



PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

E-Fiscal Summer Workshop - 3-4 July 2012

*The PRACE High Performance Computing infrastructure, Cost aspects
and sustainability perspectives*

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PRACE

The Partnership for Advance Computing in Europe is *the* European HPC Research Infrastructure

- PRACE enables world-class science through large scale simulations
- PRACE provides HPC services on leading edge capability systems on a diverse set of architectures
- PRACE operates up to six Tier-0 systems as a single entity including user and application support
 - International non-for-profit Association with seat in Brussels; 24 members
 - Systems funded by hosting members with 100 Million € / 5 years each
 - Currently France, Germany, Italy, Spain
- PRACE offers its resources through a single pan-European peer review process
 - Governed by an independent Scientific Steering Committee

Supercomputing Drives Science through Simulation



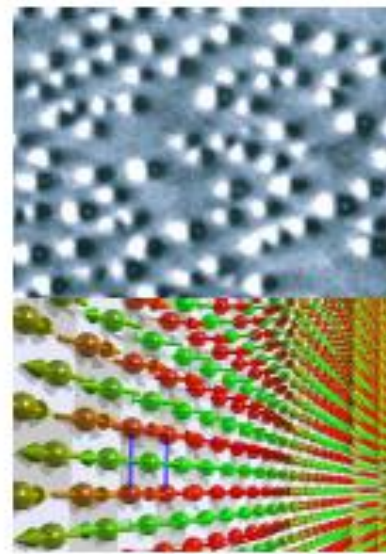
Environment

Weather/ Climatology
Pollution / Ozone Hole



Ageing Society

Medicine
Biology



Materials/ Inf. Tech

Spintronics
Nano-science



Energy

Plasma Physics
Fuel Cells

HPC on ESFRI Roadmap 2006

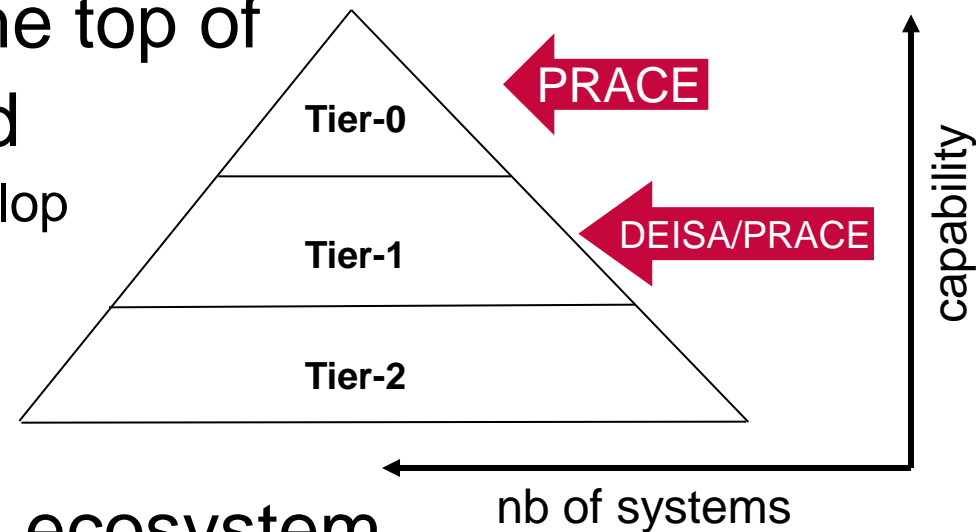


- First comprehensive definition of RIs at European level
- RIs are major pillars of the European Research Area
- A European HPC service
 - strategic competitiveness
 - attractiveness for researchers
 - access based on excellence
 - supporting industrial development

The ESFRI Vision for a European HPC service

- European HPC-facilities at the top of an HPC provisioning pyramid

- Tier-0: 6 European Centres for Petaflop
- Tier-1: National Centres
- Tier-2: Regional/University Centres



- Creation of a European HPC ecosystem

- Scientific and industrial user communities
- HPC service providers on all tiers
- Grid Infrastructures
- The European HPC hard- and software industry

