FP7 - ICT Work Programme 2011-12

Objective 3.1

"Very advanced Nanoelectronic components: design, engineering, technology and manufacturability"

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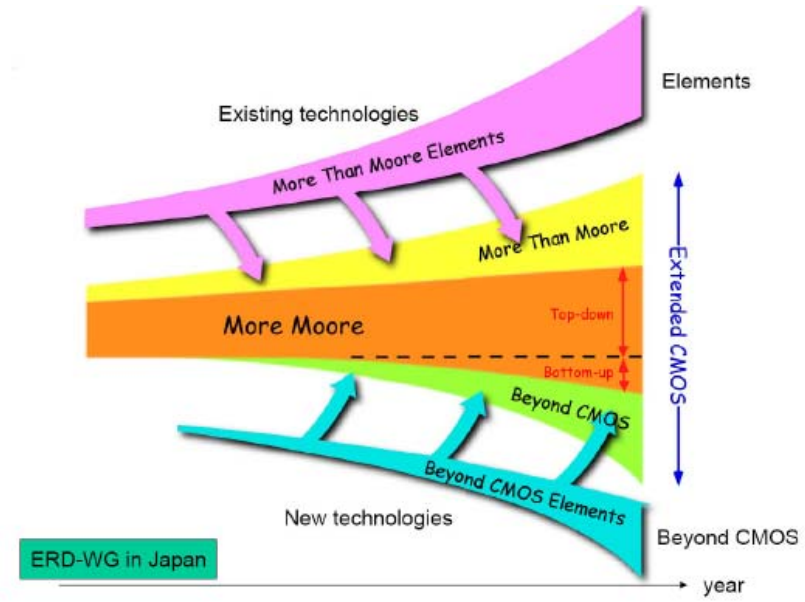
Nanoelectronics

NCP, 13th May 2011, Brussels.

Presentation Outline

- Objective 3.1:
  - What are we looking for?
  - General concepts
  - Target outcomes
  - What do we not want?
- Related Objectives or Programmes
- Key groups / Leading players
- Additional background documents

What are we looking for?



ITRS-ERD vision of the role of Beyond CMOS and More than Moore elements to form future extended CMOS platforms (2010).

- **New advanced nanoelectronic components** based on "beyond CMOS devices" and their integration with advanced More than Moore elements and with existing and new nano-CMOS to support miniaturised electronic and communication technologies for 2020 and beyond.
- Improved technology, engineering, nano-manufacturing and design solutions for **increased performance, increased systemability, integratability and manufacturability**.
- **Joint equipment assessment** and **broker services** to facilitate access to world wide market for SMEs and academics.

Obj. 3.1

Budget: 60M€

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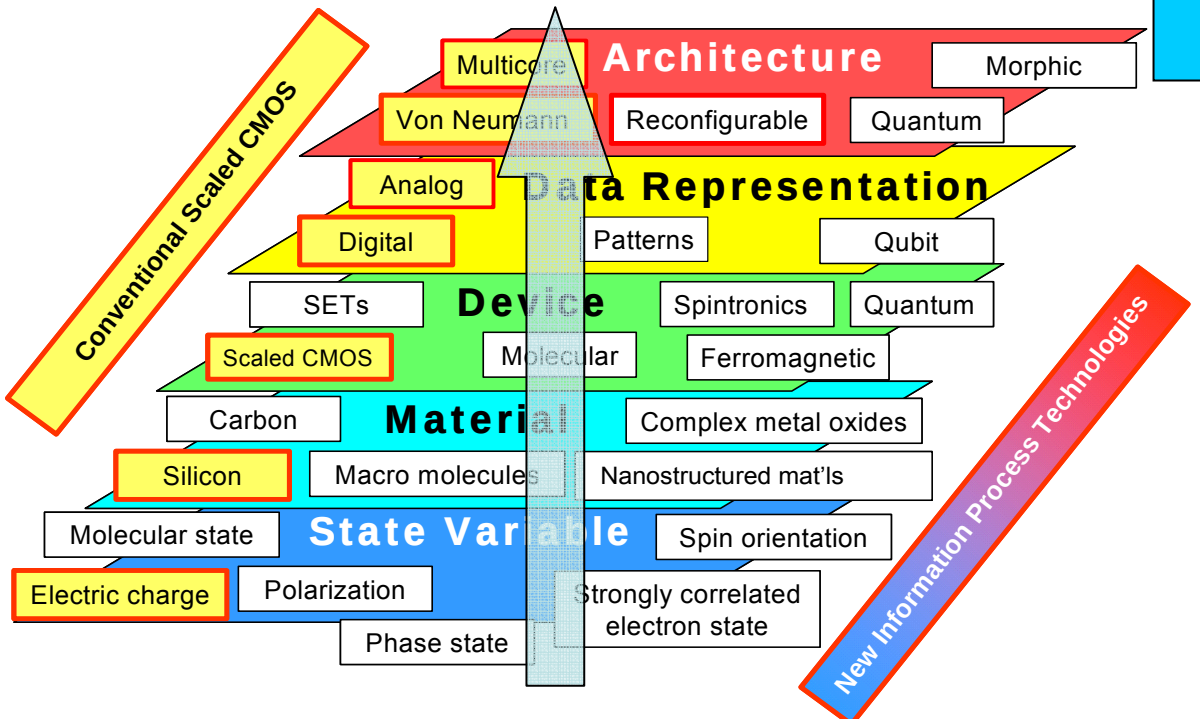
Work Programme 2011-12
General concepts

