European Research on Future Internet

in Framework Programme 7

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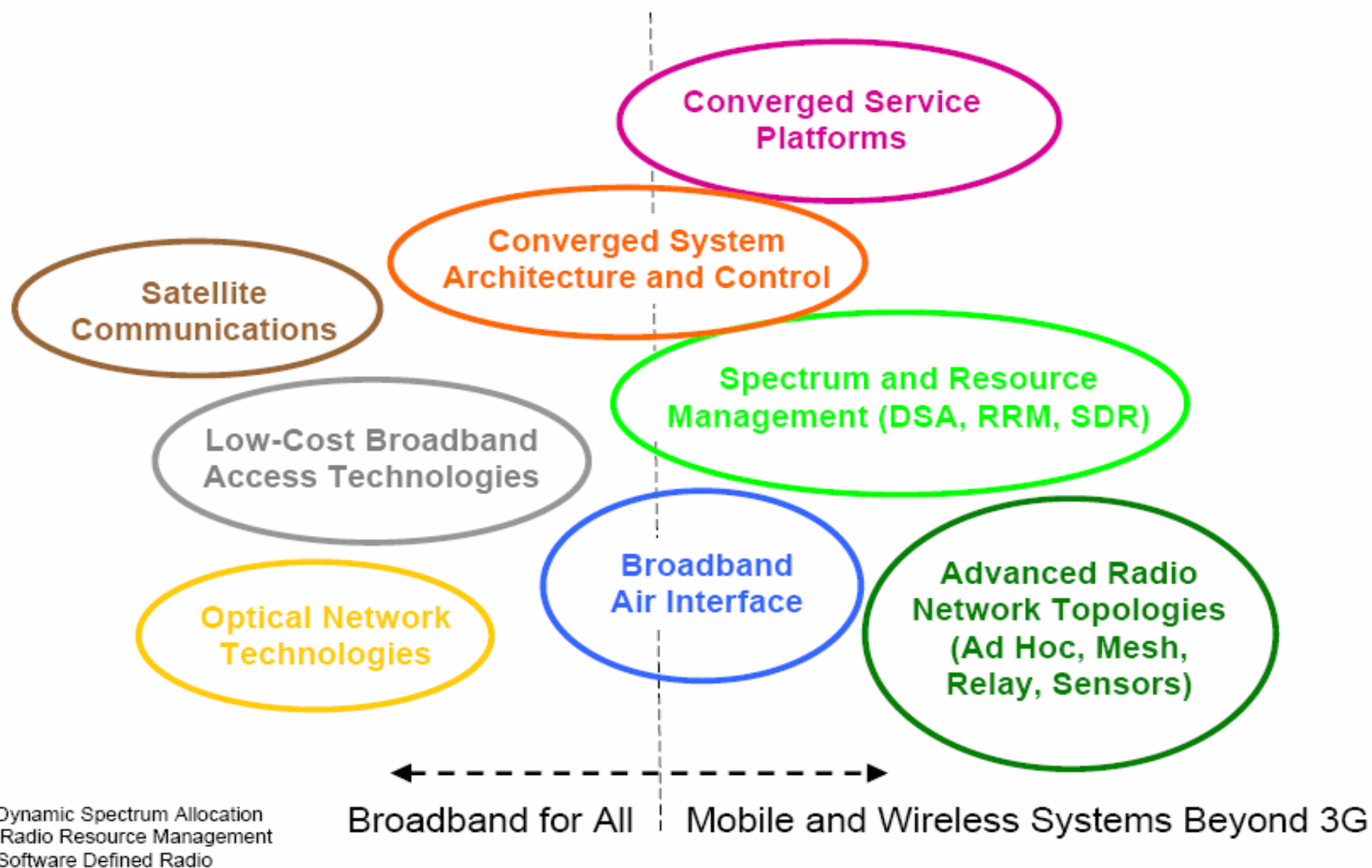European Commission

European Commission
Information Society and Media

i2010: Three priorities (3 I's)

- A Single European Information Space
  - i. The completion of a Single European Information Space which promotes an open and competitive internal market for information society and media

- Innovation and investment in research
  - *-> FP6/FP7: Research Framework Programme*
  - ii. Strengthening Innovation and Investment in ICT research to promote growth and more and better jobs

- Inclusion, better public services and quality of life
  - iii. Achieving an Inclusive European Information Society that promotes growth and jobs in a manner that is consistent with sustainable development and that prioritises better public services and quality of life

FP6 Clusters Mobile and Broadband

Converged Service Platforms

Converged System Architecture and Control

Satellite Communications

Spectrum and Resource Management (DSA, RRM, SDR)

