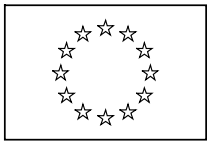


EUROPEAN COMMISSION
Information Society Directorate General

EXPRESSIONS OF INTEREST

ANALYSIS ON THE INFORMATION SOCIETY'S TECHNOLOGY THEME 1.1.2

September 2002

1. Introduction

The invitation for Expressions of Interest (EoI) for potential Integrated Projects (IPs) and Networks of Excellence (NoEs) was launched on 20 March 2002 and closed on 7 June. Some 3000 EoIs were received, addressing the IST thematic priority, which have subsequently been analysed by the Commission. The conclusions represent the synthesis of the individual analysis performed by the Directorates and refined in workshops.

The main objectives of the exercise were to stimulate partnership-building in view of the first calls for proposals in FP6 and to measure the readiness of the constituency to use the new instruments. The analysis of the Expressions of Interest will feed into the FP6 WorkProgramme preparation process.

2. General Statistics

The **statistics** for the EoIs received and analysed for the IST thematic priority are listed below for the 11 areas specifically addressed.

Topic	Total	IPs	NoEs
Trust & Security	4%	73%	27%
Societal challenges	20%	67%	33%
Work and Business challenges	27%	71%	29%
Complex problem solving & Grids	3%	52%	48%
Communication and network technologies	12%	81%	19%
Software, embedded systems & distributed systems	11%	68%	32%
Micro-, nano- & optoelectronics	5%	49%	51%
Micro- and nano- technologies, microsystems & displays	4%	64%	36%
Knowledge technologies	6%	64%	36%
Intelligent interfaces & surfaces	5%	70%	30%
Future and emerging technologies (FET)	3%	58%	42%

Countries	
EU	83%
Associated Countries	15%
Third Countries	2%

Type of Coordinating Submitter	
Industry (including SMEs)	25%
Public and private research organisations	21%
Universities / Educational establishments	41%
Other	14%

3. Executive Summary and Conclusions

The analysis has revealed a number of **useful** and **encouraging** results.

- The exercise has been successful in stimulating the building of **partnerships** in the constituency with a view to preparing for the first calls. There is evidence of more extended partnership chains emerging in line with the ambitions of the new instruments.
- Useful feedback has been obtained on the state of **readiness of constituencies** to propose IPs or NoEs in an early call, thereby helping to shape the Work Programme development and roadmapping exercises.
- The exercise has uncovered a wealth of interesting research **ideas** which will contribute to the refining of the Work Programme.
- The **traditional constituency** was well represented in the submissions received, with the additional bonus of some **new players** appearing in certain areas and new partnerships built in emerging fields such as advanced interfaces, context-based knowledge handling and networked embedded systems.
- The programme appears to be attracting "renewed" interest from **larger industries** in specific sectors. Additionally, this appears to have been achieved without any apparent global lessening of the **interest of SMEs**.
- In both IPs and NoEs submissions a distinct **shift towards longer term research** was observed.

The analysis has also uncovered a number of **issues** to be addressed to ensure a successful programme launch. Some preliminary suggestions in respect of **remedial action** are contained in the final section of the report.

- The ~3000 submissions received were roughly broken into 2/3s IPs and 1/3 NoEs. Between **15 and 30% of the IPs** (depending on the particular domain) were judged to be **genuine potential IPs**. There can be little doubt that there is still a **lack of understanding** of the nature and potential of the Integrated Project instrument and a degree of unpreparedness in the community.

  NoE submissions generally exhibited a superior understanding of the instrument, but there were still important **weaknesses** - especially in a failure of vision and genuine impact potential. The large number of NoE EoIs received points in itself to a certain level of misunderstanding.

- FP6 is understood within the Commission as having the original facet of being a means by which to implement the **ERA**". The evidence of the EoI exercise shows clearly that it is **not so far understood** in these terms by the constituency, who have too often ignored this dimension.
- Some **EoIs** in excess of 200M€ were received. Serious reflection needs to be undertaken in respect of the genuine opportunities for funding projects of this size, taking into account factors such as the effective use of **resources, risk management** and **funding from other sources**. These large proposal apart, **Budgetary information** was absent in the majority of EoIs.
- With some notable exceptions, the participation of **Newly Associated States (NAS) was not as strong as expected.**

4. Analysis of Constituency

Crucially for the ultimate usefulness of the exercise, **important information** was gathered helping in the identification of those areas and actors who are **"ready" to propose** using the new instruments - as well as those who would, perhaps, be better advised to make use of traditional instruments to focus their work in the preliminary stages.

However and because of the different nature of the new instruments, the characteristics of the partnerships proposing IPs and NoEs were dissimilar and they are therefore analysed separately in the following two sections. Section 4.3 concludes with some additional, pertinent observations.

4.1. **Constituency expressing interest in IPs**.

- The large majority of IP are industry-led. **Partnerships** were generally in line with **expectations**.

- Major players in particular were omnipresent and indeed expressing a "renewed" interest in certain specific domains such as work and business challenges. **Large companies' increased interest** was also noticed in the knowledge-based systems, audio-visual, trust and security, and software domains.

- There was relatively little evidence of the appearance of totally new communities – which is interpreted as reinforcing the validity of previous analyses – with the exception of **some new groupings** being observed in the interface, machine learning and complex systems domains and some interest expressed from the forensic community in the trust and security area.

The increased participation of the major players is not seen to have militated against the presence of **SMEs in many IPs**.

Interestingly, in those domains which could be said to be more traditionally user-oriented such as societal challenges and business and work challenges an increased element of technological push was noted, whereas some of the areas more traditionally thought of as having a generic science orientation recorded a healthy participation of users. A **balance between technology push and application pull** seems to have been reached.

In those submissions which were considered to be genuine candidates for the creation of IPs (representing between 15 and 30% depending on the sector), the nature of **partnerships** has generally been **expanded** as one would expect to encompass the larger remit of the IP. Specifically, consortia have added partners at the "soft science" end (**socio-economic impact etc**) as well as for downstream exploitation activities. On the **negative** side, **user/supplier** partnerships have been addressed only in some areas (applies equally to NoEs).

A particular feature of "good" IP submissions, very often building on ongoing FP5 roadmapping projects, was the frequent interlinking with or incorporation of NoEs in their structure.

4.2. **Constituency expressing interest in NoEs**. As a general observation, **universities and research institutes** were **over prevalent** in the totality of NoE submissions with, however, some important exceptions in trust and security, work and business challenges, micro-, nano and opto-electronics, and to a lesser extent in major societal challenges.

The number of NoEs bringing together virtually all the main players in particular areas was surprisingly high, as the number of NoEs in a particular sector that could possibly integrate all or virtually all the key players should **necessarily be limited**!

NAS participation in NoEs was higher than in IPs and indeed their participation, and even lead role, in a number of **proposals** in societal challenges and future and emerging technologies is a feature. However, in the area of complex problem solving there have been instances of obvious lack of understanding of the real nature of NoEs where NAS proposals have been straightforward propositions to conduct work in their particular area of expertise.

Finally, and as might be expected at this stage, user/supplier partnerships are addressed only rarely and generally superficially.

4.3. **Some final constituency issues.** In light of the recent IT tech boom turning into something of a bust, it was not of any great surprise to find that some of the web publishing community had disappeared from the exercise. Interestingly, the reemergence of telecom operator participation in what for them are relatively new domains can perhaps be seen as the compensating factor (given the pattern of their acquisitions over the past 18 months!). Media industries and especially the audio-visual sector were well represented.

Many EoIs did not provide a substantiated list of partners which, when taken with those EoIs - particularly for NoEs - which included hugely comprehensive lists of “potential partners”, would suggest that caution be advised in making too many concrete deductions at this early stage.

5. Use of the New Instruments

A significant percentage of the expressions of interest submitted consisted of suggestions for research ideas without sufficient details on how best to address these ideas in the context of an Integrated Project or a Network of Excellence. Not all these ideas need necessarily be implemented in IPs and NoEs. The extent to which this represents **ignorance** of the real nature of the **new instruments** or the enthusiasm of certain proposers to submit an EoI just to share ideas is both open to interpretation and **area/field dependent.** There can be little doubt however that some **level of confusion** is prevalent in the wider community.

As with the analysis of the constituency, it has proved more useful to conduct the analysis of the use of the instruments separately for IPs and NoEs before concluding with any additional issues.

5.1. **Use of Instruments in IP Submissions**. Two distinct types of IPs were received. The first group consisted of those that could be said to truly exhibit the genuine characteristics of an **embryonic IP** and which numbered

between **15 and 30% of total** submissions depending on the area/field. The remainder generally consisted of those where the concept of an IP and particularly the integration aspect was at the very least poorly described and often clearly misunderstood. Into this sector effectively fell numerous proposals for "classic", if inflated, FP5-type projects.

The **first group of IPs** (the 15-30% with genuine potential) often addressed integration across the value chain and made use of a range of activities (RTD, take up etc) and, occasionally, explicitly mentioned supplementary funding sources. These submissions often originated from **well prepared constituencies** representing fields where the research and industrial community have already developed **shared visions** such as in Mobile and wireless systems and microelectronics. Quality proposals were received from constituencies that participated in **preparatory activities** such as the workshops organised subsequent to the Commission-internal reflection group (IRG) exercises, or those taking part in Commission-supported roadmapping exercises in the trust and security or work and business challenges areas.

Concerning the **second type of IP** proposals, it should be said that they often provided good ideas that could be addressed using more "**traditional instruments**". This reinforces the necessity to retain the use of these instruments in specific sectors and at specific times over the course of FP6 (eg as preparatory actions in certain sectors in the first years of the programme).

Some **very large EoIs** in excess of 200m€ were received. Some of the consortia behind these proposals are extremely solid and the Commission needs to clarify its thinking in respect of the genuine opportunities for funding projects of this size. Factors that need to be taken into account are the effective use of **resources, risk management** and the possibility of **leveraging significant funding** from other sources.

Because of the very nature of FET multidisciplinary consortia were dominant in the EoI's it received in areas like neuro-IT, robotics and complexity. In addition, a number of IPs were analysed that were of an explicit **cross domain** character, including:-

- Work and business challenges where synergies were identified with activities in the societal challenges domain, software and distributed systems and IMS domains.
- Microsystems, micro/nanotechnologies and displays where the possibility of joint IPs with micro, nano and opto electronics were clearly exhibited in addition to possibilities with a number of sectors in the applied IST domains (trust and security; societal, business and work challenges) as well as in the 3rd thematic priority.
- Societal challenges also identified obvious potential for joint IPs with the 1st, 4th, 6th and 7th thematic priorities of FP6

5.2. **Use of Instruments in NoE Submissions**. As previously stated, there are some grounds to question the **high number of NoEs** received in certain sectors. Nevertheless it is true that the number of submissions which could be considered as **genuine** embryonic NoEs was certainly **higher than for genuine embryonic IPs**.

The integration activities covered in NoEs too often included only coordination actions as a means to ensure coherence in research work, with the actual RTD continuing to be conducted in isolation. This obviously **stops short of the full range of activities** that would help in shaping and structuring the research community in the context of ERA and which could include the sharing of facilities, the creation of common resources (such as software libraries and platforms) and considerations of the sustainability of the NoEs subsequent to the funding period.

More comprehensive addressing of these integration issues were to be found in the very best EoIs, and especially in cases where the NoEs in question were **linked to and complemented submissions for IPs** – examples occurred in trust and security, microsystems, micro/nano technologies, displays, work and business challenges and societal challenges (environment).

Too many EoI submissions **relied on the inherent federating nature** of the activity to supply the necessary ERA dimension and therefore explicit reference to relevant member state policies, activities and complementary funding resources was absent in most cases.

Generally, potential **NoE proposers appear more prepared** for the launch of FP6 than do potential IP proposers – exceptions notwithstanding.

Finally, the suspicion remains that a number of proposers have **confused** the 5th FP Thematic Network with the new 6th FP instrument.

5.3. **Some final instrument analysis issues**. There is still a degree of **confusion in the constituency as to the true nature and potential** of the new instruments and whereas the high profile which the launch of FP6 in the second half of this year will certainly help in clarifying a number of issues, there is no doubt that a **significant amount of work remains to be done** to ensure that the community is well prepared.

However, it is also observed that **more structured industries** such as in micro and optoelectronics look globally **ready to propose** significant IPs and NoEs right from the start of the first call.

The objective-driven nature of IPs compared with the more investigative nature of the NoEs means that the **crucial concept of integration** is quite distinct for both. Once again, an effort needs to be made to clarify these concepts for the constituency.

NoEs are designed as key **pillars** for realising **ERA objectives**. However their very nature (i.e. “Networks”) frequently meant that submissions were short on detail on the specific ways in which the EoIs might contribute to ERA objectives. IP submissions were too often even more obviously lacking detail on the concrete measures required. In both cases, and if an unfortunate wave of tokenism is to be avoided in the early calls, **expectations in terms of genuine ERA dimensions in all proposals need to be made** as clear as possible to potential proposers.

6. Analysis of Research Priorities

Very few of the EoIs received were out of scope for the IST theme, indicating that **the constituency**, at the very least, **recognised** itself. There were **no significant gaps** in research areas addressed, and the broad range and diverse approaches identified were consistent with the research domains addressed. In fact, the exercise has **confirmed many of the findings of previous technology watch** and prospective exercises such as those conducted by the various working groups of ISTAG, the IRG exercise and its spin-off workshops etc.

The EoIs received are proving extremely useful to the Commission services in refining and detailing specific aspects of the **Work Programme**. Many **excellent ideas** were well-described even in EoIs that were ultimately judged inadequate in terms of being embryonic IPs or NoEs (lacking critical mass, integration etc).

In the area of nanoscale information processing some EoIs were submitted to Priority 3 (and some others to 1.1.2.iii). The reason may be a misconception in the research community that all nanotechnology-related research would be carried out in Priority 3 – even research explicitly aimed at future technologies for nano-scale computers. Therefore, there is a necessity to clarify the objectives of the IST Priority vs. Priority 3 within nanotechnologies.

Furthermore, there have been occasional signs both of **new areas emerging** (for example, forensic computing in trust and security, artificial consciousness in FET) and certain players exhibiting a **new interest** in activities that were for them perhaps of a lesser priority in times past.

The timescales for results to flow from the IPs and NoEs proposed show a distinct **shift towards longer term research** – and this trend is especially marked in the "good" submissions.

Budgetary information was absent in the majority of EoIs.

As noted above, **cross domain proposals** have been received but there is still a tendency for the **visionary aspect** of proposals to remain somewhat **restricted**.

ANNEX – Expressions of Interest

1.1.2. Information Society Technologies

1. TECHNOLOGIES FOR TRUST AND SECURITY

Reference text from the Specific Programme

Technologies for trust and security: The objective is to develop technologies for key security challenges posed by the "all-digital" world and by the need to secure the rights of individuals and communities.

Research will focus on basic security mechanisms and their interoperability, dynamic security processes, advanced cryptography, privacy enhancing technologies, technologies to handle digital assets and technologies for dependability to support business and organisational functions in dynamic and mobile systems.

General Statistics

- A total of 131 EoI were allocated to the area. In terms of instruments targeted by the EoIs, 96 selected IP and 35 NoE. However, after a first analysis it appears that more than one third (precisely, 51) of the EoIs has proposed activity that would better fit the scope of TRP.
- The overall quality of EoIs varies very much in view of the actual existence behind the idea of an already thought out plan for an IP or NoE. Some EoIs appear to have been produced by individuals or single organisations possibly seeking partners.

