



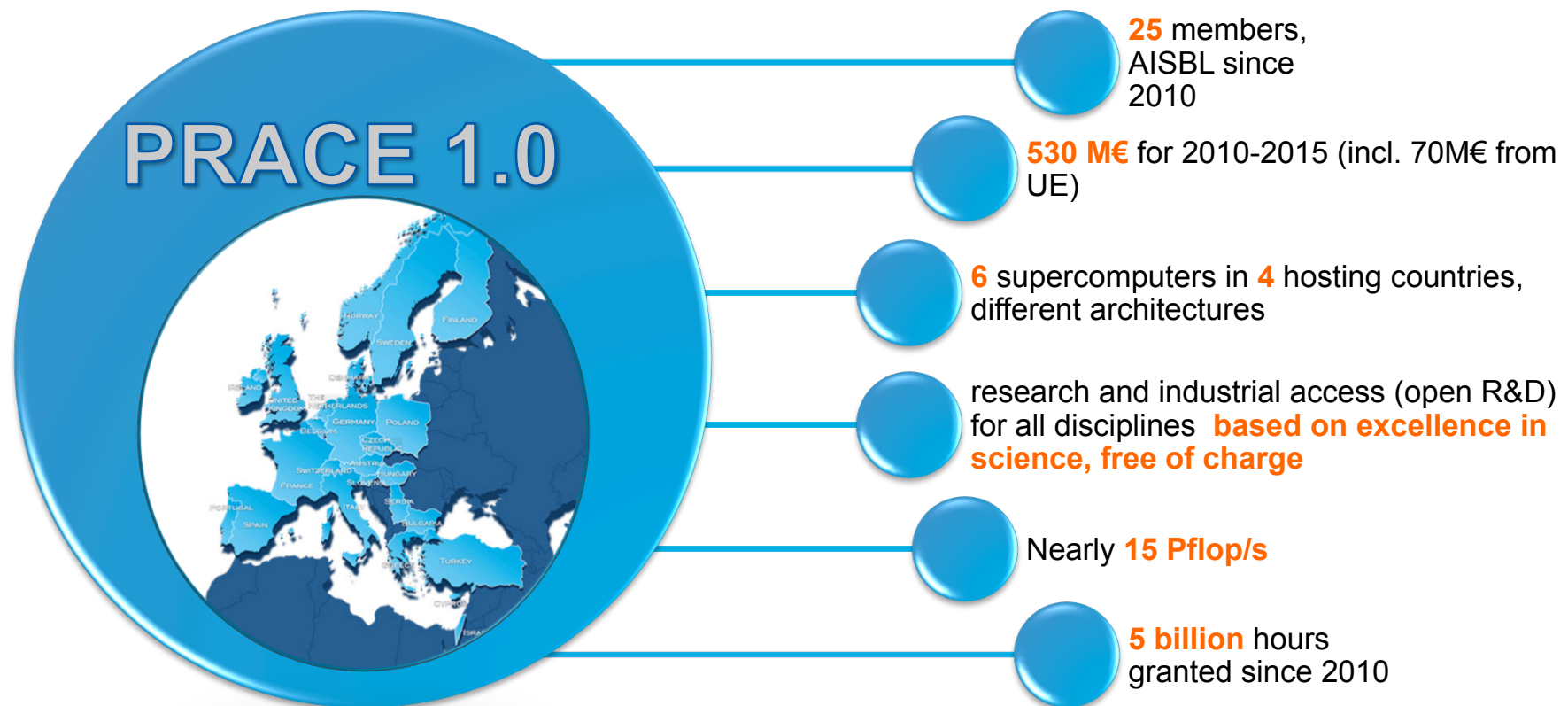
PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

PRACE Scientific Conference 2013
Sergi Girona

Chair of the Board of Directors and Managing Director

ISC, Leipzig, 16-June-2013

The HPC European e-infrastructure (ESFRI)





25 members since 2010

PRACE has 25 members, representing European Union Member States and Associated Countries

4 Hosting Members

France: [GENCI](#)

Germany: [GCS - GAUSS Centre for Supercomputing](#)

Italy: [CINECA - Consorzio Interuniversitario](#)

Spain: [BSC – Barcelona Supercomputing Center](#)

21 General Partners

Austria: [Johannes Kepler University of Linz](#)

Belgium:
[Direction générale opérationnelle de l'Économie, de l'Emploi et de la Recherche](#)

Bulgaria: [NCSA](#)

Cyprus: [CaSToRC](#)

Czech Republic: [VŠB - Technical University of Ostrava](#)

Denmark: [DeIC - Danish e-Infrastructure Cooperation](#)

Finland: [CSC - IT Center for Science Ltd.](#)

