PRACE the European HPC Research Infrastructure

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Barcelona, 6-June-2013

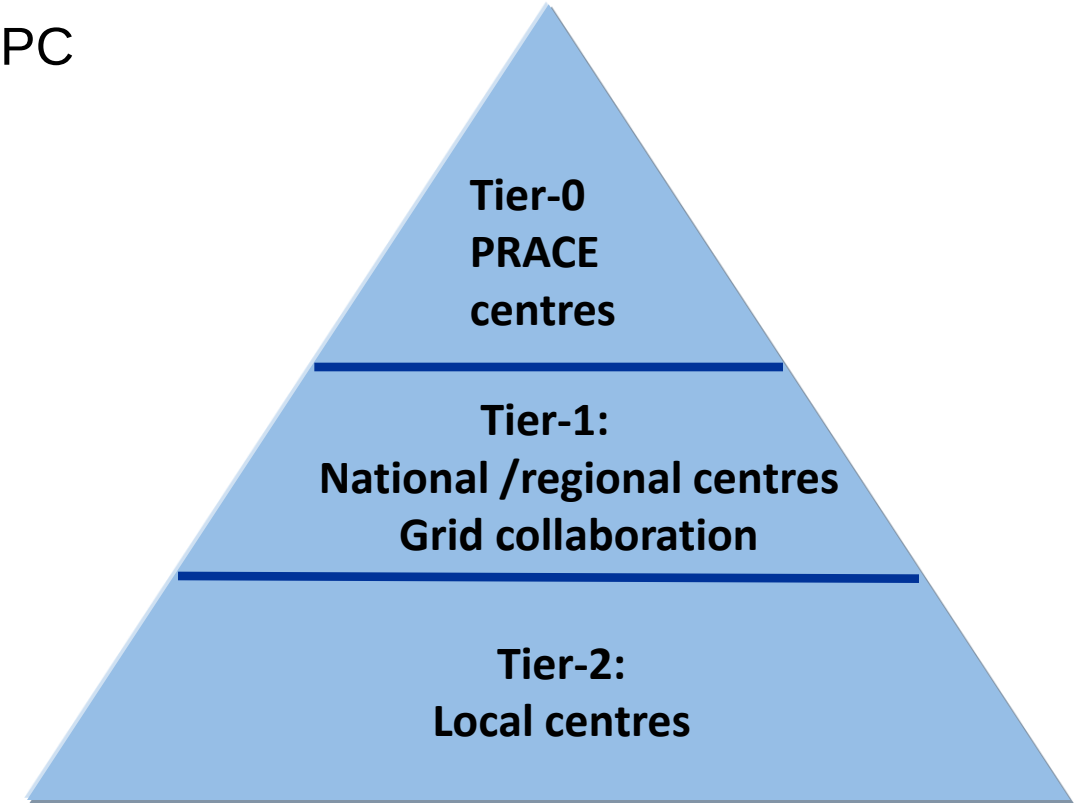
PRACE an European e-Infrastructure & ESFRI-list item

- in operation since April 2010
  - PRACE (AISBL) a legal entity created with 22 European countries with head office in Brussels (nowadays 25)