Low-Cost Broadband Access Technologies

Broadband Air Interface

Advanced Radio Network Topologies (Ad Hoc, Mesh, Relay, Sensors)

Optical Network Technologies

Broadband for All ← → Mobile and Wireless Systems Beyond 3G

DSA: Dynamic Spectrum Allocation
RRM: Radio Resource Management
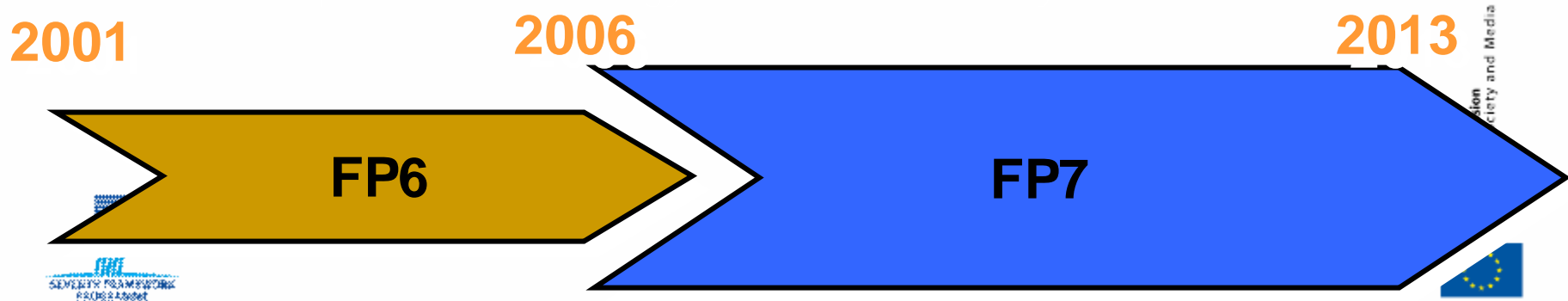SDR: Software Defined Radio

FP6 Next Generation Internet Activities

- Examples of projects
  – Network of Excellence federating the EU computer & networking science community: *Euro-NGI, E-NEXT, CRUISE.*
  – Large integrated projects focusing on large industrial initiatives: *Ambient Networks, MAGNET, E2R, E-SENSE, NOBEL*
  – Targeted research projects focusing on specific issues: OBAN, WIP, EVERGROW, ANA...

