SIXTH FRAMEWORK PROGRAMME

PRIORITY 2: Information Society Technologies

ECSS White Paper on Software and Service Architectures, Infrastructures and Engineering – Action Paper on the area for the future EU competitiveness

Volume 1: Recommendations of action

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Executive Summary

This document, which we have entitled the **ECSS White Paper** for several reasons, as explained below, aims at supporting the EC to push the European SSAI to a competitive position worldwide identifying strategies and technologies that will facilitate future developments and reduce fragmentation.

It is structured in two volumes. The present volume, that is the first one, compiles executive contents of the paper, in a form of sixteen recommendations of action to the EC, so to achieve the described aims. The second one includes all background texts related to the recommendations given, aiming to become the thinking arena for future discussions on actions needed for the future of ICT, Society and Industry in Europe.

Recommendations are classified in two categories. Firstly, six critical research topics are pointed out to the EC (page 3). We believe they will somehow become the basis for the industrial competitiveness, in both mid and long terms. Therefore, their deadline is set beyond 2010.

Priority has been given to security and trust issues, both considered horizontal, with an impact on all the other recommendations, and having a clear relation to current needs, demands or worries coming from industry and end-users. It is followed by three recommendations on research challenges related to the Internet of services. Finally, complexity and problem solving are being tackled as important research topics for the future.

The second category includes ten policy-oriented recommendations (page 9). Their nature varies, especially when in relation to research topics; some are more technical and others more focused on legal or regulatory issues, while some could be even considered a bit philosophical. Certain aspects, which are usually tackled by the non-ICT communities, are included in this document because there is a feeling that the whole picture should be analysed and the future competitiveness addressed. Nonetheless, the ICT sector claims to willingly open a fluent and continuous dialogue with the other disciplines which are more involved in the reality of regulation, industry and Society.

In the ECSS White Paper we have tried to clarify the use of certain terms that are widely used by the ECSS and out of it, but which do not always have the same meaning or connotations. There is a growing world of buzzwords around us and a clarifying language is important for facilitating productive discussions. For this reason, an extensive glossary is included in volume 2.

Policy-oriented recommendations are grouped as follows:

1. Improved research organisation (page 9)
2. Facilitating open access for all (page 10)
3. Business in the Internet of services (page 12)
4. (A policy for) people in the Internet of services (page 14)

The first group is positioned as a link between the recommendations related to future research and policy-making. It also includes actions that are considered very important from the industry's perspective. Free and Open Source Software (FLOSS) and standardisation are further identified as key opportunities for the European competitiveness, both industrial and academic.

The third group, Business in the Internet of services, highlights the need to strengthen the efforts towards free competition and to support SMEs. Finally, regulatory issues, related to the privacy and identity, are dealt with in the last group as potential enablers towards knowledge-based society.

This Paper is prepared within the **3S Project (Strategy for Software & Services within the European Research Area)** an FP6 SSA starting on 1st July 2006. In September 2007, the 3S Consortium released the **3S Green Paper on Software and Service Architectures, Infrastructures and Engineering**. The Green Paper compiled several challenges which the European Union had to face up to, in order to support the strong development of flexible and distributed computing technology and to sustain the innovation pace of software services development. The present document is the result of the 3S Green Paper opening to a wide public consultation within the **European Community for Software and Software Services - Architectures, Infrastructures and Engineering (ECSS**, www.eu-ecss.eu), enhancing it to the level of White Paper[1].

The **ECSS White Paper** has been prepared in collaboration with the **3S Advisory Board**, an exclusive group of high level experts in the Service and Software Architectures, Infrastructures and Engineering fields (SSAI). The group includes a balanced mix of academic experts, industrialists, researchers and policy-making stakeholders but also involves representatives of the most relevant initiatives in the SSAI sector in Europe and at international level, as well as some representatives from the European Commission.

Our desire is that this document remains alive, for the benefit of the European competitiveness in the area. For this purpose, the ECSS website will be kept as an open channel through which it will be possible to sustain discussions towards the future of sector[2].

[1] "White papers published by the European Commission are documents containing proposals for European Union action in a specific area. They sometimes follow a green paper released to launch a public consultation process.": http://en.wikipedia.org/wiki/White_paper

[2] This document is available at www.eu-ecss.eu. Please contact us through that website in case you want to contribute.

1. Research topics

1. Languages for description of privacy and security related policies should be explored to obtain a secure and seamless data exchange

Related to Challenge 6 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

An efficient, fast and seamless data exchange is vital for today’s society. At the same time, such exchange should not create risks of violating confidentiality and privacy that may be associated with the data. Enterprises and Organizations are increasingly facing the challenge of management of confidential and sensitive data.

