress was placed by some speakers on Bluetooth, as this could form an early radio infrastructure for 4G services.

Focus on Network Architecture
Network architecture was given much greater focus. Several speakers described the foreseen evolution, from the vertically-integrated, embedded-service model of 1G and 2G systems, to networks based around horizontal layers of services. Various descriptions, resembling network operating systems architectures and client-server structures, were offered. The key impact of this evolution on the management of 4G networks was highlighted.

Focus on Network Services
There was considerable stress on the definition of services within each network layer on the way to 4G. It was emphasised that these should be open tools, with which new application services could be built, rather than fully-formed user services themselves. This approach – in which European standards programmes were already playing an important part - was necessary because no one today could predict for what 4G networks would actually be most useful. In particular, the need for an improved approach to security and payment support services in the mobile network layer was emphasised, together with the need to converge these with standards in the fixed network to create a single transaction fabric.

New Paradigms
The evolution towards 4G will offer the chance to create new service paradigms, different from the traditional approach to mobile networks, the session was told. In particular, one such new approach, called the Spontaneous Information System concept, was described. Following the style of the session, it focused on a new mobile network operating system rather than an air interface, and offered an approach to deal with fluid, temporary networks with frequent node disconnections and transient network membership. Application examples included car-embedded systems, mobile robotics and meeting productivity tools. It illustrated the diversifying network ecology that will arise as 4G develops.

Conclusions and Future Directions

Speakers praised the role of the Commission in this area, since the past Framework programmes had focused European efforts in standardisation in a most important way and they considered RTD to be key to the development of future standards.

Several speakers stressed the importance of structuring standardisation around network services – as opposed to air interfaces- as the way to 4G, and the Commission must surely bear this in mind when considering priorities for future RTD programmes. There were also policy recommendations to converge standardisation of fixed and mobile network services in areas where a single fabric would be valuable, such as security

Rapporteur: Andrew Bud
Speakers:
Chairperson: Jens Zander (S), Professor, Royal Institute of Technology, KTH
- Juha Ylä-Jääski (FI), Research Fellow, Nokia Research Center
- Fiona Williams (IRL), Director, Ericsson Eurolab Deutschland
- Michel Banatre (F), Director, INRIA
- David Birch (UK), Director, Consult Hyperion

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Towards a Safer Information Society by Combating Cybercrime

Whereas the Internet offers huge opportunities for electronic commerce, it also opens doors for increased cyber-crime, which knows no national borders. Combating cyber-crime is an issue that has been acquiring increasing international attention and debate in the information society context. The objective of this workshop was to explore and elaborate on the various viewpoints and means of preventing and combating cyber-crime, for it may affect anyone, anytime, anywhere. It provided an opportunity to highlight new crimes, as they occur in everyday life, consequent risks and damages for users and socio-economic impact, ethical aspects, prevention mechanisms, new skills and technology and regulatory requirements. Combating cyber crime is a challenging operation with ethical, political, economical aspects that reflect to the development of legislation and technology. The speakers were high level experts, with "hands-on" experience in preventing/combating effectively cyber-crime from their specific fields of action. The workshop had a twofold dimension and the key themes focused on:

a) Legal problems - their solutions & their limits, and the law enforcement perspective by specialised police: in the era of globalisation, the criminal laws in different States are not always "compatible" with each other. Concerns on combating cyber-crime are being voiced in international forums. In the field of substantive criminal law, discussions involve sensitive issues such as privacy, confidentiality, fraud, child pornography etc. In the field of the procedural criminal law, the ongoing discussions involve sensitive issues like trans-border co-operation, interception, search, seizure, and preservation of data (stored/traffic), competent jurisdiction etc.
b) The existing and the future technological solutions & their limits: RTD has the potential to provide affordable and effective security and other trust-building technologies. So far, considerable achievements have been booked to this end, and ever more promising ones are expected in the near future (e.g. by endeavours of the IST Programme).

Main issues raised

The chairman Mr. George Papapavlou introduced the topic by stressing the opportunities provided by the IST for business growth, improvement of the quality of life, education and job creation. He pointed out that as information flow assumes an ever-increasing economic, political and social value, so do the potential gains of criminal abuse, and cybercrime has developed into a threat for today's Information Society. He mentioned that at international level various fora have been co-ordinating or harmonising activities for

Within the framework of the Council of Europe-Committee of Experts on Crime in Cyber-Space (PC-CY), the European Countries but also the US, Japan and other observers are working since February 1997 on the drafting of a Convention on cyber-crime. The Convention is expected to be completed in December 2000.

On 10 December 1997 the G8 Ministers of Justice and of the Interior approved a 10 point Action Plan for combating the use of the Internet and other high technologies for criminal purposes, which is currently being implemented.

Illegal and harmful content on the Internet: Decision No 276/1999/EC of the European Parliament and of the Council of 25 January 1999 adopting a multiannual Community action plan on promoting safer use of the Internet by combating illegal and harmful content on global networks (Official Journal L 33 of 06.02.1999, p.1). See the Internet Action Plan website, http://www2.echo.lu/iap.

Protection of minors and human dignity in the Information Society: Council Recommendation of 24 September 1998

combating cybercrime, such as the Council of Europe, the G8, etc. At the European Union level, in the last three years there have been several relevant initiatives,,,.The Council of Ministers adopted an Action Plan to combat organised crime, and there are possibilities for further initiatives at EU level.

The first speaker Dr. Ian WALDEN focused on the UK experience on Offences, Jurisdiction & Evidence. He pointed out that traditional legislation does not cover adequately computer related offences such as computer fraud, computer forgery, unauthorised access/computer misuse ("hacking"), transnational crime (extraterritoriality) etc.To overcome the climate of uncertainty, and to cope with the cyberspace needs, new legislation has been developed in the UK. The speaker stressed also the vital importance of effective training for justice and law enforcement authorities. Dr. Walden replied to the questions raised after his speech as follows: Electronic evidence gathering has both pros and cons, and that the issue is a complex one concerning sensitive aspects of human/civil rights protection and the needs of law enforcement; the existence of different Training Programmes requires good co-operation at national/international level between the various authorities/organisations involved; when a protected information security system is broken into (e.g. unauthorised access/hacking), this should be addressed by substantive computer criminal law; as to the ISPs' liability, the principle "the less you know the less you are liable" could apply.

The second speaker Dr. Michael Waidner, focussed on: "Cybercrime – Technology Perspective". He mentioned that IT security protects the Integrity, Availability and the Confidentiality of the data (within e.g.: communication, file system, payment system). There is multiparty or multilateral security relative to the requirement per (set of) player/s, depending on the functions of an organisation. He pointed out that there is no 100% bullet proof security. Adversaries to security systems are: Vulnerable Design & Implementation; Careless/dishonest user (inside personnel/partner), or third parties (personnel from another organisation, or other outsider), and social attacks. IT Security does not work by obscurity; strong encryption is key to security. He stressed the fact that anonymity and security against fraud do not exclude each other and that solutions are possible to protect e-commerce and users from viruses, Trojan horses etc. Dr. Waidner replied to the questions raised after his speech as follows: If the systems are customised to serve the policy of a specific organisation they are more effective; smart cards do not solve all problems; co-designing is too flexible and does not guarantee security properties; we need secure and simple OS (Operating Systems), and separating applications; security systems can boost trust; privacy should be supported by law.

The third speaker Mr. Ekkehart Kappler, focussed on "Combating Cyber-crime" with emphasis on the difficulties in the Internet investigations. He stressed the fact that the protection of human rights is a fundamental demand. Data protection and privacy laws are necessary to safeguard the human rights, they should not hamper, however, criminal prosecutions that are necessary to protect life, health, and property of the citizens. He mentioned that criminals are using modern systems obviously and often more effectively than law enforcement. There is no real new crime committed through the Internet, but the perpetrators merely follow new roads. He pointed out that the Internet industry should appreciate that the police is not its enemy but an assistant in safeguarding personal security and free

on the development of the competitiveness of the European audiovisual and information services industry by promoting national frameworks aimed at achieving a comparable and effective level of protection of minors and human dignity. (Official Journal L 270 of 07.10.1998, p.48).

Child pornography and interception of communications for law-enforcement purposes: On December 1998 the EU Justice and Home Affairs Council gave its political agreement on the basis of an Austrian initiative to a draft Joint Action (now reformatted into a draft Decision after the entry into force of the EU Amsterdam Treaty) to combat child pornography on the Internet, now subject to the opinion by the European Parliament. In the period 1996-1999 the European Commission has supported under the STOP Programme and the DAPHNE Initiative (managed by the Directorate General Justice and Home Affairs) several research and operational projects on the subject of preventing and combating child pornography on the Internet. Moreover, in December 1997 the EU Council extended the Europol mandate in trafficking in human beings to the production, sale and distribution of child pornography materials.

trade. Mr. Kappler replied to the questions raised after his speech as follows: There is no harmonisation within the EU as to the content related offences and such harmonisation could take years; currently there are 42 contact points world wide which are linked to the G8 24h/7d network, and there will be more in the future; there are not many data/privacy crimes reported by the Länder to the Federal police in Germany, where the electronic information gathering system has been working for two years; there should be a minimum retention time for freezing information by ISPs for law-enforcement purposes. In this respect and to avoid excessive costs, not all information should be stored; 50% of the in- coming information on committed criminal offences originates from outside Germany; encryption should be freely used but users may have to give law-enforcement investigators the key in specific circumstances.

The fourth speaker Dr. J.F.L. Roording, focussed on "The Information Society: A Challenge to the Criminal Law". He mentioned that modern information technology challenges the criminal law. He pointed out that traditional concepts and procedures have to be adapted to new crimes (hacking) and new investigative methods (interception of data communications), according to the so-called off-line-on-line-principle: what applies to the real world (off line), should also apply to the virtual world (on line). As to the liability of the ISPs, he mentioned that, in principle, the ISPs should not be criminalised; this exemption from liability, however, could be made conditional on certain requirements (e.g. to report to the police or block access to the relevant information). The most important challenge is the international character of computer crime. This challenge seems most difficult to meet because criminal jurisdiction is traditionally bound to national territories. Dr. Roording replied to the questions raised after his speech as follows: cyber crime should be defined more carefully; the proposed EU Directive on Electronic Commerce includes certain conditions on "Caching", which might become obsolete in few years; technology neutral legislation is required to combat cybercrime in an effective and long-lasting manner.

Conclusions and Future Directions

The chairman summed up the outcome of the debate by addressing the speakers with two key questions: 1) What should be the role of industry in combating cybercrime; 2) What could be done at EU level on effectively combating cybercrime.
As to the first question: There should be a balanced co-operation between the ISPs and the law enforcement with particular emphasis to transparent procedures. Industry should co-operate only according to the law. A relationship of mutual respect and trust should be developed between industry and law enforcement authorities.
As to the second question: The Treaty of Amsterdam has introduced provisions for closer police and judicial co-operation in criminal matters and for approximation of laws and regulations on criminal matters. It provides therefore the legal framework for EU actions. Some harmonisation of substantive criminal laws may be envisaged. There should be close co-operation with the EU and other international fora/organisations (e.g.G8, Council of Europe). There should be sufficient training of the law enforcement. In short, there is a vital need for further and eminent action at EU level, both in the legislative and in the not-legislative areas.

Rapporteur:
Kiveli Ringou (European Commission)
Speakers:
Chairperson: George Papapavlou, Head of Unit, Internet-linked Services, European Commission, Information Society Directorate General

- Ekkehrt Kappler (D), Erster Kriminalhauptkommissar, Bundeskriminalamt
- J.F.L.Roording (NL), Lawyer – co-author of the Computer crime bill pending before the Dutch Parliament) Ministry of Justice – The Hague
- Michael Waidner (A), Manager Network Security and Cryptography, IBM Research Division – Zurich Research Laboratory
- Ian Walden (UK), Director of Computer Related Crime Research Center, University of Queen Mary & Westfield College

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Intellectual Capital/Intangible Investments How much is your business worth

Radical changes are taking place as a result of the shift from a material-oriented towards an information- and service-oriented economy. In several different domains there is growing concern that the instruments available for economic and business management are no longer adequate.

- Policy makers have insufficient data on the shift from investment in tangible assets in the economy, and limited information on the volume of trade in services and intangible goods.
- Managers in industry are coming under increasing pressure to assess the impact of investment in intangible assets, such as R&D, training and the ICT infrastructure on the value and performance of the company.
- Financial analysts can no longer rely on the book value of a company as a reliable guide to valuation of an enterprise for investment purposes, and there are growing concerns over the tendency to lock in the know-how of key personnel with restrictive exclusive contracts.

Main issues raised

The economies of the US and the EU are achieving growth through new and emerging technologies which collectively provide the means of distribution and development of products and services which do not need to the same extent investment in traditional capital assets such as production machinery.
This means that businesses can no longer be valued according to traditional accounting practices which rely heavily on „historical evidence" and the valuation of fixed assets. This fact becomes obvious when comparing the book value and market (stock) value of emerging IT service providers and „internet companies".

This is a major challenge not only to our traditional notions of the values of companies which are being bought and sold, but also to business investment decision-making. This encompasses management decisions such as how much to invest in R&D, training and brand development and economic policy decision-making where traditional measures of productivity may no longer be applicable to an economy where service and digitised products are the main providers of economic growth.

The issues are of continuous importance but take on a crucial role during restructuring, mergers and acquisitions and decisions on out-sourcing.

The session provided presentations of the overall problem from Clark Eustace, the investment view from Charles Goldfinger and some practical research from the MAGIC project as well as two industrial case studies: a holistic accounting approach from Rambøll and the management of human resource capital from ICL Finland.

Conclusions and Future Directions

There appears clear evidence that there has existed for over two decades a large discrepancy between European and USA investment in intangible investments. As reported by Eustace, the US has consistently been investing about two and a half

times that of the EU. This, it was argued, could be the most significant factor in explaining US dominance in driving the digital economy.

Europe has been slow to recognise and react to this fact, but as evidenced by the case studies from ICL and Rambøll and the results of surveys from MAGIC presented at the session EU industries are now trying to address the problem. So far this is largely at the level of human resource/knowledge management and ICT investment. It is accepted that recruitment and retention of well-qualified staff is crucial to business success. But the lack of practical measurement and value assessment tools for this purpose is a real management problem. In a survey by the FhG-IAO 83 % of industrial respondants believe that measuring intellectual capital is critical to achieving business success.
If the value of a company mainly lies in the knowledge which resides in the heads of individual employees, means must be found either to encourage these individuals to share the knowledge or to prevent these persons from leaving for example if the company should change ownership or management. This means that employer-employee relationships can directly impact on the value of a business. In addition attemps are now being made to define other classes of intangible assets such as structural capital, innovation and product potential, and market capital.

The clear messages of the session were:

- Industry, especially in the ICT sector, but also in other sectors, is aware that knowledge management increasingly is a key element in a establishing the value of a business, but at present there exist no means for external stakeholders or investment analysts to measure the performance of a company with respect to these aspects. Such indicators need to be identified.
- The problem transcends all aspects of business management including accounting practices, corporate investment strategy and disclosure of information and aspects of economic management such as the use of business performance indicators for economic forecasting and decision-making. It needs to be tackled jointly by the various institutional actors on an inter-disciplinary basis.
- The issue is acute. If Europe is to compete with the US, investment in „intangibles" relating to R&D, innovation, training and market development must be increased and this needs to be recognised at a policy level.
- ICT industries are not alone with this problem, all sectors are moving to a more service or „intangible" based economy, but the very low level of tangible assets required by many new ICT companies has provoked an earlier awareness of the issue in this domain because of the high stock value of emerging digital technology companies.

Strong support was given by attendees at the session for a separate workshop to be organised by the Commission on this topic. It was recognised that the full implications of what the speakers proposed needed fuller discussion between high level managers, and appropriate Commission services. Case studies need to be identified and worked on to find practical performance assessment indicators. The sense of the meeting was that the Commission should take an initiative in this.

Rapporteur: Monica Schofield
Speakers:
Introduction and welcome: Ronald Mackay, European Commission, Information Society Directorate General, Electronic commerce unit
- C. Eustace (USA), Mantos Associates / Brookings Institute: The key issues
- C. Goldfinger (B), GEF S.A.: The investment perspective
- L. Haapanen (FI), QPR : The MAGIC project
- J. Warschat (D), Fraunhofer IAO: The research perspective

Current industrial best practise
- J. Loudes (F), Cap Gemini
- C. Støvring (DK), Rambøll
- A. Haggren (FI), ICL

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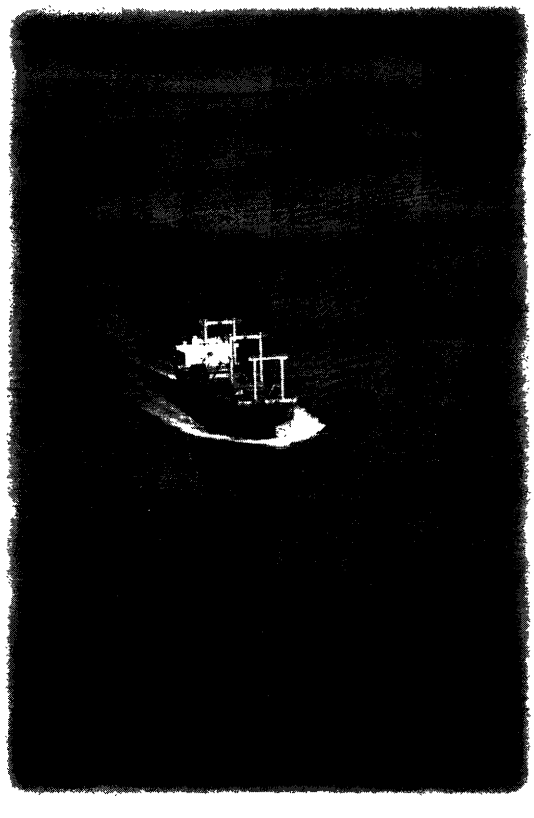
Partnerships Across the Oceans – International Co-operation

The session highlighted RTD co-operation opportunities with industrialised countries, chiefly with the US and Japan. The session indicated opportunities and practical solutions towards intercontinental partnerships.

Reports were presented on EU-US experiences from business partnerships, in the field of dependability - the EU-US initiative on dependability was launched in this session. There was also reporting from the area of multi-lingual systems - the first results of the joint IST-NSF call on multilingual systems was presented as well as further opportunities for EU-US co-operation in this domain.

EU-Japan co-operation was first highlighted in the context of the International Manufacturing Systems initiative. The IMS initiative has seen its first call for proposals in the Fifth Framework Programme in June. Substantial experience has been gained in this initiative for RTD co-operation in a multilateral context including with Japan.



Bilateral co-operation with Japan also develops, and an SME partnering event is planned to take place in Japan in October 2000. This event will provide Japanese and European companies active in the fields of multimedia with opportunities for finding partners and matching their skills and competence.

