FP7 - ICT Work Programme 2009-10

ICT-2009.3.1: Nanoelectronics Technology

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Challenge 3: Components, systems, engineering	ICT 2009.3.1 Nanoelectronics Technology	CP, NoE, CSA
	ICT 2009.3.5 Engineering of Networked Monitoring and Control Systems	CP, NoE, CSA
	ICT 2009.3.7 Photonics	CP, CSA
	ICT 2009.3.9 Microsystems and Smart Miniaturised Systems	CP, CSA

Presentation Outline

- Introduction
- Motivation for the Objective 3.1
- Content of the Objective 3.1
- Expected Impact
- Funding Schemes & Budget

Introduction: FP7 ICT WP 09-10 Main Principles

- Continuity:
  - Same structure of challenges and objectives as in WP 07-08
  - 2 years duration

- Adaptation:
  - Within Challenges, objectives to be adapted to technological evolutions, socio-economic developments and lessons from first calls
  - Existing objectives to be reworked, replaced or removed
  - Complementarity with JTIs and Art.169 initiative

Introduction: FP ICT WP 09-10 Structure

- A WP structured around a limited set of "Challenges" that should be addressed

- A Challenge is
  - Focused on concrete goals that require effort at Community level and where collaboration is needed
  - Ambitious and strategic proposing a European vision on ICT for the next 10 to 15 years
  - Described in terms of the set of ***outcomes targeted*** and their ***expected impact*** on industrial competitiveness and on addressing policy and socio-economic goals

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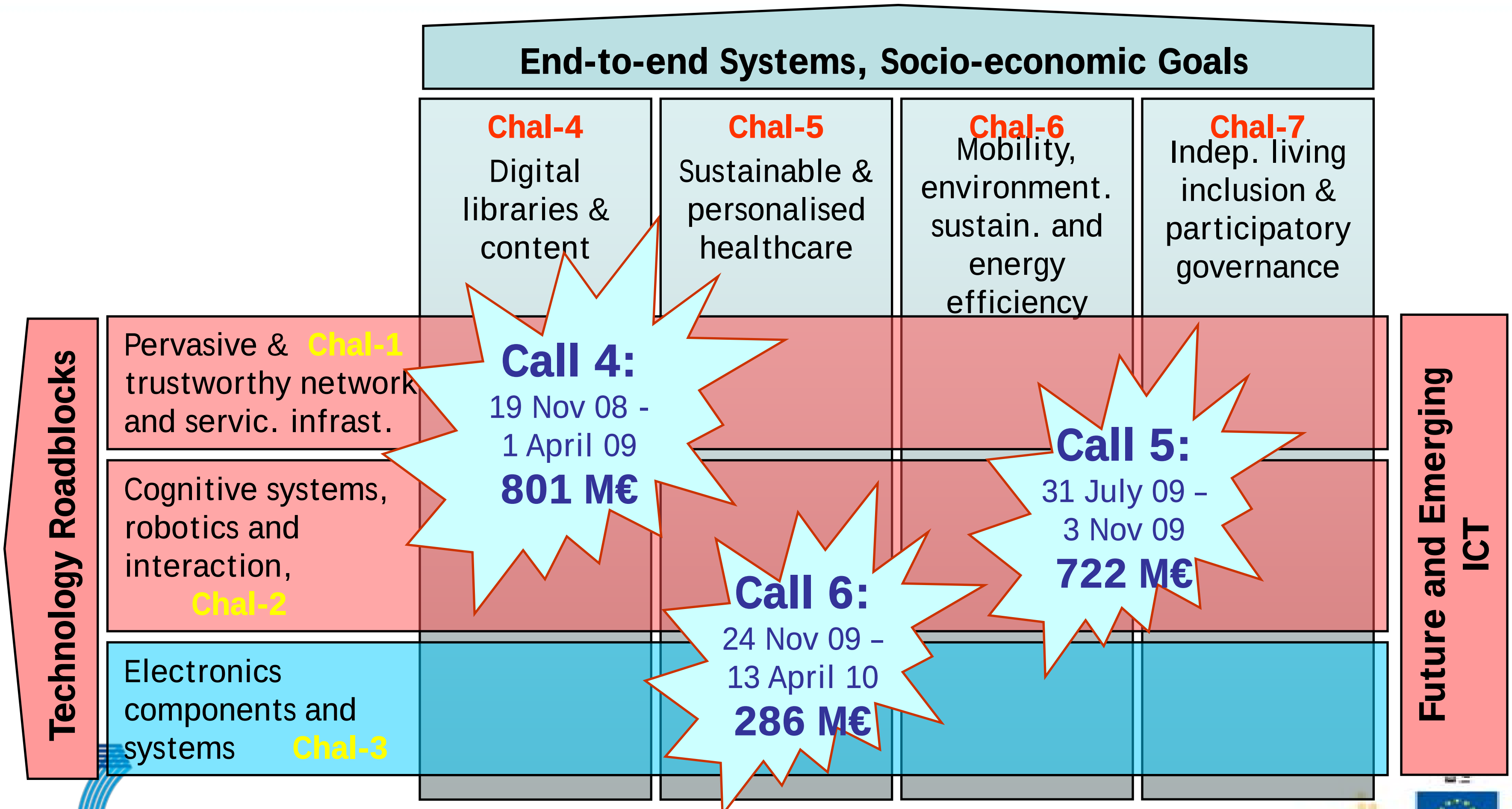
Introduction: ICT Work Programme 2009-10



FP ICT WP 09-10: synergies throughout the Programme

Technology-led challenges
removing roadblocks and improving the capability of generic technology components, systems and infrastructure

Application-led challenges
new technology-based systems, products and services that provide step-changes in the capabilities of the resulting solution