Various technologies are available to manage user identities and to handle authorization and authentication. However, there is currently no standardized way to assert policies. This lack of standardization obviously prevents interoperability among various existing technological solutions and it hinders the wide adoption of privacy and security.

The research community is investigating the use of formal languages in order to define, not only Security Policies, but also Data Sharing Agreements. The use of formal languages and detailed definition of data sharing agreements can provide some advantages, especially with respect to interoperability and automation of certain tasks, such as policy verification, policy translation, policy enforcement etc.

The major technological challenge consists, first of all, in conveying all the various research efforts related to policy languages into a consistent and comprehensive solution which is standardized, interoperable and supported. Such solution should be well supported by market vendor and compatible with existing software and hardware infrastructures.

The online markets and economies would benefit from a technology that allows for fluid data sharing agreements that would increase the overall adaptation of market negotiations. Such mechanisms would affect the economical models and probably open up the possibilities for new paradigms, causing an economical shift that raises challenges and requires appropriate regulation mechanisms, not existing today.

From the social impact perspective, an adaptive data sharing agreement technology has to face up to the big challenge of “user acceptance”. Despite the potential benefits and the possible inherent security of such mechanisms, their success is strongly related to the way the society perceives them. It is essential to conduct some thorough studies that analyse social impacts and social acceptance of these technologies.

The introduction of new technological mechanisms in the area of flexible data sharing agreements poses the challenge of evolving the current legislations in order to regulate the new possibilities and to cope with their effects and/or undesirable side-effects.

This is obviously a challenge for the European Community with all its diversity of political ecosystems and its variety of cultural backgrounds.

The definition of policy languages for a seamless data exchange is necessarily an interdisciplinary research area, covering not only technological aspects, but also organizational, legal, and economical ones. In fact, it is essential that data exchange copes with regulatory compliance established in various countries.

A successful definition, implementation and deployment of standard, interoperable, supported and backward-compatible policy languages would give an undeniable competitive advantage to the European Union, covering the lack of standardised way to assert policies. A leading position in both standardisation bodies and vendors product implementations would give the European Union the possibility of setting the direction for a technological solution with high potential on future markets and economies.

2. Service matching and composition is needed to realize a service-oriented marketplace and dynamic collaboration

Related to Challenges 2, 3 and 4 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

Going from products to services is considered to be one of the major current paradigm shifts within the ICT and it represents a new market for the European SME-based business. Service-oriented infrastructures promise to deliver a scalable architecture, where reusable and cohesive software modules can be accessed as services under different ownership domains, and can be used as building blocks for composing new services that provide fully-featured functionality meeting the requirements of a continuously changing business environment. Establishing ecosystems of collaborating enterprises – referred by Gartner as a "megatrend" - that are created and dissolved in response to fluctuations in demand and market conditions, will allow these to add value to their services and jointly compete in the market. Dynamic discovery, matching and composition of services are essential mechanisms that must be provided by the service infrastructure in order to deliver this promise. Challenges are:

- Semantic data mapping and mediation of service descriptions;
- Combinatorial growth of composition alternatives;
- Service adaptors;
- Mapping business goals to the services.

To dynamically identify and match services, an important challenge is applying semantics to determine interoperability mappings and the subsequent mediation of services and data. Platform independent service metamodels and corresponding ontology and metadata formats providing standardized domain-specific languages are necessary for interoperability of services. Dynamic matching is further complicated by the fact that we may not find a single useful service, thus a set of different services must be composed in order to provide the required functionality. However, as the number of services needed by the composition increases, the number of composition alternatives grows exponentially. This is referred to as the problem of combinatorial explosion, where the number of service combinations to be searched is so huge, that it is either unfeasible to find at runtime or almost impossible to find at all. We can also encounter situations of almost fitting services, where adapters are needed to bridge the differences with the specified service. A significant part of the challenge of matching and composition is automating the process in line with the business goals, as we, for example, would prefer for the said adapter to be automatically generated.

The fierce competition that follows the globalization of markets demands businesses to be flexible and able to adapt quickly to changing conditions. Given the dynamic matching and composition, the software services offer architecture for dynamic assembly of new supply chains and services, allowing the European businesses to compete through dynamic collaboration.

3. Software needs a higher degree of autonomy to aid decision-making and reduce human intervention

Related to Challenge 5 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

The spiralling cost of managing the complexity of computing systems is becoming a significant inhibitor that threatens to undermine the future growth and societal benefits of information technology. A required attribute of future software services is the ability to exhibit autonomous and self-adaptive behaviour. This has been recognized by several reports and initiatives, like the NESSI Strategic Research Agenda and the Service Oriented Knowledge Utilities vision by the Next Generation Grid Group. An autonomic system can be defined as a set of autonomic components which can manage their internal behaviours and relationships with others, in accordance to high-level policies. Several principles that govern all those systems have been identified, such as self-awareness, context-awareness, self-protection and self-healing. Challenges are:

- Goal specification;
- Behavioural abstractions and models;
- Architectural design of autonomic elements;
- Learning and optimization;
- Robustness.