Main issues raised

This session addressed RTD co-operation between the industrialised countries, in particular the USA, Japan and the EU. It described some problems experienced, how these had been overcome, and new opportunities for international co-operation.
Cultural barriers to co-operation were mentioned by most speakers. These included language, administrative rules, intellectual property rights and protection, and business culture.

Timescales for establishing international collaboration and obtaining benefits were long. For example, in multi-lingual systems, it had taken 18 months to organise parallel Calls for Proposals in the USA and the EU. Once collaborative projects started, it took time for the international partners to understand each other before the real benefits of co-operation began to flow.

Perhaps because of the problems of collaboration at this level, the subjects addressed had specific focuses. In one case, access to a unique technical resource motivated collaboration. In others, the scale of the problems addressed encouraged a concerted effort across developed countries. Some topics - such as remote support of equipment across the world - have an intrinsic international dimension, and could benefit from international insights.

Conclusions and Future Directions

Overcoming communication problems require more than just translation. Words

have different meanings in different cultures. For example, for some the word "model" means a high level description of causes and effects, while for others it means a precise equation or physical mock-up. In a similar way, the same concept can be expressed in different ways in different regions. "Trustworthiness" in the USA translates as "dependability" in the EU.

Differences between the regions concerning IPR and Anti-Trust Law can inhibit collaboration. For example, if the Japanese government funds research, it also owns the resulting intellectual property. In the equivalent case in the EU, ownership would rest with the developer. In the USA, experience of collaborative research is limited and so consistency with anti-trust legislation is often questioned.

EU funding of RTD is carried out according to a single set of administrative, financial and legal rules. In the USA, many agencies fund research, each with its own priorities and support mechanisms. It was suggested that the NSF could provide a single interface to US funding agencies.
International collaboration in RTD can produce concrete benefits. This is not limited to cases where the scale of the problem requires international resources. The different approaches of the different regions – incremental improvement in Japan, generic analysis in Europe, "can do" approach in the USA – can combine to achieve more than a consortium from one of the regions might achieve.

To establish a collaboration framework, three ingredients – in addition to money – were required:

- Suspension of formal processes and procedures, to facilitate discussion and exploration of possibilities
- Recognition that all sides must gain from collaboration
- Participation of the research community in each region in developing the framework.

Rapporteur: Paul Drath

Speakers:

Chairperson: G. Metakides, Director, Essential Information Society Technologies and Infrastructures, European Commission, Information Society Directorate General

- B. Randel (UK): Dependability, The Context.
- B. MacDonald (USA), White House and G. Metakides, European Commission: Launch of EU-US Joint Dependability Initiative
- G. Strong (USA), NSF: EU-US co-operation initiative in multilingual systems
- H. Ohkura (JPN), Toyo Engineering Corporation , Japan: EU-Japan co-operation in the IMS context
- M. Ollus (FI), Vtt Automotive: Experiences from industry in co-operation with Japan

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Content Driving Competitiveness

As we stand on the threshold of the new millennium, creativity and digital expression are shaping our culture, research and economy. From the citizen and the artist publishing freely and globally to a fusion of research and applied creativity. From the digital entrepreneur to 1001 channels, cascading multimedia content back to the citizen: the ultimate 'consumeter' of what will and will not sell. And so the digital momentum gathers speed.

Content Driving Competitiveness looked at emerging standards and business models for digital content and examined the impact of new content technologies on the Information Society and beyond. Realising the Information Society and empowering the citizen has profound implications for all concerned and presents particular challenges and opportunities for culture, science and the economy. The session examined these issues through the eyes of an artist, a scientist and a businessman. They will help us to come to terms with and understand the societal and cultural changes and the technological and economic developments we can expect.

Main issues raised

New media artists need a high speed cultural backbone to collaborate in pan-European projects. (Broeckmann)

A survey of art projects on the web reveals a high degree of innovation, talent and usage of limited resources compared to browse and buy style of American sites. A European level cultural backbone connecting the active centres such as Berlin, Amsterdam, London and other places will contribute to an explosion of European art talent.

85% of the budget is spent on a film before anyone sees it. Technology can enable people to be involved in the film making process, provide location information, hunt for costumes and sets and build up publicity through word of mouth.(Hoegh)

The user's role in traditional film making is grossly neglected. New business models cut down production costs by redefining the production process without affecting the quality of end product. These models apply to other domains as well such as architecture.

Let a thousand flowers bloom. It is better to have many small projects than mega projects. Everyone is a bit of artist, scientist and businessperson. (Davenport)

Convergence was anticipated in 1980s. But it was expected in tools not networks as is the result now. Mega projects are suitable if the anticipated outcome is well defined. Smaller projects are flexible and evolve innovatively within constraints. A Mexican opera project puts out a new episode just 36 hours after last episode based on audience feedback.

Conclusions and Future Directions

There are plenty of European non-commercial sites which are innovative, have compelling content, high usage and limited resources. Broekmann showed several such sites. B-92, a political site from Belgrade, had 18 million hits in seven days during the Kosovo war. Audio artists who broadcast music on the net invented a site which is a virtual studio of one physically located on a server. With this they can continue to broadcast even while travelling to several countries. Innovation is driven by limited resources, passion and a need.

People are willing to participate and help build something for a 'fair exchange of value'. As they become involved in projects, they aspire from amateurdom to professional quality inputs. They move from consumption (driven by curiosity, affiliation) to value creation (dedication, passion and work). Companies which build this people involvement into their process command high values. Eg. Geocites sold to

Yahoo at a high prize because of their member relations, unfortunately without giving any benefits to users.

The MIT 'things that link' and 'things that think' projects create new content in extraordinary ways - through interactions of people with physical environments. Eg. Pigeons on a video wall fly away when somebody walks past and settle down later. Their philosophy is open-knowledge framework based on creativity, openness and sociability. It is up to the industry to discover and exploit value.

Key issues:

- Enabling conditions need to be created for user created content in non-commercial and artistic settings
- In commercial settings, an 'exchange value' has to be created which encourages people to participate for something in return (could be an experience...like TV shows).
- Use of technology for social applications is not realised. Normal uses tend to be productivity oriented.
- Perhaps this form of people participation is unique and may acquire a distinctive European flavour over time (like Scandinavian co-operative approach or the Dutch polder model).

Suggestions for policy

1. The involvement of artists and media community is grossly underestimated in IST programmes. Some of the work in this sector far beats the projects undertaken in IST by technology community. Artists understand and invoke emotions in humans. Their participation is essential in IST to improve quality of life. Special initiatives and contractual mechanisms may be formulated (an artist is most of the time an independent person without any organisational affiliation) to draw artists and media explorers into IST projects.

2. New business models and application scenarios that involve participation of end users as content creators, editors and production assistants needs to be encouraged.

3. Issues related to IPR and remuneration in user created content need addressing.

Rapporteur: Raghu Kolli

Speakers:

Chairperson: Kieran O'Hea, Seagrange Ltd. (L),

- Glorianna Davenport (USA), MIT Media Lab
- Andreas Broeckmann (NL), V2_Organisation, Co-ordinator of the European Cultural Backbone.
- Thomas Heogh (UK), Arts Alliance

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Free Software – Behind the scenes

This session explored some aspects of the "Libre software" role (also called Free software or Open source software) in the Information Society.

First of all, the "distributed" development process were discussed, trying to understand if and why it could produce better software than other "classical" development processes, by trying to compare classical business models versus "free software" based business models. Also explored were the underlying economic aspects of free software and the robustness of such an economy. Finally, discussion in the panel addressed some aspects that were developed in previous speeches, for instance the strategy for businesses using, or based on, free software or on the use of free software to enforce publicly available standards (data formats, protocols, etc.).

Main issues raised

What is Free Software?
"Free software", or "Open source software" is software developed along open standards: i.e. the sources are freely available for all to use and further develop provided it is pursued under the same scheme. With open source software it is possible for all software developers to create their own work. In fact, open source software producers have left the game of competing for monopoly.
Quality control is based on peer review: one puts code on the Internet and gets feedback from users and other developers: this makes it possible to improve the software.

Is there a "business case"?
Although there is a growing class of people driven by altruistic motives according to the chairman, open source software development does not have to rely on that, alone. Companies make open source software to make money. By giving out something you receive appreciation by society/market. It can also be a good way to promote other activities. After all, in the IS the money is no longer in the product: it is now in the service. For instance when Kodak started to sell cheap cameras: it led to a much larger market, buying a lot of films and a lot of photo paper. The same goes for printers: the money is not in the printer, but in the ink used.

How to use Free Software?
Open standards make you less dependent on the "owner": there is no monopoly of installed base. Regarding the security of open source software, it was expressed that security is a matter of trust. Hiding a source will not secure the use. Open it shows where the strengths and weaknesses (to be improved) are. Again another factor in "free software" providing a business case: as important developer in the domain, companies may want to "buy" your services to ensure security based on the latest developments.

Regarding trustability of free versus proprietary software: it is clear that one looses one side of accountability that comes from the transaction: who to blame. However, this can be solved by statistical proof, or by paying someone to be accountable. For open software it is possible to hire someone to take responsibility: for propriety software one does not have a choice but trust the "owner".

Conclusions and Future Directions

Rishab Gosh demonstrated the "cooking pot model" to explain why making open source software would make sense. Instead of barter goods (exchange one good against another) it often makes sense to put both goods into a process (the "cooking pot") and get a meal out of it which is better then one + one. This better meal you split, thus making profit (win – win: both have "better food" this way).

In IS products like open source software the result is even better, since there is

Infinite replication. It doesn't matter when someone takes something out of the pot, because there is nothing less after!

In the new economy net gain is no longer dependent on transaction: you have your "net gain" already achieved by production. Therefore a "contribution to the pot" is not based purely on altruism, but on perceiving the value to be there. And it gets better: the more people use the product, the higher your added value becomes to be. Of course developing open source code should not be all of you do, but it can help to improve your profile/provide market leadership: based on this you can "sell" other products or services.
Even more so: there is not only one pot. If you put the lid on your pot, the value will start diminishing rapidly, because people will go to the other pot.

Open source removes friction and allows people to make decisions, with full information, without the ballast of installed base. More people understand that, as the growth of the "market" for open source software shows. Two years ago at COMDEX Linux was presented in a small room with a handful of people. Linus Torvalds at COMDEX in 1999 got the same number of audience as Bill Gates. The only difference in terms of interest was that Linus Torvalds received a standing ovation.

In a way it is sad that in the most recent court case the judge concluded that Microsoft did act as a monopoly. This means somehow that the free market system failed. Linux should have prevented that, not the US Department of Justice.

On a question from the audience on what will happen if complexity creeps into Linux / open software as much as in Microsoft's, where nobody knows anymore what is in it, the panel responded that indeed open source software does not have someone clearly responsibly, but one can go to service providers and pay them to be responsible.

Conclusion by the chairman, concerning the possible role for the European Commission was to put in some money to stimulate further collaboration, but should not attempt to lead the research. As such the Commission should support open software development as policy. The reference of a draft issue paper was given to the audience (http://eu.conecta.it).

Under the European co-operative research programme the programme pays for the pot, i.e. for the "overhead of collaboration". Within the IST Workprogramme 2000 "To foster the development and use of open source software" is recognised as specific objective.

Rapporteur: Maarten Botterman

Speakers:

Chairperson: Michael Tiemann (US), CYGNUS,

- Jonathan Prial (US), IBM : IBM and Open Source Software
- Rishab A. Ghosh (India), First Monday: Free software economics models

Panel : What Strategies for business ?

- Jean-Claude Guedon (CA), Université de Montreal, Panelist
- Dirk Hohndel (D), SuSE Rhein/Main AG, Germany, Panelist
- Bernard Lang (F), INRIA, France, Panelist
- Philippe Aigrain, European Commission, Information Society Directorate General: Results from the working group and further steps by Commission

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Opportunities for Partnerships with Emerging Economies – International Co-operation

Emerging economies are rebounding. The Asian economies are strongly recovering, the Latin American countries are stable and the Mediterranean area is more closely linked to the EU than ever before. The countries have a very well developed human potential and the market opportunities are immense.

In order to support co-operation in IST with emerging economies, the Commission is launching new programmes in 1999: the EUMEDIS programme which will support co-operation activities with the Mediterranean Countries and the ASIA IT&C programme which will foster co-operation with Asia. Discussions for further co-operation with Latin America are ongoing, and a successful EU-Latin America Forum on Global Communications was held in June this year. Furthermore arrangements are being made for emerging economies to finance their participation in projects of the IST programme.

Based on their extensive experience the speakers highlighted how co-operation in RTD can be mutually beneficial for the industry and academic world in both the EU and the emerging economies, and which support mechanisms exist to further this co-operation.

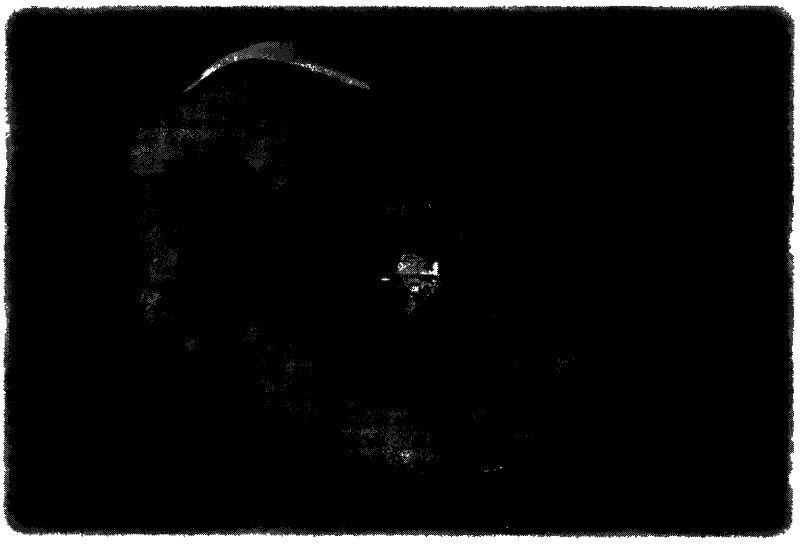
Main issues raised

The session outlined the potential for RTD collaboration between EU organisations and those in emerging economies, in Central and Southern America and South East Asia.
Co-operation between organisations in Europe and the emerging economies can potentially benefit both sides. The challenge is to find out how mutually beneficial collaborations could be established.
While information technology is important to the emerging economies, it is not a panacea. Collaboration in the IT area is needed to address the development objectives of the country concerned.

Collaboration in IT can be viewed as a threat, rather than an opportunity. This is especially the case where the emphasis is on selling hardware rather than on collaboration in software development.
Within the emerging economies, administrations and governments have limited awareness of the possibilities for collaboration in research and development where this involves companies rather than universities and research institutes. Companies wishing to become involved have to rely on other sources for guidance in this matter.

Conclusions and Future Directions

In most of the regions discussed, the economy is growing faster than that of the EU. In the case of Turkey, half its external trade is with Europe. This should represent an opportunity for EU organisations.
Each region is investing in IT in a variety of applications. For example, in Costa Rica, there are initiatives in telemedicine, which link half the country's hospitals; in linking rural communities using satellite commu-



nications to provide services such as health and email; and in providing computer based training for students. In Turkey, 7000 SMEs are being attached to an e-commerce network, while policies and the legal and technical infrastructure for e-commerce are under development. A national academic network has been established, and investment in IT was forecast to be 100 billion euro over the next five years. In Asia, co-operation is promoted between 16 countries and the EU in eight domains. Plans such as these indicate areas where collaboration would be possible.

The emerging economies are, however, cautious concerning the type of collaboration in which they might become involved. Some view IT as a threat, since it could allow easy access to their markets. Some consider the WTO agreement on IPR in software to be against their interests. Areas where collaboration is less favoured are ones involving exploitation of the natural resources of their countries, or exploitation of their low labour costs, or "vulture capitalism" – buying in order to sell quickly at a profit. More favoured are relationships which increase the value added within the economy, which may be achieved through strategic partnerships.
At the company level, collaboration with the EU has brought significant benefits, in providing access to technologies which would otherwise have been too expensive, and supporting certification of processes and products, necessary for their acceptance in European markets. EU partners can benefit from localisation of their products, and also from low cost resources. The outstanding problem to be overcome was mentioned to be the transition from successful project collaboration to successful collaboration in marketing products. This requires collaboration with companies, rather than research organisations, within the EU.

Rapporteur: Paul Drath

Speakers:

Chairperson: R. Chaabouni, Director for Planning, Office of the Prime Minister, Tunisia

- Keynote Speaker: J. Figueres, Former President of Costa Rica
- C. Arikan (T), Vice President of Tubitak, Turkey
- N. Bhattacharya (India), SEMA Group: Co-operation with Asia in IST : a wealth of opportunities. The Asia IT&C programme
- F. Brum (Uruguay), CCC, : EU-Latin America co-operation; experiences from industry

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Language Matters!

Human Language Technologies aim at easing the use and accelerating the uptake of new technologies and services through natural and transparent communication, intuitive and effective information access and knowledge management. As such, they are key underpinning information society technologies that are equally relevant for citizens and for business.

This session looked at some of the language technologies, stressed their impact on current economic and societal developments, presented their successful deployments in digital services, and provided a vision of their future role in the information age. Amongst the relevant technologies are:

- Transparent and natural interfaces supporting multi-modal interaction – spoken, visual, gesture and hand written – that improve the ease of use of portable (wearable) and mobile communication and computing devices. With the advent of UMTS and the explosion of new service offerings, the need for a natural dialogue with personal devices becomes compelling.
- Intuitive, multilingual and adaptive interactivity for electronic commerce in the global market place that is flexibility with respect to the available communication modalities to ensure terminal independence, mobility and ubiquity of electronic services. Sustaining the growth of electronic commerce for broader segments of the population and in geographically diverse areas rest on the provision of such technologies.
- Intelligent language agents able to process content semantically support Web-related activities and knowledge intensive tasks, including decision making and knowledge acquisition. With the next generation internet and the growing importance of intranets for information age enterprises, intelligent language agents become critical components of the information infrastructure.

The focus of the session was on spoken and multi-modal communication, multilingual information management, knowledge computing and their impact of the way we will communicate, interact with information and do business tomorrow.

Main issues raised

Opportunities and challenges for voice interface deployment

The speech technology market is already there, and substantial. In 1998 the market accrued to a total of 450 million USD, it is expected to grow to 8 billion USD in 2003 (source: H.C.Wainwrigth & Co 1999). This is without counting the localisation industry, which is a multi-billion business today.

Technology challenges are to cope with the wide range of uncontrolled (noisy) user environments and the variability in speakers, including non native speakers (how to recognise French when spoken with a heavy English accent?), a very important user group. The terminal capability is still a bottleneck, as well as the bandwidth, particularly in the mobile domain.

