www.prace-ri.eu

PRACE

PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

Partnership for Advanced Computing in Europe

Symposium on European Funding Instruments for the development of Research Infrastructures

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Partnership for Advanced Computing in Europe

PRACE is an international not-for-profit association under Belgian law, with its seat in Brussels.

PRACE counts 25 members and 2 observers.

The **PRACE** Hosting Members are France, Germany, Italy and Spain.

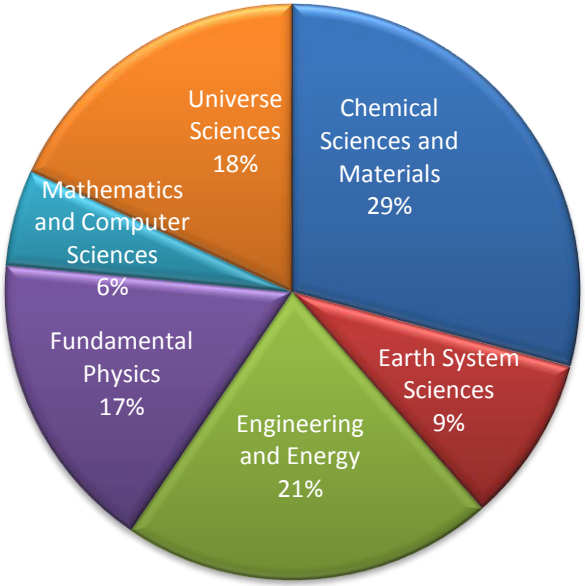
PRACE is governed by the **PRACE** Council in which each member has a seat. The daily management of the association is delegated to the Board of Directors.

PRACE is funded by its members as well as through a series of implementation projects supported by the European Commission.

PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

4 Countries offering computing resources on 6 world-class machines

MareNostrum: IBM
BSC, Barcelona, Spain



CURIE: Bull Bullx
GENCI/CEA
Bruyères-le-Châtel, France

JUQUEEN: IBM BlueGene/Q
GAUSS/FZJ
Jülich, Germany

SuperMUC: IBM
GAUSS/LRZ
Garching, Germany

Hazel Hen: Cray
GAUSS/HLRS,
Stuttgart, Germany

FERMI: IBM BlueGene/Q
CINECA , Bologna, Italy

Partnership for Advanced Computing in Europe

437 scientific projects **enabled**

11.5 thousand million core hours awarded since 2010 with peer review, main criterion is **scientific excellence**. **Open R&D** access for **industrial users** with **>50 companies** supported

>7 350 people trained by **6 PRACE Advanced Training Centers** and others events

25 Pflop/s of peak performance on **6 world-class systems**

530 M€ of funding for **2010-2015**, access **free at the point of usage**

25 members, including **4 Hosting Members**
(France, Germany, Italy, Spain)

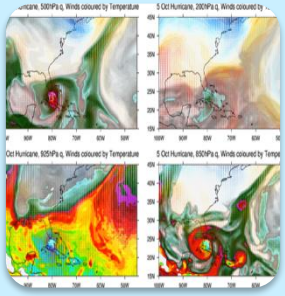
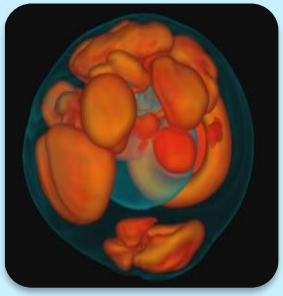
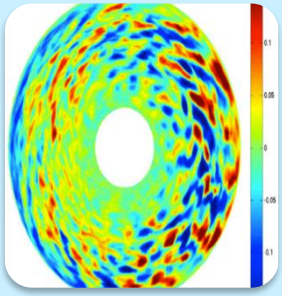
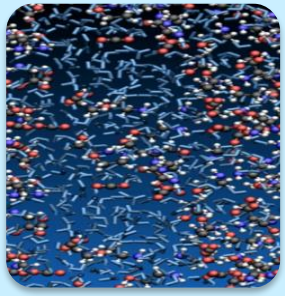
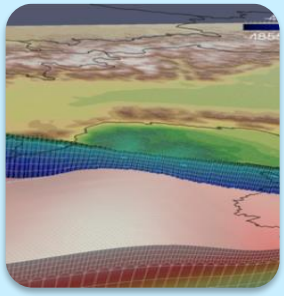
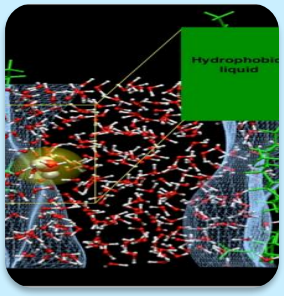
Access through PRACE Peer-Review