Analysis of Research Priority

- In order to provide some structure to the analysis of the research priorities proposed by the EoI and building on the outcomes of earlier reflection exercises (like IRG, PCM, etc.), a number of categories were defined grouping together topics and/or technologies.
- Because of the nature of the new Instruments, most of the proposals – in particular those focussing on technology and architectural developments for novel scenarios – have covered more than one category. Below is a first view of the coverage of the submission

Description	EoI	IP	NoE
Information and service security infrastructures, security technologies, crypto	**34**	**26**	**8**
Trusted components/ devices, smart card	**10**	**8**	**2**
Information security management systems, security frameworks, security policies and ontologies	**5**	**3**	**2**
Privacy enhancing technologies, identity management, privacy	**11**	**8**	**3**
Electronic signatures, authentication, non repudiation technologies	**7**	**7**	**-**
Biometrics	**14**	**12**	**2**
Digital asset management, multimedia content protection, smart document and media, DRM	**14**	**8**	**6**
Security and mobility, mobile communication, secure ubiquitous networking, GRID	**12**	**9**	**3**
Cybercrime, high tech crime, forensics	**4**	**2**	**2**

Others (i.e. quantum cryptography, legal, etc.)	**2**	**2**	**-**
Dependability, Critical Infrastructure Protection, distributed Intrusion detection system	**18**	**11**	**7 (+2)**

- In the following are the areas that have attracted substantial interest:
- **Smart cards** with focus on crypto design, authentication, electronic signature, protocols, contactless, architecture for speed, low power, packaging (materials, thinning, downscaling), polymer electronic and energy (power management, embedded), large scale deployment, standardisation, international co-operation.
- **Biometrics** with interest in new algorithms, alternative solutions, speed, robustness, novel pattern recognition approaches, multi-modal biometrics, data fusion issues, standardisation of testing (creation of certification centres), statistical methods.
- **Dependability and protection of critical infrastructure** with main interests in holistic view of dependability in Society; security of communication for critical infrastructure emergency; dependability technology and products for CIP; information dependability; highly dependable embedded devices; micro and nanotechnologies for homeland security; interdependencies of control systems and energy grid.
- **Security and mobility** with focus on security model and technologies for GRID; advanced crypto for multimedia mobile and m-commerce; secure software for mobile platforms; novel trust and security models for mobile and ubiquitous computing; dependable home connectivity as the advent of ambient intelligence; privacy, authentication, accounting and reliability for mobile Internet.
- **Privacy** digital identity management, privacy mediation, personal data environments; privacy and authentication in mobile environments.
- **Digital asset management:** watermarking, advanced cryptography, standardisation services for digital rights and payments; method to secure CD/DVD, virtual electronic licensing.
- Beside the above areas, it is worth recalling that there are some topics (like cryptography, forensic computing) for which the interest is well substantiated even by a single proposal.
- Lastly, a number of EoIs not allocated to the area of Trust and Security also touch on different aspects of security. This is, in particular, the case for EoIs targeting applications in areas like health, environment, e-government, e-commerce and m-commerce, etc.. Similarly, in certain technology-oriented areas, communications, software and knowledge technologies, the security and dependability aspects are sometime very important and very sensibly tackled in the envisaged technology development cycle. Some outstanding cases of this approach concern digital asset management technologies in the area of "Knowledge technologies and digital content", security mechanisms and architecture in "mobile communications", dependability technologies in "Software" and "Embedded systems" and, last but not least, smart card in areas like "e-government" and "e-health".

Analysis of Constituency

- The constituency appears to be very fragmented. This is not a surprise in view of the very limited experience of collaborative transnational EU research beside what has been done in defence and intelligence related projects. However, an interesting process of aggregation has initiated around certain topics, for which instrumental seems to have been the roadmap projects.
- In terms of submission, the vast majority of EoIs come from Academia. Looking inside the proposals, we may say that for IP, the most developed ideas come from industry-led consortia whereas, as it was expected, for NoE the university-led proposals prevail.
- For those EoIs where the constituency behind appears to have done some preparatory work to understand the Instruments and to develop an adequate plan fitting with them, the maturity of the idea and the breath of the proposed project seem to be adequate for the new instruments.
- It is worth highlighting that a number of EoIs originated from Accession countries proposing ideas in the area of advanced crypto and security protocols.

Analysis of Instruments

- The high number of EoIs for IP seems to reflect to the lack of understanding on the actual nature and scope of this instrument. Similar type of consideration may also be said for the EoIs targeting NoE where, sometime, the approach proposed seems not to differ from what might have been of interest for NoE in the current FP.
- The analysis has identified some topics for which the submission of IP and NoE could easily be anticipated, should the topics become part of open Calls.
- The new instruments do not appear adequate for all themes and topics. In a number of cases (i.e. novel security models for Ambient Intelligence) some more germinal work may be needed before going for full fledge IPs or NoEs.

Analysis of Integration

- The most advanced and technological oriented EoIs look at integration through the entire technology and system development cycle, pooling together all relevant players and parties to be engaged in it.
- A number of EoIs show the difficulty to mobilise heterogeneous parties around a unique and large project. This is due to the lack of practice to work globally on security challenges apart in the field of mobile communications (and, of course, in the are of defence and intelligence). However, the urgency and need to improve security of our digital and increasingly open environment is raising a lot of interest that the Commission may have the need to catalyse and bring to the next step, that is, building effective collaboration.

Conclusions

- The overall submission confirmed the relevance and pertinence of the areas addressed in earlier reflection exercises and by the security roadmap projects which have recently been launched. Indeed, a number of EoIs addressed the areas of the roadmap projects without being directly or indirectly involved in such activities. It seems, therefore, necessary to plan for some proactive actions that would facilitate and support the aggregation of the constituency around the most promising EoIs.
- In the most solid EoIs there is a strong push towards more interdisciplinary and multisectoral approaches to tackle security and dependability challenges associated to ambient intelligence and, more generically, Information Society. This push acknowledges the complexity of ambient intelligence and Information Society scenarios as well as provides the right perspective for more speculative thinking that is needed to cope with these new challenges. Furthermore, the most solid EoIs focus on the entire cycle and dynamics of technological research and development by embracing also aspects of education, training, technology transfer and deployment across different sectors.

The submission of EoI is just the only the first step of a complex planning and constituency aggregation process where the Commission need to act. Indeed, despite the clear push towards more interdisciplinary and multisectoral approaches bringing together different communities, at technical level (i.e. security, safety, econometrics, advanced protocols, wireless communications, etc.) and/or at the business level (i.e. Telecom, ISP, ASP, system integrators, embedded systems, etc.), appears not to be easy. In this context, the roadmap projects would play an important role but the Commission should also undertake some actions that would support and ease this process.

2. SOCIETAL CHALLENGES

Reference text from the Specific Programme

Research addressing societal challenges: The focus is on "ambient intelligence" for a broader inclusion of citizens in the Information Society, for more effective health, security, mobility and environment management and support systems, and for the preservation of cultural heritage, integration of multiple functionalities across these different domains will be also supported.

Research activities on "e-inclusion" will concentrate on systems enabling access for all, on barrier-free technologies for full participation in the information society and on assistive systems that will restore functions or compensate for disabilities thereby enabling a higher quality of life for citizens with special needs and their carers. In the area of health, the work will focus on intelligent systems aimed at supporting health professionals, at providing patients with personalised healthcare and information, and at stimulating health promotion and disease prevention in the general population. Research will also address intelligent systems to enhance the protection of people and property and for securing and safeguarding civil infrastructures.

In the area of mobility, research will focus on vehicle infrastructure and portable systems to provide integrated safety, comfort and efficiency and allow for the provision of advanced logistics info-mobility and location based services. Research in the area of environment will focus on knowledge-based systems for natural resource management and for risk prevention and crisis management including humanitarian mine clearance. In the area of leisure, research will focus on intelligent and mobile systems and applications for entertainment. In the area of tourism, research will address knowledge sharing and interactive services. For cultural heritage, the effort will focus on intelligent systems for dynamic access to and preservation of tangible and intangible cultural and scientific resources.

General Statistics

The high quality of the content of the 623 expressions of interest submitted in the area of 'Societal Challenges' has largely confirmed the importance of the vision of ambient intelligence for broader inclusion of citizen in the information society.

Out of the 623 Expressions of Interest (EoI) received in this area, two thirds were submitted as Integrated Projects while one third were proposed Networks of Excellence.
The distribution of the EoIs submitted per topic was as followed :

- Health 242
- Cultural Heritage 118
- Environment & Protection of People & Property 101
- Mobility 77
- eInclusion 65

- Leisure & Tourism 20

Analysis of Research Priority

The research topics addressed by the EoIs can be clustered as followed [1]:

Health

- **Biosensor and AMI systems for citizens and patients** (20 IPs & 3 NoEs)
  Intelligent clothing and textiles, Intelligent drug delivery, Focus on wearable smart biosensors that interact and communicate
- **Biomedical informatics** (6 IPs & 8 NoEs)
  New tools by modeling, simulation and integrating genetic and clinical information.
- **Health knowledge management and HealthGrid** (21 IPs & 5 NoEs)
  Evidence based medicine, medical risk management and securing timely access to health data repositories
- **Intelligent environment for non-invasive diagnosis and treatment** (23 IPs & 8 NoEs)
  Imaging technologies, micro- and nano-systems for diagnosis, virtual reality systems for training, robotic surgery, systems to aid rehabilitation
- **Personal and pervasive eHealth systems and services** (8 IPs)
  Mobile services, information for management of life style and well-being, virtual reality base systems for disease prevention and training
- **Research networks on particular medical fields** (5 IPs & 17 NoEs)
  Ex. Diabetes, Pediatrics, Mental health, Opthalmology, etc..
- **Research into implementing *e*Health systems and services** (70 IPs & 23 NoEs)
  Electronic patient records, systems for Continuity of Care when mobile, telemedicine systems (homecare, telecare), health promotion/disease prevention systems & services for citizens

Cultural Heritage

- **Digital preservation and digitisation** (19 IPs & 11 NoEs)
  Digital preservation infrastructures, European Web archiving, preservation factories for historic film and audio-visual archives and for contemporary art and visual culture, science of conservation and mapping risk for European heritage.
- **Advanced digital libraries and content infrastructure** (16 IPs & 15 NoEs)
  Advanced Digital Libraries infrastructures, cultural GRIDs, humanities computing research, music collections.
- **Intelligent heritage and artistic expression** (11 IPs & 13 NoEs)
  Image processing and synthesis, "digital" archaeology, new markets & services for cultural & artistic digital content, "augmented" cultural artifacts, cultural digital games.
- **Building community memories** (3 IPs & 9 NoEs)
  Building eEurope services linking culture, educations and tourism, "heritage for all", collective memory, culture and media literacy.

Environment & Protection of People & Property

- **Risk and emergency** (49 IPs & 12 NoEs)
  Including natural hazard, man induced hazard, security / threat to persons & properties.
- **Environmental protection and management** (20 IPs & 10 NoEs)
  Water, air, noise, natural resources sustainable management.
- **Humanitarian demining** (9 IPs & 1 NoEs)
  Explosive detection and release of safe land through area reduction process.

Mobility

- **E-safety** (12 IPs & 1 NoE)

Advanced Driver Assistance Systems, Active Safety Systems, Human Machine Interface (HMI), including advanced sensors and data fusion applications

- **Navigation and Location Based Services** (15 IPs & 2 NoEs)
  Multipurpose platforms for Location Based Services, Global Navigation Information Systems including GALILEO advanced services, creation of standards for digital mapping applications and services
- **Advanced services for logistics and info-mobility** (21 IPs & 2 NoEs)
  IST-enabled services for individual travellers, collective and freight transport, providing seamless access to information & management services.
- **Vehicle and Infrastructure management systems** (21 IPs & 3 NoEs)
  IST-enabled systems & services to improve operational network efficiency and enhance safety for various transport modes

Remark : Several of EoIs addressed to priority 1.1.6.2. as first priority are also addressed to mobility in priority 1.1.2.1 (estimated to around 20%). Some EoIs related to Navigation and Location Based services have been addressed to priority 1.1.4.

eInclusion

- **Social integration of elderly and disabled persons** (18 IPs & 13 NoEs)
  Barrier free technology - Making IST accessible on technical & cognitive level, Empowering technology - IST communication disabilities.
- **Smart Homes and remote care of elderly and disabled persons** (12 IPs & 4 NoEs)
  Barrier free technology - Collecting environmental data, direct access to care providers, creation of standards for telecare applications and services.
- **Intelligent assistive technology systems** (11 IPs)
  Empowering technology – navigation for persons visually impaired, intelligent wheel chairs, other assistive devices.
- **Physical accessibility** (2 IPs & 2 NoEs)
  Barrier free technology – Transport & buildings accessibility, others

Tourism & Leisure

- **Tourism** (14 IPs & 2 NoEs)
  Interoperable platforms and knowledge management sharing and distribution for the tourism business chain, intelligent interaction systems for seamless delivery of services to the mobile tourist.
- **Leisure** (1 IP and 3 NoEs)
  Building European wide constituency in games and mobile infotainment research

Addressing the underlying societal challenges in these areas will improve the quality of life of all citizens, including people with special needs, and will contribute to build a more secured and better managed natural, social and cultural environment for the mobile citizen.

Analysis of Constituency

The constituencies of the current IST programme were strongly represented in the EoIs received. Whereas large industries confirmed to be well present in the health and transport sector, their participation in other areas can still be improved. Universities, research centers, regional and national authorities, and SMEs were well represented. Organisations in central and eastern Europe were fairly present as well in a number of EoIs. Users participation through associations and organisations was overall considered to be at an appropriate level.

Analysis of Instruments

EoIs confirmed that the implementation of new instruments is a well received initiative that gets the clear support of existing and new constituencies. At this stage, a number of EoIs appear to lack of some characteristics such as ambition, integration, critical mass,… to be able to fully exploit the possibilities offered by the new instruments. A significant effort, both from the constituencies in terms of preparation and maturation as well as from the Commission in terms of communication and support should enable to improve the level of readiness of all actors towards the new instruments.

a) Integrated Projects:
While some promising EoIs need to be refined further to become strong and mature IPs, it is likely that a sufficient number of them will be ready for submission to early calls in most domains. Other suggested IPs might still fit better as TRPs.

b) Networks of Excellence:
Promising NoEs were submitted in all domains. Although some of them also need to mature to fit the new instrument approach, they addressed in most cases the appropriate innovative content.

Links with member states activities and other funding bodies

Although most EoIs have implicit links to national activities, these were not mentioned as such. In a limited number of cases, references were made to national funding arrangements and national projects. At this stage, the references were mainly given to establish the background or the state of the art rather than to build synergy or take advantage of Member State activities. Only a few EoIs have mentioned sources of funding or even an estimate for the budget.

Conclusions

- Clear commitment shown by the constituencies that has led to a strong demand for research into 'societal challenges'- primarily in health related topics- with the emergence of a number of innovative and promising ideas in all areas.
- Although most ideas are not yet IPs or NoEs ready to fly, it is likely that a significant number of them will be ready in almost all areas for submission to early calls (in particular in the health and mobility domain).
- IPs addressing cross domains are to be expected (specially in the mobility, health and environment domain).
- Awareness of the EoI submitters of the new instruments, their goals, and the need to contribute to an ERA needs to be increased.

[1]. EoIs not enough describe to enable an appropriate analysis or not relevant are not taken into account in the following detailed allocation per topic.

3. WORK AND BUSINESS CHALLENGES

Reference text from the Specific Programme

Research addressing work and business challenges: The objective is to provide businesses, individuals, public administrations, and other organisations with the means to fully contribute to, and benefit from, the development of a trusted knowledge-based economy, whilst at the same time improving the quality of work and working life and support life-long continuous learning to improve work skills. Research will also aim at a better understanding of the socio-economic drivers and impact of IST development.

Research in e-business and e-government will focus on providing European organisations, private and public, and especially SMEs, with interoperable systems and services to enhance innovation capacities, value creation and competitive performance in the knowledge economy and on supporting new business environments ("business ecosystems"). Research in organisational knowledge management will aim at supporting organisational innovation and responsiveness through elicitation, sharing, trading, and delivery of knowledge. Work on electronic and mobile commerce will target interoperable, multimodal applications and services across heterogeneous networks. It will include anytime-anywhere trading, collaboration, workflow, and electronic services covering the whole value creation cycle of extended products and services.

Research into eWork systems will focus on new workplace designs incorporating innovative technologies to facilitate creativity and collaboration, on increasing resource-use efficiency and on extending work opportunities to all in local communities. Work on eLearning will focus on personalised access to, and delivery of, learning as well as on advanced learning environments at school, university, in the workplace and in lifelong learning in general, taking advantage of the development of ambient intelligence.

