Future and Emerging Technologies (FET) Work Programme 2014-2015 in H2020

FET Info Day 20st January 2014

Future and Emerging Technologies

DG CONNECT

European Commission

Overview

- FET in Horizon 2020, **Aymard de Touzalin**, Deputy Head of Unit, FET, EC DG CONNECT
- FET-Proactive initiatives in Call 1 of Horizon2020, FET-Open and FET Coordination and Support Actions, **Walter Van de Velde**, FET, EC DG CONNECT
- FET-Proactive - towards exascale high performance computing, **Panagiotis Tsarchopoulos**, FET, EC DG CONNECT

European Commission

HORIZON 2020

the EU framework programme for research and innovation

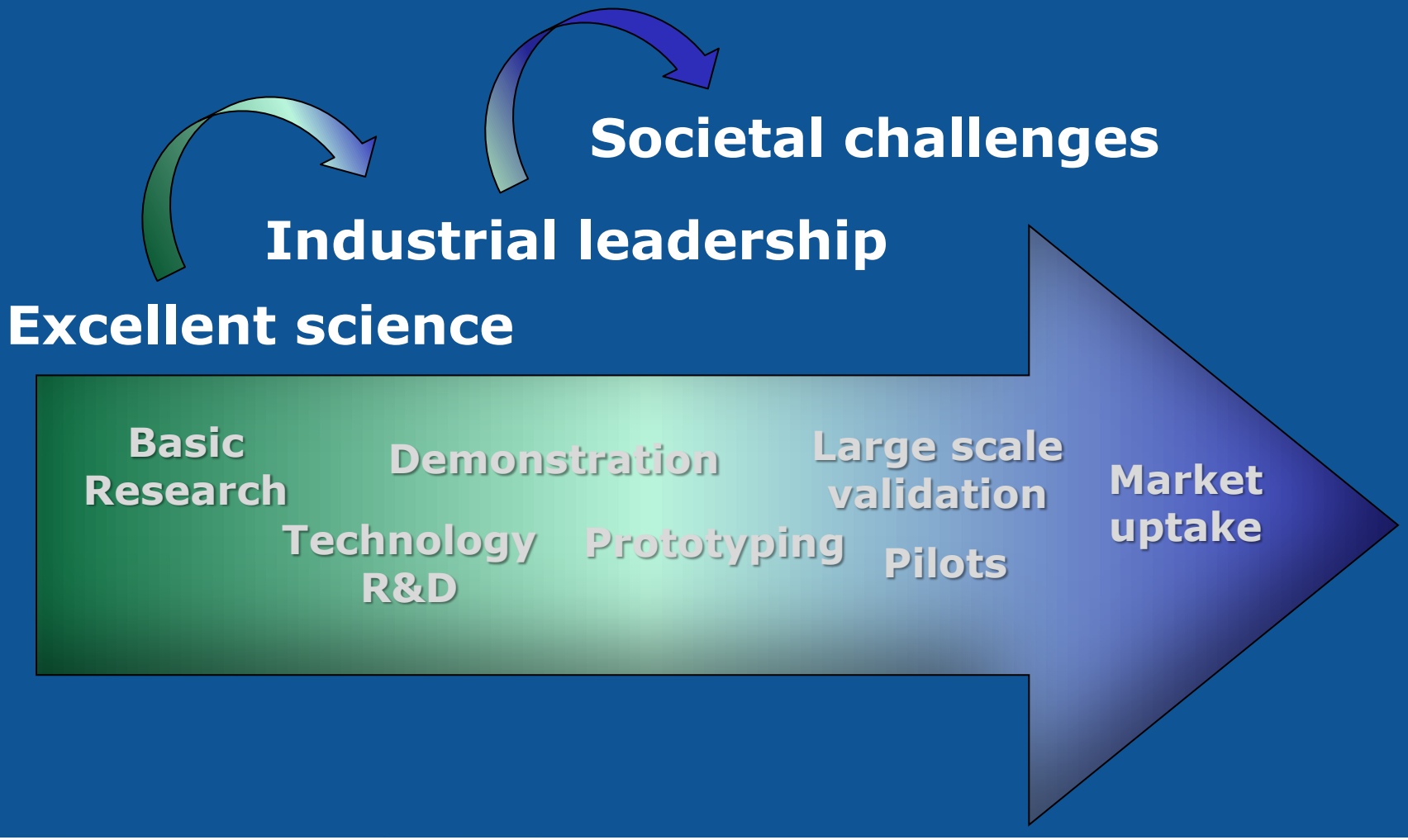
2014-2020

A stronger, clearer focus

H2020 Budget: 77B€ (current prices)