The ICT WP addresses a research problem through different angles corresponding to different technological challenges

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Challenge 3: Components, Systems, Engineering Objectives

Call 4
Nov 2008

- **IST-2007.3.2: Design of semiconductor components and electronic-based miniaturised systems (25 M€)**
- **IST-2007.3.3:** Flexible organic and large area electronics (60 M€)
- **IST-2007.3.4:** Embedded systems design (28 M€)
- **IST-2007.3.6:** Computing systems (25 M€)
- **IST-2007.3.8:** Organic photonics and other disruptive photonics technologies (30 M€)

Call 5
July 2009

- **IST-2007.3.1: Nanoelectronics technology (35 M€)**
- **IST-2007.3.5:** Engineering of networked monitoring and control systems (32 M€)
- **IST-2007.3.7:** Photonics (60 M€)
- **IST-2007.3.9:** Microsystems and smart miniaturised systems (80 M€)

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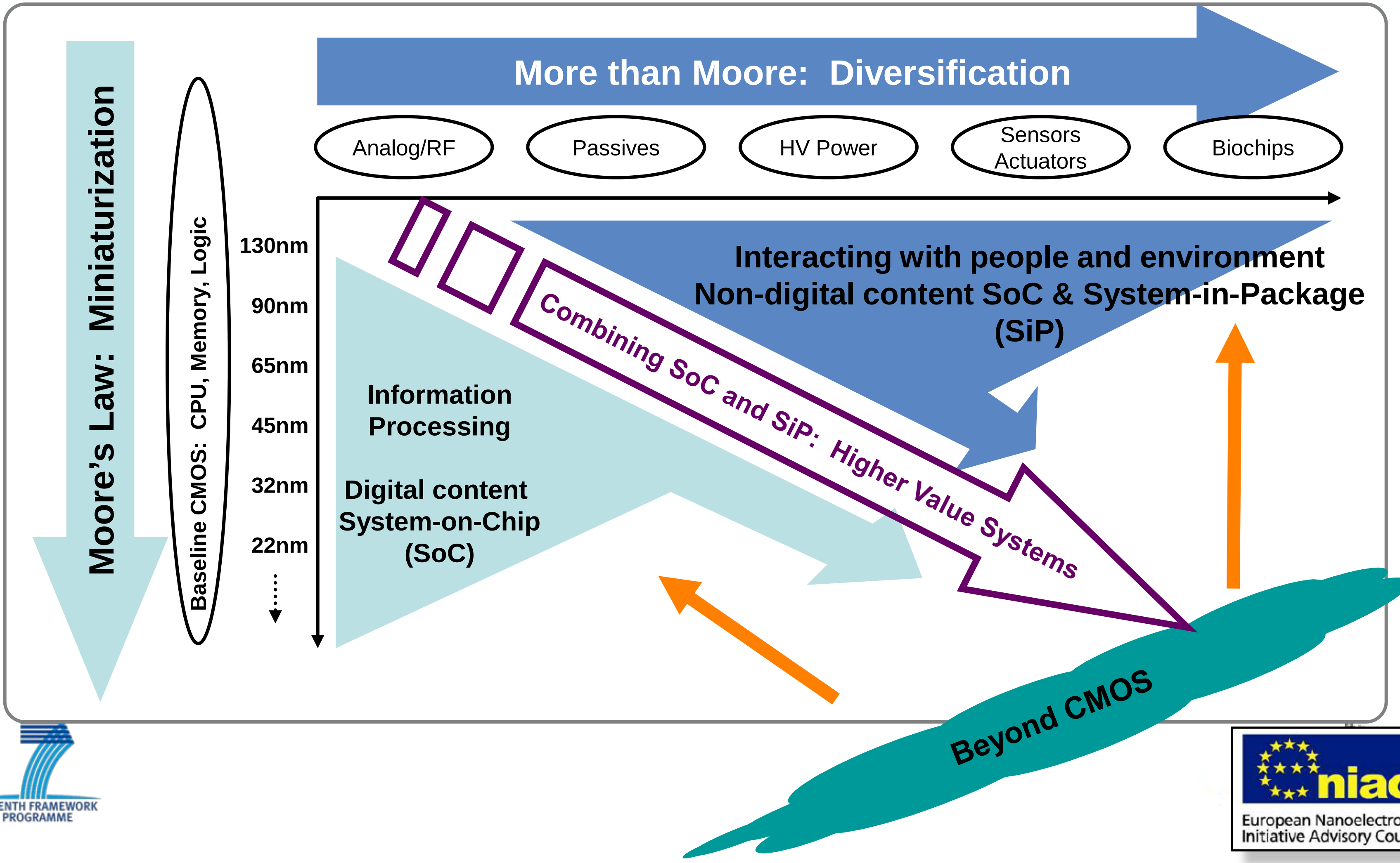
FP7 ICT WP 09-10: Nanoelectronics

- Two objectives
  - IST-2007.3.1: Nanoelectronics technology (35 M€)
  - IST-2007.3.2: Design of semiconductor components and electronic-based miniaturised systems (25 M€)

