EXDCI European eXtreme Data and Computing Initiative

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EXDCI project

- Partners
  - PRACE
  - ETP4HPC

- Duration: 30 months, starting September 2015

- Budget: 2.5 M€

- PRACE
  - Barcelona Supercomputing Center
  - CEA
  - CINECA
  - EPCC
  - GENCI
  - INRIA
  - JSC
  - Neovia
  - SurfSARA
  - Uni. Aachen
  - Uni. Ljubjana
  - Uni. Salento

- ETP4HPC
  - Bull
  - Eurotech
  - Fraunhofer
  - IBM
  - Intel
  - Scapos
  - Seagate
  - Teratec
Objectives

- Coordinate the development and implementation of a common strategy for the European HPC Ecosystem
Strategic Goals

- Development of a common European HPC Strategy
  - Coordination of activities of stakeholders
- Operating a synchronised European HPC Community
  - Joint community structuring and synchronisation
Overall planning and Workplan structure

Periodic updates of the Strategic Research Agenda (SRA) : leaded by ETP4HPC

Update the PRACE Scientific Case.

KPIs
Next/firsts actions

- European HPC Summit, May 9-13, Prague
- Coordination initial workshop, Rome 29-30 September
  - EXDCI organized
  - Participants: PRACE, ETP4HPC, CoE, FETHPC projects
  - For all
    - to understand the whole HPC ecosystem
    - Build together the new HPC vision
EXDCI Technical Overview

• HPC is strategic for economical growth and industry competitiveness

• The road to Exascale requires a continuing, global, mid-term, coherent and large R&D effort

• Need an effort with a critical mass

• Large world wide challenge
HPC Critical for Economical Growth

• HPC (and corresponding data analysis) is a key enabler for the high tech industry
  • On the critical path of innovation, no HPC no innovations in oil and gas, climate modeling, astrophysics, molecular simulations, finance, transportation, environment, …

• Today’s HPC capability innovations will be tomorrow capacity solutions
  • Exascale / low energy HPC is key for future HPC efficient systems

• EESI / IDC HPC ROI study shows*
  • $1 HPC investment allows to generate a ~$850 generated revenue with a ~$50 benefit
  • HPC based innovation has a particularly strong economical impact

*EESI 2 / IDC Report: Special Study To Measure And Model How Investments In HPC Can Create Financial ROI And Scientific Innovation In Europe
• Propose paths to Exascale solution while considering
  • Parallelism
  • Fault tolerance
  • Energy efficiency
  • Heterogeneity
  • (Big) Data management and exploration

• An exaflop also means a petaflop in a box and 20 KW/PF
  • The road to Exascale is not to build one of a kind system but to
design the new generation low energy HPC technology

• In a context of technological disruptions
  • Photonics, new memories, many-core CPU, …
In a Complex and Fast Moving Landscape

• The Laws that are reaching limits
  • Moore’s Law on transistor density
  • Dennard’s Law on constant energy density
  • Kryder’s Law on storage density

• The Laws that remain
  • Rock’s Law on foundries cost
  • Amdahl’s law on speedup
  • Gustafson’s Law on « weak scaling »
Energy consumption dominated by data movements
  - Massively parallel multicore processors
  - Accelerator technologies (e.g., GPU, FPGA)

Memory wall

Data explosion

Diminishing MTBF

Economical constraints
  - Code efficiency (i.e. scaling)
  - Time to solution

Climate Earth System Modeling
Data produced in total in Gbytes/month-of-simulation
PRACE Scientific for High Performance Computing in Europe
EXDCI is an Interdisciplinary CSA

Tools and Programming Models
Massively Parallel Architecture

EXDCI

Ultra Scalable Algorithms
Efficient Exascale Applications

Data Centric Approach Big Data
WP4 Transversal Vision and Strategic Prospective

• Objectives
  • Building a global vision of the roadmaps, towards a shared European e-infrastructure roadmap (with DG-CNECT, DG-RTD, ESFRI, e-IRG)
  • Identifying synergies to lead to a co-design approach