General Statistics

The team consisting of 27 persons from 5 units in 3 Directorates in the **"Research addressing work and business challenges (WBC)"** area analysed a total of **844* EoIs (596 IP, 248 NoE).** The statistical distribution of budget is not significant since only very few EoI explicitly mention the budget.

eBusiness, eCommerce and eWork	611 EoIs (440 IP, 171 NoE)
Technology Enhanced Learning (e-learning)	179 EoIs (118 IP, 61 NoE)
e-Government	54 EoIs (38 IP, 16 NoE)

Analysis of Research Priority

The coverage of the submitted EoIs can be clustered into the following research topics **:

Research Priorities	IP	NoE
Management of dynamic collaborative business networks Organisation of dynamic collaborative network structures, Harmonisation framework for virtual organisations, Multidisciplinary approaches to business networks and knowledge-based interactions.	57	19
Technologies for Interoperability in Networked Organisations and Business Process Integration Automated workflow web-services operating across heterogeneous environments, Planning, control, co-ordination and performance management in collaborative business networks, Enterprise Interoperability, Technologies for negotiation, contracting and management of resources.	58	22
Integrated product design, development and engineering Interoperable co-design in business networks and Product-service integration, Virtual engineering of Extended Products, Multi-sensory and multi-modal, adaptive interface technologies.	33	18
Mobile e-Business Services and Applications Generic enabling technologies for mobile e-services and mobile e-security, Mobile e-business applications and mobile e-service environments, Location-based mobile information services, Mobile enterprise & supply-chain management/logistics applications and Mobile e-service applications in specific economic sectors, Mobile users and Socio-economic or regional development aspects.	54	12
Supply Chain Management and Digital Markets Optimisation of supply chains, Reorganising a supply chain networks around electronic marketplaces, eCommerce related services.	65	22
Technologies for Organisational Knowledge Management Next-generation co-operative, contextual and distributed KM technologies, Knowledge-based business processes, Virtual interaction environments, Knowing for Innovation.	61	21
Scalable and adaptive technologies for business ecosystems in the local eEconomy Adaptive, networked environments fostering rapid expansion of ICT use in SMEs, Scalable and interoperable technologies for SMEs, Competitiveness of Europe's local areas, Transfer of eBusiness knowledge through support of ICT skills, Technologies for the sustainable development of rural areas.	60	25
Integration of sustainable development in business and work Intra- and inter-process optimisation through integration of sustainable development parameters into established enterprises, ICT systems of strategic enterprise planning and execution, Strategies to develop sustainable IST products, services and applications, Sustainable development in the knowledge economy.	18	11
eWorking and New Workplace Designs Novel workplace designs and solutions supporting mobility, resource efficiency and networked business, Collaborative engineering and virtual reality in the workspace, Emerging working environments.	34	21
Advanced technologies and infrastructures for access to learning Personalised access to learning content over broadband network and GRID, Mobile learning, Learning appliances, Avatar and Intelligent Agents, Virtual Reality and Mixed-augmented reality, simulators, interfaces, Intelligent ambient learning environments.	33	17
Transfer, sharing and management of knowledge for learning Building and sharing competencies for the knowledge society, e-learning for social inclusion; e-learning across the extended value chain of e-business. Integration of Learning Management System and ERP, Learner modelling, Metadata for Learning Objects, Virtual sharing knowledge spaces.	28	12
Learning Content Management New forms of learning content modelling, authoring and distribution, Standards, Learning content management systems, Certification. Novel applications for creating and delivering e-learning content in different contexts (schools, universities, at work and for lifelong learning).	27	15

Virtual learning communities Learning Regions, Social Learning, Collaborative knowledge producing, Communities of practices, Virtual campuses, Interconnections between technological, pedagogical, social and organisational aspects.	30	17
AmI architectures, standards and systems for pan-European government services Identification of pan-European government e-services including the definition of open e-government architectures based on European standards/national initiatives, Implementation of infrastructure and validation of basic services, Multi-application smart cards, Expert systems for e-Government.	23	7
Piloting, monitoring and evaluation of e-government projects Tools, methods, knowledge and change management practices for governments and designed to facilitate re-use and benchmarking of e-government best practices, Backend integration platforms for legacy applications of European public administrations, Test-bed environments for the validation of technology transfer.	4	2
Systems and toolkits for e-democracy and e-governance Small, secure, open, interoperable, standards and easily customisable plug-and-play components, Evolutionary community/constituency building, Internet voting systems (mobile and fixed). E-voting, e-polling, multimedia environment for Parliamentarians, Co-operative work environments (local, national and European level).	11	4
Socio-economic research and development in e-Government Research methods from political science, social science and information science for the understanding and modelling of democratic and governance processes, Evaluation model supporting e-government implementation in key functional areas and enabling to measure progress against excellence.	0	3

Analysis of Constituency

For the **"WBC" area** the number of envisaged participants is around **10.000**. The trend estimated is based on a subset of the analysed EoIs is (the statistical figures are not based on precise statistical analysis and should therefore be regarded as estimations):

Large Industry	SMEs	University	Research Institution	Other (Technology Transfer Organisations, Networks, Chambers, etc.)	NAS
16%	21%	34%	14%	15%	8%

Most EoIs in the "WBC" priority came from the existing constituency with a significant increase in participation from large companies. The shift from short 'time-to-market' RTD projects to longer-term/more risky RTD projects seems to attract large (ICT) companies to the 6th Framework Programme. However the SME constituency is still there. NAS participation has increased (particularly in e-Government with about 20% of the participants from NAS).

Analysis of Instruments

There are some 'innovative consortia' submitting sound, rather mature and promising proposals (IPs and NoE) focussing on a common "programme" vision and clear strategic objective. These proposals show the necessary ambition and critical mass as well as a sound management and scientific project approach, holistically integrating the different types of actions. But even this group of promising proposals misses the link with member states activities and other funding bodies. The promising NoEs do not convincingly show how the Joint Programme of Activities lead to a lasting Common Programme of RTD in the field. Many NoE proposal include only universities or research centres.

Many of the proposers still had difficulties in perceiving the differences between IP/NoE and the traditional FP5 projects. For some proposers, an IP is a collection of 'traditional' projects or the combination of R&D projects and accompanying measures.

Conclusions

Good coverage of research priorities in compliance with the outcomes of FP6 workshops, IRG groups, ISTAG, EICTA etc. Some very good EoIs with the right vision, ambition and participation. High potential for long-term, high-impact research.	Many good ideas not yet in the format of new instruments. Some "free electrons". Many EoIs characterised by an incremental approach, too narrow focus on just one part of the IP/NoE lifecycle/layer. No links to national programmes (ERA concept for NoEs).

The analysis of the submitted EoIs shows a strong interest in the area of "Work and Business Challenges". The number of Expressions submitted and the quality of many of them show the interest of the constituency to participate in the 6th Framework Programme (FP6) under the new instruments. However there is still a need to explain better the new instruments, since part of the constituency is still thinking in FP5 terms. In the area of "Work and Business Challenges" some research topics are ready for IPs and NoEs. The analysis of the EoIs in combination with the Roadmap and Cluster Projects can be used to reinforce the constituency in terms of critical mass and ambition. Other topics may benefit from further consolidation of constituencies in the first calls.

* as of 11. September 2002

** It should be noted that a set of domain-specific applications, tools and services have been proposed, e.g. Textile/Clothing, Agri-Food, Construction, Maritime etc. These approaches are not described in detail as they are sector-specific particularities of the following technologies, applications, theories etc.

4. COMPLEX PROBLEM SOLVING AND GRIDS

Reference text from the Specific Programme

Complex problem solving in science, engineering, businesses and for society: The objective is to develop technologies for harnessing computing and storage resources which are distributed in geographically dispersed locations, and for making them accessible, in a seamless way, for complex problem solving in science, industry, business and society. Application fields include environment, energy, health, transport, industrial engineering, finance and new media.

Research will focus on new computational models, including computing and information GRIDs, peer-to-peer technologies and the associated middleware to make use of large scale highly distributed computing and storage resources and to develop scalable, dependable and secure platforms. It will include novel collaborative tools and programming methods supporting interoperability of applications and new generations of simulation, visualisation and datamining tools.

General Statistics

Category	Subcategory	Type			
		IPs	NoEs	Old instrum.	undefined
Development/demonstration of generic Grid/P2P environments/platforms	1	7	3		
Building/demonstration of grid-based supercomputing facilities	2	2	0		
Development/demonstration of Grid/P2P environments specialised for groups of application fields including customisation of applications (primary innovation on integration of relevant components to constitute the customised environment)	3	9	9		
Research on individual Grid/P2P components and paradigms	4	9	2		
Development of Applications using Grid/P2P technologies (primary innovation on application)	5	5	3		
Provision of research infrastructures and testbeds	6	2	0		
Grid/P2P Dissemination/awareness/concertation	7			2	
Not fitting the area	8a Complexity Research	6	9		
	8b Solving of general complex Problems	2	7		1
	8c Others	2	7	1	1
Total - 89		**44**	**40**	**3**	**2**

Analysis of Research Priority

The 89 EoIs which have been received (6th September 2002) or are relevant to the area as specified in the Specific Programme are classified as follows:

1. **Development/demonstration of generic Grid/P2P environments/platforms**
   10 EoIs (7 IPs and 3 NoEs) demonstrate a strong interest in the development of generic Grid or P2P environments or platforms. Being medium term, many proposals lack a strong vision and address many individual aspects and components and their integration into existing or evolving environments rather than contributing to a possible long term vision of developing an innovative next generation Grid environment (eventually leading to a "semantic grid"). By merging groups of proposals redundancies could be reduced and synergies exploited. Many EoIs could profit from increased industrial user participation.

2. **Building/demonstration of grid-based supercomputing facilities**
   Two EoIs for IPs suggest building large supercomputing facilities by networking existing supercomputer infrastructures in a Grid-like environment. Overlap potentially suggests joining forces and avoiding redundancies. The level of innovation on top of existing US environments (TERAGRID, Distributed Terascale Facility) incorporating new developments of components is not sufficiently worked out.

3. **Development/demonstration of Grid/P2P environments specialised for groups of application fields including customisation of applications (primary innovation on integration of relevant components to constitute the customised environment)**
   18 EoIs show a strong interest in Grid-like environments for many application fields going beyond the traditional field of science. Application areas considering the use of Grid-like technologies include automotive engineering, chemistry, biology, e-health, e-government, e-learning, e-business, dynamic virtual organisations, environment, traffic, etc. Rather than focusing directly on the application area, many of these EoIs focus on the development of enabling application technologies for the solution of complex problems in domains requiring a grid-based approach, including next generation tools and environments for modelling, simulation, data mining, visualisation, process control, remote operation, collaborative working in dynamic virtual organisations, etc. Only a small number of EoIs demonstrate a clear understanding of the low maturity of Grid technologies being in their pioneering phase and still requiring a lot of development, integration and customisation of Grid components and applications. Many other EoIs take a more naive and unrealistic view based on the assumption that Grid technologies are mature and easily applicable solving automatically existing problems and reducing the work to be done to primarily porting the applications to existing environments. Many of these EoIs lack sufficient expertise in computing and in particular Grid technologies. As a conclusion, it is not clear why different applications require their individual customised Grid environment. It may be more appropriate to establish a smaller number of Grid environments, each suitable for a larger number of applications with similar properties. For example, several EoIs include significant research on intelligent data mining technologies including semantics-based cognitive methods. Whereas the

stakeholders involved are different and would normally not liaise with each other, the requirements for the data mining tools for Grid-like distributed resources are similar. A joint approach sharing at least the lower levels of the Grid-environment and the datamining tools would be appropriate and cost-effective. This approach would require additional preparatory work in aggregating EoIs.

4. **Research on individual Grid/P2P components and paradigms**
   11 EoIs suggest research on different essential components of future Grids, which are currently not satisfactorily addressed. These include access and security. In addition, research is suggested on new paradigms such as agent technologies applied to the Grid. Most EoIs would profit from being part of a larger IP or NoE in category 1 rather than being stand-alone.

5. **Development of Applications using Grid/P2P technologies (primary innovation on application)**
   8 EoIs suggest application development based on the Grid. All innovation however is related to the application either not considering or not being aware of the maturity of Grid technologies. As they are presented, these EoIs are only marginally within the scope of the area. If refocused, some of them would potentially fit to category 3.

6. **Provision of research infrastructures and testbeds**
   1 IP proposes the extension of GEANT (Terabit Research and Education Network in Europe). 1 EoI suggests the extension of the GEANT infrastructure to South Eastern Europe. As infrastructure provision, this is not considered being within the scope of the area.

7. **Grid/P2P Dissemination/awareness/concertation**
   Two EoIs suggest NoEs for bringing together the community currently involved in Grid research for exchange of experiences and dissemination. The proposed "networking" is considered important, but could not be implemented by any of the new instruments. Instead, as in the predecessor project, the traditional instrument of an accompanying measure or thematic network should be used. Alternatively, the work proposed could become part of an IP under group 1.

8. **EoIs not fitting the area**
   36 EoIs are considered being out of scope of the area. In most cases this results from misinterpretation of the reference text: 15 EoIs address complexity research, 10 EoIs address the solution of general complex problems in engineering outside the scope of the domain. 11 EoIs were wrongly assigned to the area.

In conclusion, in order to better prepare and achieve the most possible impact of a large initiative in the area, more preparatory work and networking of the stakeholders on different levels of the value chain is necessary. It is therefore considered as appropriate to not call for IPs or NoEs in the area in the first Call under WP 2003/2004, but rather support roadmapping, networking, and constituency building via the traditional instruments or without funding , in order to be ready for Calls for projects under the new instruments in the second Call or the next work programme.

Priorities should be formed based on categories 1-3, eventually even considering merging categories 1 and 2. In order to be ready for larger projects in category 1, a vision for a next generation semantic Grid would need to be developed incorporating many of the ideas suggested in the current EoIs. In category 3 a small number of infrastructures should be considered for groups of applications with similar properties forming one IP structured like a cluster. EoIs in category 4 could either be included as subprojects in EoIs of categories 1 and 2, or could form traditional RTD projects. EoIs under categories 5 could either reconsider their content eventually fitting in category 3, or consider a more application-oriented priority. EoIs under category 8b should consider another priority of the programme more relevant to the respective application field, if at all identifiable or available. EoIs under category 8c do not fit the domain and should be transferred. EoIs under category 8a are on complexity research and could be transferred to FET initiatives.

Analysis of Constituency

In many IPs, one or more relevant levels of stakeholders are not included, e.g. industrial users. In many EoIs for NoEs, the link of the academic partners constituting the NoE to the industrial needs is unsatisfactorily addressed. Many EoIs lack involvement from one or more of the disciplines relevant to the research proposed (multi-disciplinarity). In order to better prepare for projects under the new instruments, the following preparatory actions are necessary:

- Aggregating overlapping consortia;
- Involving missing but relevant levels of stakeholders (industrial users, technology providers, system integrators, …);
- Enhancing multi-disciplinarity as appropriate.

Analysis of Instruments

General conclusion is that proposers have limited understanding of the spirit behind the new instruments. In particular, many EoIs lack a strong vision as it would be expected from IPs and NoEs. In order to better prepare for projects under the new instruments, preparatory work either with or without funding is necessary:

- Developing a broader vision, deriving research roadmaps for this vision, and merging of current EoIs under this vision;
- Clustering of EoIs for applications using Grid-like technologies with similar requirements into a structured IP sharing GRID infrastructures and tools.

5. COMMUNICATION AND NETWORK TECHNOLOGIES

Reference text from the Specific Programme

Communication and network technologies: The objective is to develop the new generations of mobile and wireless systems and networks that allow optimal service connection anywhere as well as all-optical networks to increase network transparency and capacity, solutions to improve network interoperation and adaptability, and technologies for personalised access to networked audio-visual systems.

Work on terrestrial and satellite [1] based, mobile and wireless systems and networks beyond 3G will focus on the next generation of technologies, ensuring cooperation and seamless inter-working at service and control planes of multiple wireless technologies over a common IP (Internet Protocol) platform as well as novel spectral efficient protocols, tools and technologies, to build wireless re-configurable IP enabled devices, systems and networks.