- Numerous Workshops and consultation exercises
  – Internet of Things workshop in March 06
  – Future Internet workshop Dec 2006 (book available)
  – OECD/ NSF workshop jan 2007
  – Work within the ETPs (Telco's initiative in the making)
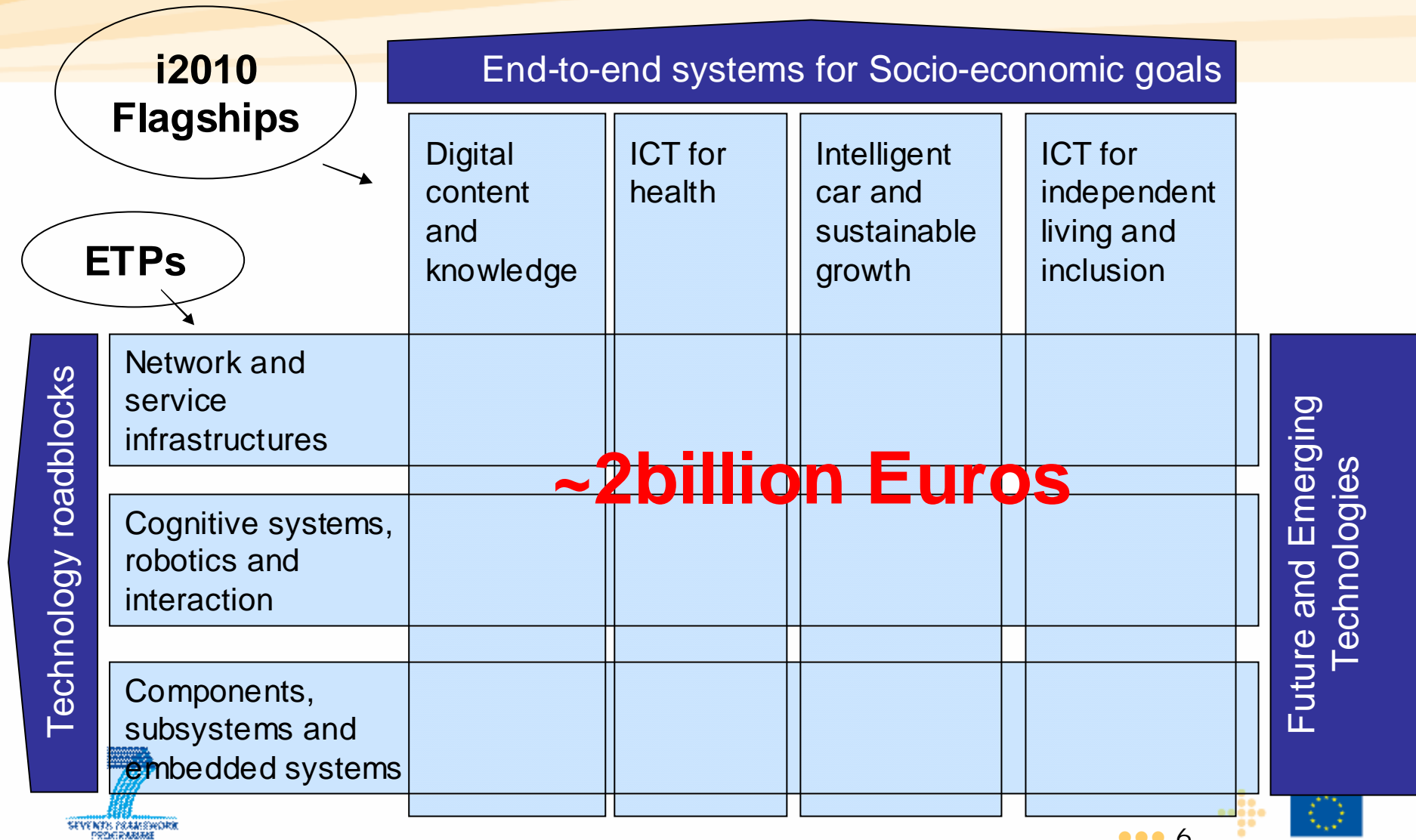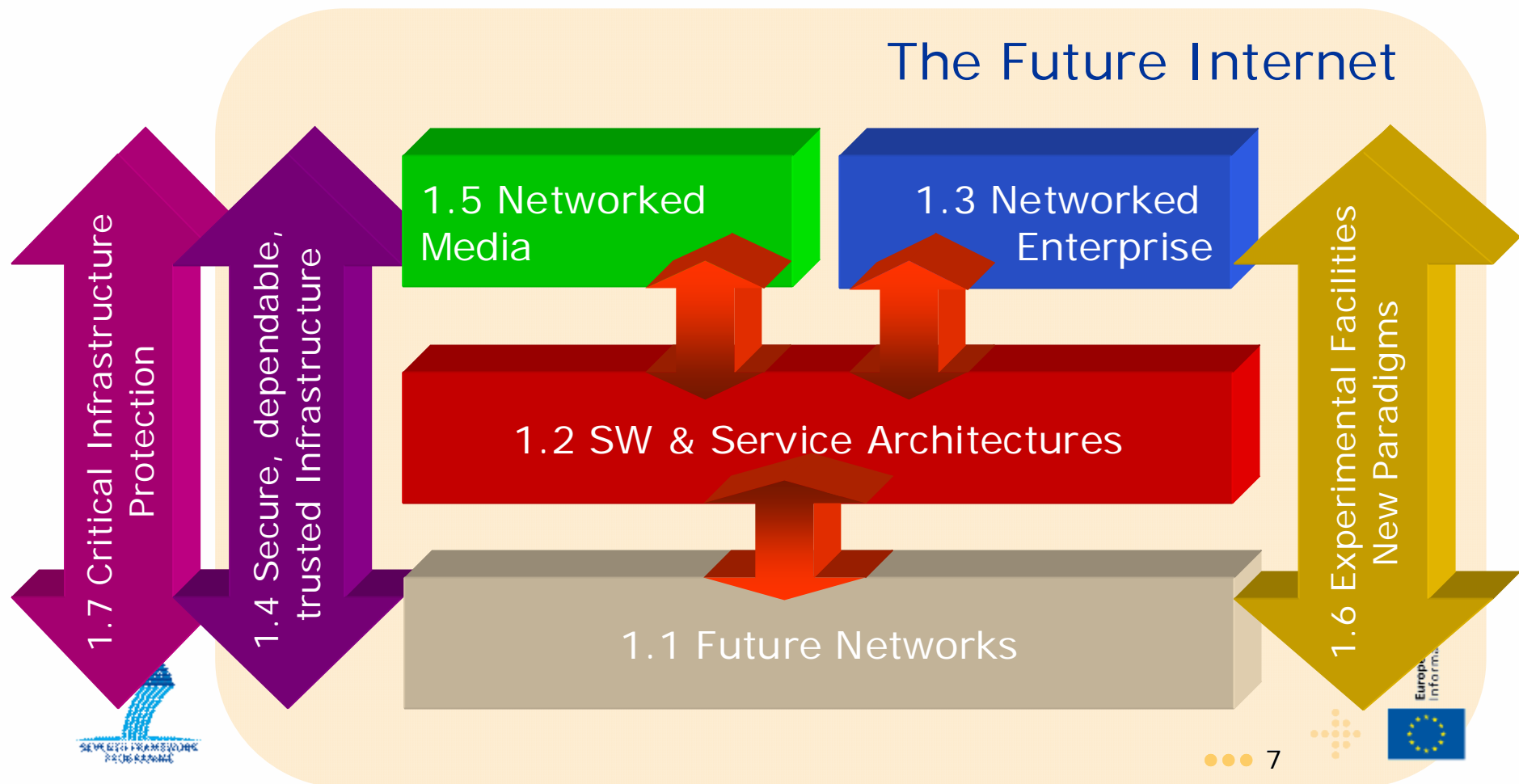 – EIFFEL, FIRE and eMOBILITY published position papers, 2007

