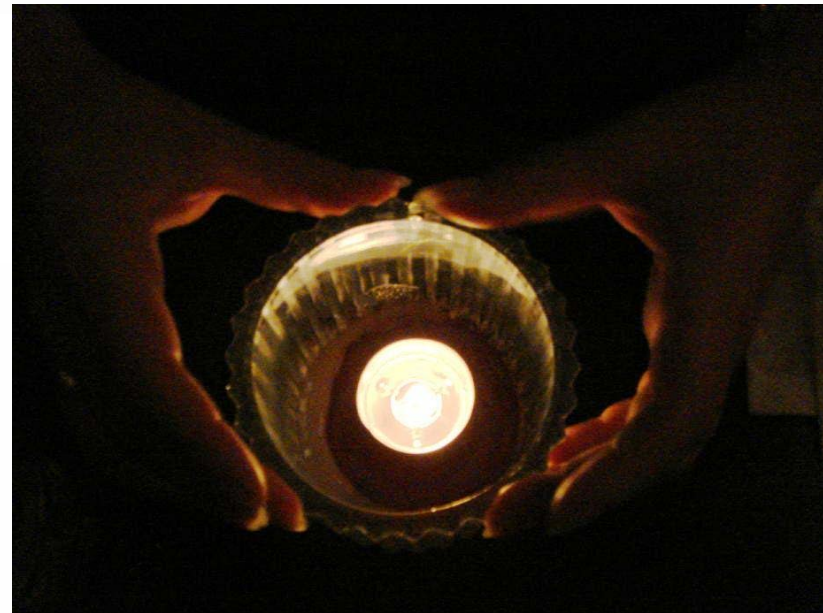


New Infrastructure Paradigms & Experimental Facilities

fire

***Future Internet
Research and
Experimentation***



Fabrizio Sestini

**ICT unit F4 New Infrastructure Paradigms & Experimental Facilities
DG Information Society and Media, European Commission, Brussels**

Background: the Internet... and its **limits** (architecture, IP protocol)

- Scalability
 - Devices (users AND nodes, mostly wireless) will outnumber humans by several orders of magnitude
 - Not only numbering: Service-centric networks in contrast to the source-destination approach of the Internet (semantic processing, space-aware mobility)
 - Need to overcome the intrinsic limitations of a centralized management, self-organizing and interdisciplinary approaches to cope with complexity (e.g. bio-inspired)
 - Multiple types of attachments to the infrastructure
 - Routing
- Suitability for ad-hoc/mesh networking
 - disconnected operation (opportunistic, trust and privacy, ...)
- Mobility
 - Mobile IP (or MIPv6) not effective, overhead
- Transparency
 - S???
 - st?
- Security
 - How to cope with it, how to cope with heterogeneous networks
- Machine-to-machine communication

patches

patches

patches

patches

patches

patches

FIRE baseline: starting from FP6 research

- **long-term research in communications and networking under Future and Emerging Technologies:**
 - **Situated Autonomic Communications projects:**
 - ANA, BIONETS, CASCADAS, HAGGLE
 - **other future internet related projects**
 - CATNETS, COOPCOM, EVERGROW, NET-REFOUND

- **Research Infrastructure Testbeds**
 - **Onelab STREP to widen Planetlab and create an autonomous Planetlab Europe**
 - **PANLAB SSA preparing the federation of testbeds**
 - **Testbeds related to QoS, new routing, convergence of services, IPv6, mobility and multihoming, etc.**

