PRACE the European HPC infrastructure: World Class HPC Services for Science

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DRIHM-DRIHM2US Workshop – February 2015

CAPACITIES

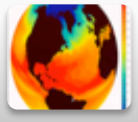
e-infrastructure

PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

PRACE

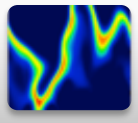
HPC Context in Europe: a strategic tool

For Science



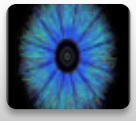
Meteorology, climate, earth sciences

- Measure global warming and climate evolution
- Anticipate climate events



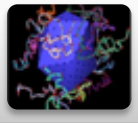
Astrophysics, Particle physics, Plasma physics

- Understand the evolution of galaxies
- Explore advanced physics (LHC, ITER)



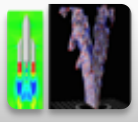
Material sciences, Chemistry, Nanosciences

- Design smart materials
- Understand better nanomaterial properties



Life sciences

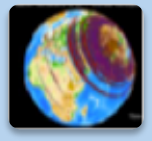
- Explore biological systems
- Drug design



Energy and engineering

- Lower the energetic impact of industry
- Design tomorrow's power plants

To support public policies

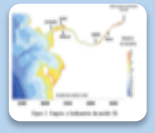


Natural risks

Modeling the progress of the seismic waves during the Sichuan earthquake

Epidemiologic risks

Modeling the spread of the H1N1 infection



Public policies impact

EDF: transport of sediments and saltiness in the Loire basin, on a time period of 10 to 20 years

Security

Search of virulence and resistance to antibiotics

To boost Industrial innovation

Solve instabilities in helicopter engines

CERFACS

Shortens conception cycle (6 months)

Speed-up airplane design

AIRBUS

Saves money in wind-tunnel costs (20%)

Increase efficiency of oil search and production

Eni

Avoids useless drillings (80 M$ avg)

PRACE AISBL
a persistent pan-European supercomputing infrastructure

- **25 members**
- **4 hosting members:**
  France, Germany, Italy and Spain
- **Enables world-class science** through **large scale simulations**
- **Offers HPC services** on **leading edge capability** systems
- **Awards its resources** through a **single** and **fair** pan-European **peer review process for open research**

History

HPC part of the ESFRI Roadmap; creation of a vision involving 15 European countries

Signature of the MoU

Creation of the PRACE AISBL the RI legal entity

Creation of the Scientific Case

HPCEUR | HET | PRACE Initiative | PRACE RI

2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

PRACE Preparatory Phase Project

PRACE-1IP

PRACE-2IP

PRACE-3IP

PCP

PRACE-4IP

PRACE at a glance, HPC services in Europe

530 M€ of funding for the **2010-2015** period

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

346 scientific projects **enabled**

>9 billion core hours awarded since 2010 with peer review , scientific excellence as the main criteria

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

Open R&D access for **industrial users**

≈3000 people trained by **6 PRACE Advanced Training centers** and others events

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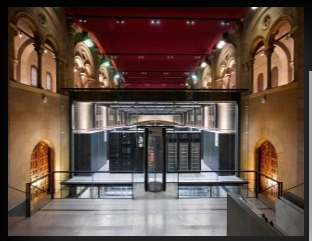
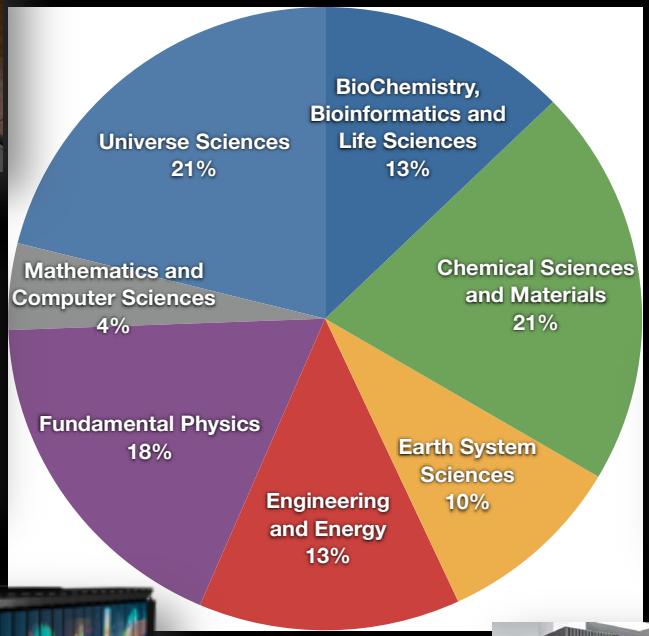
PRACE's awards in 4 years