For a system to behave autonomously it needs to have a set of goals it wants to achieve, and one must ensure that goals are specified correctly and systems behave reasonably, even when they do not. A related specification issue is to provide behavioural abstractions and models for understanding, controlling and designing emergent behaviour in autonomic systems. Providing a common architectural design and implementation of the basic autonomic element would also help to control emergent behaviour, since the lack of such elements complicates the interactions among different self-managed technologies. Furthermore, in sophisticated autonomic systems that consist of agents continuously adapting to their environment and to each other, the learning and distributed systems optimisations are important challenges. Finally, robustness theory is another topic that needs more work, i.e. the ability of a system to maintain its usefulness and to persist when changes occur in the internal structure of the system or in the external environment.

A higher degree of autonomy in software is required, not only to offer improved services but to manage and maintain software systems, which are being increased in number, complexity and importance for our society. Examining data on the cause of computer system outages shows that about 40 percent are operator errors. The reason for this is the complexity of today's computer systems together with the IT operators and managers under pressure who try to make decisions and resolve problems in a short time. Autonomic software can potentially significantly change the way system administrators work, enabling them to work at a higher policy level, thus automating maintenance processes and reducing human intervention and aiding decision making.

4. Fully disembodied computing should be made possible to make services available where and when needed

Related to Challenge 14 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

The world is still not good at distribution and parallelism, where computing is disaggregated or disembodied into components - or “services” - that run simultaneously, anywhere and anytime. This approach has important implications at the hardware level, but also it is considered to be the main research challenge in software services architectures for the following ten years. The EC

should take the lead while being aware that some of existing architectural models (clusters, supercomputers, grids, cloud computing) are nowadays obviously winning the race to become a global solution for computing. Challenges within SSAI are:

- Developing 'languages' (which may involve speech, gesture, mouse-clicks and keyboard) for the end-user to design and develop applications from available services;
- Developing an architectural framework to provide better software components required as services;
- Developing new programming techniques for new services to be usable;

Future system models must be more human-centric. Applications, web-based or not, will no longer come as some big chunk of software, but will be made up of computing services put together by the end-user. This will involve re-writing existing applications. Within this context, traditional operating systems will be deconstructed and operating system functionality will be orchestrated using libraries of services and virtual machines.

Therefore, a new way of providing the ICT will be developed and an adequate architectural framework based on metadata will be needed, capable of managing functional and non-functional requirements. The overarching goal should be to develop new systems engineering techniques to make it easy for service components to execute autonomously and efficiently on highly distributed and parallel architectures.

At the same time, a new hardware environment and software models are needed. On one hand, developing massively parallel processor arrays and power consumption are key issues. New benchmarks will also be needed in order to support these research trends. Furthermore, new programming techniques are needed for the development of new computing components with full scalable parallel capabilities.

5. Model-centric engineering should see further research to tackle complexities in software service engineering

Related to Challenge 1 – Chapter 2 "Challenges for a Software Service-Oriented Europe", Volume 2

Mastering complexity is a fundamental and continual problem in software engineering and has been identified as one of the main challenges facing the European ICT sector. The constantly evolving technological infrastructure presents a major challenge of development and assurance of software systems with their increasing size and complexity. Researchers have been continuously searching for improvements in development techniques by raising the abstraction level of programming languages and automating tasks in order to tackle the complexity issues, thus increasing productivity and software quality. As a next step in this evolution, the software lifecycle is being increasingly handled at the model level, reflecting the ongoing paradigm shift towards Model-Driven Engineering (MDE). Projects like Modelware and Modelplex show that substantial progress has been achieved within this area during the past decade. However, significant challenges still remain, as follows:

- Widespread adoption of processes and methodologies for model-driven engineering;
- Model-driven estimation, verification, validation, testing and simulation;
- Executable models and models at runtime;
- Service infrastructure models and modelling languages.

