

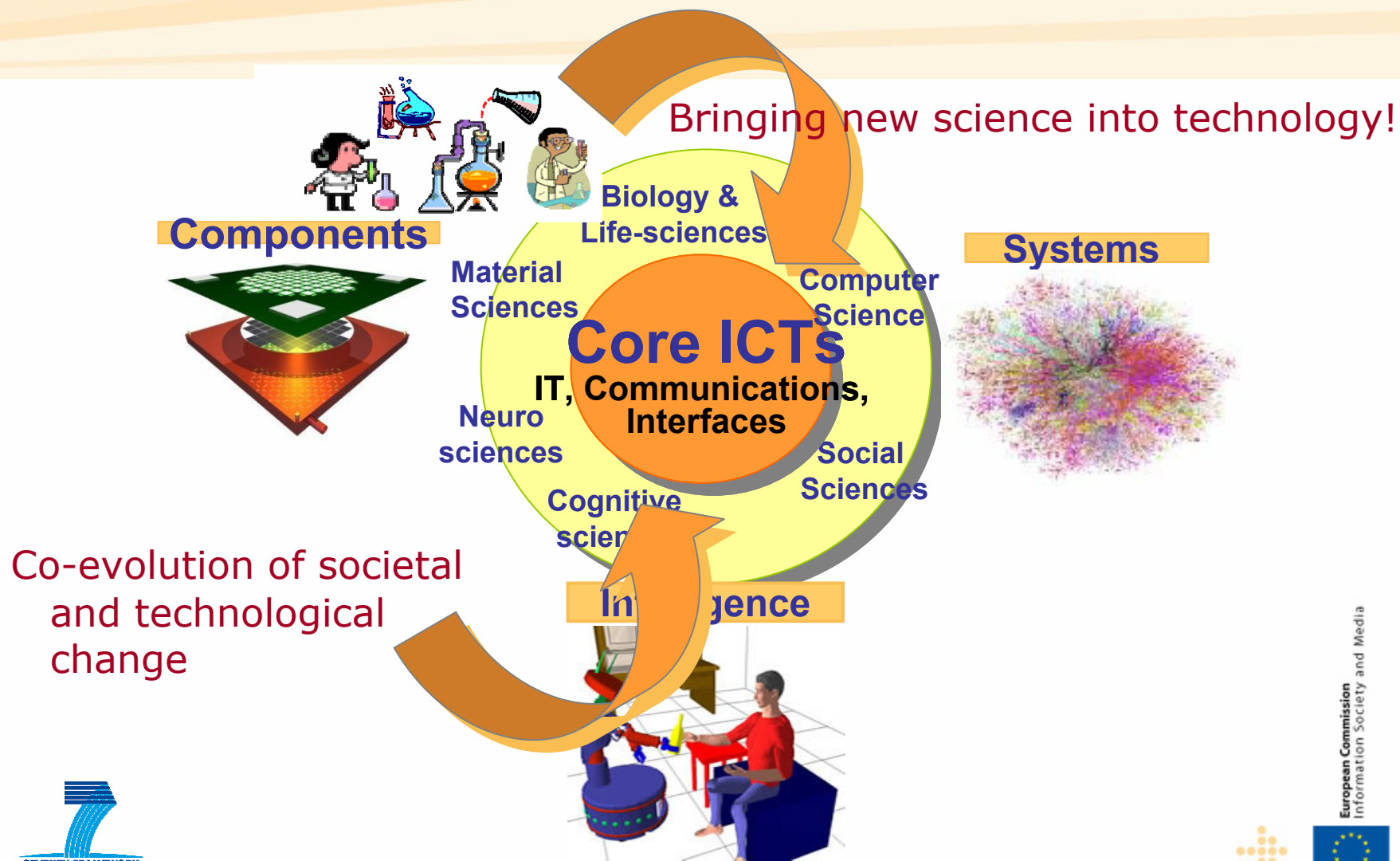
# Future and Emerging Technologies Overview and Future Strategy Proactive and Flagships