The significant language barrier offers a great opportunity (cross language conversation support) but also a tremendous challenge: there are only a few significant

uniform language areas in the world. It is also very difficult to segment products by languages.

Efficient voice Interfaces will greatly benefit from integration with other user interface technologies (pointing device, pen, keypad) as back-up.

DARPA has posed the following research challenges to its community:

- Spoken dialogue in the car (with a lot of noise around)
- Real user interacting with live data, making real arrangements via spoken dialogue (test in Jan 2000)
- MT in a Day (Mandarin-to-English)
- Multi-lingual press service: translate from any language in the target language
- Minority languages: create toolkit that can "easily" support new language combinations

The need for and impact of speech technology in relation to mobile communications
The ubiquity and penetration of mobile communication devices and the upcoming of UMTS, which will bring the potential of multimedia in the mobile domain within a couple of years, speech technology can substantially improve the usability of mobile devices. These mobile devices can either be multipurpose units, which we already use today (telephone, PDA), but also an increasing range of single purpose devices (e.g. music players).

The mobile segment is also a very attractive target for investment in voice interfaces, since it is big, and growing:

- Highest penetrations exceed 60%
- Penetration in all advanced markets range of 20-50%
- Over 1 billion users in 2005 with a significant share of media phones.

Specific use for mobile devices would be in support of cross language communication, but also in allowing spoken access to web content.

Application Development
First of all: voice interfaces should not be an add-on to existing applications, but must be build in already in the design phase of an application. The development paths for speech integration in applications (and appliances) is:

1. Limited command and control application with very robust performance
2. Advanced dialogue applications for limited target groups and usage environments
3. Ubiquitous availability.

An example where a voice interface could well be extremely useful is the computer fridge:

- Dialogue application with a specific scope;
- Frequent use;
- Controlled environment.

Speech recognition (and action) is of great assistance in call centre handling. Nuance has put in place a speech recognition system that enables 250 employees to handle over 2.5 million calls per day.

It is also very useful in domains where machines excel. The following systems run successfully, already today:

- Stock quotes: the speech application knows all 16.000 names of stock offering companies and handles without human intervention 200.000 Calls a day.
- Long alphanumeric strings: people cannot remember them or quickly check database (Federal Express)
- Fidelity Investments: applications quotes and trading with natural language dialogue enables the handling of up to 1 million calls a day (over 4.000 available ports)
- Latest application is servicing a home shopping network: the voice authentication which recognises the real owner of a credit card allows up to 5 million different customers to make 200.000 calls a day.

Conclusions and Future Directions

We will see a continuing convergence between the voice- and data networks (PSTN vs. Internet based). In the next generation all information will be available via both interfaces (voice/terminal).
In this speech recognition will be impor-

tant. It is already there, it is already useful: it works. In fact that brings us back to the good old days, where voice used to command the network (human operators as interface for connections).

Technologies allow us to access content wherever we are with voice (although robustness, user friendliness and penetration are still low). The next step is to replace the voice dialogue with a digital dialogue. Of course these developments need to be seen in perspective:

- Internet access is still a dream to most of the World
- Most of the world are not literate
- Cultural and linguistic diversity is fact of the world

According to DARPA there are 6700 World Languages, of which 1000 have 10.000 users or more. Language is important, as it is the carrier of the cultural inheritance systems. Therefore basic research is needed. What is needed to progress to a next generation of speech systems is:

- A human genome level of description of all languages
- A model of the language generation process
- A model of group processes that involve language use
- A signal-to-text transcription mechanism for all languages
- A model to understand overlap

In this it is seen as important to move beyond the information retrieval paradigm in interaction with external knowledge sources towards just-in-time dialogic interaction with world class expertise (net-centricity). In order to further developments in this area, an infrastructure for language technology education needs to be created. Currently we don't have the people to do the research!
Support by public funds in this early phase of deployment of speech technologies does make sense. The first systems in Europe have been deployed thanks to support by European Union. The initiative to collaborate between the US research community and the EU one is well appreciated. Last remark: be realistic when setting priorities: voice interfaces for special groups for instance may well be useful, but depend on needs. In this voice-in is seldom asked, whereas there is a high demand for voice-out.

Rapporteur: Maarten Botterman

Speakers:

- Petri Haavisto (FI), Head, Speech and Audio Systems Laboratory, Nokia Research: Language technology and information age appliances.
- Christian Dugast (F), Director, Nuance Europe. Speech recognition in the network: Case studies to help understand the new generation network.
- David Nahamoo (USA), Director, Human Language Technology Group, IBM: New perspectives in electronic commerce and information services.
- Gary Strong (USA), Director, Communicator and Tides programs, DARPA: Bridging the digital divide: Language technology research in the United States.

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Innovative Workplaces

This session brought together novel and 'forward looking' concepts of architecture, office design, and 'wearables', which will help to design the innovative workplaces of the future.

The globalisation and the considerable expansion of information technology and telecommunications require novel concepts of working methods and practices. Universal mobile telecommunications play a great role in present day working environments. Applications of wearable computers are beginning to emerge. Working in a fixed office environment is giving way to 'working from anywhere'. The implication of this needs to be taken up by architects and office designers, in order to make the new reality more adaptable to the people. We need to look at totally novel concepts of 'virtual offices, working methods, wearables and working environment' which should also act as 'customised agents', in the 2010 and beyond!

The speakers specifically addressed facility management and automatically reconfigurable workplaces using dynamic sensors, virtual environments for team work, and groupware systems for awareness in 3D environment using avatars and ambient displays. A particular point of discussion was also the sustainability aspects of the workplaces and how modern technology and novel approaches can be best employed for it.

A timely and important discussion is the relevance of this topic for the IST Workprogramme 2000. The ISTAG report proposed the vision statement: "start creating an ambient intelligence landscape (for seamless delivery of services and applications) in Europe relying also upon testbeds and open source software, develop user-friendliness, and develop and converge the networking infrastructure in Europe to world-class." The draft IST Workprogramme 2000 for Key Action II – New Methods of Work and Electronic Commerce, among others, takes this into account. In the draft work programme, the Sustainable Workplace Design has the general objectives to develop and validate sustainable workplace designs incorporating emerging technologies into new workplace and work team concepts, incorporating multidiciplinary approaches. These should enhance creativity and productivity; ensure safe working conditions; improve the quality of working life and reduce the overall resource-use burden on the environment, with particular focus on:

- Development of novel IST-enabled workplace designs, as well as solutions and organisational practices aimed at supporting mobility, at sharing building facilities and office space, at increasing overall agility and at promoting sustainable use of resources in the workplace
- Development of novel wearable solutions and software upgradable designs aimed at significantly extending the life of workplace equipment and infrastructure and/or at substantially enhancing sustainability

In addition, the New Perspectives for Work in the draft workprogramme has the objectives to develop a better understanding of the social, economic, industrial and environmental impact of novel technologies for work and business and, in the process, provide guidance to other activities in Key Action II as well as to related legal and policy activities. One focus would be:

- Improve understanding of the linkages between IST-enabled work and sustainable development in a global information society. Particular attention should be given to social relationships in the workplace, quality of worklife (including health and safety), changes in transport, energy and material consumption, as well as new opportunities for the built environment and city planning.

Thus, this session had a two-pronged objective: to consider 'forward looking' concepts of innovative workplaces, and to discuss opportunities to conduct research under IST 2000 work programme, in this technologically exciting field and important for employment.

Main issues raised

Technologies are far advanced than the spaces we live in. Spaces need to become more intelligent. (Fournier)
In innovative offices, the technology will become invisible without insistence of presence.

Workplace is a collection of familiar tools. New metaphor 'Carry tools and data on you'. Head quarters will reside in virtual space. Physical space is essential but secondary (Fournier)
The division between working and non-working time blurs. The facilities of the entire town are used. Office paraphernalia is reduced.

Working is a social experience in the experience economy. New ideas : office laboratory, buffet office (Tuominen)
The office space will not diminish in the coming years. The nature of office will change. Frequent organisational changes, knowledge requirements and mobility will require to organise office activities differently.

70% of competence develops on job. The main causes of job stress are : work-family conflict and lack of information. A survey of 30 projects revealed that traditional office is not the ideal way. (Widen)
People work more productively at home than at office. Multiflex is the ability to work inside and outside the office. Exploratory office models resulted in reducing lead time by 17%, costs by 14% and improving quality by 5%.

Work is a theatre of activities, roles, artefacts, time, logic, geography, social behaviour, trust, group interactions...(Schikel).

Conclusions and Future Directions

This heavily attended session of more than 400 people showed their concern and interest. The office as we know it is set to change for sure. Everyone is trying to figure out how. All the scenarios assume a certain stereotypical version of office - an urbanised office with computers and network and smart people. The speakers made no references to other kinds of offices: ateliers, small companies, site offices and so on.

Key issues:

- The current office will undergo a phase of de-construction for new models to emerge.
- We need to understand how to support knowledge work in office space, factory space, living space and public space.
- Changing attitudes (space that reflects hierarchy is on the wane) office life style, social interactions, collaboration, access to information will govern the new office.
- Everyone needs to be involved in implementing the changes. This will not be easy for large companies.
- The requirements to meet and discuss increases at key decision making phases of project, at the beginning and at the end.
- 40-60% of business communication is done in informal meetings.
- Video conferencing is not successful to this day.
- Impact of changed offices on cities is not known.
- SMEs are able to take up new workplaces faster than large companies.

Rapporteur: Raghu Kolli

Speakers:

Chairperson : Keith Alexander (UK), Director Centre for Facilities Management, Strathclyde Graduate Business School

- Colin Fournier (UK), Professor of Architecture and Urban Planning, Bartlett School of Architecture : Innovative Workplace in the Built Environment
- Tommi Tuominen (FI), President, Equator Helsinki Oy : A New Workplace Strategy for Globalisation : Virtual Workplace
- Bo Widen (S), Executive Consultant, Ericsson Radio System AB: Flexible Offices : New Ways to work.
- Peter Schickel (D), Manager, Blaxxun Interactive AG: The Work Environment of the Future

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Inclusive Information Society

It is not self-evident that the Information Society will become an inclusive and empowering society, as education, work and services, including health services, are more and more based on the concept of an active, motivated and technologically skilled citizen. Nevertheless, some of the threats for social exclusion could be counteracted by information and communications technologies themselves, especially by the development of new communication tools for specific groups of persons with disabilities and by the use of telematics to enhance experiences of social connection and interest.

The session had a dual scope:

1. It highlighted technologies and applications with good potential for improving "quality of life" by empowering older and/or disabled people. The focus is especially on tools for inter-personal communication and on equal access for all persons.

2. The role of information technology as both a risk factor and contributor to well-being and quality of life was also discussed against the background of the challenge of developing effective and user-friendly applications in health and social sectors, and the progress of the European Mental Health Agenda promoted by the Finnish Presidency in 1999.

The following projects, initiatives and perspectives were presented and discussed:

Telematics Applications Projects

- TASC:Telematics Applications Supporting Cognition. This software is intended as decision support for persons with cognitive disabilities (brain-damage or dementia). It enables these persons to cope with daily tasks, social interaction and the outside world with reduced need for assistance.

- ALDICT: Access of Persons with Learning Difficulties to ICT's. The ALDICT software converts automatically between text and communication symbols. Combined with automatic translation and an e-mail module it will enable persons with learning disability (intellectual disability) to use electronic mail and communicate across language barriers.

- MORE : MObile REscue GMS phone with localisation and emergency features, aims at integrating disabled and elderly people into the mobile information and communication society.

Other European and large-scale efforts

The European Mental Health Agenda will highlight the potential role of information society technologies for more empowering services in many sectors of the society, including the promotion of mental health.

The activities of STAKES (Finnish National Research and Development Centre for Welfare and Health): STAKES is the leading Finnish R&D agency for ICT in the health care and social sectors.

Main issues raised

The session presented several projects that highlight examples of possibilities to enhance inclusion, and projects aiming at awareness raising. Main issues:

- The information society as a stimulator of social isolation;
- IST as contributor to well being and quality of life;
- Applications with good potential for improving quality of life by empowering older and/or disabled people (interpersonal communication and equal access).

Conclusions and Future Directions

We do know that the Information Society will affect our well being in significant ways, but still we understand very little of it. The Information Society does not necessarily become an inclusive society. In order to avoid society to work in a way

we do not want, we need to make choices now and act accordingly.

In order to work towards the future in a positive way a European Mental Health Agenda has been established as one of the Finnish EU Presidency (2nd half 1999) priorities. IT will, amongst other things, highlight the potential role of IS Technologies in enabling the development of new and more empowering services in many sectors of the society, including the promotion of mental health and prevention of substance abuse.

One of the projects developed under this banner is the European Inspiration Society Network. Inspiration Society is defined as a society where information and communication technologies are used successfully to promote social inclusion and empowerment.

It was highlighted that an inclusive information society is first of all a community. This means that you need to consider community members, not only users. Based on this it becomes clear that building the information society we need to consider:

- How to keep/create a Community Identity
- What about Rights in, but also Duties to the Community
- Communities are about Feelings and Friendships (not only learning abilities)

It is to be expected that our Information Society will move towards a global web of virtual communities, based on virtual coalitions between virtual communities will build a communities society. In understanding the concept of collaboration between multiple communities Europe is in a leading position.

Applications to support participation
During the session there was a lot of emphasis on results by existing projects. Some examples are:

- TASC: to develop and evaluate computer support for people with cognitive disabilities, a growing group towards the future (www.tascsupport.com)
- ALDIC: Access of persons with learning disabilities to ICTs; "Easy-to-read", "easy-to-understand" improves access of people with all kind of literacy problems. The project developed a set of pictures to help compose messages (the picture messages will be translated to "normal" languages, although not in "normal" languages grammar. www.ilsmh-ea.be)
- DAILY Makes daily life easier for elderly people who have some difficulties in daily living activities and minor activity restrictions in daily life. Daily has produced a CD Rom with information on assisting devices for people with handicaps, including "where to get them in your own country".
- MORE developed a Mobile Rescue system, consisting of a wireless GSM Phone with an integrated GPS receiver. The system is backed by a MORE Service center with DGPS (thus able to determine the position of the MORE correspondent).

The role of Europe
During the seminar the main emphasis on support by the Commission was given in terms of priorities for R&D. Future R&D should support the development of:

- Professional support
- User and community support
- Both research and awareness and dissemination actions

Whereas the focus has been on telemedicine, care chains and administrative applications may have been of interest in the 4th Framework Programme, it was stated that the EU should now focus its support towards truly innovative projects, with a focus on communities, social innovations and empowerment. In fact a focus should focus at community empowerment through use of the actual and future potentials of ICTs.

A particular problem towards the design of IST products and services is that it is focused at large groups, and early adopters (innovators). In this way these

products and services often need to be redesigned to become useful for user with specific requirements. This is not trivial: today up to 25% of the population are critical users, having special requirements due to age, disability, or temporary handicap.

When design considers from the outset a design for all concept, products for users with specific needs become as affordable as for others: thus reducing the gap of inequality. For instance the ADA legislation in USA requires manufacturers to design for all user groups.

Of course the stimulation of Digital TV offers new opportunities: its adoption will "open" the wired world to many people that would be hesitant to use or buy a PC.

Available technologies and a positive approach by governments will bring the IS in reach of everyone ... who wants to participate.

Rapporteur: Maarten Botterman

Speakers:

Chairperson: Eero Riikonen (FI)

- Gunnar Fagerberg (S), Senior Adviser at the Swedish Handicap Institute, President of the AAATE : Telematic applications supporting cognition
- Dr Geert Freyhoff (B), Project Manager of ILSMH European Association : Access of persons with learning disability to Information and Communication Technologies
- Elizabeth Kampmann Hansen (DK), Deputy Director of the Danish Centre for Technical Aids for Rehabilitation and Education : Making daily life easier for older persons: Providing information on assistive devices to older persons using new, multi-media applications
- Dr Mauno Konttinen (FI), Deputy Director General at Stakes: Towards seamless chains of care and cure
- Dr Eero Riikonen (FI), Development Manager in Rehabilitation Foundation, Co-ordinator of European Inspiration Society Network : The European Mental Health Agenda and the telematics of mental health promotion
- Kristiina Sunell (FI), Benefon, Western Europe and member of the MORE DE-3006 project team : Freedom of mobility for all
- Artur Serra (S), Anthropologist, Co-ordinator of the Centre for Internet Applications, Universitat Politecnica de Catalunya: Community networking and new community health care systems: Complementarities in the digital society

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Internet Governance

Lawrence Lessig, Professor at Harvard Law School, recently asserted "We have no problem of governance in cyberspace. We have a problem with governanceSee Policies, Politics & Governance." It seems that was a long time ago. Internet and Governance are now two notions that are inevitably linked. The modern convergence of values, concepts and usage, supported by digital contents, has found its territory on Internet.

It is fair to say that over the past few years, the Internet has developed a paradigm of economics and politics in itself. It justifies growth, wealth and employment. It tends to shape modern democracy. In short, the web plus adequate software and hardware equals e-business. But the Internet has also increased a feeling of uncertainty and complexity for trade, investment and commerce. Traditional policies for public affairs are blurred as well as the former frontier between private and public instruments and the confidence in co-operation for information exchanges. What will be the rules for Internet, if any?

It is therefore essential to consider what are the main paths and basic principles for the deployment of the Internet worldwide. The session reflected on the pending issues of Internet infrastructure and architecture, international guidance for its management, competition for the Domain Name System, availability and fair distribution of IP addresses, evolution of IP protocols, global openness, and more.

Thus, in the light of the decisions to be taken by ICANN (Internet Corporation for Assigned Names and Numbers) and its related Councils, supported by industry, users and governments world-wide, it will be possible to envisage how research and industry for the Information Society could support a stable, yet progressive and potentially truly international Internet.

Main issues raised

The challenges of Internet governance

The session discussed the challenges created by a medium which is instantly local and instantly global, creating challenges to understanding, regulation and enforcement. It has had a culture of consensus and self-regulation, which is now being challenged by its growth and prospective economic impact. It is changing so fast that it demands a governance structure that can also change rapidly. There is wide agreement that it should remain a private-sector phenomenon, yet government has a key role to play – even if, according to some in the US administration, that should only involve the US government. The extension of US concepts of the primacy of market forces into a global context leads also to friction and disagreement.

The workings of ICANN

The session was presented with a description of the structure and procedures of ICANN, the US-based authority which is responsible for co-ordinating the global administration of Internet names, IP numbers and IP port and parameter numbers. There was particular emphasis placed on the fact that ICANN has no power other than its mandate to create and implement consensus policies. It is a bottom-up organisation driven by its members, in the private sector and has an advisory committee of governmental representatives. It was pointed out that this latter arrangement is a reversal of the usual regulatory model, although one governmental representative present pointed out that it was also illusory, since governments could step in and legislate at any time. The French representative paid tribute to ICANN as useful and innovative.

