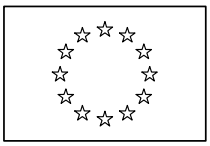

COMMISSION OF THE EUROPEAN COMMUNITIES

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COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT, THE COUNCIL, THE EUROPEAN ECONOMIC AND SOCIAL COMMITTEE AND THE COMMITTEE OF THE REGIONS

A public-private partnership on the Future Internet

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1. INTRODUCTION

The Internet has become one of the most critical infrastructures of the 21st century, supporting social and economic developments just as railways, roads and aeronautic transport networks have been doing over the past century. It is not only the vehicle of a new economy of services but also a tool supporting the emergence of the 'fifth freedom' and a truly knowledge-based society.[1]

The changes the Internet has made to our economies and societies will be even more evident in the future, driven by the progress of Information and Communication Technologies and by the blossoming of novel business and societal applications.

Public services such as health, mobility, environmental monitoring or energy management are currently sustained by complex infrastructures traditionally not powered by the internet. These infrastructures can be made 'smart', i.e. much more efficient and sustainable, as soon as the internet is fully integrated into their basic functions and processes. However, new levels of efficiency and productivity gains will only be possible if technological roadblocks are overcome with multi-disciplinary and open innovation approaches.

The internet has enabled multiple waves of innovation: first with the introduction of the web, then with the integration of communication and audio visual services (e.g. VoIP and IPTV)[2] and more recently with multiple online services and applications. However, the large-scale integration of multiple technologies, such as distributed computing platforms, web 2.0, peer-to-peer services, diverse broadband access networks, mobile devices and sensors ('things'), calls for a rethink of the internet architecture, which was conceived more than thirty years ago. Trust and security are key aspects where new answers are needed. New functionalities with ever increasing performance levels are required to support the real-time requirements of novel applications.

Beyond technological issues, the restructuring of business and social interaction processes unleashed by the future internet infrastructure could provide European stakeholders with a golden opportunity to lead a new wave of innovation and to establish a position in the internet economy that is commensurate with their technological and scientific know-how.

Elsewhere in the world, in the USA, Japan, Korea and China, for example, the 'Future Internet' has become a strategic priority. In the European Union, it is one of the priorities of the FP7 ICT research programme, with about 20% of the ICT budget supporting R&D in this domain. Several Member States have also launched ambitious initiatives in this field.

Making Europe a leading region in Future Internet technologies and applications requires a coherent approach to leverage the multiple ongoing efforts at European level and in the Member States. The European Union has taken several steps within a wider policy approach on the internet, for example, to drive the deployment of innovative internet technologies such as IPv6[3] and to create a favourable environment for the emergence of the 'Internet of Things'

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1 http://www.consilium.europa.eu/ueDocs/cms_Data/docs/pressData/en/ec/99410.pdf.

2 Voice over IP, IP television services

3 COM(2008) 313 final, 'Action Plan for the deployment of Internet Protocol version 6 (IPv6) in Europe'.

(IoT),[4] while at the same time supporting the founding governance principles of the internet: the end-to-end principle, openness and interoperability. It is essential to reap the early benefits of long-term research investments, with short to medium-term innovation initiatives that can make for the emergence of novel industrial and service providers in Europe.

A comprehensive approach to digital society and economy is now needed, that will encompass the Future Internet - one of its building blocks. This approach and the measures announced in this Communication will be integrated into a comprehensive European Digital Agenda, which the Commission will present in the course of next year, to tackle the main obstacles to a genuine digital single market, promote investment in high-speed Internet and avert an unacceptable digital divide[5].

2. OBJECTIVES OF THIS COMMUNICATION

The anticipated technological developments of the Future Internet and the trends towards smart infrastructures (in energy, mobility, health, work, environment, etc.) provide Europe with an opportunity to progress towards a sustainable economy, in line with the Commission recovery package adopted on 26 November 2008.[6]

Leveraging Future Internet technologies through their use in smart infrastructures offer the opportunity to boost European competitiveness in nascent technologies and systems such as sensor networks[7] or 'cloud computing', and will make it possible to measure, monitor and process huge volumes of information.[8]

This Communication seeks to provide a framework to make the most of these trends, underpinning the emergence of a 'smart' society while at the same time increasing the competitiveness of the European ICT industry, in particular by:

- capitalising on **the steps taken at EU level** to push the frontiers of internet technology forward;
- consolidating the **short to medium-term approach**, re-emphasising key aspects and encouraging new initiatives to help give Europe a leading edge in the Future Internet;
- preparing for the launch of a **Public-Private Partnership (PPP) initiative on the Future Internet**, as also encouraged by Member States[9] and industry.[10]

