

# Výpočetní zdroje IT4Innovations a PRACE pro využití ve vědě a výzkumu



## IT4Innovations Centrum excellence

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EVROPSKÁ UNIE  
EVROPSKÝ FOND PRO REGIONÁLNÍ ROZVOJ  
INVESTICE DO VAŠÍ BUDOUCNOSTI



# Introduction I

**Project objectives:** to establish a centre focused on research in the field of IT with emphasis on development of HPC

## 3 basic project levels:

1. Resources management – creating a functioning research centre
2. Research programmes implementation
3. Acquisition of research infrastructure – particularly supercomputing facilities



# Introduction II

**Implementation period for the grant-covered part of the project:**

July 2011 to December 2015

**EU+MEYS grant:** over 75 million EUR

**Principal stages:**

7/11 – start of implementation

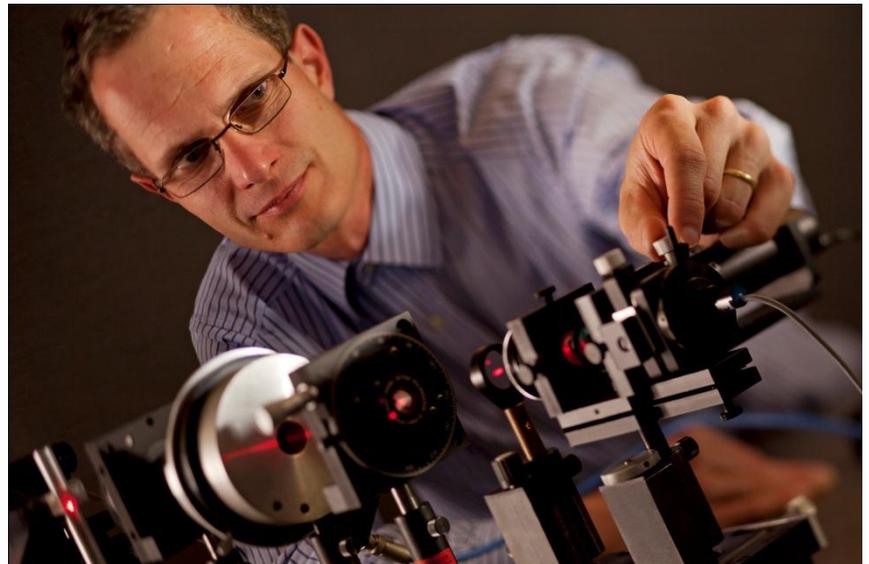
9/11 – start of research programmes

III.Q/12 – acquisition of “small cluster” – container solution

I.Q/13 – ”small cluster” ready for utilization by external academic institutions

2014 – installation of “big cluster” in the new building

2015 – full operation of IT4I centre



# Research areas and programmes

## Information Technologies for People - IT4People

- RP1 IT for Disaster and Traffic Management – VSB - TUO
- RP7 Multimedia Information Recognition and Presentation – BUT

## Supercomputing for Industry - SC4Industry

- RP2 Numerical Modelling for Engineering – VSB-TUO and IG AS
- RP3 Libraries for Parallel Computing – VSB - TUO
- RP4 Modelling for Nanotechnologies – VSB-TUO

## Theory for Information Technologies - Theory4IT

- RP5 IT for Knowledge Management – VSB - TUO
- RP6 Soft Computing Methods with Supercomputer Applications – UO
- RP8 Secure and Safe Architectures, Networks, and Protocols – BUT

All the partners - VSB-TUO (Technical University of Ostrava), BUT (Brno University of Technology), OU (University of Ostrava), SU (Silesian University) and IG AS (Institute of Geonics) – cooperates within these programmes.

# IT infrastructure: HW 2012

## “small cluster“

- X86 cluster, 4096 cores, 4GB RAM / core, Infiniband QDR (non-blocking topology)
- GPU accelerated nodes

## storage capacity

- ca. 1 PB storage (5/20/75 % cap. SAS/SATA/tape – HSM)

## system ALADIN

- arch. x86/Power, 26 TFLOP/S, up to 5 PB storage (5/20/75 %), most likely SMP/NUMA



