Partnership for Advanced Computing in Europe

PRACE (and Industry)

Thomas Lippert, Forschungszentrum Jülich, April 16, 2012

Coordination PRACE 1IP – 2IP – 3IP

4th PRACE Industrial Seminar: HPC driving innovation in Europe, Bologna, Italy

CAPACITIES

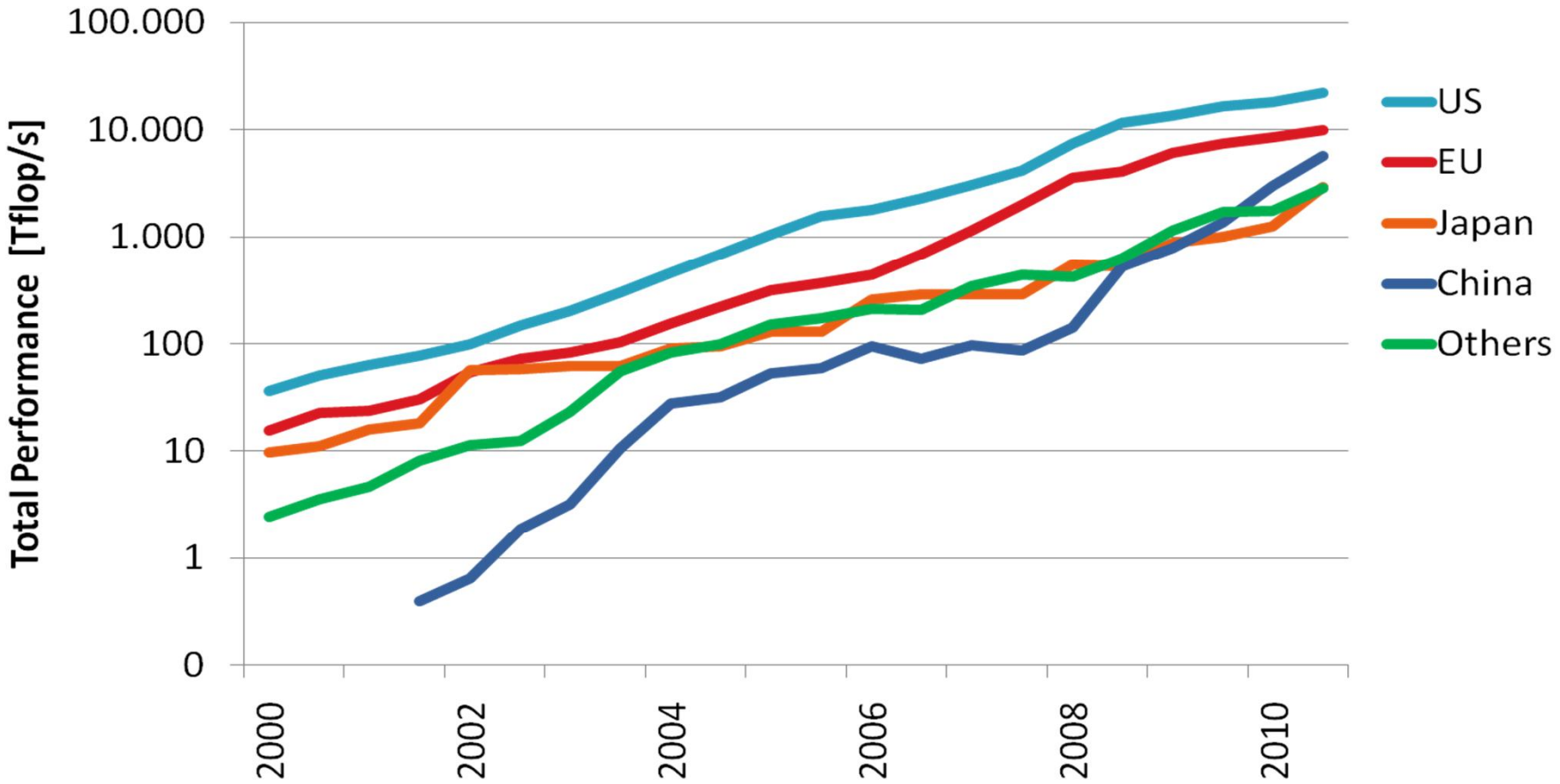
e-infrastructure

PRACE RATIONALE

Why Does Europe Need PRACE?

- **Europe must still increase its already high standards in computational science and computational engineering**
- **Europe has to guarantee independent access to HPC-systems of the highest performance class for all computational scientists as well as European industry**
- **EU and national governments are motivated through PRACE to establish robust and persistent funding schemes**
- **User requirements as to a variety of architectures will profit from harmonized procurements of high end systems**
- **Scientific Excellence requires peer review on European scale to motivate and foster best ideas and groups**

HPC performance of countries



History and Status

H
ESF
creat

How it all began:
2003: Richard Kenway and Hugh Pilcher-Clayton contacted the German Ministry of Research

Signature of the MoU

Creation of the PRACE Research Infrastructure

HPCEUR | HET | PRACE Initiative | PRACE RI

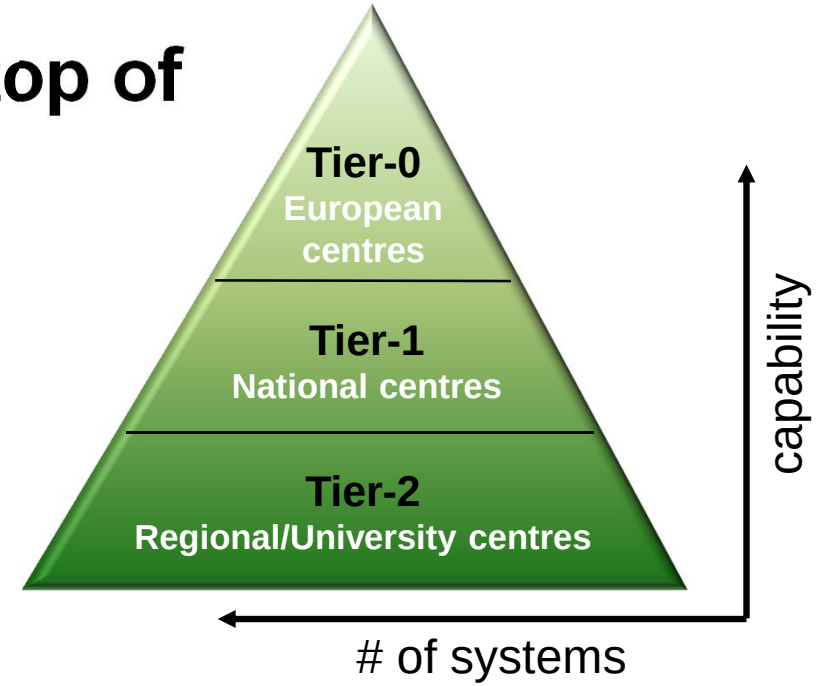
2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012

