Future and Emerging Technologies

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March 27, 2013
European Commission - DG CONNECT
Excellence in Science
FET IN FP7

Pathfinding future ICT
Establishing new foundations for future ICT

Redefines the conventional boundaries of ICT

- Venturing into uncharted territories
- Relying on fresh synergies, cross-pollination and convergence with different scientific disciplines
  
  E.g. Biology, chemistry, nano- and molecular science, neuro- and cognitive science, ethology, social science, economics, including the arts and humanities

Nurture early proofs-of-concept into novel directions for mainstream research and innovation
FET – three complementary approaches ('schemes')

Open, light and agile ↔ Roadmap based research

- **Individual research projects**
  - Early Ideas
    - FET Open
    - Exploring novel ideas

- **Research clusters**
  - Incubation
    - FET Proactive
    - Developing topics & communities

- **Common research agendas**
  - Large-Scale Partnering Initiatives
    - FET Flagships
    - Addressing grand challenges
FET-Open: 'Challenging current thinking'

Incubator for radically new research ideas for future technologies

New and visionary ideas with long-term impact on ICT

... come from anywhere, from anybody and at anytime
... hard to find
... fragile and easy to shoot down
... hard to do and take time to incubate
... require an open and transdisciplinary research atmosphere

Needs a specific approach...
• **FET-Open**, a long history of more than 20 years.

• Foundational breakthroughs based on novel ideas and long-term visions that can open up radically new directions for future ICT.
  
  • Light, topic-agnostic and deadline-free scheme
  
  • Continuously open 24/7

  ~3000 short proposals in FP7, ~2 per day in the last years.

• 2-step submission and evaluation

  Step 1: 5 pages proposal, with double-blind evaluation of S&T

• **FET-Open Xtrack**, a pilot to become lighter and faster
Linking biological and artificial neuronal assemblies to restore lost brain functions: towards the design of innovative bi-directional neuroprostheses

A closed-loop neural prosthesis for dizziness suppression

ICT challenges of mineral extraction under extreme geo-environmental conditions

A theoretical framework for swarms of GRN-controlled agents which display adaptive tissue-like organisation

Optogenetic Neural stimulation platform

Body on a Chip

Hyper Interaction Viability Experiments

Social Interaction and Entrainment using Music PeRformance Experimentation

Curved Artificial Compound Eyes

Similarity-Based Pattern Analysis and Recognition

Electronic Chemical Cell
Popular FET-hallmark scheme
Attracts new disciplines and actors, including many young ones and SMEs
Numerous success stories
A source of new directions and early signals
Largely academic, with some high-tech industry and SME participation
Highly competitive
FET-Proactive ‘targeted transformative research’.

A set of thematic initiatives for creating novel areas and themes, and the new interdisciplinary communities around them.

- Fixed deadline calls
- Topics defined bottom-up
  - FET-Open portfolio analysis
  - Consultations
  - Coordination and support actions
- Mix of instruments depending on purpose and maturity of the area
Foundations of Computing & Communication

- Nano-Scale ICT Devices and Systems
- Science of Complex Systems for Socially Intelligent ICT
- Unconventional computation
- Dynamics of Multi-Level Complex Systems
- Concurrent Tera-Device Computing
- Quantum Information Foundations & Technologies
- Quantum ICT
- Molecular Scale Devices and Systems
- Towards Zero-Power ICT
- Minimising Energy Consumption of Computing to the Limit
- Atomic and molecular scale devices and systems

Intelligence and interaction

- Embodied Intelligence
- Pervasive adaptation
- Science of complex systems for Socially Intelligent ICT
- ICT Forever Yours
- Human-Computer Confluence
- Self-Aware Autonomous Systems
- Fundamentals of Collective Adaptive Systems
- Fundamentals of Creativity

Convergence and symbiosis

- Bio-ICT Convergence
- Bio-Chemistry based ICT
- Brain-Inspired ICT
- Neuro-Bio-Inspired Systems
- Evolving Living Technologies
- Symbiotic human-machine interaction
+ Balance between continuity and new directions
+ Creation of communities
  + for instance in, Bio-ICT, quantum technologies, Neuro-IT, complex systems
+ Successful transfers
  + for instance in quantum cryptography, cognition, nano-tech, robotics, bio-ICT
- It can take time to mature an avenue
- Implicit success and exit criteria
- Avoid lock-in effects
FET Flagships are science-driven, large-scale, multidisciplinary research initiatives oriented towards an ambitious unifying goal, with a transformational impact on science and technology and substantial expected benefits for European competitiveness and society.

- The need was identified by a FET working group of ISTAG (2009).

- Some S&T challenges are so big, and require such a sustained level of support that they cannot be implemented with the traditional FET schemes of Open and Proactive (~10 years, ~1BEuro budget).

