Towards a European Software Strategy

Industry Expert Group

WORKING GROUP 1 - "Future Internet"

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1.Introduction

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 open infrastructure for information, communication and commerce. 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**. Benefits include greater access to knowledge, services, recreational resources and the ability to connect with multiple communities of like-minded users. It has lowered the barrier to market entry and service innovation for countless SMEs, and massively extended their markets across borders. It has become the lifeblood of industry, government and society around the world, and the primary platform for information technology product and service innovation.

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 network and IT infrastructures.

The *Future Internet working group* believes that the future of the European software industry is bound to that of the Future Internet in that the industry will be founded on Internet-based business models, as well as software being a fundamental enabler of the Future Internet. Web-based computing environment - "cloud computing" - opens a range of new opportunities for innovation, efficiencies and collaboration, provided that the challenges for openness and standardisation of this new, emerging Internet platform are met. However the scope of the Future Internet is far broader than software and impacts all aspects of the ICT market. Consequently the recommendations made in this paper are concerned with the Future Internet rather than the software industry per-se. More specifically, the paper is concerned with enabling a European "web-services" based industry which will provide new markets and new business models for the current software industry.

2.Overview of the Future Internet

The Future Internet will be enabled by software and will introduce dramatic changes in the economy over the next decade. And it will unquestionably define Europe's future competitiveness. The scope of the Future Internet can be characterised by the "Internet of Services", the "Internet of Things", and the network and data centre infrastructure services that underpin them.

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.

2.1.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. Another area for productivity gains is the adoption of collaborative technologies made possible by cloud computing that are embedded in the workplace. "Enterprise 2.0" is a transformation of business practises that is bound to have a profound impact on Europe's competitiveness in the future, for instance by efficiency gained through better collaboration and communication technology . 'Cloud computing' at its core is not only about information being available anywhere and everywhere because of the Web, but about bringing products and services online which will change the way people work and collaborate.

- **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. Platform-as-a-Service could become a major enabler for innovation especially by smaller IT firms in Europe. PaaS means providing development environments from the network where developers can design, build, and test applications that run on the Cloud provider's infrastructure and then deliver those applications to end-users from the provider's servers. The result of such service for companies using it is that the time to market for an innovative digital idea has been slashed, and even the sort of viral success that Internet services often enjoy can be catered for by simply dialling up additional access as a companies' business grows. That leaves entrepreneurs to carry on being innovative, and should play well to the structure of the European software market with many smaller companies, which cannot afford buying the necessary infrastructure.

- **Cloud computing can enable companies to save costs, and this will enable growth in particular by small businesses.** It used to be that every growing business would at some point have to make a big investment in computers and software for accounting systems, customer management systems, email servers, maybe even phone or video conferencing systems. All of those services will be increasingly be available via the network cloud, and users pay for it only as they use it. So small businesses can scale up without making those huge capital investments. The UK Broadband Stakeholders Group (BBSG) estimates the online model would save companies £350 a year per person in support costs. If 30% of SME staff made the switch to cloud computing, the savings across the UK would total £620m a year. Access to sophisticated computer systems, and all the value they can deliver, was previously the realm of larger companies. Cloud computing levels that playing field so that the small business has access to the same systems that large businesses do. Given that small businesses generate most of the jobs in the economy, this is no small trend.

2.2. Current trends relevant to the Software industry

The Internet of Services and the Internet of Things represent very broad trends that will impact the European software industry. More specifically, there are many inter-related trends that will have a direct impact on today's software industry: Software-as-a-Service (SaaS), Cloud Computing, and Service-Oriented Architecture (SOA), are examples of trends that are either emerging within the Future Internet or are transferring over from the traditional ICT industry. The following is a list of the key trends relevant to the Future Internet and the Software industry. It is not an exhaustive list

Software-as-a-Service enables users to access software on-demand via hosted service. This provides an alternative business model for using and charging for software

Platform-as-a-Service provides development environments from the network where developers can design build and test applications that run on a cloud provider's infrastructure and then deliver those applications to end-users from the provider's infrastructure

Cloud Computing provides flexible, on-demand processing and storage services for running software applications and software development environments

Within the next decade people will use their computers completely differently to how they do today. Access to data, applications and content will be seamless and device agnostic.