# Resources management

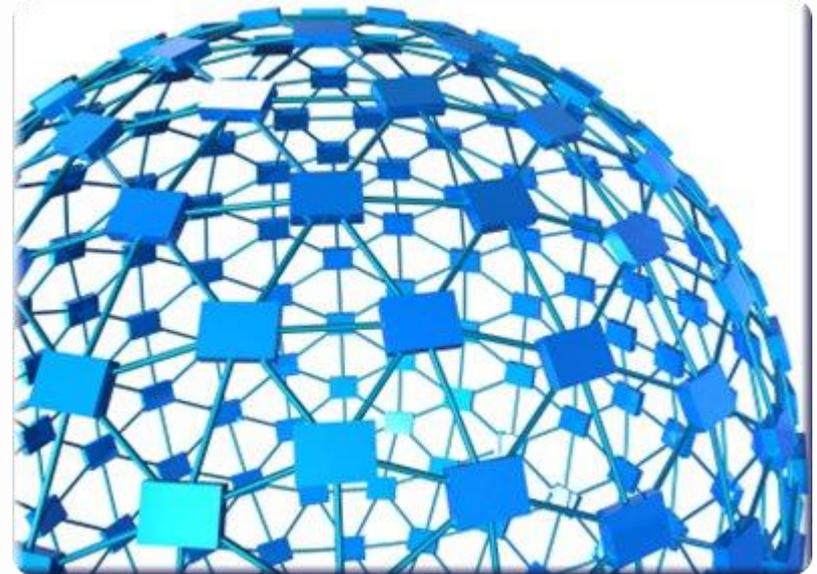
**= Business model**

**50% internal access for own research programmes**

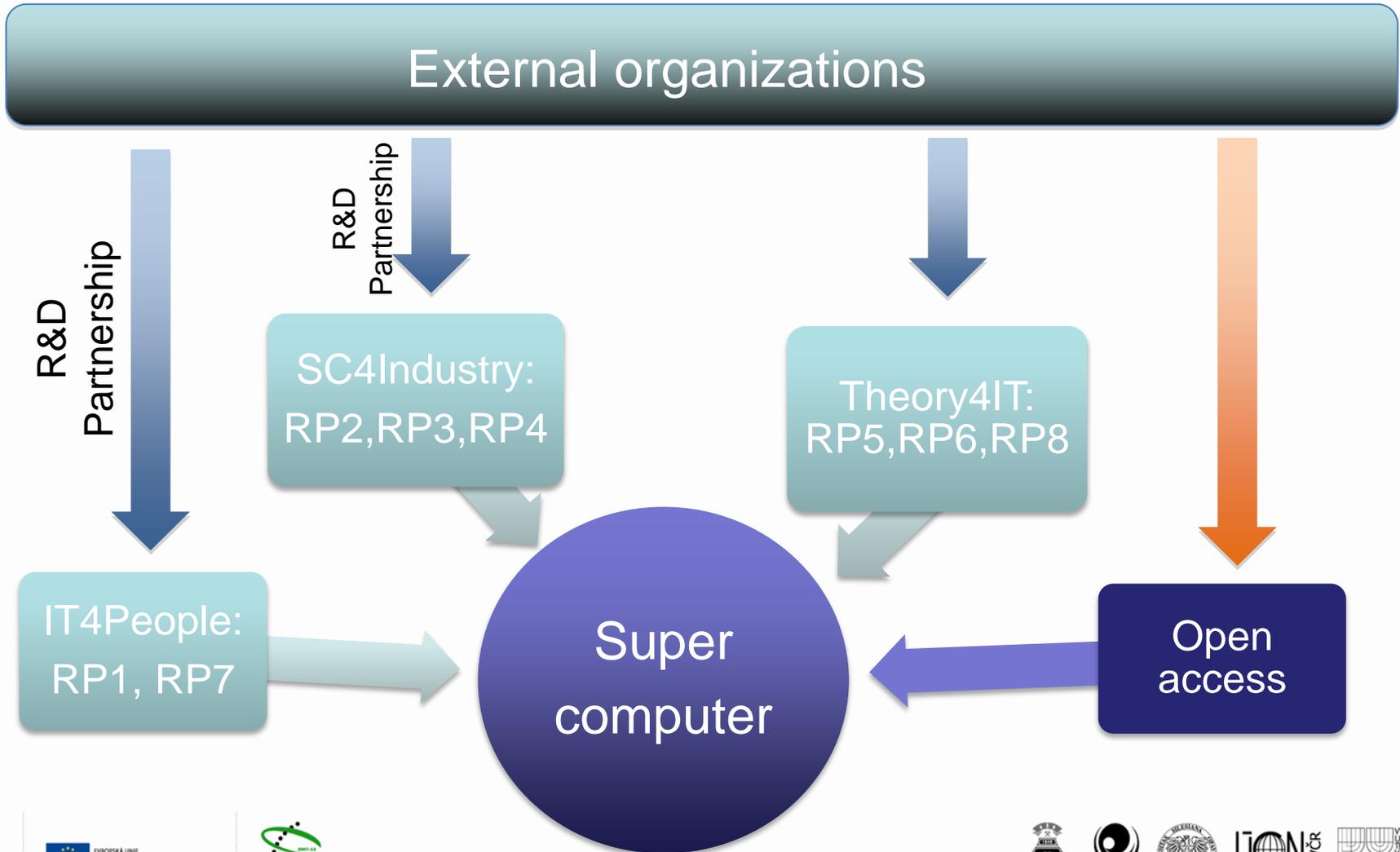
**30% open access for external institutions**