- **Free-of-charge** required to **publish results at the end of the award period**
- **Preparatory Access** (***2 to 6 months***)
- **SHAPE Programme** (***2 to 6 months***)
- **Project Access** (***12, 24 or 36 months***)
- **Centers of Excellence: 0,5 % of the total resources available for the 11th call for CoE**

Criterion: Scientific Excellence

www.prace-ri.eu/call-announcements/

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

98M on CURIE (FR) + 49M 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 decent 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

60 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 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 JUQUEEN (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.

SHAPE

SME HPC Adoption Programme in Europe

- Designed to **SMEs** willing to adopt a new HPC-supported solution
- Based on an integrated set of services:
  - **networking,**
  - **training in PRACE Centres,**
  - **expertise provided by HPC and domain-specific experts,**
  - **access to PRACE HPC systems (Open R&D model)**
- Support SMEs up to a **proof-of-concept**
  - Co-development of a **industrial project** with PRACE experts using HPC resources.
- After the SHAPE demonstration, companies will have a clear view about:
  - **potential of HPC,**
  - **investments to perform and skills to hire,**
  - **software or methodologies to develop,**
  - **next HPC Services to use :** PRACE services for Open R&D, buying their own HPC facilities , remote access to HPC services on commercial Cloud platforms.

H2020 Centres of Excellence in HPC

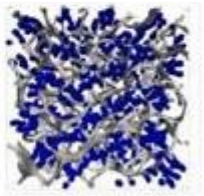
BioExcel
Centre of Excellence for Biomolecular Research
(Led by KTH)

COEGSS
Center of Excellence for Global Systems Science
(Led by Potsdam Uni)

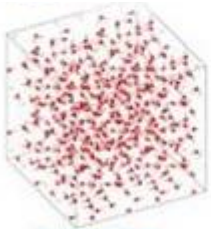
EoCoE
Energy oriented Centre of Excellence
(led by CEA)

E-CAM
Software, training and consultancy in simulation and modelling
(Uni College Dublin)

ESiWACE
Excellence in Simulation of Weather and Climate in Europe
(Led by DKRZ)



MAX
Materials design at the eXascale
(Led by CNR)



NOMAD
The Novel Materials Discovery Laboratory
(Led by Max Planck)

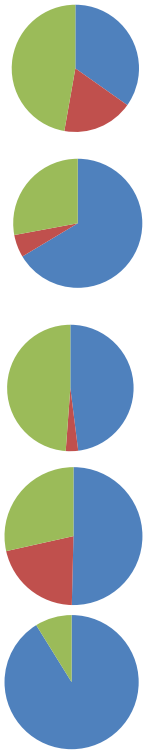
PoP
Performance Optimization and Productivity
(Led by BSC)

Funding of PRACE

- Hosting members contribute with 100M € TCO
  - CAPEX
  - OPEX
- All members contribute with membership fees for the office operation, including centralised peer review
- EC and members contribute via the Preparatory and Implementation Phase projects