Total FP7: 60 M€

European Roadmap for Nanoelectronics



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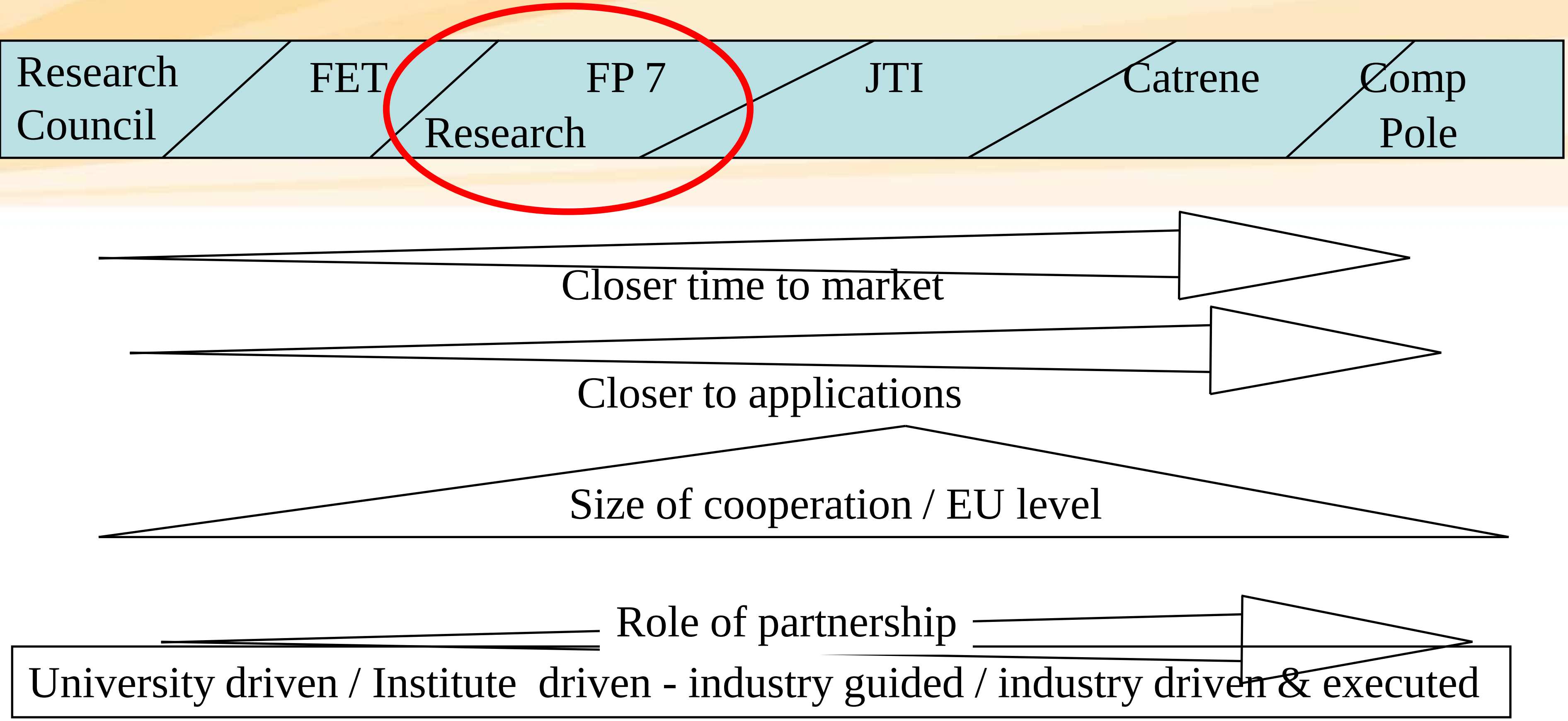
niac
European Nanoelectronics Initiative Advisory Council

The funding landscape in Nanoelectronics Research



<u>Role of strategic alliances:</u> global alliances, involvement of system houses, involvement of material and equipment suppliers

<u>Role of infrastructure:</u> from research tools towards the fab is the lab

<u>Converging technology:</u> a lot of room at the interface, a new multi-disciplinary game with new actors and new rules? System thinking from the beginning?

Thematic Coverage Call 1

Technology
Requested: 137 M€
Funded: 50 M€
37 %

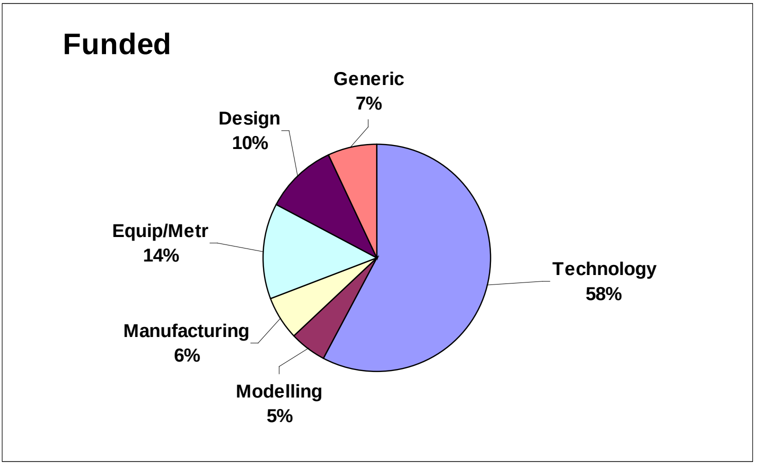
Modelling
Requested: 17 M€
Funded: 5 M€
29 %

Design
Requested: 108 M€
Funded: 9 M€
8 %

Generic
Requested: 12 M€
Funded: 6 M€
50 %

Equipm./Metrol.
Requested: 79 M€
Funded: 12 M€
15 %

Manufacturing
Requested: 28 M€
Funded: 5 M€
18 %



Motivation for the Objective 3.1

The **continuous miniaturisation** on integrated electronic components has almost reached the physical and technological limits

- integration of a large number of less known materials
- complex technological solutions
- increase of R&D and semiconductor manufacturing costs

Industrial R&D in Europe is shifting towards a product oriented approach by adding extra **functionalities** to the basic components

Combination of miniaturisation and functionalisation, 'More Moore' **and** 'More than Moore' devices into total system solutions through the process of **monolithic** and **heterogeneous integration**