OTHERS: 5,8B€ (Spreading excellence & widening participation, Science & Society, JRC, EIT)

Coverage of the full innovation chain



FET in Horizon 2020

Excellent Science pillar in H2020

- European Research Council (13B€)
- Marie Skłodowska-Curie actions (6,1B€)
- **Future and Emerging Technologies** FET: 2,7 B€
- Research infrastructures programme (2,4B€)

*"**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."*

HORIZON 2020 - THE FRAMEWORK PROGRAMME FOR RESEARCH AND INNOVATION (2014-2020)

Pathfinding Europe's technological future

FET's missions

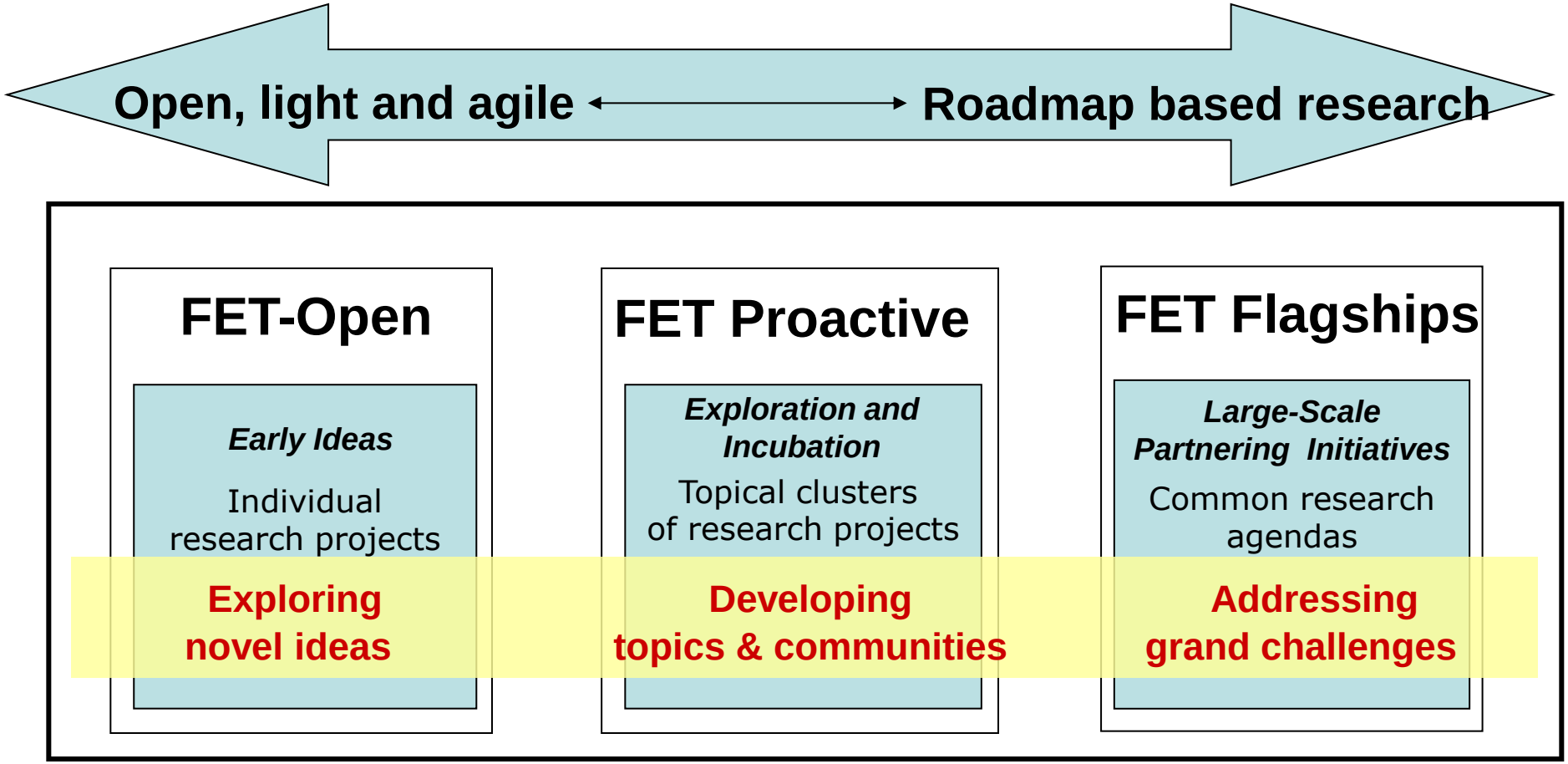
- *Seeds of future industrial leadership and potential solutions for societal challenges by:*
  - **Fostering the emergence of radically new technology areas**
  - **Building innovation eco-systems around them**
- *To turn Europe into the best environment for research on future and emerging technologies*
  - including facilitating the wider training of researchers in new areas.

