TOWARDS A EUROPEAN SOFTWARE STRATEGY

REPORT OF AN INDUSTRY EXPERT GROUP

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DG Information Society and Media - Directorate for Converged Networks and Service –

"The Internet People"

European Commission
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Contents

Rapporteur's note:

This draft of the report aims to reflect the consensus of the Group. The focus is on providing background/context for the reader and summarising arguments in each of the sections. References to views/contributions of individual organisations have been removed. Gaps and uncertainties are indicated in [square brackets] and by … Comments on the logic of the document are welcome.

No concrete recommendations are made at this stage but notes around recommendations from the first meeting are included. Further material is available in the documents to be provided for each Working Group.

We should think about a unifying idea which could serve as the report's main message and title. I suggest: ***Rebooting Europe's Software Industry: Towards a European Software Strategy. Report of an Industry Expert Group***

Mike Sharpe, 9th February 2009, mike@msconsulting.co.uk

1. Introduction

Software is everywhere today. It is in the personal computers we use to write emails or make calculations; it is in the mobile phones we use to call friends and business partners; it is in the games consoles that our children play at home. Software is in the cars we drive, in the e-health applications used by our doctors, and in the sophisticated systems professionals use to track criminals, manage our transport networks, and keep the lights on. But because software is ubiquitous its significance to Europe is not always easy to identify or appreciate.

Yet the instrumental role of software in the digital economy should not be overlooked. With market revenues of over €200 billion in Europe and growth rates of between 6% and 8%, software is the largest and the fastest-growing segment of the information and communication technologies (ICT) market. Furthermore, software is embedded within the majority of products we use today and a key enabler for innovation, growth, and employment in almost all sectors of the economy. Software has become the nerve centre of all modern economies.

In her speech at the Truffle 100 event on 19 November 2007 Commissioner Viviane Reding both recognised the importance of the software industry and indicated her willingness to discuss how to leverage its contribution to the Lisbon strategy. The thrust of her analysis was that Europe is punching below its weight in software. Despite excellent skills and research, European companies rarely become global leaders. Europe is a major producer of in-house and embedded software but remains a large net importer of packaged software. Things are changing, however, with the shift towards new paradigms, such as Software as a Service (SaaS) and the Future Internet, where Europe could still take the lead. She invited the industry to come forward with concrete ideas to help put together a European Software Strategy to realise this potential.

This document represents the European Software Industry's response to that call. It presents the collective views of leading industry experts – software vendors, SMEs, business associations and analysts - who have engaged in a process of open discussion and exchange. At the invitation of the European Commission[1], this group has collaborated in reviewing the status of the industry, identifying the main issues facing it and formulating a strategy for addressing them. The group as a whole met on [two] occasions during the period January – April 2009, while individuals also participated in a series of 'working groups' physically and online. Group members are listed in Annex 1.

Our main conclusion is that **Europe still has all to play for in the software market**. The innovation necessary to create economic growth, drive societal change and address environmental challenges relies on ICT, at the heart of which is software. The sector is undergoing massive change, with developments such as SaaS and Service-Oriented Architectures (SOA) revolutionising the way software is produced, applied and consumed. At the same time, new paradigms are emerging around the Future Internet where software will be an essential pillar. This is a new world, with new rules and Europe must compete. **Software should be a key part of an information society strategy for Europe post-i2010**.

[1] Specifically, these discussions have been led by DG Information Society & Media, Unit D.3 Software and Services Infrastructures and Architectures and have also involved other Commission services.

Why do we need a European Software Strategy?

Europe has made much progress in ICT over the last decade and software has benefited from this. In the internet and telecommunications fields, deregulation and vigorous policy making have boosted the ICT sector, including software. The ICT Task Force was one of several initiatives taken under the European Union's industrial policy, which aims to help create a more favourable environment for business in the EU and was designed to complement the Commission's main ICT-related initiative, i2010. The European software industry participated in this effort[2].

The EU's most impressive effort in the field of software is the priority given to embedded software that has led to heavy investment in the industry-led ARTEMIS initiative[3]. However, this covers only a discrete – but very important – sub-sector of the software industry (see below).

Europe's packaged software sector also faces very specific challenges, such as a need for a rare mix of skills, atypical innovation and sales cycles, and software piracy. Meanwhile, it is clear that the future paradigms will be very different from the present, with profound impacts on all of Europe's software industry. This report highlights the issues and demonstrates why the EU's demand side approach has to be complemented by a software-specific supply side strategy.

To date an absence of policy in this area has made it difficult for the Commission and policy-makers to act. Yet industry needs a clear policy framework within which to plan and operate. **The time has come to reboot the European software industry**.

[…possibly list specific objectives around issues such as:

- *Maximising the impact of software as an enabler of competitiveness in post-industrial society and economy;*
- *Try to redress the balance in import/export of software and related services;*
- *Mitigating Europe's dependence on non-European providers and technologies.]*

What is Software?

The creation of software encompasses many different activities which together form the software value chain. The main aspects include: architecture (consulting, analysis, concepts); developing code (i.e. programming); testing; implementation, marketing and distribution; maintenance (e.g. software update management); helpdesk and training & education.

The software sector actually comprises several different types of companies:

- **Independent Software Vendors** (ISVs, also referred to as "Packaged Software companies"): These are producers and vendors of commercially available "packaged software". They offer packaged software through sale, lease, or rental, or as a service. Revenue typically includes fees for initial and continued right-to-use software licenses.

[2] For ICT Task Force see: http://ec.europa.eu/enterprise/ict/policy/taskforce/reports/icttf_report.pdf

[3] ARTEMIS is a Joint Technology Initiative launched by the EU to support research in embedded software systems and services. See http://www.artemis-ju.eu/

- **IT Services companies:** These are companies for whom a major part of their business consists in developing custom software applications that are turnkey solutions for a specific client. This is a very different business to packaged software, although many small companies in Europe sell both.
- **Embedded systems software:** Embedded software is computer software or firmware which plays an integral role in the electronics it is supplied with. It is written for machines that are not, first and foremost, computers. Manufacturers in a wide range of sectors include embedded software in their products. Key users include electronic components, mechatronics, consumer electronics, automobile, aerospace, defence, health, network & telecom equipment.