Motivation for the Objective 3.1

Challenges Manufacturing:

- Reduce cycle time
- Enhance production quality and variability control
- Improve equipment productivity
- Reduce the environmental impact
- Support heterogeneous integration
- Foster advanced system integration and functionalized packaging

Objective 3.1: Nanoelectronics technology

Focus on:

a) Miniaturisation and functionalisation

- Beyond CMOS domain
- Advanced aspects of the ‘More than Moore’ domain
- their integration and their interfacing with existing technologies

b) Manufacturing technologies

- Flexible manufacturing with a high product mix and joint equipment assessment
- prepare for more disruptive approaches

c) Support measures

Target outcome

a) Miniaturisation and functionalisation

- Beyond 22 nm devices, advanced components with lower scaling factors including non-CMOS devices, and
- their integration and interfacing with very advanced CMOS

Activities with a high risk factor

Industrialisation perspective beyond 2014 and having a generic development focus

Funding schemes:
STREPs
NoE

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Target outcome

a) Miniaturisation and functionalisation – STREPs

- Increasing process variability and expected physical and reliability limitations of devices and interconnects;
- The need for new circuit architectures, metrology and characterisation techniques;
- Interface and system integration technologies on a single silicon chip (SoC) and/or integration of different types of chips and devices in a single package (SiP);
- New device structures for non-Si and Si based advanced integrated components to add functionality to circuits and (sub)systems;
- Disruptive technologies and functional devices beyond the traditional ITRS shrink path ('Beyond CMOS'): new non-CMOS logic, analogue and memory devices, and their integration in and/or interfacing with CMOS
- Specific issues: electromagnetic interference, heat dissipation, energy consumption

Target outcome

a) Miniaturisation and functionalisation - NoE

- **The merging of ‘Beyond CMOS’ and advanced ‘More than Moore’ devices and processes to create CMOS backbone, to meet the challenge of**
  - **the increasingly analogue behaviour of ‘Beyond CMOS’ devices and**
  - **systems partially based on new architectures and on less reliably functioning devices.**

1 NoE is expected
Budget: 3 M€

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Target outcome

b) Manufacturing technologies

- New semiconductor manufacturing approaches, processes and tools
- Joint assessments of novel process/metrology equipment and materials
- Supporting 200/300mm wafer integration platforms
- Preparatory work for 450mm wafer processing

Funding schemes:
STREPs
IP

Target outcome

b) Manufacturing technologies

- IPs:
  - Integrate approaches for flexible and sustainable short cycle time manufacturing
  - Clustered joint equipment assessments or wafer integration platforms
- STREPs:
  - Focussed and complementary semiconductor manufacturing topics

Target: At least 1 IP

Target outcome

c) Support measures

- Roadmaps, benchmarks, selection criteria for the industrial use of ‘Beyond CMOS’
- Access to affordable silicon state-of-the-art technologies for prototyping and low volume and to design expertise and commercial tools
- Stimulation of interest of young people, training and education
- Linking of R&D strategies and stimulation of International Cooperation
- Support and coordination of preparatory work for 450 mm processing and equipment

Funding schemes: CSA	Budget: 4.5 M€

3.1 Nanoelectronics technology

Expected Impact

- Strengthened competitiveness of the European nanoelectronics industry
- Contribution to the competitiveness and the attractiveness of Europe to investments
- New electronics applications of high economic and socio-economic relevance
- Maintained European knowledge and skills,
- Increased critical mass of resources and knowledge,
- Contribution to preserving a critical mass of manufacturing capacity in Europe

3.1 Nanoelectronics technology
Summary

- **Call 5**
  - Open: 31 July 2009
  - Close: 3 November 2009

- **Funding schemes:**
  a) Miniaturisation and functionalisation: STREPs and one NoE;
  b) Manufacturing technologies: STREPs and at least one IP
  c) Support measures: CSA

- **Indicative budget distribution - 35 M€:**
  - IP/STREP 27.5 M€
  - NoE 3 M€
  - CSA 4.5 M€

Information Society and Media:

http://ec.europa.eu/information_society

http://cordis.europa.eu/fp7/ict/nanoelectronics/mission_en.html

European research on the web:

http://cordis.europa.eu

http://www.eniac.eu

Contact:

dirk.beernaert@ec.europa.eu

Objective ICT-2009.3.5

Engineering of Networked Monitoring and Control systems

The activities in this area address engineering technologies for large-scale, distributed and cooperating systems for monitoring and control

- **Foundations of Complex Systems Engineering**
- **WSN and Cooperating Objects**
- **Control of Large-Scale Systems**
- **International Cooperation**
  - **USA, India, Western Balkans**

Call 5
Deadline 3 Nov 2009
Indicative budget 32 M€

It is fine to address only one of the above, if sufficient for the purpose of your proposal

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Relevance of the area

- Monitoring and control is an important scientific and technological field and market sector
  - Europe has a 32% market share of a 188+ B€ world-wide market (See EC study, www.decision.eu, 2008)
- It is based on rigorous sensing/measurements, modelling, decision making, control and actuation, and optimisation
- Sensors–actuators networks and Wireless Sensor Networks constitute a critical enabling technology, and cooperation amongst smart objects an important extension thereof
- Large-scale deployments constitute the next major challenge, extending from instantiation to management and maintenance to updating

Embedded Systems and Control Target Outcomes

Embedded Systems Design

Theory and novel methods for embedded system design
•heterogeneity, predictability of non-functional properties (performance, fault tolerance, life expectancy and power consumption)
•robustness validation
•adaptivity and self-awareness
•self-configuration

one IP: end-to-end design methodologies and associated tool chains
STREP: specific methods and tools

