The Future Internet Research Strategy of the EU ICT Programme

FIRE: Future Internet Research & Experimentation

September 2009

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www.cordis.lu/fp7/ict/programme/challenge1_en.html

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- **Motivation**
- **Future Internet Research and Experimentation**
- **European strategic approach towards a Future Internet**
- **Conclusions & References**

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the issue...

Internet by its simple and open design has successfully enabled innovation!

But...

Novel societal and commercial usages are pushing the Internet architecture to its limits

Simple is beautiful!

But...

Simple can become complex and big!
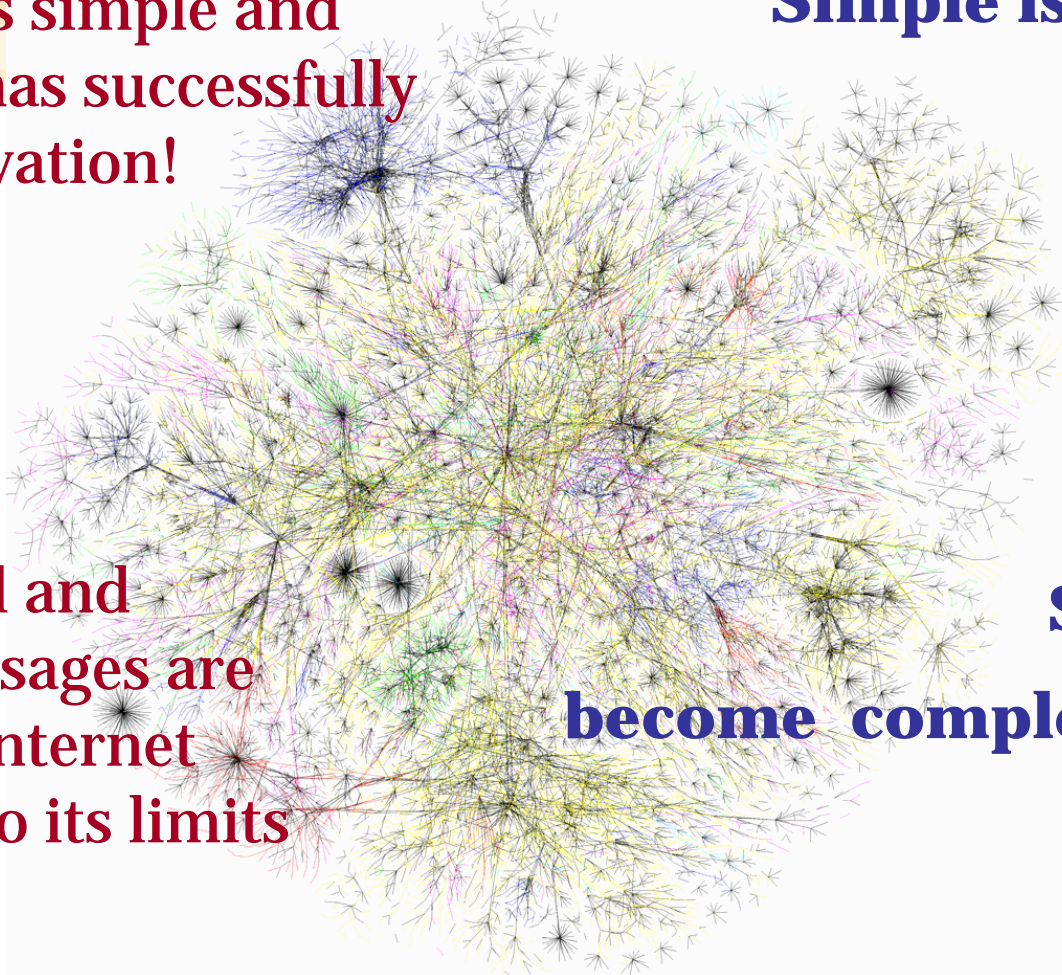
scale factor: how big is big?

Number of computers on the Internet

WEB sites:
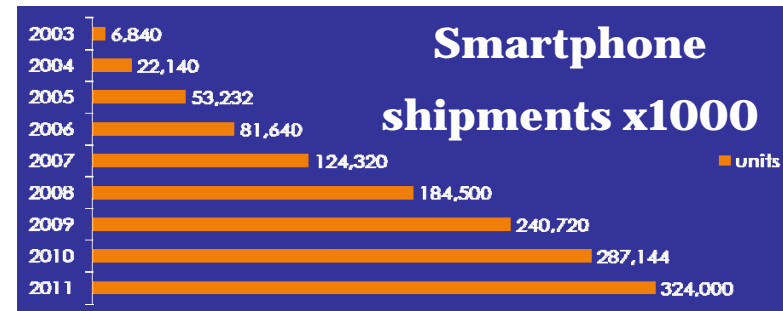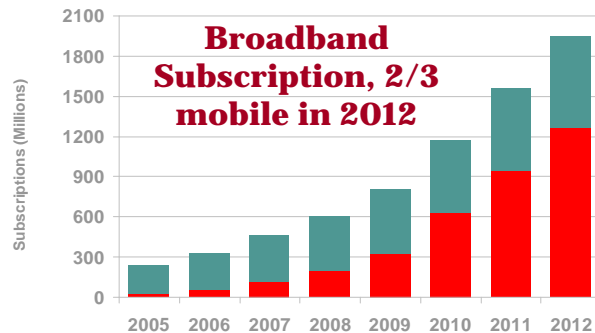30 new Million sites added in 2008
17% annual growth
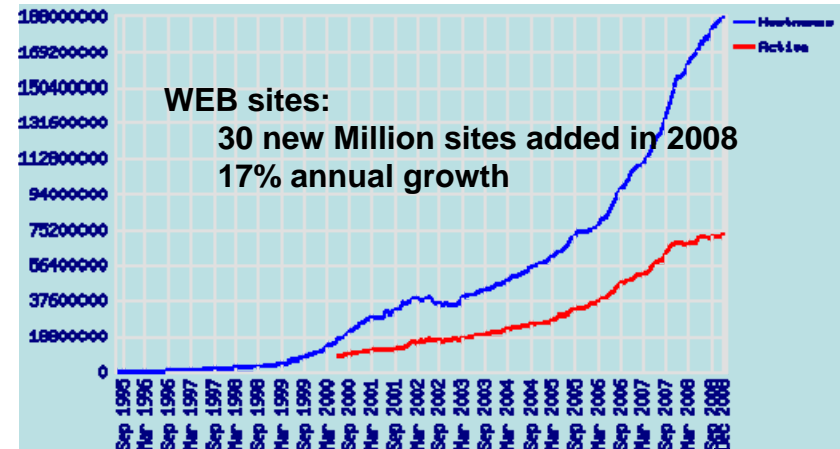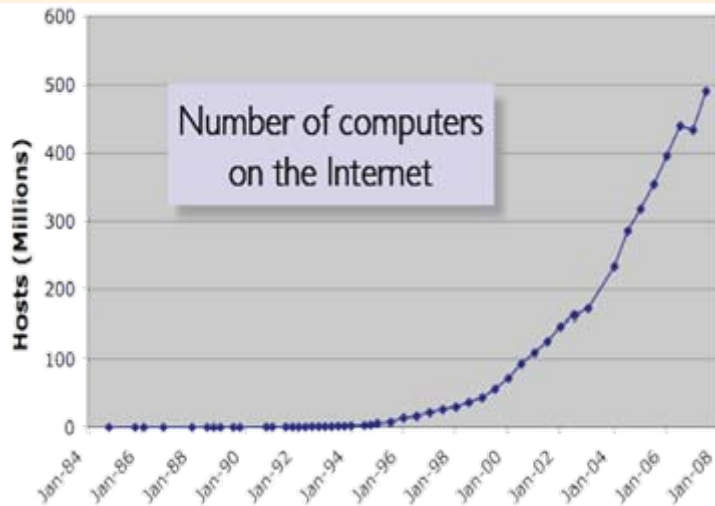
- Google indexed 26 Million pages in 1998 – today it **indexes 1 trillion pages**
- There are currently **210 billion emails per day** (73% spam)
- User generated content (e.g YouTube) produces **73+ billion streams in 2008**
- Facebook and MySpace each have over **100 million users** (3/4 teenagers)
- **3.7 million pictures** uploaded every day in Flickr
- **1.3 trillion SMS messages** in 2008