Greece: [GRNET](#)

Hungary: [NIIFI](#)

Ireland: [ICHEC](#)

Israel: [IUCC](#)

The Netherlands: [SURFsara](#)

Norway: [SIGMA](#)

Poland: [PSNC](#)

Portugal: [Universidade de Coimbra](#)

Serbia: [IPB - Institute of Physics Belgrade](#)

Slovenia:
[University of Ljubljana, Faculty of Mechanical Engineering](#)

Sweden: [Vetenskapsrådet – Swedish Research Council](#)

Switzerland: [ETH](#)

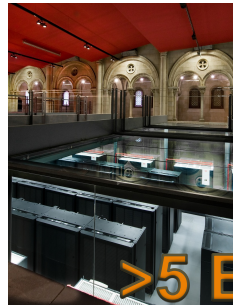
Turkey: [UYBHM](#)

UK: [EPSRC](#)

PRACE's HPC resources in 2013

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

MareNostrum: IBM IDPX
at BSC, >48 000 cores



JUQUEEN: IBM BlueGene/Q
at GCS partner FZJ,
>458 000 cores



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

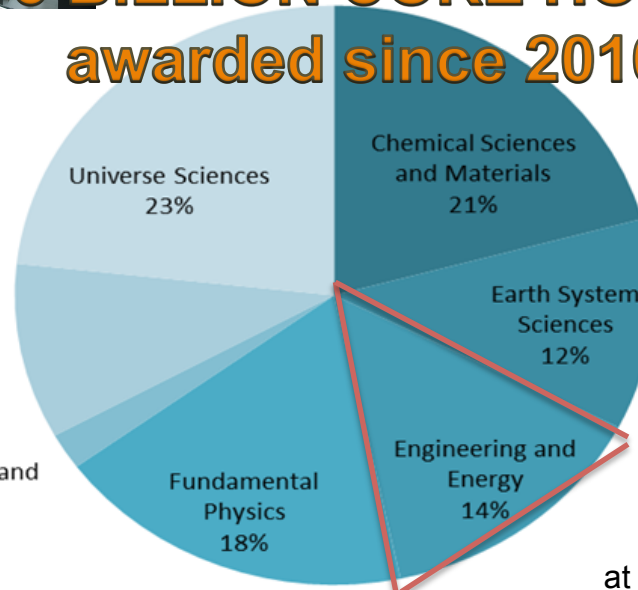


SuperMUC: IBM IDPX
at GCS partner LRZ,
>147 000 cores

**>5 BILLION CORE HOURS
awarded since 2010**

Biochemistry,
Bioinformatics
and Life sciences
10%

Mathematics and
Computer
Sciences
2%



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



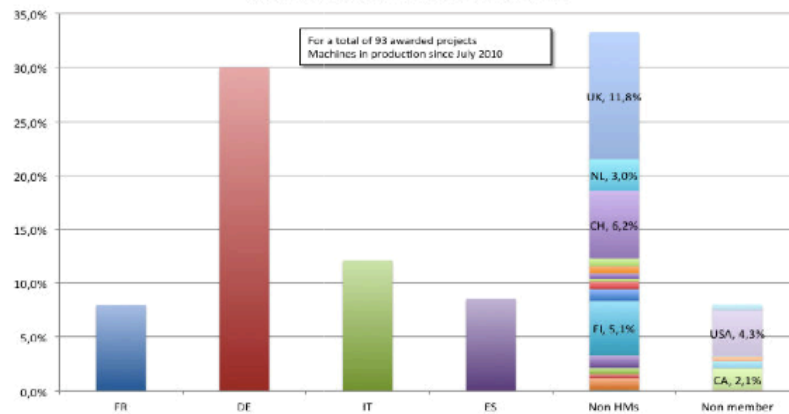
HERMIT: Cray
at GCS partner HLRS, >113 000 cores

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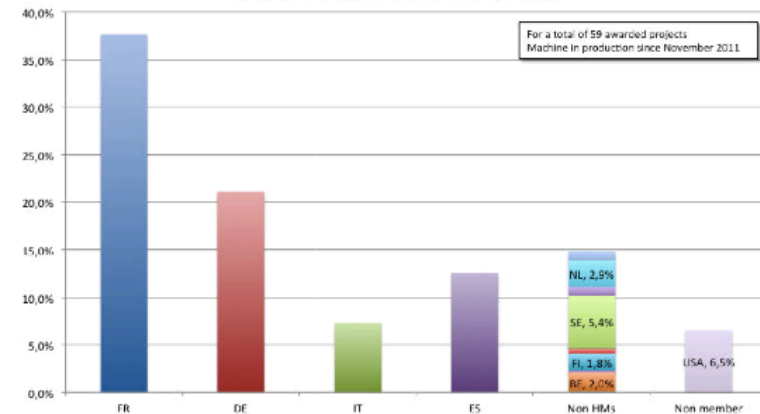