- access based on “grant” competition

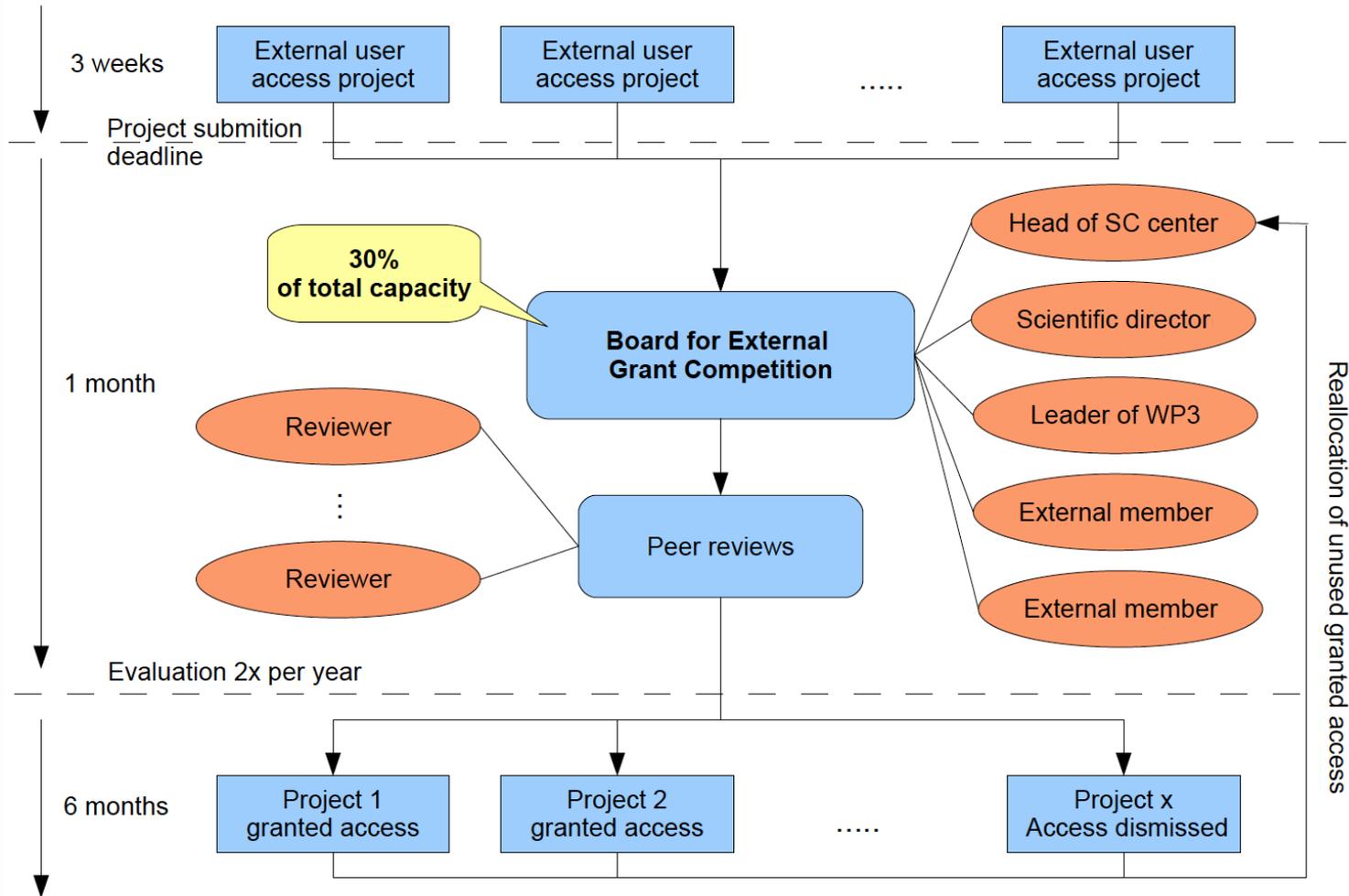
**20% dedicated access for projects of national importance**



