Cloud Computing, Internet of Services and Advanced Software Engineering

OBJECTIVE ICT-2011.1.2
CALL 8 OF FP7-ICT

"Scientific research creates the future. And there is no branch of research more associated with the future than Information and Communication Technology (ICT) research. We need solid ICT research strategies today to ensure a sustainable society and economy in the future."

Neelie Kroes
European Commission Vice-President for the Digital Agenda
(ICT 2010 Conference, Brussels, 27 September 2010)

SEVENTH FRAMEWORK PROGRAMME

European Commission
Information Society and Media

This document provides a brief introduction to Cloud Computing, Internet of Services and Advanced Software Engineering research in the Seventh Framework Programme (FP7). The only document describing the type of work for which eligible proposals may be submitted is the work programme of ICT research. Information on the work programme and other legal texts is given in the final section of this document.

1 Progressing towards the **Internet** of **Services**

The speed of change in Internet technologies continues to be impressive. In the last couple of years the availability of devices and tools to access software-based services has increased dramatically. Also, the number and the quality of those services has improved.

Software is becoming more and more **pervasive**: it runs on many of the devices that we use every day. Those devices are actually computers, even if they may have a shape and user interface that hides them. The amount and variety of current **network-connected devices** opens a new world of possible applications at the crossroads of **Internet of Services** and **Internet of Things**. At the same time, challenges arise in areas such as privacy and data protection, security, scalability and manageability.

Cloud computing is changing the landscape, with the promise of cheaper and more flexible software-based services. But the future evolution of the cloud is not yet clear today. Different vendors struggle to impose their own model, and this situation could well evolve into a landscape where incompatible **"walled gardens"** limit interoperability, lock customers in proprietary solutions, and kill real competition on the market.

IT security, resilience and **data protection** are now concepts known well outside the circle of specialists. Individuals and SMEs are affected in their everyday life by problems that can have a direct economic impact when, for instance, their email systems break down or private information is wrongly exposed. Research is needed to make the use of **IT easy and reliable**.

Information technology **uses a lot of energy**. On the one hand, there is a great potential for savings in the IT infrastructure itself, while on the other hand software-based services can help **reducing energy consumption** in many domains, such as public transport and energy distribution.

In conclusion, there are many challenges around. Research not only solves challenges, but has a direct effect on the life of people, creates new jobs and wealth, and helps the creation of a better European society.

Today the Internet of Services has the potential to play a very important role in our future.

2 Cloud Computing, Internet of **Services** and **Advanced** Software Engineering

The objective focuses on technologies specific to the networked, distributed dimension of software and access to services and data. It will support long-term research on new principles, methods, tools and techniques enabling software developers in the EU to easily create interoperable services based on open standards, with sufficient flexibility and at a reasonable cost.

TARGET OUTCOMES

a. Cloud Computing

- Intelligent and autonomic **management of cloud resources**, ensuring agile elastic scalability. Scalable data management strategies, addressing the issues of heterogeneity, consistency, availability, privacy and supporting security.
- Technologies for **infrastructure virtualisation**, cross platforms execution as needed for service composition across multiple, heterogeneous environments, autonomous management of hardware and software resources.
- **Interoperability** amongst different clouds, portability, protection of data in cloud environments, control of data distribution and latency.
- Seamless support of **mobile, context-aware applications**.
- **Energy efficiency** and sustainability for software and services on the cloud.
- Architectures and technologies supporting **integration of computing and networking environments**; implications of Cloud Computing paradigm on networks
- Open Source implementations of a **software stack for Clouds**.

b. Internet of Services

- **Service engineering** principles, methods and tools supporting development for the Internet of Services, including languages and tools to model parallelism.
- Services enabled by technologies for seamless integration of real and virtual worlds, through the **convergence with Internet of Things and Internet of Contents**.
- Massive **scalability, self-management, verification, validation and fault localisation** for software-based services.
- Methods and tools to **manage life cycle** of secure and resilient Internet-scale applications from requirements to run-time and their adaptive evolution over time.

c. **Advanced Software Engineering**

- **Advanced engineering** for software, architectures and front ends spanning across all abstraction levels.
- **Quality measure and assurance techniques** which adapt to changing requirements and contexts, to flexibly deal with the complexity and openness of the Future Internet.
- **Management of non-functional requirements** typical of Internet-scale applications, like concurrency levels which will be orders of magnitude larger than in today's applications, huge data stores and guaranteed performance over time.
- Tools and methods for **community-based and open source software development**, composition and life cycle management.

d. **Coordination and support actions**

- Support for **standardization** and **collaboration** in software and services technologies.
- Support for the **uptake of open source development models** in Europe and beyond.
- **Collaboration with Japanese entities** on: cloud computing, particularly on common standards for data portability and on interoperability; services having more efficient energy usage.

EXPECTED IMPACT

- Emergence of **European interoperable clouds** contributing to an internal market of services in the EU whilst providing very significant business opportunities to SMEs; improved trust in cloud-based applications and storage for citizens and business.
- Availability of **platforms** for easy and controlled development and deployment of value-added services through innovative service front-ends.
- **Lower barriers** for service providers and users to develop, select, combine and use value-added services through significant advances in cloud computing technologies and standardised and open interfaces.
- **Efficient implementation** of mainstream software applications on massively parallel architectures.
- **Easier evolution of legacy software** over time, thanks to innovative methods and tools managing the complete lifecycle of software from requirements to run-time.
- **Fast innovation cycles** in service industry, e.g. through the use of Open Source development model.
- A **strengthened industry in Europe for software-based services** offering a large choice of services satisfying key societal and economical needs, with reinforced capabilities to engineer and produce software solutions and on-line services.

3 Join us!

Interested in performing research into "Cloud Computing, Internet of Services and Advanced Software Engineering"? A great deal of further information is available to help you.

HOW TO PARTICIPATE IN ICT RESEARCH IN FP7

Information about ICT research in FP7 is available online at http://cordis.europa.eu/fp7/ict/ with details about:

Work Programme 2011 – 2012
ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/ict-wp-2011-12_en.pdf

Participating
http://cordis.europa.eu/fp7/ict/participating/home_en.html

Calls for Proposals
http://cordis.europa.eu/fp7/ict/participating/calls_en.html

You can submit proposals for Objective ICT-2011.1.2 under Call 8 of FP7-ICT. This call will open in July 2011 and close on 17 January 2012.

MORE INFORMATION ON FP7

The FP7 website http://cordis.europa.eu/fp7/participate_en.html has both general information about the Framework Programme including **who** can participate (eligible countries, eligible consortia...), **when** events happen (calls for proposals, for experts, ...), **what** (budget, funding schemes, ...) and **how** (financial rules, forms of grants, IPR, ...).

ONGOING RELATED RESEARCH AND CONSULTATION

Future of the Internet
http://ec.europa.eu/information_society/activities/foi/index_en.htm

Software and Services
http://cordis.europa.eu/fp7/ict/ssai/home_en.html

Reports
http://cordis.europa.eu/fp7/ict/ssai/workprogramme-2011-12-orientations_en.html

And a look forward: preparations for FP8
http://cordis.europa.eu/fp7/ict/ssai/fp8preparations_en.html

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Free phone number (*): 00 800 6 7 8 9 10 11

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A great deal of additional information on the European Union is available on the Internet. It can be accessed through the Europa server (http://ec.europa.eu).

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