Research in all optical networks will focus on the management of optical wavelength channels enabling flexibility and speed in service deployment and provisioning and solutions for fibre to the LAN. Research on interoperable network solutions, including end-to-end network management will support generic services provision and interworking, and interoperation between heterogeneous networks and platforms. It will include programmable networks to provide adaptive and real-time allocation of network resources and enhanced service management capabilities by customers.

Research will also address the enabling technologies for personalised access to networked audio-visual systems and applications as well as cross-media service platforms and networks, trusted digital TV architectures and appliances able to process, encode, store, sense and display hybrid 3D multimedia signals and objects.

General Statistics and Methodology

The sets of EoI's analysed for the communication and Audio Visual technologies area are:

- The 462 EoI's submitted under the identifier 1.1.2.ii;
- The 839 EoI's submitted under the generic IST identifier.

Within these two sets, EoI's have been considered relevant to the communication and A/V area when the proposed work was clearly driven by innovation for communication & A/V systems and services. EoI's having their explicit focus on Software technologies applicable in a generic context have not been analysed under this area. EoI's with their main innovation focused on a specific application domain, rather than on the generic communication and service infrastructure, have also been transferred to other areas of the program.

With this approach, 261 EoI's submitted under 1.1.2.ii (57%) and 121 EoI's submitted under 1.1.2 (15%) have been analysed, i.e 382 EoI's in total relevant to the communication and networked Audio Visual technologies.

Analysis of Research Priority

Main Topics addressed

A very broad range of topics could be identified in the analysed EoI's. Similarly, diverse approaches could be identified, with EoI's focusing on very specific technological issues, such as components for RF or optical systems, whilst other took a more generic system approach, with dedicated technology treated as an activity within the proposed work. Clearly, those EoI's starting from a system approach were found to be in principle closer to the concept of Integrated Projects, whilst dedicated technological work was found more appropriately covered in a number of NoE's (e.g NoE's on antennas, propagation, optical technologies…).

Although it is fairly difficult to classify topics which are somewhat interwoven, it was found that the vast majority of the analysed EoI's could fit under either of the following categories:

i) Communication oriented EoI's

EoI's on optical networks and technologies: all optical networks, with optical routing and optimised/reconfigurable bandwidth allocation over multiple domains remain a key driver for these technologies. A significant number of EoI's are also addressing the overall integration of IP and optical layers for optimised control of the network resources, in line with the GMPLS concepts or ITU ASON/ATON versions. A couple of EoI's are also addressing combined wireless (Fixed Wireless access) and optical access, as an extension to the Radio over fibre concept. A number of more technology oriented EoI's can also be found in this category, such as new technologies of fibres (plastic, metalised), single photon sources…

Estimated time frame to deployment: 2006 onwards

EoI's on wireless networks and services: evolution of systems beyond 3G networks and service emerges as a key driver for the wireless EoI's. A strong focus is placed on ad hoc, PAN, BAN , reconfigurable networks, whilst more stable technologies (DVB, UMTS, W-LANs) are mainly addressed through interoperability, with seamless roaming and handover of services. Novel techniques such as UWB are also included in the overall system picture, which includes service adaptability to the underlying bandwidth limited radio layer. This is complemented with EoI's on the satellite component, bringing notably an overall multicast overlay network.

Not directly related to the 'beyond 3G' problematic, a number of 'wireless' EoI's are also addressing the problematic of satellite broadband access, in line with the mainstream strategies of related manufacturers and operators.

Estimated time frame to deployment: 2008 onwards

EoI's on Networking and network/service management: The evolution towards (wired or wireless) all IP(v6) networks represents the common feature of this set of EoI's. End to end QoS provision across a variety of heterogeneous networks (wired

and wireless) and across a multiplicity of service provider domains is one of the dominant issues. Emphasis is placed on the FCAPS [2] 'operators services', as these issues are evolving in an IP based world. User services are on the other hand addressed through issues such as programmable networks and service architectures allowing for dynamic content adaptation on top of the IP layer.

Estimated time frame to deployment: 2006-2008 onwards, depending on access technology

Other EoI's: a limited number of EoI's proposed network related work targeting some specific classes of usage, such as education or e_commerce.

The overall coverage of those EoI's analysed under the communication topic is illustrated on figure 1. Each bubble is supported by a set of corresponding EoI''.

ii) Audio Visual oriented EoI's

EoI's on End to End Networked Audio-visual Systems and Applications (ETE): these EoI's relate to Standardised appliances, interfaces, storage and buffers (DVB, MPEG, IETF, TV-Anytime etc.) for end to end delivery of audio-visual services accessing open networked consumer platforms and applications. They also include trusted free choice environments for more intuitive access and interaction with advanced content and services. Work is focused on personalised, location and delivery independent services supported by intelligent audio-visual customer platforms and portals.

EoI's on Audio-visual Home Network Architectures (AVHNA): these EoI's do address delivery to home environments of audio-visual rich media Adaptive services with Quality of Services, audio-visual internetworking, interactive AV service management.

EoI's on Cross Media Services on Extended Home Platforms (CMS): these EoI's do address extended home AV platforms for private and/or professional applications. The target is on low-cost and user-friendly home audiovisual platforms that are reconfigurable to the user requirements. It includes user and provider friendly audio-visual portals to storage, management and repackaging appliances, including extended home distribution (TV-Anytime, Home to Home AV architectures), as well as advanced retrieval methods to support access to stored audio-visual media anywhere in the home and car environment from any device.

EoI's on Technologies for Acquiring, Processing, Encoding, Storing and Rendering Hybrid 3D Signals and Objects (APES)): these EoI's do address new imaging frontiers and audio-visual representation, coding and delivery of 2D and 3D interactive immersive environments and experience portals suitable for both distribution and peer-to-peer transparent communication. They also includes higher spatial, colorimetric and temporal quality levels suitable for applications such as electronic cinema.

EoI's on Displays, sensors and modules as components to support audio-visual terminals (DSM)[3] : these EoI's do address better usability of portable terminals, through higher visual quality and lower power displays. They also relate to large area stationary displays where the issues is on new approaches with much lower manufacturing cost potential than today's technologies competing for the consumer market, high resolution and 3D for immersive applications including e-cinema, and display architectures and addressing electronics best suited to visual data feed.

Estimated time frame to deployment of these A/V technologies: 2006-2008

The overall coverage of those EoI's analysed under the Audio Visual topic is further illustrated on figure 2 (non yellow bubbles). Each bubble is supported by a set of corresponding EoI's.

Remarks on topics addressed under the analysed EoI's

In general, these topics are fully in line with reports previously made available through various industry consultation mechanisms [4] The addressed topics are clearly related to the following industrial and societal challenges :

- Increased mobility through evolution of systems beyond 3G, as currently discussed at world-wide level, and in line with corresponding RTD issues in the US and in Japan;
- Provision of affordable, generalised broadband access, as targeted under the e_europe 2005 objectives;
- Pervasive introduction of full networking capability based on IPv6 and associated services, as recommended by a recent Communication of the Commission;
- Seamless service roaming and access, in support of increased competition and consumer choice ('The network does not own the customer ; the customer owns the network');
- Availability and portability of rich AV services through a multiplicity of platforms, thus maximising potential impacts and audiences;
- Emergence of new mass markets and of new business sectors with products of high potential added value, such as High Definition Home Cinema over Broadband Home Platforms or Immersive 3D TV.

Only 3% of the analysed EoI's were found not to be in line with available reports. Such EoI's covered notably subjects such as communication technologies related to disaster relief and emergency networks; a couple of NoE's are proposed e.g to federate radio astronomer community and their measurements in the frequency range up to 100GHz. In the former case, it was found that the subject would be better addressed in other areas of the programme. Issues related to radio astronomy systems, in spite of the very extensive proposal, were found to be very loosely related to communication challenges.

Access technologies such as HAPS, xMDS, DSL, HFC, are little addressed in the communication EoI's. On the other hand, a number of EoI emerged dealing with PLC networks, strongly supported by large numbers of power network operators, which may form a basis for IP's in this area.

More generally, the general thrust in the field of communication and audio visual systems is clearly to research and develop infrastructures that are generic, open and versatile, such that any application can be developed on top of these networks. This is clearly evidenced by the fact that less than 5% of the analysed EoI' were related to a specific application. Further details on EoI breakdown per topic can be found below.

EoI	WIRELESS	NETWORKING	OPTICAL	AUDIO VISUAL	TOTAL
Total	35%	27%	20%	18%	

IP	*82%*	*87%*	*73%*	*83%*	*81%*
NoE	18%	13%	27%	17%	19%

Constituency

Constituency information exhibit very large variations: from EoI's submitted by a single partner or by a very limited number of companies, up to EoI's submitted by very large number of partners. Main conclusions are as follows:

- all major manufacturers are there, on every topic (wired, wireless, audio visual, services/network management);
- Whilst a certain decline in operators participation could be noted when moving from FP4 to FP5, the analysed EoI' show a renewed interest from network operators .
- The declared and committed participation of SME's is not very high, in the order of 20% of the EoI's. Similarly, the declared and committed participation of NAS is not very high, also in the order of 20%.
- Third countries are present in about 15% of the analysed EoI's. Participation relates primarily to Russia (in the field of satcoms), Japan, in the field of wireless mobile technologies, US and Canada, in the fields of wireless and high speed networking.
- On the communication side, a low participation of Service providers is noted, except those that may be anticipated as associated to large com operators. This is not the case of the AV part, which has significant participation from service providers, and also some "Governments" supporting new AV platforms for interactive services)
- The participation of content providers (e.g media groups, …), is invisible but this may be because they appear in application oriented projects ;
- Users are diversely represented (difference if a user is a network oerator or an 'end user')
- Very strong presence of the academic world, where most of the relevant European Universities and research /education institutions are represented. This trend is naturally very apparent in the Network of excellence EoI's;
- Research centers are also very strongly represented in the various EoI's.
- The table below details the observed distribution of partners. The most representative IP's and NoE's are to be found in categories 'beyond ten partners'. A number of EoI's are not enough detailed and an assessment of the committed entities can not be made.

IP's/NoE's	WIRELESS	NETWORKING	OPTICAL	AUDIO VISUAL	TOTAL
< 10 partners	47%	46%	65%	43%	49%
Between 10 and 50 partners	43%	43%	27%	43%	40%
> 50 Partners	4%	7%	4%	2%	5%

Instruments

Regarding the use of the new instruments and of their understanding by the research community, the following remarks/conclusions can e drawn:

- About 80% of the analysed EoI's were submitted as IP proposals, the remaining 20% being submitted as NoE's;
- A number of proposals were submitted as initiatives federating a number of IP's (meta IP's), or as NoE built on top of a set of IP's. In a number of cases, it is possible to assess the commitment of the federated IP's. In some cases, it is not possible to judge whether the federated IP's are in agreement with this approach;
- A large number of submitted EoI's are very similar to projects as they exist today. Out of the IP submissions, only about 20% would qualify as a real IP, in terms of representative constituency, critical mass, ambition and challenges addressed. The remaining set would correspond either to a typical FP5 project (about 50%) or to a subtask in an IP (when dealing with a particular technological challenge clearly related to a larger system work); additional details per technology area can be found in the table below.

EoI	WIRELESS	NETWORKING	OPTICAL	AUDIO VISUAL	TOTAL
Total	35%	27%	20%	18%	
IP	*82%*	*87%*	*73%*	*83%*	*81%*
NoE	18%	13%	27%	17%	19%
True IP	23%	30%	15%	17%	23%
True Noe	25%	22%	15%	50%	26%

- Similarly, the proportion of real NoE's is not so high: about 25% of the submitted NoE's would actually be close to a true NoE;
- It can be noted that the academic community has apparently prepared the EoI exercise in a very thorough manner, with credible NoE's from content viewpoint;
- Regarding NoE's it can be noted that the meaning of 'integration' is however not always understood. NoE's are in general quite detailed on the topics, but the level of integration is poorly described. What facilities (computing capacity, test and measurement facilities..) will be actually integrated is generally overlooked. The long term sustainability of the NoE is also poorly addressed in general;
- The main integration factor addressed in IP,s is primarily the vertical integration. Other integration parameters (training, mobility of researchers..) are generally overlooked;
- Regarding IP's, it can be noted that a number of topics are irrelevant. IP proposals to address socio economic issues in relation to telecom evolution or regulatory issues are irrelevant, as it is considered difficult to provide multi million financing to sheer paper studies. This would better fit as a dedicated package under a technology oriented IP;

- Regarding NoE's, the fear of a 'research divide' (academics in NoE's, industry in IP's) is not apparent. Most of the NoE proposal include a decent level of industrial participation, except in very specific cases (e.g NoE on propagation or on Radio astronomy);
- A number of very consistent NoE's are building up on COST actions; these are in general very well structured;
- Very consistent constellations of IP/NoE's can be identified: e.g wireless IP's complemented with NoE's on specific technologies such as antennas or ad-hoc; optical IP's complemented with NoE's dealing with more fundamental aspects of optical research..
- Regarding budgets, It has to be noted that a large number of EoI's did not specify the requested financial resources. For those who did, the table below provide a rough distribution of budgetary requests. (Nb: NoE's to be found under the <10 ME category)

IP's/NoE's	WIRELESS	NETWORKING	OPTICAL	AUDIO VISUAL	TOTAL
unspecified	76%	70%	75%	52%	70%
< 10 M	15%	10%	9%	55%	27%
Between 10 and 50 MEuro	60%	60%	55%	45%	52%
> 50 MEuro	15%	30%	36%	0	21%

Readiness

At this stage, it can be stated that the telecom/Audio Visual constituency is fully ready to submit relevant IP and NoE proposals in the field. Even with a large number of weak EoI's, each of the areas of figure 1 is covered supported by at least one strong IP proposal. From the analysis, about 20 'federating areas' can be identified. These federating areas (at the technological level) can clearly be associated to structuring objectives (at the more global level) such as broadband access or enhanced mobility towards 4G. Mature associated NoE's can also be identified.

Other Funding Resources

None of the analysed EoI did report on their intention to secure finances from other sources such as Eureka or else. Only the satellite proposals, are clear candidates to be complemented under the ESA framework (as is already the case today), considering that they represent the 'user dimension' of broadband and mobile technological work supported by this Agency.

A number of IP proposals, around 8, are targetting very large fundings, in the order of 100 MEUR or above. Funding of these from the IST programme alone is clearly a problem. Modalities for including also funding from National programs, or elsewhere, may need to be urgently explored. Another possibility would be to encourage these very large endeavours to consider themselves as a collection of smaller IP's, more loosely related through other instruments (e.g co-ordinated actions).