PRACE is a European infrastructure

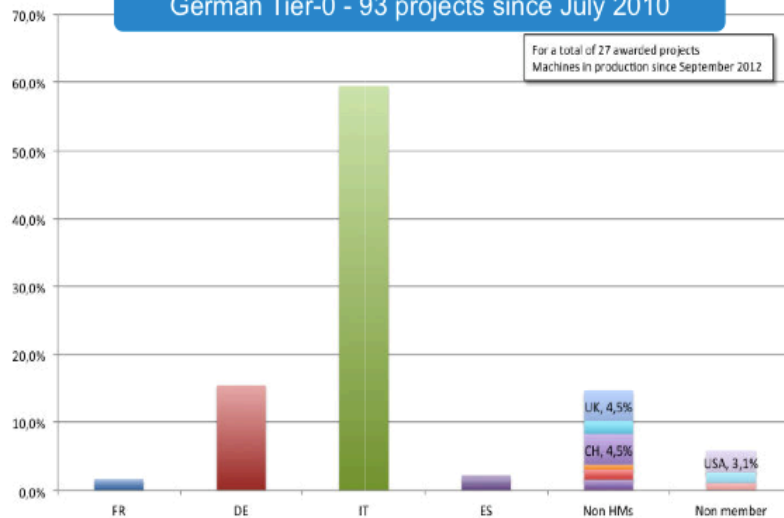
Distribution of PRACE resources in GCS machines



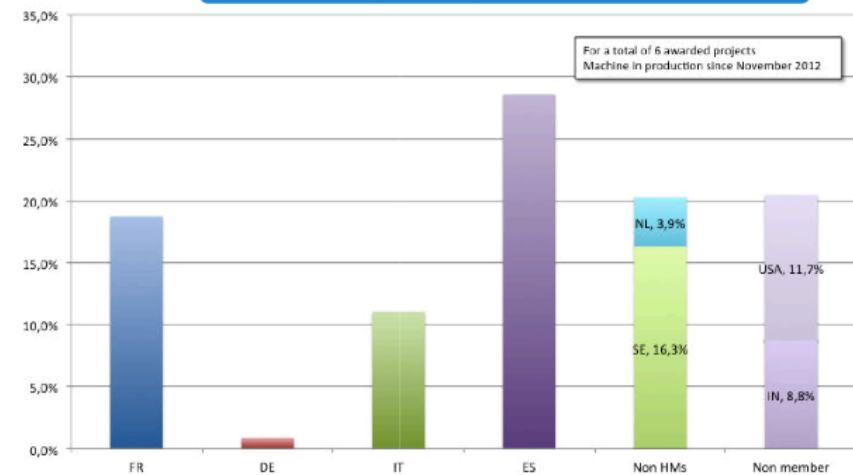
Distribution of PRACE resources in GENCI machines



German Tier-0 - 93 projects since July 2010



French Tier-0 - 59 projects since November 2011



Italian Tier-0 - 27 projects since September 2012

Spanish Tier-0 - 6 projects since November 2012

Financing: 530 M€ for 2010-2015 (incl. 70M € from UE)

Contribution of Hosting Members (400 m€)

- TCO (total Cost Ownership) of HPC systems
- Includes: HW, software, facilities, operations, energy,...