Embedded software is very different to packaged and custom software; specifically, it has no user interface with which to interact. Embedded software already accounts for a significant part of development and production costs in these industries and will drive all major product innovations in the years ahead. Today, European manufacturers have a strong position in the field of embedded systems and software and major European initiatives – such as ARTEMIS – have been launched to support these activities. For these reasons, embedded software should not be a priority under a European Software Strategy and is not discussed further in this report.

Our focus is on **packaged software and related services**, and the **role of software in the evolution of networks, especially the Future Internet**.

2. Software and Services in Europe: Sector Overview

2.1 The European Software Market

The European software industry is a significant contributor to the European economy and a key driver of innovation and change. Spending on software and related services is worth around €258 billion to the European economy, or around 2.6% of GDP[4]. The software industry creates tax revenues, is a major source of high-value jobs, and has downstream multiplier effects throughout the economy.

The observation that much of Europe's poor growth performance compared to the US is due to lack of investment in ICT has been widely made. In summary, ICT accounted for as much as 0.4 percentage points of the 0.52 point difference between GDP per head growth rates in the US and the euro zone big three (Germany, France, Italy) in 1995- 2002[5]. The European ICT R&D *expenditure* per inhabitant is only about one third of the amount spent by the US or Japan[6]. And the total and per capita ICT R&D *investments* are significantly larger in the US and in Japan than in Europe. Europe is unlikely to close this gap unless significant progress is made in areas such as skills, innovation and competition.

[4] IDC Economic Impact Study 2007,"The Economic Impact of IT, Software, and the Microsoft Ecosystem on the Global Economy." October 2007. Sponsored by Microsoft [quoted by CompTIA]

[5] "Reaping the benefits of ICT: Europe's productivity challenge", The Economist Intelligence Unit, 2004 [quoted by NESSI]

[6] "Recherche et développement en sciences et technologies de l'information dans les grands pays industriels", Rapport CSTI, France, 2003, 2005 [quoted by NESSI]

It is not our purpose here to give a detailed statistical picture of the European software market. Such analyses are readily available elsewhere. A few selective figures serve to illustrate the position, however.

- **Software is a growing sector:** The software market is growing more rapidly than the ICT sector as a whole. According to one analyst [ref 4], between 2006 and 2011 in the EU software will grow at a compound rate of 6.9% per annum, versus 6.0% for the ICT sector overall. Growth is particularly strong in Central and Eastern Europe, which has some of the fastest ICT growth worldwide (CAGR of 20.5% between 2002 and 2006, and 14.1% predicted for 2006-2011).

- **Software creates value**. The annual revenue per employee in the software industry is over €100,000 per employee, which is among the highest rates in the whole economy[7].

- **Software contributes to greater productivity**: Use of software is one of the key drivers of productivity growth in almost all European economic sectors. Packaged software and related integration and consulting activities are a key source for productivity improvements in service industries, such as retailing, transport and logistics, and professional services. Embedded software defines the attributes and functionalities of products and services in sectors such as automotive, aerospace, medical equipment, automation, telecoms, and consumer electronics.

- **Software is a major focus for research and innovation:** Total investment in software R&D from 2002 to 2015 for key sectors is forecast to grow by 128% to €133 billion, which would almost double the growth rate for these sectors' total R&D (74%). European packaged software companies in the Truffle 100 have a collective workforce of 175,000, of which 38,000 are employed in research and development.

- **Software is a source of high-value jobs:** The benefits of software are felt most dramatically in terms of employment. In 2007, the EU software industry employed 4.3 million people, 55% of all ICT jobs. Employment is forecast to grow at 5.0% per annum for the EU as a whole, and around 14% p.a. in Central and Eastern Europe. *[NTAs quote 205,000 (only) for employment in packaged software, but this seems to weaken the case?]*

While official statistics and market studies focus primarily on proprietary software (where data are easier to obtain), open source software (OSS)[8] is now a key feature of the European software market and of increasing economic significance. One study on the economic impact of OSS, prepared in 2006, shows that European firms have invested an estimated €1.2 billion in developing OSS and these firms have a total of 565,000 employees and €263 billion in annual revenue (it is unclear if the firms produce only OSS or cover multiple platforms)[9]. The same study reports the 'notional value' of OSS investment in Europe at €22 billion.

Europe represents around one third – 36% - of the global software market (Figure 1). However, Europe's overall trade position in software products is poor. Around two-thirds of the packaged

[7] "Finnish National Software Industry Survey 2008", http://www.sbl.tkk.fi/oskari/ ; and "Etude économique sur le secteur des éditeurs de logiciels en France", OPIIEC, 2006. [quoted by NTAs]

[8] Sometimes called free/libre/open source software or FLOSS. This is discussed further in Section 4.

[9] "Study on the Economic Impact of Open Source Software on Innovation and the Competitiveness of the Information & Communications Technologies Sector of the EU." UNU-MERIT, the Netherlands, 2006. [quoted by CompTIA]

software sold in Europe is produced elsewhere. Europe is therefore a net importer of packaged software, although there are differences between countries. Overall, reliable data is lacking.

…pie chart to be added based on EITO 2007 figures

According to OECD figures, in 2002 59% of the software produced in Europe was developed internally (by user organisations), 24% was spent on packaged software and 16% on outside subcontractors.[10]

2.2 The European Software Industry

Within packaged and custom software three major sub-segments can be identified:

- *System infrastructure software*: Proprietary as well as open operating system and system-level software used across all types of hardware from mainframe to PC.
- *Tools*: Collaboration and content tools; database engines; business intelligence infrastructure; development tools; and integration platforms.
- *Application software*: Office automation, business applications and other applications. Business applications are process-oriented applications such as financials, Human Resources Management (HRM), Customer Relationship Management (CRM), Supply Chain Management (SCM) as well as industry-specific solutions such as billing (telecom, utilities), core banking systems, etc. Other application markets include graphical software, embedded systems, and other technical software.

Games and leisure software is an important category of software application but is generally excluded from industry definitions because these are seen as pure B2C products and artistic creations rather than as packaged software (which is mainly B2B).

Europe's software industry is fragmented and faces fierce competition

Out of the 100 largest software-companies worldwide most are US-based and have a global presence[11]. Only eleven are headquartered in Europe[12]. In 2007, only two out of the top 10 companies (see table) and five out of the top 25 obtained 100% of their revenues from software[13]. One is well known for its on-line sales and the other is a leading playing in software games.