From FP7 to H2020

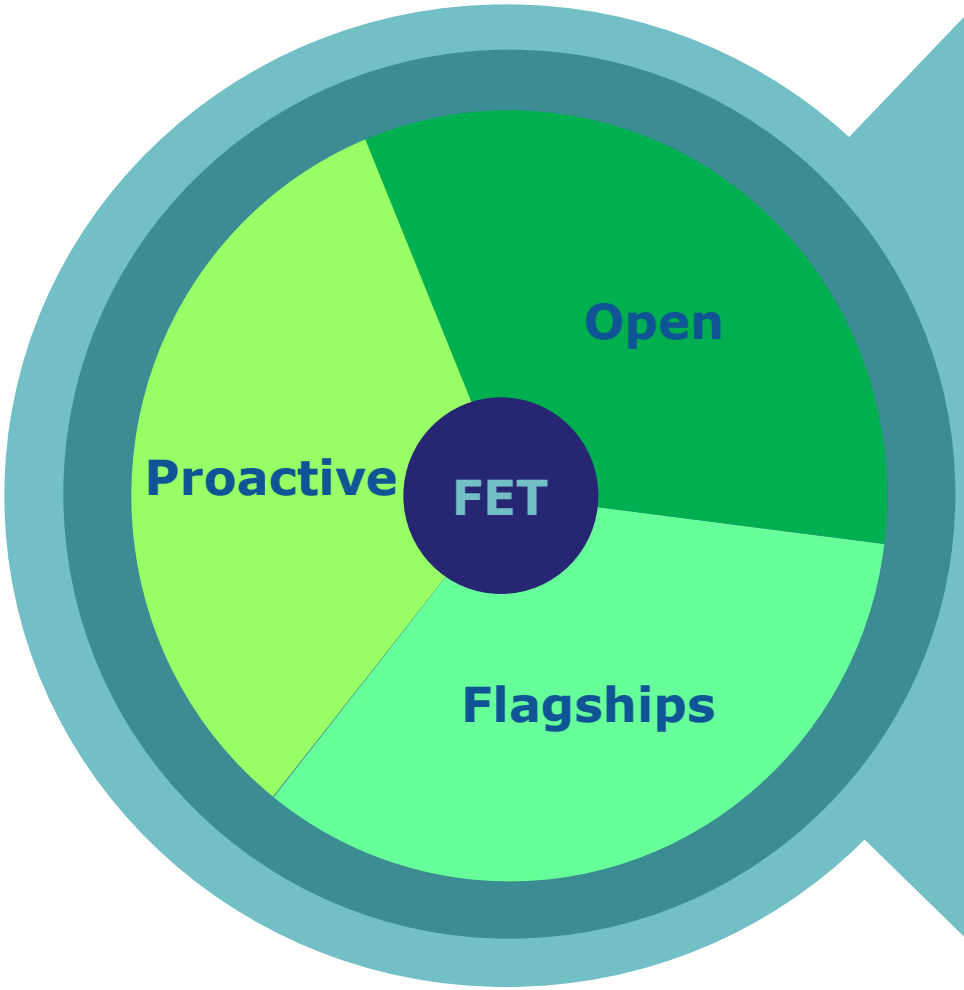
A new level of ambition

- *New mandate, going beyond ICT*
  - Pathfinding Europe's technological future
  - Bootstrapping new R&I eco-systems
- *New large-scale partnering initiatives complementing small and medium scale activities*
  - FET Flagships
  - High-Performance Computing (PPP)
- *A new actor in the S&T funding landscape*
- *A much larger intervention budget*

FET funding schemes



FET cross-cutting issues



New interdisciplinary synergies, new collaborations and new actors

Promoting new approaches and tools for doing science

Innovation by building leadership in new technologies as a baseline for industry and spin-offs and by digital science

Responsible research and innovation promoting societal debate and scientific exchanges and ethics

Digital Science and Open Access

Making science and research more efficient, transparent, better valued and with higher impact through the tools, collaboration models and openness made possible by ICT.