- FP6: 6th Framework Programme of Community Research
  - 3.9 billion euro over 5 years

- FP7: 9 billion euro over 7 years !!!
  - + European Research Council
    - pan-European funding agency for frontier research
    - to attract talented individuals
  - + European Institute of Technology
   - To promote technology transfer to industry

2001   **2006**   **2013**

FP6   **FP7**

FP7 ICT Work Programme 2007-2008

i2010 Flagships

ETPs

End-to-end systems for Socio-economic goals

Digital content and knowledge	ICT for health	Intelligent car and sustainable growth	ICT for independent living and inclusion
Network and service infrastructures			
Cognitive systems, robotics and interaction			
Components, subsystems and embedded systems			

~2billion Euros

Technology roadblocks

Future and Emerging Technologies

Challenge 1 – Pervasive and trusted Network and Service Infrastructures

The Future Internet

1.7 Critical Infrastructure Protection

1.4 Secure, dependable, trusted Infrastructure

1.5 Networked Media

1.3 Networked Enterprise

1.2 SW & Service Architectures

1.1 Future Networks

1.6 Experimental Facilities New Paradigms

7

The Network of the Future

- Background
  - The Challenge is to deliver the next generation of ubiquitous and converged network and service infrastructures for communication, computing and media.
  - From "Mobile and Wireless Systems" and "Broadband for All" in FP6, to a converged Objective 1.1 "The Network of the Future"

- Main Drivers and Objectives
  - Ubiquitous network infrastructures and architectures
  - Convergence of mobile, fixed telecom and Internet network infrastructures
  - Optimised control, management and flexibility of the future network infrastructure
  - Towards mobile broadband and efficient/dynamic spectrum usage
  - Technologies and system architectures for the Future Internet