Firstly, several studies show that the biggest challenge for most businesses in adopting MDE is the lack of MDE processes and methodologies and the immaturity of tools. A recurring challenge with new engineering techniques is scalability, addressed especially to industry needing to adopt model-driven engineering. Another continuous challenge of interest is to transfer additional software engineering disciplines to the model level: estimation, verification, validation, testing and simulation. For example, a model-driven development approach lends itself nicely to the model checking and testing in order to gain insight into the application behaviour early in the development process. This will help to discover design flaws, modelling errors and performance bottlenecks. Having executable models would help in these processes, in addition to further shorten the distance between the problem and solution domains in software engineering. In addition, using models at runtime has seen a growing interest in recent years, where the system model has been manipulated during runtime to enforce adaptive behaviour. Finally, a challenge lies within the language engineering. Abstraction is an important part of tackling complexity and models are the natural next step to take in this direction. Developers need model-driven techniques and domain specific languages that allow them to build and evolve systems based on the use of multiple models (and languages) on various abstraction levels - with well defined relationships and transformations in-between.

Conservative estimates indicate that the yearly tab for failed and troubled software amounts to a figure between $60 and $70 billion in the United States alone[3]. Improved development methodologies will reduce errors and increase productivity of the whole sector.

6. Problem Solving Theory needs to take up Agent Theory to improve modelling of Real Problems

Related to Challenge 9 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

Problem Solving theory concerns complex problem modelling that reflects real world systems. Main characteristics are high complexity by definition, with high flexible interaction between various computational entities representing organizational structures.

Rigid relation structure performed by current software engineering doesn’t reflect the flexibility and dynamism exposed by problem solving nature.

Artificial Intelligence is offering the next step in the research aiming to move closer to a world where dynamism is fundamental. Agent theory with its dynamic structure reflects the nature of such problems and organizations, and is viewed as the natural step towards them: multiple *autonomous* agents to represent the *decentralized* nature of problems.

Dynamically changing relationships are under control of each individual agent which reacts to them, and no central control, overwhelmed by rescheduling activities amongst component agents, is needed to reflect the changes in the system: Agents will make their decisions at *run-time*.

Some crucial points to take into consideration are agent’s *mentalist* notions like beliefs (what agents know), desires (what agent wants) and intentions (what agent is doing).

Two main challenges often come from the same concept that makes this theory stronger, if compared to some others, and in this case we refer to autonomy.

Agents are autonomous by definition and that point of strength can lead to unpredictability in the run time system, as each agent aims for a request that is based on its internal decision process. Determining the ensued result is thus source of unpredictability, and that is the major challenge to

[3] Robert N. Charette: “Why Software Fails”, in IEEE Spectrum Online, September 2005.

be faced up to.

The second challenge in this promising field relates to the emergent behaviour, defined as “the whole is greater than the sum of the parts”. That is the considerable scope for the unexpected collective behaviour and could lead to unpredictability.

Artificial Intelligence agent theory looks like the natural field where computer engineering fits better when dealing with real word problem modelling. Industry dealing with complexity will greatly benefit from agent: examples that come from production plants, and where high interaction among components to be assembled and machines designed to do that, could manage to describe each component and each machine as an Agent.

Research in this field could highly raise EC competitiveness over Problem Solving theory.

2. Policy-oriented Recommendations

GROUP 1: Improved research organisation

REC 1.1: Accessibility of results of European and National projects should be implemented and centralised.

Related to Chapter 2.15 “Further feedback from the consultation process”, Volume 2

The amount of information produced by the EC and the member state funded projects and activities is vast and it keeps growing along with the EU research. Surveys, reports, websites, software, audio-visual material and conference proceedings are just some examples of what is daily produced and published on the web through projects.

The value of such knowledge is recognized to be significant, not only as it represents the state-of-art in many technological fields, but also as it contains tacit and hidden knowledge about research networks, groups, activities and lastly, people who actually embody the European research.

It is a common understanding that, the loss of such implicit relations and the information fragmentation, which results in having many different channels and formats for publishing such content, makes it difficult to fully extract actionable knowledge from this wealth of information.

The European Commission should support the creation of different channels - complementary to CORDIS - to preserve explicit relationships among research people and organizations, and should define and support the adoption of a common standard for describing and exporting project and publication metadata with semantically-rich features, as Dublin Core.

These tools would allow the development of social research networks across different technological interest areas. It would also foster the collaboration between researchers, enterprises, institutions and common people.

Information should be stored and made available to the public on a project-by-project basis, according to the consortia copyright and the IPR protection policies and needs. It should, at the same time, promote the adoption of Creative commons licenses.

The EC should strongly support, not only the knowledge exchange but also the "culture of" knowledge exchange and re-use, building a strong awareness raising policy that entices projects to re-use the project results. In this respect, a system identifying similarities and relationships among different projects before their submission should be introduced in order to allow for an integration of resources and results in a more efficient way, rather than aggregating similar projects after their funding.