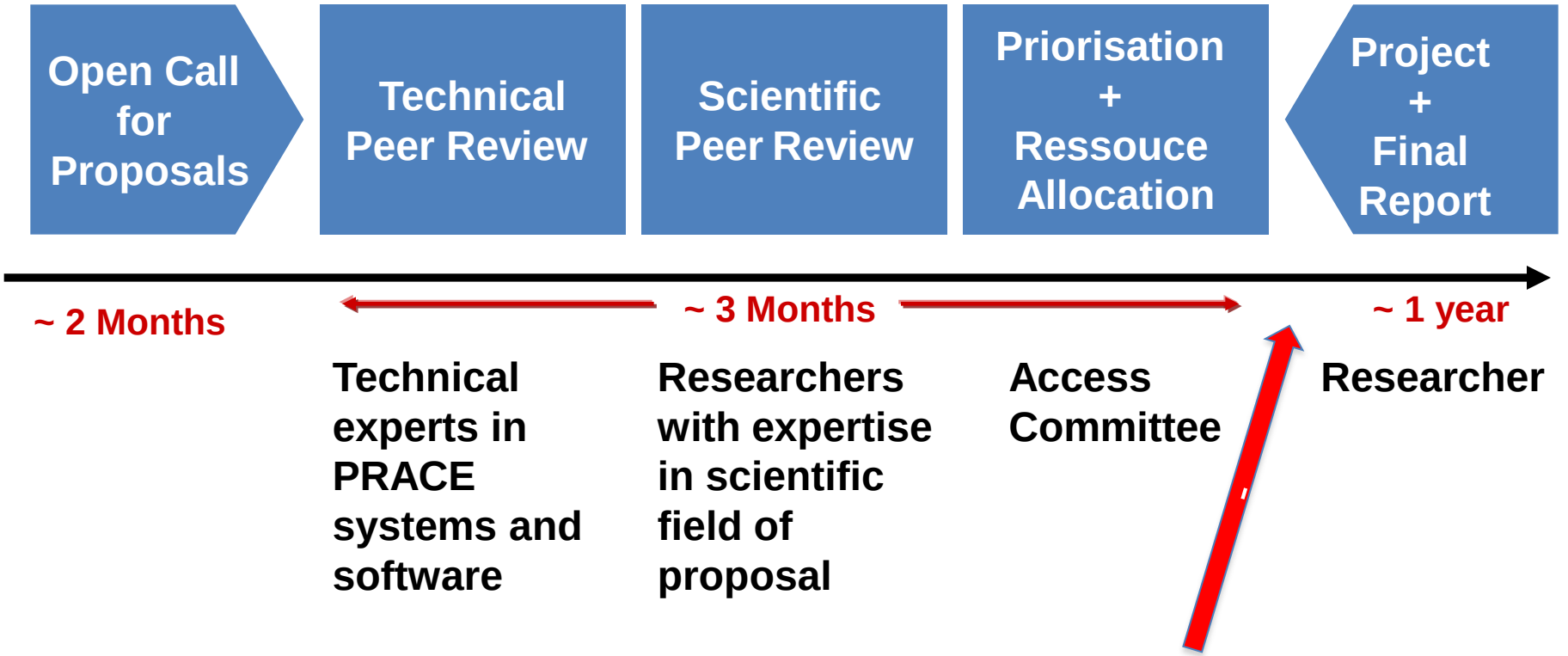
The ESFRI Mandate:

implement the European HPC Service

- Implementation of European HPC service portfolio
  ➔ single European entity
- Access to highest capability computers
  ➔Tier-0 systems
- Ensurance of diversity of architectures
- Support and training of HPC professionals
- Benchmarking of HPC systems



Access to Tier-0 computers



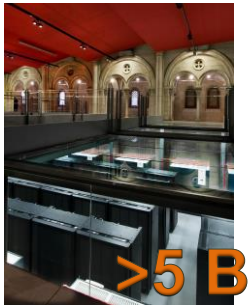
The HPC European e-infrastructure (ESFRI)

- **25** members, AISBL since 2010
- **530 M€** for 2010-2015 (incl. 70M€ from UE)
- **6** supercomputers in **4** hosting countries, different architectures
- research and industrial access (open R&D) for all disciplines **based on excellence in science, free of charge**
- Nearly **15 Pflop/s**
- **5 billion** hours granted since 2010

PRACE's achievements in 3 years

In 2013, PRACE is providing nearly 15 Pflop/s (Tier-0 competencies)