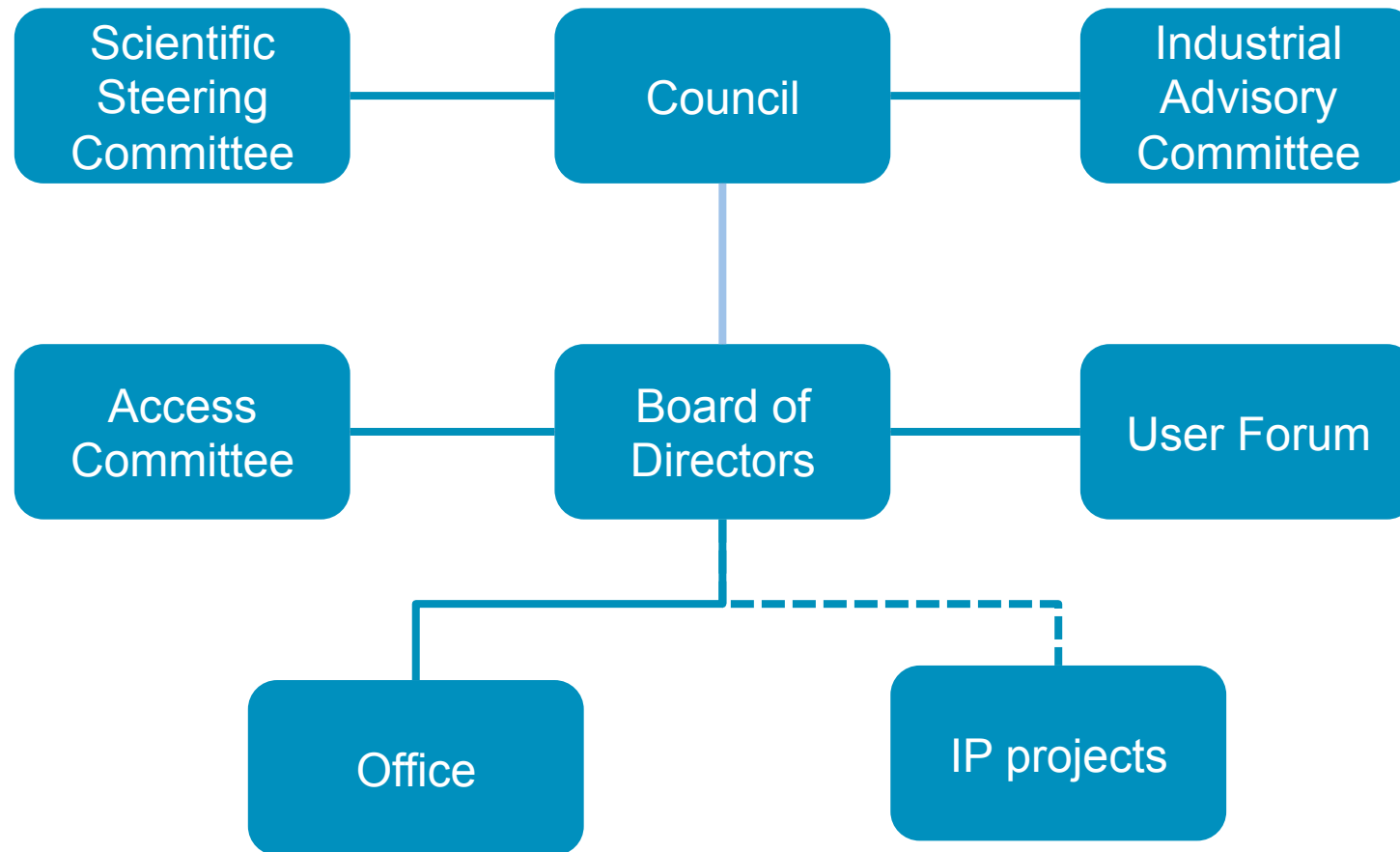
Membership fee, all members (7,5 m€)

- Office operation: peer review, dissemination, legal

Projects: PP, 1IP, 2IP, 3IP (122,5 m€)