- Initiative on Open Access in H2020:
  - Mandatory for all publications resulting from H2020 projects
  - Open data pilot for specific areas**, including FET**
  - E-infrastructure support for open access to publications and for research data management & sharing

Open access = free online access

FET Advisory Group (FETAG)

- Provided for in the legislative text to **give consistent and consolidated advice on relevant objectives and S&T&I priorities** during the WP preparations
- 26 members selected from an open call for candidates
  - Balanced composition in terms of countries, gender, stakeholders, disciplines, age.
- First meeting planned for 21 February 2014

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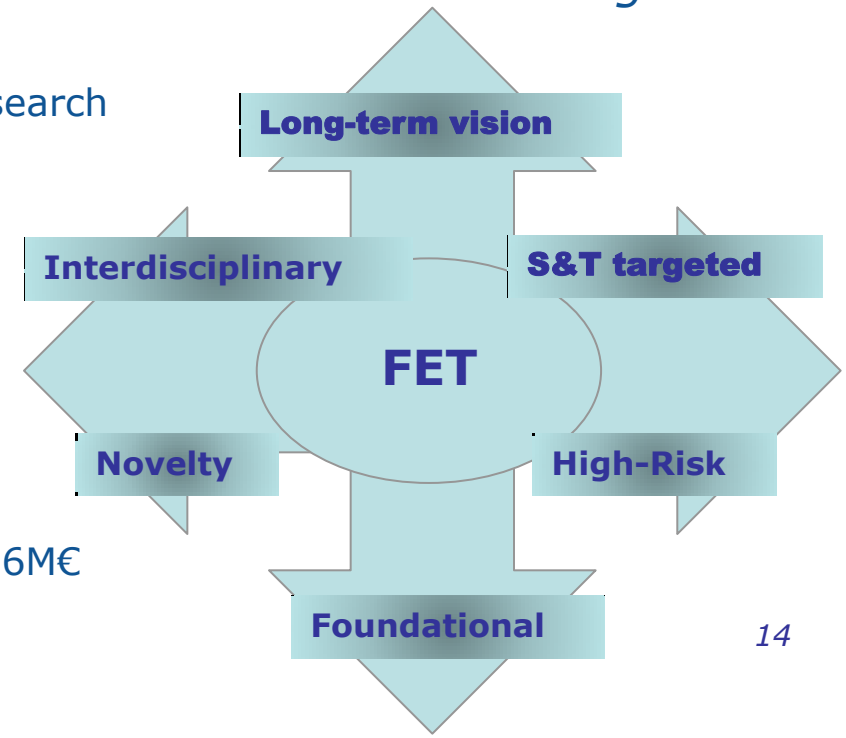
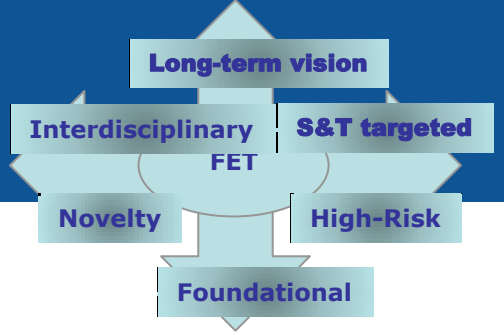
Call FET-Open : novel ideas for radically new technologies

- **'Open is open'**
  - All technologies, no thematic restriction
- *FET gatekeepers define the kind of research that FET is looking for*
  - Scope defined by the 6 gatekeepers
  - Bottom-up, but targeted - not blue sky research
  - Collaborative research
- *Total budget: 160M€ in 2014-15*
- *Instrument*
  - Research and Innovation Action - 154M€
  - Coordination and Support actions (CSA) – 6M€



FET Gatekeepers



***Long-term vision**: a new, original or radical long-term vision of technology-enabled possibilities going far beyond the state of the art*

***Breakthrough S&T target**: scientifically ambitious and technologically concrete breakthroughs plausibly attainable within the life-time of the project.*

***Foundational**: the breakthroughs must be foundational in the sense that they can establish a basis for a new line of technology not currently anticipated.*

***Novelty**: new ideas and concepts, rather than the application or incremental refinement of existing ones.*

***High-risk**: the potential of a new technological direction depends on a whole range of factors that cannot be apprehended from a single disciplinary viewpoint.*

- This inherent high-risk has to be countered by a strongly interdisciplinary research approach, where needed expanding well beyond the strictly technological realm.