Rank	Software company	Software revenues (Million $)	Total revenues (Million $)	%
1	Microsoft	37337	45494	82%
2	IBM	18204	91424	20%
3	Oracle	13099	16489	79%

[10] Internal Reflection Group on Software Technologies, Embedded Systems and Distributed Systems, DG INFSO, 2002 [quoted by NTAs]

[11] The full list is available at: www.softwaretop100.org. The 100 largest software companies in Europe can be found in the Truffle 100 study available at: www.truffle100.com/europe/downloads/2007/Truffle100_2007.pdf

[12] These are: SAP (4), Dassault Systèmes (20), Sage (36), Misys (37), Business Objects (40), SoftwareAG (47), Philips (49), Cegedim Dendrite (57), Unit4Agresso (64), Exact (71) and Visma (79).

[13] The companies are ranked according to US-dollar "software revenues". Revenues from support activities (also known as 'maintenance') and subscription are included but those from service activities, such as consultancy, installation, offshore and custom software development and system integration, are not.

4	SAP	8717	12408	70%
5	HP	4115	93103	4%
6	Symantec	3879	3879	100%
7	Computer Associates	3514	3887	90%
8	Electronic Arts	3216	3216	100%
9	Adobe	2484	2577	96%
10	Nintendo	2418	7253	33%

In 2005 there were an estimated 18,000 European packaged software companies[14]. Most of these had less than 15 employees and €1 million in revenues. Companies generally rely heavily on local (i.e. national/regional) markets. US companies are at an advantage here due to a large home market and common language.

Consolidation is moving up a gear, but the European industry is still highly fragmented. In Western Europe, the Top 10 players account for 46% of the software market[15]. The Top four, consisting of the four biggest global players, reach 37%. The share of the Top 10 has risen in recent years as consolidation has accelerated at the top of the market. Several top European software vendors have been acquired, mostly by US companies.

Finally, apart from industry-level aggregations, we note that the quality of statistical information on the European software market and sector is poor and needs to be improved.

[…if available, could add data on company formations & entrepreneurial activity; R&D investment]

3. Business and Technology Trends

3.1 The Changing Software Landscape

The software market is facing a period of unprecedented change. New technologies and business models with mass appeal are being introduced to the market almost on a daily basis. Software has reached a critical mass and has become ubiquitous in many aspects of 21st century life. As a result the driving force of consumer demand will continue to push this sector to reach new horizons for some time to come. New technologies also bring with them new ways of doing business which can occasionally make existing regulation or incentives obsolete.

Key business and technological trends affecting the software market include:

- **A proliferation of software-based devices and infrastructures:** The number and variety of computing, communication and purpose-built devices is growing and systems are becoming more complex. Users are looking for integrated solutions that include offline software, services, mobile devices or large servers, with emphasis on sharing and reuse. This creates opportunities to create new services that connect the various pieces of the ICT infrastructure, be it in a

[14] IDC figures [quoted by NTAs]

[15] EITO figures [quoted by NTAs]

manufacturing process or consumer offering. Each combination creates unique offerings for the user.

- **Rising market expectations:** As devices become ubiquitous and diverse, perceptions are changing of what software should look like and how it should be applied. There is a growing awareness amongst users of what software is capable of, and of how it needs to be aligned to business objectives. At the same time, new business models are having a profound effect on the economics of software and service development. The net result is that customers expect software to be high quality, easy to use, and affordable (and at least part of the service to be free of charge).

- **Increasing commoditisation of software:** Software is increasingly independent of the hardware platform and can be composed as needed. This, together with rising market expectations, has reinforced the trend towards specialisation amongst software producers. It providers users with greater value for money and has enabled more competitors to enter the market.

- **Software as a source of systemic innovation:** Software innovation is now systemically linked to innovation in other sectors. The use of software in these other sectors is key to their competitiveness and a major enabler of the post-industrial society and economy. On the other hand, innovators in software technologies are mainly driven by opportunities or needs in application domains. Innovation and application are thus two interdependent components in a system, which depend and feed on each other. Conventional linear models of innovation, based on a one-way flow of R&D results towards new products, processes and services, are no longer effective.

- **Blurring of sector boundaries:** The boundaries of the software industry are increasingly difficult to discern. On the one hand, technology enables users to create their own content (and increasingly services too) and share it with others ('Web 2.0'). This opens up a host of new opportunities and issues, such as content ownership and rights, and quality of user-generated information. Traditional vendors also face competition from another direction: companies from outside the sector (e.g. banks) that have developed their own software solutions and are seeking to capitalise on their investment.

3.2 An Industrial Revolution In Software

These market and technological trends effectively amount to a revolution for the European software industry. A wave of consolidation is sweeping the industry as companies seek to safeguard their position within a maturing market. New business models are emerging as companies try to gain competitive advantage and seek out new niches. And innovations such as virtualisation and software-oriented architectures (SOA) enable software to be increasingly sold as a service.

Consolidation creates new opportunities

As noted above, the European software industry is highly fragmented and relies heavily on local markets. While there has been some consolidation, it has been slower than in other sectors. The main driver here is the "speed to scale". Acquiring another software producer can also be the best

way for a company to expand beyond national borders, to enlarge its customer base and to implement diversification strategies.

The degree of consolidation depends very much on the maturity of a given market segment. Every year, new technologies and innovative software are produced by young companies that are quickly able to become leaders in these new markets. Once the market has developed consolidation takes hold and, very often, they are acquired by one of the top software vendors (usually from outside Europe). But in this fast evolving environment, the top players of today will not necessarily be the top players of tomorrow. **Europe, therefore, still has the opportunity to establish top positions**.

The challenge, essentially, is how to improve interoperability for software users while guaranteeing a more open market for software suppliers. Business models/eco-systems, SME policy, standards and interoperability, intellectual property protection, and fiscal incentives for research are all important issues here which are addressed in detail in the following sections.