# Resources access



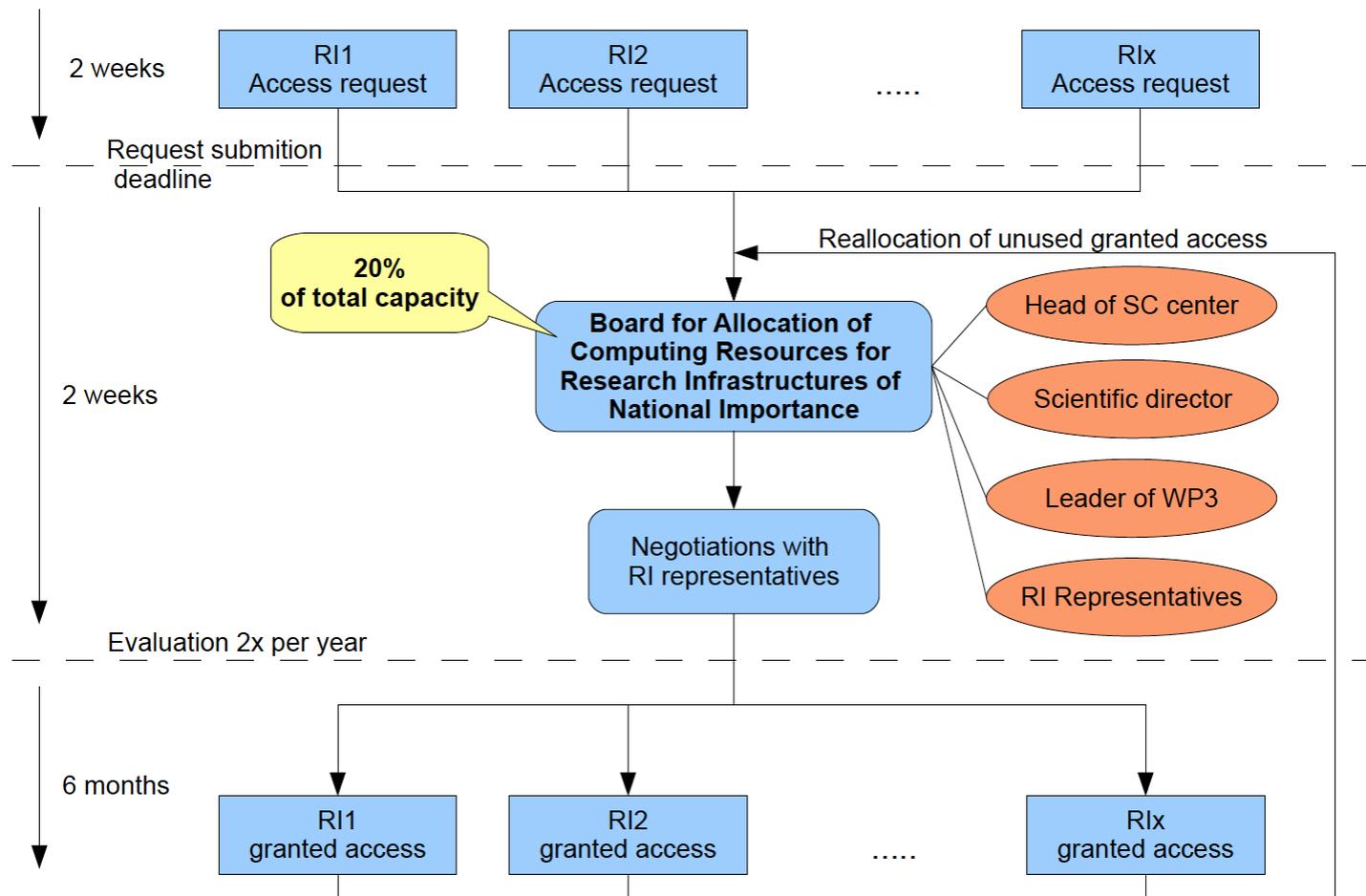
# External users access scheme



# External open access

- Types of allocations
  - Small ( up to 5.000 bu per month + 10GB disk storage)
    - Testing purposes, evaluation 4x per year, no peer review
  - Medium ( up to 50.000 bu per month + 50GB disk storage)
    - Advanced projects for parallel computing, 4x per year, no peer review, possible sharing of operational cost
  - Large ( up to 500.000 bu per month + individual disk storage requirements)
    - Large projects for parallel computing, 2x per year, peer review, possible sharing of operational cost
  - Grand Challenge ( more than 500.000 bu per month)
    - Possible use of PRACE resources)
  - 1 bu = 1 Billing Unit = 1 core hour

