Evocation de quelques projets et collaborations nationales et internationales

Jean-Yves Berthou, EDF R&D

Jean-Philippe Nominé, CEA

ORAP, 14 octobre 2011

Sources et références

- IESP http://www.exascale.org/
  Workshop à Cologne, 6-7 octobre
- EESI http://www.eesi-project.eu/
  Conférence finale, Barcelone 10-11 Octobre

Excellent panorama du HPC!

Update of Investigation Report on Existing HPC Initiatives

European Exascale Software Initiative

Deliverable D2.2 Update of Investigation Report on Existing HPC Initiatives

CONTRACT NO EESI 261513
INSTRUMENT CSA (Support and Collaborative Action)
THEMATIC INFRASTRUCTURE

Due date of deliverable: 31.08.2011
Actual submission date: 09.09.2011
Publication date: September 2011

Start date of project: 1 JUNE 2010 Duration: 18 months

Name of lead contractor for this deliverable: EPSRC

Authors: Damien Lecarpentier (CSC) and Lorna Smith (EPCC); Per Öster (CSC), Mark Parsons (EPCC), Xu GUO (EPCC)

Name of reviewers for this deliverable: Jean-Yves Berthou (EDF), Peter Michielse (NCF)

Abstract: This deliverable investigates large-scale HPC projects and initiatives around the globe with particular focus on Europe, Asia, and the US and trends concerning hardware, software, operation and support.

Revision R1.0

Project co-funded by the European Commission within the Seventh Framework Programme (FP7/2007-2013)		
Dissemination Level : PU		
PU	Public	X
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

http://www.eesi-project.eu/pages/menu/publications/report-on-existing-hpc-initiative.php

Table of Contents

1. EXECUTIVE SUMMARY 6

2. INTRODUCTION 7

3. HPC LARGE SCALE INITIATIVES IN THE U.S., ASIA AND EUROPE 11

3.1 HPC INITIATIVES IN THE U.S. 11
3.1.1 General overview 11
3.1.2 HPC funding bodies in the U.S. 11
3.1.3 Current supercomputing systems 13
3.1.4 Supercomputing applications areas and funding 14
3.1.5 Current funding and near future petascale systems in the U.S. 15
3.1.6 Funded exascale projects in the U.S. 16
3.1.7 Laboratory and research institute initiatives 17
3.2 HPC INITIATIVES IN ASIA 19
3.2.1 General overview 19
3.2.2 Japan 20
3.2.3 China 24
3.2.4 South Korea 28
3.2.5 India 29
3.3 HPC INITIATIVES IN EUROPE 31
3.3.1 General overview 31
3.3.2 European Union 32
3.3.3 National initiatives in EU member states 37
3.3.4 HPC trends in Russia 44
3.3.5 Public-private partnerships and collaboration 47

4. CONCLUSIONS 50

- La Commission Européenne prépare une annonce fin 2011/début 2012
  - Vision globale HPC – horizon 2020
  - Diverses sources de réflexions et recommandations dont EESI, diverses réunions d’experts, études IDC…

Rappel/précisions
Prototypes Exascale

Project name /call	**Exascale computing, software and simulation (FP7-ICT-2011-7 Objective ICT-2011.9.13)**
Short description/target	The objective is to develop a small number of advanced computing platforms with the potential for extreme performance (100 PFLOPS in 2014 with potential for exascale by 2020), as well as optimised application codes driven by the computational needs of science and engineering..
Url	ftp://ftp.cordis.europa.eu/pub/fp7/ict/docs/ict-wp-2011-12_en.pdf
Funding source	European Commission
Budget	25 M€ (IP: 24M€ / CSA: 1M€)
Schedule	Projects funded for 2-3 years, starting in 2011-12.