EU-level initiatives such as the European Research Area (ERA), the European Technology Platforms (ETPs) and the Joint Technology Initiatives (JTIs) are helping to integrate European efforts and reduce fragmentation, at least within the research domain. These could be a means to encourage SMEs to work with regional centres and networks. In addition, the transition to the Future Internet is an opportunity to reinforce a Europe-wide approach (see Section 9). *[…this para might be better in the SMEs section?]*

Business models are converging

Traditionally, developers of packaged software create value in one of two ways:

- *Licensing software*: The software company develops a software program and sells copies of the program via its sales force, distribution partners, systems integrators, stores and/or the internet. This business model leads software companies to grow as fast as possible ("speed to scale") to be able to recover their initial fixed costs (e.g. R&D), create *de facto* standards and then increase profits by benefiting from economies of scale with both a leadership position and with limited software development and reproduction costs.
- *Subcontracting & outsourcing*: A specialised company develops or tests a software programme (or part of it) as a subcontractor. By outsourcing aspects of the development process, the software vendor tries to reduce its time-to-market and/or be more cost efficient or more innovative.

Over recent years, other models have emerged, primarily:

- *Open source software (OSS):* The software company develops programmes and makes the source code "public". Other companies or individuals can improve the software or adapt it to their needs. Companies are allowed to add value for their clients by offering implementation and maintenance services. Open source businesses thus generate revenue from services such as systems integration, support, tutorials and documentation (generally through subscription models). OSS can also be sold "as a service" by Application Service Providers (ASPs) or as a component of a packaged software by ISVs.

- *Software as a Service (SaaS)*: A software company develops and owns software that is then delivered and managed remotely by itself or by an ASP (see further discussion below).

New business models based on open source, SaaS, and advertising-based web applications are all in evidence. Indeed, the traditional distinction between 'closed/commercial/proprietary' models and 'open/free/non-commercial' models no longer applies.

Models are converging as companies become increasingly active outside of their traditional parameters. So-called 'commercial' software providers are developing and offering open source programs and components, while companies typically considered open source are offering commercial software for sale. Further, the two are actively working together to produce software. For example, Red Hat, the best-known open source producer also ships some commercial software products that run on top of its open source platform. IBM offers integrated open source and commercial solutions and even Microsoft, typically viewed as the archetypal commercial software vendor, actually produces products along a spectrum of software models.

Software is becoming a service

Software-as-a-service (SaaS) refers to a model where functionality is delivered over the network and users pay for what they 'consume' rather than per copy or by license. The SaaS market is still embryonic: according to IDC, global SaaS spending in 2007 amounted to $5.7m, of which the European market accounts for around 10%. But explosive growth is forecasted (over 50% per year) and it is expected to become mainstream within a few years.

This is more than just an incremental development: SaaS represents a new paradigm for software provision. It offers the potential for users to be able to build and evolve their systems more flexibly and for new suppliers to readily join a pool of service suppliers and compete on an equal footing with installed suppliers.

Such a trend would require major change from European companies offering packaged software. Shifting to a pure SaaS business model implies a complete change to revenue recognition and a strong investment in new skills to move from a product-oriented to a service-oriented company. For instance, they would increasingly need to re-craft their sales proposition and retool their sales approaches to deal with the increasing number of technical queries.

Software: The Driver of the Future Internet

All of these trends are important in their own right, but they come together in a very significant way: shaping the future of the internet. Software will drive the next generation of the internet as it grows to occupy an ever-more central position in our society and economy.

The internet is now an essential economic and social infrastructure, that supports not just consumers and domestic users but also businesses. This business aspect is becoming ever more important, influencing the way companies (and the public sector) operate in the future.

The Future Internet is a huge opportunity for Europe but also a huge threat to major parts of European industry. This in itself justifies a key role for the Future Internet in European policy. We return to this issue in Section 9.

4. Open Source Software

Over recent years, open source software (OSS) has become an established feature of the software landscape. Having shaken off its 'garage'/hobbyist origins, OSS is now a credible alternative to proprietary offerings and in some areas is the only alternative to dominant commercial products. A lack of 'market confidence' remains, however, due to concerns such as availability of support, skill levels, understanding of licence terms, and liability. OSS tends to push the integration function into the hands of users as opposed to vendors, as is the case for commercial products. Users are then exposed to issues, problems and extra support and integration costs which can be off-putting.

Open Source can be seen in a number of different ways: some see it as a business model that reinvents the whole value chain; others view it merely as a software model, an alternative way of writing and distributing code. The overall trend is towards mixed models, where companies offer both proprietary and OS offerings to meet customers' needs.

OSS is often quoted as a European success story; the facts do not entirely bear this out, however. While European experts and contributors are prominent and highly regarded in the OS community worldwide, many of the OS technologies developed in Europe are exploited by US companies. According to one estimate, 90% of the business derived from OSS is generated by non-European players.[16] In addition, most OSS consortia – the non-profit organisations managing OSS development and marketing – are based in the United States and funded by US IT companies. Europe must address this imbalance. **We need to exploit OSS better and make sure the benefits stay in Europe, with European developers, users and entrepreneurs**.

Open source can stimulate innovation and open up a new generation of software products. But the market still lacks a thorough understanding of OS business models and how they can develop along a planned roadmap. Without action there is a very real prospect that the next generation of OS software will be developed and supplied from elsewhere. There are specific issues around public procurement. European legislation requires that public procurement be founded on principles of technology neutrality, but OSS solutions are not always given a level playing field. Some argue that the application of RAND[17] terms for intellectual property discriminates against OSS.

How can Europe help here? While it would not be appropriate to favour one part of the software ecosystem over another, there does appear to be some scope for policy action. Aspects such as simplifying licensing, developing skill sets, and ensuring European research leads to OS results are all areas where policy action is justified to enable Europe to nurture the potential of open source.

…[recommendations:

- ***either** specific recommendations around the above issues e.g. promoting OS in public procurement and promoting role of OS service companies*
- ***or** say the issues will be addressed within the sections on public procurement, IPR, entrepreneurship, skills, etc)].*

[16] *MS comment: NESSI figures, full reference needed. Is this consistent with CompTIA's claim: "an estimated €1.2 billion has been invested by European firms in open source software development" ??*

[17] RAND: 'Reasonable And Non-Discriminatory'

5. Standards and Interoperability

Standardisation plays a crucial role in the development of the software industry, as it is a key element for innovation and interoperability. Standards can help to ensure that an ICT product or service is 'fit for purpose', and that competing products and services can communicate with one another and share information. As a result, standards can increase users' efficiency, reduce transaction and implementation costs, and promote competition. In new fields, such as the Future Internet, standards could be pivotal in giving Europe a better competitive edge.