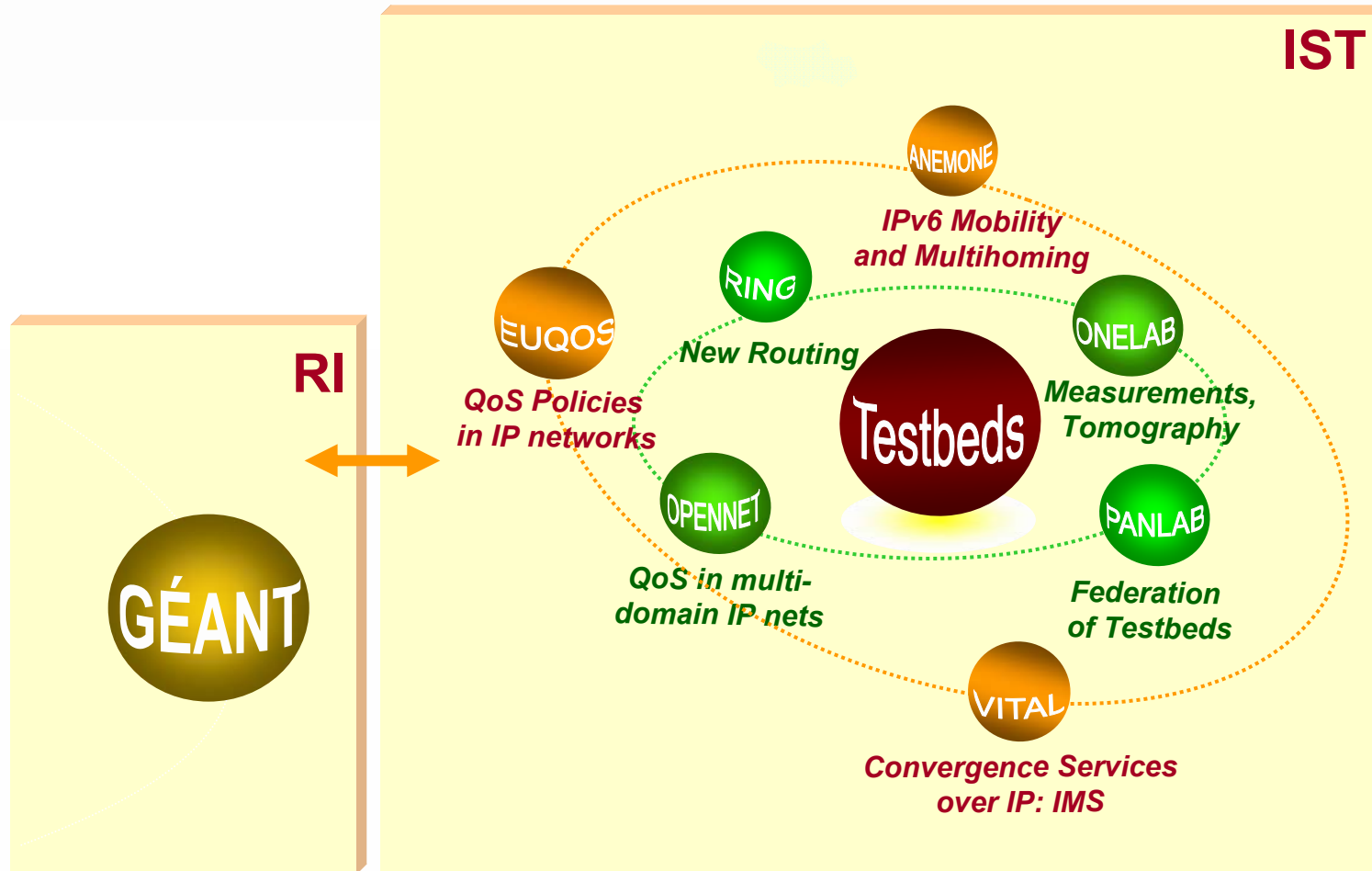
Future and Emerging Technologies: SAC (Situated and Autonomic Communications)

- July 2003: First brainstorming meeting
- March 2004: Consultation Meeting on "Communication Paradigms for 2020"
 - Participants from university, industry, telecom operators and research centers
 - Outcome: background document on Situated and Autonomic Communications
- October 2004: Coordination Action on Autonomic Communication (ACCA) start
- December 2004: Call launch (20 Meuro) - Autonomic Communication Forum launch
- August 2005: negotiation of 4 selected proposals (out of 12 submitted)
 - Joint negotiation meeting, will have joint events and reviews
- January 2006: start of 4 Integrated Projects

