European Commision Seventh Framework Program announcement
Objectives of the FP7 ICT Call 7 topics named:
1) Exascale computing, software and simulation
2) Computing Systems

IESP workshop

Maui 18-19 October 2010

Presented by Patrick Aerts

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1) Exascale computing, software and simulation

- Background: IDC report
- Call objectives

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Workprogramme details:
ftp://ftp.cordis.europa.eu/pub/fp7/docs/wp/
cooperation/ict/c-wp-201101_en.pdf

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IDC Study 2010: A strategic agenda for EU leadership in Supercomputing: HPC 2020 (1/2)

Executive Overview, a few conclusions…

- HPC use is indispensable for advancing both science and industrial competitiveness

- Europe is under-investing in HPC, while other nations are growing their supercomputer investments dramatically

  Even in 2009, the most difficult year of the global economic recession

- Supercomputing revenues (annual spending on systems priced above €375,000, or $500,000) increased by 25% worldwide in 2009

  But only 9% in Europe

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IDC Study 2010: A strategic agenda for EU leadership in Supercomputing: HPC 2020 (2/2)

- HPC research funding in Europe includes a diversity of EU, national and regional programs, and few countries have a coherent HPC development strategy

- HPC stakeholders from research, industry and academia rank U.S. and Japanese HPC research programs ahead of Europe's research programs

- The transition to petascale and exascale computing **creates opportunities**

  For Europe's scientific and computing communities to return to the forefront of development for the next generation of research and HPC software technologies

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Reciprocity

- The following slides about new EC funding opportunities are just the start, but show EC's commitment to the Exascale endeavor

- However, it is as yet unclear what the level of *reciprocity* really is that the EC may expect from the international co-operations in this domain.

- The EC is to engage into *all levels* of Exascale developments: software(!), applications, creative HPC-industry

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Exascale objectives in FP7

- First call in FP7 dedicated specifically to exascale computing

- Marks the commitment of the EC to support research at the leading edge of High Performance Computing

  - PRACE for the HPC infrastructures

  - Other objectives related to HPC (FET, Computing…)

  - Ongoing support to international collaboration of European R&D stakeholders with the International Exascale Software Project (IESP) through support action EESI (European Exascale Software Initiative)

- *Important note: response to this objective will influence future EC support to exascale efforts*

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Exascale objective in FP7: What?

R&D (through Integrated Projects (IP)):

- To develop a small number of advanced computing platforms (100 petaflop/s in 2014 with potential for exascale by 2020),

    - Platforms relying on vendors' proprietary hardware or on COTS.

- To develop optimised application codes driven by the computational needs of science and engineering and of today's grand challenges (e.g. climate change, energy,…)

- Proposals should address major challenges of extreme parallelism with millions of cores (programming models, compilers, performance analysis, algorithms, power consumption ...)

Support (through Coordination and Support Action (CSA)):

- For a common European strategy and a driving role for European stakeholders in international efforts of extreme-scale HPC systems.

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Exascale objective in FP7: Why?

Expected impact:

- Put Europe in the frontline of international efforts for the development of HPC system software and tools

- Strengthen European industry supplying and operating HPC systems: preparing European industry and research organisations to achieve world-leadership in this area.

- European excellence in exascale level simulation codes for the benefit of society, industrial competitiveness and policy making; emergence of EU top-class simulation centres for exascale systems

- Reinforce cooperation in international endeavours on exascale software and systems.

Reap the benefits of the new big opportunities created by the transition to petascale and exascale computing!

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Exascale objective in FP7: Who?

Each Integrated Project should bring together:

a) one or more supercomputing centres with a leading role in system software development;

b) technology and system suppliers, whether these are academic centres or private companies, including system vendor(s) in case of targeting particular vendors' machines;

c) industrial or academic centres to co-develop a small number of exascale application codes.

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Exascale objective in FP7: How?

Integrated Project Proposals characteristics:

- All software should be developed as open source.

- Splitting the effort roughly 40/60 in applications and simulation vs. systems development.

- Demonstrating synergies with efforts under the Capacities programme on the deployment of leadership-class HPC systems.

- Proposals may include international cooperation components that are essential and complementary to European expertise.

Selection

- Two to three Integrated Projects are expected to be selected.

- Attempt to balance between application domains and new exascale computing methodologies

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Exascale objective in FP7: When/How much?