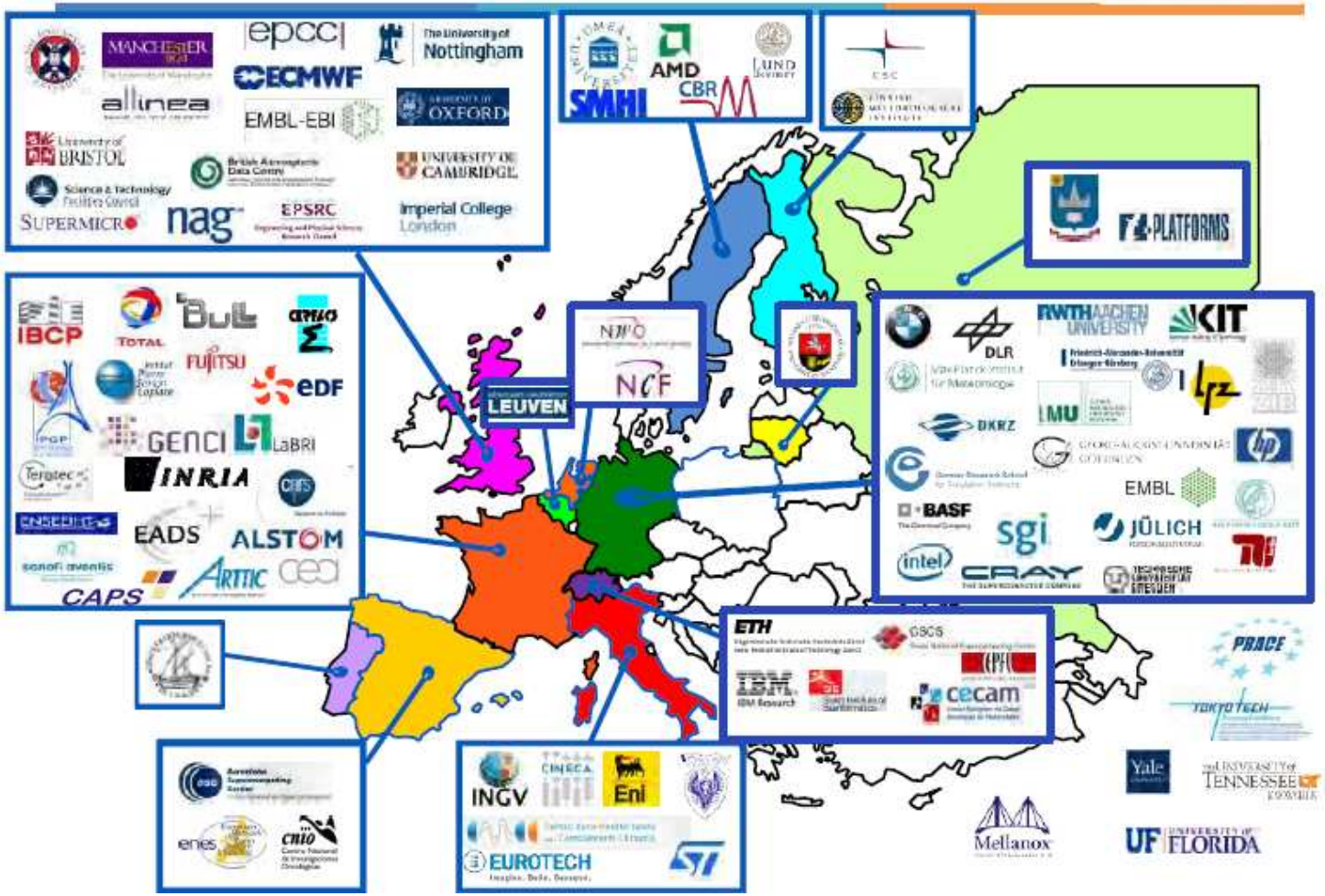
- Appel clos en janvier 2011
- 3 projets financés, démarrage ~octobre

3 projets financés

- MontBlanc
  - Low power, embedded
    http://www.exascale.org/mediawiki/images/6/6b/Talk11-Ramirez.pdf
- DEEP
  - Hybride
    http://www.exascale.org/mediawiki/images/7/7e/Talk10-Eiker.pdf
- CRESTA
  - Logiciel, co-design
    http://www.exascale.org/mediawiki/images/1/11/Talk12-Parsons.pdf
- ~8 M€ EC chacun

EESI

EESI: 150 participants, 100 entities



EESI Motivations and Organization

Origins of EESI: IESP

www.exascale.org

10^{18} INTERNATIONAL EXASCALE SOFTWARE PROJECT

Build an international plan for developing the next generation open source software for scientific high-performance computing

IESP meetings

- **Nov 2008**
- **Apr 2009**
- **Jun 2009**
- **Oct 2009**
- **Nov 2009**
- **Apr 2010**
- **Oct 2010**
- **Nov 2010**
- **Apr 2011**

www.exascale.org

(parenthèse IESP)

- X-stack et autres projets
  un début de financement…
- 3 co-design centres

The International Exascale Software Project Roadmap[1]