mobile and "things" factor

- Internet goes mobile due to the widespread of smart terminals and of broadband mobile networks

- +50% in 2008; >1 Billion users expected to use their mobile as Internet gateway in 2012

Broadband Subscription, 2/3 mobile in 2012

Year	
2003	6,840
2004	22,140
2005	53,232
2006	81,640
2007	124,320
2008	184,500
2009	240,720
2010	287,144
2011	324,000

Smartphone shipments x1000 — units

Towards trillions of connected devices, Internet of objects, novel applications driven by **user needs**:

CONTEXT: e.g. Geo-location as embedded capability

PARTICIPATION: e.g. Combine virtual with the physical world

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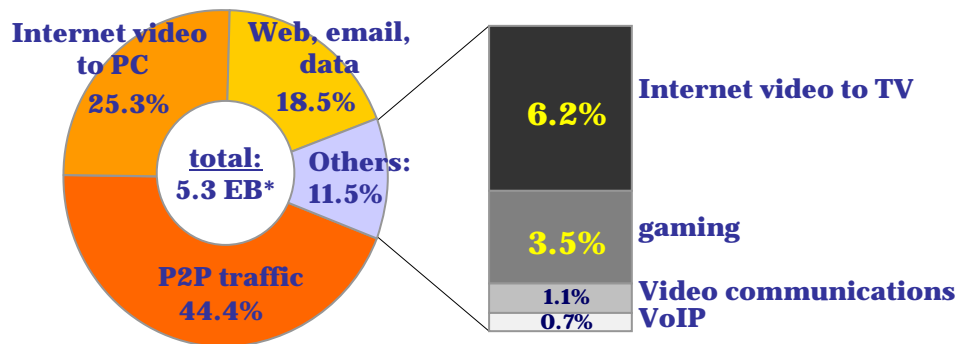Information Society and Media

5

video factor

Changes in consumer Internet IP traffic:

- P2P stable (even low decrease)
- Strong growth of video streaming
- Video doubles traffic every 2 years

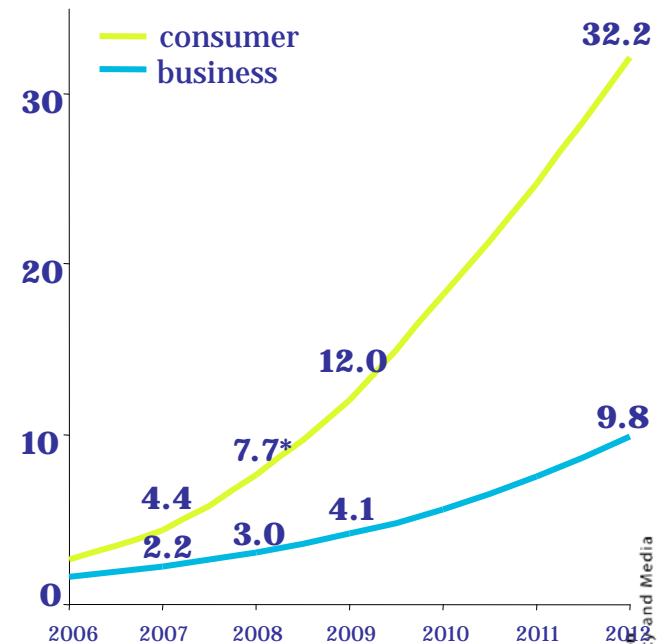### Breakdown of consumer Internet IP traffic*
monthly traffic 2008, as a % of total traffic