- **Work Programme 2011-12**: Cooperation (ICT – Information and Communications Technologies)

  - **ICT Call 7:**

    - *Open: 28 September 2010*

    - *Deadline: 18 January 2011*

- Exascale topic: "Objective ICT-2011.9.13 Exascale computing, software and simulation "

- **Indicative budget distribution** (total 25 m€):

  - Integrated Projects: 24 m€

  - Coordination and Support Action (CSA): 1 m€

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2) Computing Systems

- ## Call objectives

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Events and Consultation workshops:
cordis.europa.eu/fp7/ict/computing/events_en.html

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Computing systems in FP7: general info

- **Builds on the results & content of the previous Calls.**

- **Budget increased to 45m euros compared to 25m in previous Calls**

- **Call opened 28 September 2010**

- **Deadline 18 January 2011**

- **Projects starting mid 2011 & ending 2014.**

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Computing Systems in FP7:background

- Input from:
  - Consultation workshops
    cordis.europa.eu/fp7/ict/computing/events_en.html
    - 25 June 2009 on Analysing European Success in Computing Systems Research
    - 29 September 2009 on Virtualisation
    - 16-17 November 2009 on Computing Systems overall
    - 14 December 2009 on high-performance computing
  - Analysis of previous Call results and project achievements
  - HIPEAC* research vision
  - Member states and FP7 associated states

  *European Network of Excellence on High Performance and Embedded Architecture and Compilation

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Computing Systems in FP7: topics overview

a) **Parallel & Concurrent Computing**
   - Multicore, multichip (beyond single-chip)
   - Parallel/concurrent software & tools

b) **Virtualisation**
   - Heterogeneous multicore systems

c) **Customisation**
   - Reconfigurable architectures
   - Multicore on single-chip
   - Tool-chains
   - System modelling & simulation

d) **Architecture & Technology**
   - 3D stacking
   - Alternative computation models

e) **International collaboration**

STREPs (40m)

NoE (4m)

CSAs (1m)

Total budget: 45m euros

Instruments: STREPs, NoE, CSAs

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* EC Funding Terminology

- STREP= Specific Targeted REsearch Project
- NoE= Network of Excellence
- CSA= Coordination and Support Action
- INCO= International Cooperation

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a) Parallel and concurrent computing: details

- > Automatic parallelisation
  > New high-level parallel & concurrent programming languages
  > Maybe extensions to existing languages
  > Runtime implementation to provide portable performance
  > Usability/user friendliness essential requirement for uptake

- Projects should address issues <u>beyond on-chip, off-chip boundaries,</u> the challenges of programming, testing, verification and debugging, performance monitoring and analysis, low-power and power management especially for <u>large scale parallel systems and data centres</u>, and <u>heterogeneous and accelerator-based multi-core systems</u>.

- Research priorities include:
  - domain-specific languages;
  - concurrent algorithms and transformation of concurrency to parallelism through adaptive compilers and runtime systems;
  - new verification and optimisation environments for parallel software;
  - efficient execution exploiting heterogeneous cores;
  - new approaches to scalability of high-performance computing application codes.

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e) International Collaboration: details

- The purpose is to analyse international research agendas and to prepare concrete initiatives for international collaboration for all topics of the objective, in particular with:
  - USA,
  - India,
  - China
  - Latin America

- Separate proposals per geographic area are expected.

Only CSAs

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Computing Systems in FP7: Expected impacts

- Drastically improved programmability of future parallel multicore/multichip computing systems, providing efficient execution and portable performance of codes on a large variety of computing platforms

- Efficient and ubiquitous use of virtualisation for heterogeneous multi-cores.

- Accelerated system development and production, enabling new products to be realised with a considerably shorter time-to-market.

- Reinforced European excellence in multi-core computing architectures, system software and tools.

- Strengthened European leadership in cross-cutting technologies that are applicable to different market segments of computing systems and, in particular, European leadership in parallel computing systems for large data centres.

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Addendum: INCO Russia

EU-Russia Research and Development cooperation

Call: INCO Russia,   4M€ EU + 2M€ Russia,

3 STREPs of 2 years, 1 project per topic

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INCO Russia: Objective

Target outcomes:

a) **Programming Models and Runtime Support**
  - → generic and portable programming models
  - → heterogeneous multicore and accelerator based systems

b) **Performance Analysis Tools for High Performance Computing**
  - → measurement, analysis, and modelling tools to support hybrid programming
  - → towards abstract characterisations of the performance of applications

c) **Optimisation, Scalability and Porting of Codes**
  - → Optimisation and scaling of application codes to thousands of cores
  - → Examples of application domains: Computational Fluid Dynamics, molecular dynamics, electromagnetic, biology, seismic signal processing and remote sensing.

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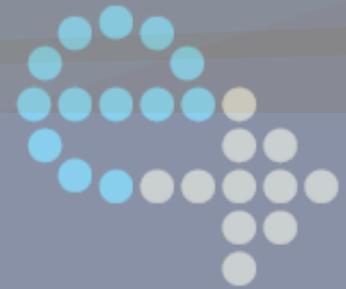**Connecting** the finest minds

••• Linking ideas at the speed of light

Sharing the best scientific resources

••• Harnessing the unlimited power of computers, instruments and data

Building virtual global research communities

••• Innovating the scientific process

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