European Commission  
Future and Emerging Technologies proactive



# Future and Emerging Technologies multidisciplinary transformative research



# FET Proactive – WP 2011-2012

Call FET-F

FET Flagship Initiative Preparatory Actions (CSA) 10M€

Call 7

9.12 ERA-NET follow-up (CSA)

2,5M€

0,5M€

26 July  
2011

9.6 Unconventional Computing (STREP) 15M€

Call 8

9.7 Dyn. of Multi-Level Complex systems (IP/Strep) 22M€  
INCO dimension (CSA) 1M€

17 Jan  
2012

9.8 Minimising Energy Consumption of  
Computing to the Limit (Strep) 15M€

18 Jan  
2012

9.9 Quantum ICT (IP/Strep) 15M€  
including ERA-NET Plus (ERA-NET-Plus) 7M€

Call 9

9.10 Fundamentals of Collective  
Adaptive Systems (IP/Strep) 23M€

17 April  
2012

9.11 Neuro-Bio-Inspired Systems (IP/Strep) 22M€  
INCO dimension (CSA) 1M€

9.12 INCO (CSA)

9.12 Coord. Communities (CSA)

9.12 organising conferences (CSA)

9.12 Identifying new FET topics (CSA)

3M€

2.5M€

# **Joint Programming:**

## **ERA-NET-Plus action in QICT (call 9)**

- **Target outcome**
  - A joint call of a group of member states for proposals on QICT
  - To be funded through an ERA-NET-Plus action between national and/or regional grant programmes.
- **Expected Impact**
  - Closer cooperation and greater alignment between the participating national/regional research programmes

## ERA-NET Plus actions

*EU to provide a **financial topping up of max 33%***



small part for call management (eligible costs) and



the bulk of the 33% **to top up joint call** budget

☞ If MS put together 14 M€, the Commission may provide up to 7 M€, for a total budget of up to 21 M€

### Rules of 5 :

- 5 participants of 5 different Member States or Associated Countries
- Joint call of minimum 5 M€ (Total budget)
- Maximum duration of 5 years



# FET Flagship Initiatives

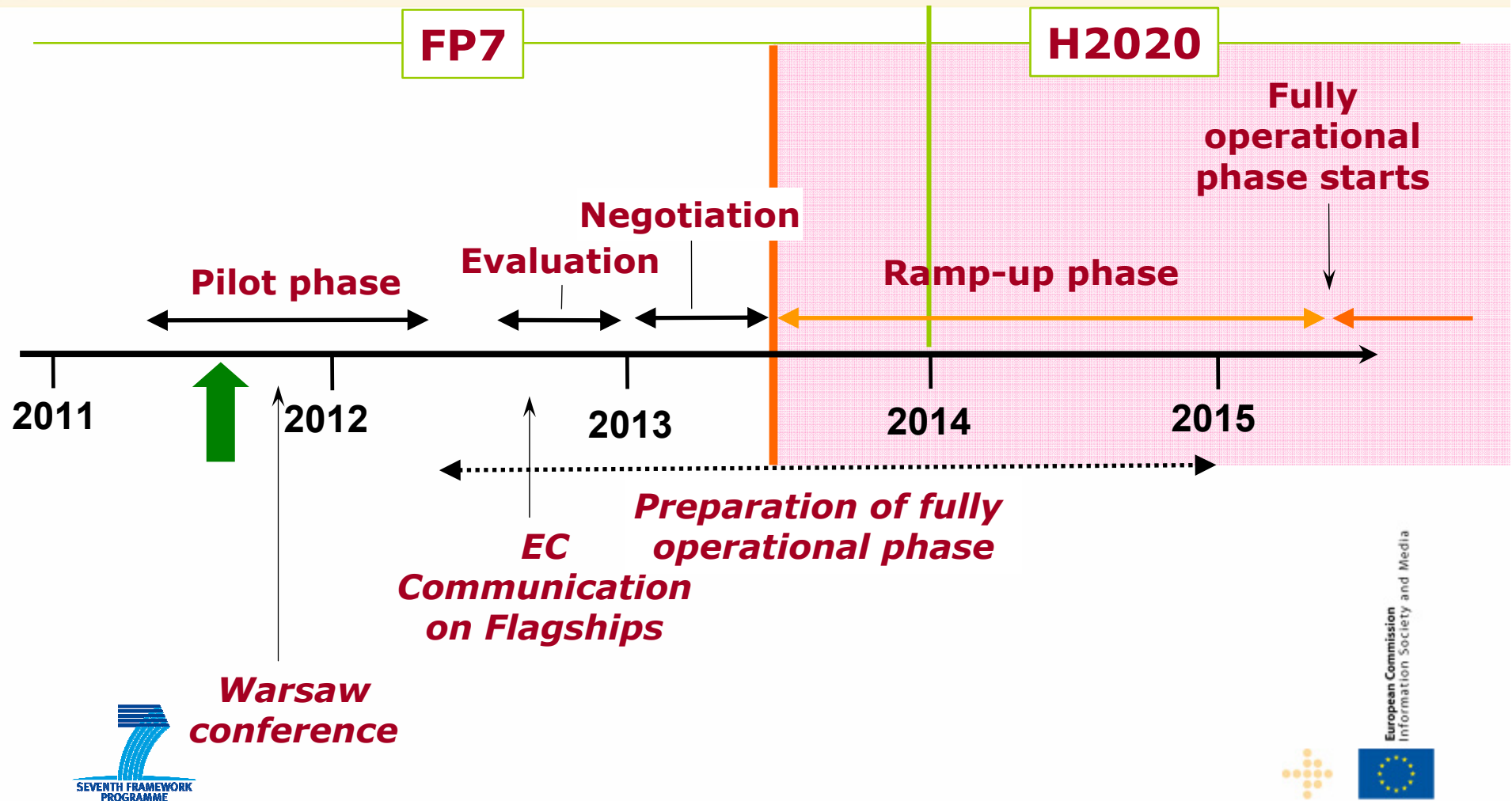
## Partnerships for scientific leadership