Internet video to PC 25.3%

Web, email, data 18.5%

total: 5.3 EB*

Others: 11.5%

P2P traffic 44.4%

Internet video to TV 6.2%

gaming 3.5%

Video communications 1.1%

VoIP 0.7%

Change in IP traffic by category
2006-2012, in Exa Bytes** per month

— consumer
— business

32.2
30
20
12.0
9.8
10
7.7*
4.4
4.1
2.2 3.0
0

2006 2007 2008 2009 2010 2011 2012

Source: Cisco Visual Networking Index, 2007–2012 (June 2008)
*: 2008 consumer IP traffic = Internet traffic (5.3 EB) + non-Internet traffic (2.4 EB), or 7.7 EB
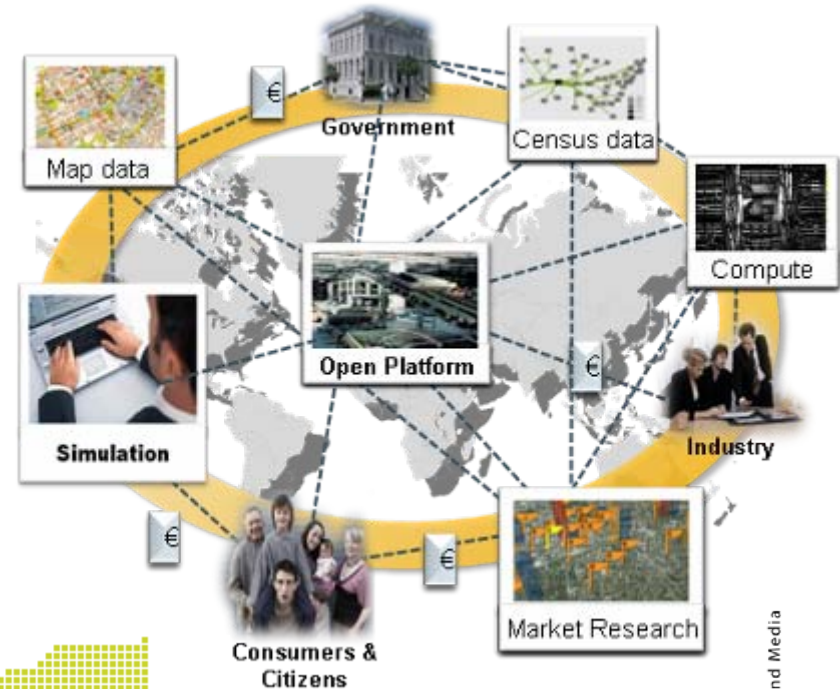**: 1 ExaB = 10^{18} B

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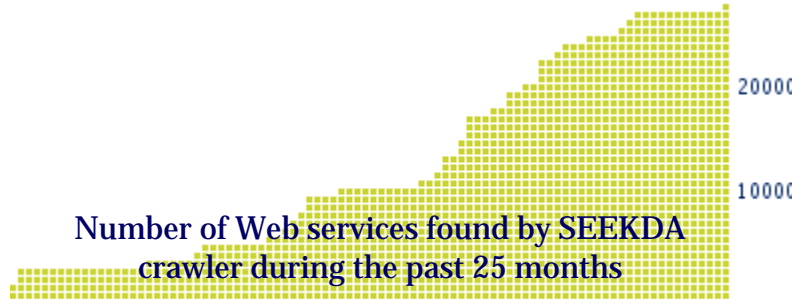Information Society and Media

6

services factor

A multitude of connected IT services, which are offered, bought, sold, used, repurposed, and composed by a worldwide network of service providers, consumers, aggregators, and brokers

- resulting in -

a new way of offering, using, and organising IT supported functionality

Number of Web services found by SEEKDA crawler during the past 25 months

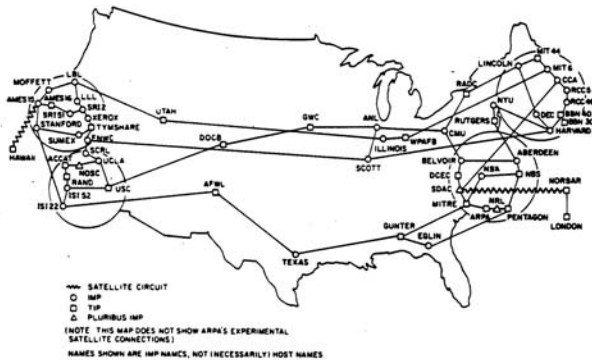*Adapted from SAP Research, 2008, and SEEKDA, 2008*

trustworthy information society

- Cyber-threats, cyber-crime
- Complexity of critical Infrastructures
- Trust, accountability, transparency
- Identity, privacy and user empowerment
- Human values and acceptance

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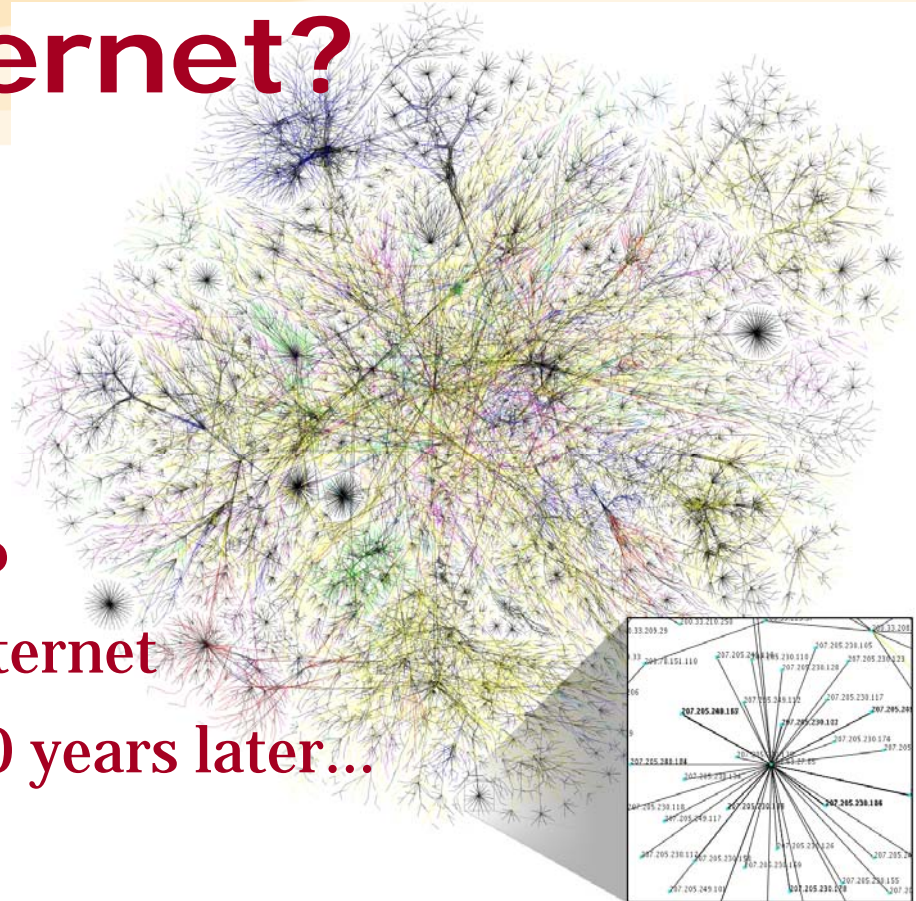Information Society and Media
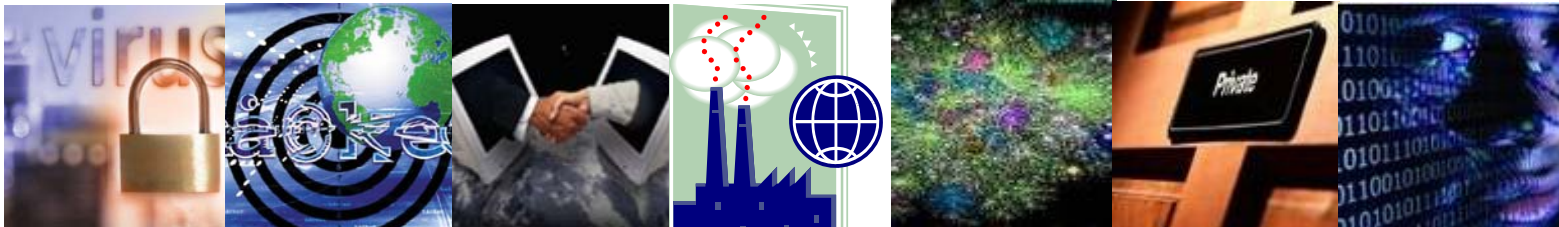
Why experimenting with the Internet?