Transversal Research Projects

Multi-disciplinary cooperation



-System-technology interaction
-Nanofabrication
-Energy efficiency
-Next switch
-Universal memory
-3D integration
-Novel architectures

- Advanced component technology + advanced system design
- Beyond CMOS + advanced More than Moore integration with More Moore

For systems 2020 and beyond

Systemability, integratability, manufacturability

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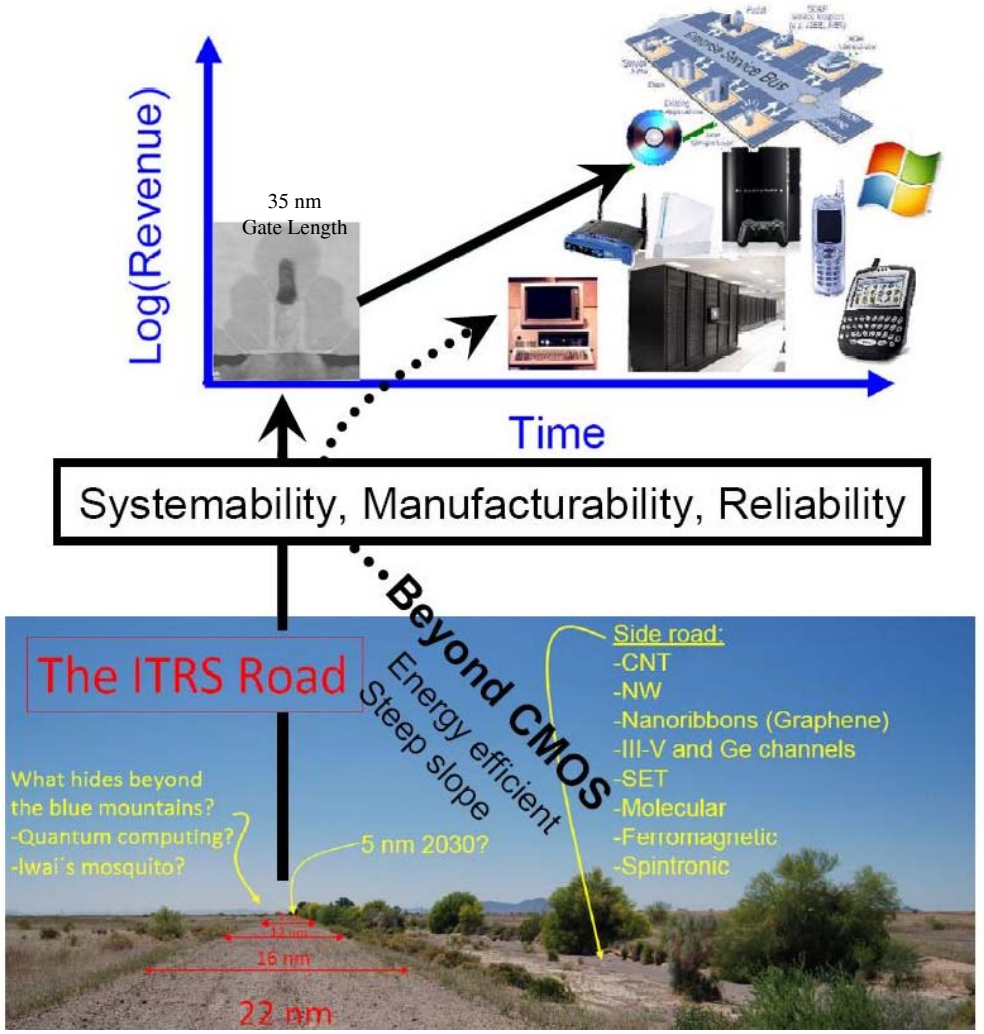
Objective 3.1:
Advanced Nanoelectronics Technology