Due to the rapid evolution of the industry, many standardisation developments have been undertaken by industry consortia outside of the official standardisation bodies[18]. Formal standards processes tend to be too slow for a fast-paced market such as software. Industry-based consortia and other forums are seen as being able to respond more quickly to market requirements and so have been much more widely used in developing software specifications. In some cases this has led to a dominant proprietary platform becoming the *de facto* standard.

While both 'formal' and 'informal' processes co-exist, this fragmentation has led to a need for an in-depth reflection on the coherence and efficiency of the entire standardisation landscape. Calls by customers for greater interoperability among software and other ICT products and services have also raised the question of whether standards could be better used in this sector.

Although standards can help facilitate interoperability[19], they are no panacea. Standards change over time, as do the products in which they are used. The evolution cycles of the standard and the products that implement it are rarely in synch, leading to different generations of the standard being enacted, which brings its own interoperability challenges. These choices may have been made by engineers for the best of reasons – to improve the welfare of consumers. The aim should be to foster interoperability that is practical and meets market needs. We must guard against laws that define interoperability too strictly and so drive flexibility out of this constantly changing process.

Openness is a key issue here. In core areas of software and service interoperability, the openness of standards determines whether technology development becomes locked-in by a single proprietary technology, or can be pursued openly. Only open standards[20] permit all potential vendors to enter a market, develop innovative competitive interoperable products and offer choice to European consumers. Thus, **open standards should be at the core of a strategy that seeks to promote an innovative and competitive European software sector**.

For the software industry, standards have to respect three major principles: their initiation and drafting have to be market-led, their acceptance and usage have to be voluntary and flexible, and the development process should be open and transparent, allowing for implementation in a range of

[18] The main European and international bodies in software are: the European Committee for Standardisation (CEN) and the International Standardisation Organisation (ISO). Examples of industry consortia and forums include the Motion Picture Experts' Group (MPEG), the Institute of Electrical and Electronic Engineers (IEEE), and the Worldwide Web Consortium (W3C).

[19] Interoperability has a number of dimensions here: it can be applied internally among the software-based systems within an organisation; between the systems of different organisations, such as within supply chains; and for interconnecting future systems with existing systems ('future-proofing').

[20] An open standard is a standard that is publicly available and has various rights to use associated with it, and various properties of how it was designed. It is not the same as open source - open standards can result from either OS or proprietary routes.

competitive products to ensure consumer choice. These factors are especially important for SMEs, both as developers of technologies but also as users. Moreover, given the international character of the industry, it is important for Europe to focus its efforts on benefiting and influencing the development of international standards, rather than on promoting European standards once they have been adopted. This should also apply to the reference of standards in public procurement.

The European Commission has a comprehensive and mature policy framework on ICT standardisation. This includes technical activities led by the ICT Standardisation Steering Committee, policy work on ICT standardisation led by DG Enterprise[21], and proposals for a European Interoperability Framework (EIF) for online government services. This work has led to a broad conclusion that **the European standardisation system needs improvements rather than a fundamental reform. Any additional measures in this area arising from the Europe Software Strategy should reinforce these efforts**.

In conclusion, it is clear that standards are essential in achieving interoperability which is vital for the success of the European software industry in world markets. On the other hand, standards on their own will not drive innovation and in our view are of secondary importance to issues such as entrepreneurial capacity and skills.

[…Recommendations: along the lines of:

- *measures to facilitate pooling of resources in standardisation efforts, such as through consortia?*
- *noting the good progress achieved in standardisation on eSkills, which could serve as a model.*
- *…other points from above?]*
-

6. Small and Medium-sized Enterprises

Small and medium-sized enterprises are considered the backbone of the European economy, providing jobs for millions of European citizens and the basis for economic innovation. As set out in Section 2, they also form the backbone of the European software industry, a situation that is closely related to industry and market fragmentation. One consequence is that they are often dependent on large software companies headquartered outside Europe.

Not only does Europe lag the US in terms of commitment to IT innovation, but India and China are rapidly catching up[22]. To compete in this global marketplace Europe's software SMEs must focus on quality, innovation and competitiveness.

[21] For example, "EU Study on the Specific Policy Needs for ICT Standardization", July 2007, and "The Way Forward" document prepared in view to the Open Meeting of February 2008

[22] "Venture Capital, Innovation and IT; Driving forward the knowledge based economy", Library House June 2007

European software SMEs have been successful in creating ideas and developing products, but they have been rather less successful in creating businesses to take those products to market. The main problem is lack of management and marketing skills, resulting in under-performance at the crucial commercialisation phases (product marketing, packaging, customer support services, etc.). Excellent R&D is no substitute for excellent development strategy, marketing and a channel policy. Indeed, each stage of a software company's growth is critical, from seed to early stage, domestic development and international expansion. Public policy should target and encourage companies that invest in the complete innovation chain: idea, concept, development and localisation, validation-pilot, go-to-market – consistent, of course, with international trade rules.

Europe should encourage investment in innovative companies with special attention to high-growth companies (the so-called "gazelles"). This will help accelerate the adoption of software-specific measures by Member States. This, in turn, raises the **need for a single definition of "innovative enterprise"** that would qualify for this sort of support. Such companies should be "innovation-centric" – as opposed to R&D centric under existing definitions - and should also include medium size enterprises.

Studies (e.g. eBusiness Watch) have shown that policies for ICT are vertical (sector oriented) whereas support actions tend to be local/horizontal (sector generic)[23]. Hence there is scope to improve innovation policy for the sector. The EU has many experiences in associations, networks and clusters of ICT and software SMEs, but still relatively few companies are involved. Further efforts should be made to improve coordination and exchange of experience.

[…recommendations: possible measures as in the original paper, plus: ;

- *Realign EU R&I policy towards innovation; set ambitious objectives and guidelines to boost innovation and growth in software SMEs, define "key performance indicators", benchmark successful policies and monitor progress.*
- *introduce a single definition of 'innovative company' that would qualify for this type of help.*
- *create a European Software Expertise Network (ESEN) based on existing trade associations, clusters and expertise centres. This should be a light virtual organisation, which would enable packaged software companies to share expertise and improve skills in key areas, notably management and market. It will also contribute to further enhance innovation and quality of 'made-in-Europe' software.]*
- *help with management skills for software SMEs*

7. The Innovation Environment

7.1 Intellectual Property Protection

Intellectual property rights (IPR) are an essential feature of the software industry, enabling software vendors to invest in innovation and attract venture capital. Protection of IP encourages investment,

[23] [*Reference to be added]*

offering the potential for a return on that investment. It also facilitates trading in innovations, so that innovations can be composed and can evolve further over time.