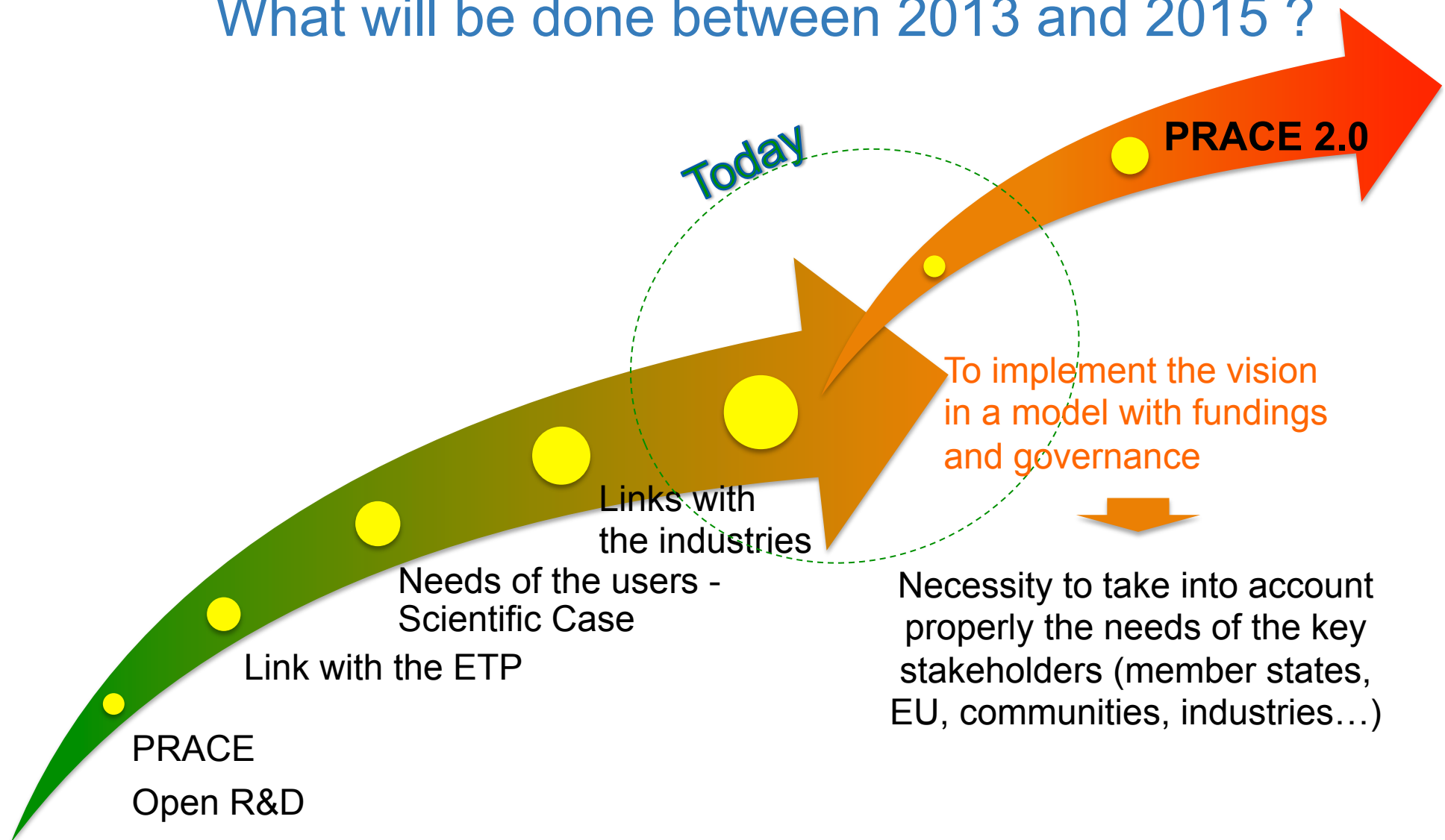
- Legal support
- Dissemination
- Training
- Operation
- Application enabling
- Market watch
- Prototypes
- PCP, Pre-Commercial Procurement

Governance

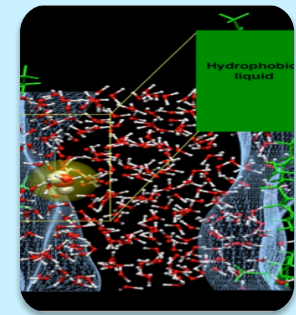
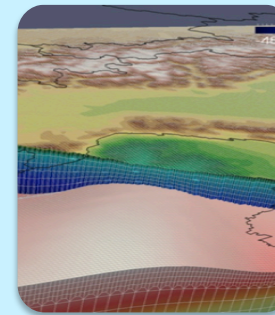
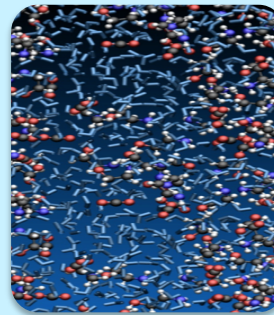
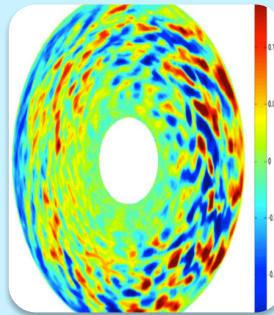
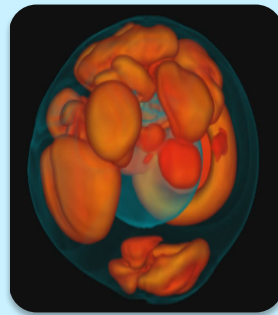
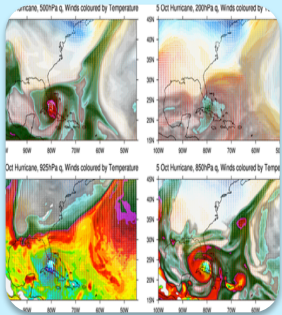




What will be done between 2013 and 2015 ?