- To stimulate **interaction of system and technology** to better explore European system competences.
- To address **energy efficiency** needs for mobile applications
- Nanoelectronics products as **system enablers and solution providers** for global challenges as aging society, global warming, growing population or sustainable manufacturing.
- To prepare for **"beyond" traditional shrinking** (ITRS roadmap)



Objective 3.1

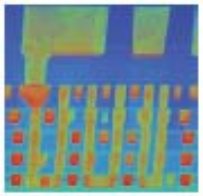
Manufacturing and Equipment assessment

- Access to **nano-manufacturing and to advanced technologies** to be assured in Europe.
- Access to world wide **equipment** market for European suppliers, especially SMEs, need to be stimulated.

Semiconductor Equipment for
Wafer Bonding with Plasma Activation
EV Group, CEA-LETI, Soitec

Ruthenium Atomic Vapor Deposition
Competitiveness in Nanoelectronic
Device Generations
AIXTRON, Fraunhofer IISB, Infineon
Munich

Low Energy and Dose Implant Test
SEMILAB, Fraunhofer IISB,
ST Microelectronics Crolles II,
NXP Crolles R&D



Metrology Using X-Ray Techniques
Jordan Valley, CEA-LETI,
STMicroelectronics Crolles II,
NXP Crolles R&D

EVG SmartView® Wafer Aligner

3D Integration of Bulk Si Wafers
EV Group, CEA-LETI,
STMicroelectronics Crolles II

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Call 8

60M€

ICT Work Programme 2011-12

Nanoelectronics

Objective 3.1: Very Advanced Nanoelectronics Components

a) Beyond CMOS technology	STREPs	55 M€
b) Circuit-technology solutions	STREPs and at least 1 IP	
c) Nano-manufacturing and Joint Equipment Assessment	STREPs and at least 1 IP	
d) Coordination and Support Actions	CSAs	5 M€

SEVENTH FRAMEWORK PROGRAMME

European Commission
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3.1 Very advanced nanoelectronic components: design, engineering, technology and manufacturability

Target outcomes

a) Beyond CMOS technology

- New switches and interconnects (scalability, performance and energy efficiency gains, operational reliability and RT operation);
- Advanced system integration technology and new methods for computation;
- Emerging memories targeting the concept of non-volatile universal memory;
- Nano-photonic devices & interconnects integrated with nano- and Beyond-CMOS
- Carbon based electronic devices;
- Novel materials for interconnects , nano-packaging, Beyond-CMOS (logic and memory);
- Understanding fundamental artefacts and limits: nano-scale thermal processes; computational material and device science.

Developed components and technologies need to fulfil the criteria of "**systemability**", "**integratability**", and "**manufacturability**".

Funding schemes: STREPs

3.1 Very advanced nanoelectronic components: design, engineering, technology and manufacturability

Target outcomes

b) Circuit-technology solutions

- Architectures including energy efficiency, spin devices; silicon with molecular switches; ferromagnetic logic; heterogeneous and morphic system architectures.
- Circuit design methodologies and tools
- Technology addressing e.g. device leakage current, power dissipation, … monolithic as well as 3D integration of Beyond CMOS and advanced MtM.
- Modelling and simulation
- Design-technology solutions for energy efficiency, high reliability and robustness.

Developed components and technologies need to fulfil the criteria of "**systemability**", "**integratability**", and "**manufacturability**".