### Key features:

- **Ambitious, unifying goal**
- **Science-driven, seeded from FET, extending beyond ICT**
- **Large-scale** - 10 years of support up to 100 M Euro / Flagship / year
- **Visionary and transformative impacts** on Science, Technology, and Society
- **Federation with national programs, Member states** and other key stakeholders (industry, international etc)

✓ FET Flagships are a **response to the fragmentation** and the leveraging of investment in basic research seeded from ICT leading towards innovation in technology and societal impact.

# FET Flagships - Timeline



# Flagship Pilots Overview(I)

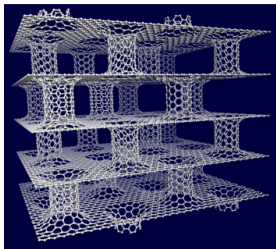
## FuturICT

### *The FuturICT knowledge accelerator*

a "Living Earth Simulator" involving planetary-scale simulation of impacts from humans on the planet and global crisis management support



## Graphene



### *Graphene S&T for ICT and beyond*

development of the science and technologies for a new class of material beyond the era of silicon; includes four Nobel prize laureates

## Guardian Angels

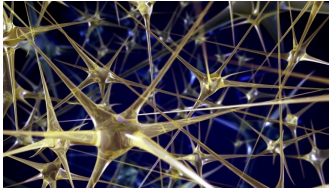
### *Guardian Angels for a smarter planet*

development of the science and technologies for zero-power ICT components and systems at nanoscale with compute and networking functionalities for environmental and health monitoring



# Flagship Pilots Overview (II)

## HBP



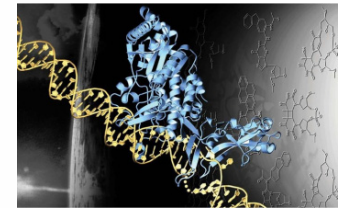
### *The Human Brain Project*

simulation and understanding of the Human Brain to develop new diagnostic tools and treatments for brain diseases, and new class of low-energy technologies with brain-like intelligence, such as neuromorphic computing

## ITFoM

### *Molecular modelling in health and medicine*

offering a revolution in healthcare: aiming at the ultimate goal of developing personalised preventive medicine based on individual physiological data processed against globally integrated medical knowledge



## RoboCom



SEVENTH FRAMEWORK  
PROGRAMME

### *Sentient Robot Companions*

a 'sentient nurse' with flexible properties, such as soft bodies and adaptive behaviour based on new levels of perceptual, cognitive and emotional capabilities