A rich semantic description of results and resources would allow both current and future search engines - in a broader conception of this word - to fully group, classify, process and deliver actionable information. This is especially important for the Software and Services fields, given that the availability of the up-to-date information needs to be balanced with a correct understanding of the context, not only at the EU level, but on a global perspective.

REC 1.2: Applied research could be an opportunity for Europe to make profit out of R&D results

Related to Chapter 2.15 “Further feedback from the consultation process”, Volume 2

During the Framework Programme, the IST research investments contributed to the creation of the European world leadership in some research areas, even if they were not always translated into the lead market capabilities in the ICT and applications. There is a need to design and implement a portfolio of measures affecting the R&D and innovation systems, in order to enhance the extent to which knowledge created in Europe is exploited in Europe. Challenges are:

- Taking the necessary steps for converting R&D results into future products and services;
- Facilitating the understanding of coming products and services;
- Developing the entrepreneurial environment necessary to allow gathering of results by industry and society.

It is important to highlight that, between the FP R&D results and the final limp to the market, there is very often a technological gap preventing these results from being successfully transferred to the enterprises and society. Although relevant efforts are being carried out by the European Commission to fill this gap (i.e. the Competitiveness and Innovation Framework Programme, CIP), they focus mainly on the last steps of the innovation chain, prior or directly related to the final take-up of the technologies involved. However, there is still an urgent need for a further applied research, aiming to complete the development and validation of highly innovative products or services raising from the European Framework Programme for Research and Development (FP).

There is an opportunity to improve the environment for innovations by the ICT research through implementation of the applied research, filling the current gap between the FP, which at present focuses on creating new knowledge, and CIP. The objective would be to design a new instrument within the FP to guarantee the continuation of the successful R&D projects with the results needing further applied research, so that they can be ready for their future transfer to the markets or to “make them really work”.

Within this new instrument, the future end-users should be involved more extensively and efficiently. Furthermore, interdisciplinary research could be encouraged in order to create synergies that allow for a better understanding of new technologies, products and services. Finally, means for the real exploitation of the results should be developed (i.e. venture capital).

In the ICT sector there is a net flow of knowledge ranging from Europe to the US (ref). While enterprises often choose Europe as their location for the R&D, the commercialisation of their research results takes place in the US in many cases, that being a tendency further supported by the fact that the top 50 global companies in the ICT sector are predominately American or Japanese. To ensure that the R&D results are converted into growth and benefit for the Europeans, there is a need for a multifaceted demand-oriented effort.

GROUP 2: Facilitating open access for all

REC 2.1: Using Open Standards in order to increase competitiveness and maximise welfare

Related to Challenge 13 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

Open Standards usually become a requirement when interoperability becomes an issue. They are often defined by the procedure under which they are established, e.g. by agreements of industrial players in standard bodies. However, the term Open Standards is ambiguous and allows classifying standards as “open” even if they affect the European software and services sector in an

anti-competitive way. Therefore, the challenge is to define Open Standards in a way that takes their economic effects into account and secures a maximisation of welfare benefits.

Standards should only be considered as “open” if they allow all possible competitors to operate on the basis of equal access to the ability of implementing the standard. This would help to prohibit the anti-competitive effects of exclusive standards.

Standard bodies should counter anti-competitive strategies of companies (or consortia) that own rights over technologies for interoperability, and agree on a strategy in order to avoid monopoly rent-seeking behaviour and to enable increased competition (including SMEs and individuals, such as FLOSS developers) on the basis of the commonly agreed and used open standards. For instance, software vendors could compete on the basis of the commonly defined platforms. This would particularly help SMEs.

Standardisation entities (e.g. ISO) should help to ease accessibility of open standards by allowing free (or very low-cost) access to these standards; and standardisation processes should be facilitated and accelerated in order to reduce time and cost for companies. Otherwise, industries, especially SMEs, will not be willing to adopt open standards.

In general, a preference should be given to Open Standards. MS and the European Commission should reinforce Open Standards in public procurement through laws, guidelines and policies. Research should be undertaken in order to examine how such measures operate in different market segments and under different market conditions.

Such approach would help to increase competition and innovativeness in the European software sector. It would particularly help SMEs that often cannot afford to pay licence fees nor face other difficulties to get access to standardised technologies. Open Standards would increase the number of products, shorten the development cycles and increase interoperability.