Status and Achievements

- PRACE RI established as an international non-profit association (AISBL) in Brussels on April 23, 2010
 - 24 member states (and associated countries) involved
 - 400 Mio € from France, Germany, Italy, Spain for 2010-2015
 - 70+ Mio € from EC for preparatory + implementation phase projects
 - + membership fees

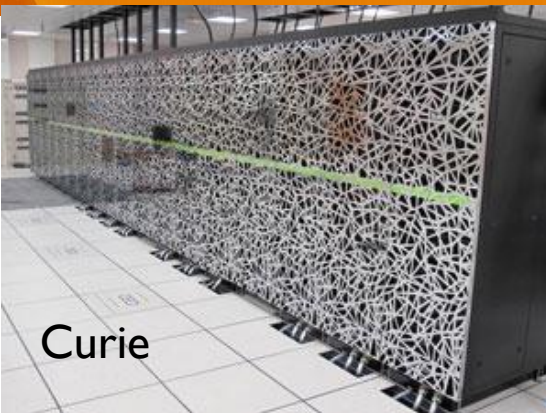


IBM BlueGene/P (FZJ)



Bull Bullx cluster "CURIE"

PARTNERSHIP
FOR ADVANCED COMPUTING
IN EUROPE



Curie



Hermit



Fermi



superMUC
Created by UIZ (2012)



Mare Nostrum



Top 500 - June 2012

- **R_{max}** and **R_{peak}** values are in TFlops
- Power data in KW for entire system

Rank	Site	Computer/Year Vendor	Cores	R _{max}	R _{peak}	Power
1	DOE/NNSA/LLNL, United States	Sequoia - BlueGene/Q, IBM	1572864	16324.75	20132.66	7890.0
2	RIKEN Advanced Institute for Computational Science (AICS), Japan	K computer, SPARC64 Fujitsu	705024	10510.00	11280.38	12659.9
3	DOE/SC/Argonne National Laboratory, United States	Mira - BlueGene/Q, IBM	786432	8162.38	10066.33	3945.0
4	Leibniz Rechenzentrum, Germany	SuperMUC - iDataPlex IBM	147456	2897.00	3185.05	3422.7
5	National Supercomputing Center in Tianjin, China	Tianhe-1A - NUDT	186368	2566.00	4701.00	4040.0
6	DOE/SC/Oak Ridge National Laboratory, United States	Jaguar - Cray XK6, Cray Inc.	298592	1941.00	2627.61	5142.0
7	CINECA, Italy	Fermi - BlueGene/Q, IBM	163840	1725.49	2097.15	821.9
8	Forschungszentrum Juelich (FZJ), Germany	JuQUEEN - BlueGene/Q, IBM	131072	1380.39	1677.72	657.5
9	CEA/TGCC-GENCI, France	Curie thin nodes - Bull	77184	1359.00	1667.17	2251.0
10	National Supercomputing Centre in Shenzhen (NSCS), China	Nebulae - Dawning	120640	1271.00	2984.30	2580.0

4
European
in TOP 10



Commitment : Provision capacity and access

- Binding commitments by Germany, France, Italy, Spain
 - 100 Mio € over 5 years in terms of cycles
 - Contribution accounted as TCO (Total Cost of Ownership)
- Access strictly by peer review at a European level
 - Early access call (April/May) – 5 months before allocation of resources 2010
 - Test / evaluation access
 - Project access – for a specific project, grant period ~ 1 year
 - Programme access – resources managed by a community
 - Free-of-charge for European scientific communities and for industries in case of open R&D

Detail of TCO calculation

- Investment costs taking into account the expected lifespan of
 - supercomputers, including installation costs;
 - related Information Technology (“IT”) equipment required for the operation (storage system, back-up and internal computer centre networks);
 - buildings;
 - technical facilities, including cooling, power supply
- Maintenance of the supercomputers and related IT equipment and software licenses, including vendor support for hardware and software;
- Maintenance of the buildings and technical facilities;
- Electricity charge, including the depreciation cost of the power line and main substation if needed;
- The staff, including management, computer centre operation, building and technical infrastructure support;
- Changes and upgrades that might be required during the first five years