PRACE Preparatory Phase Project | PRACE-1IP | PRACE-3IP

PRACE-2IP

Realizing the ESFRI Vision for a HPC RI

- **European HPC-facilities at the top of an HPC provisioning pyramid**
  - Tier-0: European Centres
  - Tier-1: National Centres
  - Tier-2: Regional/University Centres
- **Creation of a European HPC ecosystem**
  - Uniting HPC service providers on all tiers
  - Addressing scientific and industrial user communities
  - Fostering the European HPC hardware and software industry
  - Supporting other e-Infrastructures

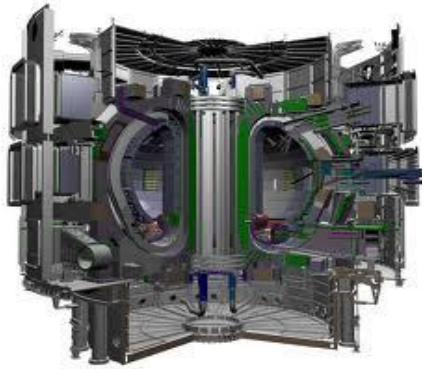


April, 23rd 2010 creation of the legal entity (AISBL) PRACE with seat location in Brussels, Belgium

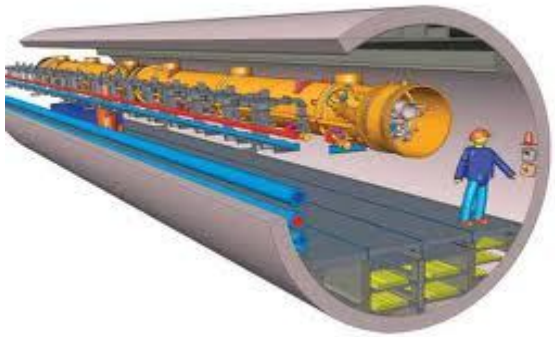
24 PRACE Members

68+ Million € from EC FP7 for preparatory and implementation
Grants INFSO-RI-211528, 261557, and 283493
Complemented by ~ 50 Million € from PRACE members

PRACE is not typical for an ESFRI-list item



- "Standard" ESFRI items: ITER, FAIR or XFEL
- National funding, EU member state contributions and operation by hosting European member state
- HPC ≠ **1** infrastructure, ≠ **1** experiment, ≠ **1** machine
- Several independent machines with different architectures in different countries
- The PRACE ecosystem structure is closer to industrial needs than many other ESFRI items
- → **PRACE challenges the ESFRI "culture"**

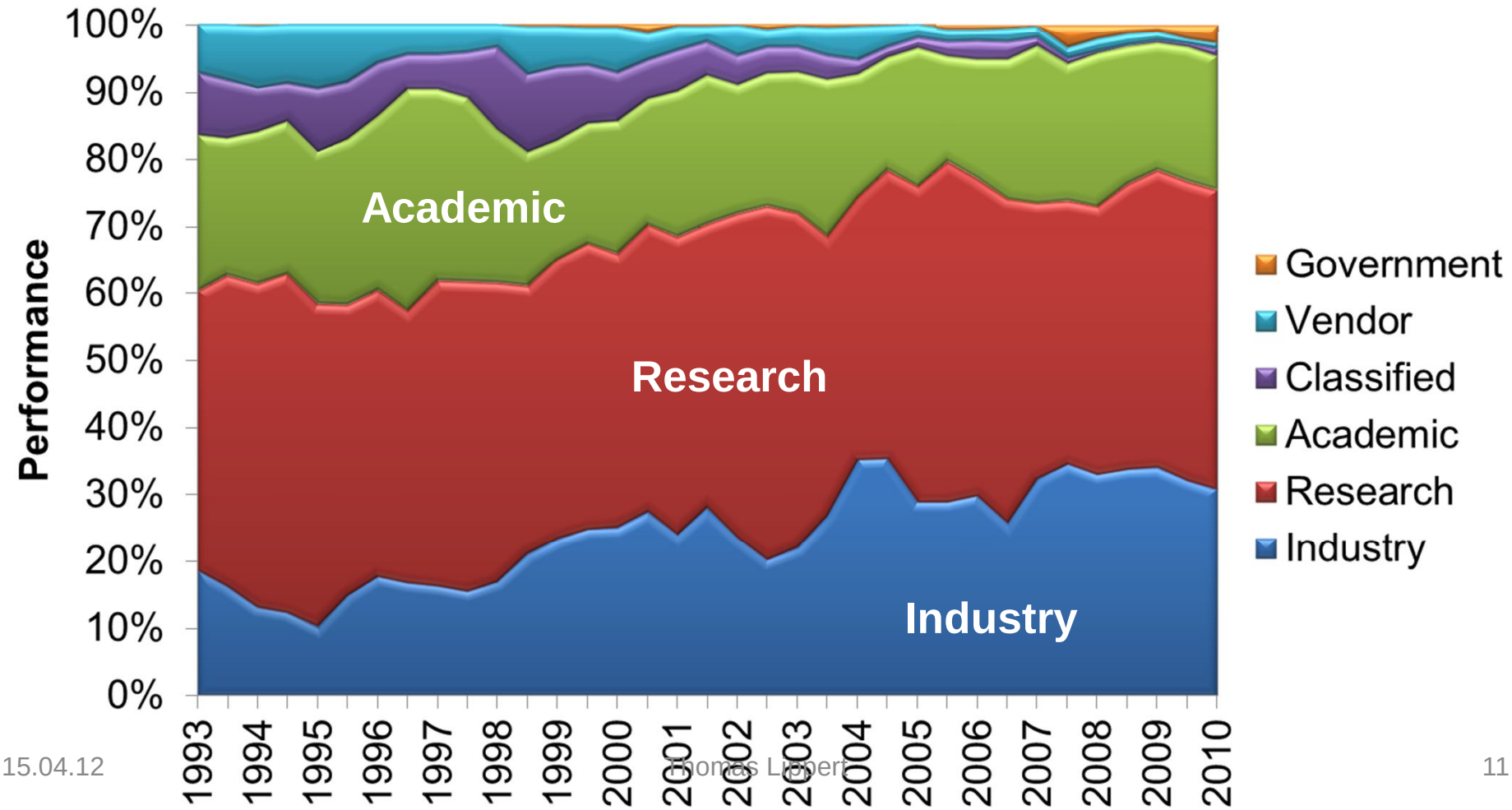


ADDED VALUE FOR INDUSTRY?