The **interaction** of **circuit, device and technology research communities** will be stimulated

Funding schemes:
IP
STREPs

3.1 Very advanced nanoelectronic components: design, engineering, technology and manufacturability

Target outcomes

c) Nano-manufacturing and joint equipment assessment

- Manufacturing approaches to Beyond-CMOS and advanced MtM, and to their integration with nanoCMOS including 3D integration.
- Enhanced variability control; integrated metrology/inspection/analysis concepts and tools to support 3D approaches; functionalised assembly and packaging.
- Joint assessments of (combined) equipment/metrology/process solutions ranging from proof of concept for "disruptive" approaches and for 450mm to prototype testing with suppliers and users.
- 200/300 mm wafer integration platforms and short user-supplier feedback loops.

Comprising the **complete manufacturing supply chain** for flexible and customised manufacturing of **integrated nano- and Beyond-CMOS** components

Funding schemes:
IP
STREPs

Target outcomes

d) Support measures

- Broker services to offer European researchers and SMEs access to training, to CAD tools and to advanced technologies, design kits and IP blocks for education, prototyping and small volume production.
- Roadmaps; benchmarks; strategy papers; studies of limits of Beyond-CMOS and advanced MtM processes, devices and architectures.
- Stimulation of young people towards electronics careers.
- International cooperation (USA, Taiwan, Korea, Japan)
- Support, coordination and standardisation actions including preparatory work for 450mm wafer processing targeting material and equipment companies

Funding schemes: CSAs	Budget: 5 M€

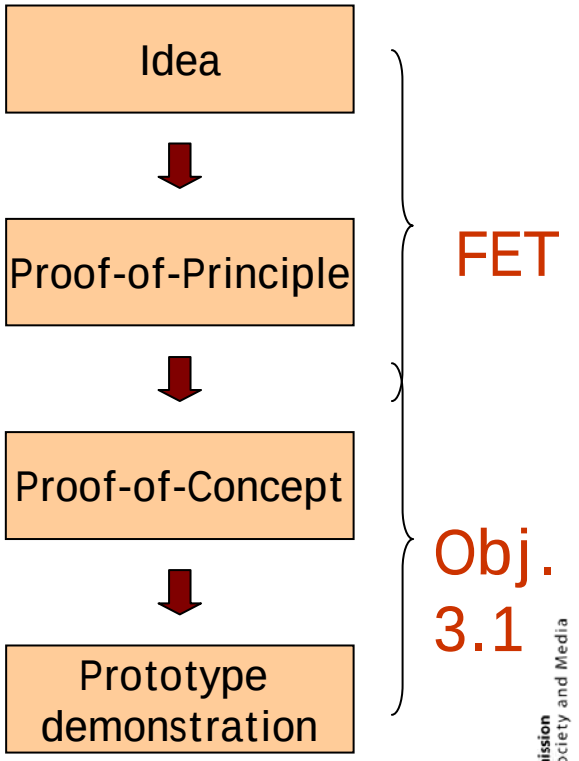
3.1 Very advanced nanoelectronic components: design, engineering, technology and manufacturability

Expected Impact

- **Increased European knowledge, resources and skills** at the frontier of nanoelectronics technology and miniaturised electronic systems, enabling further European partnerships in ww collaborations. European research organisations in leading positions.
- **A more integrated nanoelectronics technology, device and design research community**, better targeted to the business strategy of the European industry.
- **Increased attractiveness for investments** in components miniaturisation, functionalisation and manufacturing in Europe; increased business opportunities and market share.
- **New electronic applications** of high economic and socio-economic relevance
- **Strengthened competitiveness** of the European foodchain for the nanoelectronics industry (materials, equipment and components suppliers, academia and institutes).

Related Objectives or Programmes

- NMP
- FET
- WP 2011-2012: Obj. 3.1
- WP 2011-2012: Obj. 3.2
  (a) "Future smart components and smart systems"
- ENIAC Programme
- CATRENE Programme



Materials → Equipment → Devices → Components → Systems → Manufacturing

What do we not want?

- **We want** very Advanced and Multidisciplinary Research, but

- **We do not want**
  - Research on components and technologies that do not investigate the need to fulfil the criteria of "systemability", "integratability" and "manufacturability", where appropriate.
  - Research focused on materials
  - Research focused on the development of equipment
  - Research focused on large systems integration

Key groups / Leading players

Key Groups

- International Roadmap of Semiconductors (ITRS - ERD)
- Scientific Council of ENIAC ETP
- NANOTEC CA - Building a Nanoelectronics Design and Technology Community (https://www.fp7-nanotec.eu/)
- ENI2 Nanoelectronics Infrastructure (http://www.sinano.eu/sinano/projects/eni2.html)