Precision on PRACE costs items

- PRACE manages the in-kind contribution of each hosting member (100 M€ over 5 years)
- PRACE's contributions are mostly forecasts
- Resources provided by PRACE are operated by national centers
- Only a pourcentage of each computing system is open to PRACE for access
- A center can operate other computers than PRACE machines in the same building
- PRACE itself does not manage people in centers

PRACE provides a mutualisation of systems to build world class computer services to the key scientific and industrial communities in Europe



but PRACE does not manage directly the operational costs

Cost calculation : tier-0 means scaling-up

- The initial cost of the computer systems is higher
- The infrastructures have to be adapted
 - Securitised buildings
 - New computer rooms
 - Specific cooling systems
 - Specific electrical infrastructures
 - Powerful connectivities
- Depreciation costs are higher
- and run over different periods
 - 3 to 5 years for computers
 - ~25 years for buildings

Mutualisation is the
interest of PRACE

PRACE RI is operational and ramping up rapidly 5 calls already ended

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

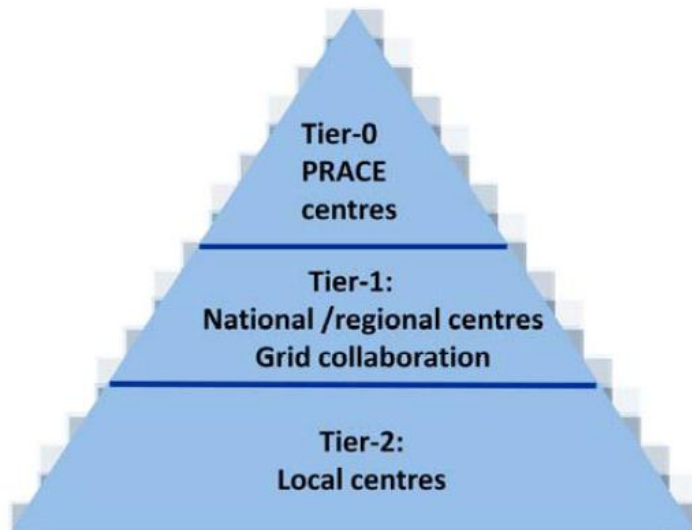
Call	Requested Hours (million core hours)	Requested Projects	Awarded Hours (million core hours)	Awarded projects
Early Access	1870	68	324	10
1st	2900	59	362	9
2nd	1250	47	398	17
3rd	1700	53	721	24
total	7720	227	1805	60



= 30,1 million core hours/proposal



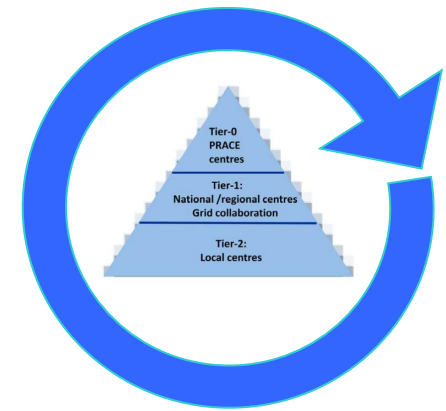
Consequences to e-fiscal study



- To detail the costs
 - Total cost, occupancy costs
 - Maintenance items
 - services
- To classify the centers answering the questionnaire in the pyramid
- To detail the usages in those centers
 - national vs european
 - Academic vs industrial
 - Use or service provider
- ... and services offered
 - Computing, pre-post treatment, visualisation
- To avoid the comparison HPC and cloud
- To detail the needs and types of users :
 - infrastructure for research and private providers have not comparable costs

Sustainability : matters to consider

- Strategy and missions : at european level / national level
- To make a coherent ecosystem from Tier 2 to Tier 0
- To build up a business model over the whole life cycle
 - Construction
 - Maintenance / upgrades
 - Operation
 - Occupancy
- To have a coherent development of services for research
- To have a coherent development of technical matters, soft and hardwares, academic training, staff management
- To coordinate the access
- To find the best performance indicators
 - For access, for innovation
 - Metrics of success, return on investment, quality level



How to tackle those issues in e-Fiscal ?



Questions ?

Thank you