From
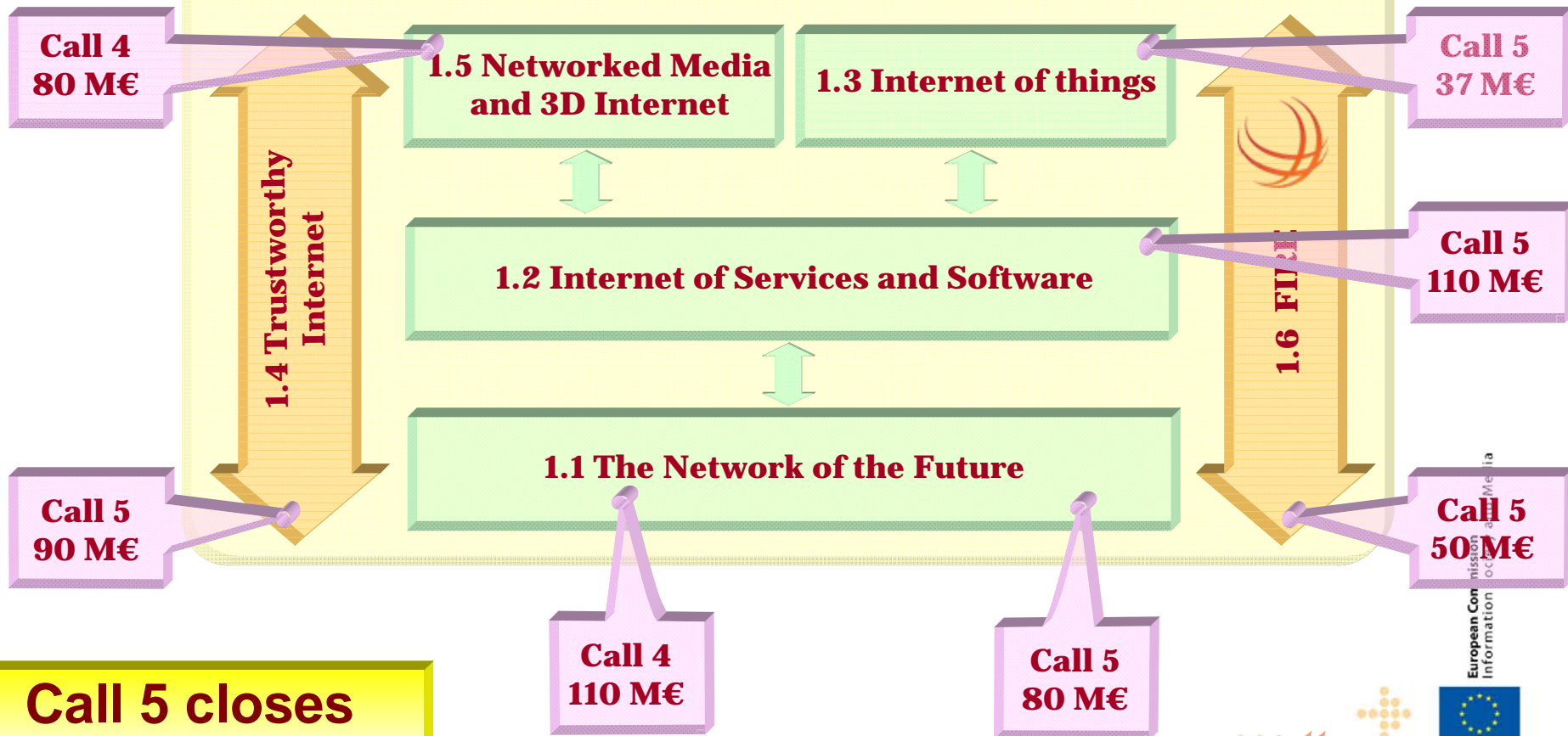
ArpaNet 1977

To

Internet

30 years later...

Internet as we know it today was built and expand beyond the original intent as an experiment!

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Work Programme 2009/2010: ICT Challenge 1/Future Internet