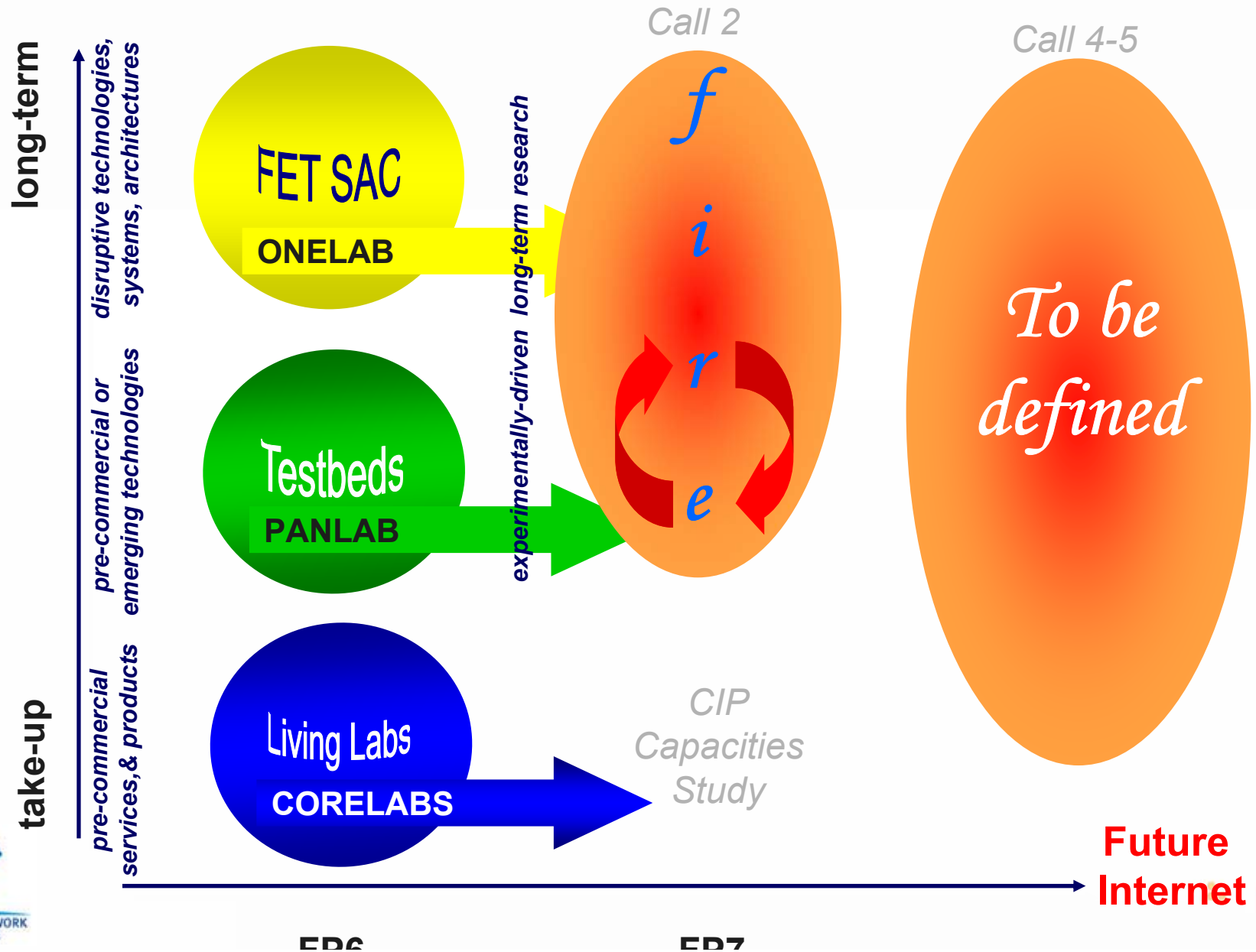
SAC Project Partners

- **Universities:** Cambridge, Oxford, Waterloo, Basel, Athens, Lancaster, Oslo, Paris (Pierre et Marie Curie, Paris 11, ENS) Liege, London (Imperial College, LSE), Budapest, Berlin, Basel, Aachen, Ulster, Kassel, Trento, Bruxelles (ULB, UCL), Modena e Reggio Emilia, Kobenhavns, Magdeburg, Crete, Jerusalem, Tel Aviv, Uppsala, Cyprus, Navarra, Cairo, Madrid (URJC), UPC, CTTC, Bayreuth, Karlsruhe, Ancona, Cardiff, Eindhoven, SUPSI, SICS, EPFL
- **Research Centers:** ETH, KTH, Fraunhofer, VTT, ICTP, Create-NET, Hamburger ITC, Eurecom, CERTH, RACTI, CNR, CNRS, ISI, INFM, ITC
- **Industries:** Nokia, Ericsson, NEC Europe, Thomson Research, Sun Microsystems Iberica, ex-Intel Research Cambridge
- **Telecom Operators:** British Telecom, Telecom Italia, France Telecom, Telekom Austria, Teliasonera

FIRE Baseline: Testbeds in FP6 (2006 – 2009, ~ 30M€)



FIRE strategy



Objective ICT-2007.1.6

New Paradigms and Experimental Facilities

- *Experimentally-driven long-term research related to the Future Internet*
 - *“Advanced networking approaches to architectures and protocols: to cope with the increased scale, resilience, complexity, mobility, security and transparency of the Future Internet, coupled with their validation in large scale testing environments based on a combination of physical and 'virtual' infrastructures”*
- *Interconnected testbeds to support large scale validation*
 - *“Interconnected testbeds addressing: novel distributed and reconfigurable protocol architectures; novel distributed network and service architectures, infrastructures and software platforms; advanced embedded or overlay security, trust and identity management architectures and technologies”*
- Part of Challenge 1 - complementary to “Technologies and systems architectures for the Future Internet”, part of Objective “The network of the Future” (Call 1, 200M)
- To bootstrap and prepare the **FIRE Initiative**
- **Call 2 - Budget: 40 M€**
IPs, STREPs, NoE, CA/SSA - planned opening June, deadline September 2007