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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

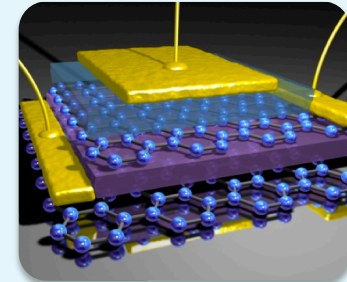
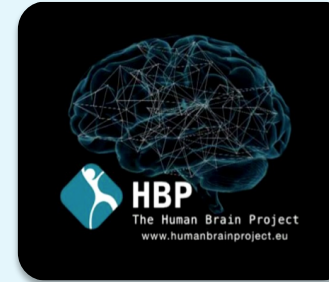
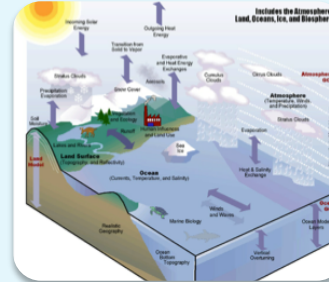
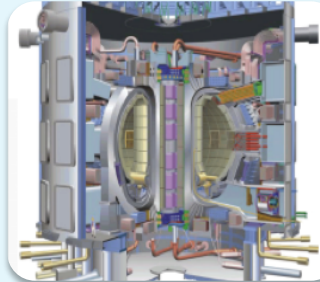
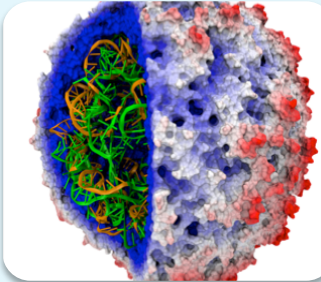
Europe's long-term competitiveness depends on people with skills to exploit its HPC infrastructure. It must provide ongoing training programmes to keep pace with the rapid evolution of the science, methods and technologies, and must put in place more attractive career structures for software developers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



Scientific Case for HPC in Europe 2012-2020

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 H₂ 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

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

Links with the industry

PRACE's Industrial Advisory Committee (IAC)

- To gather strategic expectations of industries
- To advise PRACE on the directions that best suit industrial needs
- To help to stimulate the use of HPC and numerical simulation by industry
- 1st meeting before October 2013

Specific initiatives

- PRACE : interactions with ETP4HPC
- Initiative towards SMEs : SHAPE (SME HPC Access Programme in Europe)
- Initiative towards large Companies : High-level executive meeting with industrial users
 - Airbus EADS, Rolls Royce, TOTAL, ENI (Feb. 8th)

Examples :

EDF Energy (UK)

20.8 Mh on Hermit (HLRS, Germany)
6th call PRACE (March'13 to March'14)

Objective: by LES methods, modeling flow in a rotor of type « Magnus » or Turbosail

- alternative-Concept for diesel engines



More ecological marine propellers



A. Revel (Univ Manchester)

RENAULT (France)

42Mh on CURIE (TGCC, France)
6th call PRACE (March'13 à March'14)

Objective: Improve the safety of vehicles by leveraging the simulation parameters of crashes

- Unattainable ambition with internal resources of Renault



Anticipate new security regulation (EuroNCAP6 in 2015)



M. Pariente, Y. Tourbier (Renault)



Amplify services beyond Open R&D

❑ Pre-Competitive R&D

- Like an Open R&D model, but with **more time to publish results** (2 or 3 years), so to gain competitive advantage in the meantime
- Possibility to not publish at the end and pay for the compute hours used



Pilot with interested companies ?

❑ SHAPE : SMEs HPC Adoption Programme for Europe

- In complement of national initiatives in France, Germany, Italy, UK, ...
- **Evangelize SMEs** who want to engage in numerical simulation and HPC
- Support them with services up to a **proof-of-concept** :
 - Training in PRACE centers
 - Expertise, both in HPC and in domain-specific problems
 - Access to resources to demonstrate a real industrial case



Pilot with supply chains in one or two selected fields ?

PRACE Advanced Training Center

- 6 Centers: BSC, CINECA, CSC, EPCC, Gauss Center for Supercomputing, Maison de la Simulation
- Joint Curriculum, with 71 PATC courses in 2012-13
 - Message Passing (9)
 - Threading (8)
 - Mixed-mode Parallel Programming (7)
 - Performance Analysis, Optimisation, Debugging (14)
 - Scientific Programming and Computing (8) • Software Engineering (8)
 - Numerical Libraries (2)
 - Scientific Visualisation (3)
 - Accelerators (10)
 - PGAS Programming (5)
 - I/O Optimisation and Parallel I/O (7)
 - Domain-specific courses (6)

Success Story: May 2012 – March 2013

- 60 Courses
- 176 Training days
- 1394 participant
 - 24 PRACE countries, rest of Europe, Africa, Asia, N & S America.
 - On average per course, ~23 participants and ~16% “visiting”.
- **8.5/10**: Average overall course rating, from 658 feedback forms collected from 47 courses

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)