The role of regulation

The French representative discussed the role of regulation on the Internet, and described the French concept of "co-regulation". Their view is that both more self-

regulation and more public regulation will be required. The Internet cannot be considered an unregulated environment, since existing laws do apply to the Internet, often inappropriately; hence new, more appropriate law is required. In addition, conflicting interests are now arising on the Internet, in contrast to the communitarian approach of the early Internet culture. Such conflicts, relating for example to trademarks, false rumours, protection of children etc. require guaranteed means to protect rights and litigate to do so. The importance of litigation as a means to defend and enforce rights was emphasised, although panel discussion also highlighted the inevitable difference in approach between countries with different legal systems, in which litigation plays different roles.

The role of the United States

The role of the United States was addressed from a number of perspectives. On the one hand, the Policy Director of ICANN emphasised that ICANN, although a US-registered organisation, is not constructed as an instrument of American power, even if he conceded that the views of the US Government are of particular significance at present. This was accepted and supported by the French representative. On the other hand, there was concern raised during questions from the floor about US policy on Internet interconnect pricing and on the US-centric domination of "Star Tap" in Chicago (which excited as much confusion as concern amongst those present). The Australian representative sought an end to the bilateral character of the Washington-Brussels dialectic, pointing out that now all nations are stakeholders in Internet governance.

Conclusions and Future Directions

It was clear that the issue of Internet governance is of primary importance and concern to the Information Society and to all its stakeholders in Europe. The session demonstrated that the issues excite enormous interest, and that many have a contribution to make.

At the session, Mr Wilkinson of the European Commission indicated that he would create and operate a mailing list and a panel of participants on the subject, and this is an initiative to encourage. There is clearly a great thirst for information, and other dissemination techniques should be studied in order to encourage a more inclusive debate throughout Europe.

A clear policy imperative emerged, related to the speed at which Europe can act on such matters. In an environment in which whole new commercial phenomena can arise in under a year, the traditional EU approach to regulation, with its structured two-year cycles, is no longer sustainable.

Specific action points that emerged during the session related to the role of "Star Tap", which in future, it was suggested, would concentrate control over the global Internet in the US. Whilst the CEC is aware of this issue, it clearly needs to be addressed with some clarity.

Rapporteur: Andrew Bud

Speakers:

Chairperson: Paul Twomey (AUS), CEO of the National Office for the Information Economy, Chair of the Governmental Advisory Committee of ICANN, Australia

- Mr Joe Sims (USA), General Counsel of ICANN
- Dr Pekka Tarjanne (FI), V-P Oxygen, former Secretary-General of ITU
- J-N Tronc (F), Adviser to Prime Minister

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I-Play, You-Play

Just ask any 12-year old what he likes to do in his spare time, and you'll almost certainly hear the word "Nintendo" or "Playstation". But what makes a box of technology amusing? And, equally important, how will the evolving answers to that question change the way in which we work with technology? How can we use technology in our leisure time? How can we use technology to make our leisure time more enjoyable, with more emphasis on the useful realities? To provoke insight and debate, the panel assembled people with a variety of views on technology and play.

John Browing, Editor of Wired magazine, was the moderator of this session. Wired is a leading new technologies magazine, which makes technology fun. It has introduced us to exciting and new products and services. It aims to change the 'nerdy' image of technology into something we can enjoy. Whether it is a discussion on a new microprocessor or an insight into a major player, their articles look at the lighter side of things and make reading enjoyable.

The "I Play, You Play" session had, as its core, the use of technology for leisure. In fact, judging by store fronts, one would think that technology is ONLY for leisure, what with the proliferation of computer game titles, games which are many steps beyond the Pacmans or Space Invaders of yesteryear. See the success a game like Tomb Raider has had in structuring today's culture, or that the Star Wars Episode One game was available before the film came out, and you see that leisure is a major part of business today. Combine such a market with the internet and you get multiplayer games, real time and excitement that beat most amusement parks in 'bang for the buck.'

Leisure however is not limited by games. Leisure includes pastimes such as chess, checkers, educational software, hobby

related toys (including radio control by software of model aeroplanes and trains), software controlled gadgets and devices and much more. Combine this with the internet and you get short wave radio on the internet (just type in the frequency of that radio station, and you get sound via the computer's audio port), as well as Internet chat, video phones, web cameras to see what the world looks like and much more.

'I Play, You Play' looked at these issues and saw how we use the internet to entertain ourselves in ways previously the domain of science fiction.

Main issues raised

The most powerful learning can take place through playing games, where the individual can interact and explore possibilities. It contrasts with traditional teaching, which can be described as pouring content into people's heads.

Playing on computers has been characterised as anti-social, because it did not

involve interaction with others. Now it is possible for multiple players to play the same game simultaneously, providing an even richer learning environment.

IT users in general and children in particular can be creative users of technology, finding ways to use it that its designers did not envisage. IT therefore needs to be designed in consultation with users, even if they are children.

Teachers can be a barrier to learning using computer games. In some cases this is because they are reluctant to embrace new technology. In other cases, this is because they don't appreciate how creative children can be in adapting the technology.

Conclusions and Future Directions

Some of the benefits of IT in learning had long been demonstrated in playing chess. Computers and the Internet allowed players to readily find competitors (human or electronic) of similar standards, to find teachers, and to locate specific games and news in the field of interest.
Some recent developments had been aimed at young children. One example is the CitySpace website, a virtual city environment built collaboratively by children, educators and media artists across the Internet. The project invites young people to share stories, pictures, sounds and 3D models of their own creation, and to assemble them into a navigable, three-dimensional city model.

Another example is KidPad, a shared whiteboard for storytelling. This supports multiple mice. Initially, sharing leads to "scribble wars", and then to division of the whiteboard into individual territories. Eventually, children see items of interest in each other's territory and begin to collaborate in the development of a story.
Developments such as these threw up the question: what should the role of children be in the design of this educational technology? We all have prejudices on this subject, but are these adequate substitutes for user involvement? If children are given the tools, they will use them in unexpected ways, so it could be valuable to involve them in the design of the tools. While some of the panel strongly favoured a large role here for children, members of the audience were less supportive, suggesting there were already too many pressures on teaching, without changing schools into computer laboratories.

To use computer based games to teach adults, it was observed that computer simulations needed much more extensive content and environment models if they were to be effective.

Rapporteur: Paul Drath

Speakers:

Moderator: John Browning (USA), Wired Magazine

- Coco Conn (USA), Cityspace.org
- Murray Campbell (USA), IBM, Creator of Deep Blue
- John Thackara (NL), Netherlands Design Institute

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PLENARY DEBATE
The Ambient Network

Recent technological advances have paved the way for the emergence of a host of new consumer devices, which look set to oust the PC from its status as the universal computing device.

The proliferation of affordable, powerful and compact microprocessors has enabled our computing needs to be embedded in devices which can be handheld, have more specific functionality than the PC and above all, offer ease of use. These devices also offer connectivity, thanks to the ubiquity of high speed networks. It is forecast that within the coming years there will be billions of 'networked information devices' - taking the form of smart-cellular phones, Internet screen phones, palmtop computers, network computers, to mention but a few - answering our day-to-day computing and connectivity needs.

The story does not end here. With the advent of software interconnection technologies, some companies are looking to a future where embedded computing power will not only mask the complexity of the network and networked devices, but will allow devices to interact and share resources via the network. According to this vision, a device can adapt or enhance its functionality by hooking up with services – applications, storage, compute-power - on the network. In one scenario, a mobile phone can become a 'tape-recorder' by enlisting the services of a disc on the network. In another, information or data residing on remote devices can be accessed and made available via the network to Web clients for e-business.

From the perspectives of companies with diverse but key technology offerings in this arena, The Ambient Network session aimed to review technological, economic and marketing issues to be considered before the vision of pervasiveSee Ambient computing power and ubiquitous network connectivity can be realised. It examined the implications for the way devices and systems are conceived and constructed (what components can be 'put out' on the network?), for the evolution of the greater networking infrastructure (when can we expect 'consumerised' network access and services?), and for business, consumers and citizens in general.

Main issues raised

Wired's post-Mcluhan paradigm
Marshall Mcluhan said that "the medium is the message". This was true as long as the medium constrained the message. Now mobility and Internet remove those constraints, embedding information into people's lives. Wired believe that in future, the message will not be constrained by bandwidth but by "band-depth" – how well all this information is linked together.

SUN's view
SUN takes the view that ubiquity of network access and network functionality will change the focus from connectivity to service. Mobile phones, key locks, even intelligent signet rings will be nodes on the network. SUN promotes the use of their JINI protocol as the service discovery and provisioning infrastructure in this JAVA-powered world. Their view is that in two years the term "e-business" will be forgotten: there will be e-business or no business.

Symbian's view
Symbian believes that the creation of new services will depend upon the creation of self-fulfilling prophecies – in other words, that new mobile services will be marketing-driven, rather than demand-led. To facilitate this, they look at the role of terminal hardware in the commercial value chain, and conclude that the opportunities for advertising-driven business models are so huge that mobile devices will soon be given away. Content-driven value will tend to substitute for connectivity value as the cost of bandwidth declines.

Alcatel's view
Alcatel described the evolution to a new service provider architecture for the provisioning of more intelligent services. This attacked head-on the challenges of implementing a greater variety of terminals, a range of connectivity options, and a greatly increased quantity of information. Complex new systems will be required to support integration, service negotiation, accessibility and ubiquitous usability.

Ericsson's view
The central issue raised by Ericsson was that the key to devices becoming intelli-

gent network elements would be the creation of excellent user interfaces, to give people real control. The VCR was cited as an example of capability without control, and mobile manufacturers will have to do better. Ericsson believe that Bluetooth and the networking of things will actually be more important than mobile access to the Internet.

IBM's view

The future of ambient networking does not lie with any one killer application, although it may pass through such a dominant application during its early growth. The analogy was drawn with electricity, which is today ubiquitous but has no longer a single killer application. This ubiquity will occur when general-purpose solutions fragment into specialised solutions, if necessary migrating complexity into the network, so that applications become sources of convenience not complexity to people. When challenged by Intel to consider whether customer control, rather than network centricity will not remain the preferred model, the speaker noted his lack of success in attempting to convince his wife to use a Swiss Army knife in the place of all domestic cutlery!

Conclusions and Future Directions

The session went beyond the PC and the Web. The panellists covered a number of areas and presented a picture that is complex, unpredictable and inevitable in a way. There is no hype nor 'we have got it right' solutions. The issues that emerged for an ambient network are :

- Each player tends to see the playing field from their own perspective. A user experiences the whole environment - the result of non-collaborative or part collaborative effort by many players. The experiences of users vary widely. How can the individual players understand the total experience of the user ?
- To build an end-to-end service, a number of players need to work together on a technology and information infrastructure which is emerging and not necessarily mature.
- The business models for how individual providers appropriate percentages of value from the service chain will have to emerge.
- Ubiquitous usability, universal accessibility, negotiation and integration are key to any network devices.
- The negotiation between devices can be transparent to users.
- The content for Internet took years to develop. It was pre-print physics papers to start with. It will take some time for content to emerge for devices.
- WAP will be important in Europe. Web will be important in the US.
- Everything is not going to be paid by the end user. New revenue models will emerge.
- Killer applications of the future might be: general access to the Web, access to real time information, transactions, devices that let you do things in between, local information and unified directory services.

Clearly, ambient environments is a complex area and requires effort from a wide variety of players and disciplines - business models, marketing, architecture, industrial design, sociology, ethnography and so on. Realising the vision requires effort at multiple levels in multiple forums.

Rapporteurs: Andrew Bud (Main issues) & Raghu Kolli (Conclusions and Future Directions)

Speakers:

Opening: George Metakides, Director, Essential Information Society Technologies and Infrastructures, European Commission, Information Society Directorate General

Moderator: John Browning (US), Wired Magazine

- Hellmuth Broda (CH), Sun Microsystems, Chief Technologist Europe: Enabling Pervasive Services
- Steen Thygesen (UK), Symbian, Vice President, Business Development: The Wireless Tsunami - what to expect where mobile communications and the Internet converge
- Alain Bravo (F), Alcatel, Technical Director, Alcatel Group : Ubiquitous Networking Intelligence
- Bernt Ericson (S), Ericsson, Vice President, Research and Innovations: From Embedded Computers to Intuitive Services
- Mark Bregman (US), IBM, General Manager, Pervasive Computing: Pervasive Computing: When Computers Disappear

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Sustainable e-nvironment

This workshop presented and discussed opportunities for information society technologies in support of sustainable development. A review and assessment of uses of environmental IST services for monitoring and management purposes, in support of an open and democratic society and as efficient tools in economic activities and decision making took place. Encouragement to foster interaction and enable affective dialogue among researcher, industry, policy makers and stakeholders, and agents of social change toward sustainability. The aim was to highlight emergent technological innovations and their potential implications for enhancing trajectories toward sustainability, and address the importance of realising Sustainable IS through local initiatives and citizen participation.

The workshop also focused on environmental dimensions of sustainable development and the interactions between environmental factors and the information society technologies in different socio-economic and cultural contexts.
Among the perspectives that were highlighted are:

- market perspective on environmental information services
- "best practice" for today's environmental information services
- relationships between sustainable development and IST
- futures perspective for sustainable e-nvironment and development

Main issues raised

The chairman presented the context via statements and issues such as:

- Sustainable Development is far more than environment protection: the concept was developed to address simultaneously the two global problems of a too high pressure on the environment and an increasing gap between the Northern and the developing countries.

- The European Union's adoption of Sustainable Development as its guiding principle via the Treaty of Amsterdam is perceived as very important and a sign of leadership in the area.
- Sustainable Development can only be achieved if the decision process is open and accessible to everybody. The decision process, which needs to involve many different stakeholders and address environmental, techno-economic and socio-cultural issues simultaneously, is very complex and needs to be supported by IST.
- Policy development will have a stronger impact on Sustainable Development than development of performance indicators.
- The IST-sector has many characteristics of unsustainability. It has the potential to contribute to the Sustainable Development of other sectors, but this is insufficiently used.

In an overview from a Commission official of 5th FP activities related to Sustainable Development, and specifically of the IST program and its environmental IST applications, it was underlined that::

- Sustainable Development is not yet thoroughly implemented in the 5th FP.
- There is a potential for IST to contribute to Sustainable Development.
- There is a need to discuss, to set focus and to integrate actions in support of Sustainable Development. The IST program could foster such integration.

The workshop was structured into two main themes. For each, invited speakers gave short presentations, followed by discussions. Under the first theme: "Is there an emerging market for environmental information services?" issues brought up were:

- IST services are necessary for the long-term monitoring of the environment;
- IST services are necessary to implement Disaster Management;
- Remote-sensing information is an essential tool for sustainable environmental management
- Telecom Operators have an important role to play in support of the environment, as manifested by the ETNO (European Telecoms and Network Operators) Group Environmental Charter. Moreover, they can assist in the development of a more sustainable society, because their products and services contribute to dematerilisation of other products and services.

For the second theme: "What are the relationships between Sustainable Development and IST?" issues presented and discussed were:

- There is a conflict between environmental and social Sustainable Development aspects;
- The gap between have and have-nots is increasing;
- It is not clear how to study interdependencies between IST and Sustainable Development;
- Sustainable Development interdependencies can be explained by the equation Environmental Pressure = Population * Consumption per capita * (Inefficiency of) Technology. This implies that, if one wishes to reduce global environmental pressure by a factor 2 and, simultaneously, obtain the present Northern standard of living for the entire (then doubled) world population, technological efficiency increases are needed by a factor 20 to 50. These can not be obtained by extrapolation of present trends, but demand "technology-leapfrogging";
- The 'rebound effect' (the beneficial potential of a new IST development is outweighed by large-scale new applications) is a reality;
- Today the Sustainable Development concept is primarily driven by legislation and institutional (non enforced) conventions, concepts for other, market driven incentives should be developed;
- Insufficient methods and instruments are available to "set peoples' mind";
- The enlargement of EU offers a unique opportunity to reconsider Sustainable Development and environmental policies and their implementation.

The workshop ended with a presentation of an initiative for strategic partnership and global networking for sharing of information related to Sustainable Development. Issues raised were:

- The importance of globalization and strategic partnership; IST should be better utilized as a strategic domain for policy reflections and development;
- Networking must address the problems caused by information overload and different languages; whereas knowledge is power, the power of knowledge is to be better exploited and distributed.

Conclusions and Future Directions – IST-related

Environmental information services, both in monitoring and data provision as well as management (decision support), are considered as having emerging markets in public administrations and industries. Citizens and NGOs also request environmental services, although it is unlikely that they are prepared to pay for them. The availability of environmental information services for the citizens should be addressed in a context of IST and Sustainable Development. Accurate and timely environmental information, relevant for the individual citizen, should become a normal public commodity.

There is a need for strong alliances between industry, the public sector, NGOs, citizens, consumer groups and research institutions, in the development of environmental information services. New information architectures need to be developed, to integrate local and regional information and services, taking into account different spatial and temporal scale. The importance of open systems and standards for data and its quality needs to be stressed
Major challenges for environmental information services are systems compatibility and appropriate user interfaces; these parts are often inadequately developed and addressed in research, but are crucial to a successful development and take-up of the services.

Actions to approach peoples' mind-setting in relation to Sustainable Development should be identified. Such actions should be based on more interactions rather than on more information, e.g. by bringing key stakeholders together under IST support measures.

R&D should address citizens as pro-active actors for realising Sustainable Development, that have to be supported by IST tools, especially tools for interaction and decision support. Examples are Teledemocracy pilots, such as in various the Government-on-Line initiatives, or noise maps at the finger tips of each citizen. The IST-sector should address its inherent unsustainability, inter alia via longer lifetime of its products, standardisation, upgrading and repair facilities, reuse and recycling.

Information Society Technologies and Sustainable Development are trends that are both forcefully promoted by most nations. However, their relationships and impacts on one another are not well understood. There is an urgent need for research in this area, particularly to understand mutual impacts and interdependencies between IST and Sustainable Development and to minimise the risk of adverse effects.
The need for interdisciplinary research in the area as well as for socio-economic and cultural studies is generally agreed. An example of suggested research concerns issues related to eco-rating of products and services. Various efforts to study the Sustainable Information Society have been done in EU countries. However, they have remained "remote islands of knowledge" and concerted actions on such activities should be initiated.

Sustainable Development issues are covered explicitly as well as implicitly in different parts of the 5thFP and the IST programme. There is a need for integration and for cross-programme actions related to Sustainable Development, that should be addressed in future FP IST actions. New areas for IST support of Sustainable Development should be investigated and appropriate actions initiated.

Conclusions and Future Directions - Policy related

There are two major trends in the last decade of the 20th century that will strongly influence our life in the 21st. These are the Information Society Technologies and the increasing consciousness for Sustainable Development. It

is believed that Information Society Technologies can help realise a sustainable society. However, the rebound effect is considered as a reality and may outweigh this IST potential.