346 projects **9.2 thousand million**



MareNostrum:

CURIE:



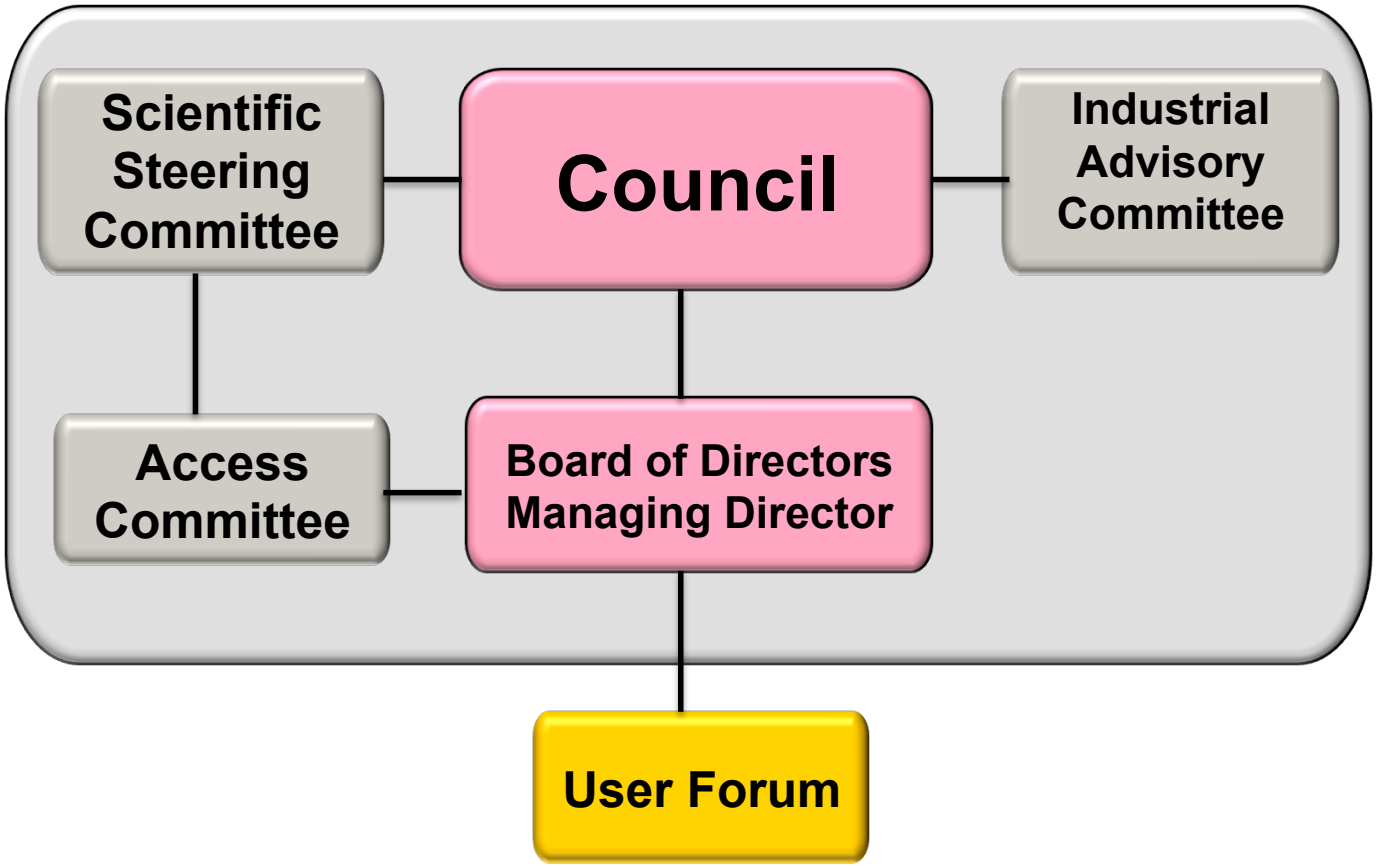
JUQUEEN:

SuperMUC:

HORNET:

FERMI:

PRACE AISBL governance



User and communities in the governance

❑ Scientific Steering Committee

- Responsible for giving opinions on all matters of a scientific and technical nature
- Proposes the members of the Access Committee
- Examples
  - Guides Peer Review Process
  - Steered Creation of Scientific Case
  - Gave advice on Programme Access, Cooperation with XSEDE, …
  - SSC Chair is member of the Board of Directors

❑ Industrial Advisory Committee

- Similar role for industrial users and their requirements

User and communities in the governance

❑ Access committee

- Giving opinions on the scientific use of Tier-0 Infrastructure
- Providing recommendations on the allocation of PRACE resources based on the Peer Review process

❑ User Forum

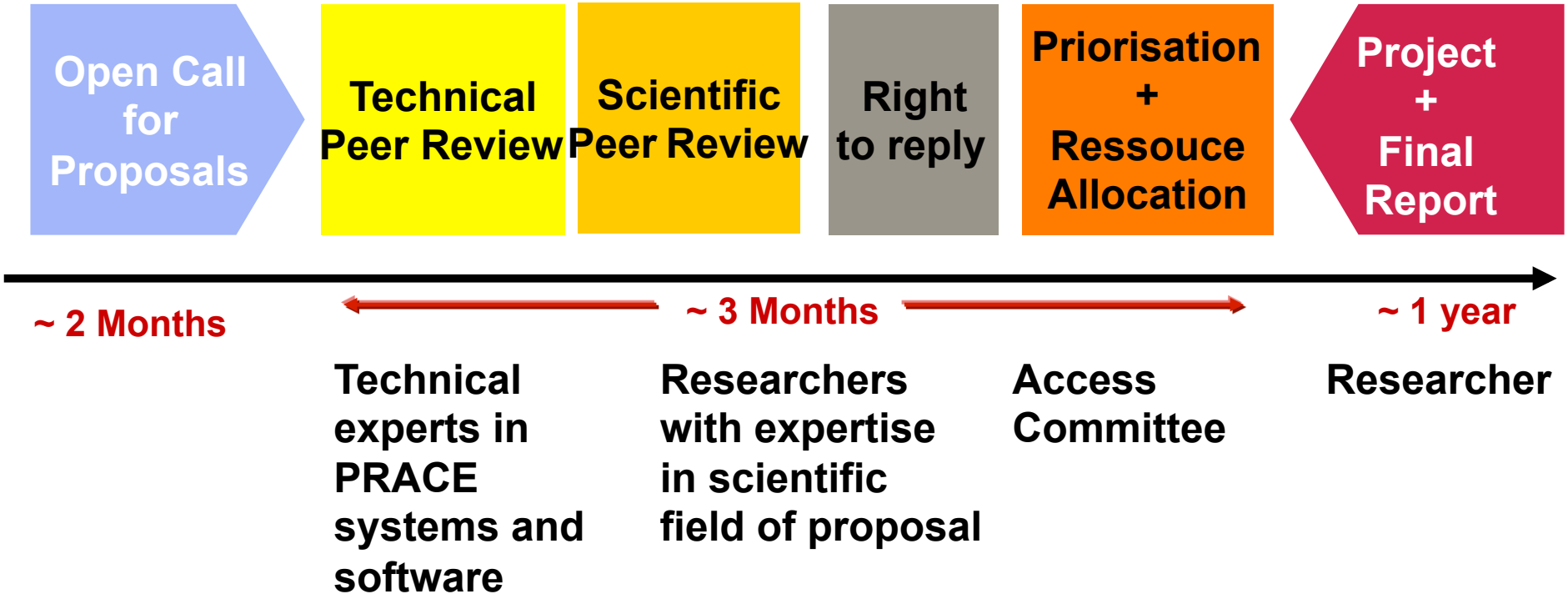
- Open to all (potential) PRACE users from academia and industry
- Main communication channel between HPC users and PRACE AISBL
- Interaction with members of the PRACE AISBL
- Discussion and issuing recommendations to PRACE AISBL
- Promoting HPC usage
- Fostering collaborations between user communities

PRACE peer-review access

- Free-of-charge, need to publish results at the end of the award period
- PRACE calls are open for international projects
- Types of resource allocations for scientists
  - **Project Access (every 6 months)**
    - For a specific project, award period 12 months
    - For individual researchers and research groups (no restriction of nationality for both researcher and centre)
    - Requires to demonstrate technical feasibility of project
  - **Multi-year access (up to 3 years)**
    - purpose: to ensure a stable and reliable minimum access to the necessary computational resources for large-scale, long term projects of very high scientific quality and with a broad European scope, importance and relevance
    - maximum of 20% of the total resources available for multi-year access
  - **Preparatory Access (quarterly cut-offs)**
    - Optionally with support from PRACE experts
    - Prepare proposals for Project Access