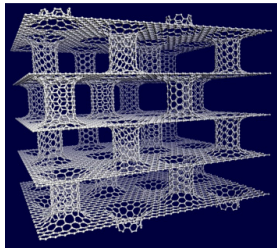
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# Flagship Pilots retained

topics/themes beyond ICT

## FuturICT

Environment & Climate, Science and Society,  
Energy, Research Infrastructures  
(ICT: e-Gov)



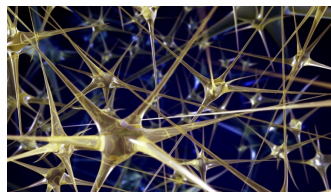
## Graphene

**NMP**

(ICT: Nanoelectronics)

## Guardian Angels

NMP, Energy, Environment, Health, Research Infrastructures  
(ICT: AAL, Nanoelectronics, Microsystems, ICT for Sustainable  
Growth, e-Health, e-Gov)



## Human Brain Project

Health, Research Infrastructures  
(ICT: e-Health, Robotics)



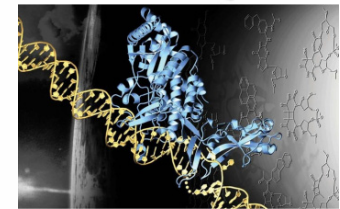
## RoboCom

**NMP**

(ICT: Robotics)

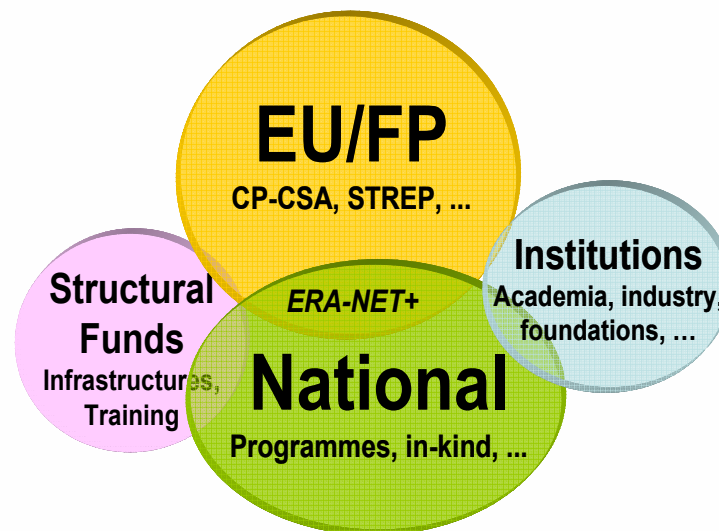
## ITFoM

Health, Research Infrastructures  
(ICT: e-Health)



# FET Flagships Funding Sources

- EU funding
- National and regional funding
- Institutions funding
- Structural funds



# FET Flagships Governance

## Principles

- Scientific leadership
- Representation and commitment of funding parties
- Efficient implementation of strategic decisions
- Progress monitoring
- Open and adaptive to cope with changes