Modules and tools for embedded platform-based design
•integrated design environment for ES
•software, HW/SW and system design tools
•interoperability of tools primarily from SME vendors
•technology for efficient resource management

one IP: address design tool integration
STREP: specific issues or topics

Coordination of national, regional and EU-wide R&D strategies (CSA)
•align research agendas

Complementary to ARTEMIS JTI

Engineering of Networked Monitoring and Control Systems

Foundations of Complex Systems Engineering
robust, predictable and self-adaptive behaviour for large-scale networked systems; foundational multi-disciplinary research

Wireless Sensor Networks and Cooperating Objects
support spontaneous ad-hoc cooperation between objects; experimenting large-scale applications of wireless sensor networks

Control of Large-Scale Systems
scalable and modular architectures and platforms; Standardisation is encouraged

International Cooperation

Computing Systems (Streps)

Parallelisation & programmability
•automatic parallelisation
•high-level parallel programming languages
•holistic approach: underlying hardware / operating system / system software
•exploiting dynamic (run-time) information
•testing, verification and debugging

Methodologies, techniques and tools
Continuous Adaptation
beyond strict separation between compiler, runtime and hardware
Virtualisation
portability, flexibility, optimised use of resources
Customisation
rapid extension and/or configuration of existing systems

System simulation and analysis
Simulation and analysis of complex multicore systems

Technology implications
System architectures, tools and compilers for next-generation semiconductor fabrication

Coordination (CSA)

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ICT-2009.3.5 a)

Foundations of complex systems engineering

- To develop *novel* scalable methods for sensing, control and decision-making. to achieve robust, predictable and self-adaptive behaviour for large-scale networked systems

- Scope : foundational multi-disciplinary research in modelling, sensing, monitoring and actuation, adaptive, cooperative control and decision making.

Note : Activities to encourage and enable multi-disciplinary education in the areas of systems engineering and monitoring and control are welcome.

Instruments: One NoE and STREPs

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ICT-2009.3.5 b)

Wireless Sensor Networks & Cooperating Objects

- To develop architectures, hardware/software integration platforms and engineering methods for distributed systems composed of heterogeneous networked smart objects

- Scope : Research challenges include e.g :
  - **methods and algorithms to support spontaneous ad-hoc cooperation between objects;**
  - **network-centric computing with dynamic resource discovery**
  - **semantics that allow object/service definition/instantiation;**
  - **lightweight operating systems and kernels;**

Instruments: One IP and STREPs

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ICT-2009.3.5 c)

Control of large-scale systems

- To enable optimal operation of large-scale dynamic systems through proactive process automation systems applicable across several sectors, going far beyond what current SCADA and DCS/PLC can deliver today.

- Scope : The architectures should facilitate re-use, enable QoS, reduce the reconfiguration effort. Standardisation of monitoring and control systems in industrial environments is encouraged in all projects.

Note: Pro-activeness requires e.g. novel predictive models for higher performance and fault adaptation and recovery.

Instruments: One IP and STREPs

ICT-2009.3.5 d)
International cooperation

- Facilitation and promotion of cooperation with the Western Balkan Countries, U.S.A and India (separately) with mutual benefits.

Instruments : CSAs

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Expected Impact of proposed R&D

On top of (one of) a, b, c, d !

- Strengthened competitiveness of the industry supplying monitoring and control systems through next generation process automation products that are superior in terms of functionality, accuracy, dynamic range, autonomy, reliability and resilience.

- Higher energy efficiency and reduction of waste and of resource use in manufacturing and processing plants; **improved ease-of-use and simplified operation and maintenance of monitoring and control systems, also for non-experts**; and more effective management systems for natural resources and the environment.

- Reinforced European inter-disciplinary excellence in control and systems engineering and associated **modelling and simulation tools** as well as in **real-time computing, communications, wireless sensor (and actuator) networks and cooperating objects**.

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Summary of Instrum

Total 32 M€: at least 27 M€ are for IPs + STREPs

a) Foundations of complex systems engineering: One NoE and STREPs

(4 Mi)

b) Wireless Sensor Nets and Cooperating Objects: One IP and STREPs

c) Control of large-scale systems : One IP and STREPs

(1Mi)

d) Int. cooperation: CSAs

More Information

FP7

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

Embedded Systems and Control

- Networked Embedded and Control Systems
  http://cordis.europa.eu/fp7/ict/necs
- Ongoing FP7 projects
  ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/necs/booklet-necs_en.pdf

Contacts

Objective 3.5 Coordinator: Jorge.Pereira@ec.europa.eu

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Objective ICT-2009.3.7

Photonics

l kit

- Questions on scope:
  - Ask us / refer to us any time
  - Pre-proposal check service !!!

infso-photonics@ec.europa.eu
gustav.kalbe@ec.europa.eu

- Background document (coming soon)
- Information Events
  - *Taking part in forthcoming EU and TSB collaborative competitions* University College London, 12 May
  - *4th Photonics Concertation Meeting*, NTUA Athens, 10/11 September http://cordis.europa.eu/fp7/ict/photonics/concertmeet_en.html
  - *European R&D for Components, Systems, Engineering within ICT Call 5,* 25 June, Basel http://www.ideal-ist.net/events/challenge-3-face2face-in-basel

WP Content

a)

Communications *NEW*

Light Sources

extension

Bio-Photonics

Imaging *NEW*

High-Power Lasers *NEW*

Applications

b)

extension

III-V Foundry

manufacturing

Coordination & Support

c)

~~ERA-NET Plus~~

Call-4

d)

SME & researchers

NEW International Coop.