Criterion: Scientific Excellence

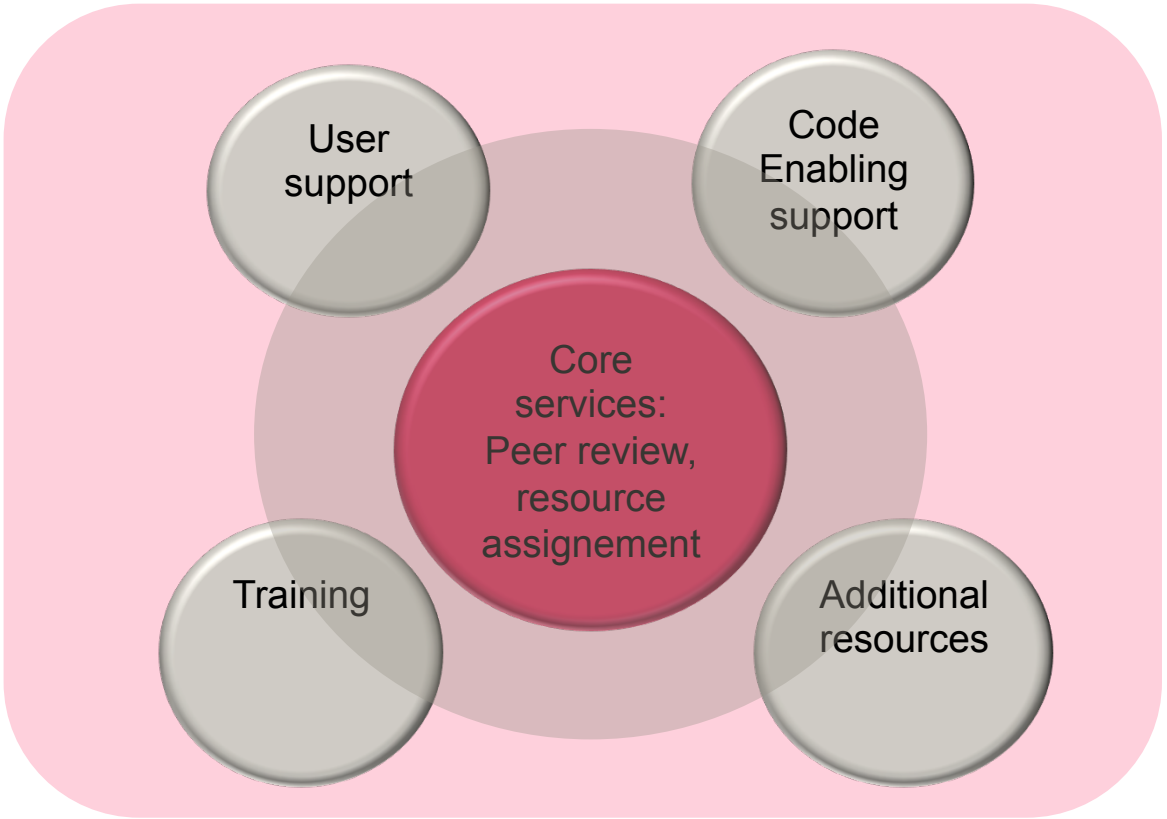
Project Access



Types of Access

	Preparatory	**Project**	**Multi-year**
Technical Assessment	Yes	Yes	Yes
Scientific Assessment	No	Yes	Yes
Mid-term Review	No	No	Potentially
Duration	6 months	12 months	36 months
Final Report	Technical	General	General

User oriented approach for the HPC ecosystem



Code enabling support, user support

- Support to users comes from the activity carried out by the PRACE 4IP project
- Typical access type: PA, SHAPE (industrial users), Tier-1 (DECI style)
- Preparing for exascale systems

Prototypal new services

- Urgent computing
- Link to large-scale scientific instruments
- Smart post processing tools including in situ visualisation
- Provision of repositories for European open source scientific libraries and applications

Support for storage needs of PRACE users

- PRACE HM centers provide the storage environment in terms of capacity focused on the life time of the awarded proposal (12 months)
- Present status:
  - Storage transfer to/from production: 20-100TB
  - Short term storage: scratch (20-200TB), work(1-200TB), home(max 100GB), archive(>100TB)
  - Access by dedicated PRACE network (based on 10Gb technology)
- Data have to be transferred within 2 months from end of project