MareNostrum: IBM IDPX
at BSC, >48 000 cores
1Pf

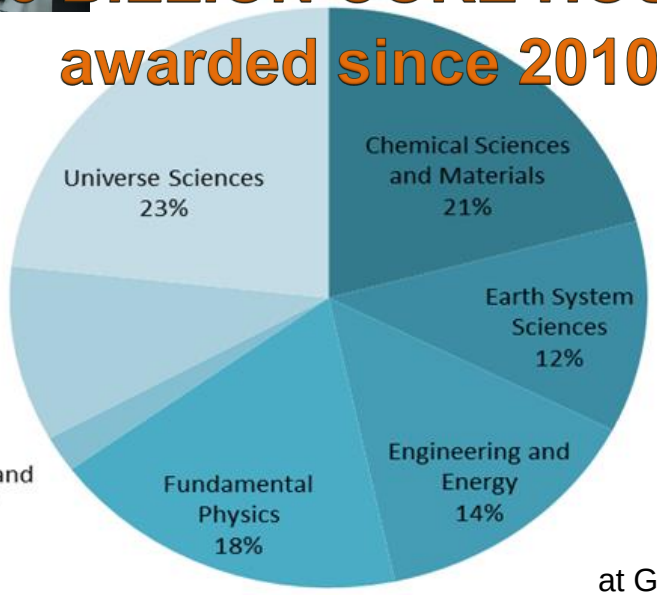


JUQUEEN: IBM BlueGene/Q
at GCS partner FZJ,
>456 000 cores
5,87Pf

>5 BILLION CORE HOURS awarded since 2010

FERMI: IBM BlueGene/Q
at CINECA, >163 000 cores
2.1Pf

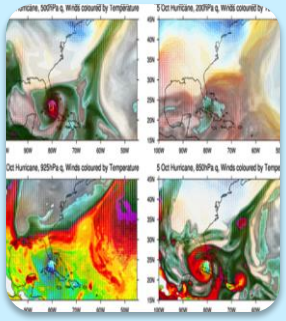
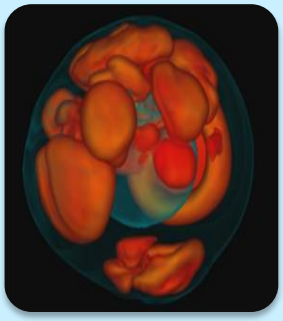
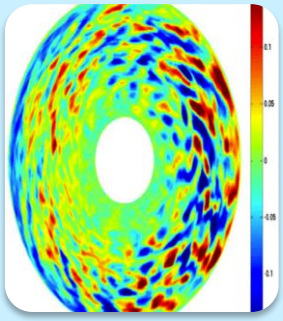
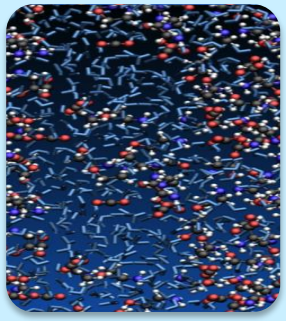
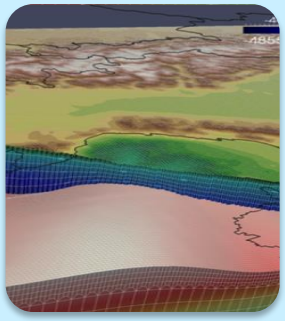
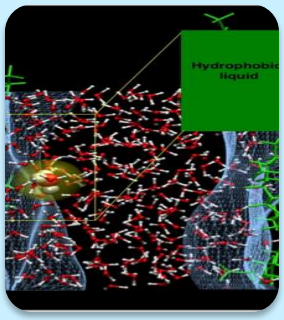
CURIE: Bull Bullx at
GENCI partner CEA
>90 000 cores.
1.8Pf



SuperMUC: IBM IDPX
at GCS partner LRZ,
>155 000 cores 3Pf

HERMIT: Cray
at GCS partner HLRS, >113 000 cores
1Pf

Partnership for Advanced Computing in Europe

Climate

144 million core hrs on Hermit (DE) for UK - UB

PRACE will give to UK Met a 3 years advance in the development of their models (high resolution global weather & climate models).

Astrophysics

million core hrs: 98 on CURIE (FR) + 49 on SuperMUC (DE) for Germany

This PRACE grant is one of the biggest worldwide allocation in this domain. Without this huge computational resources this project would not have been carried out in a reasonable time.

Energy

30 million core hrs on SuperMUC (DE) for Finland

PRACE resources enable the first European direct comparison of first-principles simulations to multi-scale experimental data for fusion energy (Link ITER).

Chemistry

59,8 million core hrs on JUQUEEN (DE) for Switzerland

Simplified models would not give reliable or meaningful results: Only PRACE systems are large enough to allow these computational models to be calculated.

Seismology

53.4 million core hrs on SuperMUC (DE) for Italy

The massive allocation of computing resources awarded via PRACE can be used to explore the non-linearity involved in the dependence of local ground shaking on geological structure.

Life Science

40 million core hrs on JUGENE (DE) for Germany

A single standard PC would need 5.000 years to do what JUGENE did in 100 days (40 million core hours) Only a PRACE system can offer enough resources to accomplish such a computationally intensive project.

Recommendations from PRACE Scientific Case

1 The need for HPC infrastructure at the European level

Europe should continue to provide a world-leading HPC infrastructure to scientists in academia and industry, for research that cannot be done any other way.

2 Leadership and Management

Leadership and management of HPC infrastructure at the Europe level should be a partnership between users and providers.

3 A Long-Term Commitment to Europe-Level HPC

A commitment to Europe-level HPC infrastructure over several decades is required to provide researchers with a planning horizon of 10–20 years and a rolling 5-year specific technology upgrade roadmap.