Pervasive and Trusted Network and Services Infrastructures

1.4 Trustworthy Internet

1.6 FIRE

1.5 Networked Media and 3D Internet

1.3 Internet of things

1.2 Internet of Services and Software

1.1 The Network of the Future

Call 4
80 M€

Call 5
37 M€

Call 5
110 M€

Call 5
90 M€

Call 5
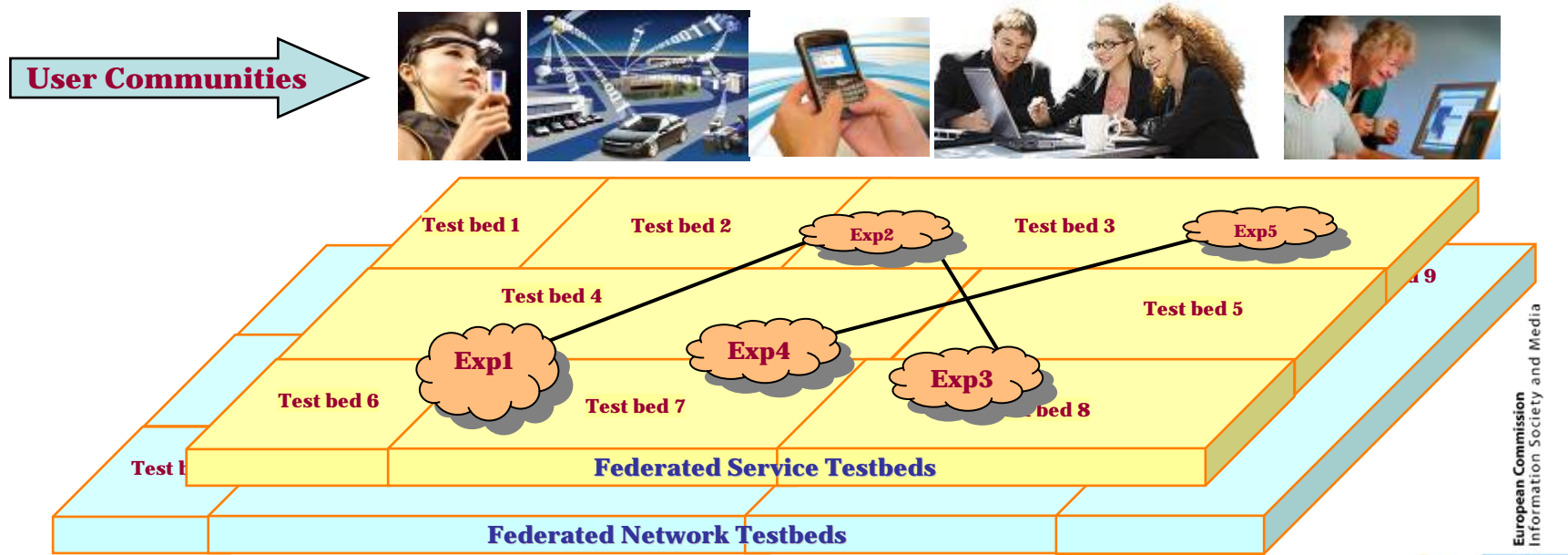50 M€

Call 4
110 M€

Call 5
80 M€

**Call 5 closes
26 October 2009**

FIRE Future Internet Research & Experimentation

- Anticipating technology trends
- Assessing business models
- Evaluating societal impact

- User-centric development
- Data-intensive experimental research

FIRE Experimental Facility

FIRE - Overview of Projects

experimentally-driven, multi-disciplinary research

| OPNEX | ECODE | N4C | SmartNet |

| Perimeter | Nanodata centers | ResumeNet | SelfNet |

validation

long-term research ⟳ large scale experiment.

requirements
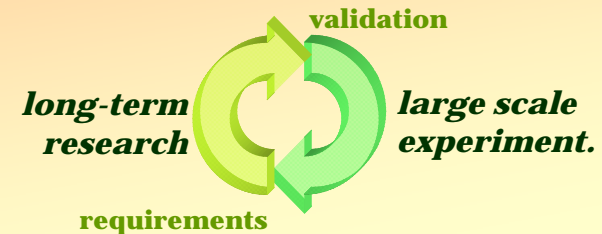
Building the experimental facility

VITAL++   WISEBED

Federica

PII

OneLab2

Testbed	Testbed
Testbed	Testbed
Testbed	Testbed

support actions

FIREWORKS   PARADISO

(from Call2 Objective 1.6: Community Funding 40 M€)

13

Building the FIRE experimental facility and stimulating its use

FP7 – WP 2007/08: Prototyping the federation concept

- open and dynamic
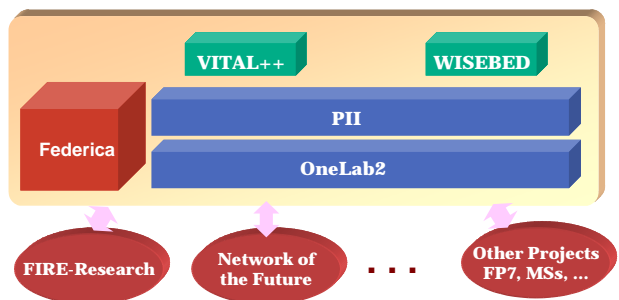- focus on network connectivity layers
- supporting academia and industry
- proof-of-concept → pre-commercial tbs
- understanding the socio-economic dim.
- **availability & gradual expansion of prototype services starting in 2008**

FP7 – WP 2009/10: Building the facility + stimulating its use

- building the FIRE Facility to consist of several FIRE Facility Projects based on the design principle of **open coordinated federation of testbeds**
- supporting **FI Research at all stages** of R&D cycle
- **expanding the scope** towards experimentation at large scale & comparison of visionary approaches for
  - ✓ network architectures and technologies
  - ✓ service architectures and platforms
  - ✓ networked media & trustworthy infrastructures
- experimentation with the FI as a system cutting across layers or being layer less
- direct involvement of user communities
- dynamic, sustainable, open
- early operati0nal prototypes of **FIRE Facility projects** - to be gradually expanded
- stimulating **innovative use** of the FIRE Facility by research customers