Legislation and (eco-) taxation are seen as the current main driving forces for Sustainable Development. There is a need for a larger framework for the use of natural resources that includes legislation and taxation. At the same time, the mind-setting of people in relation to Sustainable Development is considered as equally important.

The enlargement of the EU offers an opportunity for Sustainable Development, because the situation is bad and many actions are needed. The ongoing transition in Central and Eastern Europe presents a window of opportunities for impact on peoples' mind-setting as well as for implementation of cost-effective IST tools in support of Sustainable Development. Actions suggested for approaching peoples mind-setting and awareness of Sustainable Development should be initiated and specifically tailored to the enlargement process.

Particular attention is needed for the developing countries. The potential of IST should be used to reduce rather then to widen the already existing gap with the North. Moreover, the South can only become a market for IST from the moment its population is (IST) literate and has access to required infrastructure.

Rapporteur: Eva Lindecrona, European Commission

Speakers:

Chairperson: Prof. G. Vonkeman (NL), Institute voor Europees Milieubeleid: Sustainable Development - a challenge for IST

- Wolfgang Boch, Head of Unit, European Commission, Information Society Directorate General: IST-Environment and Sustainable Development R&D in the 5th framework programme
- Maurizio Cecchi (I), TelecomItalia: Environmental IST tools: a business for Telecom Operators?
- Einar-Arne Herland (FI), Tekes, Best practice of today's environmental information services
- Sergio Vizzari (F), Matra Systems & Information: Geospatial Infrastructure & Services for DisasterManagement : a viable market perspective
- Dr Thomas Schauer (D), FAW, Ulm: IST and Sustainable Development - Chances and Illusions
- Jernej Stritith (HUN), Regional Environment Centre, Szentendere: Ways in which IST can support sustainable development in Central and Eastern Europe.
- Dr Auli Keskinen (FI), Ministry of Environment, Finland: Joint interests of Sustainable Development and information Society
- Anders Wijkman, MEP: The synergy between Sustainable Development and the IT revolution
- Prof. Nazil Choucri (USA), MIT: Strategic Partnerships with Multilingual Functionality for Globalisation and Localisation.

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Activity Afoot? (Networked Europe)

Active Networking refers to the addition of user-controllable computing capabilities to data networks, which allows computation to happen within networks as data passes through nodes (e.g., modifying, storing, or redirecting the data). The network elements (switches, routers) perform computations on user data that passes between nodes, moreover the computation may be performed in response to a (application-specific) programme supplied by the user.

The expected impact of active networking is in accelerating innovation of the network infrastructure. The key lies in the fact that by decoupling hardware and software innovations, new protocols can be deployed in existing equipment. In mobile communications where the nodes associated with devices (e.g., mobile phones) are constantly on the move (as callers and receivers change location), active networks could greatly simplify call routing management. Its major selling point may be to add flexibility to the network without compromising its scalability.

Main issues raised

Active networking as a response to the content explosion

As sources of information on the Internet multiply, so the number of simultaneous feeds to a user will increase. Multicast will increase the number of feeds originating from a single source. Also the richness of information feeds will increase as video becomes increasingly common. This will place hugely increasing strain on the network – strain that is inherently unnecessary, because at the edge of the network is a human being whose capacity to perceive and to generate information is actually very limited. The solution will be to reflect those limitations ever further back into the network, by filtering information feeds, inside active network nodes, as near to their origin as possible. Examples of this were given in several papers, showing how video streams could be adapted to prevailing network constraints by the network to optimise the user experience.

Active networking as a response to the network management explosion

Modern IP networks are so complex that it is already impossible to manage them fully. Large amounts of status information must be thrown away or ignored. The problem will explode when active networking allows producers and consumers of information to mount applications and policies directly into the network at their discretion. Future large networks will be simply unmanageable unless new approaches are found.

Such an approach, supported by 5th Framework RTD, was described by one speaker, involving the delegation of management tasks to each node, according to a policy-based approach. Each node autonomously monitors and notifies events, according to detailed policies. The network operator then administers policies and notifications, rather than network states. Implementation of this technique might appear in the network in five years.

Beyond this, a more speculative approach exists, based upon a study of biological ecologies, which are highly reactive and self-stabilising without requiring centralised control. Simple working models of network control have been based upon the functional model of the bacteriophage, showing promising behaviour. Implementation of this method is ten years away.

Architectural Approaches to Implementing Active Networks

Several papers highlighted the challenges of implementing active networks, including safety and security. These are partly architectural issues. Architectures can range from the rigid, where nodes are preloaded with certain application-specific programmes, to the anarchic, where network packets themselves carry node-executable code. One speaker outlined a pro-

posed architecture which addresses the safety and security issues. Using a network of managed programme servers, it combines the flexibility to rapidly update node programmes, with the security provided by centralised control and distribution of code.

Programming Approaches to Implementing Active Networks
Similar challenges of security, safety and, particularly, performance must be also addressed by the technology used to programme the node itself. If network users can themselves programme nodes, the risks include such code crashing or locking the node, creating storms of network traffic or swallowing all passing traffic, or slowing the node down to a bottleneck. One speaker described how the use of a very specific language (PLAN-P) for such code could automatically exclude these risks. To function securely, only the source can be distributed, implying the slow performance of an interpreted language. The speaker proposed a solution to this, based on a Just-in-Time compiler, delivering in tests a performance only 5% slower than compiled C code.

First steps
Most of the discussion dwelt on research work. However, one speaker described early experience with a middleware-controlled prototype intelligent network. This addresses some of the basic architectural precursors to Active Networking, such as the separation of network services from network infra-structure.

Conclusions and Future Directions

This is clearly an important area, already supported by the Fifth Framework programme. However, the number of contributors and participants at the Workshop rather implies that it is receiving insufficient attention. The impact of Active Networking upon all aspects of the Information Society is likely to be so great that it deserves more focus.

In particular, floor discussion raised the idea of developing hardware implementations of virtual machines for compiling or running specialised Active Networking languages like PLAN-P. This excited interest amongst those present, and should perhaps be encouraged by RTD support.

The use of biological metaphors for network management is an extremely interesting idea, receiving relatively few resources. The Commission should review whether this should be encouraged by explicit RTD focus.

Rapporteur: Andrew Bud
Speakers:
Chairperson: Nelu Mihai (USA), Director Network Systems, IP Technologies, AT&T Labs:
Commercial Use of Active Networks
- Jonathan M. Smith (USA), Professor, Distributed Systems Lab, University of Pennsylvania: Directions in Active Networks
- Ian Marshall (UK), Senior Engineer, BT Labs: Network Management
- Gilles Muller (F), Chargé de Recherche, IRISA/INRIA: Active Network Programming
- Bernhard Plattner (CH), Professor, ETH Zuerich: Active Network Nodes

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What Future for Employment?

Unemployment figures in Europe grew steadily during the 70-s, 80-s and early 90-s., Since 1997 a modest decline has started to take place, and the average figure dropped from 10.8% in February 1997 to 9.3 in July 1999. This EU-15 figure does not show the huge difference across Europe, ranging from 2.8 % unemployment in Luxembourg and 3.3% in The Netherlands to almost 16% in Spain.

Many jobs still disappear every day, mainly in the industry sector. But new jobs, often in new sectors, often requiring new skills, are now making up for the losses. These new jobs are mainly in the service sector, and most of them are flexible in terms of contract and work scheme (EWON report, March 1999, Labour).

The countries best fighting unemployment are those that manage to match flexible labour supply and demand better, thus achieving more competitive economies. This is reflected, for instance, by the Davos World Ranking of Competitive Nations, now led by The Netherlands.

These developments go hand in hand with the shift towards the Information Society, partly, but very visibly, typified by the uptake of new technologies. Some indicators, according to a Eurobarometer Survey by the end of 1998:

- rapid growth in numbers of users of Internet at home (8% EU average, ranging from 19% in Germany to 40% in Sweden)
- integration of PC's in households (31% EU average ranging from 12% in Greece to 60% in The Netherlands)
- rapid adoption of GSM phones for private use (30% EU average, ranging from 19% in Germany to 60% and higher in Sweden and Finland)

In business, a PC is now the norm, and e-mail is dominant, with the availability of Internet access, according to the SPECTRUM ICT Survey 1998.

The session presented the latest views on employment strategies in the context of the Information Society, both presented by government representatives and industry. It was capped off by the Strategic vision of the so called "Gillenhammer report" and the latest work of the European Commission, in preparation for the European Summit that took place in Helsinki shortly after the IST Conference.

Main issues raised

Moving from Employment to Employability.
Employable people do not need to be without work: unemployed people can be trained effectively to become employable. A change of learning and education system is crucial, and both employers, employees and government need to collaborate in this, since: a large part of the population does not have a fixed job, and, on the other hand, investment in modern IST skills are investments that cannot be protected/

Innovation is the key driver to growth, is the key driver to employment.
Without innovation of your organisation you will loose competitive edge, and will not be able to provide the stake holders what they can get elsewhere. Without innovation of your products and services you will loose your market, because others will offer better products and services at lower prices, at some stage.

Flexible methods of working are key for any organisation; many have experienced this. The session included some reports from major players on experiences (how to, and: leads to what), and on plans from other major organisations to introduce it. SME's collaborate effectively in networks in order to become full service providers.
Conclusions & Future Directions
The introduction of new technology seems to affect the number of personnel negatively, except for ICT technology: more investment seems to lead to more employment, here. The countries with the

highest investments in ICT are those with the lowest number of unemployed. Today any invention or idea has only comparative value. In order to keep your customers you need to keep on improving your product/service. Ongoing innovation has become a vital necessity.

Hanne Shapiro introduced a new abbreviation for learning in the digital Age; ICT:

Intelligence
Imagination
Innovation
Creativity
Communication
Competence
Turbulence
Trust
Transformation

The information society is not just about highways and infrastructures: it should be about how it HELPS to be on-line: how do we learn there, how do we navigate in that space. And ... where is the fun. Initiatives are to be put in place in which people can experience what participation in the virtual space can be about (e.g the "virtual dancing tent"!).

The Finnish Workplace Development programme is proactively promoting the improvement of the quality of working life in both enterprises and government bodies. The Programme funds consultants to assist companies in implementing new workplace organisation and technologies. It is based on the belief that boosting workplace change leads to boosting innovation leads to economic growth and leads to more jobs. The learning organisation is key in this Programme. Up to today more then 45.000 people have been directly affected.

The growing volume of supply activity, caused by the trend towards outsourcing in large enterprises, allows newcomers to enter new markets. Although the number of SMEs with a real potential to become system suppliers is quite small, networking SMEs can be quite effective. Methods and tools have been developed over the last years that drasticly improve the relationship between customers and suppliers. How dramatic the change is may be best reflected in a quote from Andy Groves (Intel): "In 5 years there will not be any internet companies because they will all be internet companies – or they will not be companies at all." In order to create employment it is necessary to create enterprises first. For enterprises to be competitive one needs low cost broadband telecommunications services. This requires ongoing efforts of the European Commission to promote the necessary unbundling of the local loop. For today's organisation of work it is important to think Activity, not Place. In the liberalised telecommunication sector reduction of cost is now crucial. BT has taken the challenge to do so by reduction of Cost of Property by 40% in 2 years. Flexibility in work organisation is crucial in order to be able to respond to the needs for changing working patterns. People want it, it can reduce the impact of business on the environment, and lead to a cost reduction. Technology is there today to facilitate this, and cannot be ignored. For this reason BT launched Options2000: a programme aiming at enriching the quality and variety of work settings. A key element is home working (working from home), of course on a voluntary basis. For this technology is put in place, and dedicated furniture is made available. For the tele/home workers a dedicated helpdesk is put in place, in order to assist when problems with the technology occur. In addition a flexible working surround is created in the office, which include touch down places for visitors, and hot desking for an increasingly large part of the workers.

All these concepts work and could only work on a "win-win-win" approach, taking into account both the wishes of the individual, the family, the company, and the larger society.

Deutsche Telekom is in the process of developing quality standards for telework, thus making it a "normal" form of working.

Like in most enterprises, this is mainly based on "alternating telework". Once the standards are in place it is the intention to spread the concept rapidly throughout the organisation. With the introduction of telework, which is is an ambivalent form of employment; negative effects needs to be avoided, actively. In the pilot phase the most important measure of success is the fact that all participants basically are prepared to proceed to next stage.

As a former public institution France Telecom has undergone a dramatic change in ways of business and people over the last years. A big challenge was to keep everyone within the company: this required the rapid moving of people from many of the traditional activities to sunrise activities. A stimulus for doing so was also that many of the required skills were not available on the market. Over 31000 people were re-deployed and retrained in 3 years, and 10.000 people will move towards target jobs in the next 3 years. 13.000 people were offered early retirement, and 12.000 new (young people) were recruited. The "New Jobs" reflect very much the full transformation from a network operator towards a service deliverer.

Unisys is one of those companies that organised a specific training of unemployed people to tackle the Millennium Bug. In order to overcome the huge shortage of skills for coping with Y2000 problem it was decided to train non IT people. Over the past few years over 130 unemployed people trained: 73% succeeded in reaching the level of competence needed. They are all employed now. And that is likely to proof to be sustainable on the longer term. More then 60% of these specifically trained people are now integrated in non Y2K teams. Most have learned a 2nd skill: QA and testing; domain knowledge; NT skills. It was striking to see that there were no differences in the team, and all these people with such different backgrounds were without problems introduced in complex computing

What lessons were learned:

- Way of thinking is crucial
- Technical skills come second
- Personal attitude matters

What will happen after the Millennium? Despite the fact that most people were specifically trained for "old" computer languages, most of current employees are already integrated, the need in the market is still growing. With a predicted shortage of 600.000 IT skilled people there will be no problem whatsoever with integrating the others, and more. Main trends expected in the sector:

- The shift from process work to knowledge
- Internet will ask more "mainframe skills"

A barrier for further development is the ongoing integration of IT: investing in the NT or Internet skills of your people makes your people become very employable ... anywhere. It is for this reason that these kind of investments should be seen as a joint responsibility rather then that of the individual company. There is a role for a "code of conduct" on training people, and a clear role for public authorities for enabling current weak groups (handicapped, long term unemployed, etc) to train. One speaker suggested public private partnerships as a logical way to deliver IT skills to the unemployed.

Policy conclusions to the debate included the need for:

- Speed, quality and innovation in knowledge production;
- Linkage between formal and informal learning through the use of ICTs requires new concepts and models;
- Training and (re-)skilling is a joint responsibility of employers, employees and government, and cannot be left to employers alone, since many people do not have a fixed employment relationship, and the cost of investment in IST skills cannot be protected;they are of value in any company;
- Accreditation of skills and competencies: informal learning places are apparently becoming so much more important;

- Policy focus should change from employment to employability.

Joan Majo, chairman of the Information Society Forum workgroup on Work and Employment concluded the debate with the remark that employment development is in correlation with innovation. We should not only look at technical innovation, but also at social innovation. The technologies and tools around us change much faster then our way of thinking. Therefore the limitations in development have become to be our mentalities, our current way of thinking.

We all agree that our society was organised along the lines of the industrial age. In these times there was a need for concentration of capital and people, all at the same place, all at the same time. This changed dramatically the way our ancestors used to live, and led to the way our lives are organised, today. However, in the Information Society we have to move bits instead of materials. This opens up many new opportunities. Old restrictions are not valid anymore, today. The relationship between employer and employee used to be based on the employer renting time from the employee.This makes no sense in the IS: labour relationships can no longer be based on this. We were used to accepting the cycle for change of basic knowledge to be longer then life: this is not the truth anymore. The emergence of the IS has accelerated the replacement of knowledge to become much shorter now then the cycle of replacing people. This affects the way we should design our educational institutions. There is a need to revolutionise our systems for education and training, hand in hand with social innovation.

This revolutionising will be hindered by the fact that the people currently in power in our society are the product of their times: the industrial age. This puts high demands on their ability to understand today's change, and act to it.

Rapporteur: Maarten Botterman

Speakers:

Moderator: Rick Hornik (UK), Business Editor Europe, Time Magazine

- John Kelly (IRL), Irish government official Dept. of Enterprise, Trade and Employment Entrepreneurship policy in Ireland– Presentation of the Irish Initiative
- Hanne Shapiro (DK), Director of Competence and IT of the Danish Technology Institute on the Danish National Initiatives towards Support of Life Long Learning: Adequate training, learning and education of the workforce in the Information Society.
- Dr Tuomo Alasoini (FI), Director of National Workplace Development Programme of the Finnish Ministry of Labour, Labour Market Counsellor: Supporting change in work organisations
- Matti Salmenperä (FI), Finnish Ministry of Labour, Member of the European High Level Group; Strategies for Job opportunities in the Information: Innovations - the core of employment and quality work

Industry experts will present their views of the impact of technology on employment in the next Millennium.

- Sylvie Fauconnier, (F) France Telecom : Impact of new technologies on the evolution of jobs and professional practices.
- Bruno Schröder (B), Unisys Belgium. Unisys organised a specific training of unemployed people to tackle the Millennium Bug : what will happen after the Millennium change
- Dieter Seitz (D), Deutsche Telekom AG
- Les S. Clarke (UK), Director Business services, British Telecom: Think Activity, not Place – Flexible Working in Practise .

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Dear Consumer, Trust Me!

The Internet opens up uncharted new means of communicating, and will soon change drastically the way we are living, working, doing business, banking and more. The possibilities seem unlimited with the proper technological developments, the right legal and regulatory environment, and, most importantly, the correct understanding of the consumers expectations and demands. Building trust and confidence is the challenge for a full exploitation of the information society potentialities.

The nascent information society is already challenging existing legislation and regulation. In many cases it is not obvious how to adapt or to change laws and rules, or how to introduce the appropriate new ones. Because of these uncertainties, consumers do not always have the necessary trust and confidence in "the rules of the game" set up by the legal landscape. The lack of such trust and confidence prevents consumers from fully exploiting the information society potentialities.

The development of the information society heavily builds on advanced technologies consumers are not expected to grasp, and still one expects them to have trust and confidence in what they do not understand!

The session addressed trust and confidence with the consumers as a focal point. Issues covered included the question of privacy, the role of technology, the legislation and regulation, and consumer protection. The speakers identified the various trust and confidence building requirements and discussed the possible technical, legal, and regulatory solutions addressing these requirements.

Main issues raised

Protection of privacy is a major concern that might limit the uptake of electronic commerce. Transactions usually require the provision of personal data, which can for example be linked with other data to establish a profile of a customer. This in turn can be used to sell different products. Some people consider this a misuse of their personal data.

Transaction security is another major concern. Is the supplier really who he says he is? Can he be relied on to deliver? Will the product be the one ordered? Will the supplier receive payment?

Protection of intellectual property is a further important problem, especially in the case of digital goods. These could include music, books, CDs and computer programs. How can illegal copying be prevented?