Advanced networking
approaches

Interconnected
testbeds

Other relevant objectives

▪ ICT-2007.8.2 FET proactive 2: Pervasive adaptation

- Call 1 – 20 M€ for IPs, STREPs and CSAs
- Evolve-able and adaptive pervasive systems
- Networked societies of artifacts

▪ ICT-2007.1.4 Secure, dependable and trusted Infrastructures

- Call 1 – 90 M€ for IPs, STREPs, NoEs and CSAs
- Security and resilience in network infrastructures
- ...

Other relevant objectives:

Objective ICT-2007.1.1 The Network of the Future

- 1.1.a Ubiquitous Network Infrastructures and Architectures
- 1.1.b Optimised Control, Management and Flexibility of the Future Network Infrastructure
- 1.1.c Technologies and System Architectures for the Future Internet
 - New architectures, routing, identification and addressing schemes - free from current constraints
 - Scalability of terminals, devices and objects; multiplicity of service scenarios, and application environments
 - Mobility, security and trusted domains; new forms of content delivery in an ubiquitous mobile and wireless environment.

Leading the Future Network Standards

Leveraging on the ETPs and seeking industrial impact

Call 1 – Budget 200 M€ <http://cordis.europa.eu/ist/ct/index.html>

Contact andrew.houghton@ec.europa.eu / paulo.desousa@ec.europa.eu

The FIRE Initiative

Future Internet Research and Experimentation

- **Experimentally-driven long-term research**
 - Open to fresh bottom-up ideas, no backwards-compatibility constraints
 - starting from the running FET SAC projects, to include new projects from call 2
 - Integrating and validating new concepts developed in multiple research disciplines
- **Setting up large-scale testing environments for the ICT research in the field**
 - Creating a European Lab for testing potentially disruptive internet concepts
 - possibly building on ONELAB and on the advanced testbeds of SAC projects
 - Federating upfront existing and planned testbeds for emerging technologies:
 - e.g. in line with the framework provided by PANLAB
 - Open to relevant testbeds from outside the Objective, e.g. EU, national, regional
- **Not just paperwork: new internet paradigms need large scale validation and testing**
- **Considering at the same time technological, economic and social/policy aspects**
- **FIRE is a long term initiative: Call 2 is just a first step – more calls planned in FP7**
- **Definition of a European identity based on EU needs and strengths**
- **Exploiting the GEANT pan-European Gigabit research network**
- **Collaboration with FIND/GENI (US) and related initiatives in the Far East**

Different perspectives for the Future Internet

■ Industrial

- backward compatibility / standards
- security for supporting commercial services and applications

■ Academic/Technological

- aiming at clear improvements
- clean slate approach to overcome intrinsic limitations

■ Political

- European competitiveness on future internet
- redesigning the internet involves a huge social responsibility
 - cannot be based solely on technological or commercial constraints
- how to preserve openness, fairness, social role of the Internet
 - needs for security/accountability versus right to privacy
 - Intelligence to the core? QoS vs. innovation vs. network neutrality...
 - a network that knows what an attack is, is not net neutral
 - is internet open and democratic by design or by accident?
 - do not throw the baby out with the bath water!

Thank You! Questions?

fire

(non-trivial logo sought)

<http://cordis.europa.eu/fp7/ict/fire>

fabrizio.sestini@ec.europa.eu
max.lemke@ec.europa.eu
per.blixt@ec.europa.eu

Work Programme 2007-2008, two complementary approaches:

- **Objective 1.1 The network of the Future:**
 - To continue to improve current Internet technologies and investigate new ones, based on the industrial agendas of the main European Technology Platforms
 - Total budget of €200m in Call 1
 - The direction of this research has been shaped also by the EIFFEL Think Tank <http://www.future-internet.eu>

- **Objective 1.6 New Paradigms and Experimental facilities**
 - To investigate new paradigms for the long-term possible evolution of the Internet, and to set up large-scale experimental facilities for their proof-of-concept testing
 - Total budget of €40m in call 2
 - It will be the start of the FIRE (Future Internet Research and Experimentation) Initiative <http://cordis.europa.eu/fp7/ict/fire/>