Over the last decade, the significance of IP has become even more apparent, as technological developments have made piracy and patent infringements easier. At the same time software-based systems have become a part of the critical infrastructure of companies, governmental institutions and society at large. In this new environment, companies need to be able to choose from a portfolio of IPR, to ensure their rights as creators are protected from illegal and illegitimate copying.

The most appropriate means of protection will vary depending on the type of software, the investment made in developing it, its usage and the business model adopted. The main options are:

- Patents: used to protect the technical solution implemented in the software program, if it is novel and inventive[24].
- Copyright: covers the program as a form of expression[25].
- Trade secrets: used to protect the valuable and confidential information contained in a program.
- Trademarks: used to protect product and service brands.

Copyright and trade secrets have been the traditional forms of IP protection for software. Commercial software companies typically distribute their works in object code form, and rely on copyright to prevent unauthorised copying and distribution. Contrary to perceptions in some quarters, even open source developers rely on copyright to ensure that their innovations are freely distributed and not expropriated and made subject to more restrictive terms by their competitors.

Is the software sector different to other technology industries in its IPR requirements? We believe it is, for a number of reasons:

- Firstly, the number of software patents has grown significantly over recent years, partly due to defensive strategies by some players. This has led to situations such as ‘patent holes’ or ‘patent trolls’ (where a patentee does not declare a patent until a technology is widespread) and ‘patent thickets/fences’ (unused patents being used to block innovation). Many of these patents are of questionable quality.
- Secondly, patenting has implications in terms of standards and interoperability. Patenting in some areas of the software market is particularly powerful, e.g. APIs[26].
- Thirdly, uniquely[27] within the patenting field, software is an intangible. The end result is not hardware, or a device or a drug, but computer code. The sector’s IP provisions will become

[24] In Europe, patents are not generally available for software (known in legal jargon as ‘software as such’), but inventions with technical effect that are implemented by software (sometimes called ‘computer-implemented inventions’ or ‘CIIs’) are patentable in the same way as other inventions. National patent offices and the European Patent Office have granted patents on CIIs since 1973. Computer-implemented inventions which *only* solve a business problem using a computer, rather than a technical problem, are considered unpatentable as lacking an inventive step, although they are allowed in the United States. Controversial proposals to widen CII provisions in Europe to include business methods were rejected by the European Parliament in 2006 […*check date??*].

[25] Specifically, copyright protects against unauthorised copying of source code, object code (sometimes called ‘machine’ or ‘compiled’ code), the underlying design materials and other ‘expression’ of software.

[26] Application programming interface – enabling interfaces that support the building of software applications.

[27] MS comment: is it unique??

increasingly important in future as the boundaries between hardware and software are blurred.

In software, companies need to share knowledge to innovate, leading to a high degree of collaboration and pooling of resources. Innovation is generally incremental, rather than through big breakthroughs, but involves rapid cycles. Patenting, on the other hand, is slow and the period of the grant is much longer than the period of exploitation. The current IPR system is out of tune with this fast-moving, collaborative, incremental innovation model.

The position regarding IPR in standards is also problematic. Some argue that IP provisions provide an incentive for rights owners to contribute their IP-based technology for use in standards by assuring that their innovations are protected and can be licensed on reasonable terms. Others believe that FRAND provisions are discriminatory, especially against SMEs. They wish to ensure that, as far as possible, standards are royalty-free.

We propose a middle way. Royalty terms should be discussed at the standardisation stage, so all are clear how much compliance would cost. Standards bodies should not be obliged to follow but should know it is permissible.

Finally, we note that a number of other factors influence the efficiency and effectiveness of IP protection for software. Litigation procedures for solving infringement must be fair (and be seen to be fair); enforcement of IPRs in overseas markets must be efficient and workable; and patent assessment and search procedures should be speeded up. Regarding the latter point, we note as a welcome development the use of open exchanges to share information between patent offices and interested communities[28].

Accessible, robust and effective IP protection remains essential to the software industry. The issues here have been well rehearsed elsewhere and we do not wish to re-open old debates. Nevertheless, the problems are real and urgent and we look forward to meaningful and concrete progress on these issues within existing forums. In particular, it is necessary to reduce complexity of the system and improve its flexibility and responsiveness. **The software industry has specific [unique?] requirements in relation to IPR and it is essential that any new horizontal measures cater for the industry's special situation**.

Software is the foundation of innovation and adding value in the 21st century; it cannot easily be accommodated within a system created for the industrial age. A paradigm shift is needed.

…[Recommendations to other bodies?? Issues raised include: Simplification of the legal environment; education on IP principles; R&D for protection platforms; simplification and harmonisation of the European patent system].

[28] *[reference or URL needed]*

7.2 Public Procurement

Today it is widely acknowledged that ICT - and in particular modern software solutions - are essential to enhance the cost efficiency as well as the quality of public services. In turn, public sector investments in technology will reduce administrative burden for businesses and citizens and will significantly contribute to European growth and competitiveness. Public administrations in the EU have yet to fully exploit the potential of ICT, however. Member States' investment in eGovernment is not sufficient and cross-border public services are still the exception. Consequently, a truly internal market for eGovernment applications does not exist, despite various EU initiatives such as the i2010 eGovernment Action Plan, and Ministerial Declarations on eGovernment.

The public sector is by far the largest procurer of software and therefore public procurement policies can exert huge leverage in the European software market. The large majority of public procurement contracts, which are of interest for ICT SMEs, fall under national procurement legislation. This has enormous macro economic implications, and strongly impacts the ICT industry and wider business stakeholders. Public procurement presents particular barriers for SMEs, who are often not able to accommodate the high costs and slow processes involved in public tenders.

As noted above, public procurement should be as open as possible and technology neutral. In practice, the public procurement policies set by governments often express a preference for one software model over another. These decisions may impact the choices of other organisations that work with the government sector, inhibiting the ability of software companies to compete on a level playing field. **Provided that software is creative, competitively priced and licensed on a valid model it should be considered equally, irrespective of its development methodology**.