REC 2.2: FLOSS should become a strategic component in European economy and in industrial policy

Related to Challenge 10 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

FLOSS is a strategic resource of Europe. However, studies show that the commercial take-up of FLOSS happens in North America rather than in Europe. The reason for this is that there are significant obstacles that hinder taking full advantage of the opportunities FLOSS provides. The challenges are to:

1. Ease the distribution of FLOSS and the take-up of FLOSS by companies
2. Provide the best-practice examples of service-based business models and models to transfer them to SMEs
3. Provide a test-bed and a show case for FLOSS in order to demonstrate its security capabilities
4. Integrate FLOSS as an integral and strategical component in the European industrial policy

Regarding 1: The European Commission, industrial players and the FLOSS community itself should collaborate in order to revise and simplify the multitude of FLOSS licenses, so to ease the take-up of existing FLOSS products by commercial players. This strategy should be accompanied by measures to inform better about the IPR issues related to copyright, licenses and patents. It must be made clear that FLOSS does not imply an infringement of IPR.

Regarding 2: FLOSS business models are service-oriented and have an impact on software related services, as well as on the side effects in fields such as education. The studies show that peer support apparently outplays traditional forms of learning and evaluation, and reinforcement of this impact addresses policy as well as industry.

Regarding 3: Though FLOSS performs very well in terms of security and reliability, possible security threats and how the community can counter them should be investigated continuously. This recommendation addresses policy, industry and community.

Regarding 4: FLOSS should become an integral component of any industrial policy, including explicit FLOSS policies and a requirement to support FLOSS in public procurement and research.

Altogether, these measures would help to secure the sustainability of the European market for FLOSS and to fully tap the strategic advantage Europe has over its competitors in this field. Improving the distribution and take-up of FLOSS through companies would initiate strong economic dynamics and improve competitiveness in the software industry, focusing on services, and side-effects would probably result in substantial spill-over effects of these dynamics.

GROUP 3: Business in the Internet of services

REC 3.1: Free competition should be further encouraged in telecommunications market

Related to Challenge 11 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

Though significant effort in enforcing truly competitive electronic communications market has been made in Europe, especially in the area of fixed networks, the European Commission should pursue its policy to favour unconstrained competition in communications market, in relation to both mobile and fixed networks.

Europe needs appropriate communications infrastructures to work on, as the basis for competitiveness in the area of software services. The current regulations related to electronic communication must be revised in order to have these infrastructures as competitiveness enablers, not barriers. The availability and affordability of broadband is on stake. Both are indispensable, if the software service market is to flourish in Europe.

The availability of broadband can only be reached if mobile and fixed communications network operators generate fair profit that will enable them to recover the investment in network infrastructures, providing incentives to continuously improve networks qualities and capacities. The affordability of access to users and independent service providers can only be guaranteed if the communications networks operators face up to a true competition by other operators. If such competition is unlikely to emerge, due to particularities of the sector, the regulator must step in as in the recent case of roaming fees applied by the European mobile operators.

In the legal process aimed at “forced” sharing infrastructure owned by companies of dominant position, it is essential to provide the regulations that will make possible for the independent service providers to construct SLAs under the same conditions as infrastructure owners. In this context, more effective legal instruments of quality control and enforcement must be deployed.

Furthermore, there is a need to establish rules aiming at guaranteeing easy and open access to mobile networks for independent service providers, which is also applicable to other communications infrastructure owners.

The availability of affordable or free broadband has positive impact on the development of software services market. From this perspective, the availability of free Internet access in public places should be encouraged rather than hampered. Clear rules allowing national and local communities to establish networks providing public access must be established in accordance with the common market, in particular State Aid rules.

It is furthermore recommended that, each time the impact of the implemented liberalisation measure is assessed, the end user’s perspective should firstly be taken in consideration.

REC 3.2: Debate on IPRs protection model for software and software services should be concluded

Related to Challenge 11 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

The community of the European software developers and entrepreneurs is strongly divided in their attitudes towards the IPRs protection strategy related to software in Europe. At the present, there are 2 divergent approaches in relation to this issue. One is underpinned by the belief that ideas behind software should be protected, at least for some time or for a period of approximately 2-3 years, in other words, it would allow inventors to profit directly from their inventions or to gain advantage over their competitors. This is believed to stimulate innovation, as it compensates inventors for the investments made during their research. Supporters of this approach advocate for legal enforcement of the IPRs protection in the form of software patents or some other legal measure different from copyright that would protect, not only the implementation (as copyright does) but also the idea behind a software solution.

The opponents of the above approach say that copyright is enough to protect the IPRs related to software and, like in the case of software and software services, only the implementation should be protected. They argue that protection of ideas behind software hampers the innovation and spoils the competition. Consequently, they claim that introducing patents in Europe would bring more damage than benefit to the European software industry, closing the door to any further innovation.