- They are partnerships for scientific leadership that aim to enable alignment of national, regional and EU actions and initiatives around grand scientific challenges.

- FP7 supported 6 flagship pilots and ramp-up phases of 2 flagships (HBP and Graphene).

More details later.
Genesis of FET Flagships

Stimulating ideas & structuring the scientific community 2009 - 2010

Call for Preparatory Actions 21 → 6 July 2010

Preparatory Phase Pilots 05/11 - 04/12

Flagship selection 6 → 2 end 2012

Operational ramp-up phase mid 2013- end 2015
Vice-President Neelie Kroes announced at a Press event on 28.01.13 the two winners of the FET Flagships competition.
Graphene, is a 2D material, a single layer of carbon atoms, stronger than diamond, yet lightweight and flexible and an exceptional electricity conductor.

The Graphene Flagship will bring graphene, and related 2D materials, from academic labs to industry, manufacturing and society.

Examples of products:
- electronic paper
- bendable smartphones
- enhanced solar cells and batteries
- lighter and more energy efficient airplanes.

On the longer term, graphene is expected to give rise to new computers and revolutionary medical applications such as artificial retinas.
The Human Brain Project (HBP) will build a realistic model of the human brain, from genes to mind, understanding how the brain really works.

HBP will produce a complex simulation and visualization facility that will run on the most powerful supercomputers in Europe.

HBP will produce brain-inspired ‘neuromorphic’ computing hardware that could drastically reduce power-consumption and costs.

In healthcare, HBP will identify new drug targets and treatment in response to the urgent need to combat brain disease and its associated costs to society.
FET IN HORIZON 2020

Pathfinding future technologies
H2020

Excellent Science

Industrial leadership

Societal challenges

24598 MEuro

17938 MEuro

31743 MEuro

All figures refer to the Commission proposal for H2020
Excellent Science

All figures refer to the Commission proposal for H2020
"Future and emerging technologies shall support collaborative research in order to extend Europe’s capacity for advanced and paradigm-changing innovation. It shall foster scientific collaboration across disciplines on radically new, high-risk ideas and accelerate development of the most promising emerging areas of science and technology as well as the Union wide structuring of the corresponding scientific communities."

COMMISSION PROPOSAL ON ESTABLISHING HORIZON 2020 - THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION (2014-2020)

"Future and Emerging Technologies (FET) provides a unique combination of high-risk, long-term, multidisciplinary and collaborative research with the structuring of more mature ideas and communities. It involves fostering radically new technologies by exploring novel and high-risk ideas. Thus, it should prepare for the conversion of novel proofs of concepts into mainstream research and innovation and ultimately industrial applications and systems."

THE HORIZON 2020 STRATEGIC PROGRAMME FOR THE 2014-2016 WORK PROGRAMMES (28/1/2013)
A new level of ambition

- Pathfinding Europe’s technological future
- Bootstrapping new R&I eco-systems
- Prominent large-scale partnering initiatives
  - FET Flagships
  - High-Performance Computing (PPP)

A new actor in the S&T funding landscape

- Pathfinding
- Dialogue
- Engagement
FET integrated logic

Future and Emerging Technologies

Individual research projects
- FET Open

Open research clusters
- FET Proactive

Common research agendas
- FET Flagships

Kick-Starting
(with incentives for Young Explorers and unusual suspects)

Delivering
(with incentives for innovators and high-tech SMEs)

Building new R&I ecosystems, pathfinding and dialogue

Exploring novel ideas

Developing topics & communities

Addressing grand challenges
HPC: What for?

Weather, Climate & Earth Sciences

Fundamental sciences: Physics, Chemistry, Material Sciences, Astrophysics Applications.

Industrial & Engineering Application (e.g. transport, energy)

New applications e.g. Health, Big data
HPC has a fundamental role of in driving innovation leading to societal impact through better solutions for societal challenges and increased industrial competitiveness.

Vision: to ensure European leadership in the supply and use of HPC systems and services by 2020 in a strategy combining:

(a) developing the next generation of HPC towards exascale; (transition to exascale requires revolution – not evolution – of fundamental science and technology developments)

(b) providing access to the best supercomputing facilities and services for both industry and academia; (world-class HPC infrastructure – PRACE- for the best research)

(c) achieving excellence in HPC applications; (scientific/industrial HPC applications in (new) domains that are most important for Europe)
FET has become a reference for high-risk interdisciplinary science & technology research at the European level.

FET combines renewal of ideas with renewal of actors (innovators, high-tech SMEs, young researchers, interdisciplinary institutes) and research practices.

Bottom-up nature of FET orientations reflects a strong engagement with the S&T community.

FET is catalysing European scientific partnerships at unprecedented level.

Merci de votre attention!