Interoperability is a key factor in gauging technology neutrality. This may be achieved at the technical and semantic levels, through commercial arrangements and/or through implementation of open standards where they exist. The guiding principles should be to promote: competition, vendor choice and adaptability to evolution in technologies and user needs. Functionality, security, reliability and price are also important factors. Consumers should be allowed to select which model works best for them. Similarly in deployment, policies should be agnostic between self-hosted, hosted, Software and Services, or pure SaaS models. Consumers should be free to choose how they wish to consume software in order to increase the size of the market.

The prospects of public procurement being used to create 'lead markets', in which public agencies become early adopters of new technology, has been discussed for some years. In 2006, a Working Group of the National IST Research Directors Forum drafted procedures that would comply with state aid rules of the World Trade Organisation.

[…Recommendations:

- *…Re promoting best practices: use the Open Method of Coordination to bring together national PP initiatives .*
- *…Re lead markets: Focus would be on pan-European evaluation of new technologies and accelerating the innovation process, possibly using the CIP as a vehicle*
- *…Measures for SMEs??]*

7.3 Financing Software Innovation

Few people perceive the software industry as capital intensive. Yet access to capital is one of the major critical success factors. When it comes to speed of delivery, factors such as packaging and go-to-market require much investment. Even if the early stage is the most critical, capital is even more needed during the development stage for international expansion and acquisitions.

The European industry faces a number of barriers here:

- Firstly, venture capital markets in Europe are less mature than in the US. Given that venture capital is needed to start businesses, the European software industry is held back by a lack of development finance *[MS comment: strong statement which needs to be backed up by data]*.

- Secondly, the software industry suffers from a lack of appreciation by investors of intangible assets and misperceptions due to its resemblance to value-add services industries.

- Thirdly, Europe's risk-averse environment is not conducive to serial entrepreneurs, in contrast to the dynamic investment environment of the United States.

These shortcomings could become even more challenging in the future. While European software companies have traditionally been technology-centric solution providers, the global trend now is towards services. Many of them have already added the SaaS delivery model to their offering, but heavy investment will be required to compete with more business- and process-oriented global players as the market takes off. Against the background of the current 'credit crunch', these investment demands will not be easy to meet and could soon escalate into a crisis.

Joint initiatives between government and private financial institutions appear to be the most efficient way to leverage public financing. Examples are found throughout the Member States, while at European level industry-led Joint Technology Initiatives (JTIs) pool public and private (at least 50%) investment in areas where existing funding mechanisms cannot deliver the scale and speed needed. Benchmarking of these initiatives (both within Europe and outside) can provide successful case studies and help to spread best practice.

We believe there are also opportunities within European R&D schemes. Packaged software companies experience the same problem of accessing R&D funding schemes as SMEs in general. They also face specific difficulties, primarily that the innovation cycle in software does not match the pace of traditional European R&D projects. Packaged software companies generally operate in the innovation part of the spectrum, rather than in research. Very often, they already have the technology in place and need to focus their efforts on pilots, demonstrators and go-to-market. Bottom-up projects that do not correspond to Strategic Research Agendas should be given a chance as they meet consumer demand and can generate rapid growth and jobs.

[…Recommendations along the lines of:

- *Benchmark and promote the best examples of national public-private funding schemes specific or adapted to the software sector, so as to boost public-private funding in strategic innovation.*

- *Set up a European Software Investment Fund within the High Growth and Innovative SMEs Facility, of the Competitiveness and Innovation Framework Programme (CIP) (run by the European Investment Fund). This should focus on those areas where there is a market failure, e.g. investments below €250k, and should be implemented through venture funds investing in innovative SMEs.*
- *Test, on a small scale, an ambitious new programme called EUROSOFT, which would fund projects focussing on innovation rather than just R&D and award a label to companies for meeting a series of criteria (such as usability of products in different European languages and cultures).]*
- *…opportunities in the green IT agenda – software could play a key role in making IT greener and in sustainable development more generally.*

8. Skills and Lifelong Learning

For the European software industry to succeed in global markets it has to attract and retain the top talent – the best software programmers, managers and entrepreneurs. Yet, like other areas of the ICT industry, software is affected by a lack of experienced and well qualified people.

An IT skills shortage is now a serious and worsening problem throughout Europe and at all levels of IT use, from consumers and business users through to software engineers. The number of IT graduates has dropped considerably over recent years, especially in the software sector. In the UK, for example, the number of software engineering students has dropped by 60% in the past five years[29]. Similar falls have been seen in other European countries.

The roots of this problem lie in a variety of factors - social, economic, cultural and structural. Poorly defined career paths in ICT; the unattractive – even 'nerdy' - image of software in the eyes of the public; the lack of interest in science at school shown by young people in all western countries – all of these contribute to the situation, which we can justifiably call a skills crisis, now unfolding.

This shortage is compromising Europe's growth in several ways. It prevents large sections of the population from participating in the e-economy; it makes the European workforce less attractive to companies seeking to base operations here; it provides an incentive to outsource software development to other regions; it inhibits the uptake of new technologies by European organisations; and it is threatening to put a brake on Europe's technological innovation and development.

We must do more to maintain and develop the European skill-base in software and its applications. The need is not just for IT specialists, but for software engineers skilled in applying software and services technology in all other application domains and industrial sectors. In such a fast-evolving sector, replenishing the knowledge of existing practitioners is also a key requirement. Moreover, a general public that is comfortable with IT, enthusiastic about using it at work and at home, and excited about its future prospects will offer an environment in which the youth will be drawn to it as a profession and so supply the future scientists and engineers.

[29] www.vnunet.com/vnunet/news/2159726/20bn-risk-uk-skills-shortage

There is also a strong business dimension here. As noted in Section 6, the key challenges for SMEs are human challenges. European software SMEs often have strong technical competences but need help in developing management capacity and business skills. Technical skills are generally well covered by training providers but areas such as marketing, finance, and entrepreneurship need to be improved. Again, the key difference in software is the fast-moving business environment.

In software, as elsewhere, skilled workers are becoming increasingly mobile. Changes in the work model with an increasing number of dispersed offices and project engagements rather than long term employment, and the willingness of graduates to follow a career abroad have had a significant impact on employers. This trend has been reflected in off-shoring, both within the European Union and beyond. Currently, cumbersome work and residency permit requirements impede and sometimes even prevent software vendors from employing third country nationals on pan-European projects, resulting in lower levels of service to customers and lost opportunities for the providers. More must be done to improve the mobility of skilled workers at all levels – as students, researchers and employees - and in this respect we welcome the Commission's proposals for a 'Blue Card' scheme for highly qualified employment[30].