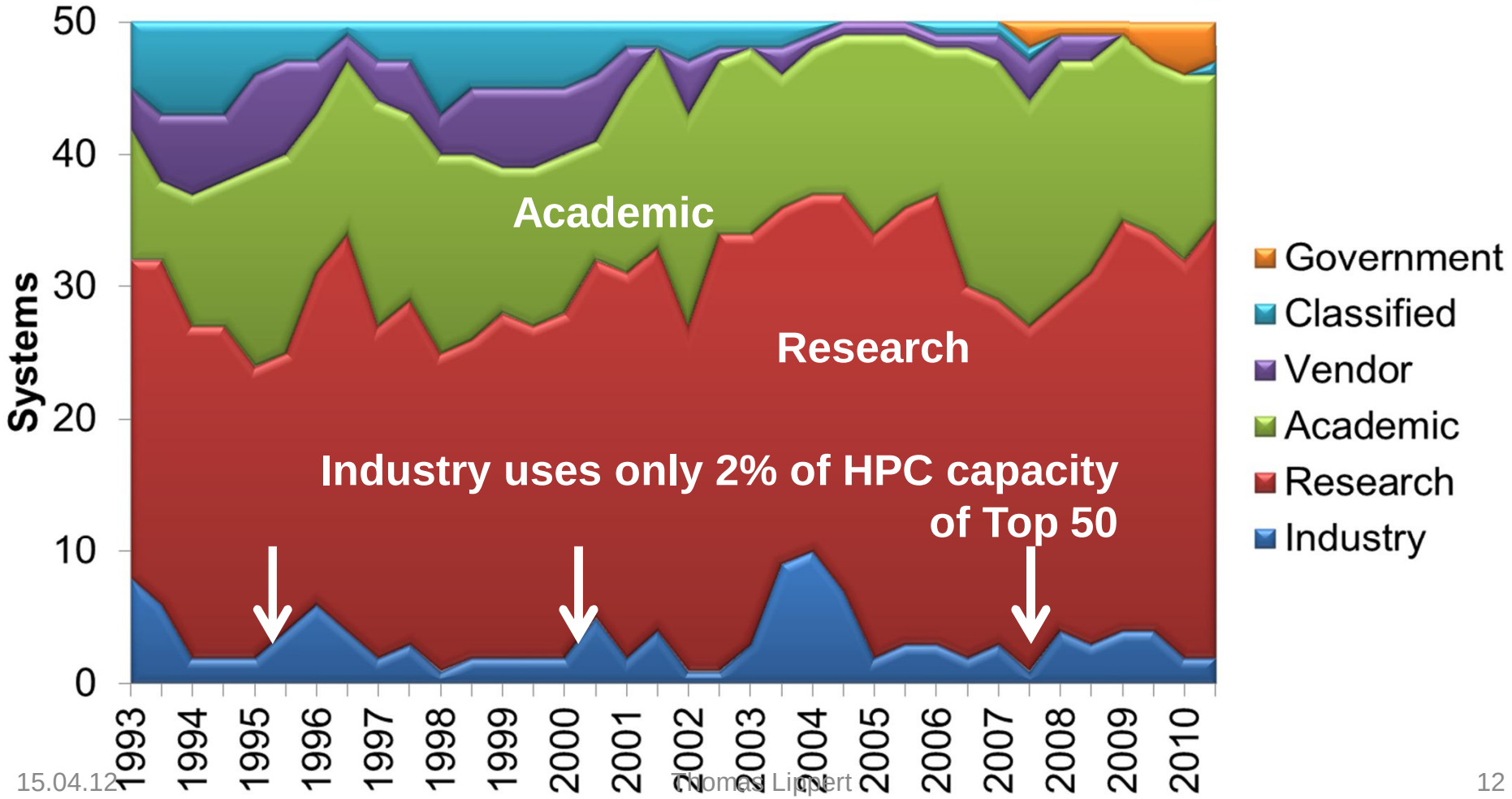
From Previous Seminars:

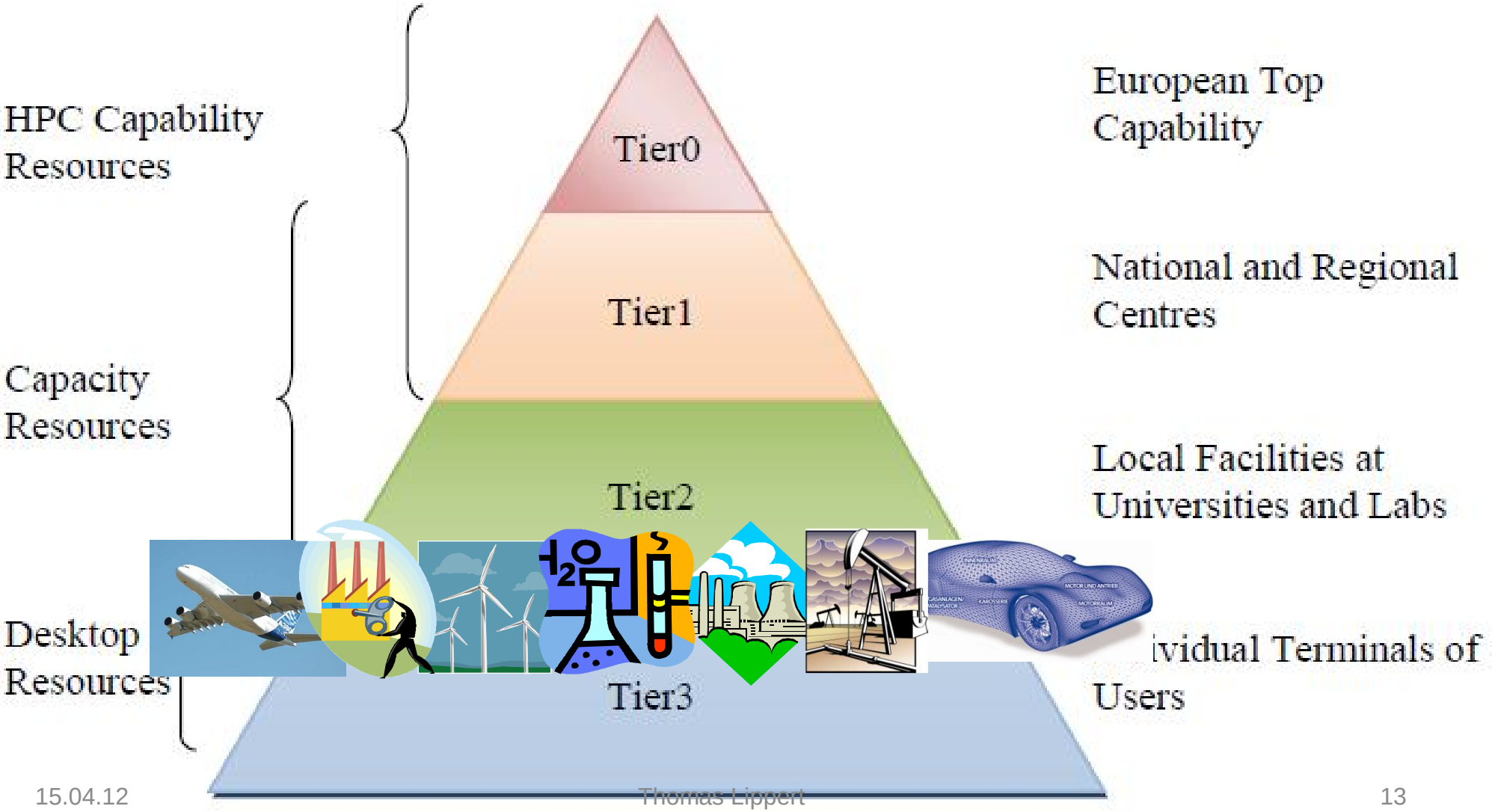
- **Jean-Francois Hamelin, EDF**
  - Why Petaflop/s to generate TeraWatts of Energy?
  - Planning 100 years ahead
  - Predictive simulations to narrow down design space
  - Industry needs well trained academics in HPC
- **Jesús Garcia San Luis, Repsol**
  - Oil exploration and Seismic Imaging are important examples: Marriage of HPC *and* data intensive computation
  - Limitation: computer resources *and* efficient applications

Customer Segments 1993-2010



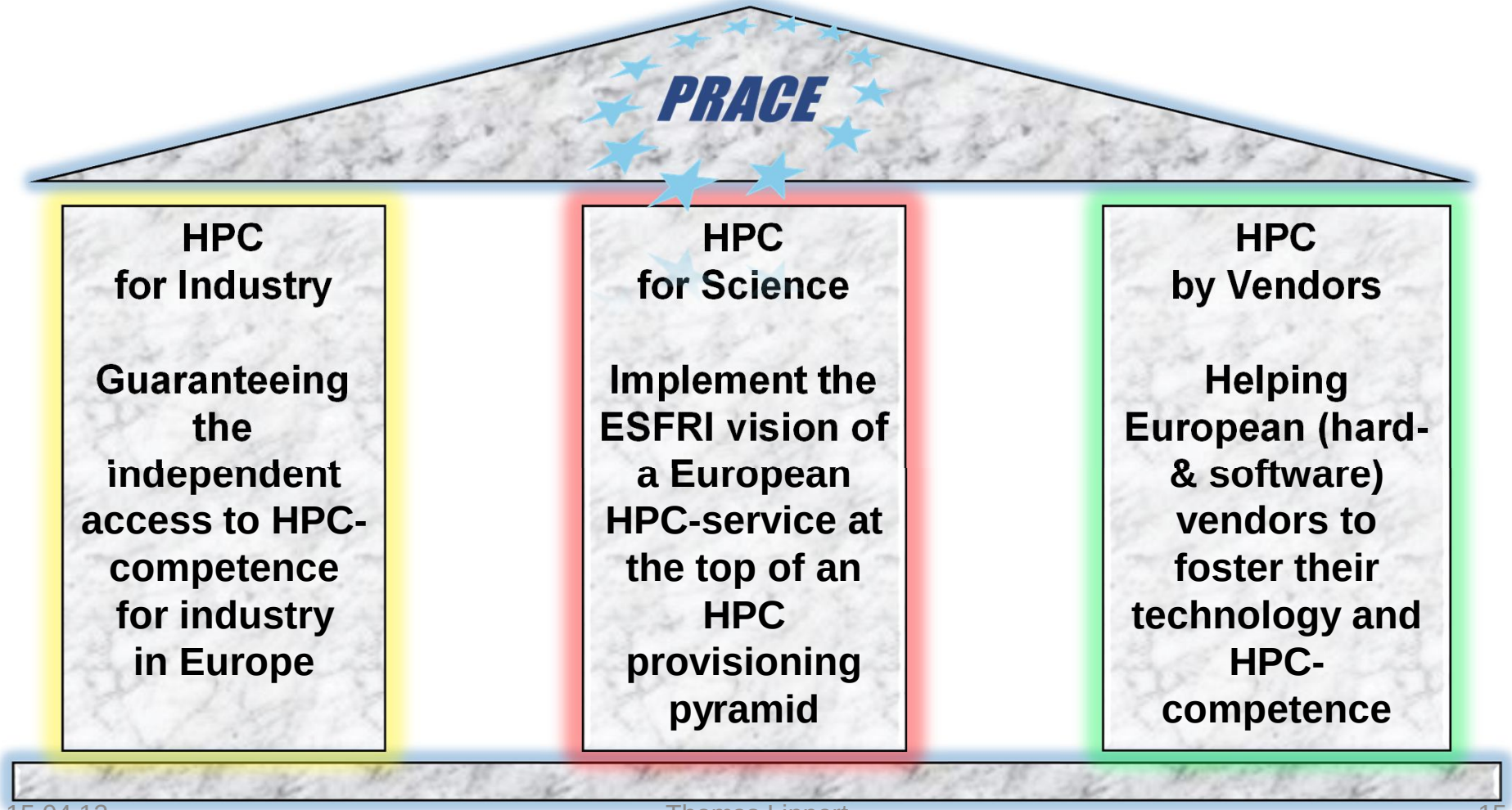
Customer Segments 1993-2010




HPC Capability Resources
Capacity Resources
Desktop Resources
Tier0
Tier1
Tier2
Tier3
European Top Capability
National and Regional Centres
Local Facilities at Universities and Labs
ividual Terminals of Users