[1]. The activity on satellite communications is done in coordination with the activities in priority 4 "Aeronautics and space".
[2]. Fault, Control, Admission, Performance, Security
[3]. See also report on subject 1.1.2iii.
[4]. Consultation meetings, EICTA reports, WWRF reports, ITEA report; ASMS reports; ISTAG reports; IRG Workshops and reports

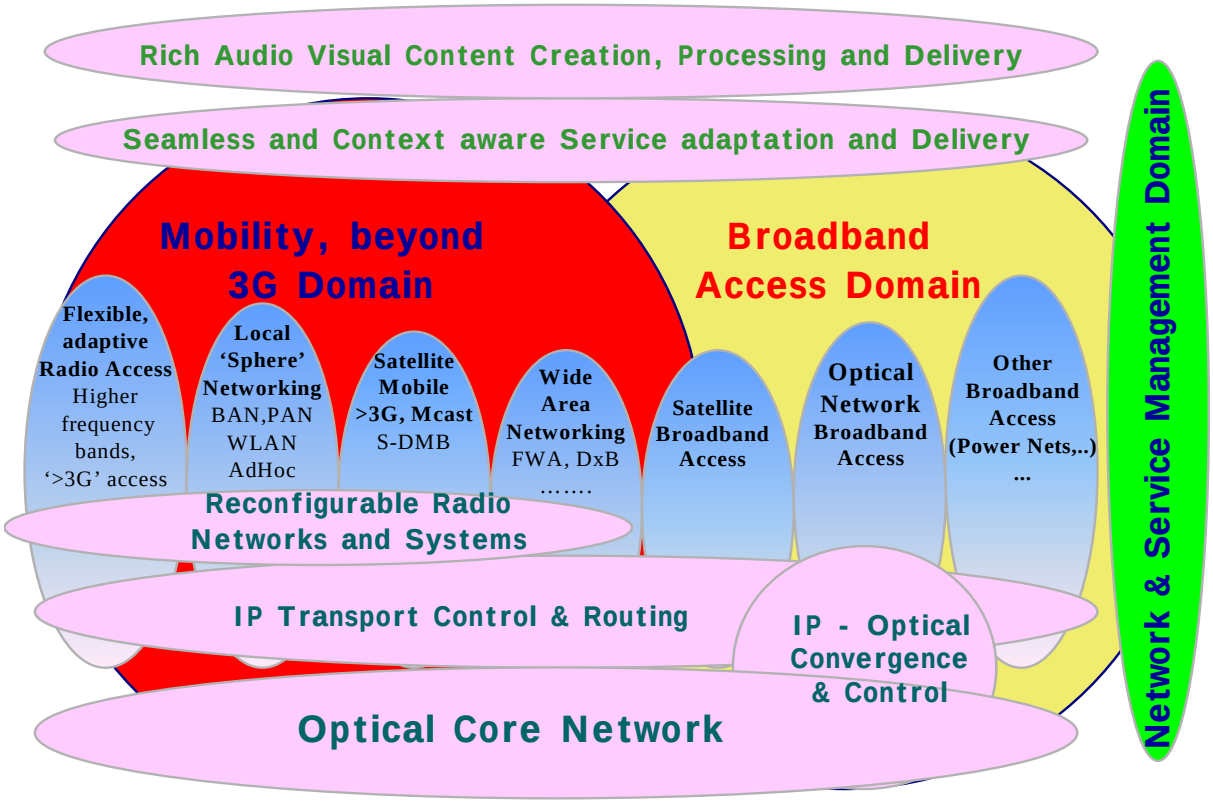


Figure 1

Networked AV Systems and Applications

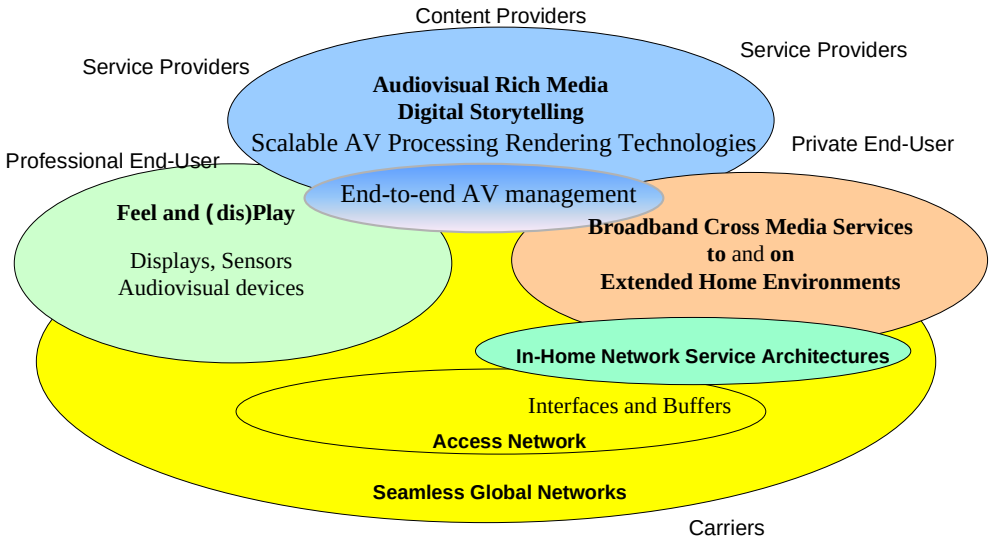


Figure 2

6. SOFTWARE TECHNOLOGIES, EMBEDDED SYSTEMS AND DISTRIBUTED SYSTEMS

Reference text from the Specific Programme

Software technologies, embedded systems and distributed systems: The objective is to develop new software technologies, multifunctional service creation environments as well as tools for the control of complex distributed systems for the realisation of an ambient intelligence landscape and for coping with the expected growth and spread of applications and services.

Research will focus on new technologies for software and systems, that address composability, scalability, reliability and robustness as well as autonomous self-adaptation. It will include middleware for the management, control and use of fully distributed resources. Work on multifunctional service creation environments and new component frameworks will aim at the development of service functionality, including meta-information, semantics and taxonomy of the building blocks.

New strategies, algorithms, and tools for systematic and accurate design, prototyping and control of complex distributed systems will be addressed. Work will include networked embedded systems, distributed sensing, computing, storage resources and related intercommunication. Dynamic resources allocation will be a key feature as well as cognitive techniques for generic object and events recognition.

General Statistics

This report is the analysis of 337 EoI. It takes into account 254 submissions within the sub thematic priority 1.1.2ii "Communications, computing and software technologies" and 83 submissions which did not specify any sub thematic priority. Out of the 254 submissions to the sub thematic priority 1.1.2ii 76 EoI were deemed out of scope and were transferred to a more appropriate sub thematic priority.

For their analysis the EoI were sorted as follows: 52 EoI on Productivity and Quality in Software Development, 14 on Information Management and Database Technologies, 58 EoI on Embedded Systems, 38 EoI on Control Systems, 52 EoI on Middleware Technologies and 47 on Service Creation and Access.

Analysis of Research Priority

WHAT in Productivity and Quality in Software Development (52 EoI)

From the 52 EoI with a common interest for Software development, there are 27 which are complete, correspond with the description given in the specific programme text and have potential for becoming credible IPs or NoE. The other 25 EoI are disregarded.

The 27 most relevant can be divided in 3 groups :

1.- A group of 9 EoI addressing Software architecture, product lines, components. Domain covered include: Model Driven Architecture, COTS,

component-based design techniques for non-functional aspects and frameworks for integrating large industrial and business software systems.

2.- A group of 10 EoI addressing Support for specific aspects of development. These propose to research and develop technologies centred on key phases of development including requirements engineering, aspect oriented programming, agile methods, verification, testing and certification

3.- A group of 8 EoI addressing Integrated Development environments. These are integrating support for different aspects of the development lifecycle, with focus on specific aspects like collaborative and distributed development, or specialised for different domains like Web engineering, internetworked applications, end-user development, domain knowledge capture and reuse.

Many EoI's in groups 1 and 2 above are also concerned with tools and development environments for supporting the specific techniques that they are addressing.

WHAT in Information management and database technologies (14 EoI)

From the 14 EoI with a common interest for Information management and database technologies, there are 7 which are complete, correspond with the description given in the specific programme text and have potential for becoming credible IPs or NoE. The other 7 EoI are disregarded.
The 7 most relevant can be divided in 2 groups :

1.- A group of 3 EoI addressing data management in ubiquitous computing, that is, down scaling the current data Management infrastructure to the level of PDAs and further down to embedded processors in any possible Gizmo.

2.- The other 4 each one addresses a different domain. These are: data management on P2P computing, portable storage devices, Web data-management and Information fusion.

WHAT in Embedded Systems (58 EoI)

From the 58 EoI with a common interest for Embedded Systems, there are 19 which are complete, correspond with the description given in the specific programme text and have potential for becoming credible IPs, NoE. The other 39 EoI are disregarded.
The 19 most relevant can be divided in 3 groups :

1. A group of 15 EoI addressing Hardware-Software co-design including the system design problems specific to HRT (Hard Real Time) system. They address methodologies, tools, development environments and certification of components.

2.- A group of 2 EoI addressing Safety Critical applications.

3.- A group of 2 EoI addressing Soft-Real-Time systems.

The networked embedded systems, including ad-hoc computing, are analysed under the "middleware technologies" heading.
It can be therefore concluded that industry and academic efforts are concentrated in the first domain: Hardware-Software co-design.
This domain is addressing concepts, methodologies and tools for the design and implementation of HRT (Hard Real Time) Systems with emphasis on correct handling of complex real-time constraints. New challenges include unification of computational models and composition methods, and hardware-software holistic design aiming at hard and soft real time addressing event and time constraints. Certification of safety critical systems is a major challenge. This calls for the use of

rigorous techniques and integrated validation tools and for the design of ultra-stable embedded systems.

WHAT in Control Systems (38 EoI)

From the 38 EoI with a common interest for Control Systems, there are 17 which are complete, correspond with the description given in the specific programme text and have potential for becoming credible IPs or NoE. The other 21 EoI are disregarded.
The 17 most relevant can be divided in 3 groups :

1. A group of 14 EoI addressing Hybrid Control Systems, that is, distributed over networks, working in an uncertain environment, based on models and optimisation, composable architectures and adapting in dynamic environments.
2.- 1 EoI addressing Fault-tolerant controls
3.- 2 EoI addressing modelling and control of complex distributed systems.

It can be therefore concluded that both industry and academic efforts are concentrated in the first domain: Hybrid Systems.
Hybrid systems designate systems that explicitly and simultaneously include continuous and discrete-based phenomena or models (dynamics). The research objective is the advancement and consolidation recent developments in hybrid systems theory and to produce significantly rigorous but practical methods and algorithms for the decentralised control of large-scale systems which include non-linear processes with both constraints and switching modes. Hybrid systems will play a major role in mastering complexity and heterogeneity in an uncertain environment, especially true for control systems, where systems have to fulfil safety and performance critical requirements.

WHAT in Middleware Technologies (52 EoI)

From the 52 EoI with a common interest for middleware, there are 28 which are complete, correspond with the description given in the specific programme text and have potential for becoming credible IPs or NoE. The other 24 EoI are disregarded.
The 28 most relevant can be divided in 3 groups :

1. A group of 20 addressing the development of a middleware for the development of networked applications to be embedded in wireless devices (PDAs, mobile phones, etc.) focussing on context awareness. (This group is closely related to Networked Embedded Systems).
2.- A group of 5 addressing middleware for systems (PCs and up) based mainly on GRID, peer-to-peer computing and Agent technologies.
3.- 3 each one dealing with a specific domains: 1 addressing middleware for the development of distributed application to be embedded in consumer electronics devices (set-top boxes, etc.), 1 addressing “electronic dust” as addressed in the US research community and 1 EoI addressing middleware for the processing in real time of high volumes of data received at high data rates and which can’t be transferred to a permanent storage for subsequent slow analysis.

It can be therefore concluded that both industry and academic efforts are concentrated in the first domains: Middleware to be embedded in wireless devices.
The objective is to make design, programming, verification and maintenance of applications involving networked wireless systems as easy as for traditional distributed systems. This requires a distributed software layer “micro-middleware” to be embedded in all appliances which, (abstracting the complexity and heterogeneity

of the underlying network technologies, computer architectures, operating systems and programming languages), will make possible the emergence of an application programming community independent of network providers and hardware manufacturers.

Also important efforts are devoted in the second area, that is, middleware for large scale distributed, autonomous and adaptive systems. The objective is to improve maturity of systems, increase stability of tools and ensure scalability in order to make emerging paradigms (as Peer-to-Peer and GRID computing) to be used with quality standards required for commercial software development. Also research is need in new methods to describe, formalise and maintain this large scale distributed, autonomous and adaptive systems.

WHAT in Services creation and access (47 EoI analysed)

From the 47 EoI with a common interest for Services, there are 24 which are complete, correspond with the service-related description given in the specific programme text and have the potential to become credible IPs or NoE. The other 23 EoI are disregarded.

These 24 most relevant can be divided in 2 main groups:

1.- The first group of 8 EoI addresses technologies and engineering for context-aware services in the ambient intelligent landscape. Addressed issues include context aware, trusted and pervasive services, personalisation, wearable computing, ambient information spaces, personal area networks.

2.- The second group of 16 proposals can be categorised as creation and runtime environments for value added services. Proposed technologies and approaches to address this area include traditional telecom technologies as well as web-service, grid, ad-hoc computing, peer to peer technologies, fuzzy software agents and ambient middleware.

The areas are clearly related to each other and address important enablers of next generation services and ambient intelligence.

WHO in Productivity and Quality in Software Development

Group	Main partners involved
1	Many SMEs and large industries More than 30 research institutions
2	About 50 research institutions Many SMEs and large industries
3	About 20 research institutions Some industrial participation

A good mix of large companies, SME's, institutes and universities. Good users participation mainly from automotive, telecommunications and utilities.

WHO in Information management and database technologies

Group	Main partners involved
1	About 40 research institutions Many large industries including the relevant software companies and equipment providers
2	About 20 research institutions Many large industries including users form the automotive, media and space sectors.

WHO in Embedded Systems

Group	Main partners involved
1+2+3	About 100 research institutions A good collection of SMEs and large industries

A good mix of large companies, SME's, institutes and universities. Good user participation mainly from Automotive and Aeronautics.

WHO in Control Systems

Group	Main partners involved
1	About 60 European research institutions Many SMEs
2+3	Many universities and some large industries

A good mix of large companies, SME's, institutes and universities. Good users participation mainly from aerospace, automotive petro-chemical, banking and manufacturing.

WHO in Middleware Technologies

Group	Main partners involved
1	All relevant equipment providers, the main European telecom operators, the big Software Companies, about 70 Research Institutions. Users in automotive, space and media sectors. SMEs: about 30 different names
2	Big Software Companies, Users in space and research sectors SMEs: about 20 different names. About 100 relevant universities and research centres.
3	Bout 7 SMEs and equipment providers, a group of 30 relevant universities and users from the research sector.

A good mix of large companies, SME's, institutes and universities. Good users participation mainly from telecoms, aeronautics, automotive and media. Effects on e-work, e-learning and m-commerce are quoted but the EoI do not include any well known company in these domains.

WHO in Service creation and access

Group	Main partners involved
1	Research institutions: 55 relevant universities and research centers Industry, Software companies, SMEs, Telecom Operators: wide variety of European telcom operators
2	Research: More than 70 relevant relevant universities and research centers Industry, Software companies Telecom Operators

A good mix of large companies, SMEs, institutes and universities. In this area the industrial and software partners are very often themselves the users of the targeted results. Area 1 also includes end-user involvement. Low involvement of ISPs can be noted, which might be linked to the fact that their current business model is mainly based on providing access to functionality provided by others.

HOW - Instruments

Domains/Groups	1	2	3
Productivity and Quality in Software Development	7 IP – 2 NoE	4 IP – 6 NoE	4 IP – 4 NoE
Information management and database technologies	3 NoE	3 IP – 1 NoE	
Embedded Systems	10 IP – 5 NoE	1 IP – 1 NoE	1 IP – 1NoE
Control Systems	5 IP – 9 NoE	1 NoE	2 NoE
Middleware technologies	18 IP- 2 NoE	4 IP- 1NoE	3 IP
Services creation and access	7 IP - 1 NoE	13 IP - 3 NoE	

"Embedded Systems", "Middleware Technologies" and "Services" are focussing on IPs. This is not surprising because these are research domains which are industry oriented.

"Control Systems" focus is on NoEs. This confirms the more long term orientation of the research done in Europe in this domain.

"Software development" and "Information management" do not show a focus on any particular type of Instrument.

Other considerations

1.- In general the majority of the proposed EoI intent to integrate RTD with training, dissemination and networking. Take-up aspects are considered in a number of cases, most often as integrated activities, but in a couple of cases as stand alone EoI. For the NoEs aspects like the continuation of the collaboration after the end of the Commission contribution and the integration of infrastructures are not properly addressed. Additionally, some EoI look like a continuation of FP-5 projects or follow the model of an FP-5 project. Therefore, there is a need for further structuring the constituencies and for better communicating the different aspects behind the concept of both IP and NoE.

2.- The time horizon, when indicated, is around 4-5 years.

3.- For both, IPs and NoEs, the relation with national activities and funding bodies other than the European Commission is not explicit. Almost none of the entries do yet identify related national and/or other (e.g. EUREKA) projects. As a result, the structuring nature with the ERA dimension of the entries is at the moment difficult to judge. This aspect requires further attention from the proposers, the Member States and the Commission.