As noted above, the skills crisis is not confined to software but is symptomatic of issues facing the digital economy more generally. At a generic level, Europe has a well developed agenda on eSkills, led by the eSkills Industry Leadership Board (ILB)[31], which we wholeheartedly support. **Initiatives under the European Software Strategy should aim to extend and build on this by focusing on professional software skills within the industry itself and in other domains and application sectors**. Also, it is important to recognise that ICT-SMEs are everywhere and embedded in their communities, and hence can be a key enabler to transmit eSkills throughout the economy.

[…comment needed on the situation regarding ICT certification which has not been discussed up to now; issues around vendor versus general qualifications; need for multi-stakeholder partnerships]

[Recommendations: main issues discussed were:

…proposal for a European Software Expertise Network. Not a new institution but an open network bringing together established centres and companies. Barriers have been lack of resources and focus on national markets/activities. Possible vehicles include: networking trade associations, research networks, and a KIC (within the EIIT).

…other recommendations: specific measures needed to raise profile of the industry in general, and in particular to attract more women into software careers. E.g. a 'European IT Night' to demonstrate the profile of the sector.]

[30] Council Directive on the Conditions of Entry and Residence of Third-country Nationals for the Purposes of Highly Qualified Employment. The Directive would introduce a Blue Card work permit system whereby, after an initial two year period, third country nationals would be allowed to work across the 27 Member States and not be restricted to work opportunities in the Member State that initially grants the work permit.

[31] See: www.e-skills-ilb.org

9. The Future Internet

What is the Future Internet?

Over the last 30 years the internet has revolutionised our economy and society. From an obscure academic network in the early 1980s, the internet has grown into a truly worldwide infrastructure for information and communication. The internet is now a central part of our lives in all sorts of ways, and in many activities is displacing traditional channels as people's first port of call. **It is *the* global network of the 21st century**.

We are now witnessing the emergence of the next generation of the internet, which will lead to a wealth of new services and will have an even greater impact on society and the economy than the internet today. In fact, the Future Internet will be the essential part of Europe's future ICT infrastructure, which will be instrumental to fostering the internal market as well as to achieving the goals of the Lisbon agenda and ensuring growth, productivity, and employment in Europe. The main building blocks of the Future Internet are the 'Internet of Services', the 'Internet of Things', and the underlying networked infrastructures.

The Internet of Services makes use of service-oriented architecture (SOA), a flexible, standardised architecture that allows various applications to be combined into interoperable services. The Internet of Services also uses semantic technologies that understand the meaning of information and make content (video, audio, print) more accessible (including by machine). Thus, data from various sources and different formats can easily be combined and processed toward a wealth of innovative web-based services.

In parallel, 'things' are becoming smarter. The Internet of Things combines the power of ubiquitous networking connectivity with modern sensor technologies, such as radio frequency identification (RFID). It merges the digital world with the physical world in the sense that information concerning the identity, location, and condition of physical objects can be made available through the internet anytime and anywhere. Moreover, these objects possess the capability to communicate with each other and therefore can become active participants in global business processes.

Impact on the European economy

The impact of this Future Internet on the European economy and society will be significant:

- **The Future Internet will invigorate innovation**, resulting in tremendous productivity gains. The benefits of these gains will be reflected most especially within the retail, manufacturing, logistics services, and energy sectors. According to industry experts, RFID technologies could lead to efficiency enhancements of 40% in the luxury goods industry or even 100% in the food sector. Indeed, rapid adoption of the Internet of Things and Services throughout the European economy could be instrumental in closing the productivity gap with the United States and secure European competitiveness in the years to come.

- **The Future Internet will shape the future of the services sector**. The Future Internet will undoubtedly become one of the major growth engines in all knowledge-based societies. It will be a business opportunity especially for start-ups and SMEs, and could lead to the creation of high level jobs. As services comprise two-thirds of European GDP, it is clear that

Europe can only sustain economic growth and prosperity by developing strong web-based services industries. Moreover, web-based services that will be developed in Europe could easily be exported to global markets.

- **The Future Internet will bring disruptive technologies** that will create tremendous business opportunities for the ICT sector itself. The world market for technologies, products, and applications related to the Internet of Things alone is estimated at €7.76 billion by 2012, with average annual growth rates of almost 50%. As explained above, SaaS also presents a major growth market.

A level playing field for Future Internet development

Unfortunately, many of the new web-based industries and their underlying ICT infrastructures are being developed outside of Europe, in the United States and Asia. All major service platforms for the Future Internet, such as Amazon, Google, iTunes and eBay, are headquartered in the US.

Furthermore, the service platforms offered by these companies are proprietary, with a 'stack' of infrastructural services running on a computing 'cloud' that is made available to the user as a basis on which to build their higher level services. This guarantees the user that the component services are able to interoperate and have been widely validated by many other users, so issues such as trust and availability can be assumed to be managed well. **But the fact that US-based companies are setting the pace and the standards represents a barrier for European companies trying to enter the market.**

We need to do more to achieve a 'level playing field' for service development, deployment and access[32]. One of the successes of the internet has been its openness. At stake is not just the competitiveness of European suppliers but also maintaining openness for all users.

[…for discussion: possible policy issues in FI noted in areas such as: privacy (e.g. harmonisation of legal framework for data stored in clouds); use of spectrum; governance; security.

…recommendations along the lines of:

- *industry welcomes and supports the EC's Future Internet initiative and, in addition to the technical work, encourages a focus on business models and policy issues as part of this work;*
- *industry encourages the formation of a Joint Technology Initiative as a means of mobilising European efforts in this strategically important area.]*

[32] Similar arguments are made by ISTAG in its recent report on the "Web-based Service Industry" [full ref needed]

10. The European Software Charter

[to be added in next draft]

… wrap-up of key arguments and summary of recommendations

… the conclusions should be presented around core challenges, rather than the individual issues discussed above. Examples are found in most of the original submissions, especially those of CompTIA and the NTAs. Formulation of these Challenges should be a key focus for the Working Groups and the second Experts' Meeting.