Taking advantage of this opportunity means:

- establishing close partnerships between stakeholders in the different domains, ICT and smart infrastructures,

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4 COM(2009) 278 final; 'Internet of Things – An action plan for Europe'.
5 http://ec.europa.eu/commission_barroso/president/pdf/press_20090903_EN.pdf
6 COM(2008) 800 final; 'A European Economic Recovery Plan'.
7 76 million sensors for energy grids have been installed world-wide. This will double in the next 4 years or so.
8 See e.g. item 44, COM(2009) 279/4; 'A sustainable future for transport: Towards an integrated, technology-led and user friendly system'.
9 http://register.consilium.europa.eu/pdf/en/08/st16/st16616.en08.pdf.
10 http://www.future-internet.eu/fileadmin/documents/reports/Cross-ETPs_FI_Vision_Document_v1_0.pdf.

- overcoming fragmentation and building critical mass at EU level,

- fostering competition, openness and standardisation, involving consumer/citizen, ensuring trust, security and data protection with transparent and democratic governance and control of offered services as guiding principles.

An industry-driven PPP implemented with existing Framework Programme mechanisms in the coming ICT Work Programmes for 2011-2013 will ensure a quick start of these activities. The PPP will capitalise on the work of five European Technology Platforms[11] (ETPs), with cross-fertilisation of the internet-related issues of their respective Strategic Research Agendas.

3. FUTURE INTERNET – A TOOL FOR A SMARTER WORLD

Multiple initiatives have been initiated world-wide to make infrastructure supporting applications of social value 'smarter'. They respond to the need to move towards a more sustainable and efficient economy, to ensure harmonised use of natural resources, to mitigate the effects of climate change and to preserve our environment. These endeavours are very much in the public eye. In Europe, the 'Climate and Energy Package'[12] provides an ambitious policy framework for the reappraisal of infrastructure serving public needs.

3.1. Smart Infrastructure Trends

Many of these initiatives will make extensive use of connectivity and distributed information processing to redesign their business and operational processes and make them 'smart'.

Examples of smart infrastructure include:

- **Smart energy grids**: electricity generation around the world will nearly double, from about 17.3 trillion kilowatt-hours (kWh) in 2005 to 33.3 trillion kWh in 2030. Energy grids will increasingly face risks of congestion and blackout. Internet connectivity, computing power, digital sensors and remote control of the transmission and distribution system will help to make grids smarter, greener and more efficient.[13] 'Smart grids' or 'energy internet' can be more responsive, interactive and transparent than today's grid. It can cope with new sources of renewable power, make for coordinated charging of devices and provide information to consumers about their levels of use; it will allow utilities to control their networks more effectively, and help to reduce greenhouse gas emissions. In some pilot projects, using today's internet technologies has made it possible to reduce peak loads by more than 15 %.

- **Smart environmental information systems**: the use of sensor networks for collecting real or near real time environmental data is a growing field of application. It requires Internet connectivity for data management, dissemination and integration in complex information systems. These environmental information services are also expected to support a multiplicity of sectors, such as location and operation of various renewable energy

[11] ETP's eMobility, NEM, EPoSS, ISI, NESSI.

[12] http://ec.europa.eu/environment/climat/climate_action.htm.

[13] Up to 40 % of the energy produced may be lost on its way to the consumer.

production centres, efficient management of intelligent buildings, safer road transport systems or general public information on environmental risks and hazards[14]

- **Smart systems for transport and mobility:** traffic jams are thought to cost Europe €135bn a year. In Germany alone, it is estimated that traffic jams cost 33 million litres of fuel and 13 million idle hours every day, an economic loss of €250m per day.[15] Building new roads is often not a viable option. Putting 'intelligence' into the roads and cars with Intelligent Transport Systems (ITS)[16]– with e.g sensor networks, radio frequency tags, and positioning systems[17] – offer a promising alternative. The internet provide a solution to interconnect these diverse technologies and bring more efficiency to mobility through real-time management of public and private transport resources, traveller information and decision-making tools, way beyond the capability of current solutions.[18]

- **Smart healthcare systems**: to reduce medical costs and improve patient comfort, medical treatment is increasingly provided in the domestic environment rather than in hospitals. Current research experiments aim to develop technologies for 'ambient' environments capable of assisting patients and satisfying their information and communication needs. These technologies combine devices (sensors, actuators, special hardware and equipment), networks and service platforms to harness information about medical conditions, patient records, allergies and illnesses. These huge databases can be used either for medical assistance or for research and statistical purposes.