As reaching the consensus over this issue seems to be very difficult and the above presented views appear impossible to be married to one another, the European Commission should take the role of an arbiter and conclude the endless debate for the sake of legal environment predictability and stability. Before it is decided which software-related IPRs protection model should prevail, whether it is copyright, patent or any "third option” measure tailored for software (see sub-section 4.12 in Vol2 for detailed discussion), it is recommended that the economic consequences of the implementation of any of these measures is carefully assessed. The results of this assessment should be decisive in the choice of which legal measure to implement for software and software related IPRs protection in Europe.

The IPR protection regulation is a pivotal policy instrument for encouraging innovations and managing advancement of innovative economy. Regulation stability and predictability in this context is highly important, given the long-term character of investment in R&D.

REC 3.3: SMEs should be supported by financial and labour resources as well as by providing means of participation in forming research policy

Related to Challenges 2 and 3 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

The importance of SMEs is well-known in European entrepreneurial system: more than 95% of the European companies are SMEs, providing over 2/3 of its employment, accounting for approx. one half of the investment and representing more than one half of its wealth. The ICT sector is not an exception.

Within this context, important efforts were carried out during the 6th Framework Programme (2003-2006), to support SMEs in particular. In accordance to the report on the effectiveness of the Information Society Research in FP6 issued in May 2008 (ref), overall participation rate of SMEs was sustained at over a 20%, which was well above the 15% target set by the European Council and the European Parliament. One of the challenges now is to involve new players, particularly companies with high growth potential.

Besides financial resources, supporting SMEs is also important in other aspects: SMEs should have a voice in the research policy creation, and instruments to really facilitate this participation should be designed and implemented. As there is the lack of financial and labour resources in SMEs for these types of activities, the importance of making use of associations and/or national

technology platforms is higher, as they offer a manageable way. Some attempts have already been carried out accordingly within the European Technology Platforms (ETP), however, specific measures to enhance the results obtained so far should be implemented. This should particularly include the “forcing” measure for a certain number of the SME representatives to participate in these platforms managing boards (and related JTIs). Another option could be the weighting of the outcome from ETPs, in accordance with the representation behind.

On the other hand, workshops like the ones organised by the 3S have also proved to be effective as the policy consultation instruments (especially when addressing SMEs), and therefore could be widely used in the future. It can also enhance the networking possibilities: during the workshops and the follow-up actions, players can personally get to know each other, which results in the wider and more open dissemination of results as well as in establishing new and future prosperous connections.

Finally, there is a need to develop methodologies and measurements that really allow to asses the impact and/or influence SMEs on the European SSAI market competitiveness and performance, both as developers and users. This will allow the using of results and feedbacks, and the improvement of the representational capabilities of SMEs by selecting the effective tools. Therefore, SMEs will realise their importance and will be able to vindicate their rights and opinions.

GROUP 4: (A policy for) people in the Internet of services

REC 4.1: Pan-European interoperability of e-signature infrastructures would be a pivotal enabler for European software services market

Related to Challenge 6 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

Trusted relationships building over the digital networks requires widely accessible technical infrastructure for identity management, authorization and authentication handling along with trust-establishing mechanisms. Though initial trust-building over the network is still a social and business challenge, the technologies allowing for the remote identification of entities and secure exchange of information, are already in place. Still, the lack of interoperability of policies and technical solutions hamper the fast deployment of common electronic signature infrastructure in Europe [Vol. II 4.6]. Interoperability of electronic signature based on PKI, which allows for secure identification, authentication, message integrity, confidentiality and non-repudiation in over-the-network transactions, must be pursued across all the Member States of the European Union. The major issue is currently the interoperability among the various existing Certification Service Providers (CSPs), at both national and international level, in terms of technical, policy, business, and legal aspects. Though the Directive no 1999/93/EC introduces a basic legal framework for Europe-wide deployment of electronic signature, a cross-border interoperability is not encouraged sufficiently and is not considered to be the key priority by the member states and national CSPs, even if it was pointed out by many investigations including IDABC Report on eSignatures (Nov2007).

It is recommended to take into consideration the European parliamentary elections as a driver for pursuing eSignature infrastructures interoperability across Europe. The pan-European signature certificate validation platform should be considered in this direction, in order to support cross Member State PKI certificate validation and establish trust between existing CSPs. Lessons could be learned form the Spanish case of '@firma' MultiPKI Validation Platform for eID and eSignature Services developed by the Ministry of Public Administrations of Spain. As in the Spanish case, open source technologies and open standards should be leveraged for establishing an affordable and secure and, therefore, accessible and efficient, technical infrastructure. Two issues are of strategic importance with regard to this infrastructure: it must meet the highest security standards and it must support eSigning by means of mobile terminals.

The European parliamentary elections allowing for electronic voting would, not only push technical and policy interoperability, but are also expected to promote acceptance and to encourage more widespread usage of eSignature by EU citizens.