THE PRACE MISSION

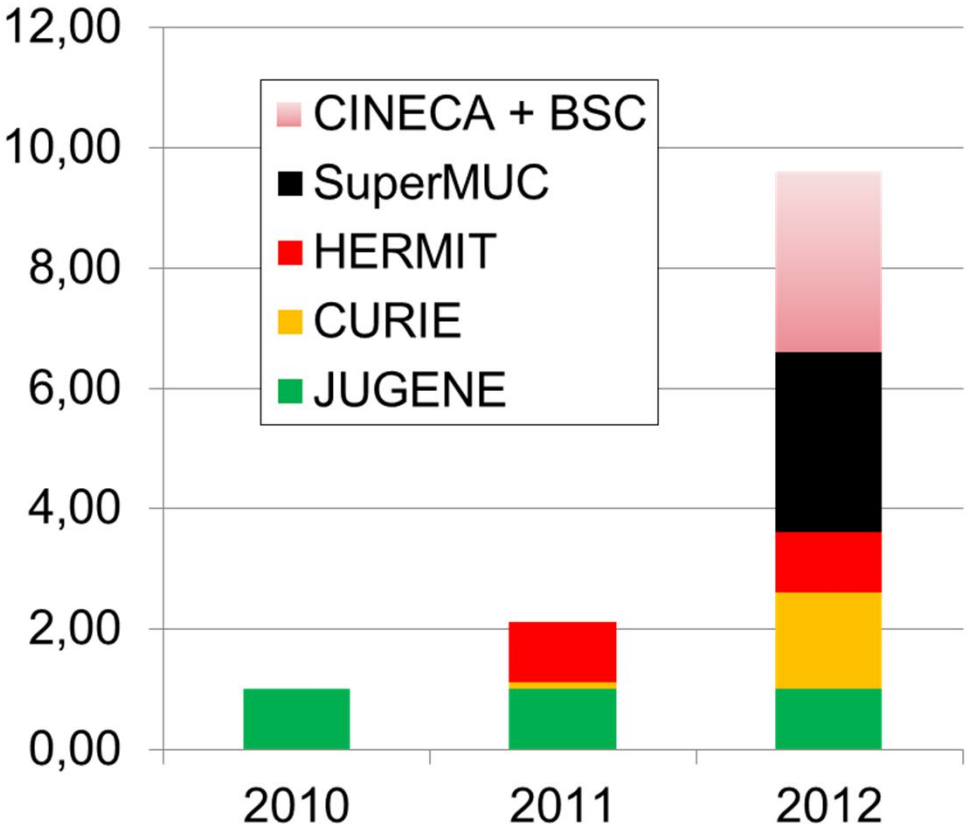
The Three Pillars of the PRACE Mission



Provision of Capacity and Access

- **Binding commitments: France, Germany, Italy, Spain**
  - GENCI – GCS (HLRS, JSC, LRZ) – CINECA – BSC
  - 100 Mio € over 5 years in terms of cycles
  - Contribution accounted as TCO
- **Access strictly by peer review at a European level**
  - Calls: 5/2010, 9/2010, 2/2011 .. .incl. DEISA call
  - Start of provision: 8/2010

PRACE Tier-0 Capability and Support



- Accumulated Tier-0 performance
  > 15 Pflop/s in 2013/14
- PRACE includes 18 Tier-1 systems with accumulated capability of > 2 PF (building on DEISA / DECI)
- PRACE provides capability support competence centres over several sites

High-End HPC Resources granted

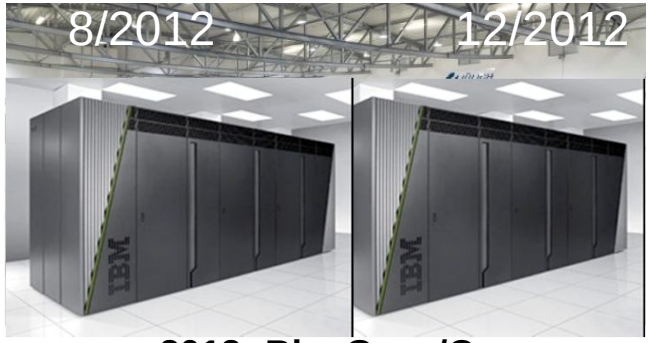
Year	TFlop/s years granted / to be granted	Provider
2005	6	DEISA
2006	6	DEISA
2007	15	DEISA
2008	24	DEISA
2009	30	DEISA
2010	**201**	PRACE
2011	**450**	PRACE
2012	**expect 1600**	PRACE
2013	**expect 3000**	PRACE

Tier-0 Petaflop-Capability in PRACE

➔ 2012: approx. 15 PF accumulated performance

BlueGene/P
PRACE@Jülich

Bull Cluster **Curie**
PRACE@GENCI:



2012: BlueGene/Q
PRACE@(CINECA & Jülich)