These networked infrastructures provide typical examples of internet technologies supporting both the economic and social efficiency of vital day-to-day processes. In Europe, several cities have started pilot projects in these domains, albeit on a small scale: Stockholm (transport system), Amsterdam (mobility and work), Malta (energy grid), Paris (healthcare) and many more throughout the world.

This move is already being embraced by prominent internet companies. It will continue to expand in the future, opening up tremendous opportunities for public and private players alike. ***It is time for Europe to seize this opportunity and to develop an ambitious approach towards internet-enhanced infrastructures***.

3.2. Trends driving the Future Internet

The scope and scale of new application scenarios also raise concerns as to the capability of the current internet infrastructure:

- Access rates are exploding. A number of EU Member States are planning at least 100 Mb/s access by 2015. Other countries in the world (e.g. Korea) have set the objective of nationwide access rates of 1Gb/s by 2012, a 250-fold increase compared on the average broadband access on offer today.

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[14] See e.g. the European Environment Agency Bathing water quality - viewer initiative. http://www.eea.europa.eu/themes/water/status-and-monitoring/state-of-bathing-water-1/bathing-water-data-viewer

[15] http://www.bundesregierung.de/nn_6562/Content/EN/Artikel/2008/01/2008-01-01-hightech-verkehr-innovationsstrategie-januar-2008__en.html.

[16] COM(2008) 886 final/2 « Action Plan for the deployment of Intelligent Transport Systems in Europe »

[17] These may be based on Global Navigation Satellite Systems (GNSS) or on other location technologies.

[18] Recent city pilot projects have already shown that gridlock cuttings of 20% and gas emission reduction of 12% are within reach of today's technology.

- Internet data traffic is growing by 60% every year. Trends such as peer-to-peer, video sharing and high-definition online TV will continue to drive traffic growth at exponential rates. Bottlenecks are being exacerbated by the current low incentive to invest in infrastructure.

- By 2012 the number of internet users will grow by an additional 1 billion with the global take-up of broadband mobile, although the internet is not designed to support mobile usage.

- Viruses and attacks on the internet and the web are proliferating. Electronic identification theft and privacy breaches through inappropriate use of personal and critical business data are also on the increase. With the massive deployment of sensor-based infrastructure, the soaring of devices accessing the Internet, security concerns and vulnerabilities are bound to increase and possibilities for cybercrime to rise dramatically. The lack of 'trusted environments' further compounds the issue.

- Internet services[19] are mushrooming. This is also fuelled by the emergence of what is known as the open innovation model and 'cloud computing'.[20] Cloud computing radically reduces market entry barriers for service providers, especially SMEs.

- Prospects are for trillions of different devices, sensors, services and 'things' getting online. This will make existing infrastructure 'smarter', and allow these services to be used by citizens, businesses and public administrations alike. Our capacity to employ comprehensive approaches in support of societal applications needs to be enhanced.

A mere technological response is not enough to rise to the challenge of these trends. A stronger link is required between the development of technologies and user and application requirements.

4. THE EUROPEAN FOOTPRINT ON THE FUTURE INTERNET

4.1. Future Internet in FP7

The Commission has already recognised the importance of the Future Internet.[21]

Steps have been taken through FP7 to position Europe as a leading region in the technological arena.

Europe's current research efforts on the Future Internet account for about 90 projects, involving more than 500 European entities with total EU funding of around €400m over two-year periods on average. This work includes the 'FIRE' initiative, which supports experimental large-scale test-beds to assess Future Internet technologies, envisage future requirements, and anticipate the social and economic implications. The research network

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19 Typical examples: Gmail, Facebook, Amazon ,e-Bay….

20 Cloud computing is a model of computing where resources are provided as a service over the internet instead of being owned and managed by the service providers.

21 COM(2008) 594; 'Communication on future networks and the internet'.

GÉANT also supports the early deployment, testing and experimentation of the Future Internet.[22]

This investment has had a significant federating effect on the research community in Europe, namely through the creation of the Future Internet Assembly (FIA).[23]

The research undertaken so far needs to be further consolidated by:

– extending interrelations between the various technological domains contributing to the emergence of the Future Internet;

– developing a comprehensive understanding of the socio-economic requirements and their technological implications;

– leveraging the use of high-speed research networks, such as GÉANT, to support the early deployment, testing and experimentation of the Future Internet.