Finally, there are questions of redress in the event of a failure of the transaction. What are the contract terms? Where is the supplier located? What system of law governs the transaction (is it, for example, the law of the country of the supplier or the purchaser)? Who is responsible if an intermediate distributor fails to make delivery?

Conclusions and Future Directions

Few consumers trust transactions over the Internet. They might browse the web to find product information, but then they buy in shops. The reason for this is lack of trust, which here means "do without fear of the consequences". A US survey identified loss of personal privacy as a greater current concern than economic downturn, racial tension and unemployment. A European source claimed that 10% of goods ordered over Internet failed to arrive. Questions concerning trust and confidence need to be resolved so that electronic commerce can realise its full potential.

Not only does electronic purchasing need to be secure and confidential: it also needs to be easy to use. The more complicated the process, the less likely the consumer is to trust it. So user interface design is also important.

There are several approaches to addressing these problems: regulation; self-regulation by the suppliers; education of consumers; and technology. Self-regulation was considered to lack precedents that would give confidence that it would work. A survey of existing supplier web sites showed that more than 25% lacked an address, a similar number were unclear about the price of the products on sale. 73% lacked crucial contract terms, and 90% did not state which system of law would apply to a transaction. Consumer education had a history of failure: consumers will spend little time to develop sufficient knowledge to match the expertise of the supplier. Trustmark standards might have a role to play here. Technology can assist in increasing security of the transaction. But some technologies, such as the use of "cookies", can be used to track the behaviour of people, so invading their privacy. Other technologies, such as electronic cash cards, can be used in transactions while preserving privacy. It might be useful to classify technologies as "privacy enhancing" or "privacy invading". The general conclusion was that some form of regulation was required.

Rapporteur: Paul Drath

Speakers:

Chairperson: Gerard J. Nauwelaerts (B)

- Marc Rotenberg (USA), Electronic Privacy Information Center: No E-Commerce without E-Privacy
- Ursula Pachl (B), The European Consumers' Organisation:
- *Consumer protection in the information society*
- Dominique Brouchet (F), GIE Echangeur: Confusion doesn't help sales to boom

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PLENARY DEBATE
Policies for the Digital Age

Digital technologies, which can access, transmit, copy and manipulate information at ever-increasing speeds, pose new problems for policy-makers. Public policy in certain areas is being bypassed and made redundant by technological developments. In other contexts, the full or effective implementation of new technologies force or require regulatory or other policy and governance changes.

In this session, representatives from leading organisations, involved in developing, implementing, or integrating new technologies, illustrated how these technologies have been affected by, or have themselves affected, policy. Speakers instrumental in policy making reacted to the new challenges, and presented options for a future framework. This exploration of the technology/policy interface considered how policy-makers can best ensure that the digital revolution is effectively exploited in Europe.

Main issues raised

The speaker from BskyB stated that Sky TV represents the new business in the Digital Age. In a short time an enormous growth in additional television choice has been taken place. Additional content creation is the priority here. Next is digital TV, which will allow you for instance to choose your own angle in a sports game, but also digital shopping. In the UK, free "Sky-boxes" are given to households on the condition that the telephone is connected to it, thus allowing interaction between TV advertiser and consumer.

Change happens, but is often difficult to understand for regulators. The speed of change stimulates the creation of new rules, without enough emphasis on revising or abandoning the old ones. As part of a solution, the UK now intends to go to one regulator for the converged market.

Regulation on content has become extremely difficult since content provision will soon be possible via Internet: an environment which can't be controlled. Discrimination towards other ways of broadcasting would not be fair. It is also in this light that the role and mission of public broadcasting should be reviewed: what is the nature of public broadcasting, what is the market failure and how can it be rectified. Through calls for tender?

Nowadays policies have to focus on consumer protection, cross border interaction, and acknowledging the existence and importance of different languages. Policies should become more global, rather than national, since borders do not limit broadcast/service anymore. It was stated that:

1. We would like policies to be made on national/European basis, but always with a global perspective
2. We would like to have removal of all trade restrictions on security products, since this is hindering rolling out e-commerce world wide, by hindering development of trust

Many of these restrictions on security products are still dating from the cold war age, and should now be left to the market. Trust is key: signatures that can be exchanged in order to guarantee legal binding should be enforceable, and, to complicate matters, even more so in trans-border trade

The Digital Citizen brings a different set of attitudes and expectations to society. The new generation expects customization and options and wants to "try-before-they-buy". Technology does not count, functionality counts.

A comparison of the models of governance :

	Industrial era	Digital era
Democracy	Representative, passive	Participatory, active
Policy	Broadcast, mass production	One-to-one

Other challenges for policy making in the digital age are the speed of change (if government moves too slowly, technologies

will provide ways around it) and the need to rebuild the model from the ground up.

Following liberalization, there has been a very rapid deployment of telecom services. The growth of the market is estimated to be very high, but is probably still underestimated. Positive action from the regulator is needed, but competition procedures are currently too slow to cope with market needs.

Lessons for the future:

- Avoid increasing weight of Universal Service
- Keep pressure on interconnection cost orientation
- Maintain asymmetrical regulation for the coming years
- Make a difference in operators that invest heavy in infrastructure, and those who don't
- Avoid over regulation of the mobile sector
- Be market driven in setting up the rules of the game
- Take in account a positive divergence scenario
- Don't let private monopolies substitute public monopolies
- Enlarge regulators responsibilities spectrum

In Italy, the following is now seen as priority in reducing the regulatory aspects to a minimum, whilst protecting the interest of the end consumers. Priorities are:

- Unbundling of the local loop. New technologies help: Digital Terrestrial TV; Wireless local loop, UMTS;
- Definition of quality of Service;
- Control on retail conditions/market distribution and pricing;
- Regulation of the audiovisual sector.

Conclusions and Future Directions

Conclusions from the debate:

1. We need regulation that does justice to global aspects of the Internet, but does not hinder its development. It should protect minors and copyright, and therefore requires close co-operation between governments and businesses.
2. Policies should balance the interest of users with those of companies. NB: this does not mean consumers against enterprises: there should be more in it for both.
3. The job creation potential of the digital age is very high, and should not be underestimated.
4. The regulatory framework should clearly distinguish responsibilities of the State, Enterprise and Citizen. Where liability starts and stops needs to be clearly defined, because stakeholders need certainty.
5. Policies should be based on tolerance towards diversities in our societies.
6. Trust and credibility become key.

Robert Verrue of the European Commission referred to the recent Communication on the Telecom Regulatory Review. As a result of liberalisation, prices are falling, more players are coming through, strategic alliance emergence underlines the competitive nature of the sector, quality of service has improved considerably, and telecoms has clearly become the leading growth sector.

In adapting the regulatory framework one needs to establish EU Directives. Since getting a Directive adopted takes about 2 years, it is evident that regulation should take change in consideration, well before it happens: therefore the EU regulatory framework should be taking into account the rapid change of technology development. Regulation should be kept to a minimum, and the regulation policy should be more clear than today. It should aim at achieving technology neutrality and provide opportunity to deal with uncertainty. Enforcement of the regulatory framework should be done at appropriate locations: as close as possible to market situation.

With the recent Communication, it is the intention to replace the over 20 existing Directives on telecommunications and media by just six new Directives.

More benefits could be obtained if national regulators work more systematically together, since they are often facing the same challenges/situations.

Rapporteur: Maarten Botterman

Speakers:

Moderator: Paul Taylor (UK), Financial Times IT Correspondent

- Ray Gallagher (UK), Director of Public Affairs, Sky Broadcasting Ltd, BSkyB
- Stefan Röver (D), CEO of BROKAT Infosystems AG
- David Agnew (CA), Executive Director, Governance in the Digital Economy, The Alliance for Converging Technologies
- Elmar Brok (D), Senior Vice-President, Media Development Bertelsman
- René Russo (F), Vice-President, Bouygues Télécom
- Roberto de Martino (I), Director, Autorità per le comunicazioni
- Robert Verrue, Director General, European Commission, Directorate General Information Society

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Regulation in a Liberalised and Converging Environment

Where is regulation heading? What should be regulated in liberalised markets? What will be the impact of convergence on future regulation? What will the '99 review achieve?

The EU has already liberalised the telecoms markets in Europe. Under the terms of current legislation, the Commission is charged with conducting an examination of the operation of the current telecoms regulatory framework in the light of technical and market developments and changes in user demand in 1999.

The Commission will also want to include in its assessment the conclusions which were drawn in the consultation on convergence, the experience with implementation of existing directives, the conclusions of the consultation on spectrum management and the report on the operation of Directive 95/47/EC on the use of standards for the transmission of television signals. The time frame for the launch of this comprehensive assessment coincides with the IST 99 conference.

The session/panel discussion examined the issues which are of greatest relevance to the review, allowing an exchange of opinion on how the future regulatory framework should best be adapted to take account of developments and market evolution.

Main issues raised

The session consisted of a discussion by five panellists each representing an interest in the telecoms sector as follows: users (INTUG), an incumbent, a new entrant, a national telecoms regulator and an equipment manufacturer. In repsonse to the Commission's recently adopted communication on the '99 Review (COM (99) 539), the panellists addressed how the regulatory framework should be adapted to take account of evolving markets and technical advances. It focussed on changes needed in two or three years from now - the same timeframe as set out in the Review Communication.

Most panellists agreed that access to the local loop is a major barrier to competition. The former state-owned monopolies ("incumbents") still dominate this part of the telecommunications infrastructure for fixed lines. While radio communication offers an alternative method of access, the incumbents are also strong in this sector.

One panellist expressed concern about the effectiveness of the National Regulatory Authorities (NRAs). Limited resources – especially compared with the regulatory departments of the telecommunications operators – could lead to slow processing of complaints concerning interconnection. Inconsistency between NRAs (eg concerning number portability) could restrict the emergence of a single European market.

Another panellist noted that the bundling of telecommunications infrastructures and services had both limited competition and led to an over-detailed regulatory environment. Another commented that this bundling also led to a lack of transparency in accounting for the cost of services.

Incumbents frequently argue that increased competition should reduce the need for regulation, which might in future be limited to areas where there are bottlenecks. Competition law could then be used to solve access disputes. However, from a regulatory perspective, most of the panellists concurred that the application of competition law was considered too slow to encourage timely investment, except by the incumbents, who already own an extensive infrastructure based on historic investments.

Conclusions and Future Directions

The panel generally agreed that, to users and regulators, the monopolistic heritage of the industry was still apparent. Incumbents frequently still hold over 90% of the market. The cost of phoning mobile phones from fixed lines could be three

times the cost of the reverse operation. Dominant operators had the resource and the power to dominate adjacent markets, not just for telephony, but also for related services such as Internet or multi-media content provision. For most of the panellists, sector specific regulation should therefore continue to play a large role in the industry.

Most panel members felt that unbundling of infrastructure from service provision in the local loop would significantly enhance competition. This was, however, a long term solution. In the short term, increased transparency of accounting would assist in achieving the objective. Cost-based pricing for infrastructure access was one possible approach. However, as a member of the audience observed, in the mobile sector, prices were frequently not cost related, yet competition was intense.

One panellist suggested that increasing the available radio frequency spectrum might allow an increase in competition in the local loop. However, the practice of licensing only four or five operators might still limit competition and innovation. Another panellist observed that auctioning licences also had a negative effect on competition, since the highest prices could usually be paid only by the largest organisations – often the incumbent telecommunications operators. One suggestion was to limit the licence fee to cover only the cost of frequency management (as suggested in the Commission's Review Communication), while limiting the licence to infrastructure only, with open access to that infrastructure by service providers.

One panellist noted that NRAs were not the only cause of slow processing of complaints. If a reference to the competition authorities was required, two years might elapse before a decision was made. This timeframe in effect meant that the new service or product simply did not emerge competitively with the incumbent's.

For most panellists, the long term scenario was one where infrastructure and service provision were unbundled and regulated, if necessary, separately. Technologies such as VDSL could increase the viability of this separation. Service provision would then be much more open to competition: the need for regulation here might eventually disappear. Regulation concerning the converged telecommunications infrastructure would, however, continue to be needed.

From a user perspective, one panelist suggested further changes which would support open competition. These were:

- Number portability between telecommunications operators should be mandatory. Competition would then be on the basis of service provided, rather than on restricting customer choice.
- Directory services should encompass all operators and not be limited to the incumbent.
- Transferring the responsibility to provide universal access from the telecommunications operators to governments, where it would be treated as part of regional or social policy.

Rapporteur: Paul Drath

Speakers:

- Chairperson: Robert Verrue, Director General, Information Society Directorate General, European Commission
- Martin Andersson (FI) Manager of Regulatory Affairs, Sonera Ltd
- Allan Fischer-Madsen, (DK) , partner, Fischer & Lorenz European Telecommunications Consultants representing INTUG
- Linda Ward (UK), Director of Regulation and Carrier Affairs at BT (Worldwide) Ltd, Belgium.
- Dan Kiernan, Director of Regulatory Affairs, Alcatel Group, Paris

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Health in the Information Society

This session bought together those people involved in bringing about change in healthcare as a result of Information Society Technologies. The speakers came from the Telematics industry, Healthcare industry and Basic research, that are in the process of introducing sophisticated professional tools for both clinicians and administrators (Electronic Medical Record, Decision Support Systems, Human Computer Interface, Virtual Reality, Simulation and Sensors).

The session focused upon brand new issues that will change everyone's life in the Information Society, empowerment of the citizen (Personal health System, Home Monitoring and Care) as well as the doctor and patient co-operative environment (Telemedicine Services and Co-operative Environment) - both new aspects of Telemedicine.

Main issues raised

This session described trends in the use of IT in healthcare, both for clinicians and administrators.

The electronic patient medical record is central to the evolution of IT in healthcare. It will support exchange of data between departments within hospitals and between hospitals and other healthcare agencies. While progress has been made in standardising lexical and syntactic aspects of medical records, development of European interoperability standards in this area still appear too slow to support the evolution of IT in healthcare.

The extensive use of IT in healthcare has given rise to concerns about the use of patient medical data. IT gives the benefit that patient data can be transmitted rapidly, for example, for analysis by remote experts. As a result, questions such as "who is the owner of this information" and "who can see what, and when" have become major issues.

Health information is increasingly available on the web. Patients and their families will increasingly use this as an alternative source of information. This gives rise to issues concerning the quality of the information available on these sights. It also might indicate a change in the role of the medical community, who no longer can control the availability of information to their patients.

Conclusions and Future Directions

Data protection legislation introduced in all European countries provides a reasonable starting point for addressing ethical issues in healthcare telematics. This says that data about the patient should be handled in the same way that the patient would be treated, which therefore requires authorisation and, in IT, perhaps digital signatures.

However, data is also used for analysis. It can be derived from multiple geographic locations, and processed using software from third parties. This can give rise to questions concerning its accuracy and reliability, and also of responsibility for its secure transmission, storage and accurate processing.

Health informatics can benefit from trends in computing. One which has considerable significance for the future is the move to component based development. Components are small programs which can be assembled together to form a system. The components are separate from their implementation on a specific type of operating system, and separate from the user interface. So they can be re-used in many different computer systems. As a result, systems can be developed more rapidly, and the resulting system can be more reliable.

More than 20,000 web sites now provide health and medical information. As Internet usage grows, so will the numbers of patients and their families using these sites. Partly this is to find out more about illnesses and treatments, partly to research conditions which some people fell uncomfortable discussing with their physicians, such as depression. The quality of the information available from these sites can be assessed through the reputation of those contributing to the site. By providing ready access to information, the web sites can change the relationship between the medical community and patients. Potentially, healthcare providers will become medical infomediaries, directing patients where to find trusted information and advising them how to interpret it.

Standardised patient medical records have already assisted the exchange of information between specialist departments within many hospitals. However, patient care requires the co-operation of agencies outside the hospital as well as within, so that a single consistent set of information is available for use throughout a clinical episode. To achieve this "virtual hospital" requires standardisation between many agencies and countries concerning the data to be collected and stored. Interoperability can only be assured through real experiments to test whether the proposed standards work in practice.

In recent years, medical imaging techniques have supplemented and extended the classical X-ray. As well as digital radiography, cross-sectional imaging methods such as computed tomography, magnetic resonance imaging, sonography and emission tomography have come into use. In addition, new techniques such as optical imaging and bioelectronic methods are now becoming available. Together with advances in computing, they will make possible imaging during an intervention, for example to assist a surgeon while operating.

Research projects supported under the first IST Call for Proposals included a number involving advanced imaging and augmented or virtual reality for surgery planning and radiotherapy. Other projects focused on handheld devices, home sensors and robots (for help in surgery and in the home). Areas weakly addressed included projects aimed at the citizen rather than the doctor, evidence based medicine, security and ethics, and cost savings in medicine and healthcare.

Rapporteur: Paul Drath

Speakers:

Chairperson: Prof. Juan Sancho

- Prof. Juan Sancho (E), IMIM Instituto Municipal de Investigaciòn Médica : Health, Health Care, Well-being: a Tentative Vision
- Clive Tristram (UK), Caspe Healthcare Knowledge Systems Ltd : Ethical Issues in Healthcare Telematics
- José Cavanillas (E), SEMA Group – Service Management, Software Engineering Division
- New Technologies, New Care: a Software Engineering Approach to Health Care nowadays
- Carol A. Calta , Arthur Andersen Business Consulting : The Internet Revolution: Telemedicine and Co-operative Environments
- Pierre Dujols (F), Hôpital de Montpellier, Information Médicale : The Virtual Hospital: Electronic Medical Record, Decision Support Systems, Human Computer Interface
- Dr Thomas Mertelmeier (D), Siemens AG, Bereich medizinische Technik, Basic Research & Development: Medical Imaging: The Visualised Human for Safe Diagnosis and Smart Therapy

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Scenarios for Business in the Digital Economy

Fostered by the rapid and ever increasing pace of development of Information and Communications Technologies (ICT), a new digital economy is emerging around the globe. In this new digital economy, individual citizens and small businesses will have more chances than ever before to play a role alongside the big players. Since the Internet is being adopted as the most important global communications infrastructure, and because global knowledge is becoming accessible by everyone with Internet access, the digital economy will be characterised by radically new forms of business relationships and will have a profound effect on the way we work and live.

This session aimed to present and explore scenarios for doing business in the digital economy, that is, scenarios for electronic commerce. It consisted of an introduction by three keynote presenters, followed by a moderated roundtable discussion involving representatives from various business sectors and the audience.

Main issues raised

New rules of the digital economy

Although new technologies change the way things are done in our society, the strategic principles for "playing economic games" remain the same. Of course this does not apply to "industrial age" rules of thumb. Those were based on a paradigm of homogenous goods in perfect competition. Today's trade is increasingly in information, in which marginal costs for selling yet another copy are negligible, and are based mostly in fixed costs.