## Structure

- Steering Committee
- Board of Trustees

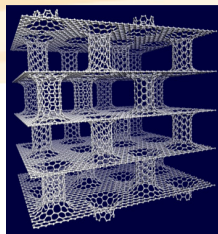


# Selection and implementation

**FuturICT**



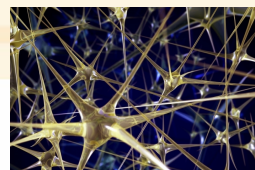
**Graphene**



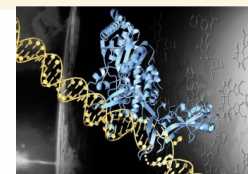
**Guardian  
Angels**



**HBP**



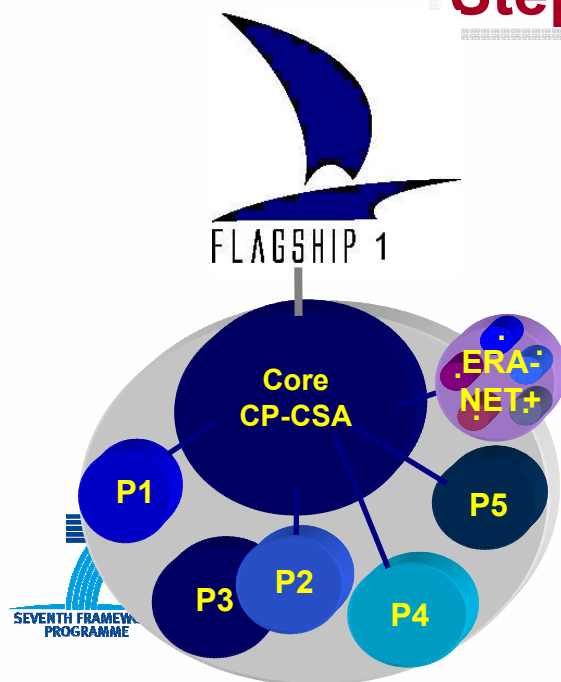
**ITFoM**



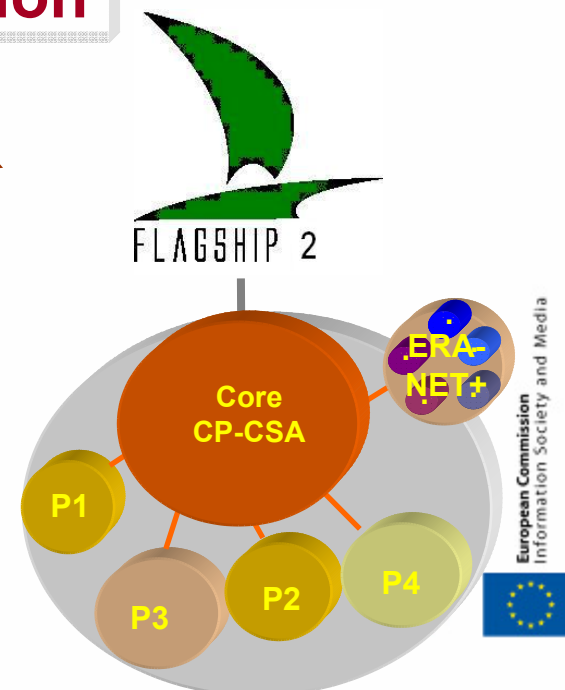
**RoboCom**



**Step 1: Flagship selection**



**Step 2:  
Implementation**



# Objective ICT-2011.9.6

## FET Proactive



## Unconventional Computation (UCOMP)



# Objective ICT-2011.9.6: Unconventional Computation (UCOMP)

## Rationale

Nature (e.g. living cells), and our physical environment in general, show many unconventional ways of information processing, such as those based on (bio-)chemical, natural, wetware, DNA, molecular, amorphous, reversible, analogue computing, etc. These are generally very sophisticated, ingenious and highly effective for specific purposes, but sufficient knowledge (either from a theoretical or an engineering perspective) to properly exploit, mimic, or adapt these systems, is lacking.

# **Objective ICT-2011.9.6: Unconventional Computation (UCOMP)**

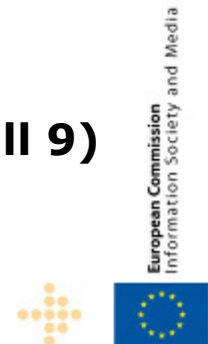
**“The objective is to develop alternative approaches for situations or problems that are challenging or impossible to solve with conventional methods and models of computation (i.e. von Neumann, Turing).”**

## **Typical examples:**

- computing in vivo
- performing massively parallel computation

**Relates to initiative: Bio-Chemistry based ICT (Call 4)**

**Beyond existing initiatives: Quantum ICT (Call 9)  
Neuro-Bio-Inspired Systems (Call 9)  
Brain-Inspired ICT (Call 6)**



# Objective ICT-2011.9.6: Unconventional Computation (UCOMP)

## Target outcomes:

- Foundations for a ***radically new kind*** of information processing technology based on ***unconventional*** paradigms.