Extending data support

- PRACE Call 11 includes a pilot for extending data infrastructure and services (joint call with a number of existing entities/organizations/centers)
- Users will have the possibility to access data facilities and services for medium-long term storage as additional rersources, free at point of use
- PRACE is open to collaboration with emerging and relevant players
- Interoperability and/or integration at service level is considered key factor

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Access open to industrial users since January 2012

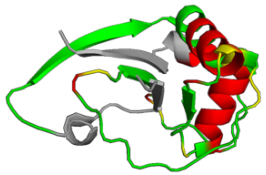
Access to leading-edge resources

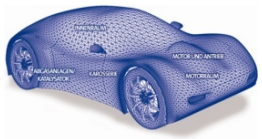
- **Regular Calls open to industry twice a year**
  - **free of charge**
  - based on scientific excellence only
  - commitment to **publish results** in publicly available media
  - 6 companies benefited from PRACE allocations for more than 100M cpu hours (SMEs, large companies, Private-Public Research Centers)
- **Permanent Preparatory Access call**
  - Assess the scalability and port the codes ➔ preparation for future regular calls
  - Large companies & SMEs

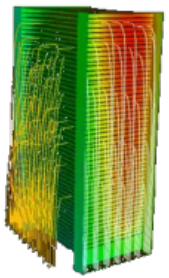
Access to high-value services

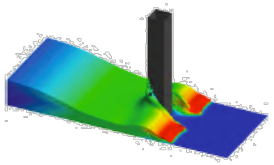
- **Access to new knowledge enabled through PRACE**
- **Training**
- **Code enabling**
- **Information, Promotion and Networking**

Since 2012: 12 companies
> 150 million CPU hours
More than half of them: SMEs









PRACE Open Competition
Most Innovative European Industrial HPC Application
5th PRACE Industrial Seminar
April 15-16, 2013, Stuttgart, Germany

PRACE Training

6 PRACE Advanced Training Centres (PATC):

- Barcelona Supercomputing Center (Spain)
- CINECA – Consorzio Interuniversitario (Italy)
- CSC – IT Center for Science Ltd (Finland)
- EPCC at the University of Edinburgh (UK)
- Gauss Centre for Supercomputing (Germany)
- Maison de la Simulation (France) are the first PRACE Advanced Training Centres.

PATC events:

from March 2012 until February 2014 (PATCs started in 2012)

125 events

2,733 participants

360 PATC training days

ALL PRACE training events

(including PATC courses, seasonal schools, workshops, International HPC Summer School, etc), since 2008/09:

4992 participants

197 training events

591 training days

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International Summer school on HPC, Hungary 2014: Challenges in Computational Sciences

Leading American, Canadian, European and Japanese computational scientists and HPC technologists offered instruction on a variety of topics:

- Access to EU, U.S., Japanese and Canadian HPC-infrastructures
- HPC challenges by discipline (e.g., bioinformatics, computer science, physics…)
- HPC Programming Proficiencies
- Performance analysis & profiling
- Algorithmic approaches & numerical libraries
- Data-intensive computing
- Scientific visualization

Sponsors:

PRACE

XSEDE
Extreme Science and Engineering Discovery Environment

RIKEN

compute • calcul
CANADA

Summer of HPC & Seasonal schools

- **Summer of HPC** is a PRACE programme that offers summer placements at HPC centres across Europe to late stage undergraduates and early stage postgraduate students. Up to ten top applicants from across Europe will be selected to participate. Participants will spend two months working on projects related to PRACE technical or industrial work and ideally produce a visualisation or video of their results.

- **PRACE Seasonal schools** (Autumn school/ Winter school) addresses existing and potential users of High Performance Computing systems in Europe. Researchers and students from Europe will receive advanced training in programming models and optimization techniques, MPI/ OpenMP and hybrid programming, profiling and benchmarking.