Towards a collaboration and high level federation structure for the FIRE Facility
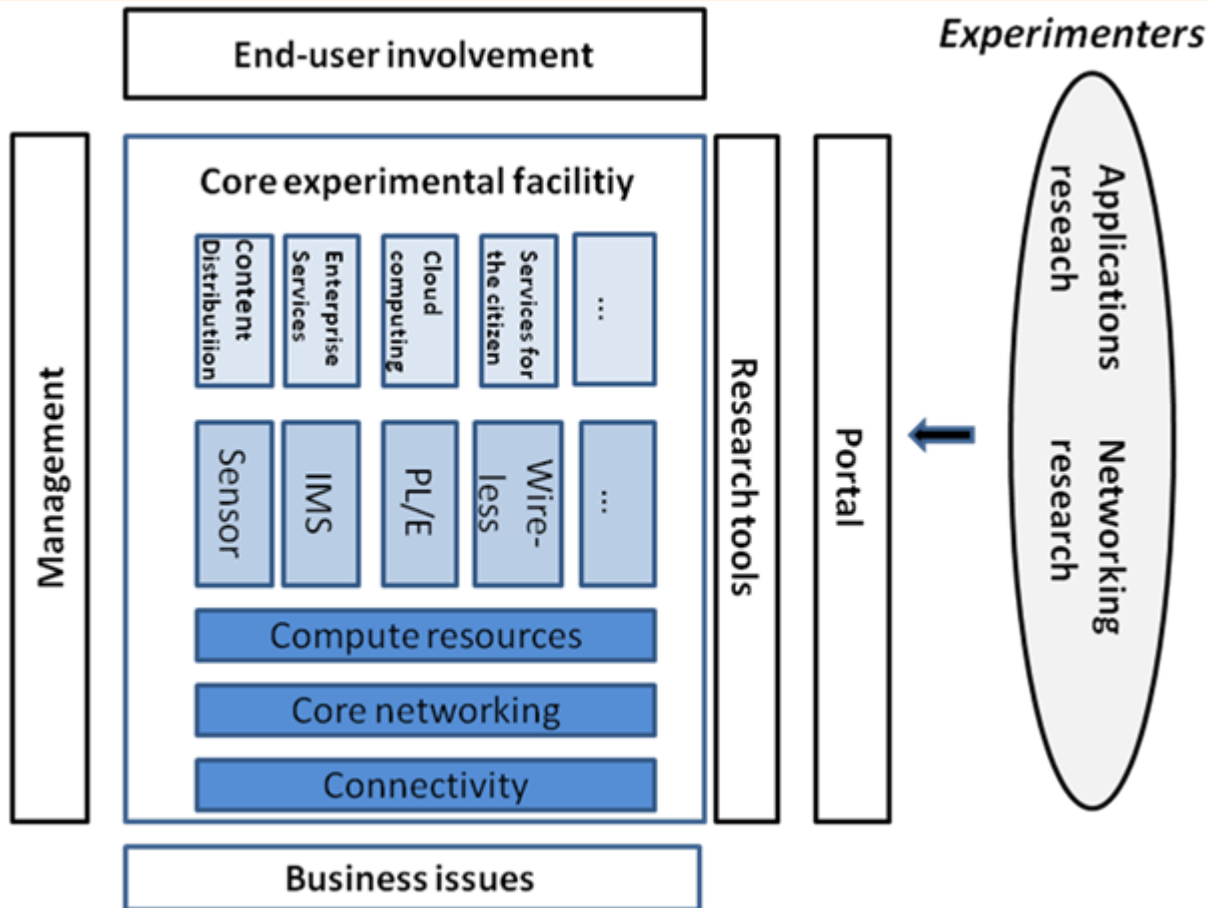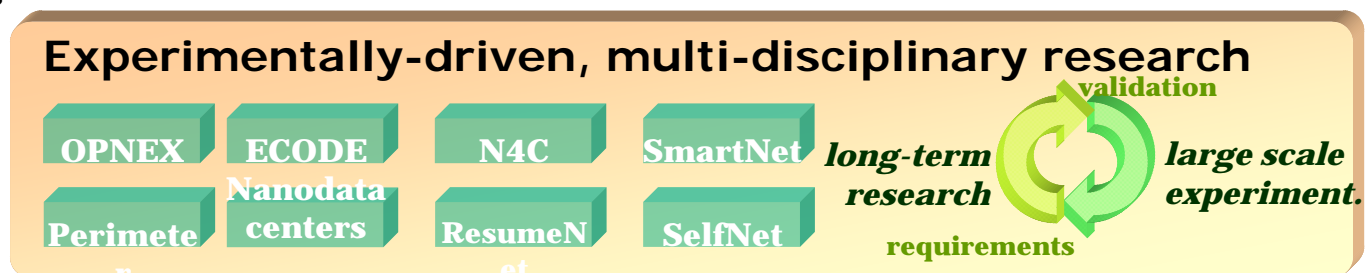
Experimentally-Driven Research in WP 2009-2010
- a playground for visionary, multidisciplinary, system-level research -

Starting Point:

- Situated Autonomic Communications Initiative under FP6–FET

- First wave of projects under WP 2007/08

Experimentally-driven, multi-disciplinary research

| OPNEX | ECODE | N4C | SmartNet |
| Perimeter | Nanodata centers | ResumeNet | SelfNet |

long-term research

large scale experiment.

validation

requirements

Visionary multidisciplinary research under WP 2009/10:

i. **Driving and using the Facility:** Defining the challenges for and taking advantage of the Experimental Facility

ii. **Experimentally-driven FI research:** Consisting of iterative cycles of research, design & large-scale experimentation of new and innovative network and service architectures for the Future Internet

iii. **Taking a system perspective of the FI**: Research to consider the Future Internet as a complex system addressing it in a holistic vision and at all relevant levels and layers including to take into account energy, low cost, environmental or socio-economic aspects

ICT WP 2009/10 - Objective 1.6: Future Internet experimental facility & experimentally-driven research

Building the FIRE experimental facility & stimulating its use

25 M€ for IPs

FIRE Components (gradual expansion) (20%)

FIRE Users (user stimulation) (20%)

Defining the challenges for the facility

Taking advantage of the facility

FIRE experimentally driven research

20 M€ for STREPs

Co-ordination and support actions - 5 M€ for CSAs

ICT Call 5
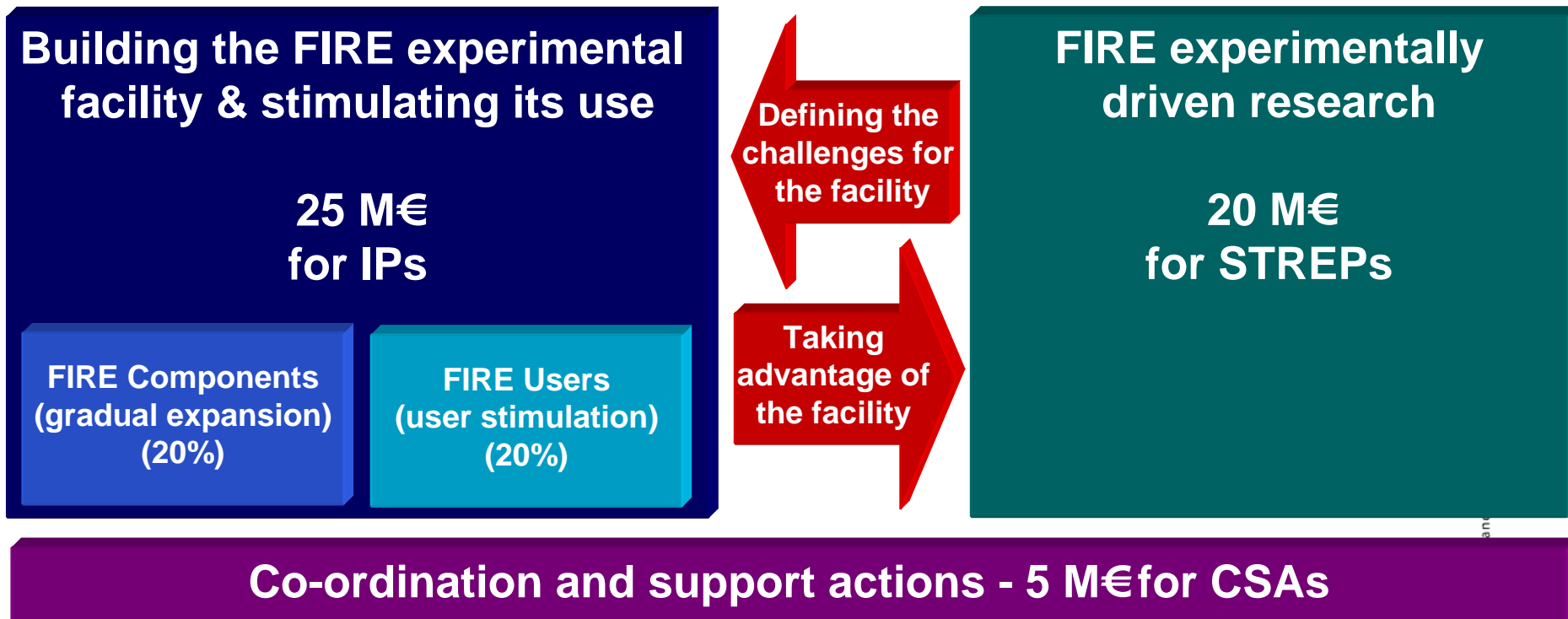
FIRE Challenges for 2009 and beyond