CRAY HERMIT
PRACE@HLRS

IBM SuperMUC
PRACE@LRZ

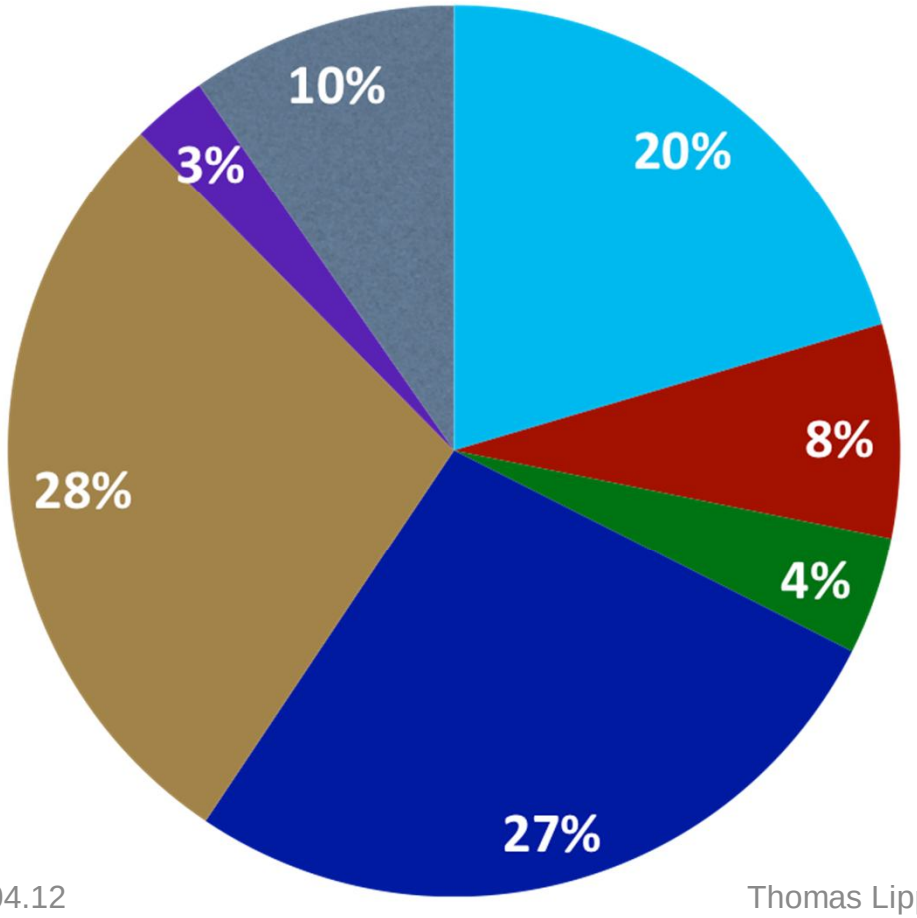
IBM in 2012
PRACE@BSC

Past project access calls for proposals (2 calls/year)

Call	Requested Hours (million core hours)	Requested Projects	Awarded Hours (million core hours)	Awarded projects
Early Access	1870	68	324	10
1st	2900	59	362	9
2nd	1250	47	398	17
3rd	1700	53	721	24
			=1000 TF/s*a	
total	**7720**	**227**	**1805**	**60**