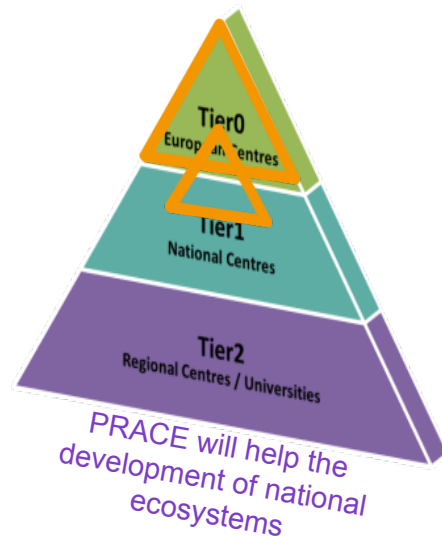
Ambitions

Provide an infrastructure for science and industry

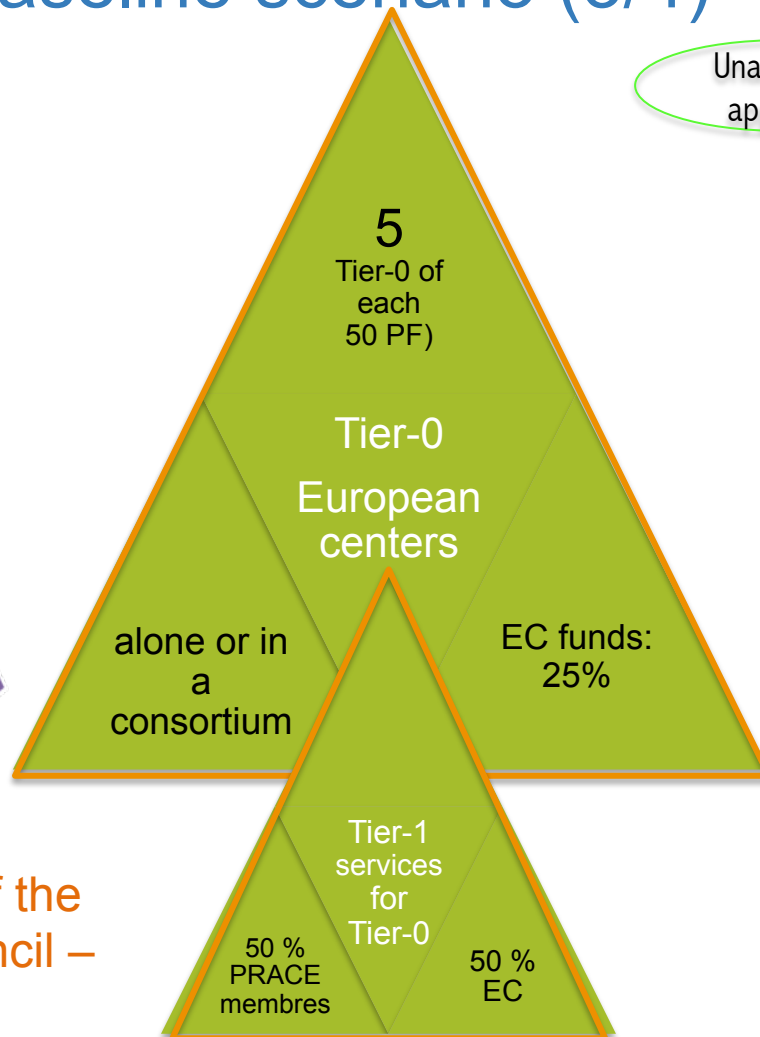
Attract, train and retain competences

Provide an high quality service

Lead the integration of an highly effective HPC ecosystem

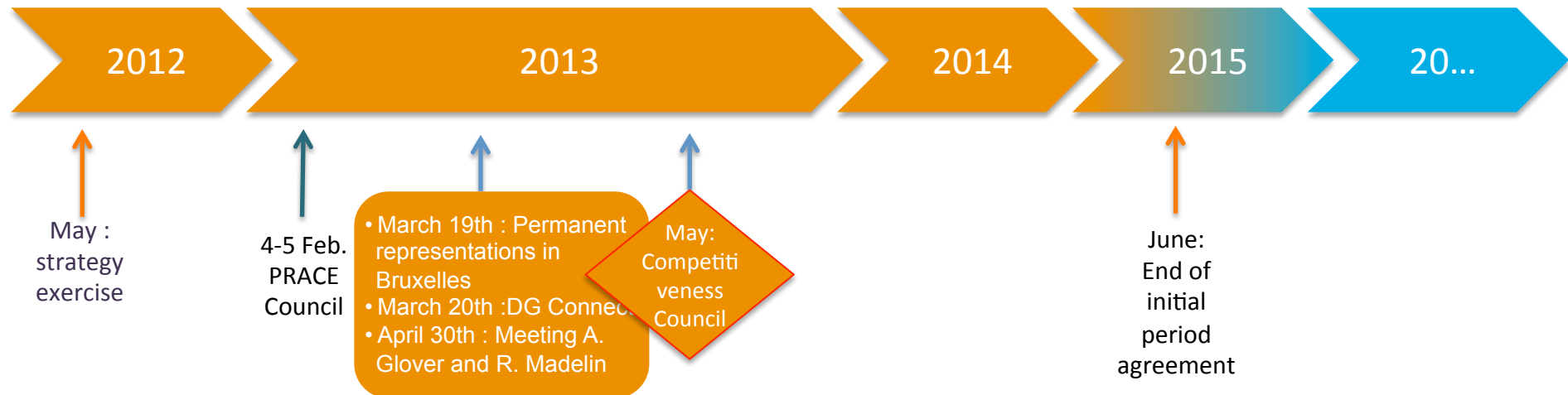


Unanimous approval



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

PRACE 2.0 strategy : Milestones of PRACE AISBL Strategy (4/4)



Allocations of Tier-0 hours – Phase 1



PARTNERSHIP
FOR ADVANCED COMPUTING
IN EUROPE



**COUNCIL OF
THE EUROPEAN UNION**

Brussels, 31 May 2013

10322/13

**RECH 218
COMPET 379
IND 170
TELECOM 149**

OUTCOME OF PROCEEDINGS

From: Council

To: Delegations

No. Cion Prop.: 6596/12 RECH 56 COMPET 96 IND 31 TELECOM 32

No. Prev. doc.: 9808/13 RECH 182 COMPET 325 IND 161 TELECOM 133

Subject: **- Communication from the Commission on "High Performance Computing:
Europe's place in a Global Race"**
- Council conclusions

Highlights of Competitiveness Council Conclusions

1 WELCOMES the attention brought to the issue of High Performance Computing

2 STRESSES **its strategic importance** to the EU's industrial and scientific capabilities

3 RECOGNISES the **achievements of PRACE** in pooling leadership-class computing systems and making them available to all researchers in the EU and associated countries, on the basis of, and in order to enhance, scientific excellence and innovation and the need to maintain this approach

4 EMPHASIZES the **strength of the EU** in applications, low-power computing and integration

5 ACKNOWLEDGES the efforts of HPC stakeholders to support the implementation of an EU- level HPC strategy, **in particular PRACE** - as an independent actor on the scientific side - and the industry-led European Technology Platform for HPC (ETP4HPC)

8 RECOGNISES the need for an EU-level policy in HPC addressing **the entire HPC ecosystem**: world-class and sustainable HPC infrastructure; HPC use by Science and by industry, including SMEs; HPC industrial supply for development of exascale computing; excellence in HPC software, methodology and applications; and achieving a level-playing field for EU companies;