Project Portfolio - Network of the Future
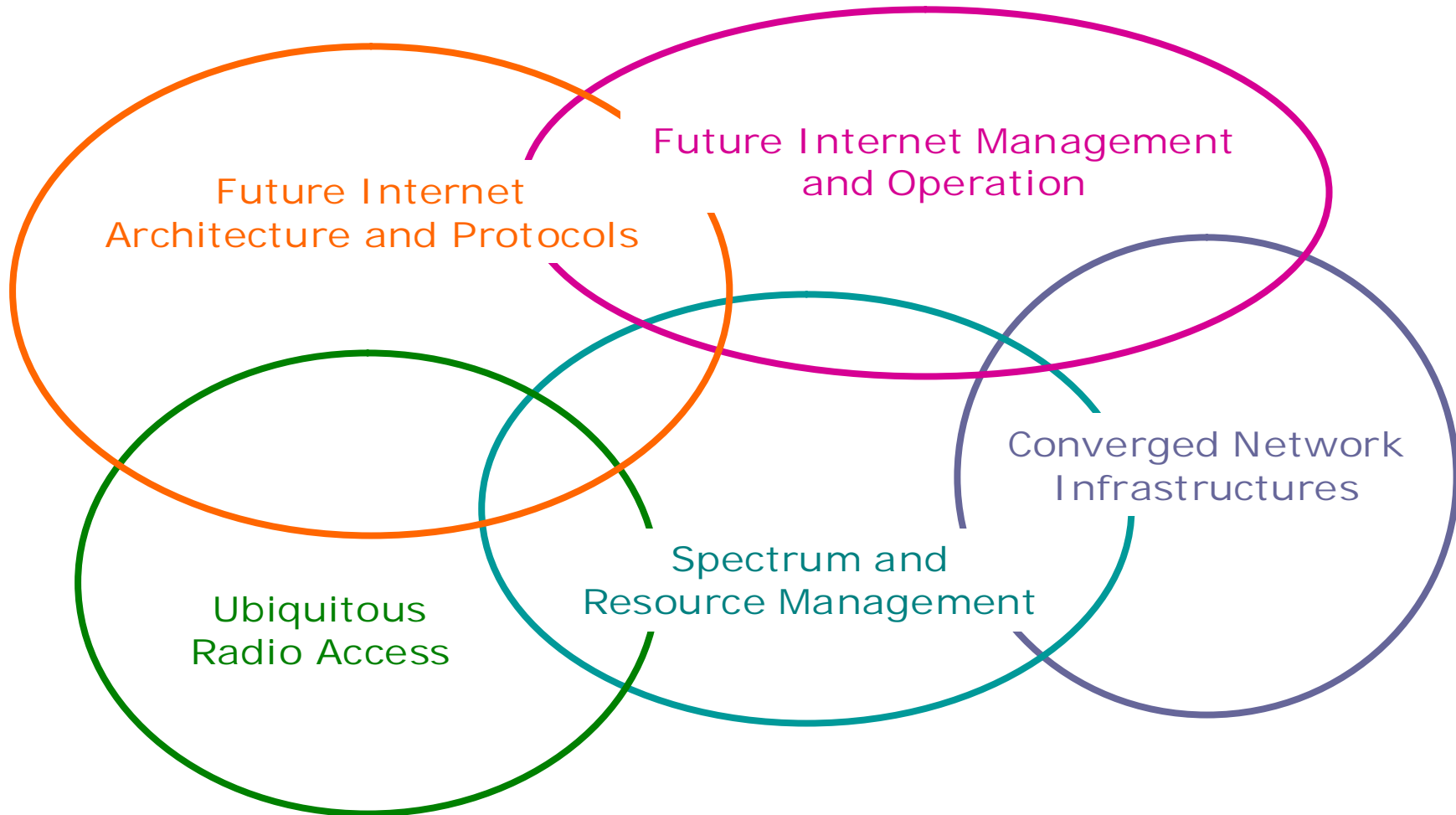
Dimensions of the Future Internet

Technological

- Fast optical networks

- Mobility

- Internet of things

- Complex system

- ...

Socio - Economic

- Changes to the Internet not neutral to societal / economic structures

- Preserve innovative force / support investment in Infrastr & Services

- Social responsibility

- Balance Security / Accountability / Trust / Privacy

- ...