Jack Dongarra, Pete Beckman, Terry Moore, Patrick Aerts, Giovanni Aloisio, Jean-Claude Andre, David Barkai, Jean-Yves Berthou, Taisuke Boku, Bertrand Braunschweig, Franck Cappello, Barbara Chapman, Xuebin Chi, Alok Choudhary, Sudip Dosanjh, Thom Dunning, Sandro Fiore, Al Geist, Bill Gropp, Robert Harrison, Mark Hereld, Michael Heroux, Adolfy Hoisie, Koh Hotta, Yutaka Ishikawa, Zhong Jin, Fred Johnson, Sanjay Kale, Richard Kenway, David Keyes, Bill Kramer, Jesus Labarta, Alain Lichnewsky, Thomas Lippert, Bob Lucas, Barney Maccabe, Satoshi Matsuoka, Paul Messina, Peter Michielse, Bernd Mohr, Matthias Mueller, Wolfgang Nagel, Hiroshi Nakashima, Michael E. Papka, Dan Reed, Mitsuhisa Sato, Ed Seidel, John Shalf, David Skinner, Marc Snir, Thomas Sterling, Rick Stevens, Fred Streitz, Bob Sugar, Shinji Sumimoto, William Tang, John Taylor, Rajeev Thakur, Anne Trefethen, Mateo Valero, Aad van der Steen, Jeffrey Vetter, Peg Williams, Robert Wisniewski, and Kathy Yelick

Abstract

Over the last twenty years, the open source community has provided more and more software on which the world's High Performance Computing (HPC) systems depend for performance and productivity. The community has invested millions of dollars and years of effort to build key components. But although the investments in these separate software elements have been tremendously valuable, a great deal of productivity has also been lost because of the lack of planning, coordination, and key integration of technologies necessary to make them work together smoothly and efficiently, both within individual PetaScale systems and between different systems. It seems clear that this completely uncoordinated development model will not provide the software needed to support the unprecedented parallelism required for peta/exascale computation on millions of cores, or the flexibility required to exploit new hardware models and features, such as transactional memory, speculative execution, and GPUs. This report describes the work of the community to prepare for the challenges of exascale computing, ultimately combing their efforts in a coordinated International Exascale Software Project.

Keywords

High Performance Computing, Software Stack, Exascale computing

---

[1] The International Exascale Software Project was organized by and has received ongoing support from a variety of national agencies: In the United states, the Department of Energy Office of Advance Scientific Computing Research (DOE-ASCR) and the National Science Foundation Office of CyberInfrastructure (NSF-OCI); In France, the Commissariat à l'énergie atomique et aux énergies alternatives (CEA), Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique (CERFACS), Agence nationale de la recherche (ANR), INRIA and Teratec; In the United Kingdom, Engineering and Physical Sciences Research Council (EPSRC); In Japan, The University of Tsukuba, RIKEN, Kyoto University, Tokyo University and the Tokyo Institute of Technology. Corporations contributing to the staging of different IESP meetings have included Cray, EDF/EESI, IBM, Intel, Fujitsu Ltd., and NVIDIA.

EESI vision and recommendations

European Strengths (1/2)

- PRACE
- HPC already intensively used in academy thanks to PRACE and in industry: Energy (TOTAL, EDF), Aeronautic(AIRBUS), Finance, Defense&Security, …
- Applications (2011 IDC survey) :
  - 83% developed in Europe, 66% of IP in Europe
  - Leader in various scientific organizations (CECAM, EN Institute): astrophysics/cosı sciences, life science, i.e A dynamics, Large Eddy Sim bioinformatics tools for data
- In some of these domains Eurc long term and costly efforts (x1

EESI vision and recommendations

European Strengths (2/2)

- Hardware: Europe has all the competences to build an Exascale computer by the end of this decade with European technologies
- Applied math.: Europe has one of the best scientists in applied mathematics, many existing scientific libraries either developed in Europe or significant European input to US-led/international projects
- Software: Europe has leading position in some software areas: programming models, validation&correctness, performance tools design and development, a long-standing activity in runtime design, system design (mobile, network, energy efficiency), simulation frameworks/coupling tools, meshing tools

European weaknesses (1/2)

- Not clear how European ISV are preparing the coming of Exascale
- Europe: 30% HPC market, 1% of HPC revenue
- Simulation as a single program is not as strongly supported as observations and experiments (ITER, LHC)

From a technical point of view:

- Lack of coordination in the devel
  often few isolated centres within
  libraries which are integrated in U
- Not enough participation in the d
  programming (MPI, OpenMP, C+

European weaknesses (2/2)

- Lack of critical mass on some critical software domains: OS, compilers, MSG passing libraries, File system, hybrid core design
- Lack of unified data layer for Bio-Data, most of databases are non-European
- Applications in various areas where European has a leadership position, will need to be redesigned, i.e Materials/Molecular Mechanics, Climate models, Life Science (molecular dynamics, Quantum Chemistry, Sequence Analysis, Protein docking,/3D structure, Chemo-informatics), some engineering domains (structural mechanics).

These applications represent X1000 man.year of development

EESI recommendations

- **General statement**
- **Funding strategy and organization**
- **Funding targets**
  - Research and Development projects
  - co-design centers,
  - Technological transfer
  - Exascale hardware platform
  - Education and training in High Performance Computing
- **Budget**
- **European and international governance**

A suivre….