Preparatory and Implementation Projects

- PRACE-PP, 18.9 m€
  - Legal and organizational framework for PRACE
  - Petaflop/s system prototyping (6.8 m€)
- PRACE-1IP, 27.7m€
  - Operation of the Tier-0 distributed infrastructure
  - Application enabling
  - Procurement of next-generation prototypes (3.2 m€)
- PRACE-2IP, 35.1m€
  - Integration of Tier-1 systems - Distributed European Compute Initiative
  - Creation of PRACE Advanced Training Centres (PATCs)
  - Industrial Application Support
  - Prototypes (2.2m€)
- PRACE-3IP, 26.5 m€
  - PCP for a "whole System Design for Energy Efficient HPC" (11.2 m€)
  - SHAPE program
- PRACE-4IP, 16.4m€
  - The road for PRACE 2 and European Exascale Systems



82M€ received from the EC, of which 6M € for prototypes and 5.6M € for PCP
43M€ co-funded by PRACE partners

PRACE-3IP
Pre-Commercial Procurement
“Whole System Design for Energy Efficient High Performance Computing (HPC)”

Goals of the "Whole System Design for Energy Efficient HPC" PCP

Fostering advances in energy efficiency (major TCO driver for HPC & Big Data)

Energy wall for Exascale requires an O(100) increase of power efficiency

Assessment of results through a pilot scalable to 100 PFlop/s

PRACE PCP Process and assessment methodology

3 phases competitive process:

- Solution design (6 months, funding 10%)
- Prototype development (10 months, funding 30%)
- Pre-Commercial Pilot system (16 months, funding 60%)

Assessment on "real" application benchmark from PRACE (suitable for PRACE 2)