4. - For the majority of the EoI the proposed resources were not properly detailed and justified. However, many EoI proposes an incremental approach in the allocation of resources to a specific IP or NoE. This seems a very sensible approach forward.

5. Management was in general only addressed in very vague terms and mainly by using FP-5 management techniques. This is by far not enough and much more thinking has to go into this area, that is crucial for the success of these new and, from a management point of view, more complex instruments.

7. MICRO-, NANO- AND OPTO-ELECTRONICS

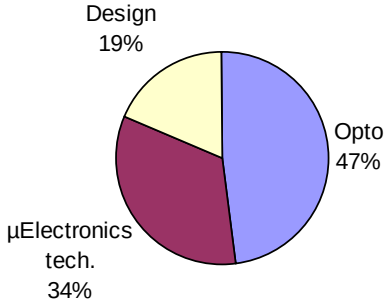
Reference text from the Specific Programme

Micro-, nano- and opto-electronics: The objective is to reduce the cost, increase the performance and improve reconfigurability, scalability, adaptability and self-adjusting capabilities of micro-, nano- and opto-electronic components and systems-on-a-chip. The environmental impact of IST systems will be taken into account.

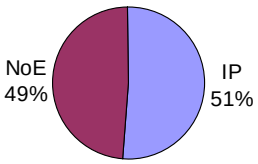
Research will focus on pushing the limits of CMOS process and equipment technologies and enhancing device functionality, performance and integration of functions. It will address alternative process technologies, device types, materials and architectures to meet demands of communication and computing. Particular emphasis will be put on RF, mixed-signal and low power design. Work on optical, opto-electronic, and photonic functional components, will address devices and systems for information processing, communication, switching, storage, sensing and imaging. Research on electronic nano-devices, as well as on molecular electronics devices and technologies, will target those that promise broad functionality and have integration- and mass fabrication potential.

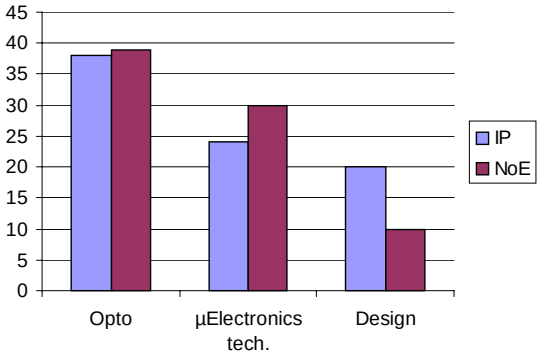
General Statistics

The total number of EoI's analysed is **161** composed of 129 out of 232 submitted in the area 1.1.2.iii "Components and Microsystems", and 32 from other areas such as 1.1.2.ii "Communication, computing and software technologies" and 1.1.2.i "Applied IST research", or containing unspecified areas. This input also contains the EoI's (~20) jointly addressing microsystems and component aspects.
The analysed EoI's could be grouped in 3 main areas – opto, microelectronics technology, and design (nano is contained in opto and microelectronics) - as follows:



In a few (6) cases, the EoI's are addressing 2 areas (e.g. nanomaterials for opto- and microelectronics, design and production of high-bandwidth devices). Those were filed in one of the three areas according to their main centre of gravity.
The distribution of the proposed instruments is as follows:





Analysis of Research Priority

WHAT IN OPTO?

Research topics: Research on optics/photonics components, devices and materials for a broad range of use has been proposed with the following industrial application sectors: a) telecommunications and infotainment, b) health care, life science and biophotonics, c) environment monitoring, security and lighting. The significant number of activities in applied material science reflects the need to re-think devices from material perspectives. Light sources also represent an important number of submissions, with a wide and sometimes multiple application context.
Needs/Problems addressed: In the telecommunications sector, the all-optical network is the main driver for the research. In the other emerging application domains, new perspectives are being opened by exploiting the expertise gained in telecoms. Diversification and pervasive use are the main stimuli for the opto area.
Industrial sectors: Telecommunications 55%, Environment/security/lighting 25%, Health/life science 20%
Impact expected: The opto industry will gradually mature as more integration takes place. Also their business opportunities will significantly grow as the technology expands into more application domains. With successful results, the research in this area is expected to establish a strong European expertise with significant, world-wide exploitation perspectives.

WHAT IN MICROELECTRONICS TECHNOLOGY?

Research topics: Four main topics for research are proposed: nano-CMOS, alternative nano-electronic devices, compound semiconductors and lithography. The work on nano-CMOS encompasses the complete range from material science, to device physics and modelling, and the complete food chain of semiconductor manufacturing

technologies. Alternative devices are being explored in fields such as superconducting or organic materials and their possible applications. Compound semiconductor devices and technologies are addressing the high frequency / high power requirements important for the ambient intelligence. Lithography includes several techniques such as EUV, maskless, e-beam, nano-imprint.
Needs/Problems addressed: Globally, the proposed work aims at overcoming the "red brick wall" from the microelectronics roadmap, i.e. the problems linked to the further shrinking of the feature sizes. This includes physical constraints, high frequency and low power requirements, but also exploring alternative and novel solutions for materials, device architectures and storage mechanisms.
Industrial sectors: Microelectronics technology food chain 100% (semiconductor industry, material and module suppliers, tool integrators and system houses)
Impact expected: The international technology roadmap for semiconductors imposes a continuous and heavy investment in research in order to be able to follow or even determine the pace of development. The longer term, world-wide strength and role of the European players in this field is dependent on the success of this research.

WHAT IN DESIGN?

Research topics: A main topic for research is system-level design, in particular for System-on-Chip (SoC). This includes items such as IP re-use, design for low power, mixed-signal, RF and packaging. Another direction is to better simulate and mitigate the production constraints. Also noticed are reconfigurable architectures for signal processing in telecommunications.
Needs/Problems addressed: The proposed work addresses the issue of the growing "productivity gap" both at system level and library level. It also considers the impact of increasing silicon complexity on manufacturing yield and reliability of operation. And with the SoC approach, the need to bring together multi-disciplinary teams is recognised as a key factor to keep control over the application knowledge.
Industrial sectors: Many user sectors are represented in wireless/telecoms, multimedia, consumer, automotive electronics. The microelectronics sector is well represented, including the large semiconductor manufacturers and the smaller tool providers.
Impact expected: The production of Intellectual Property is a traditional strength for Europe and is likely to increase its share of the added-value of microelectronics components. By enabling to master complex integrated systems, this research area will allow to keep and expand the European competitiveness in the many application domains concerned.

WHO IN OPTO?

Lead actors involved: Many large industrial actors are represented, from component manufacturers to equipment. However, not many proposed actions would be directly co-ordinated by large industrial companies, but rather by academic and research organisations, reflecting the longer-term perspectives. User organisations are participating for their respective application domains. The large academic participation from numerous high-level organisations illustrates the significant need for basic research.
Partnership distribution: 10% large industries, 12% SME's, 78% academic/research labs. Participation from NAS is rather high (8%) mostly from academia. A relatively

small constituency is emerging in SME's. The average size of an IP is 10 partners, the average NoE is composed of 20 partners.

WHO IN MICROELECTRONICS TECHNOLOGY?

Lead actors involved: The large semiconductor manufacturers are present as well as the major tool integrators, associated with tens of high-level academic and research labs. Material suppliers and component/system manufacturers are also represented.
Partnership distribution: 20% large industries, 5% SME's, 75% academic/research labs. Participation from NAS is rather low and mostly from academia. The average size of an IP is 10 partners, the average NoE is composed of 25 partners.

WHO IN DESIGN?

Lead actors involved: Large semiconductor players, many smaller IP and tool providers, and tens of high-level academic and research laboratories are represented. Large system integrators are present for their application.
Partnership distribution: 35% large industries, 15% SME's, 50% academic/research labs in IP's. In NoE's, the academic/research labs participation goes up to 80%. Participation from NAS is rather low and mostly from academia. The median size of an IP is 15 partners, the median NoE is composed of 25 partners.

HOW?

Types of activities proposed: Most entries propose to integrate R&D activities with non-R&D such as education and training, dissemination, networking. In the design area, the technology take-up dimension is also expressed. A number of entries do not demonstrate the broad scope and strategic impact that is expected of IP's and NoE's. Those look more like FP5-like projects (targeted research projects) or as a partial topic that could be integrated as a work package into a wider IP or NoE. This would need further structuring of the constituencies in order to propose fully-fledged IP's and NoE's. Therefore, the number of potential IP's and NoE's to be considered in these areas is probably around 50-70% of the entries received.
Approaches proposed to implement activities: In IP's, there is generally a clear central objective, although some activities are sometimes proposed as a juxtaposition of individual items with a risk of fragmentation. In the NoE's, several entries lack a clear integration driver and/or clear milestones to measure success. The time horizon of the research is usually clear in the IP's and less so in NoE's probably due to the longer-term nature of the latter.
Financial information: The total costs or expected funding are not always indicated. However, by extrapolating the available information (sometimes in terms of man/years), some overall figures could be estimated. Funding for an individual IP ranges from 10 to 120 M€, for an NoE between 2.5 and 25 M€.
Links with Member States activities and other funding bodies: Almost none of the entries do yet identify related national and/or other (e.g. EUREKA) projects. As a result, the structuring nature with the ERA dimension of the entries is at the moment difficult to judge. This aspect requires further attention from the proposers, the Member States and the Commission.

8. MICRO- AND NANO- TECHNOLOGIES, MICRO-SYSTEMS, DISPLAYS

Reference text from the Specific Programme

micro- and nano- technologies, micro-systems, displays: The objective is to improve the cost-efficiency, performance and functionality of subsystems and micro-systems and to increase the level of integration and miniaturisation allowing for improved interfacing with their surrounding and with networked services and systems.

Research will focus on new applications and functions that take advantage of multi-disciplinary interactions (electronics, mechanics, chemistry, biology, etc.) combined with the use of micro and nano-structures and new materials. The aim is to develop innovative, cost-effective and reliable micro-systems and reconfigurable, miniaturised subsystem modules. Work will also include low cost, information-rich and higher resolution displays as well as advanced sensors including low cost vision and bio-metric sensors, and haptic devices. Work on nano-devices and nano-systems will address the exploitation of basic phenomena, processes and structures that promise novel or improved sensing or actuating functionality as well as their integration and fabrication.

Introduction

This report analyses 137 EOI's related to the area of microsystems and displays with respect to their content, nature, structure and actors involved. It takes all submissions into account within the area 1.1.2iii 'Components and Microsystems' related to 'Microsystems, Micro @ Nano Technologies, Displays and Large Area Electronics'. The analysis also includes 11 EOI's submitted in other area's such as 1.1.2i 'Applied IST' (health, automotive, smart cards and silent commerce) and 1.1.2.ii 'Communication, computing and software technologies', which have major activities related to microsystems research. EOI's in priority 3 on nano-science and –technology related to and relevant for this area are not included.

General Statistics

80 EOI's on MicroSystem Technologies (MST), 28 EOI's on displays, 2 EOI's on large area electronics and 27 EOI's jointly addressing micro-electronic and opto-electronic components and microsystems aspects are submitted in different subareas.

			IP	NoE
MST	**MND (*)**	80	57	23
	MND+MNO (**)	27	12	15
Displays		28	17	11
Large Area Electronics		2	2	
TOTAL		137 EOI's		

(*) **M**icrosystems, Micro @ **N**ano- technologies and **D**isplays

(**) **M**icro-, **N**ano-and **O**pto-electronics.

Different applications addressed by the EOI's in MST

Half of the EOI's in MST address or can be related to a specific application domain.

Application area	IP	NoE
Health	14	4
Automotive	11	1
Communication	13	8
Environment & 'control'sector	5	3
Mass storage	2	
Smart labels	2	

Other technology driven proposals are not driven by a specific application field or the application field is very generically mentioned. A high number of technology driven proposals often refer to enlarged project-type of proposals with little integration aspects or to NoE.

The further analysis will be split up into 3 EOI-domains : MNO-MND combined, Microsystems and Displays.

Analysis of Research Priority

Microsystems

The MNO-MND field (27 EOI's)

Several EOI's address the micro-nano-opto-electronics and the microsystems and micro- and nanotechnology field together. Both areas aim at miniaturised technologies and are driven by progress towards smaller dimensions. Silicon based technologies are used in both areas and often developments are combined to improve functionality of components or to add functions to devices. Moreover a high amount of EOI's in the communication area is mainly due to EOI's that have combined activities in the area of Micro-Nano-Optoelectronics and Microsystems.

The 27 EOI's with a common interest for Components and Microsystems can be divided in 3 groups :

1. A group of EOI's is addressing dense integration technologies and technology development for (portable / wearable) communication devices. Silicon, IC and Microsystem Technologies are combined.

e.g. : 3DsoC assembly; embedded reconfigurable systems; system on a stack; SIP for IT; high frequency RF; European Amplifier research; reconfigurable subsystems; system level packaging.

2. A second group is on technology development for optical or MOEMS devices for optical communication, combined with 'sensing' and 'imaging' applications. Developments aimed at can be very pervasive in several applications.

e.g. : photonics for communication, bio-photonics; free space optical communication; opto-electronic for micro and nanosystems for optical communication and sensing; vision devices for intelligent imaging sensors for medicine, security, testing, based on CMOS technology; high energy optical sources for environment and safety applications; optical systems, difractive optics, sensors for biomedical, food control,.

3. Several of the equipment, processes, techniques used are common to both fields and will benefit from a common approach including also testing, failure analysis techniques, etc…

e.g. reliability in MST, nano-electronics, MOEMS; nano-technology processes, self-assembly … for Microsystems and nE; managing manufacturing M@NT, packaging, interconnect; general network of institutes in photonics and microsystems.

Most of the activities in these groups are suggested to address IP's and/or NoE's of common nature, to enhance co-operation/co-ordination beween micro-, nano- and optoelectronics and microsystems or to focuss their activities depending on their nature.

Type of activities addressed in the full set of 107 EOI in MST

4 types of EOI's are proposed : 1) more generic technology or device oriented developments; 2) technology and device developments driven by generic application requirements; 3) Technology RTD pulled by a clear application vision and 4) support activities.

1) Technology / device oriented developments.(47)

This category addresses a wide range of proposals grouping activities in the same technological, materials or device field. The main purpose is to gain critical mass, enhance development and knowledge in the field and facilitate roadmapping, dissemination, …

e.g. : magnetics (sensors, wires, materials); advanced ceramics; chemical and gas sensors; polytronics, polymer based devices; high T components.

2) Technology / device developments driven by generic application requirements. (20)

These activities can be grouped versus several application domains. Some although mainly focussed on Microsystems would benefit from further co-operation, integration with MNO-MND combined activities. Most of these proposals for activities will broadly cover an application field but did not define a major application driver, application vision for the field yet.

e.g.: mobile-wireless communication (Rf, short distance); automotive (MOEMS); medical (MOEMS, BioMEMS, neuro) .

3) Technology RTD pulled by a clear application vision.(24)

A third group closely related with the one above address technology development with a 'dedicated' application vision behind it. It addresses the technology-application development in a focussed, integrated manner. The force of the application vision allows to pull the different technology developments into the same direction and to mix different disciplines.

e.g. wireless universal transceiver; smart pill; healthy man; intelligent biomedical clothing; personal wearable microsystems; mass storage; smart labels; intelligent home.

4) Support activities.(14)

These EOI's are addressing generic techniques applicable to a wide set of technologies.

e.g. design and testing; stress control; cooling; manufacturing methods;

Two EOI's provided too little information, so they could not be allocated to one of these groups.

Some of these types e.g. type 2 and 3 are more suited to drive applied multidisciplinary research in an integrated manner compared to other types 1 and 4 which are more suited to get critical mass and to enhance technical or scientific competence in an technological field or domain.

The constituency

A good mix of large companies, SME's, institutes and universities are present in the EOI's in this area. The NAS are well mixed with the Member States. In particular are the NAS countries well represented in the reliability issues of microsystems and in design and modelling of MEMS, NEMS and MOEMS.