Education

Some figures

- Call-5 open/close: 31 July 2009 – 3 November 2009
- Funding Schemes (objective dependent):
  - IP, STREP = 47 M€
  - CA, SA = 3 M€
  - ERA-NET Plus = 10 M€

Call-4

- Budget flexibility (funding schemes)
  - min 23.5 M€ IP
  - min 15.7 M€ STREP
  - max 3 M€ CSA

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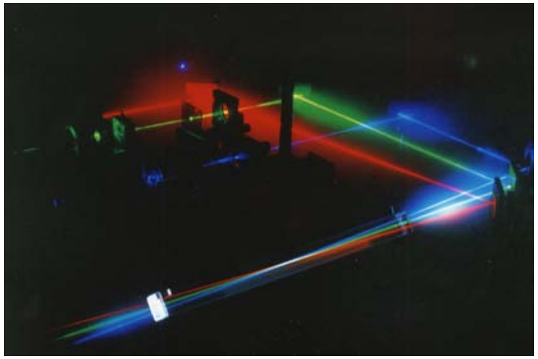
And the web…

- **Call-5**
  http://cordis.europa.eu/fp7/ict/participating/calls_en.html
- **FP7 - Photonics**
  http://cordis.europa.eu/fp7/ict/photonics/home_en.html
  - running projects
  - Call-5 / ICT-2009.3.7
  - background document
  - Evaluation of proposals
- **Photonics21 Platform**
  http://www.photonics21.org
- **EU R&D initiatives, projects, players, …**
  http://www.opera2015.org/home.asp

For completeness

the Photonics WP in detail



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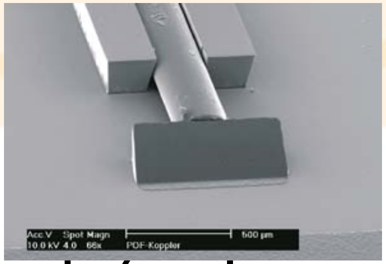
General Issues

- addresses **Photonics technologies**, **components** and **(sub)systems** (innovative devices)
- driven by key applications/social needs
- **cost-effective** (context dependent)
- from advanced research opening new opportunities to application-driven research with a view to industrialisation
- priority given to novel or "**breakthrough**" approaches rather than incremental developments
- system **integration** (where meaningful) including electronics/photonics integration (photonics on silicon)
- reduction of **power consumption** per circuit / function

a) Photonic Components & Subsystems

IP, STREP



1) Communications

– future-proof networks, any part of network (incl. interconnects), integration, more bits/photon, higher functionality, reduced network complexity …

Complementary to Objective ICT-2009-1.1 The Network of the Future

c) Ultra high capacity optical transport/access networks

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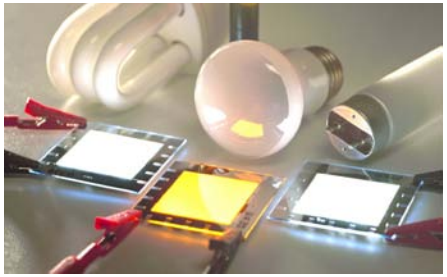
a) Photonic Components & Subsystems

2) Lighting and Light Sources

- high efficiency, color spectrum, LEDs, for lighting / illumination
- solid-state laser sources for projectors, displays, …

IP, STREP



a) Photonic Components & Subsystems

3) Bio-photonics
- molecular/functional imaging
- minimally-invasive/point of care treatment & monitoring

STREP

a) Photonic Components & Subsystems

4) Cost-effective high-performance imaging for safety & security
   - CMOS, single-photon, video-rate, uncooled
   - multi-feature, smart pixel arrays, multi-spectral, sub-ps timing precision, on chip-pre-processing

STREP

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a) Photonic Components & Subsystems

5) Highly integrated components for high power lasers
   - fibres & fibre lasers with integrated functions
   - diode lasers with new functions

STREP

Expected Impact

- Reinforce European leadership
- Reinforce European industrial competitiveness
- Create new opportunities for practical applications

b) III-V foundry processes

IP

- **Cost-effective** versatile foundry processes
- for photonic integrated components based on **III-V semiconductors (**possibly combined with other materials)
- can include module integration & packaging (where necessary)
- **design/process** interface based on widely agreed concepts / **standards**
- design supported by design-rule & **library** based platforms

Expected Impact

- Reduce non-recurring engineering costs
- provide cost-effective access for SME
- access for fab-less suppliers
- smooth path from design to prototype

d) Coordination and support actions

CSA

- **SME & researchers support**
  - access to photonics technology & design expertise
  - access to prototype components & manufacturing facilities

Expected Impact

- foster take-up of advanced photonic technologies towards innovative products

d) Coordination and support actions

CSA

- **International cooperation**
  - procedures to measure LED/OLED lighting performances
  - exchange of best practices from deployment of mature LED/OLED
  - development of LED/OLED lighting standards
  - workshops on advanced photonics research topics, research roadmaps

Expected Impact

- cooperation between EU / 3rd country for mutual benefits

d) Coordination and support actions

CSA

- **Education and training** (excludes direct support of conferences)
  - secondary school level outreach activities to encourage interest in photonics
  - transnational third level education programmes in photonics