- ❑ Working prototypes of new FIRE facility projects by end 2010
- ❑ Collaboration of FIRE facility projects in Working Groups
  - towards high level federation/collaboration/integration
  - sharing a joint user-friendly customer portal
- ❑ Match the offer of the FIRE prototypes with the demand by research projects in FIRE Research and across Challenge 1
- ❑ Establish bilateral federations between FIRE prototypes and with other EU national or intl. facilities and infrastructures
  - GEANT, research infrastructures under FP7-CAPACITIES
  - German-Lab, GENI, JGN/AKARI, ...
- ❑ Establish FIRE as an integral part of a Future Internet PPP
- ❑ Derive a sustainability model for the FIRE facility
  - Currently building the FIRE facility targeted at the Future Internet researcher is a challenging research issues
  - In the long term (e.g. FP8), operation of the FIRE infrastructure cannot be funded through research funds
  - New funding mechanisms/business models need to be found - a mix of :
    - ➢ Research Infrastructure funds,
    - ➢ Commercial business models,
    - ➢ Research funds for innovative aspects?

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the European position

- Europe has its success stories:
  GSM, MP3, ADSL, ...

- Europe has its strengths
  Mobile comms,
  system integration, ...

- European
  Services ?

1986   **1996**   **2006**   *20*

what is at stake?

The Future Internet: an opportunity for Europe

- Novel applications for the benefit of citizen
- Lower market entry barriers for high tech SME's
- Early mover advantage on novel Internet enabled markets

But it requires:

- "Complexity management" and open innovation
- Ecosystem of consumers and suppliers
- Reducing fragmentation of efforts;
- Putting industry in the driving seat; but with the users co-piloting!
- Bridging the gap between technology and applications

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multi-dimensional approach

1. Greater coordination of on-going EU R&D activities
   - Look for higher impact and take-up of results
   - Articulate activities with policy requirements
2. PPP complementing the FP7-ICT WP and CIP activities
   - Bridge the gap between the technologies and key application sectors (energy, health, transport, etc)
   - Address large scale demonstration settings
   - Involve new actors and innovation opportunities
3. Establish a Forum of Member States
   - Set the basis for a Europe wide strategy on Future Internet
   - Share best practices and reduce fragmentation

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coordination of R&D activities

- **94 EU-funded projects, 400 M€, >500 participants (+ 300-400 M€ euros expected in 1-2 years)**

- **FI activities are no longer being seen from different silos**
    - **Coordination of R&D activities**
    - **Standards, regulations, governance,...**

- **FIA meets twice a year:**
    - **Bled, March 2008 ⇨ Bled Declaration**
    - **Madrid, December 2008**
    - **Prague, 11-13 May 2009 ⇨ Future Internet I**
    - **Stockholm, November 2009**
    - **... Valencia, April 2010**
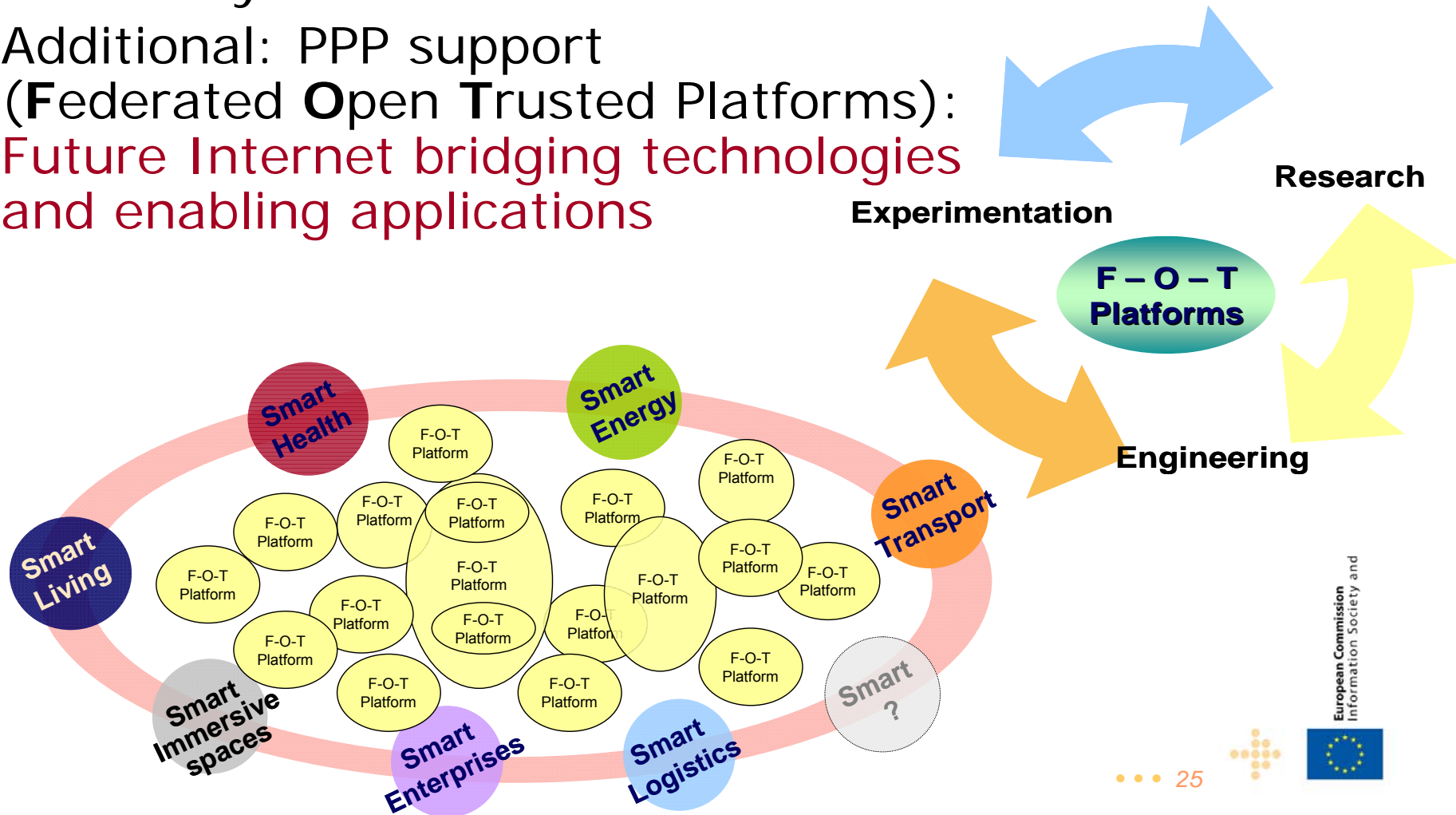
www.future-internet.eu