9 INVITES Member States, the Commission, and industry to ensure **appropriate investments in HPC**

12 INVITES Member States and the Commission to step up the efforts **to substantially increase the supply of scientists and engineers with HPC skills**, through adequate training and educational programmes addressed to industry and academia;

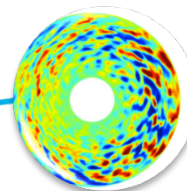
13 ASKS the Commission to explore funding possibilities and instruments **to support the development of leadership-class HPC capabilities in Europe** as well as the acquisition of world-class HPC systems on the global market on the basis of open competition to address the needs of various HPC user communities

15 INVITES the Commission **to develop and elaborate its plans for HPC**

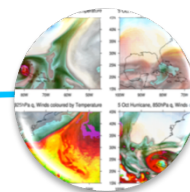
Conclusion

**Involving
PRACE is a
necessity**

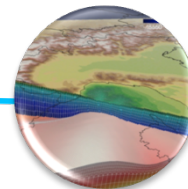
**Sustainability for
2015-2020 and beyond
EC and member states
acting together**



Recognize the achievements of PRACE to pool leadership-class computing systems and make them available to all researchers in all scientific communities on the basis of their scientific excellence



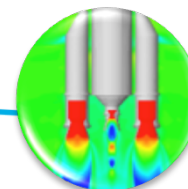
Support the development of PRACE as THE sustainable e-infrastructure to address societal and scientific challenges and for stimulating innovation in Science and industry



Contribute to the funding of the investment and operation of the European PRACE HPC systems



Support the European dynamic via a coherent and cooperative program for three pillars strengthening science, industry and the technology supply chain



Build on existing expertise, while raising the HPC skills and competencies through training and educational programs open to academia and industry



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Thank you very much
for your attention!

PRACE aisbl

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