4 Algorithms, software and tools

There is an urgent need for algorithm and software development to be able to continue to exploit high-end architectures efficiently to meet the needs of science, industry and society.

5 Integrated Environment for Compute and Data

Europe-level HPC infrastructure should attach equal importance to compute and data, provide an integrated environment across Tiers 0 and 1, and support efficient end-to-end data movement between all levels. Its operation must be increasingly responsive to user needs and data security issues.

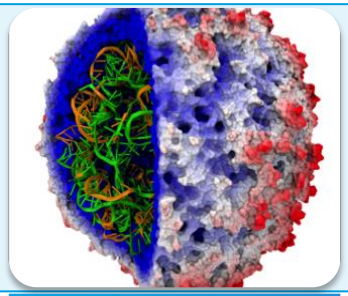
6 People and training

Europe's long-term competitiveness depends on people with skills to exploit its HPC infrastructure. It must provide ongoing training programmes to keep pace with the rapid evolution of the science, methods and technologies, and must put in place more attractive career structures for software developers to retain their skills in universities and associated institutions.

7 Thematic Centres

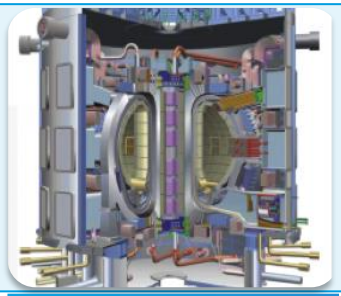
Thematic centres should be established to support large long-term research programmes and cross-cutting technologies, to preserve and share expertise, to support training and to maintain software and data.

Future challenges and scientific needs



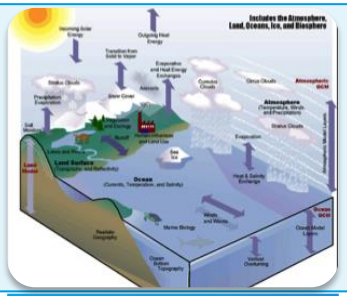
Personalised Medicines

- Beyond the Omics revolution
- Rational drug design and systems biology
- Reduce drug development costs (1.2B$/drug), make test with humans safer and avoid animal testing (REACH)



Renewable/sustainable energy supply

- Design reliable and performant fusion reactors (ITER in 2019)
- Improve combustion and reduce greenhouse gases
- Perform viable H_2 generation, storage and use on cars

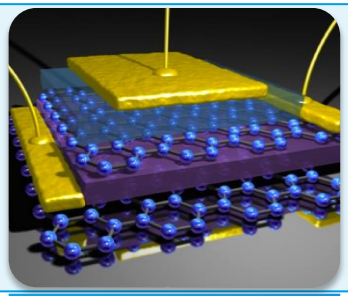


Managing the environmental change

- Towards a full global earth system for high resolution climate and weather / air quality forecast
- Early warning systems for earthquake ground motion simulation and seismic hazard

Understanding the human brain

- Toward a full model of brain behaviour
- Better understanding of the rise of serious diseases - Alzheimer - Parkinson
- New chips and networks « brain inspired » ➔ economic impact on the ICT market



Improving Industrial processes

- breakthrough insights that dramatically accelerate and streamline R&D and engineering
- Improvement of business processes
- Shorter product development duration, reduced total cost
- « green » supply chain

Scientific Case for HPC in Europe 2012-2020

Agenda setting leading edge HPC capability

Needs

- Higher resolution, longer timescale, multi-scale, multi-physics coupled models
- Validation, verification and uncertainty quantification
- Big data management, novel workflows
- (re)development of applications, algorithms and software to efficiently exploit capabilities
- Co-design by multidisciplinary integrated teams
- Increasing capability, capacity, diversity of architectures
- Training and user support

PRACE 2.0 strategy : Meeting Europe‘s ambitions with HPC (1/4)

Provide an infrastructure for science and industry

- To maintain Europe as an agenda setting science contributor
- By offering access to leading edge HPC platforms
- opened to all disciplines and countries in Europe

Attract, train and retain competences

- To attract, train and retain highly skilled and innovative workforce in science and engineering
- To share knowledge and expertise

Provide an high quality service

- With at least one supercomputer in each major architectural class
- To support world-leading science

Lead the integration of an highly effective HPC ecosystem

Including :

- A) scientific and industrial communities,
- B) national HPC centres and their support for the PRACE systems
- C) training and software development efforts