Apparently most of the consortia are 'open'. More participants can be taken up in the proposed consortia. It is unclear, especially for NoE's, whether the commitment of the proposed partners in the consortia for participation is given. An average of 10 partners is presented for IP's, 25 partners for NoE's.
Some other EOI's look like extensions of existing projects with 'closed' consortia.

The area of displays (28 EOI's)

28 EoIs have been received in displays and related technologies. A few broad and challenging topics have emerged and are consistent with previous knowledge of the area from project concertations and outside consultations. Partial overlaps exist between different EOI's, reflecting the fragmentation of the industry in many diversified sub-fields. It is however remarkable noting that to our knowledge for the first time the community is definitely trying to get organised with reasonable success.

The topics addressed are mainly about large area displays, flexible displays, organic light emitting displays, plastic electronics, wearable infotainment systems, microdisplays, light components and sources for displays.

A sizeable number of IPs and NoEs concern polymer technologies at large to be used in part or as a whole in new devices and displays. The EU-companies have been very active and are leading R&D in key areas where Europe has secured IPRs. Approximately 80-100 companies and R&D institutes are involved. It is worth noting that the technology first invented for displays now spreads to all electronic areas. It explains why the community which is today still very much display related, is expected to evolve. The roadmaps are known but not always described in the EoIs.

Similar to the MST field 3 types of EOI's are addressed.

1) Technology / device oriented developments
e.g. : organic photonics and optoelectronics; light management; display consortium; superconducting nanodectector technology

2) Technology developments driven by generic application requirements
e.g.: Flexible displays (LCD-technology); safety and security (imaging technologies), organic displays (OLED)

3) Technology RTD pulled by a clear application vision
e.g.: home cinema, head mounted displays; mobile and wearable infotainment

Depending on the objectives aimed at in displays some types will be more suited to increase critical mass and competence in a field, while others will enhance the application of new technologies.

Large area electronics and Micro@NanoTechnologies

The areas of Micro@NanoTechnology and large area systems integration and the less mature emerging technological fields in Microsystems did not receive many EoI for Integrated Projects and need further building of critical mass and cooperation.
Only 2 EOI's were submitted related to large area electronics and none on micro@nano. Specific Targeted Research Projects will suit much better to reach critical mass and coordinate activities in these areas.

The use of the different instruments

Depending on the type of EOI, there is a slight preference for one of the instruments.

More NoE's (vs. IP's) are proposed for the generic technology development. These are often large consortia. Within the objective of MST in IST it is not the purpose to develop technology / devices in isolation in separate IP s. These activities are suggested to be integrated in more application oriented approaches or they would better fit other domains in priority 2 or priority 3. NoE are particularly suited for achieving critical mass and co-ordination in the more emerging fields (such as polytronics, polymer based technology, …) with a high potential. These fields will

also benefit from roadmapping and to demonstrate some visionary application and industrialisation potential.

IP's, NoE's and scaled up version of FP5-projects are proposed for the activities on technology development for generic application requirements. Within MST such proposals would benefit from defining a major objective in the application field aimed at, mixing different competencies to reach the objective or can benefit from integration with some of the application fields already focussed upon. However within the area of displays one might organise actions vertically - combining materials, equipment, display RTD and customisation for some users in order to develop, demonstrate, industrialise and to organise RTD, related to polymer technologies, organic displays (OLED), plastic electronics (including flexible displays) for hand held devices and for larger area applications …

The 'single-application-vision technology' development is proposed by IP's or scaled up versions of FP5-projects. The IP's are often supported by NoE's. Two groups can be distinguished: developments that are aimed at a specific application with technological developments or customisation of technologies that are rather specific to the application itself. These are suggested to be addressed in the specific application domain concerned with the application itself.
A second group will drive and pull technologies that have sufficient 'generic' application potential or the underlying technologies have sufficient potential to be used in other application fields for other applications than the one developed. These are clear candidates to act as vehicles to drive the applied research in the area if sufficient transfer is installed to transfer results in other areas. Most of these are submitted to the overall IST field and refer to the area of MND as well as to the application field covered.

The support activities are often addressed by NoE's . Within the objective of MST in IST it is today not the purpose to do these activities in isolation in separate IP s. These activities are to be integrated in more application oriented approaches or would better fit other domains in priority 2 or priority 3.

Some examples of genuine good IP's and NoE's are a direct result of the workshops organised to stimulate EoI. This clearly underlines the need for sufficient interaction with the constituency to explain the target / objectives of the programme and of the new instruments. Most Integrated Projects in Microsystems with good potential have integrated device developments (MOEMS, MEMS, biochips, microfluidics, …) together with the process, integration, packaging technology including system, design and production aspects to address one or more challenging application visions. Such a visionary application is giving the activity a more long term character and is considered a good vehicle to build and focus the research around. Transfer in other application fields while developments are progressing were not sufficiently included in the submissions but are essential to broaden the application potential. The application oriented IPs include close industry–institute interaction and address different multi-disciplinary topics in an integrated manner. Objective driven IPs can be often complemented by NoE of more investigative nature.

Budget / Management / Coordination

About 70% of the EOI's have no indication of budget. For the MST-EOI's the indicative budget ranges from 10-40M€, for Display-EOI's it ranges from 10-100M€.

For the project management of an IP or a NoE, a core group of partners is often proposed instead of one project leader.

Only a few EOI's address the relation with other sources of funding (esp. for NoE) or the relation with national programmes. This is however an essential part of any IP and NoEin view of building up the ERA in this field. The joint activity program in the NoE is often very generally addressed, although this is the essential part to differ between different NoE proposals.

As MST and displays is pervasive in a lot of application domains and as links are seen with opto- and microelectronics and with RTD activities in priority 3 (nanoscience and –technology) there is a need for common IP's or NoE's.

Conclusion

More than 137 were directly or indirectly related with Microsystems and displays in IST. The exercise has uncovered a wealth of research ideas worth more than 2000 M€ funding for Microsystems alone. The exercise has been successful in building partnerships, as input for the Workplan 2003-2004 and to obtain feedback on the state of readiness to propose IPs or NoEs. In both, a distinct shift towards longer term research was observed.

Around 30% of the IPs in MND were judged to be good topics for genuine potential IPs. The NoEs brought large mainly academic consortia together around important topics. A general weakness in submissions was the lack of ambitious and visionary thinking allied to an absence of impact considerations and the dimension of the ERA was too often ignored. Most activities concentrated on RTD and did not take any transfer or other activities into account. More effort is required to further focus and to improve the understanding of the new instruments. A sustained communications effort will be needed to clarify the FP6 instruments and concepts.

A more detailed analysis on the MST and Display EOI's will be published on the Microsystems website : http://www.cordis.lu/ist/ka4/supermic/index.htm by end of September.

9. KNOWLEDGE TECHNOLOGIES AND DIGITAL CONTENT

Reference text from the Specific Programme

Knowledge technologies and digital content: The objective is to provide automated solutions for creating and organising virtual knowledge spaces (e.g. collective memories, digital libraries) so as to stimulate radically new content and media services and applications.

Work will focus on technologies to support the process of acquiring and modelling, navigating and retrieving, representing and visualising, interpreting and sharing knowledge. These functions will be integrated in new semantic-based and context-aware systems including cognitive and agent-based tools. Work will address extensible knowledge resources and ontologies so as to facilitate service interoperabilitiy and enable next-generation Semantic-web applications. Research will also address technologies to support the design, creation, management and publishing of multimedia content, across fixed and mobile networks and devices, with the ability to self-adapt to user expectations. The aim is to stimulate the creation of rich interactive content for personalised broadcasting and advanced trusted media and entertainment applications.

Summary

Knowledge technologies (KT) and Digital content (DC) cover semantic- and context-based systems and interactive multimedia (video, image, sound, text, sensor data etc). **174** expressions of interest of direct relevance were identified. The analysis brings out **common themes** where breakthrough research with a significant Community added-value can be focussed:

1. **Semantic Web and intelligent Web services**
2. **Knowledge modelling and reasoning** in science and industry processes
3. **Interactive digital TV, cinema and online music**, where entertainment, games and leisure dimensions are evident
4. **Cross-media, multi-platform digital content management and delivery**.

Taken as a whole, the Expressions of interest propose a range of approaches: basic research into new knowledge-based methods (especially in reasoning and computational modelling); component-level research into semantic and content-based tools e.g. for building ontologies, data/text mining and information retrieval, audiovisual programming and content authoring, machine translation and cross-lingual content access/management; or system-level research and applicative showcases in knowledge-intensive sectors of the society and economy.

The submissions analysed both broaden and deepen the main conclusions of the outcome of FP6 consultation seminars and expert meetings held over the last six months.

General Statistics

Introduction

174 expressions were identified as directly relevant, where 'knowledge' or 'content' were the most salient topics, with a rough 2:1 split between KT and DC. A further 35 were identified on a sample basis from unspecified expressions and from other sectors, where KT/DC has a substantial component, for example from Interfaces, Societal and Work Challenges (Organisational knowledge management, Culture, Transport, Environment), Communications, Computing and Software (e.g. complex problem-solving, GRID etc). There are certainly many more, and this reflects the generic, multi-applicative nature of KT and DC. This analysis concerns only those directly relevant EOIs.

Analysis of Research Priority

WHAT - Analysis of Research Priorities.

75 EoIs are **generic** to knowledge technologies or digital content, whilst 99 EoIs are more **applicative** insofar as they mention a broad range of areas of case study. A systematic bottom-up analysis revealed the following predominant technology themes, within the knowledge / content / Web scope: semantics, knowledge modelling and optimisation, ontology, multimedia, personalisation, database, visualisation, virtual environments, agents, meta-information, adaptive systems, video, context-aware systems, information retrieval and natural language technology. The main application areas included notably systems, Web services and cross-media publishing for innovation, healthcare, business, life-sciences, engineering, environment, e-learning, product development, culture and entertainment.

The **main clusters** which emerge are:

1. **Semantic Web technologies and intelligent Web services**. The semantic web will allow computers to act more autonomously and pro-actively (e.g. agent-based) on multimedia content and services, including through intelligent agents. Within this theme, three main clusters could be identified: (a) foundational research for bringing knowledge-based theory (e.g. formal models and languages, inferencing, multi-agent frameworks) into the semantic web environment; (b) bootstrapping the process intended to turn today's web into an open, semantically rich computing platform, with new content analysis, annotation and retrieval tools within open reference architectures (e.g. semantic-based search engines or semantic hyper-link management), through scaleable and robust ontology building, or through tools for extracting semantics from visual data. Several submissions addressed interoperability issues (the key standards being RDF, XML(S) and MPEG-7)[1] and the need to bring multimedia encoding, metadata and semantic web standards closer together thus providing system developers with coherent standards stacks; and (c) sectoral semantic webs for promising domains e.g. in engineering, digital libraries, planning support, tourism or e-business.

2. **Knowledge modelling and reasoning in science and industry processes**. The complexity of organising and sharing expert knowledge in very dynamic and cost-effective ways hampers the potential of knowledge-intensive science and industry sectors to use the (tacit) human expertise known to be available. A considerable interest is shown by proposers in combining knowledge representation and reasoning to automatically help workers to get through complex information flows and processes e.g. in product design, knowledge discovery or crisis management, e.g. in the geo-energy sector or to support industry decision-making. A key paradigm brought forward here is the "virtual community / community of practice", an approach that goes well beyond present-day approaches to e.g. knowledge management or computer-supported collaborative work (CSCW).
3. **Interactive digital TV, digital cinema, audio-visual content and online music**. The main applicative areas here are entertainment, games and leisure. EoIs address the full value chain from content capture to management and multi-platform distribution. In the case of digital cinema, for example, they would contribute to strengthening Europe's position in the cinematic production area by facilitating an end-to-end digital production chain. There are further examples in the digital television and music area, for digital libraries and the corporate e-publishing domain. In the entertainment area, future avenues for digital games and 3D environments are explored. Especially important research issues include: progressing towards a fully digital, collaborative workflow in the areas of digital cinema, TV and e-publishing, novel authoring tools for interactive content, distributed dynamic content management systems and intelligent content transformation tools. Furthermore, a number of submissions highlight actions geared towards new business models coupled to user needs (e.g. usability issues), commercial and privacy concerns (e.g. trust and digital rights) and desires specific to particular application domains.
4. **Cross-media digital content management and delivery** is a recurring theme, consistent and identifiable for all application domains, including digital television, games, 3D environments, virtual and mixed reality etc. This issue currently blocks the realisation of potential economic and quality benefits in several application domains. Particular research issues brought up here are programme authoring, metadata for multimedia, content filtering, personalisation and interactivity - in order to realise the user feedback link A number of submissions identified Geographical Information as a way to retrieve and/or visualise digital content. While most of the submissions addressed media and publishing industries, several of the underlying research issues are equally relevant for corporate content production and management.

WHO - Analysis of Constituency

- **The average size** of the consortium is noticeably larger than in FP5: for example over 50 of the EoIs had between 10-20 partners, whilst over 25 EoIs, mostly NoEs, had 20-40 partners. 10 EOIs - predominantly Networks, had over 40 partners identified. The remaining proportion of expressions had less than ten partners identified and in many cases these were below critical mass. The total participation in the EoIs is over 2100 organisations.
- **Research** laboratories and universities make up over 70% of the participations. They outweighed **industry** and **SMEs** by a considerable factor in several

proposals and in some NoEs make up nearly 100%. On balance, KT has a greater proportion of researchers compared with DC, where IPs have overall 60% industry participation. Overall, this suggests a shift towards longer-term RTD, in line with the more visionary orientation predicated by FP6.

- The specific technical **expertise** in KT comes often from the AI / knowledge-based disciplines, from the database community and the content industries, and from linguistic areas (natural language, speech). Several EoIs, both in KT and DC, include major industrial expertise.
- **Participation** of newly-associated states (NAS) was evident but did not particularly stand out; 10 EoIs were presented by co-ordinators from Eastern and Central Europe. Most of these submissions were deemed to be of a somewhat lower quality, thus suggesting that special 'educational' efforts would be appropriate.

HOW - Analysis of Instruments

- Of the 174 directly-relevant EoIs, 112 are Integrated Projects and the rest are NoEs. The relatively high number of NoEs demonstrates that more efforts are required to bring different disciplines and research networks closer together, and to encourage more broadly based, truly multidisciplinary approaches.
- Whilst some of the notably stronger submissions did suggest to combine different research methods within the same project), few actually explored the full range of possibilities offered by the new FP6 instruments in a concrete and coherent way.
- Suggestions for truly progressive IPs often encompass a combination of three main features: basic research into knowledge formalisms and languages, component-style research, particularly into search engines, indexing, visualisation methods etc, and applicative research into case studies. These features would be backed up by training, dissemination etc. Networks of Excellence in this area seem well suited for foundational, longer-term issues like Semantic Web infrastructure, Web services interoperability or metadata standards. It is evident that several of the "low-critical mass" suggestions for component-level research could equally be presented as TRPs (targetted research projects).
- **Links with national activities** were present in some cases, e.g. in the Geographic Information sector. Although not explicitly mentioned, ties with national programmes could be detected in some submissions, e.g. in the area of advanced KT. In most cases the orientation is rather industrial-sector-oriented or in new areas like the semantic web.
- A significant effort has still to be devoted to explain the practical implications of the new instruments.

Conclusion

The **coverage** of the submissions analysed so far is deemed to be appropriate and in line with the research areas identified in consultation workshops and by Commission reflection groups, ISTAG advisory group, etc. Strong consortia with the necessary ambition have submitted sound proposals. The overall **maturity** of the research community is good, given that many of the contributing knowledge-based disciplines and content / media players are well-founded in Europe.

Most of the **newcomers** tends to fall into three broad categories: (a) information/content rich tertiary economic sectors dealing with sectoral webs (e.g. health, environment) and complex document/process requirements (e.g. industrial product design, decision support), (b) research teams engaged in computational modelling, reasoning/inferencing etc. on distributed, real-life scale platforms, and (c) media industries (studios, broadcasters) planning the transition towards an end-to-end digital chain - whether mobile or PC-based.

[1]. Resource Description Framework, Extensible Mark-Up Language (Schema), Motion Pictures Expert Group-7

10. INTELLIGENT INTERFACES AND SURFACES

Reference text from the Specific Programme

Intelligent interfaces and surfaces: The objective is to provide more effective ways of accessing ubiquitous information and easier and natural interaction modes with intelligence that surrounds us.