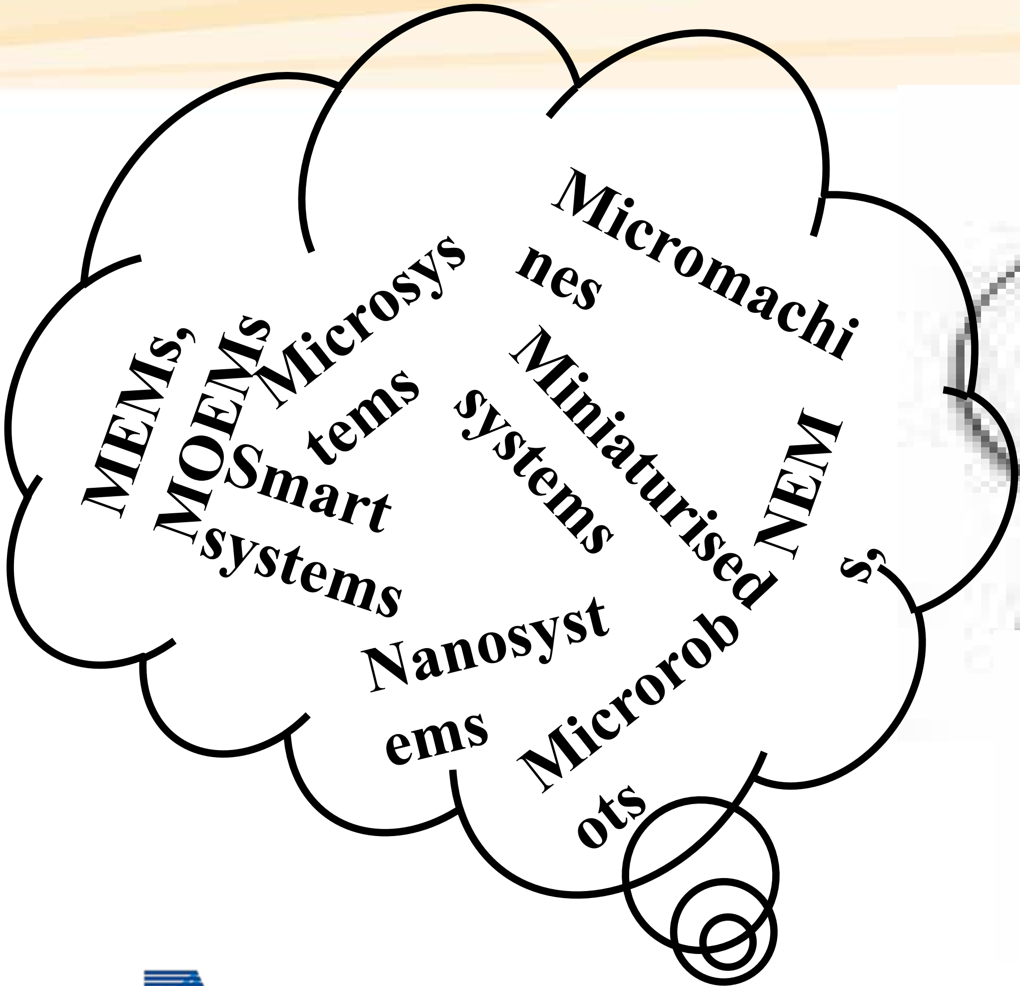
Expected Impact

- new generation with photonics skills & expertise
- create entrepreneur skills

Microsystems in the ICT Programme

Objective 3.9 : Microsystems and Smart Miniaturised Systems

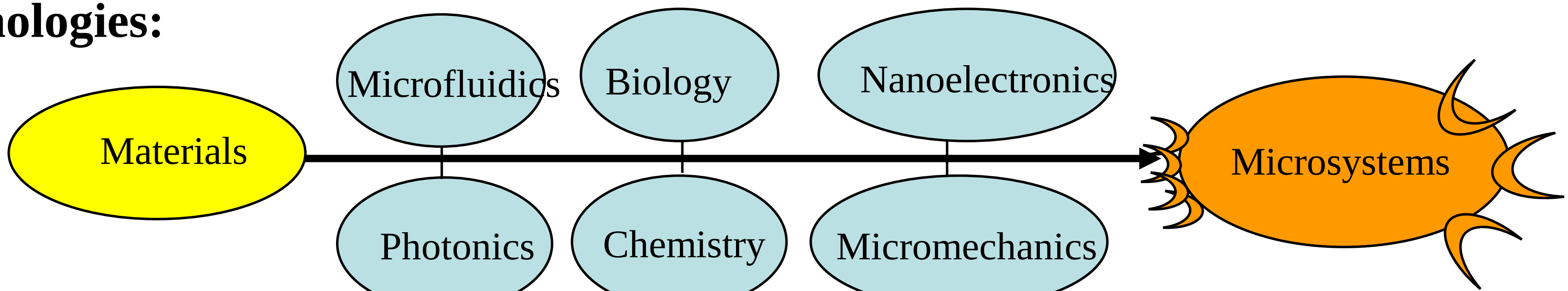
Microsystems and C° - Some simplified Vocabulary…



Microsystems
Smart miniaturised systems

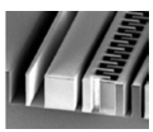
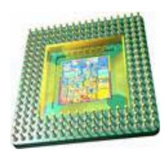
MICROSYSTEMS = Integration of technologies and functions

Technologies:



Functions:

Sensing, storing, processing, actuation, communication

Microsystems: At least 2 Technologies, 2 Functions, and "Miniaturised"!