• Ecosystem transversal relationships
  • Centres of Excellence
  • FET HPC Projects
  • Eurolab4HPC

• SME
  • Help building a framework for supporting start-ups / SMEs and see how to accelerate the creation of new start-ups

• Survey recommendations continuity (e.g. from EESI)
Eurolab4HPC / EXDCI Collaboration

• Roadmapping collaboration and coherence
  • Eurolab4HPC: Long term research, beyond Exascale oriented
  • ETP4HPC: Industry oriented
  • PRACE: Application oriented

• Trainings
  • EXDCI aims at providing Eurolab4HPC inputs to help defining an HPC Curriculum

• Innovation
  • Building synergies between the EXDCI job centers and Eurolab4HPC business prototyping (among others)
WP2 Technological Ecosystem and Roadmap Toward Extreme and Pervasive Data and Computing

- Objectives
  - Produce periodic updates of the **Strategic Research Agenda (SRA)**
  - Derived from these updates, propose research focus topics for the upcoming HPC work programs within H2020
  - Synchronize and coordinate both actions with WP3 (Application roadmap toward Exascale)

- The SRA outlines a roadmap for the implementation of a research program for a European HPC technology
Energy and programming environments are the dominating themes, data under-represented.

* Number of projects addressing the SRA themes
WP3 Applications Roadmap Toward Exascale

- Objectives
  - Provide updated roadmaps of needs and expectations of scientific applications
  - Provide inputs to the update the PRACE Scientific Case in order to support PRACE in the
  - Deployment of its (Pre)Exascale pan European HPC research infrastructure

- Initiative to create an update of the Scientific Case and capture the current and expected future needs of the scientific communities
  - Weather, Climatology and solid Earth Sciences
  - Astrophysics, HEP and Plasma Physics
  - Materials Science, Chemistry and Nanoscience
  - Life Sciences and Medicine
  - Engineering Sciences and Industrial Applications
WP5 Talent Generation and Training for the Future

- Objectives
  - Promote HPC and HPC skills to young people
  - Support employers in job specification and in recruitment
  - Undertake training gap analysis across the whole of the HPC Ecosystem
  - Support the development of a community of HPC training providers
  - Facilitating HPC staff recruitment by setting up a “Job Centre”
  - Identifying and meeting future training needs
WP6 International Liaison

- Objectives
  - Mapping and analysis of national and international R&I programs/activities/research agendas in HPC towards exascale
  - Coordination with and participation in relevant international activities
  - Establish and maintain a global network of expertise and funding bodies in the area of exascale computing
  - Act as a proactive European voice and representative into the International Exascale Software Community

- Coordination with SPPEXA (Germany-France-Japan), Belmont Forum CRA on e-infrastructures and data (14 countries), Coordinated Research on E-infrastructures (CRE) (DG-CNCT, RDA)
WP7 Objectives

• Determine Key Performance Indicators (KPI) reflecting the progress of the Ecosystem
• Measure the progresses
• Building on the HPC cPPP and PRACE KPI
  • Indicators for Industrial Competitiveness and Socio-Economy Impact
  • Indicators for the operational aspects of the programme
  • Indicators for management aspects of the programme
  • Implementing data collection and processing
  • Delivering periodic score cards (incl. for cPPP mid-term review of 2017)

WP8 Objectives

• Disseminate the project inputs to the community
• Organize a European EXDCI Conference
EXDCI in a Nutshell

- Increasing ecosystem synergies
- Economical dimension taken into account
- Eurolab4HPC – EXDCI collaboration
- Strong world wide dimension, Big Data and Extreme-scale Computing (BDEC) representative
- FETHPC RIA projects and CoE collaborations
- Interdisciplinary / co-design at the core of the roadmaps
EXDCI
European eXtreme Data and Computing Initiative

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