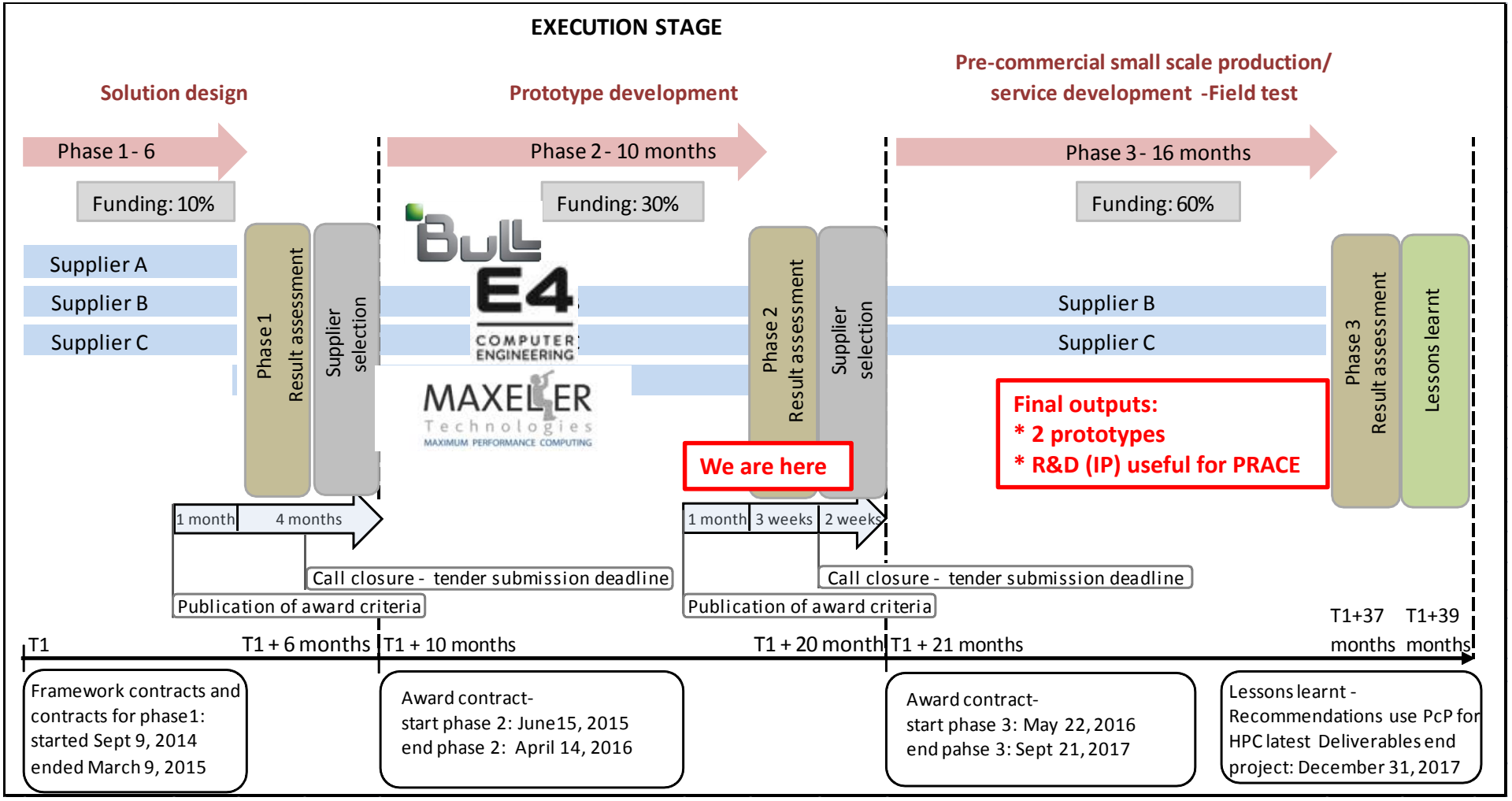
Expected results and impact

- EU HPC supply industry (80% of R&D must be performed in EU) increase competitiveness
- EU HPC users (academia and industry) get early access to disruptive technology through PCP pilot
- EC and PRACE are learning by doing a new public procurement procedure, with high leverage effect
- PRACE procure Intellectual Property (IP) that paves the way toward sustainable Exascale:
  - IP is kept by HPC suppliers
  - Discount on future IP usage for PRACE members of the Group of Procurers of the PCP

Organization of the PRACE PCP

- Procurers: 
  - Five PRACE-3IP partners (CINECA, CSC, EPCC, Juelich, GENCI) and PRACE aisbl as observer
  - A GoP (Group of Procurers) was formed and contractually regulated by an agreement
  - 9 M€ Budget contributed by the procurers and EC (50/50)
- Governance:
  - Based on the GoP Committee as decision-making entity
  - CINECA has been selected as the Procuring Entity
  - Coordination between the Procuring Entity and the project assured

PRACE PCP three stages process



PRACE PCP Evaluation Criteria

- Quality of R&D and level of innovation (30%)
  - Ability to innovate and improve substantially the scope of operation
- Technical requirements compliance (20%)
  - Level of compliance of the solution in terms of quality and completeness
- Progress in terms of energy efficiency (30%)
  - Solution's ability to progress energy efficiency beyond state-of-the-art
- Project quality and feasibility (20%)

These criteria and the weight remain the same throughout all Phases of the PCP

Their implementation is adapted at each phase

(e.g. TRL target ➔ moving toward more maturity)

Intellectual Property Rights issues

- IPR management is one the much sensitive issue of a PCP
  - It can cause HPC technology provider to discard PCP
- IP license to PRACE Group of Procurers Members:
  - Principle: irrevocable, worldwide, royalty-free, non-exclusive license for internal purposes only and for duration of IPRs (sub-licensable to affiliated entities)
  - GOP Member commercial use: at significantly better price than market
  - License for other third parties for commercial use: at fair and reasonable price
  - Includes call-back clause if the IP is not used by vendors after a reasonable time
- Background IP must be clearly distinct from Foreground (PCP developed) IP
  - In HPC value of Background IP is >> value of Foreground IP

Conclusions

- Success of PRACE financing model
  - Able to fast deliver services, only after 2 years of preparation
  - Commitment of members and EC
  - New model under development
- First pan-European PCP on HPC, and it successfully made it to Phase 3
  - 80 % of the R&D must be performed within Europe
  - More than 50% of the budget must be dedicated to R&D
  - Evaluation criteria focussed on specific technological aspects and (PRACE) real-world benchmark
- IPR management is critical and must be kept attractive for PRACE & vendors
- Work on Energy-efficiency measurement methodology will be useful beyond the PCP for other HPC and Data Centre procurement (TCO evaluation)