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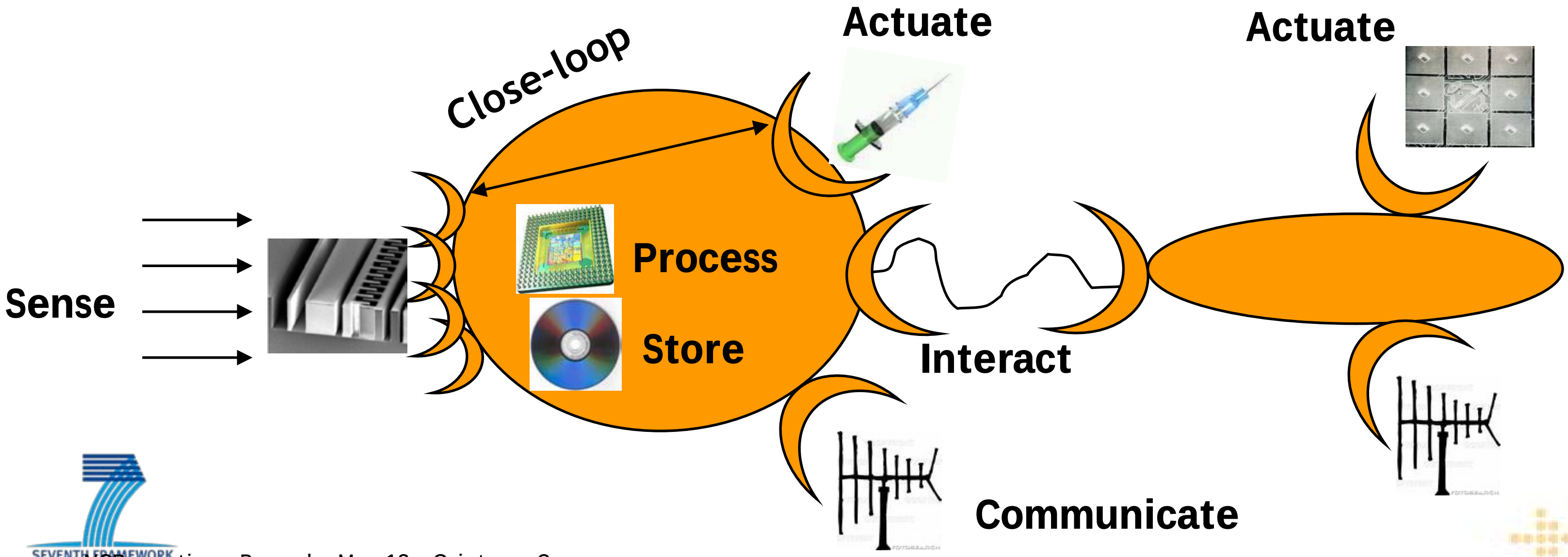
Microsystems get smart →Smart systems

Able to:

- Describe a situation, diagnose, and/or
- Predict, decide, help to decide, and/or
- Interact with the environment

→ • Smart (Miniaturised) System



Main Challenges for Microsystems and smart miniaturised systems

1. Multiple Research fields to combine
   Mechanics, electronics, fluidics, biology, magnetism, photonics

2. Multiple Materials need to work side by side
   Semiconductor, ceramic, glass, organic

3. Multiple Functions to integrate
   Sensing, processing, logic, memory, communication

4. Multiple Integration technological options
   → Heterogeneous integration
   Monolithic, hybrid, multichip

ICT Objective ICT-2009.3.9:
"Microsystems and smart miniaturised systems"

(a) Heterogeneous Integration

(b) Autonomous energy efficient smart systems

(c) Application-specific Microsystems and Smart Miniaturised Systems

Biomedical

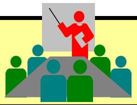
Telecommunicatio
ns

Environment
Food/Bevera
ge

Transport,
Safety and
Security

Smart Fabrics,
Interactive
Textile

(d) Coordination and Support actions



(a) Heterogeneous Integration

Multiple core technologies and materials, integrated and interfaced:

Emphasis: - Innovative concepts of industrial relevance

- Address challenges that limit the industrial take-up

Focus:

1. Heterogeneous technologies for more intelligence in microsystems:
   - multi-sensing, processing, wireless communication, actuation

2. Address the "value chain" for more efficient manufacturing:

   Materials, modeling, design, processes, packaging, characterisation, testing

3. Disruptive approaches for nanosensor-based microsystems

(b) Autonomous energy efficient smart systems

Objective:

Long-lasting autonomous operation

Challenges:

1. Energy:

Scavenging, storage and transmission

Power generation, accumulation and consumption

2. Communication:

Smart transceivers for wireless communication of sensor-based systems:

(reconfigurable, low power, adaptive, miniature…)

(c) Application-specific Microsystems (1/2)

Biomedical

1. Lab-on-chip platforms, from R&D to validation in Drug discovery, diagnosis/therapy

    emphasis: integration of sample preparation, flexibility t

2. Microinstruments for cell manipulation and micro-injection

3. Microsystems interacting with the human body

    - miniaturised active implants
    - bio-robots and non-invasive microsystems (monitoring, diagnosis and therapy)

Note: Biosensors and microfluidic chips/components "as such" out of scope

Telecommunications

Miniaturisation for multi-functional networked microsyste

1. Smart RFID
2. Ultra-low power transceivers
3. Reconfigurable antenna

(c) Application-specific Microsystems (2/2)

Environement Food/Beverage

Multi-sensing microsystems for:

- Environment (including water treatment)
- Food and beverages quality and safety

Emphasis: reliability and cost

Transport, Safety and Security

1. Transport: Safety critical microsystems:
   Emphasis: smart systems for the full electrical vehicle
2. Safety and Security: Sensors and actuators
   Emphasis: networking capabilities, operation in harsh environment

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Smart Fabrics, Interactive Textile

Multi-functional textiles and fabrics:

Seamless integration of functions:

sensing, actuating, communication, processing, power sourcing

- Integration of fibre-level components into textiles
- Stretchable and wearable electronics embedded in textiles
- Fully integrated Smart Fabric and Interactive Textile (SFIT)

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Information Society and Media

(d) Coordination and Support actions

Non-R&D projects !

1. Techno-economic analysis
2. Dissemination and promotion actions, public awareness
3. Identification of international cooperation opportunities
4. Coordination between Technology providers and Users (for in-vitro diagnostics and food/beverage quality)

Budget and “Instruments”