***Interdisciplinary**: the proposed collaborations must go beyond current mainstream collaboration configurations in joint S&T research, and must aim to advance different scientific and technological disciplines together and in synergy towards a breakthrough.*

FETOPEN 1: FET-Open research projects

Specific challenge

Supporting a large set of early stage, high risk visionary science and technology collaborative research projects *is necessary for the successful exploration of new foundations for radically new future technologies. Nurturing fragile ideas requires an agile, risk-friendly and highly interdisciplinary research approach, expanding well beyond the strictly technological disciplines. Recognising and stimulating the driving role of new high-potential actors in research and innovation, such as women, young researchers and high-tech SMEs, is also important for nurturing the scientific and industrial leaders of the future.*

Project size: 2 to 4M€

- **1 step submission and evaluation of a 16 pages proposal**
- **Proposals are not anonymous**

Budget: 154M€

Deadlines	30/09/2014	31/03/2015	29/09/2015
Budget	77 M€	38,5 M€	38,5M€

FETOPEN 2: Coordination and Support Activities 2014

Specific challenge: The challenge is to make Europe the best place in the world for collaborative research on future and emerging technologies that will renew the basis for future European competitiveness and growth, and that will make a difference for society in the decades to come.

Scope: Proposals shall address one of the following topics:

***FET Observatory**: identifying new opportunities and directions for FET research*

***FET Communication**: communicating on FET projects and activities*

***FET Exchange**: structuring an emerging FET-relevant topic and communities*

***FET Conference**: supporting the organisation of the third FET Conference*

***FET Prizes**: identifying suitable areas for prizes and competitions in FET*

***FET Impact**: Assessing the impacts of the FET programme*

Project size: 0,3 to 0,5M€ per topic, up to 1M€ for FET Conference

Budget & deadline:

- 3M€ -> Deadline: 30/9/2014

FETOPEN 3 : Coordination and Support Activities 2015

Specific challenge: The challenge is to make Europe the best place in the world for collaborative research on future and emerging technologies that will renew the basis for future European competitiveness and growth, and that will make a difference for society in the decades to come.

Scope: Proposals shall address one of the following topics:

***FET Exchange**: structuring an emerging FET-relevant topic and communities*

***FET Take-Up**: actions for stimulating take-up of FET research results towards impact and innovation*

Project size: 0,3 to 0,5M€ per topic

Budget & Deadline:

- 1,5M€ -> Deadline: 31/3/2015
- 1,5M€ -> Deadline: 29/9/2015

Call FET Proactive –emerging themes and communities

Three topics :

- **Global Systems Science (GSS)**
- **Knowing, doing and being: cognition beyond problem solving**
- **Quantum simulation**

- *Total budget: 35M€ in WP 2014-15*

FETPROACT 1 : Global Systems Science (GSS) - 2014

Specific challenge: ***The ambition is to improve the way scientific knowledge can help inform and evaluate policy and societal responses to global challenges*** *like climate change, global financial crises, global pandemics, and growth of cities – urbanisation and migration patterns. These challenges entangle actions across different sectors of policy and society and must be addressed by radically novel ideas and thinking for producing, delivering, and embedding scientific evidence into the policy and societal processes.*

GSS will put to full use the abundance of data on social, economic, financial, technological, and ecological systems available today. GSS emphasises systems thinking and the need to integrate/link data, models, and policies across all policy sectors with all societal actors. GSS will build on results from, among others, Complex Systems Science, Network Science, Mathematics of Big Data, the life sciences, social sciences and humanities, behavioural sciences, statistics, econophysics, etc.