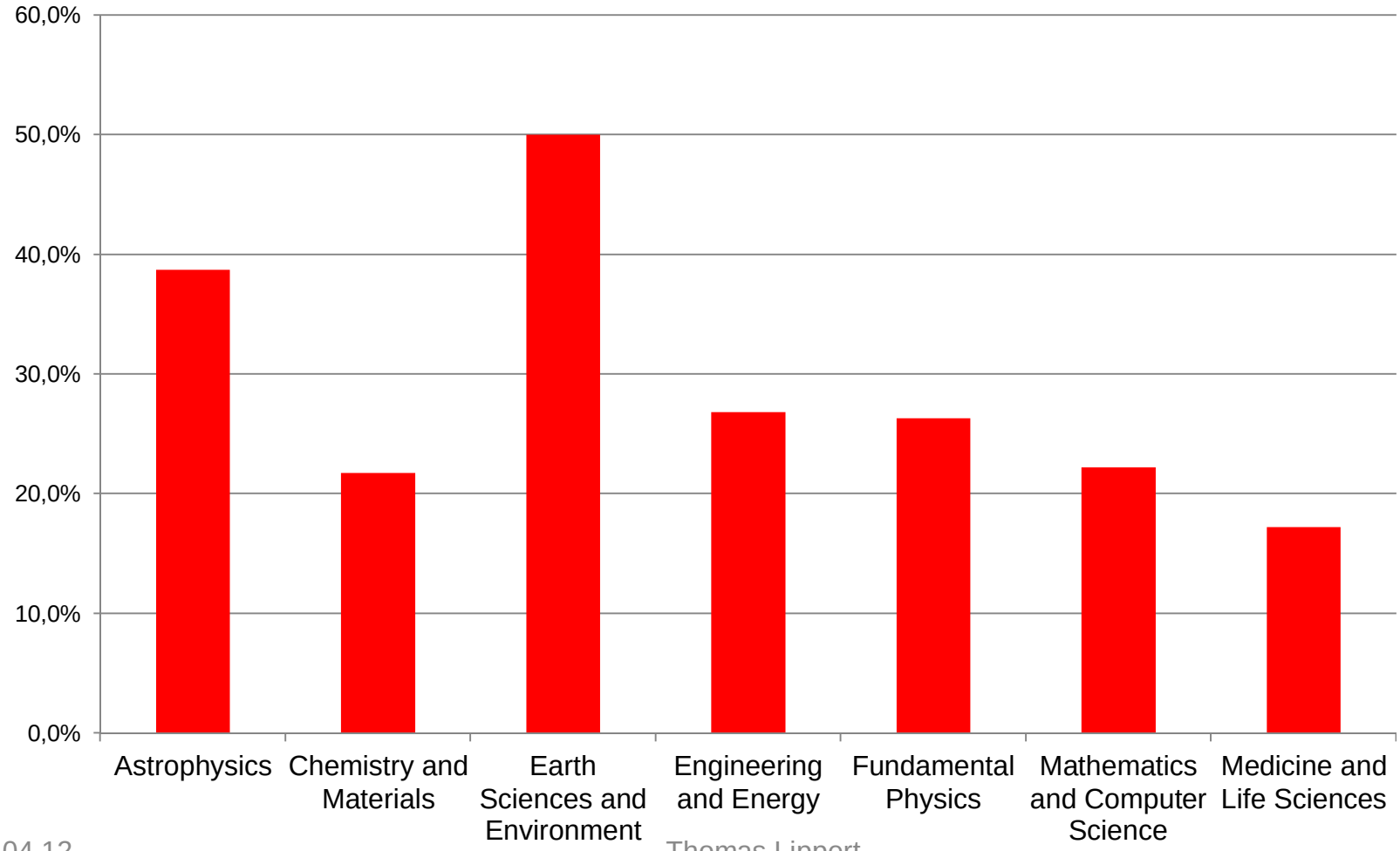
∅ = 30,1 million core hours/proposal

Fields of Provision



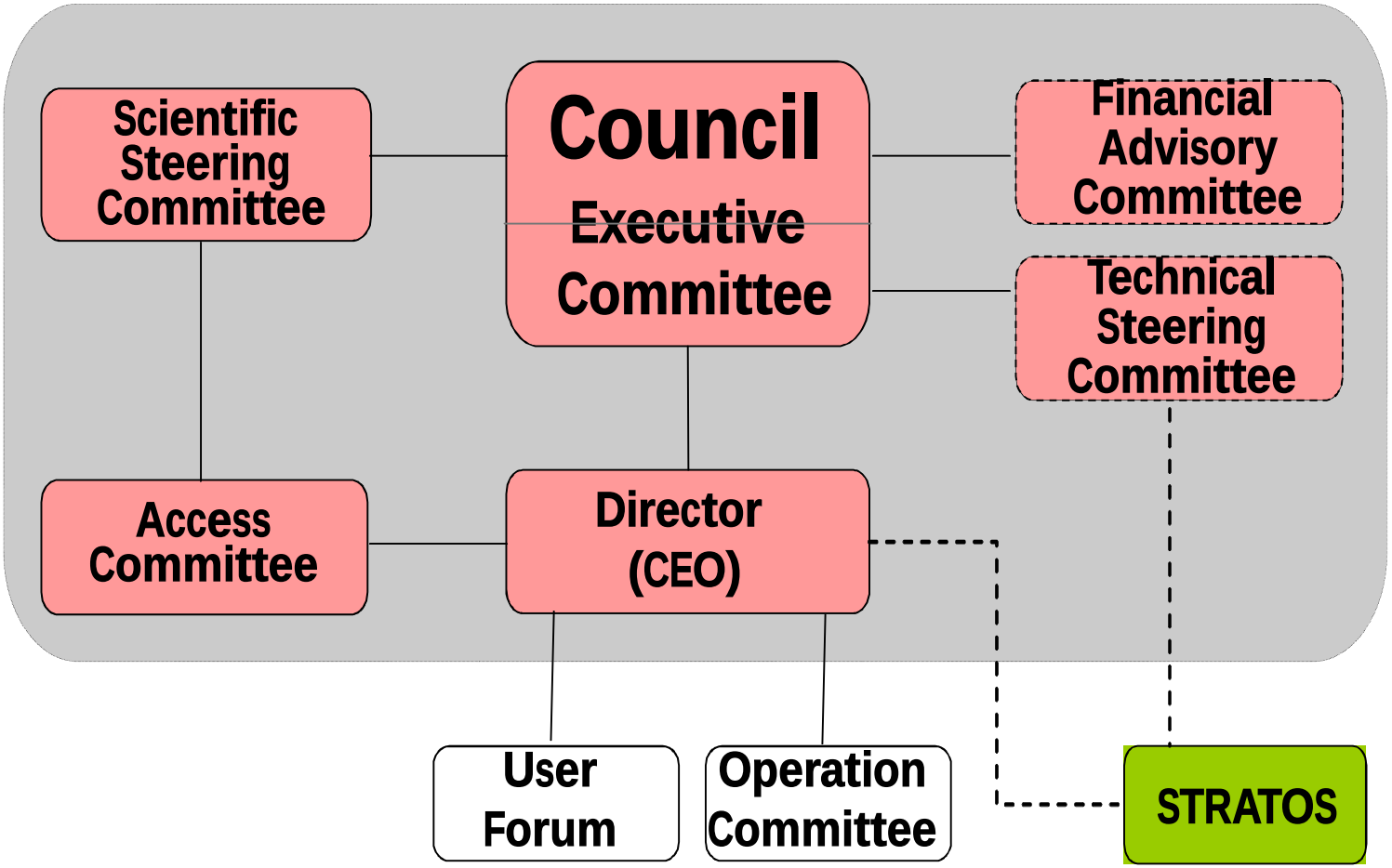
- Astrophysics
- Chemistry and Materials
- Earth Sciences and Environment
- Engineering and Energy
- Fundamental Physics
- Mathematics and Computer Science
- Medicine and Life Sciences

Success Ratio



PRACE ORGANIZATION AND ACCESS

Organization



PRACE Committees

- **Scientific Steering Committee**
  - User in driver's seat
  - Gives opinions on all matters of a scientific and technical nature
- **Access committee**
  - Gives advice on the scientific use of the Tier-0 Infrastructure
  - Provides recommendations on allocation of PRACE resources based on the Peer Review process
- **User Forum**
  - Open to all scientific and industrial user communities
  - Linkbetween users and PRACE AISBL

PRINCIPLES of ACCESS

- Transparency
- Expert assessment
- Confidentiality
- Right to reply
- Prioritisation
- Managing interests
- No parallel assessment with national organizations
- Ensure fairness to the research proposed

Types of Access

- **Preparatory access**
  - only technical peer review
- **Project access**
  - both technical and scientific peer review
- **Programme access (planned)**
  - both technical and scientific peer review
  - Important for well established communities and RIs

IMPLEMENTATION PROJECTS PP, 1IP, 2IP, 3IP

Preparatory Project

- 16 Partners (14 countries), funding 10 Million €
- 1.1.2008 – 30.6.2010, successfully finished
- **RESULT: Creation of PRACE AISBL – the European Research Infrastructure for HPC**

1st Implementation Project

- 21 partners (20 countries), funding 20 Million € by EC
- 1.7.2010 – 30.6.2012, running
- **Expected Results:**
  - **refinement of RI (operation)**
  - **improved application scaling**
  - **Definition of an industrial offer**

Update of PRACE Scientific Case in 1IP

The update is part of the 1IP Description of Work (WP 4)

„The requirements of user communities were gathered in a report ‘Scientific Case for European HPC Infrastructure’, which was published before the PRACE Preparatory Phase project started. This scientific case document will be updated during the implementation project to verify the current status.“

It will put more emphasis on socioeconomic challenges, business, and innovation than the original SC