Service-Oriented Architecture, common in Enterprise ICT solutions, provides software building blocks and a construction system facilitating the (re-)composition of IT systems

Service-Oriented Infrastructures integrate network and data centre resources to provide integrated ICT infrastructure services that respond flexibly to the requirements of business processes.

De-verticalisation of the software industry will occur as a result of SOA and SaaS leading to the emergence of software systems assemblers and platform providers, and of software component providers.

Internet-connected devices are moving towards software infrastructure (OS, middleware, application frameworks) that enable them to consume and provide web services and thus participate both in the "Internet of things" and "Internet of services".

Core services components such as real-time communications, multimedia conference, data sharing, identification and authentication, user and service profiles, information search, payment transactions, maps are now made available through service APIs and protocols to be integrated in a global end user experience mixing communication, web and local tools.

3.Challenges for Europe in the Future Internet

There are however many technical, commercial and regulatory challenges in the development of the Future Internet, not least of which is the development of a shared vision. These are being discussed and addressed in many fora within Europe and internationally. The Future Internet working group has identified those that it believes are the most significant for Europe generally and the software industry in particular.

3.1.A European infrastructure for the Future Internet

The broad vision of the Future Internet is predicated on a number of developments in the evolution of the underlying infrastructure. Ubiquitous and pervasive connectivity, increasing the

availability and predictability of high-bandwidth for all users, and the availability of on-demand "cloud" computing and storage resources. More specifically:

- That access to the Future Internet will be ubiquitous and pervasive. Ubiquitous in that all users – citizens and businesses – will have some form of access to the Internet; pervasive in that there will be a range of technical options available (i.e. fixed, fixed-wireless, mobile) and also increasing connectedness of devices and sensors into the Internet to support new services.
- That available bandwidth will increase to meet the demands of new applications & services (commercial or otherwise)
- That Internet users will continue to be able to reach the Internet applications, content and services they desire, without anti-competitive discrimination or restrictions intervening except in accordance with applicable laws.
- That all users will have fair access to available bandwidth i.e. the few will not be able to dominate the many without accountability
- That the performance, security and availability of the infrastructure will directly impact the dependability on the Future Internet applications.
- That storage and computing resources will become an integral part of the infrastructure for the Future Internet i.e. that users will have integrated access to cloud and network services

Whilst positive progress is being made in all aspects, it is important to recognise that there are issues in each area that could impact the opportunities for growth in the European software industry. They are:

- As the web continues to increase in economic and social importance, so the incentives for some economic operators to deviate from the currently prevailing open and collaborative model are accentuated. For example, platforms based on closed and vendor-specific specifications that lock-in customers (thus denying them access to innovation from 3rd parties, and constraining the available market for those 3rd parties), or discrimination by internet service providers and network operators in favour of their own or affiliated applications and services over those offered by competitors. A fair, non-discriminatory, transparent and competitive playing field that ensures consumer choice must be maintained so that end-users can reach the Internet applications, content, and services they desire, without anti-competitive discrimination or restrictions. Only then can the Internet keep innovating and drive the economy, giving consumers and enterprises greater choice at an affordable cost, and delivering maximum benefit to the European and global economy.

- The Internet is increasingly a critical component underpinning traditional industry value chains as well as the basis for entirely new markets. In the Internet's open ecosystem, all parties depend on one another and the development of advanced Internet access offerings to consumers and businesses is essential for innovation by application and content providers. Moreover, the unprecedented wave of innovation in Internet applications and content is driving user demand for significantly increased bandwidth. Consequently, it is necessary to recognise that significant investment is required at this

particular point in the development of the Internet within Europe in both core and access networks across Europe. It is therefore essential that there is clear and consistent regulation across Europe that allows the necessary investment to be made on a sound commercial basis and that preserves the natural cycle of innovation and investment in the Internet.

- The TCP protocol includes mechanisms to manage and counter the effects of traffic congestion across the Internet. However there remain opportunities for individuals and application providers to exploit the architecture and provide themselves access to network capacity that results in a degradation of the experience of others. These typically manifest themselves through inconsiderate use of P2P & UDP,. Whilst individuals - citizens & businesses - should be free to use the Internet as they wish, they should not be able to do this at the expense of others. I.e. they should be accountable for their use of the Internet resources. The IETF is studying and developing responses to these issues but these will require uptake across the industry.