Regulatory / Political

- Act where market forces fail

- Consumer protection / empowerment

- National security

- Protection of the private sphere

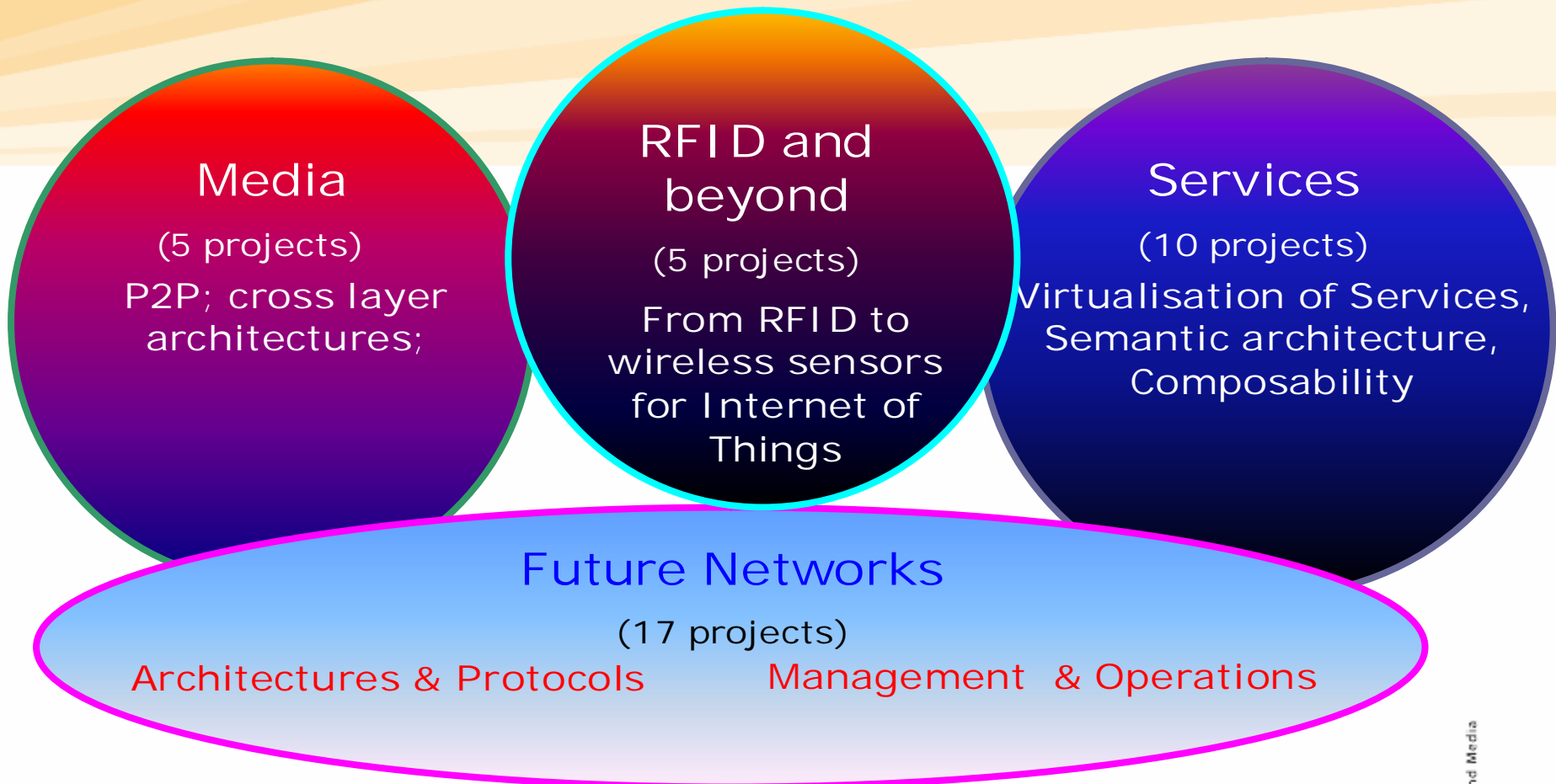- OECD process on the future of the internet economy

- ...

Changing requirements to the Internet

- Internet is a critical part of our economy's infrastructure
- Net-delivered services are reshaping the world (search, media, games and other communities.)
- Explosion of the number of people and devices connected
- Boost of Creativity for Content and processes, from Users, not just consumers
- Need for Control without limiting the Creativity for innovation—and profit?

Future Internet Networks & Services Research in FP7

Media

(5 projects)

P2P; cross layer architectures;

RFID and beyond

(5 projects)

From RFID to wireless sensors for Internet of Things

Services

(10 projects)

Virtualisation of Services, Semantic architecture, Composability

Future Networks

(17 projects)

Architectures & Protocols   Management & Operations

37 proposals, budget >150M€

System approach including networks, services, devices and content aspects

New Paradigms and Experimental Facilities Future Internet Research in FP7

- Two related dimensions:
  - Experimentally-driven long-term research related to the Future Internet
  - Interconnected testbeds to support large scale validation
    - gradually federating existing and new testbeds
    - towards becoming a sustainable, dynamic, and integrated large scale experimental facility for future internet technologies
    - supporting academia, research centers and industry in their research on networks and services

Advanced networking approaches

Interconnected testbeds

- Part of EU ICT Programme Challenge 1
  - complementary to "*Technologies and systems architectures for the Future Internet*", part of Objective "The network of the Future"
  - To bootstrap the European FIRE Future Internet Research and Experimentation Activities
  - Current Call: Budget 40 M€, closure October 2007, projects start Q2/2008

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

International cooperation issues (example AKARI)

- The main domains of work for Next Generation Networks and New Generation Networks like Power Consumption, Security, Routing Control ….are the same or very similar in Akari and Europe

- There are open questions like virtualisation of networks and service architectures

- Industry and Research have to define the possible cooperation on a project by project basis

- Major Japanese Companies (such as DoCoMo or NEC) are today very respected partners in the European Framework Programs

- The EU Japan Cooperation Forum on 4th and 5th March in Tokyo is an opportunity to progress further

International Research is paramount!