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PRACE

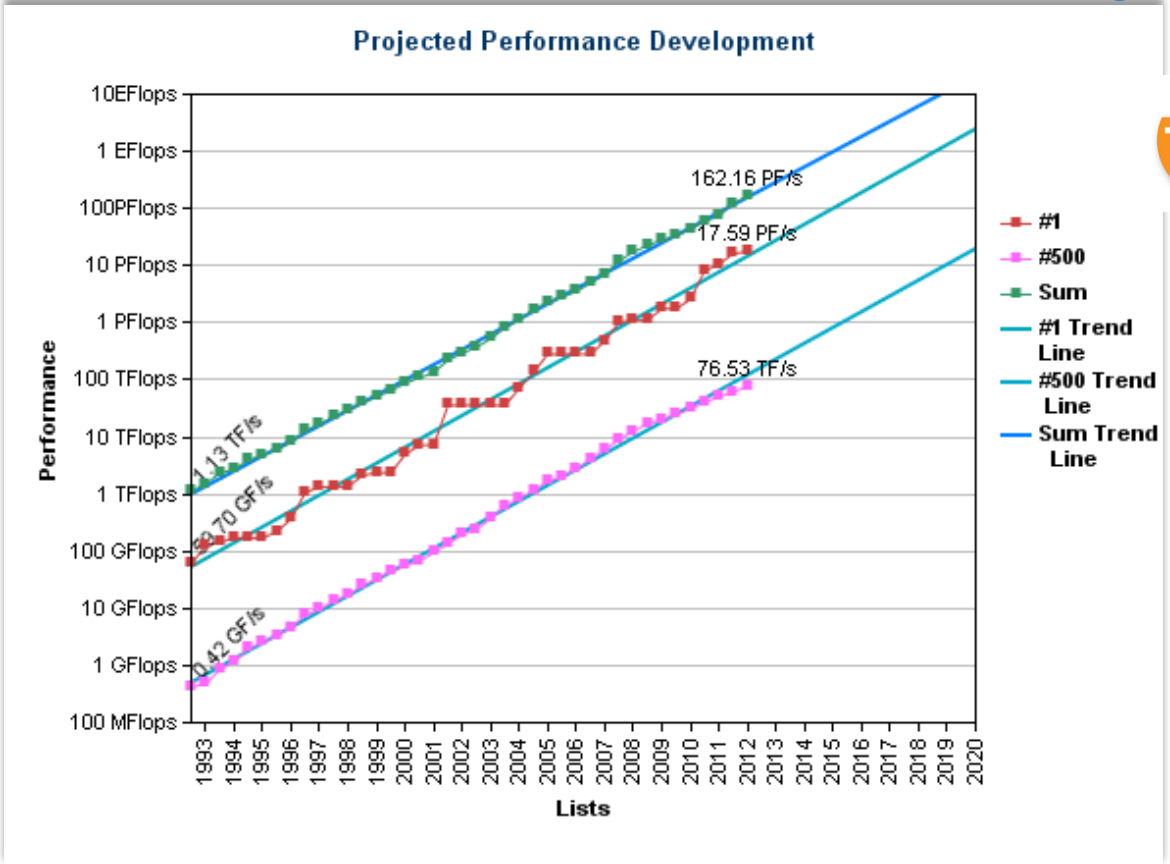
PRACE days15

enable Science foster Industry

26 - 28 May 2015, DUBLIN, IRELAND

IN CLOSING…

Technology cycle: A challenge in itself is the road to exascale and beyond



TOP500® SUPERCOMPUTER SITES

Strong issues in :

- ✓ Power consumption
- ✓ Data management
- ✓ Heterogeneity, …

But the real challenge = How to best use these machines in the future !

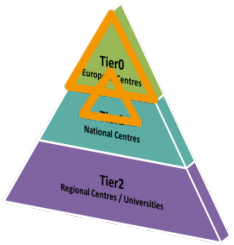
PRACE AISBL: strategy for persistency and long term sustainability

Scope of the EC H2020 HPC support

- Provision of seamless and efficient Tier-0 services adapted to the needs of different user classes
- Activities that build on national Tier-1 capabilities (training, service prototyping, software development etc.)

- Governance, business models and long term financial sustainability
- Strategy for deployment of world-class HPC environment

- Openness to new user communities and new applications, and Industrial take-up of HPC services in particular by SMEs
- Work in synergy with:
  - Centres of Excellence
  - European Technology Platform for HPC by providing specs for future exascale prototypes and systems
- Training and skills development



- Infrastructure based on 50 Pflop/s systems (minimum)
- 100 M€ minimum TCO

Services/Ecosystem

- Training
- Mobility program to users
- Code porting, application enabling
- Communication, dissemination
- New types of access

Thanks for your attention!

For more info see:

www.prace-ri.eu