2nd Implementation Project

- 22 partners (21 countries), funding 18 Million €
- 1.9.2011 – 31.8.2013, running
- Scaling of important user codes
- **Expected Results**
  - **Tier-1 Integration (DEISA → PRACE)**
  - **Scaling of important user codes**

3rd Implementation Project

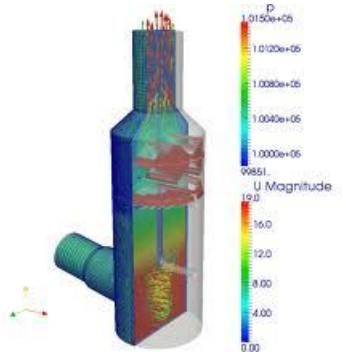
- 24 partners (23 countries), funding 19 Million €
- Mid 2012 – Mid 2014
- **Expected Results**
  - **invigorated industrial relations**

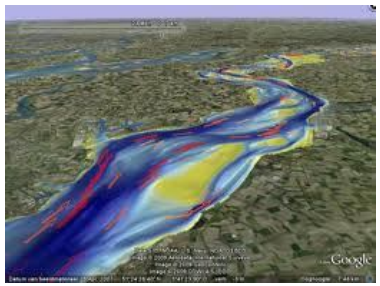
Implementation of Industry Offer in 2IP

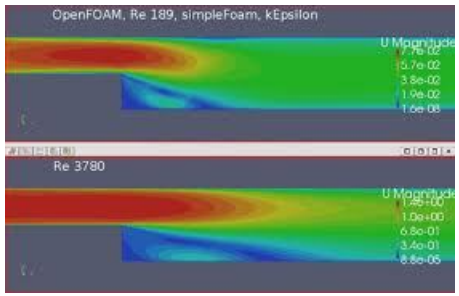
- Petascaling of open source codes interesting for industry together with industrial users
- Continuation and strengthening of relations with industrial users and ISVs
- Enabling of emerging applications of high potential impact on industrial research and innovation, but not yet ready for industrial production on PRACE systems

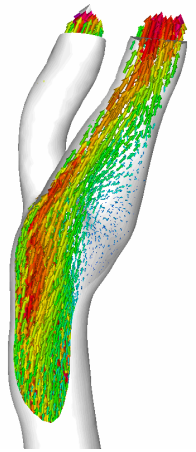
Prepare applications relevant to Industry in 2IP

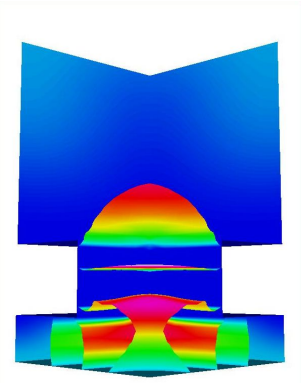
- OpenFOAM – Computational Fluid Dynamics
- Elmer – Multiphysics
- Delft3D – Hydrodynamics
- Fembio – Computational Biomechanics



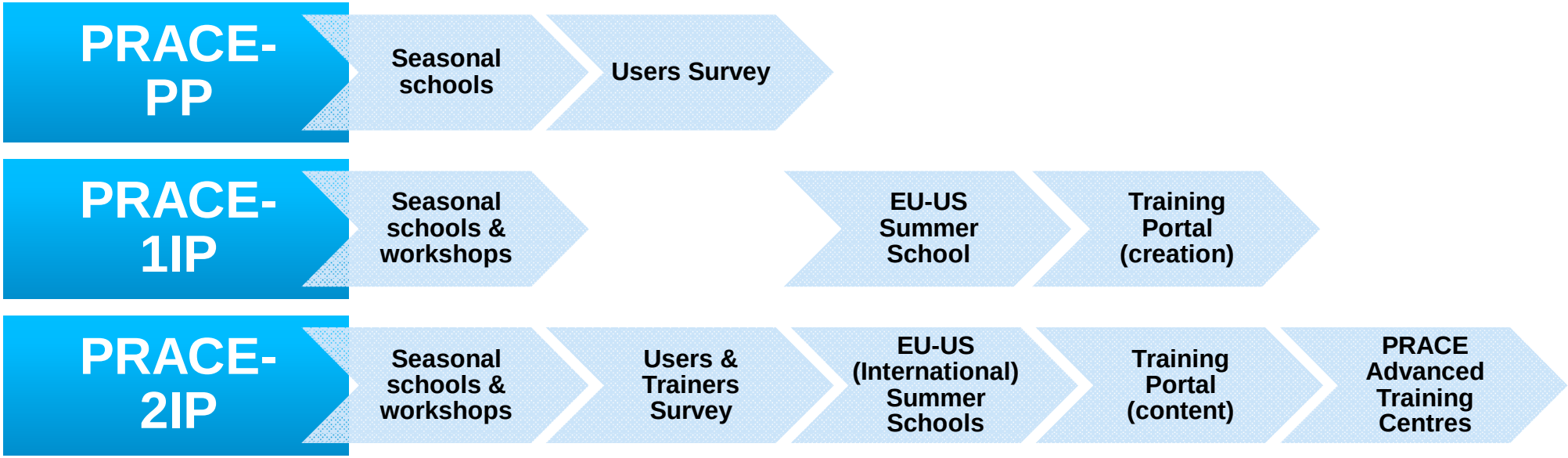








Training in PRACE



3IP Works on Plans to Include Service for Industrial Users and SMEs

WP5 of 3IP aims at

- building a comprehensive novel offer in order to engage industry and SMEs in HPC
- demonstrating the potential of HPC for their business
- fostering technology transfer from academia to industry
- providing coherent integrated services from training to access to funding opportunities to SMEs and industry

Level of Support and Resources for SME and Industry considered discussed:

Support

- Information services on HPC opportunities and offers
- Training through the 6 PATC (PRACE Advanced Training Centre) and Training portal
- Expertise from PRACE members in code enabling through preparatory access continuous calls (type B and C) in PRACE-2IP in WP7 and WP9
- Scientific support from academic and research organization related to PRACE members

Access to resources

- Open R&D access to Tier-0 systems by means of PRACE calls
- Open R&D access to Tier-1 systems before the end of PRACE-2IP
- Access to additional Tier-0/Tier-1 resources made available by partners that participate in the WP5 activity

Partnership
for Advanced Computing
in Europe

PRACE-1IP All-Hands -2IP Kick-Off, Barcelona 2011