Conclusions

- <u>Future Internet</u> a Promising Research_Topic

- <u>Cooperation is usefull on a project by project basis and for the overall design</u>

- Member States and FP7 Projects on Future Internet Provide a Basis

- Overall Success in Europe where <u>experimental-, analytical- and design-</u> approaches are balanced

- <u>International Cooperation</u> is Promising and <u>Required</u>

- European-Industry, Research and Public Services should achieve <u>Consensus</u> and Follow it

More Information

- FP7 web site with ICT WP 2007/2008 for download

  http://cordis.europa.eu/fp7/ict

- The ICT Challenge 1 web site
  http://cordis.europa.eu/ict/ch1/

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Backup Slides

Is the current Internet reaching its Limits?

- Technical limitations of Internet technology hampering or even preventing application and service innovations
- Internet moving towards a patchwork by violating its design principles
- Modifications and work-arounds implemented without any planning and coordination
- Increase of complexity leading to high configuration and managament effort, while
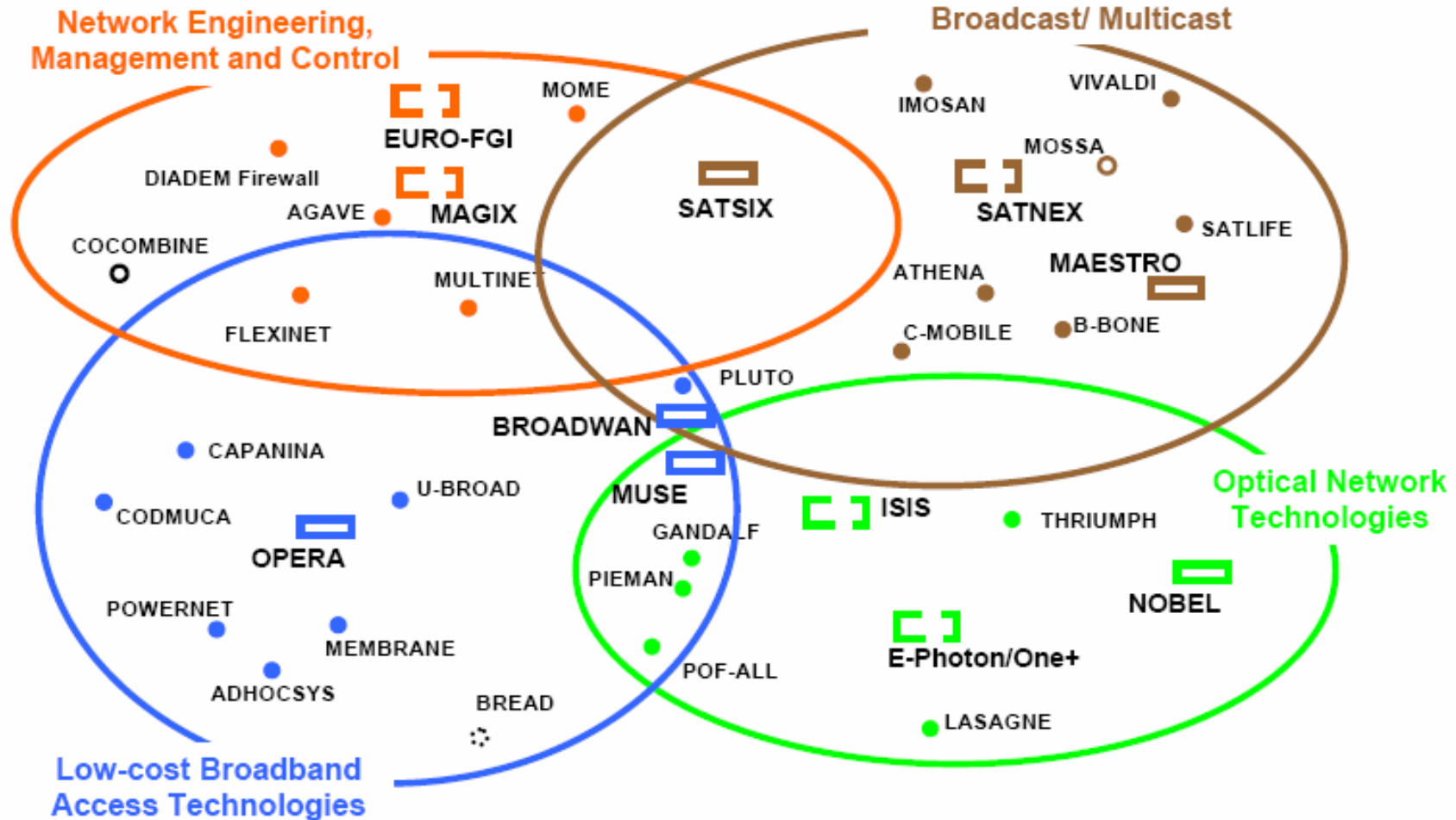
FP6 Project Portfolio - Mobile
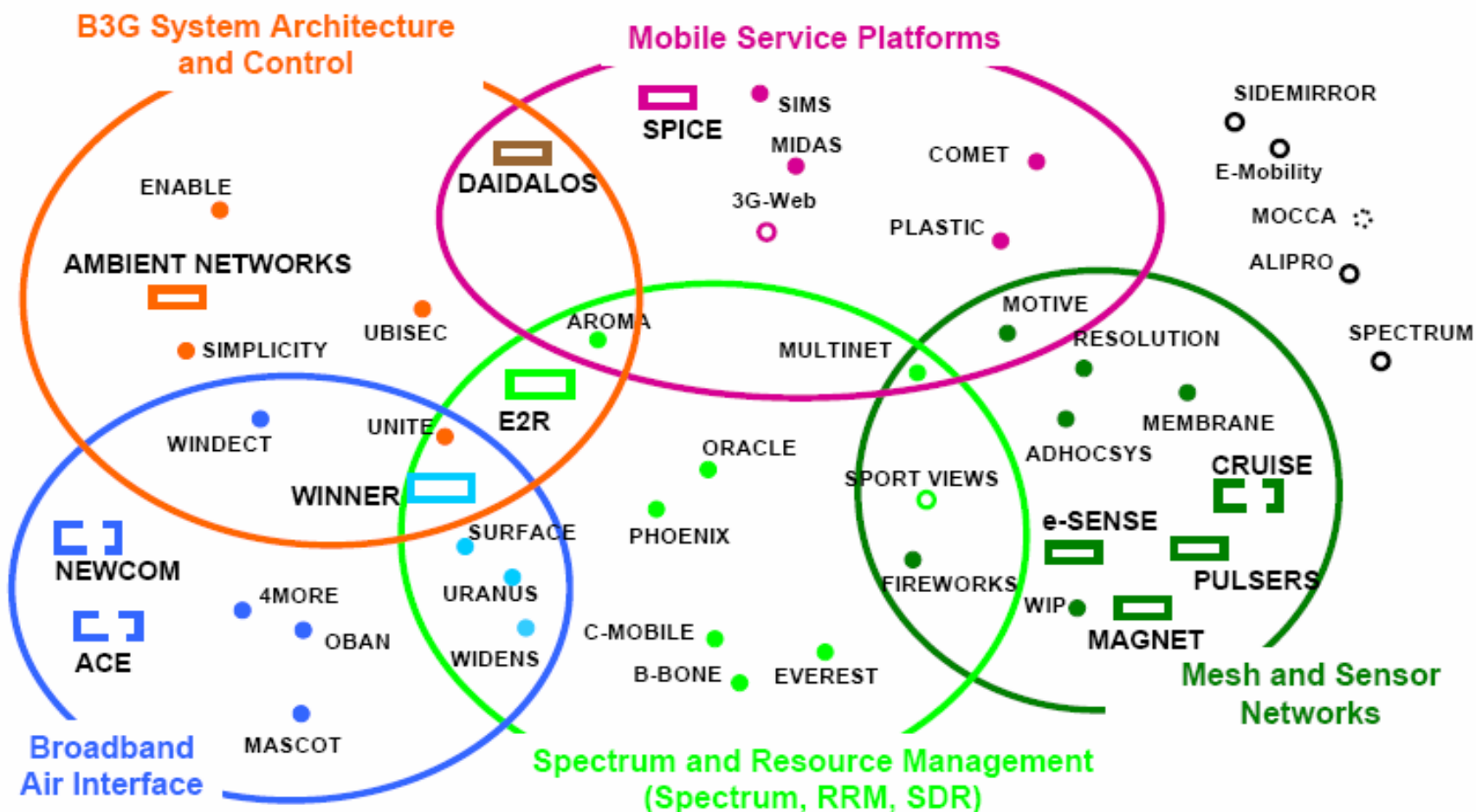
FP6 Project Portfolio - Broadband

Why Future Internet Research (and Experimentation)?

- Internet is 30 – how much older can it get?
  - scale increased by 7 orders of magnitude
  - hundreds of additional protocols and extensions
  - a lot of patchwork
- Some issues:
  - Mobility: users and devices
  - Threats: flash crowds/DoS attacks
  - Limitations: high-bandwidth real-time (video) services
  - Heterogeneity: devices, services, ...
  - Complexity: management of networks, services , security
  - Security mobility: add-ons rather than built-in features
  - Trend: episodic connectivity