4.2. Future Internet Initiatives by Member States

A significant number of Member States have launched national initiatives. In 2008, a Member States working group looked at the possibility of building common approaches in this field,[24] given the diversity of topics, strategies and industrial policies. In their report, Member States identified the benefit of '*fostering the emergence of applications of EU wide dimension and putting in place experimental facilities and testbeds'*.

A 'Future Internet Forum' (FIF)[25] was set up to coordinate national initiatives, reflecting the commitment of Member States to address the development of the Future Internet jointly by sharing information, best practices and benchmark technologies and applications. It also encourages the deployment of innovative solutions addressing common requirements, possibly through public procurement.

4.3. Industrial and innovation dimension

From an industrial policy perspective, the European Commission encourages the creation of industry-academia partnerships sharing coherent research roadmaps. Five European Technology Platforms (ETP's) are currently active in Future Internet-related technologies and systems: eMobility, NEM, NESSI, ISI and EPoSS.

These ETP's have helped to establish research priorities at European level.

The time is now ripe for a more focused and integrated partnership between stakeholders, targeting common industrial goals. To that end, a group of leading ICT companies in Europe has taken the initiative of defining the content and structure of a public-private partnership.

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22 See Communication 'e-Infrastructures for e-Science: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2009:0108:FIN:EN:PDF.

23 http://www.future-internet.eu/home/future-internet-assembly.html.

24 Report from the National ICT Research Directors Working Group on Future Internet: http://www.future-internet.eu/fileadmin/documents/reports/FI_Rep_final__281108_.pdf.

25 http://ec.europa.eu/information_society/activities/foi/lead/fif/index_en.htm.

5. ACTION LINES ON THE FUTURE INTERNET

The Future Internet will not be 'more of the same', but rather an infrastructure that incorporates new technologies on a large scale that can unleash novel classes of applications and business models.

Europe needs to tackle the attendant challenges and priorities in the context of its forthcoming Digital Agenda. Three interrelated vectors have been identified:

- strengthening investment in R&D with high leveraging effect on private investments
- leveraging on Member States' initiatives, and
- building a public-private partnership with industrial stakeholders.

Openness, democratic control of critical resources, transparent governance models, user involvement through open innovation schemes, trust data protection and security will be reflected in the proposed action lines as appropriate, as guiding principles of the Internet of the Future.

5.1. Strengthening investment in R&D on the Future Internet

The Future Internet requires a long-term approach, which necessitates sustained investment in research while avoiding distortion of competition.

Line of action:

– The Commission intends to allocate a minimum of €200m per year in the FP7 ICT work programme covering the period 2011-2013, in support of the medium to long term research issues of the Future Internet outside of the proposed PPP.

– In its regulatory and research policies, the Commission will adopt a comprehensive approach to R&D to address the Future Internet, with the objectives of overcoming the technological roadblocks, while addressing user involvement, governance, standardisation and IPR.

– The Commission will actively promote the FIA as a tool for consolidating R&D, disseminating results, exploring further research/deployment priorities and scenarios, reducing fragmentation of efforts, and promoting applications for the FI by capitalising on the momentum towards 'smart infrastructure'.

5.2. Leveraging on Member States' initiatives and promoting the international dimension of the Future Internet

Although significant, Member States' initiatives will benefit from cross-visibility and common strategies where useful. The complexity of the Future Internet, bringing together large communities of stakeholders and expertise, requires a structured mechanism to avoid fragmentation of efforts and to identify goals of common interest. Joint action is therefore invaluable to pull together the different initiatives to make Europe a more influential player on the international scene.

Line of action:

– The Commission will actively contribute to an ambitious work programme for the Future Internet Forum of Member States, with the objective of reducing fragmentation of efforts, identifying best practices and maximising the take-up of Future Internet applications of a social dimension, possibly through public procurement.

– The Commission will regularly inform the Future Internet Forum of progress achieved by the PPP in support of the objectives of reducing fragmentation of efforts and sharing best practices.

– The Commission will step up its efforts to enhance the EU's bilateral and multilateral international cooperation with other leading Future Internet initiatives, with the objective of encouraging global standards and interoperability of the Future Internet, in line with the policy adopted by the Commission in this field.[26]

5.3. Building a public-private partnership on the Future Internet

The Future Internet will accelerate a new industrial revolution where internet operators, service developers and equipment manufacturers will be called upon to work in partnership with public stakeholders. This trend can be driven through leveraging on the intermediate results of long-term research to address the demand for more intelligent services.

In this respect, industry has recently initiated[27] and proposed[28] a Future Internet Public Private Partnership (PPP) on the basis of collaborative work that has been ongoing since mid-2008. An essential characteristic of such a PPP should be to develop open, standardised, cross-sector service platforms.