- In addition to the connectivity afforded by the Internet, on-demand computing and storage resources – in the form of cloud services - are increasingly considered a critical part of the Future Internet infrastructure. The markets for these services have only just begun to emerge and there are significant opportunities for European companies to develop and capitalise on in both Europe and globally. However, whilst there is significant operational infrastructure within Europe, it is important for the Commission to consider that Europe is currently dependent on a relatively few US companies for commercial control of these critical services. Moreover there are significant financial and regulatory barriers for any European company wishing to develop competing services. For example, the varying planning regulations required to establish significant data centre sites.

3.1.1.Recommendations

The Commission should support a consistent regulatory environment across Europe that allows for an adequate return on the investment required to develop the necessary network infrastructure, and that the return should reflect the risk premium.

The Commission should support international activities to develop an Internet control architecture that allows for a fair and equal experience for all users of the Future Internet without discrimination, and should promote its adoption across Europe.

The Commission should study further the European opportunities and requirements on cloud services in the Future Internet infrastructure to identify any potential barriers.

3.2.The Future Internet as an open platform for innovation

Open standards are the guarantors of today's internet. The internet is predominantly based on open standards for protocol and data formats, notably TCP, IP, HTTP, and XML/HTML. These standards give any and all users both internet access and the ability to create innovative content and offer innovative services on the internet. Moreover and crucially, the most important internet standards are not just open, they are also non-proprietary. Neither prior permission nor royalties are required to implement them. This means that all hardware, software and service vendors can freely create products which interoperate perfectly with others across the internet.

This ability of different software applications and services to access and exchange data via the internet, to read and write the same file formats and to use the same protocols and open standards is the vital condition for the continued development and dynamism of our increasingly networked world.

Moreover, with a significant cloud computing environment emerging, policy-makers should be vigilant of attempts to leverage closed standards built on proprietary technologies, protocols, formats and programming technologies, to the Internet. It is important that the Internet logic and software players' industry-wide demands for openness survives any potential pressure from players whose business models may be challenged by trends of convergence when they have to co-exist and interoperate with other technology domains. Furthermore, the Internet industry has developed a range of dynamic standards-setting processes, and it is important that (1) these processes remain open and transparent, and (2) all players effectively implement web standards and do not "fork" agreed standards, for instance by adding proprietary extensions that create *de facto, closed* standards.

3.2.1.Recommendations

Public authorities should seek to ensure a commitment from vendors to the interoperability of software products with those of other vendors, based on open, non-proprietary standards - the very foundation of the internet. Public authorities should ensure that public R&D funding and public procurement reinforce the openness of the internet by funding and procuring open standards based products and solutions.

3.3.Accountability in the provision of composed Internet Services

In the "Internet of Services", a service accessed by an end user (through a web interface or using a dedicated device) may rely on numerous internal services hosted by different parties. The responsibility for the quality of service, the security, the reliability of the composed service will thus be shared by these parties. The responsibility chain replicating the service invocation chain should be accessible to the end user as well as some information of the different actors involved.

3.3.1.Recommendations

The EC should encourage the emergence of quality label and appropriate referencing of the elementary services available in the "Internet of Services", based on functional and non functional requirements (availability, guarantees of persistence of the service, legal information of the service provider, location of the data hosted by the service, conformance to privacy protection schemes). This may lead the creation of repository of critical services, hosted by third parties by delegation (similar to what is done regarding Domain Names).

Promote the emergence of European trusted third parties to authenticate users and services providers in the Future Internet and to enable access rights management on individual or composite services, thus protecting service providers against fraud or illegitimate uses and users from undue access to their data.

4.Conclusion

The Future Internet working group believes that the future of the European software industry is bound to that of the Future Internet in that the industry will be founded on Internet-based business models, as well as software being a fundamental enabler of the Future Internet. Consequently the recommendations made in this paper are concerned with the Future Internet rather than the software industry per-se. There are however many technical, commercial and regulatory challenges in the development of the Future Internet, not least of which is the development of a shared vision. These are being discussed and addressed in many fora within Europe and internationally. The Future Internet working group has identified those that it believes are the most significant for Europe generally and the software industry in particular.

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