Research will focus on interfaces and interactive surfaces that are natural, adaptive and multi-sensorial, for an ambient landscape that is aware of our presence, personality and needs, and which is capable of responding intelligently to speech, gesture or other senses. The aim is to hide the complexity of technology by supporting a seamless interaction between humans, between humans and devices, virtual and physical objects and the knowledge embedded in everyday environments. This includes research on virtual and augmented reality.

Work will also address technologies for multilingual and multicultural access and communication that support timely and cost effective provisions of interactive information-rich services meeting the personal, professional and business requirements of all members of linguistically and culturally diverse communities.

Scope of Multisensorial, Multilingual Interfaces and Virtual Environments

This area covers activities whose objective is to provide more effective ubiquitous information access and easier and natural interaction modes with intelligence that surrounds us. The research focus is on **natural interfaces** that are adaptive and multi-sensorial, for an ambient landscape that is aware of our presence, personality and needs, and which is capable of responding intelligently to speech, gesture and other senses. The aim is to hide the complexity of technology by supporting a seamless human interaction between humans, between humans and with devices, virtual and physical objects and the knowledge embedded in everyday environments. This includes research on **virtual and augmented reality**. Work will also address technologies for **multilingual and multicultural access and communication** that support timely and cost effective provisions of interactive information-rich services meeting the personal, professional and business requirements of all members of linguistically and culturally diverse communities.

General Statistics and Methodology

153 expressions of interest (EoI) that were in the scope of this priority 2 area have been analyzed. Amongst the EoI received, 70% were submitted as IP and 30% as NoE. The EoI were grouped into 13 thematic clusters (see **Analysis of Research Priorities**) that fully cover the ideas and topics proposed by the EoI. Subsequently, the EoI clusters were adjusted using semi-automatic and fully automatic clustering techniques. It is worthwhile noting that, although all EoIs were assigned to one of these clusters, about 2/3 thematically cover more than one cluster. Therefore, the

clusters should be seen as themes spanning across subsets of EoI larger then their membership.

Analysis of Research Priority

1.1.1. Technologies

The EoI cover a broad range of technologies related to this area, including human factors, ergonomics, speech, vision, haptics, gesture/facial expressions/lip movement understanding and animation, acoustic and visual scene understanding, biological senses, multimodal fusion and VR/AR oriented to specific applications.
Some of the more focussed technologies such as vision, tracking, multilinguality, spoken language translation, speech recognition, language processing are the topic of a number of interesting proposals for fundamental research. Most of these proposals are felt to be more suitable for *integration* into broader scoped IP or NoE.
Activities on horizontal core technologies such as machine learning, signal processing, pattern analysis etc, which are critical for applications in this area are proposed, mostly as NoEs. Longer term aspects such as brain interface and cognitive systems are also covered.

1.1.2. Thematic Clusters

0. *Infrastructures, resources and basic technologies*

   This cluster spans across the whole area and consists of infrastructure, building blocks or basic research activities needed in many if not most of the other clusters.

1. *Interface and Artefact Design and Ergonomic, Human Factors and User Acceptance*

   Keywords: Learning the user in context, aesthetics and acceptance, psychological factors, usability evaluation.

2. *Cognitive Science for Ambient Intelligence*

   Keywords: predictive cognitive user models, brain imaging and control, human-machine cooperation for problem solving, non-invasive sensors, modality fusion, emergent systems

3. *Improvement of Human Senses and Perception, including Healing*

   Keywords:new e-senses complementary to the natural senses, emotional and physical well being, new modes of learning, non-invasive implantable intelligent devices, psychoperceptive evaluation

4. *Speech and Vision Based Intelligent Interfaces*

   Keywords: scene understanding using acoustic and visual tracking, integration of speech and vision, biologically motivated modeling of perception, image understanding and mining

5. *Interfaces Based on Recognition and Synthesis of Emotion, Facial Expression and Gesture*

   Keywords: avatars representation and control, human emotion studies, vocal intonation, lip reading, talking heads, non verbal communication in speech, face identification

6. *Multilingual Access and Dialogue*

Keywords: dialogue modelling, co-operative intelligent question answering, adaptive dialogue management, portable multi-lingual and cross-lingual access, multilingual communication

7. *Intelligent Wearable Devices and Smart Cloths*

   Keywords: e-textiles, wearable electronics, close body monitoring, interaction with immersive environments, weather adaptive systems, intelligent body monitoring

8. *Interfaces for Mobile Devices and Services*

   Keywords: post-3G mobile and broadband IP services with multimodal and multilingual interaction, adaptive multi-agent technology, mobile gaming with multisensorial interaction

   This thematic cluster also included signature and fingerprint for authentication.

9. *Intelligent Rooms with Support for Collaborative Creative Processes and Virtual Environments*

   Keywords: domain-independent model of remote collaboration, multi-party speech understanding, life-like coordination of communicative acts

   This thematic cluster covers several applications for entertainment, education, language learning, specialised training, new forms of working, CAD and manufacturing

10. *Multisensory interfacing with complex information spaces and virtual manipulation of information objects*

    Keywords: analyses of mental representation of information spaces and sensory, interactive and in-context presentation, navigation and manipulation of complex information spaces.

11. *Virtual Reality and Environments*

    Keywords: networked augmented and virtual reality, ubiquitous computing, tele-immersion, visual consciousness, 3D video based interaction, teleimmersion, visual consciousness

12. *Critical Interfaces for Safer Control of Vehicles and Devices, including Training for these Environments*

    Keywords: ambient intelligence for vehicles, controlled language for safety-critical applications (e.g. cockpit alarm messages), immersive real-life like training environments

13. *Physical Interfaces, Haptics, Mechatronics and Robotics*

    Keywords: exteroceptive sensors, force-feedback, tactile sensing, biomechanics, haptics-vision fusion, head and eye tracking with voice control

Most of these thematic clusters contain between 7 and 15 EoI. Two have less (clusters 3 and 12), and two have more (clusters 4 and 6).

Analysis of Constituencies

The EoI analysed in this area involve a relatively high proportion of academic institutions and research organisations, while industry represents over one third of the actors involved.

- Academic institutions 45%
- Research organisations 20%
- Industry 35%

15% of the organisations involved in the EoI are SME, while 9% are originate from NAS. A broad variety of industrial organisations, well beyond the expected constituency, submitted EoI (telecommunication, space, textile, automotive, mass market, medical, etc). The main academic organisations active in the field, as well as many newcomers, are also present. The consortia involved are large, with an average size well over a dozen participants.

Analysis of Instruments

In this area there is a need for a *very high* degree of multidisciplinarity and *very few* single organisations exist that cover all of the expertise required. Despite this difficulty and the short time available, consortia having the critical mass have managed to submit many excellent ideas for integrated projects (IP) and networks of excellence (NoE) with a very good coverage of the area as can be seen from the clusters in the next section. As already mentioned, 70% of the EoI received were submitted as IP and 30% as NoE.

About 60% of the proposals submitted as IP, while proposing interesting ideas, lack the required ambition, scope and integration, making them more appropriate for specific targeted research (STRP) or, possibly, part of other IP. The majority of the remaining IP proposals are correctly positioned in terms scope and ambition. Nonetheless, there is also a non negligible number of EoI that are either too broadly scoped, thus loosing focus, or excessively ambitious in terms of challenges addressed, or both.

About 30% of the proposals submitted as NoE lack the characteristics of this instrument (e.g. joint activity programme, integration of existing research capacity) making them more appropriate as coordination actions.

11. FUTURE AND EMERGING TECHNOLOGIES

Reference text from the Specific Programme

The objective is to help new IST-related science and technology fields and communities to emerge, some of which will become strategic for economic and social development in the future and will feed into the mainstream IST activities in the future. To ensure openness to unforeseeable ideas, critical mass of research where strategic focus is needed, and seamless coverage of the IST frontier, two complementary approaches will be utilised: one receptive and open – the other proactive.

General Statistics

There were 79 expressions of interest received by the sub-priority 1.1.2.v, Future and Emerging Technologies (FET). A further 20 expressions of interest without specified priority or that were submitted to other priorities but were thought to fall within the FET area were also analysed. Seven of the EoIs analysed were submitted from NAS. For the purpose of this analysis, expressions of interest are clustered around several themes such as quantum information processing and communication, future robotics, biologically inspired information technologies, complex systems, nano- and molecular information processing, ambient computing and environments etc.

Analysis of Research Priority

Quantum Information Processing is seen at present as an area that could revolutionise both the way we build computers and how they operate. Increasing research investments are now being made both in Europe and in the United States. More than 9 EoIs in this area have been received, mostly from well known groups already funded under the FET-QIPC Proactive Initiative (Quantum Information processing and Communication). Overall the EoIs received show a very good degree of maturity, and could be grouped into three broad categories: solid state implementations of quantum computing (superconducting qubits, quantum dots, etc), atomic/particle implementations of quantum processors (including fundamental aspects of quantum communication and networks, state teleportation and single photon manipulation), and a Network of Excellence to cover all aspects of integration, co-ordination and networking in the area.

More than a dozen of the EoIs received are aimed at investigating novel approaches to **nano-scale information processing** which are not CMOS driven. Many of these originate from the NID proactive initiative currently in progress in FET and address *nano- and molecular electronics, spintronics, organic electronics*, etc. In addition there are a handful of EoIs addressing *nano-fabrication* issues and material developments that could lead to alternative devices for information processing or storage. The most prominent area is *molecular computing* with at least 8 EoIs. Other areas follow with a difference. *Nanomagnetism* for spin-based electronics, was suggested by three NoEs proposing basic research activities and a modest industrial involvement. *Nanopatterning*

was represented by several EoIs developing tools which may be interesting for nanoelectronics. *Superconducting electronics* was the subject of one EoI. For example, two EoIs involve small consortia specifically targeting a specific class of molecules, while on the other extreme two EoIs involve up to 80 partners cover a very broad range of research. Several research groups are in more than one EoI.

From the EoIs submitted directly to FET on **photonics**, apart from the ones related to Quantum Communications, only one would be in the scope of FET. It would however not be sensible to have it in FET as a standalone, and it would be best analysed with the EoIs sent to the 3rd sub-priority of IST, where non-linear optics are addressed. Although several of these EoIs have parts that would be within the scope of FET, their main thrust fits better the 3rd sub-priority.

Another 11 EoI's addressed the area of **robotics**. Their scope falls in three main categories: co-operative robotics, robot assistants and robotic systems augmenting or replacing human capabilities. In addition, there were EoI's on affective robotics and robots for applications like manufacturing. Some very interesting EoIs for integrated projects aimed at combining robotics and neuroscience research for augmenting human capabilities, developing affective states in robots, and studying teams of heterogeneous robots as intelligent embodied agents. Two further expressions of interest originating from the complex systems research area (see below), one on emergent development and another on embodied and communicating agents, would also be of relevance to future robotic technologies. Likewise there were several EoI's on neuro-IT that could directly contribute to an initiative in future robotics. Some other EoIs, however, were suggesting incremental research or research work aimed at catching up on the lead in other parts of the world, for example, two EoIs for IPs that addressed downstream robotic applications and would not fit the scope of FET. In terms of partners, the main and most renowned research groups were represented in the EoIs and many of the consortia were highly interdisciplinary, although the quality of the consortia of some EoIs relevant to FET was rather variable. Consortia formation needs to be actively promoted from now until the closure of an eventual call, through partner brokerage or other activities.

Another 17 EoIs touched upon the emerging field of **neuro-IT** which addresses the interface between IT and neurosciences, e.g. to build novel bio-inspired multi-sensor communication systems, novel neuronal interfaces, or test new ideas on intelligence and feeling that could be later transposed into artificial IT systems. These EoIs would contribute to the solution of complex IT perception-action problems and have applications in developing autonomous, adaptable and growing artefacts. Most leading EU robotics and neurosciences research centres are participants in the EoIs, although in a dispersed way. The cooperation between them in a few Integrated Projects and in one Network of Excellence holds significant promise and could propel Europe at the forefront of this research domain.

Twelve EoIs were received in the area of **complex systems** research including one originally submitted to the societal challenges sub-priority. One EoI for an NoE aims at establishing general concepts and methods applicable to a variety of real world complex systems, natural and man-made alike. EoIs for IPs intend to use complex system theory to advance significantly beyond present state-of the-art in several IST key areas: large scale information systems, robotics, AI (including "artificial consciousness"), and to a lesser extent socio-economic issues. It is evident that a research initiative on 'complex systems'

would also address biologically-inspired information technologies and vice versa. Particular interesting synergies can be expected in the area of emergence of consciousness in 'agent systems' – be it robots or cells.

Six other EoIs cover a range of topics that are relevant to research on **ambient systems**: communication languages and ontologies, prototype artefacts and embedded devices, interaction design, ethnographic studies, and in situe evaluations. There is a broad participation of universities, research institutes and industrial partners; some of these originate from the existing disappearing computer initiative – while others are new. All the EoIs concern IPs, and would support well FET planning for a follow-up call on the disappearing computer within the 6th framework.

In the area of **Computer Science**, 6 NoEs or IPs were proposed in multi-agent systems, evolutionary computing, knowledge discovery, constraint programming, advanced programming language design and implementation, component based software development, etc. Several EoIs stem from existing NoEs, within FET and elsewhere, including the networks CologNet, Evonet, Neuronet, KDNet and AgentLink. Some of these EoIs would support the eventual continuation of the Global Computing proactive initiative of FET in FP6.

Two further NoEs centre around the topic of **Presence Research**. In this same area, a FET proactive initiative is being launched this Autumn. One NoE aims at providing support and orientation to the newly founded community of Presence Research while the other is focussing on applying presence technologies to medical applications. The use of an instrument such as a NoE to support and expand the emerging presence research community within an interdisciplinary environment seems appropriate. Furthermore, given the fact that the initiative is in its first stages there is a strong need to avoid fragmentation of the research.

Two other EoIs for NoEs concern work on **mathematics** and do not address integration of FET-specific research, aiming rather at an extremely broad spectrum of application areas (not only IST-related, but ranging across the whole framework programme areas and industrial fields) and involving a large variety of mathematical techniques. Finally, one EoI for a network of excellence on **algorithms** was also submitted. It would continue the work of a series of FET projects that have contributed strongly to European excellence in this area.

Some of the EoI's address totally new research topics for FET, such as the use and investigation of semiotic principles to inform the design of interactive systems; research on artificial consciousness; foundational research on human learning and related digital media, etc.. Although it is difficult to draw any definitive conclusions from these indications of research topics, it will be worthwhile to investigate some of them further.

Analysis of Constituencies

In terms of general comments on "constituencies", many of the proposers have known FET for quite some time, while others represent new and emerging areas in which FET has become active rather recently. As should be expected, the set of EoI proposers was influenced from what the research communities perceive as "imminent" actions by FET early in FP6. For example, a substantial number of EoIs were received in areas like

robotics and complex systems where FET has organised workshops recently in view of launching a call in 2003, while rather few EoIs were received in the area of Presence Research where a call has just been made in 2002 (and will not therefore be called again very soon) and where the research community is still in a "structuring" phase. In the area of nano-scale information processing specifically, only seven EoIs were received by FET directly, due to an apparent misunderstanding among many researchers that anything related to nanotechnology should be sent to Priority 3.

Analysis of Instruments

In terms of the new instruments, some EoIs for NoEs did not really address strategic and integration issues but were rather loose projects that would tackle a long list of topics; a strong effort needs therefore to be made to clarify and explain to the research community what "integration" means. Furthermore, many of the EoIs for IPs did not formulate sufficiently concrete objectives. However, there seem to be plenty of value, ideas and talent in the EoIs received to support research initiatives in all the areas described above.

[1] Some of these EoIs were submitted to Priority 3 (and some others to 1.1.2.iii). The reason is that there is a widespread misconception in the research community that all nanotechnology-related research would be carried out in Priority 3 – even research aimed at future technologies for nano-scale computers. Therefore, the present analysis is based on all EoIs that would be relevant to FET, regardless of where they were submitted.