From a European policy perspective, sectors such as healthcare, mobility, environment and energy management are prime candidates to benefit from novel 'smart' – internet-empowered – infrastructures, which will facilitate the rapid take-up and adoption of services by millions of users and consumers.

5.3.1. PPP content and focus

The goals of the proposed PPP should be to:

(a) increase the effectiveness of business processes and the operation of infrastructures and applications of high societal value. This should make use of reappraised internet architectures, services and technologies in large-scale application contexts;

(b) address service architectures and platforms, building on the longer-term requirements of the internet and encouraging European industry to address the challenges of smart infrastructures, whilst contributing to EU policies in terms of innovation, sustainable growth, energy and environmental targets;

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[26] COM(2008)588; 'A strategic European Framework for international science and technology cooperation'.

[27] On the basis of European Technology Platforms (eMobility, NEM, NESSI, ISI and EPOSS).

[28] http://www.fi-prague.eu/program/p/kennedy.pdf.

(c) foster cross-sector industrial partnerships built around Future Internet value chains, and involving users and public authorities at local, regional and national levels;

(d) leverage the internet infrastructure as an open, secure and trusted platform for building networked applications on the basis of user-centred open innovation schemes;

(e) address regulatory and policy issues such as interoperability, openness, standards, data security and privacy within the context of the Future Internet complex and 'smart' usage scenarios. This may also address the required methodologies, procedures and best practice needed to address transnational aspects such as cybercrime prevention where a high degree of public-private co-operation is needed. Participation of the public sector in the PPP will be a key asset to progress in these non-technological issues.

(f) Maximise the societal benefit through involvement of civil society/consumer organisations where needed.

5.3.2. PPP implementation

Rapid implementation of the PPP calls for the use of FP7 instruments first and foremost, with the objective of producing early results with a medium-term outlook before 2015.

Under the last implementation period of the FP7 ICT Theme (2011-2013), the Commission intends to allocate **€300m to kick-start this initiative** with a critical mass of stakeholders, internet technologies and application scenarios. This amount will be earmarked within the existing ICT work programme budget and complement the work addressing longer-term research challenges.

The research community and the Member States will play a major part in PPP developments.

The Commission has launched work to review the legal and governance structures of Joint Technology Initiatives (JTIs) to implement lessons learned regarding the set-up of existing JTIs and ensure that they fully reach their objectives. In light of progress made, the Commission – working with the private sector – will explore the possibility of creating a future JTI in this area. This could offer the advantage of a more structured underpinning of the PPP on the basis of an agreed strategic research agenda, substantive resources from both the public and private sector, and a strong and shared commitment to achieving results.

Line of action:

– The Commission will develop the work programme and the specific evaluation and modus operandi of a Future Internet PPP in cooperation with industrial stakeholders, using the mechanisms of the current Framework Programme. The Commission intends to allocate €300m under the upcoming ICT work programmes covering the period 2011-2013, with a first call for proposals to be issued in 2010.

– The Commission expects the industry to define a focused PPP content by mid-2010 to meet the dual objective of: i) advancing Europe's industrial know-how in Future Internet technologies and systems; and ii) supporting the emergence of Future Internet-enhanced

applications of public relevance.

– The Commission calls on the Member States, primarily through the Future Internet Forum, to support the Future Internet PPP and to help refine policy/usage requirements.

– As soon as the legal and governance structures of JTIs have been reviewed, the Commission will examine the possibility of setting a JTI in the area of Future Internet.

6. CONCLUSIONS

Incremental change and isolated business innovations alone are no longer sufficient to reap the expected benefits of the future internet. Collaborative, cross-cutting responses involving research entities, ICT industries, stakeholders from numerous public service domains and application developers are essential to bring about the changes and to usher in the new service models required. Flexible and open innovation approaches favouring new entrants and ideas depend on the power of networks and on tapping the full potential of internet-enabled services.

This Communication proposes a way forward to develop the future internet and seeks to place Europe at the forefront of the development of smart Europe-wide internet-powered infrastructures, in support of EU policy goals.

In this context, the rapid set-up of an industry-driven Public Private Partnership is needed to complement the ongoing longer-term research supported by the FP7 ICT work programme. The PPP will help to mobilise the industrial forces and entrepreneurs behind an ambitious innovation-driven agenda.

By launching this PPP, the Commission is committing itself to being the driving force behind this effort and calls on the European Parliament, the Council and all stakeholders to work together towards achieving these promising objectives.