Benefits of a widespread adoption of eSignature in Europe are evident. Electronic signature not only increases security of transactions and lowers significantly its costs, including paper and communication and administration costs, but it brings savings related to the automation of processes, reduction in process steps, speed of transaction, ease of document processing etc. For example, after the ESIGN Act had been passed in the US, the American financial services companies that introduced electronic signature and secure documents, reported a decrease in processing time of about 50% and transactional costs decline of up to 75%[4]. Similar efficiency gains can be expected in the majority of organisations, including public administration.

REC 4.2: European Union should take leadership in research on Identity Management and privacy-aware system to have civil rights promoted

Related to Challenge 12 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

While technology is putting a high effort in enhancing the web capability, less seems to be done in the direction of how to represent each of us as individuals on the cyberspace. Though the problem is not technical, it is fundamentally a social issue.

Communication over digital networks lacks "personal identity" and that is why the trust in Internet interactions is compromised. Building identity and trust into the Internet architecture would facilitate introduction among people towards online citizenship.

Persistent identity is aimed at as a merge of 'verification feature' and 'aggregate information' containing, along with the purchase history, interests, wishes and so on. Identity providers will provide a choice to select from for the users who register, raising an online identity market.

Federated network would allow users to move in the cyberspace using the new 'digital identity', resembling the behaviour in the real world.

Trust would be based on the “trusted thirty party” and “six degrees of connection” principles, as long as references to interests or people are put inside our digital identity.

In this landscape, where a subtle challenge is the scepticism that would prevent giving personal detail to any provider, main challenge is to get engaged in this process and to try to influence or have public interest in it. As the steps are taken to fulfil commercial needs, the challenge is to raise awareness on the behalf of Public Commons in order to sustain civil rights.

Still, how the individual’s digital profile will be compiled, either automatically or manually, remains a hot issue to challenge.

To raise an identity market opposite a central control is also a challenge to be faced up to, in the honour of the “circle of trust” and libertarian, having the user to decide what information to maintain and who can access it.

The key challenge for this architecture is for the users to control and maintain their own identity status and tracking history.

The European Commission is called to assist this process, as the main risk in public commons is not even to be considered at tables where decisions are made. If civil society context is left apart, credit and business history would only be debating the rules and standards to be used. Legal Influence needs to be forced over European governments to protect social right, and same actions need to be taken at European level.

[4] K. Pauli, Electronic Signature and Secure Forms in the Insurance Industry: Taking the P&C Pen to the Web, TowerGroup, Oct 2007.

REC 4.3: Privacy as commodity - A study on costs and benefits of establishing conditions for privacy trading in Europe is needed

Related to Challenges 11 and 12 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2

Traditionally, privacy has been perceived as a right which cannot be traded. Modern economics casts some new light on privacy[5]. It has been noticed that privacy, defined as the ability (and the right at the same time) of an entity to control the disclosure of information about oneself, could be traded as other commodities, given the fact that access to private data has real market value.

Furthermore, privacy is perceived by young generation of Internet users more liberally and is pragmatically compared to older generations. These users are willing to compromise their privacy to large extent in order to gain other benefits, e.g. increased safety, self-expression, self-promotion, social networking, free goods or services[6]. This makes the concept of privacy as a commodity and is now culturally more acceptable than ever.

To be able to establish a proper market for privacy trading, three conditions must be satisfied. Firstly, privacy must be protected by law, which is already the case. Secondly, privacy must be quantified, i.e. different private data access levels must be defined by law or industry standard, which is partly achieved. Thirdly, private data flow and use must be transparent to the extent which enables its owner to track it or, in other words, the owner of the private data must be able to verify at any moment that his privacy is being explored in accordance to a relevant agreement.

The above facts pose challenges of political, legal, economic and technical type, given that such a system requires social acceptance, legal enforcement, deep understanding of privacy economics and technologies allowing for privacy rights management and audit.

Establishing a well-regulated market for privacy trading in Europe is expected to bring benefits to the society, such as: creating new business opportunities and jobs as well as enabling better control over private data, i.e. privacy protection to all citizens, including those who are reluctant to trade privacy. As for software services, it would particularly facilitate SLA negotiation related to privacy. However, the economic viability of such market is still uncertain due to the expected high cost of transactions, administration and maintenance[5]. This is why further studies on this subject are needed, in particular an analysis of costs and benefits, implementing such a market in Europe, a study on possible models for such a market and technologies required to implement it.

[5] Kenneth C. Laudon, Markets and Privacy, Communications of the ACM, September 1996, Vol. 39, No.9.

[6] Challenge 12 – Chapter 2 “Challenges for a Software Service-Oriented Europe”, Volume 2.

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