Typical for IS products are network externalities that make every other user increase the total value of products. This leads to natural monopolies that cannot be fought, unless one offers consumers a way out of the lock of the natural monopoly. For instance the natural monopoly of Microsoft, based on exchangeability of files and recognisability of the user interface, is very difficult to defeat unless you offer products that offer intuitive computing and the possibility to interact with Microsoft users (and then users must have a reason to leave their installed base....). This principle is caught in the "Law of Increasing Returns": the tendency for that which is ahead to get further ahead; for that which looses advantage to lose further advantage.

Other IS mechanisms are:

- Trust is key. Therefore the role of agents becomes very important. Organisations need to be able to trust the offerings in the market and can do so by relying on the services of an agent.
- Winners in IS markets do not worry too much about intellectual property rights, but make money out of the complementary goods and services (see also: Free Software session report).
- Losers are those that are staying on the old rules in economic theory.

Today the ICT Business is in a turmoil of changing technologies and customer expectations

- If you don't listen to your customer, you will fail.
- If you only listen to your customer, you will fail.
- You must be proactively proposing new solutions.

Furthermore it should be understood that being at the right time at the right place with the right product against the right price could make or break your product. Even more so: a technically perfect product can fail or succeed depending on accessibility of it for its target users, and the ease of obtaining it.

The power is moving rapidly from industry to the buyers/consumers. With trust high on the agenda of needs, it is the market that becomes the best referee for preventing misuse of trust. This is the only

mechanism that would control natural monopolies: when trust is clearly abused, the speed of changing towards alternative products and services will be faster then ever, when the change really starts to take place (see Law of Increasing Returns).

Consumption patterns & value
For immaterial IS goods and services consumption characteristics are not the same as for goods that you can touch. When there is a focus of material consumption, one would tend to measure the "happiness" obtained by using it in terms of relative consumption. (i.e. buying the latest model car, because the people next door bought a new one last week). Consequently, unhappiness can increase even if one's own consumption remains the same simply because of other people's consumption patterns (negative externalities of someone else consuming).

Immaterial goods, however, tend to contribute more to happiness when other people consume it as well. Take for instance a football game: if you are the only one that watches the game, you cannot share your experience with other people, and the overall value goes down dramatically (the same goes for books, films, etc.).

Value is based on what people want in life. If you add an element of physical presence in products and services, additional value is created to all affected products and services. Most value generation today is now shifting to services, rather than a tangible product itself (see above). Adding "Mobile" as dimension is an opportunity to create new value: mobile commerce is likely to provide a new dimension to life.

In order to be perceived as a value generator, products and services need to be innovated on an ongoing basis, even more so, since business is now competing on a global level. The continuous adding of products leads to consumer internal competition: features offered today are much higher then often needed. A clear example is watch that will work at 50 meters under water. As Luc Soete said: "It is comforting to know that the watch will still work at 50 meters under water, even if I would be dead by then!". Another example: the tennis racket many play with today would be suitable for a Wimbledon final!

Tip for the future: people may be looking for opportunities for producing their own value and would even be willing to pay for that!

Where do we go?
Exponential growth of processing power and transmission speed will continue for at least a decade. We can't biologically, nor sociologically, change at the same rate. For the first time, the change of human behaviour is recognised to be less predictable than the change of technologies. Technological trends have become obvious: everything must be digital, everywhere and all the time, and connected to the Internet.

Today Gross National Products are growing continuously. The release of the tight state control of telecommunications has been one of the main drivers of fast ICT developments. It led to increased effectiveness of operations, and introduced globalisation of the industry. The next issue to tackle would be broadcasting (terrestrial digital TV technology). As a cost-effective digital access it should be regulated in the same framework as telecommunications, rather then in different ones, which is how it was historically done.

Forecasting ICT is popular now, forecasting is easy, being right is difficult. While it is easy to overestimate the speed of minor changes, it may be as easy to underestimate the major changes/breakthroughs. Nevertheless it looks to be clear that future consumers will go for more mobility (both at work and leisure time), and demographics still count (more of us will be elderly and/or retired)

Electronic commerce seems to be on top of the political debate and strategic debate based on high expectations of rapid growth. The most interesting area is the business to consumer area, despite the fact that today more then 80% of Internet trade is between organisations.

NB 1: On a global level we should continue to understand that the number of buyers and sellers on the Internet is not equally high in all countries. There seems to be a gap that is widening. This will lead to a further separation of economic power between haves and have-nots. Not only between the poor [countries] and the rest, but separation also grows between middle class and richest people.

NB 2: According to the general assumption behind the global economy everybody is buying on the web and doing consumer research. However, many people do not log on, because they don't want to. They want to act local. The interest for the Internet may well boost to a next level of interest when it will serve locally, as well (see also the Global versus Local session).

Sustainability

OECD is now presenting a long-term boom: knowledge economy, knowledge society. But will it lead to a more sustainable world? The consumer society has led to high levels of waste of natural resources and pollution. Meadows says it is now too late to come to a definite sustainable growth: the whole system will collapse by 2035. For finding a dramatic change we may want to look to inertia in many goods, like the Black and Dekker drill that everybody in western society now has, but which will be used for an average of 3 minutes during its lifetime.

Another example is the high use of cadmium batteries that leads to a high level of pollution. Now businesses are changing their business models in order to take back devices that cannot longer be used. In fact people should be willing to pay the "real price" of products, taking the full cost for the environment into account and thus changing the pattern of consumption. However, they are only willing to do so if they cannot avoid paying less to the (global) competition, which as such undermines many options for "sustainable pricing".

Conclusions and Future Directions

At the end of the session all speakers and panellists were asked to draw their personal conclusion from the debate, and highlight what they think was key (taking earlier remarks into account).

Alain Rouminiguier declared that change in the organisation of work will be the hottest item for the coming decade. Reiner Anderl pointed at the dramatic influence of technologies on business cultures but most of all in working styles. This requires proper education (life long learning). The good news is that new technologies do provide access to a lot of information and an enormous amount of knowledge. Emphasis should be on creating best use competence. Gresa Palanca pointed also at one single priority: education of people, which would allow them to participate in the digital economy.

John Gillis (DTI, UK) saw a continued need for awareness raising towards citizen and industry. Hannes Werthner pointed at the lessons we can learn from the self regulation mechanisms of the internet. Bo Harald reiterated that customers have voted with their feet for electronic banking, and foresees a rapid growth in internet based banking, as was confirmed by Luc Soete, explaining that the cost of transactions were lower than in any other form.

Professor Binmore predicted clearer skies for the future: on longer term we are going to be able to use and profit from the new possibilities that technologies make

possible already today. For the moment industry is changing too fast for regulators to keep up, or for people to adapt. In the long run this will balance out, but in the meanwhile problems will occur.

Pauli Heikkila expressed to be confirmed in his belief that digital TV is key for tomorrows' society.

Professor Soete explained that the IS is not designed to be a wise or knowledgeable society. Everybody is using information in a different way. Therefore it is logical that inequality increases. Those with the tacit knowledge to access the great abundance of codified knowledge, will learn very fast. Talent will be awarded to a much larger extent, since it can be sold world-wide.

However, this is not deterministic: the policy challenge is to enlarge the basis of capturing the knowledge base for all. So far we have focused too much on IS as single society: but look at what we want in a normative way, and not just see and follow the US model without questioning.

Inequality features are changing all the time: this is as such equality. Once the same people get excluded all the time, you have a clear policy signal: action is then needed.

The moderator John Tackara concluded after the long, but most interesting session, that people in the audience might have experienced the value of spending some time on understanding change towards a new future world. He pleaded to budget 5% of time and money to thinking at long term, in expectance of a high return (on long term).

Rapporteur: Maarten Botterman

Speakers:

FIRST PART

Chairperson: John Thackera (UK), Director of the Netherlands Design Institute, Amsterdam.

Keynote speakers:

- Ken Binmore (UK), Professor of Economics, University College London:
- The new rules of the Digital Economy – Who are the winners?
- Pauli Heikkilä, (FI) Chief Executive Officer, Digita Oy
- Values and value creation in the Digital Economy
- Luc Soete (NL), Professor of Economics, University of Maastricht:
- How will the Digital Economy offer opportunities for all?

SECOND PART

Moderator: John Thackara

Panelists (in addition to the keynote speakers):

- Reiner Anderl (D), Dean, TU Darmstadt
- John Gillis (UK), Department of Trade & Industry
- Isabel Gresa Palanca (E), Institute for Furniture-related Technologies, Valencia
- Bo Harald (FI), Executive Vice President, MeritaNordbanken, Helsinki
- Alain Roumiguier (F), Vice President, Matra Datavision
- Hannes Werthner (A) Professor, University for Business and Economy, Vienna, Member of ISTAG

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WET Frontier
(Information Technology Meets the Bioworld)

During the past few decades our understanding of the fundamental information processes of the living world has progressed with giant leaps. During the same period of time information sciences and technologies have produced dazzling breakthroughs. These developments have fuelled the emergence of new interdisciplinary areas of science and inspired novel applications for the benefit of citizens, industries and societies.

Today scientists are actively employing wetware, hardware and software methodologies to uncover the basic principles and mechanisms governing the behaviour of living organisms at molecular, cellular, organism and population levels. Some scientists study how to do biology with computers whilst others are trying to do computing with biology. The prospects of possible future applications are breathtakingly vast.

The purpose of the session was to give a visionary overview of the biological frontier and the potential areas of convergence and impact on emergent Information Society Technologies. The speakers highlighted the main axes of development reaching beyond conventional software and hardware implementations and drew their inspiration from concepts found in living organisms. They debated future visions and ethical constraints of these brave new information technologies that prospect and exploit the areas on the wet frontier and beyond.

Main issues raised

Artificial abstraction, emotion and motivation (Kohonen, Sloman)
How meaningful information can be extracted from raw data and how the representations of data can be created at different levels of abstraction, without knowing a priori what to look for. Which types of information processing architectures would support different types of artificial mental states, such as reactive, deliberative or reflective behaviour ?

Artificial organisms (Winter)
Could we build a virtual human, taking into account that the amount of data in the human genome is of the order of 1 Gigabyte?

Neuromorphic systems (Indiveri)
Direct implementation on VLSI of physical processes underlying neural computation.

Self assembly of molecular scale electronics by biotechnology (Sivan)
A giant leap in technology is required in order to implement electronic structures at the molecular scale such as DNA computing (1 base consists of ca. 50 atoms). Scaling down to smaller and smaller linewidths will not constitute this breakthrough. In the future molecular scale electronics will be constructed by means of self-assembly of biological molecules, specifically by DNA.

Ethics at the wet frontier and public view on R&D (Warren)
There is a deep public concern on research into the basics of life, exemplified by the clone Dolly and the debate on genetically modified organisms. The public perception is that the research is fuelled by the interests of large companies and not the interests of the consumer and that these technologies will give the Big Brother an unprecedented opportunity to control humans.

Conclusions and Future Directions

It is not hard to forecast that the progress in molecular electronics and biology as well as in genetic engineering have opened a new interdisciplinary area of research where important new breakthrough findings can be expected. They will contribute to information technologies and make a wide range of new applications feasible. The research at the "wet frontier" is in expansion world-wide as highlighted during the discussion by Dr. Strong from

DARPA. In the US an interagency BioFutures Initiative has been launched that may involve co-operation with NSF and NIH.

In the EU RTD this area is already covered by the Future and Emerging Technologies (Neuroinformatics action line in the workprogramme 2000 and Open Domain). Further action for the year 2001 should be planned.

Rapporteur: Pekka Karp (European Commission)

Speakers:

Moderator: Prof. Bill O'Riordan (UK)

Introduction by: Simon Bensasson, Head of Unit, Future and Emerging Technologies, European Commission, Information Society Directorate General

- Prof. Teuvo Kohonen (FI) Helsinki University of Technology: Artificial abstraction
- Prof. Aaron Sloman (UK), University of Birmingham: Deep and shallow models of motivation and emotion
- Dr Chris Winter (UK), CyberLife Technology Ltd: Artificial organisms: blending biology and computers
- Dr Giacomo Indiveri (CH), University of Zürich: Neuromorphic engineering: from neurons to transistors
- Prof. Uri Sivan (IL) TECHNION Israel Institute of Technology: Self assembly of molecular scale electronics by biotechnology
- Peter Warren (UK) Technology Editor, Scotland on Sunday: The Frankenstein factor.

Commission Contact:

EU-US E-Commerce RTD Co-operation

This workshop was a follow-up to the successful workshop on EU-US co-operation held in April 1999 in Dallas in conjunction with the EUROTEX conference. The workshop focused on exploring and defining co-operation areas in E-Commerce/Digital Business RTD. The discussion began with initial presentations of the respective EU and US strengths. It then explored plans for E-Commerce RTD in the EU and in the US, addressing amongst other issues, the IST programme and American programmes such as the NIST Advanced Technology Programme. The intention was to have participants from both sides of the Atlantic give their views on priorities in E-Commerce RTD and short-term and long-term opportunities for collaboration in research and pilots.

Main issues raised

US advantages and challenges

The US has numerous strengths in e-commerce in terms of markets, processes and people. In particular there is a growing pool of e-commerce aware engineers and business people able to assess the impact of e-commerce on their business. Interest is now focusing on the new enterprise architectures, which integrates the management of business processes (ERM, CRM, supply chain management) with the creative processes of product development. SMEs are being drawn into this process, usually through the influence of a large corporate customer partner.

Europe's challenges

The thesis was offered that e-commerce is about to undergo a phase of hyper-growth, led by business-to-business e-commerce to an overwhelming extent. Early adopters will grow much faster than later adopters, leading to a substantial and irrecoverable economic realignment. Forecasts indicate that the countries of Southern Europe will be amongst the late adopters, depressing the overall level of growth in Europe. Europe is lacking the management skills and technology know-how to implement accelerated change, and the time is coming when US and Scandinavian dotcom leaders will turn their attention to the rest of Europe, making competitive conditions much tougher for native entrants.

Europe's opportunities

Europe should leverage its comparative advantages in e-commerce. These include its superior network of business-support networks, including chambers of commerce, industry associations and government programmes. These should be encouraged to sponsor the creation of dynamic trading networks for business-to-business e-commerce. Another key advantage is Europe's multi-cultural character. Several speakers commented that e-commerce tends to favour global trading models, which require skills, techniques and attitudes distinct from those of one-market operations. The view was expressed that Europe has the opportunity to leapfrog the national phase of e-commerce and establish a leading position by thinking global right from the start.

European RTD

European policy on e-commerce has taken a holistic approach, dealing with the legislative environment, business and commercial practice and technologies for access and applications. The IST RTD programme Key Action II is supporting a range of e-commerce developments, from solutions for cost reduction to entirely new models for value generation. The strategy builds on European strengths in areas such as mobile communications, DTV, smart cards and the SME support environment. Indeed, with a vision to develop from value-chains to dynamic markets, a clear role is perceived for trans-national networks of competence-based SME's flexibly linking in virtual teams. This is the kind of model the IST programme is well-suited to encourage.

US RTD

The Integrated Manufacturing Technology Initiative (IMTI) was presented by its CEO. This is built upon a two-year government-funded technology road-mapping exercise

recently completed. IMTI will now be funded by industry as it moves into its implementation phase. Its task is to create and disseminate a co-ordinated vision of current and necessary future R&D work in the integrated enterprise sector. Its activities include the creation of consensus roadmaps, the facilitation and promotion –but not the funding- of collaborative R&D, the maintenance of up-to-date activity plans, and the provision of information and analysis. To develop its roadmaps, it combined Internet-based surveys and functional model design with workshops and external reviews, to produce highly structured documents enjoying wide industry support. In particular, IMTI mapped 1,700 government-funded projects in the field, identifying gaps and overlaps.

Opportunities for Collaboration

Speakers broadly agreed on the long list of topics demanding RTD attention on both sides of the Atlantic in the area of e-commerce. Collaboration should play to each side's knowledge strengths; in the case of Europe, these are multi-cultural competence, distributed self-learning systems and mobile communications. On one hand, the Fifth Framework programme is now open to (unfunded) US participation. Other European industry groupings, such as AIT in aerospace and automotive, are also interested in collaboration. On the other hand, IMTI has much to offer from its experience with technology roadmapping and research activity database building. Mutual interest was expressed in collaboration in a number of areas.

Conclusions and Future Directions

Clear proposals emerged from the workshop in the following areas:

- IMTI and the European participants agreed to develop together an extended, integrated US/European database of research activities in the Integrated Manufacturing sector, encompassing both industry and government-sponsored programmes
- AIT offered to begin discussions with IMTI on joint activities
- IMTI offered its know-how in technology road-mapping to European RTD bodies
- Clear invitations were issued to US bodies to participate in Fifth Framework activities

Curiously, very little attention was given to the issue of standards, which discussion revealed to be a delicate issue. Perhaps the Commission should look at establishing frameworks within which joint US/European standards in Integrated Enterprise can be developed, where necessary, in a transparent and open manner.

Much stress was given during the workshop to the relative lack of skills in the e-commerce area within the EU. This must clearly be an area of concern for the Commission, and a focus for support within Fifth Framework RTD.

The Workshop was successful in engaging IMTI in a dialogue, which was fruitful considering the different nature of its work compared to the IST programme. Future Workshops may choose to involve analogous bodies from other parts of the US economy, such as services or technology.

Rapporteur: Andrew Bud

Speakers:

Chairperson: Jimmie Browne (IRL), Dean, Faculty of Engineering, National University of Ireland, Galway

- State of the art of E-Commerce in the US and the EU
- David M. Dilts (USA), Professor, Dept. of Management Sciences, University of Waterloo, Ontario, Canada
- Thérèse Torris (F), Forrester Research Europe
- Current directions and future trends in e-commerce RTD programmes
- Bror Salmelin, Head of Unit "Electronic Commerce", European Commission, Information Society Directorate General
- Mary Mitchell (USA), Deputy Associate Administrator, Office of Electronic Commerce, Office of Governmentwide Policy
- Identification of priorities and opportunities for RTD collaboration
- Richard Neal (USA), President, Integrated Manufacturing Technology Initiative
- Bernd Hirsch (D), Professor, Bremen Institute of Industrial Technology and Applied Work Science at the University of Bremen (BIBA)

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Geographic Information in the Information Society

Geographic Information (any information that can be referenced to a location on earth) is used more and more commonly for decision making by governments, enterprises and private citizens. The GI workshop presented how spatially referenced data exerts in the information society a great influence over our daily lives, both now and in the future.

Our vision of the future is the integration of tools and platforms that accommodate the spatial (and temporal) awareness features of GI, to provide appropriate information, multimedia, customised to the users' needs, anywhere, at any time, in any language. Such information services will be based on data derived from both terrestrial and satellite resources, integrated with traditional ground based geographic information, global positioning and telecommunications systems.

The workshop also analysed the GI policy needed for Europe, the role of European GIS industry in the Global Market and the impact of GI in the European economy.