Leading Players

- Leading companies (ST, INTEL, Global Foundries, Infineon, IBM, NXP, Numonyx, ...)
- Leading Regional clusters (Dresden – GF/Fraunhofer; Grenoble – CEA/ST Leuven – IMEC...) and SMEs around them.
- RTO - European Universities of Excellence

Additional/background documents

- FP7 Workshop on Advanced Nanoelectronics Technologies (ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/nanoelectronics/011209-wshop-rep-ai-v7b-clean_en.pdf)
- Workshop on Manufacturing of Beyond CMOS and Advanced More than Moore Devices (http://cordis.europa.eu/fp7/ict/nanoelectronics/elements/wshop-report-v6-fin-070211.pdf)

Summary

- **Call 8**
  - Open: 26 July 2011
  - Close: 17 January 2012 (at 17:00 Brussels local time)
- **Funding schemes:**
  - a) Beyond CMOS technology: STREPs
  - b) Circuit-technology solutions: STREPs and at least 1 IP
  - c) Nano-manufacturing and joint equipment assessment: STREPs and at least 1 IP
  - d) Support measures: CSAs
- **Indicative budget distribution - 60 M€:**
  - IP/STREP 55 M€
  - CSA 5 M€

Thank you

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:

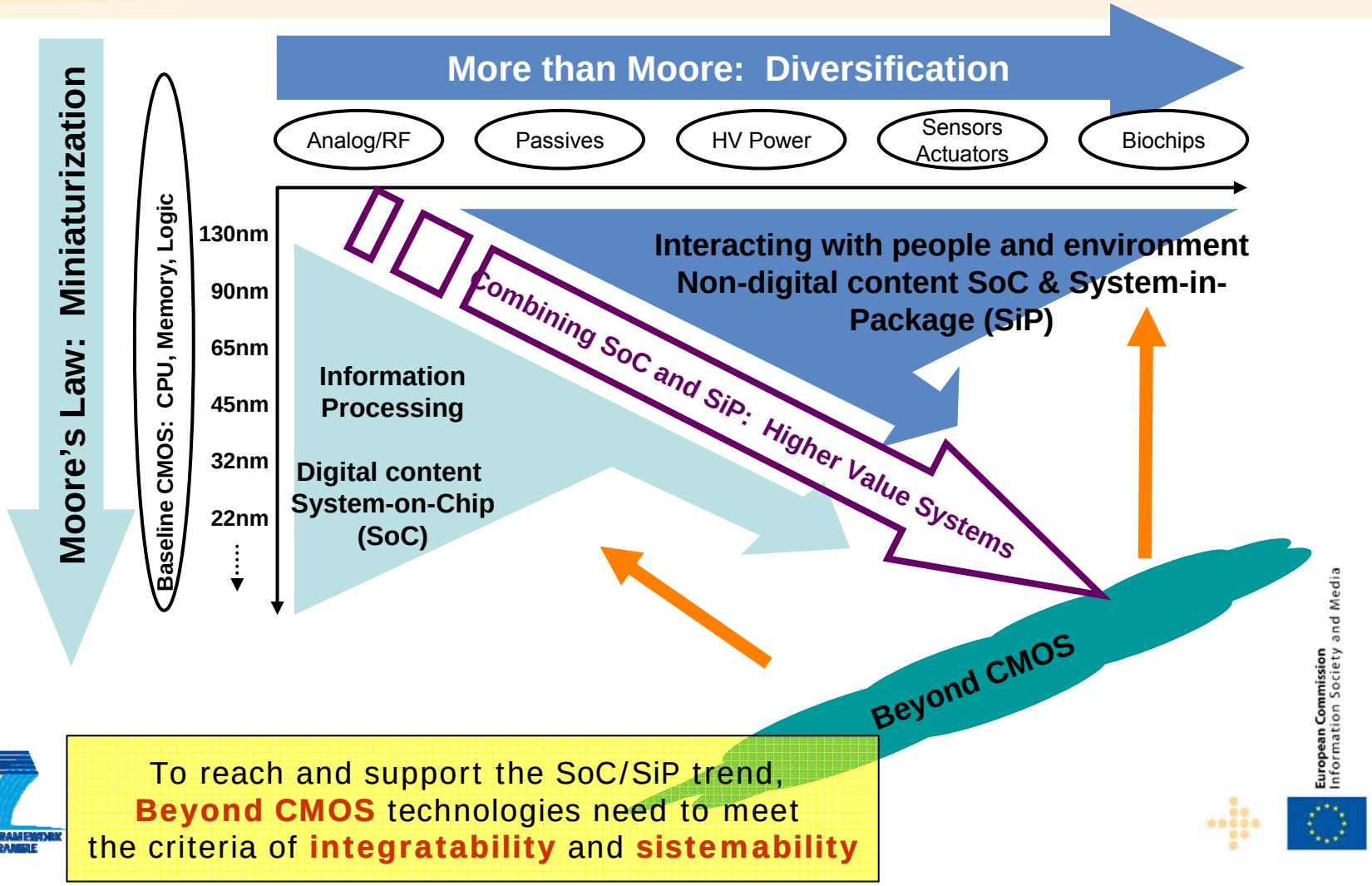
Isabel.vergara-ogando@ec.europa.eu

Nanoelectronics in FP7

- FP7 – ICT Call 1 (2007): Next-generation Nanoelectronics Components and Electronics Integration. 86 M€