### Projects should:

- Pursue information processing, respecting the link with the physico-chemical embodiment
- Strengthen theoretical foundations
- Demonstrate key steps towards physical systems
- Develop an appropriate interface to conventional IT where appropriate

# Objective ICT-2011.9.6: Unconventional Computation (UCOMP)

## Expected Impact:

- ***Foundations, approaches and proofs of concept*** for radically new kinds of computation
- Possible contributions ***beyond*** the area of ICT
- ***Global research cooperation***, in particular with participants from USA, Canada, New Zealand and Japan.



# Objective ICT-2011.9.6: Unconventional Computation (UCOMP)

## Events:

- Proposer's day in Brussels in October
- Annual International Unconventional Computation conference : June 6—10, Turku, Finland

<http://www.math.utu.fi/projects/uc2011/venue.html>

Prof. Jarkko Kari, University of Turku (chair)

## Objective ICT-2011.9.6: Unconventional Computation (UCOMP)

- Budget: 15 MEuro
- Funding schemes: STREPs only
- Contact & pre-proposals:  
[dagmar.floeck \(at\) ec.europa.eu](mailto:dagmar.floeck@ec.europa.eu)
- Further reading:
  - UCOMP portal:  
[http://cordis.europa.eu/fp7/ict/fet-proactive/ucomp\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/ucomp_en.html)
  - Expert consultation workshop report:  
<http://tinyurl.com/UCOMPbackground>



**Objective ICT-2011.9.7:**

# **Dynamics of Multi-Level Complex Systems (DyM-CS)**

**[http://cordis.europa.eu/fp7/ict/fet-proactive/dymcs\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/dymcs_en.html)**



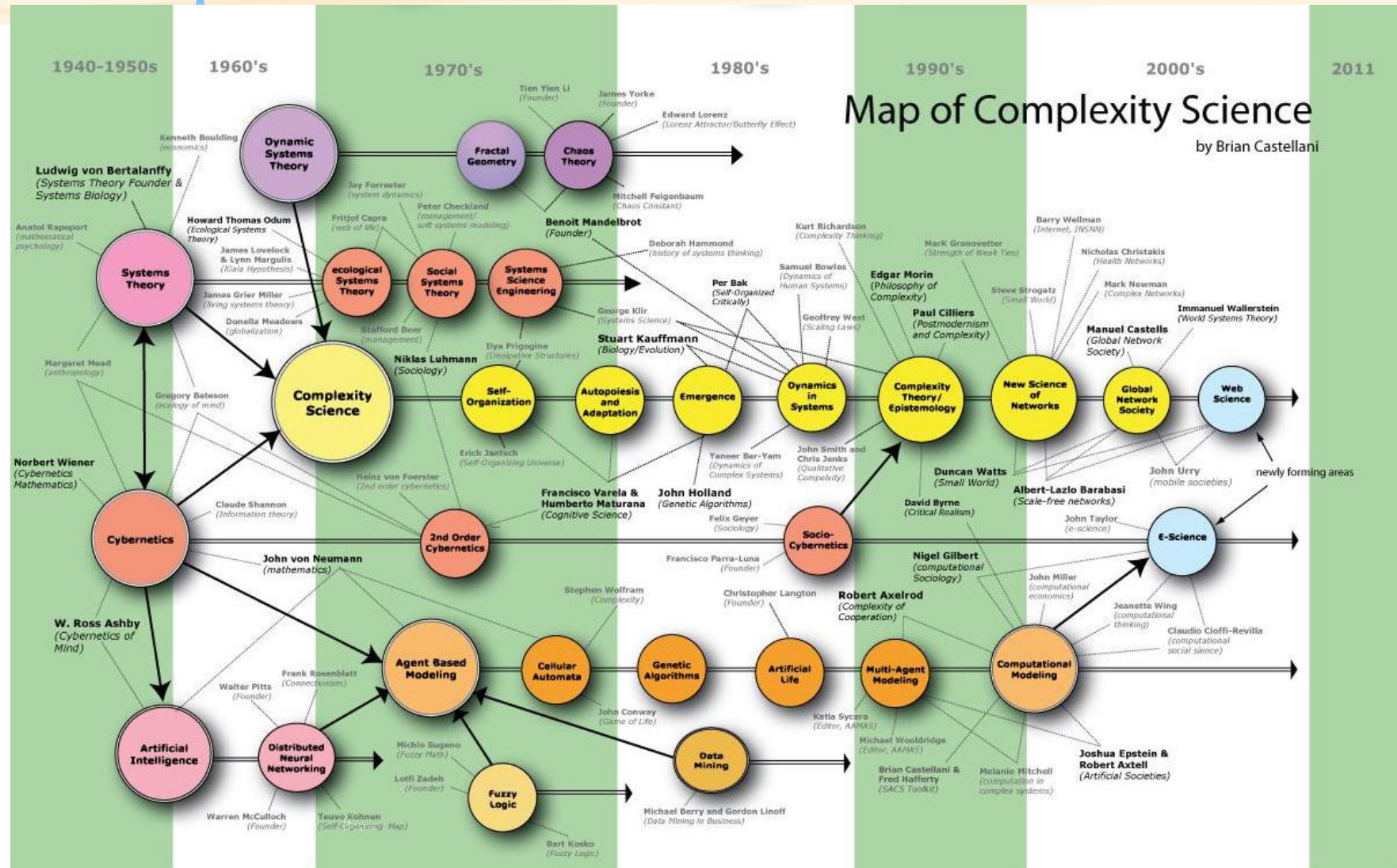
## Objective ICT-2011.9.7: Dynamics of Multi-Level Complex Systems (DyM-CS)