Project size: 2 to 3M€

Budget & Deadline: 10M€ -> Deadline: 1/4/2014

FETPROACT 2 : Knowing, doing, being: cognition beyond problem solving - 2014

Specific challenge: ***This initiative addresses the interdisciplinary fundamentals of knowing, thinking, doing and being, in close synergy with foundational research on future artificial cognitive systems, robots, smart artefacts and large scale cyber-physical systems.*** *It aims at renewing ties between the different disciplines studying knowledge (especially beyond the 'declarative' and static action oriented kind of knowledge), cognition (e.g., perception, understanding, learning, action) and related issues (e.g., embodiment, thinking, development, insight, knowledge as a social construct, identity, responsibility, culture…) from various perspectives (e.g., physical, biological, neuronal, behavioural, social, epistemological, ecological). The aim is to enable new synergies with engineering disciplines on smart and self-organising materials, embedded systems, robotics, hybrid systems or smart infrastructures and cities to take artificial cognitive systems beyond the level of dull task execution or repetitive problem solving.*

Project size: 2 to 4M€

Budget & Deadline: 15M€ -> Deadline: 1/4/2014

FETPROACT 3 : Quantum simulation - 2014

Specific challenge: Devices that exploit quantum phenomena such as superposition and entanglement have the potential to enable radically new technologies. Several promising directions are now well known, for instance in quantum computation and simulation, quantum communication, quantum metrology and sensing. However, overcoming basic scientific challenges as well as bridging from the scientific results to concrete engineering technologies has proved difficult. This objective challenges the research community to develop solutions using quantum technologies that will ultimately address real world problem, with a potential for disruptive change.

Scope: ***Proposals shall address research and development for quantum simulation to address a class of problems that is beyond the reach of classical computing, and that can contribute to answering questions in fundamental or applied sciences, e.g. in quantum materials science or the life sciences.***

Project size: 2 to 4M€

Budget & Deadline: 10M€ -> Deadline: 1/4/2014

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High Performance Computing

European Commission

Key EU developments in 2012-2013

- *Communication from the EC: "High-Performance Computing: Europe's place in a global race" (2012)*
  - **Council Conclusions on High-Performance Computing (Competitiveness Council – 2013)**

- *Establishment of the European Technology Platform on High-Performance Computing (ETP4HPC - 2013)*
  - **ETP4HPC - Strategic Research Agenda**
  - **Public-Private Partnership with ETP4HPC***

www.etp4hpc.eu

*Signed on 17 of December 2013

Competitiveness Council 29/30 May 2013

Conclusions on HPC Communication

- HPC is an important asset for the EU's innovation capacity of strategic importance to the EU's industrial and scientific capabilities as well as its citizens:
  - developing innovative industrial products and services,
  - increasing competitiveness,
  - addressing societal and scientific grand challenges more effectively.
- Europe has the technology, knowledge and human skills to develop capabilities covering the whole technological spectrum of the next HPC generation (exascale computing)
- Importance of developing state-of-the-art HPC technologies, systems, software, applications and services in Europe
- All relevant actors, public and private, need to work in partnership
- Invites the EC to elaborate its plans for HPC to support academic and industrial research and innovation under H2020

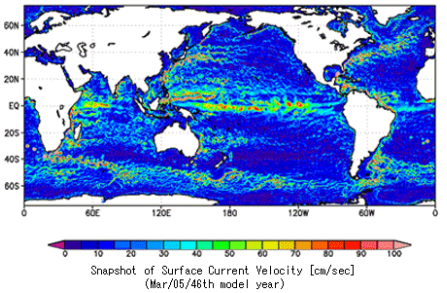
HPC in FET: Critical technologies

European Commission

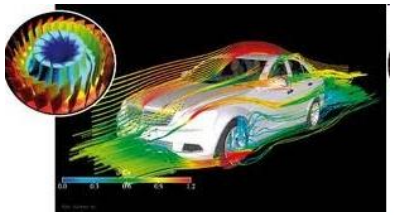
Addressing Societal Challenges

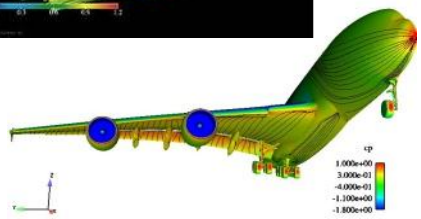
Health, demographic change and well-being
(Personalised medicine, pharma/bio-medical simulations, Virtual Physiological Human, Human Brain Project)

Climate action, resource efficiency and raw materials
(Simulators for Climate & Earth Sciences, Gas&Oil)

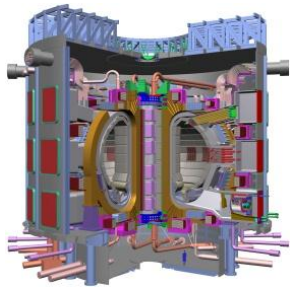


Smart, green and integrated transport Engineering
(performance, sustainability, energy efficiency)