preparation of WP 2011-13
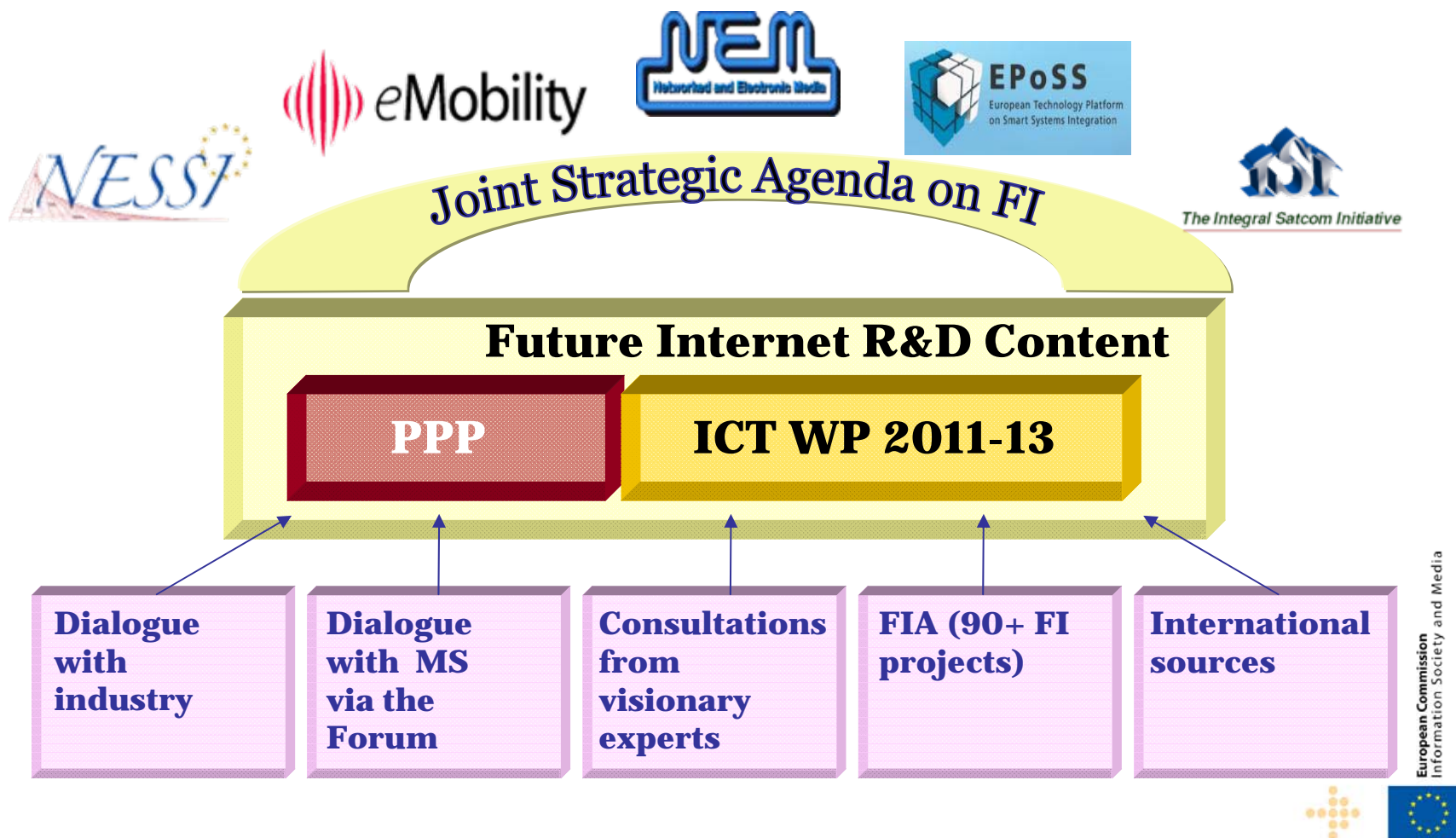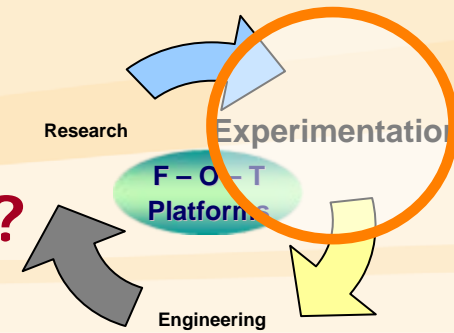
towards ICT Workprogramme 2011 – 2013

- Continuity in 2009/10 domains
- Additional: PPP support (**F**ederated **O**pen **T**rusted Platforms): Future Internet bridging technologies and enabling applications

Initial Thoughts

**F-O-T Platforms
What do we seek
in terms of experimentation?**

Research   Experimentation
F – O – T
Platforms
Engineering

- **Checking and testing new principles**
  - **Early validation of innovative methodological approaches**
  - **With users (socio-economics incl. acceptability,usability)**
- **Facilitating the experimentation by further extending existing experimentation facilities → serving the FI research communities**

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conclusions

- Future Internet is recognised as a priority at European and international levels

- A comprehensive set of initiatives and tools are in place to pool resources

- Europe can and should take the lead in Future Internet developments

- Experimentation has a crucial role in those developments

- The FIRE prototypes are offering first services to be extended in 2010

- The community represented in this event has the potential to contribute to this collective endeavour, e.g.

  - Exploit synergies between e-Infrastructure development and deployment and Future Internet research and large scale demonstration

  - Should the basic FIRE infrastructure in the long term become an e-Infrastructure for the FI Research Community ?

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references

- **Future Internet Portal:**
  http://www.future-internet.eu

- **Future Internet Forum:**
  forum.future-internet.eu

- **ICT Challenge 1:**
  www.cordis.lu/fp7/ict/program
  me/challenge1_en.html

- **FIRE:**
  www.cordis.lu/fp7/ict/fire