- FP7 – ICT Call 4 (2008): Design of Semiconductor Components and Electronic Based Miniaturised Systems. 25 M€
- FP7 – ICT Call 5 (2009): Nanoelectronics Technology. 35 M€
- FP7 – ICT Call 7 (2010): Smart Components and Smart Systems Integration. 38M€
- FP7 – ICT Call 8 (2011): Very Advanced Nanoelectronics Components. 60 M€

Introduction

European vision of the More Moore and More than Moore domains



To reach and support the SoC/SiP trend,
Beyond CMOS technologies need to meet
the criteria of **integratability** and **sistemability**

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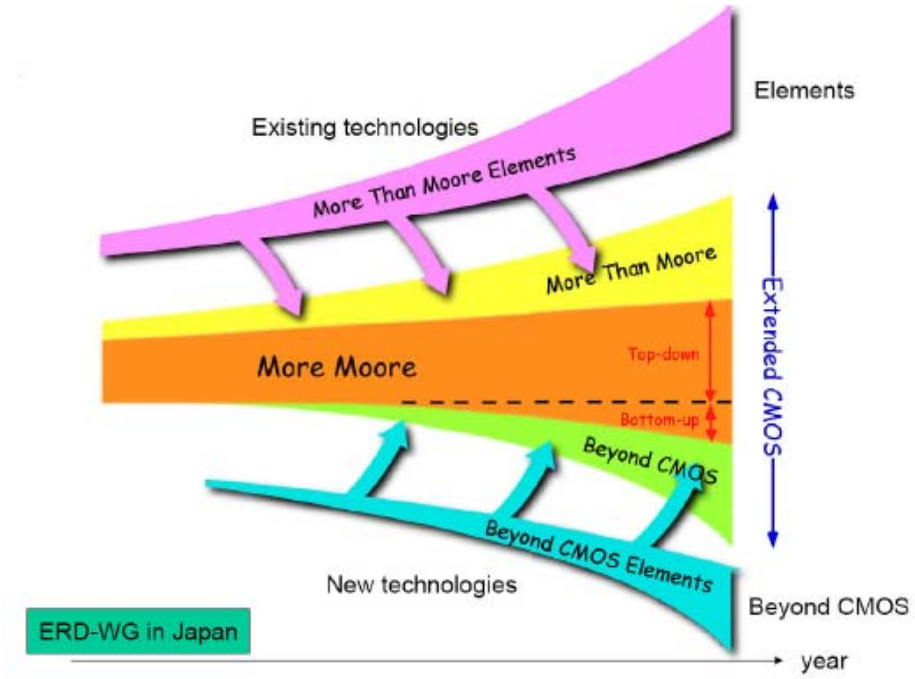
Objective 3.1: Advanced Nanoelectronics Technology



ITRS-ERD vision of the role of Beyond CMOS and More than Moore elements to form future extended CMOS platforms.

- Future developments in **Beyond CMOS and More than Moore as an extended-CMOS vision**. No disconnection from the advanced silicon CMOS in order to keep impact of its results on the applications and markets.
- Needs of **hybridizing silicon** with molecular switches, ferromagnetic logic, spin devices and sensors in order to enable heterogeneous and morphic system architectures.
- **Integrate-ability** of novel technology with CMOS and their **reliability** become key factors.