### Rationale:

- Many artificial and natural systems are characterized by a high level of differentiation in structure and organization; they exist in areas as diverse as the Internet, energy management, climate, financial markets, infrastructures (including ICT), biology, transport, epidemics, meteorology, urban planning, social simulation and policy impact assessment.
- In order to describe and control these systems there is a need to observe and reconstruct their dynamics and make sense of large amounts of heterogeneous data gathered on various scales.



# Objective ICT-2011.9.7: Dynamics of Multi-Level Complex Systems (DyM-CS)





## Objective ICT-2011.9.7: Dynamics of Multi-Level Complex Systems (DyM-CS)

### Objectives:

- New mathematical and computational formalism on dynamics of multi-level systems developed and validated on real-world applications involving large and heterogeneous data sets
- World-class international research cooperation, global alliances in this research area, and links with similar actions outside Europe, in particular with participants from USA, Japan and China

### Lesser emphasis on:

- Applications driven projects



## Objective ICT-2011.9.7: Dynamics of Multi-Level Complex Systems (DyM-CS)

### Target outcome a)

- Progress towards a general theory on complex systems
- New ICT-based methods and principles for the management of large scale systems, including ICT systems themselves
- Better understanding of structural patterns (e.g. resilience, sensitivity to failure) of complex systems in socio-economic and technological areas

### Target outcome b)

 New EU and global collaborations between researchers in the disciplines involved in CSS





## Objective ICT-2011.9.7: Dynamics of Multi-Level Complex Systems (DyM-CS)

### Related activities:

- Objective ICT-2007.8.4: Science of complex systems for socially intelligent ICT (COSI-ICT) – 4 IPs and a CA (ASSYST)
- CSS Expert Consultation Report:  
[ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/fet-proactive/shapefetip-wp2011-12-06\\_en.pdf](ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/fet-proactive/shapefetip-wp2011-12-06_en.pdf)
- FuturICT FET flagship pilot ([www.futurICT.eu](http://www.futurICT.eu))



## Objective ICT-2011.9.7: Dynamics of Multi-Level Complex Systems (DyM-CS)

### Extra considerations:

- 9 position papers received and presented: inspiration for the call – Booklet available  
[http://cordis.europa.eu/fp7/ict/fet-proactive/docs/dymcs-01\\_en.pdf](http://cordis.europa.eu/fp7/ict/fet-proactive/docs/dymcs-01_en.pdf)
- FET - Open CS call ICT-2011.9.14 'Science of Global Systems' 3.5 M Euro – emphasis on sustainability and policy narratives.
- Internal Proposers' Day - Brussels, October 12<sup>th</sup> 2011 – Ideas for proposals and networking  
[http://cordis.europa.eu/fp7/ict/fet-proactive/ie-oct11\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/ie-oct11_en.html)
- Pre-proposal service
- On-line registration
- Evaluators