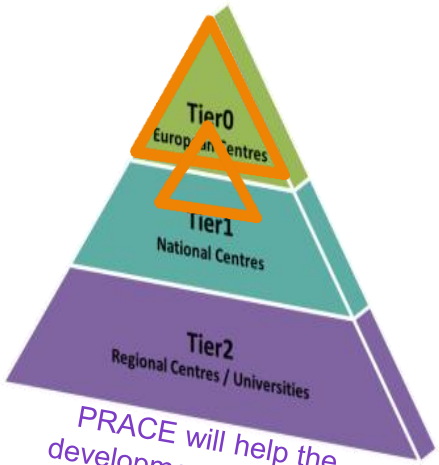
PRACE 2.0 strategy : Principles (2/4)

To serve **scientific excellence**	To serve **economic and technological competitiveness**	To reinforce **partnership** between users and PRACE
To develop a **persistent** e-infrastructure	To aim at **subsidiarity**	To take a **fair account of past contributions**
To ensure **transparency** on information, access,…	To pursue the **solidarity** among members	To strive to **openness**

PRACE 2.0 strategy : Hypothesis for the baseline scenario (3/4)

Ambitions

- Provide an infrastructure for science and industry
- Attract, train and retain competences
- Provide an high quality service
- Lead the integration of an highly effective HPC ecosystem



PRACE will help the development of national ecosystems

Unanimous approval

5
Tier-0 of each 50 PF)

Tier-0
European centers

alone or in a consortium

EC funds: 25%

Tier-1 services for Tier-0

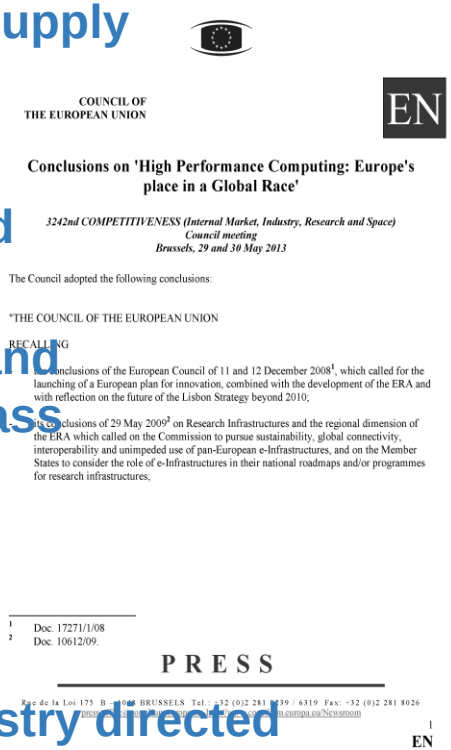
50 % PRACE membres

50 % EC

HPC at the agenda of the Competitiveness Council – 29-30 May, 2013

Competitiveness Council, May 29-30, 2013: Conclusions on 'High Performance Computing: Europe's place in a Global Race‘ (EC communication Feb. 2012)

- STRESSES the importance of the provisioning, use and supply of HPC for Europe
- ACKNOWLEDGES the efforts of PRACE
- RECOGNISES the need of all relevant actors in public and private to work in partnership
- “ASKS the Commission to explore funding possibilities and instruments to support the development of leadership-class HPC systems on the global market on the basis of open competition to address the needs of various HPC user communities;”
- INVITES member states and EC to various actions: CoEs, Software development, education & training, supply industry directed http://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/intm/137344.pdf



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Conclusions on 'High Performance Computing: Europe's place in a Global Race'

3242nd COMPETITIVENESS (Internal Market, Industry, Research and Space) Council meeting
Brussels, 29 and 30 May 2013

The Council adopted the following conclusions:

"THE COUNCIL OF THE EUROPEAN UNION

RECALLING

- Conclusions of the European Council of 11 and 12 December 2008[1], which called for the launching of a European plan for innovation, combined with the development of the ERA and with reflection on the future of the Lisbon Strategy beyond 2010;

- Conclusions of 29 May 2009[2] on Research Infrastructures and the regional dimension of the ERA which called on the Commission to pursue sustainability, global connectivity, interoperability and unimpeded use of pan-European e-Infrastructures, and on the Member States to consider the role of e-Infrastructures in their national roadmaps and/or programmes for research infrastructures;

1 Doc. 17271/1/08
2 Doc. 10612/09.

PRESS

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Thank you very much for your attention!

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