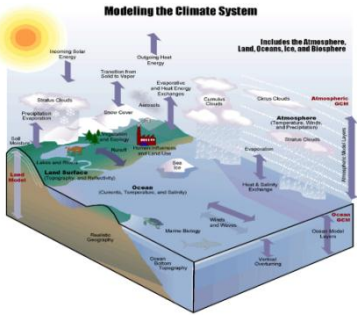


Secure, clean and efficient energy
(Fusion, nuclear plant simulations)



Food security, sustainable agriculture, marine research and the bio-economy
(simulation of sustainability factors (e.g. weather forecast, stock
plagues and diseases control, etc))

Inclusive, innovative and secure societies
(Smart Cities, multivariable decision/analytics support)



An integrated HPC approach in H2020

- HPC strategy combining three elements:

(a) Computer Science: towards **exascale** HPC; *A special FET initiative focussing on the next generations of exascale computing as a key horizontal enabler for advanced modelling, simulation and big-data applications* [HPC in FET]

(b) achieving excellence in HPC **applications**; *Centres of Excellence for scientific/industrial HPC applications in (new) domains that are most important for Europe* [e-infrastructures]

(c) providing **access** to the best supercomputing facilities and services for both industry and academia; *PRACE - world-class HPC infrastructure for the best research* [e-infrastructures]

- complemented with training, education and skills development in HPC

HPC- Exascale Challenges in FET

- **Energy**: Extrapolation of current power consumption (e.g. Top system Tianhe-2) would need ~1 GW for sustained exaflops: breakthroughs and advances in circuits, architecture and software are needed to achieve the ~20 MW exaflop computing
- **Memory and I/O**: Handling of memory, latency and locality at all levels, from processor, to network and storage
- **Programmability and algorithms**: Programmers face the challenge of handling billions of computing threads. Only very few applications using HPC really take advantage of current petaflop system.
- **Resilience:** Innovative ideas are needed to cope with a very unstable and complex environment of millions of cores with frequent fault rates
- **Co-design**: Technology development must be associated to users requirements to get the right systems to satisfy the needs of applications.

  ➢ engaging a European-wide effort to develop technology to build exascale systems within ~10 years

FET-HPC in WP 2014-15

European Commission

***FETHPC 1*: HPC core Technologies, Programming Environments and Algorithms for Extreme Parallelism and Extreme Data Applications - 2014**

Specific challenge: Addressing the exascale challenges to achieve, by 2020, the full range of technological capabilities for **exascale-class HPC systems** *which are balanced at all levels and validated with significant application drivers*

Scope :

- **a. Core technologies and architectures** *(e.g. processors, memory, interconnect and storage) and their optimal integration into HPC systems, platforms and prototypes*
- **b. Programming methodologies, environments languages and tools***: new programming models for extreme parallelism and extreme data applications*
- **c. APIs and system software** *for future extreme scale systems*
- **d. New mathematical and algorithmic approaches** *(e.g. ultra-scalable algorithms for extreme scale systems with quantifiable performance for existing or visionary applications)*

Project size : 2 to 4M€, up to 8M€ for topic a)

Budget & Deadline : 93,4M€ -> Deadline: 25/11/2014

- with a minimum of 60% to be allocated to research under part a) of the scope

FET-HPC in WP 2014-15

FETHPC 2: HPC Ecosystem Development - 2014

Specific challenge: To develop a sustainable European HPC Ecosystem

Scope:

- **Coordination of the HPC strategy** : coordination of the activities of stakeholders such as ETP4HPC, PRACE, application owners and users (including emerging HPC applications), the European exascale computing research community, the open source HPC community, etc.
- **Excellence in High Performance Computing Systems** : boost European research excellence on the key challenges towards the next generations of high-performance computing systems; cutting across all levels – hardware, architectures, programming, applications; ensure a durable integration of the relevant European research teams; self-sustainability of the research integration on the longer-term

Budget & Deadline: 4M€ -> Deadline: 25/11/2014

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Thanks for your attention!

H2020 website:
http://ec.europa.eu/programmes/horizon2020/
Participant portal:
http://ec.europa.eu/research/participants/portal/desktop/en/opportunities/h2020/index.html

FET Work Programme call text :
http://ec.europa.eu/research/participants/portal/doc/call/h2020/common/1587754-02._fet_wp2014-2015_en.pdf

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