# Objective ICT-2011.9.7: Dynamics of Multi-Level Complex Systems (DyM-CS)

## -Funding/Instruments:

22 MEuro, STREPs & IPs,

1 MEuro, CSAs

## -Closing of Call 8 - 17<sup>th</sup> Jan 2012

## -Contacts:

Jose.Fernandez-Villacanas (at) ec.europa.eu

Roumen.Borissov (at) ec.europa.eu



European Commission  
Information Society and Media

# Objective ICT-2011.9.8: Minimising Energy Consumption of Computing to the Limit

## Rationale

- Energy efficiency of today's technologies is orders of magnitude above the theoretical limits
- It prevents realizing new functionalities in e.g. mobile or distributed applications, and limits performance.
- It has increasing impact on energy supply and environment

# Objective ICT-2011.9.8: Minimising Energy Consumption of Computing to the Limit

## Target Outcome:

Foundations for radically new ICT technologies striving for the theoretical limits in energy consumption

- New elementary devices and inter-device-communication mechanisms
- Novel computing paradigms with radically improved energy efficiency (e.g. inspired by biology, post-Boolean logics, ...)
- Software models and programming methodologies supporting the strive for the energetic limit (e. g. energy cost awareness,..)
- Proof of concept, indication of expected energy gain, appropriate energy metrics or benchmarks for verification

# Objective ICT-2011.9.8: Minimising Energy Consumption of Computing to the Limit

## Expected Impact

- Understanding of theoretical limits of energy efficiency in computation (e.g. energy dissipation, thermodynamic and quantum physics limits)
- Foundations of computing technologies with negligible energy consumption
- Reduction of the environmental impact caused by the energy consumption of ICT

## Further reading: Consultation Workshop Report

[http://cordis.europa.eu/fp7/ict/fet-proactive/docs/shapefetip-wp2011-12-10\\_en.pdf](http://cordis.europa.eu/fp7/ict/fet-proactive/docs/shapefetip-wp2011-12-10_en.pdf)

## MINECC Web site

[http://cordis.europa.eu/fp7/ict/fet-proactive/minecc\\_en.html](http://cordis.europa.eu/fp7/ict/fet-proactive/minecc_en.html)



# Objective ICT-2011.9.8: Minimising Energy Consumption of Computing to the Limit (MINECC)

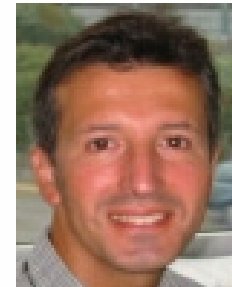
- Funding/Instruments: 15 MEuro for STREPs
- Closing of Call 8: 17 Jan 2012

## -Contacts:

[Ralph.Stuebner \(at\) ec.europa.eu](mailto:Ralph.Stuebner@ec.europa.eu)



[Francisco.Ibanez-Gallardo \(at\) ec.europa.eu](mailto:Francisco.Ibanez-Gallardo@ec.europa.eu)



# Coordinating Communities, Identifying new research topics for FET Proactive Initiatives

*ICT-2011.9.12, Calls 8, 9*

- Budget: 3 M€ (call 8) 2.5 M€ (call 9)
- Funding schemes: CSA
- Contacts:

[Wide.Hogenhout \(at\) ec.europa.eu](mailto:Wide.Hogenhout@ec.europa.eu)

[Jose.Fernandez-Villacanas \(at\) ec.europa.eu](mailto:Jose.Fernandez-Villacanas@ec.europa.eu)

- Related to Objective 9.12 in Call 7,  
Objectives 8.9, 8.10 in calls 5 and 6

# Coordinating communities

## Expected outcome (a,b,d)

The activities should

- Reinforce coordination of research projects in proactive initiatives in current or previous calls, helping to consolidate research communities.
- Strengthen European research excellence, including preparation of co-operation and co-ordination with international partners from outside Europe
- Conferences/workshops to increase visibility of FET and boost links between the EU research communities

# **New Research Topics, Emerging Trends Expected outcome (c)**

These short duration (6-12 months) projects should

- develop novel research topics as inputs for future work programmes, with an estimate of the effort required and a clear description of the expected impact
- identify topics with a greater scope than just 1 RTD project
- identify early on new trends emerging on a global scale in support of future proactive initiatives