Main issues raised

GI is used explicitly in a growing number of application fields: transport, telecommunications, environment, agriculture, marketing, medicine, geology, etc. All these disciplines face some common challenges, partly due to generic technology problems such as difficulties in accessing data, lack of common standards and interoperability. However, there are some specifically European issues such as the lack of European dimension in GI market, lack of pan-European, seamless reference data.

US Vice-President Al Gore developed the concept of Digital Earth, with a vision of "a integrated, distributed and easily accessible cornucopia of geo-referenced information and tools".

In order to increase the competitiveness of the European GI sector, European Industry, public sector and research have to face major challenges: to develop tools, datasets and methods to integrate GI into the Information Society.

What does integrating GI into the Information Society mean? Today, Geographic Information is manipulated with very specialised and sophisticated tools, used by trained experts working in dedicated laboratories within an organisation. Too few people have 'hands on' access to geographic information, with the tools they use everyday.

Our vision of the future is the integration of tools and platforms that accommodate the spatial and temporal awareness features of Geographic Information, to provide appropriate information, multimedia, customised to the user's needs, anywhere, at any time, in any language.

Such information services will be based on spatially referenced data derived from both terrestrial and satellite resources, integrated with traditional ground based geographic information, global positioning and telecommunication systems.

The workshop presented and discussed how spatially referenced data used in the Information Society exerts a great influence over our daily lives, both now and in the future.

To present such a prospective view, key speakers have been invited, from both the public and private sectors. They presented their vision of the present and the future evolution of Geographic Information usage within the Information Society.

Companies such as Oracle and SICAD GEOMATICS (Siemens) participated in the meeting and presented their visions.

The meeting was chaired by *Guenther Pichler* (A), Vice Director of SICAD GEOMATICS (Siemens) and Chairman of the Open GIS Consortium's European Special Interest Group (Europe SIG).

Mike Turnill (UK), Marketing Manager for Europe, Middle East and Africa, and *Antonio De Palmas* (I), European Community Affairs Manager of Oracle Corporation, presented the Oracle position on "*Spatially Enabling Electronic Governance for the 21st Century.*" Oracle has long identified the spatial component of data as strategically important - '*As the new millennium approaches, spatial data is rapidly emerging as a critical component of governance at all levels*'. Envisioning an '*e-Europe*', Oracle strongly supports any attempt to make spatial data an integral component of the overall IT.

Andrew Frank (A), Professor at Technical University of Vienna, presented his vision on how Geographic Information could help our daily life using public transport as an example in his presentation titled '*Improve Public Transportation with Geographic Information: Door-to-Door Public Transportation Guidance*'. By stating what a surprising amount of knowledge a user of public transportation needs to get from the Vienna Airport to the Hotel Sacher located in downtown Vienna, he underlined the fact that basically all the information required is available. However, there is a lack of integration of spatial and non-spatial information to provide a detailed guidance for travellers.

The position of the European Commission was presented by *Martin Littlejohn*, DG Information Society, in his presentation on '*GI 2000: Towards a European Policy Framework for Geographic Information*'. He pointed out the importance of the European Commission in its political role to "build Europe", to act as a major stimulator to the European GI market and in its position of possibly being the largest user of pan-European GI. He also endorsed that GI should be exploited to a global stage and that there should not be a limitation to the European borders.

The main user and producer of Geographic Information is still the public sector. *Jarmo Ratia* (FI), Director General of National Land Survey of Finland, presented '*NMA and public services vision, including data policy, electronic commerce and GI infrastructure*'. He pointed out that spatial data should be accessible in a practical, user friendly and easy understandable way. Thus, NMA's will be repositioned from their original data collectors' role more and more towards a value added service providers' role. The setup of a Geographic Information Infrastructure (GII) is essential for the development of these services in the Information Society. Spatial data are available in high quality but there is still a lack of political awareness. In addition, a pricing policy must be subject to political decisions.

The GI research community was represented by *Gregory Elmes* (USA), Professor at West Virginia University at Morgantown, West Virginia, and President of UCGIS, the University Consortium for Geographic Information Science in the USA, and *Mauro Salvemini* (I), Professor at University of Rome "La Sapienza" and President of AGILE, the Association of Geographic Information Laboratories in Europe. A formal Memorandum of Understanding between UCGIS and AGILE was established in January 1999 to ensure mutual benefits through synergy and magnitude of activities.

Gregory Elmes stated that '*In the next five years citizens in every walk of life will have access to multiple terabytes of geospatial data and unmatched processing power in their offices, schools, vehicles, and homes, on*

personal and web computers, in embedded applications, and over the Internet.' The presentations from Mr. Elmes and Mr. Salvemini outlined how the university research and education community, partnered with governments and private industry, plan to meet the challenges necessary to remove technical and institutional barriers to widespread and profitable use of geospatial information. While UCGIS is already in the position "to speak the voice of GI when lobbying", AGILE is ready for the challenging role "to establish a successful collaborative relationship with the EC".

Michael Brand (UK), former President of EUROGI, the European Umbrella Association for GI, and retired General Director of Ordnance Survey of Northern Ireland, presented the global vision with the activities organised in the frame of '*The Global Spatial Data Infrastructure: The Needs Coming From the GI Market Globalization*'. Although "Vice President Al Gore's leadership has opened the doors", there is still a lack of awareness at political level in Europe. There is a strong need of setting up a regional GI infrastructure which supports the local needs in its member states but also contributes to the emerging global initiative.

Conclusions and Future Directions

The necessity of setting up a pan-European Spatial Data Initiative was pointed out as GI pervades all sectors of the Information Society. The potential to mass market GI had been demonstrated, however, the main barriers identified to reach such potential are still the lack of political awareness and a Geographic Information Infrastructure. Another existing hurdle is the lack of a joint research funding on GI in Europe.

To finally achieve all this, the industry must be one of the driving forces. At this point, the general perception and the significant investments of the Industry in GI are already indicating that GI exerts a major influence to the Information Society.

The existing co-operation between IST and the US National Science Foundation (NSF) on e-commerce and multimedia should be extended to GI, as it is important for Europe to contribute to a GSDI initiative.

Rapporteur: Yves Reginster (for the European Commission)

Speakers:

Chairperson: Gunther Pichler, Vice Director of SICAD Siemens and Chairman of OGC Europe Special Interest Group

- Michael Turnill, and Antonio De Palmas (US), Oracle Corporation : Spatially Enabling Electronic Governance for the 21st Century
- Andrew Frank (A) - Professor at Technical University of Vienna: The economy of Geographic Information
- Martin Littlejohn, European Commission, Information Society Directorate General, Luxembourg, Presentation of GI2000: Towards a European Policy Framework for Geographic Information.
- Jarmo Ratia (FI), Director General of National Land Survey Finland: NMA and public services vision, including data policy , electronic commerce and GI infrastructure
- Michael Brand, former President of EUROGI, former Director of Ordnance Survey of Northern Ireland
- Gregory Elmes (US), University Consortium for Geographical Information and Mauro Salvemini President AGILE: The strategic vision of GI research in USA and Europe

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Strategic Issues in Multilateral International Collaboration – Learning from the Intelligent Manufacturing Systems Initiative

Outstanding economists and engineering manufacturers provided an introduction into the issues of globalisation and its impact on manufacturing and services world-wide and also on the developing world. Against this background, the workshop analysed the experiences gained in the IMS scheme as a tool for global research and development co-operation with its unique IPR provisions. The IMS project participants explained their achievements in solving problems related to global manufacturing and explain the benefits derived from collaborative efforts in the IMS scheme. The IPR provisions could serve as a model for other kinds of international RTD collaboration and specialised IPR attorneys will be at the disposition of the workshop participants offering their guidance and advice even to specific questions in the IPR domain and consortia co-operation agreements.

IMS is an international agreement signed by Europe and Norway, Australia, Canada, Japan, USA and Switzerland (Korea is about to join) on RTD co-operation in the domain of Intelligent Manufacturing Systems. An international project portfolio has been set up and involves more than 400 organisations world-wide. The IST Conference with many participants from the USA, Japan, Canada, Australia, Israel and the countries of Central and Eastern Europe is the ideal environment for presenting the achievements of IMS and discussing its future.

After an introduction of strategic issues of the role of manufacturing and related services in modern economies through, key speakers from the international scientific community introduced the technologies relevant for future manufacturing (*IT Enabled Manufacturing, Next Generation Intelligent Equipment, Advanced Design Technologies, Virtual Manufacturing*) and the contributions of the IMS projects in this regard. The opportunity was offered to exchange ideas and to develop new projects e.g. by "internationalising" current European research projects. The speakers came from practically all regions in the world, in particular from Japan and the USA.

Main issues raised

Globalisation of Manufacturing - A New Paradigm Emerging from Electronics Industry
The automobile industry was long regarded as an industry creating the dominant production paradigms and setting the best practices for the manufacturing industry. This is not anymore the case, but the electronics industry is setting now the new global paradigm by creating a virtual or networked enterprise. This makes it possibly to compete with speed, flexibility and knowledge.

Global Manufacturing: Recent Developments and Challenges Ahead.
Employment in manufacturing is the critical factor to explain the different labour market performances of industrialised countries. It was discussed how economic policies may help industrialised countries to meet the competitive challenge resulting from the increasing importance of emerging market economies in global manufacturing.

Lessons learned through IMS activities, achievements and future developments (from a Japanese point of view).
These include: - Construction of international R&D network of researchers and engineers among industry, academia and government (collaboration beyond simple academic co-operation) - Establishment of common framework of co-operative R&D (exchange of ideas, information and methodologies) - Training of internationally active engineers and researchers (overcoming of language and cultural barriers).

IMS Intellectual Property Rights Provisions. Theory and Reality.
Without attempting to describe the IMS IPR Provisions in detail, a thorough analysis was made of the practical implementation of the IMS IPR Provisions as they were drafted and negotiated by IPR experts from different IMS Projects.

The Cyber Factory - a Web of Intelligent Machines.
As manufacturers are struggling to replace the mass production of identical products by the flexible production of individualised products, the term "agile manufacturing" has emerged as the leading new manufacturing paradigm. The agile manufacturing concept has implications to all aspects of the business ranging from product design to organisational re-engineering and marketing. The contribution looked at some of the developments, which are taking place in the manufacturing scene in a drive to provide more flexibility and agility.

Using IT Innovations to Develop new added value customer services.
Today the manufacturing industry business drivers are well known and generic to many sectors. Reducing costs and cycle times, increasing quality and customer satisfaction are leitmotivs which are shared by everybody. Industry must foresee the markets evolution and anticipate the technology innovation which will impact upon its processes. As far as developing new best in class products, numbers of companies have to group themselves in virtual, distributed, extended, networked enterprises. Each company is a node which requires specific skills, know-how and level of performance.

Conclusions and Future Directions

In the closing Round Table, Mr. Pero observed that the previous discussions held during this IMS workshop had shown that there was consensus on the evolving underlying socio-economic conditions for current manufacturing and production systems and therefore on the need to revise the IMS rationale. Three topics were discussed: (a) the strategic issues, (b) the technical topics, (c) the modalities.

The strategic issues:
Since when the first ideas about IMS were discussed ten years ago, the world has changed. The time was considered to be ripe to review reconsider the global problems related to manufacturing to be tackled at the world level. Mr Viana Baptista, in his capacity as chairman of the panel of independent experts for the IMS mid term review, summarised from the presentations given during the IMS workshop that the title of the initiative might have to be adapted. Many of the issues dealt with in IMS go beyond the traditional subjects of manufacturing.

Key questions are: How to raise public perception of this international research scheme? Which are the driving forces of tomorrow? How to integrate the need for sustainable development?

Should the issues to be discussed at WTO level be considered? Mr Viana Baptista mentioned for example the aspects of delocalisation and the attitude of the developing world regarding the concept of sustainable growth.
Prof. Tomiyama underlined the need to consider more global issues and to support innovation. He reminded that the original idea put forward by Prof. Yoshikawa when launching IMS was to increase the public intellectual asset on manufacturing, to establish an international collaboration framework for basic research, avoiding competition in production technology development and duplication of research investment; to introduce better insights and remove cultural barriers. He regretted that the response by Japanese industry had not been enthusiastic and that Canada and US did not support the Initiative financially in the same way as Europe. He advocated as a revised guiding principle for IMS the "post mass production paradigm" by redefining manufacturing industry as a life cycle industry, and by referring to the new concept of inverse manufacturing (consisting of taking into account the closing life cycle loop and de-materialisation).

Mr. Salmelin, stated that IMS ten years ago had targeted the core competitive factors of the economy which he considered still valid for the research themes of IMS. However, he said that the mid term review from the EU point of view should take into account the topics for the next ten years

which will include issues of extended products, services related to products, e-commerce and new avenues addressing global issues. He highlighted the increasing role of services and relationship management in the overall "production systems" (NB: should we go from IMS to e-MS?).

The research topics:
Today, the IMS research themes are the following: (1) total product life cycle; (2) process; (3) strategy, planning, design tools; (4) human/organisation/social; (5) virtual/extended enterprise.

Prof. Westkämper addressed some examples of socio-economic evolution in the last ten years, such as the problems of increased energy consumption or the impact of automation on employment. As for the research subjects for global research, he saw a wealth of topics to be addressed and recommended considering increasingly life cycle issues of products. Other important issues to be taken up by IMS, are the advancement of information and communication technologies, knowledge management and the necessity to set world wide standards, which could lead to new solutions for manufacturing. He agreed to the concept of Prof. Yoshikawa to use IMS for dissemination of knowledge for manufacturing, but he reminded of the need to evaluate this knowledge through proper assessment tools.

Mr. Roumiguier added from an industrial point of view that IMS should address both, products and processes together, and give more attention to the needs of the concept of the "virtual company". In addition, IMS should better take into account the issues of customer services. He agreed with Prof. Westkämper on the need to look into the issues linked to information/knowledge flows. In this context, he also mentioned decision tools, and knowledge sharing.

The modalities:
Up to now 17 RTD projects are running, although the number of submitted abstracts is growing up. As the most important positive issue discussed during the workshop was networking, the question was raised why not to use much more in the future Thematic Network contracts, rather than RTD contracts. Modalities should reflect the real added value of IMS.

Mr. Falstad (US) analysed the IMS IPR provisions as bridging very different cultures involved in IMS, and he said that so far there had been no evidence that the IPR regime had not worked well. He agreed that the United States took a different, more industrially focussed view towards IMS than for example Japan, without discounting more academia oriented approaches by other IMS regions. He underlined that the major achievement of the IPR rules were their respects of the motivations of the different players participating in IMS. He expressed the hope that the IPR rules could continue to serve all regions to collaborate in the future in the new topics considered important by the IMS community.

Mr Salmelin, giving the point of view of Commission services, considered the IMS IPR regime as a unique asset, and said the IPR provisions could serve as a prototype for other collaboration schemes outside the manufacturing domain. In all, he assessed IMS as having provided a good set of building blocks on which IMS could base its future orientation. The main problem of the IMS regarding the industrial interest is its long lead time for decisions.

There was a general consensus on the issue of the duration of the IMS endorsement process which is considered to be too lengthy by many project participants. It was recommended to invite the IMS Steering Committee to come forward with simpler procedures in order to attract more interest in the research and industrial community into the IMS scheme, which competes with other less complicated schemes. In this context, Mr. Salmelin raised the issue of the IMS value added in relation to the components already in place in the European Research Framework Programme, which is open to

the whole worldMr Parker, from the Interregional IMS Secretariat, responded by underlining that IMS would offer a neutral framework with a balanced IPR regime which might be more acceptable to non-European participants in a potential research collaboration than the EU terms.

Mr. Pero concluded that all participants had agreed on the merits of the IMS scheme and that valuable contributions had been made for the future orientation of IMS. He considered the workshop a success, from the point of view of the papers presented, from a strategic point of view, and as a milestone for the first phase of IMS. This workshop opens clearly the IMS mid-term review phase, which will be carried out during the next 6 months.

Rapporteur: Paolo Garello (European Commission)

Key Speakers:

- P. Armarego (AUS), Attorney, Clayton Utz : IMS IPR provisions-background and essential elements.
- R. Falstad (USA), SEMATECH : IMS IPR provisions: Experience gained.
- Prof. F.L. Krause (D), Fraunhofer Institute IPK: IT enabled manufacturing.
- Prof. T. Moriwaki (JPN), University of Kobe : An example of international co-operation: IMS achievements, developments and its future form a Japanese point of view.
- Dr P. Nunnenkamp (D), Kiel Institute of World Economics: Role of manufacturing and related services in modern economics. (organisation of future manufacturing based industry).
- H. Ohkura (JPN), Toyo Engineering Corporation : IMS IPR provisions: Experience gained.
- Prof. J. Ranta (FI), Helsinki University : Strategic issues of globalisation.
- A. Roumiguier (F), Matra Datavision : Advanced Design Technologies.
- Prof. T. Tomiyama (JPN), University of Tokyo: The future of IMS
- Prof. E. Westkämper (D), Fraunhofer Institute IPA : Virtual Manufacturing.
- Suominen, European Commission, : Next Generation Intelligent Equipment.

Other speakers:

- Dr H. Abdalla (UK), De Montfort University : Next Generation Intelligent Equipment.
- Prof. B. Braunschweig (F), IFP : Advanced Design Technologies. .
- Dr P. Bunce (UK), Consortium of Advance Manuf. : Next Generation Manufacturing Systems project presentation.
- A. Col (F), Sollac Usinor Group : Advanced Design Technologies.
- J. Ercolanelli (F), Systus International : Virtual Manufacturing.
- Dr. M. Fuse (JPN), Sumimoto Electric Industries Ltd. : IT enabled manufacturing.
- K. Koch (D), Fraunhofer Institute : Advanced Design Technologies.
- S. McCormack (CAN), Stikeman – Elliot : Attorney – Practical advice on IMS / IPR issues.
- Dr W. Pölzleitner (A), Sensotech Forschungs und Entwicklung : Next Generation Intelligent Equipment.
- Dr T. Savolainen (CH), Idegen GmbH : IT enabled manufacturing.
- Prof. A. Schnülle (D), University of Hannover: Next generation intelligent equipment.
- H. Synterä (B), Ahlstrom Machinery Corporation : Virtual Manufacturing.
- Dr. P. Valkenaers (B), KU Leuven: Next Generation Intelligent Equipment.
- Dr R. Van den Berg (NL), Baan Development : Next Generation Intelligent Equipment.
- Dr. R. Wing (UK), Imperial College of Science Technology & Medicine: IT enabled manufacturing.

Speakers from the European Commission:

- Rosalie Zobel, Acting Director, New Methods of Work and Electronic Commerce, European Commission, Information Society Directorate General
- Bror Salmelin, Head of Unit, Electronic Commerce, European Commission, Information Society Directorate General
- Hervé Pero, Research Directorate General, European Commission

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European Commission
Information Society Directorate-General - R6
Information and Communication Unit
February 2000