# Dedicated access scheme





# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE





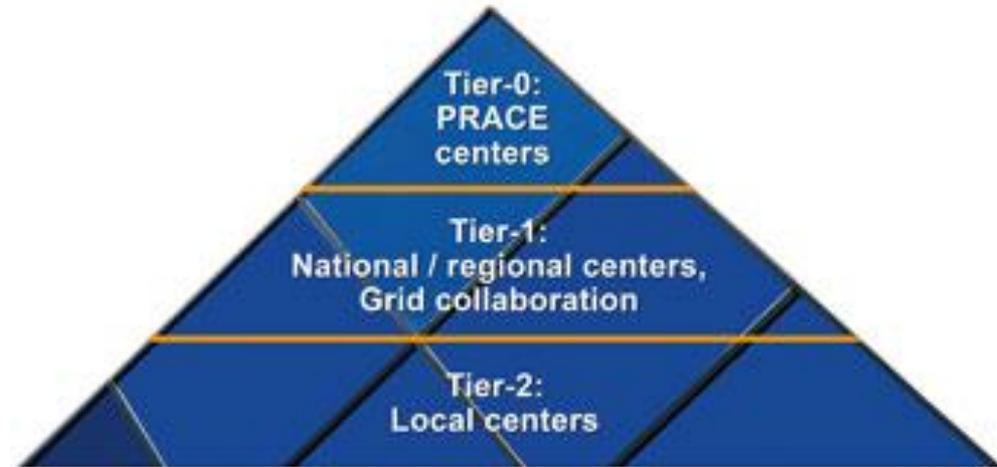
## PRACE

# 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
- PRACE offers its resources through a single pan-European peer review process
- PRACE is providing services since August 2010
- The first Tier-0 system is the fastest supercomputer in Europe

## The European HPC Ecosystem

- PRACE prepares the creation of a persistent pan-European HPC service, consisting of several tier-0 centres providing European researchers with access to capability computers and forming the top level of the European HPC ecosystem.
- Since 2010 – Czech Republic member of PRACE
- IT4Innovations – Tier-1 system in European HPC Ecosystem



## Current status

- 21 European countries are currently part of PRACE
- 4 hosting partners
- The PRACE first implementation phase started on July 1. 2010
- The PRACE second implementation phase started on September 1. 2011



## PRACE RI – Tier-0 Systems

- The first production system, a 1 Petaflop/s IBM BlueGene/P (**JUGENE**) at GCS (Gauss Centre for Supercomputing) partner FZJ (Forschungszentrum Jülich) is available for European scientists.
- The second production system called **CURIE** at CEA-GENCI by Bull has been available for European scientists since January 2011. It will reach its full capacity of 1.6 Petaflop/s by late 2011.
- The third production system, a 1 Petaflop/s Cray (**HERMIT**) at GCS partner HLRS (High Performance Computing Center Stuttgart) will be available for European scientists by the end of 2011 with an upgrade to 4-5 Petaflop/s in 2013.
- The fourth production system, a 3 Petaflop/s IBM (**SuperMUC**) at GCS partner LRZ (Leibniz-Rechenzentrum) will be available for European scientists starting in mid 2012.
- Italy (CINECA) has announced the deployment of its Tier-0 systems for 2012 (FERMI), and Spain will follow in 2013.

## PRACE RI – Tier-1 Systems

- IBM Blue Gene/P
- Cray XT and XE
- IBM Power 6
- range of large clusters including GPU resources made available from Finland, France, Germany, Ireland, Italy, Poland, Sweden, The Netherlands, Serbia, Switzerland, Turkey, and United Kingdom. Czech republic will join in 2012.



## Accessing the PRACE RI

### Access Model

- Proposals are evaluated in a single European peer review process governed by the PRACE Scientific Steering Committee.
- Three types of resource allocations
  - Test / evaluation Preparatory access
  - **Project access – for a specific project, grant period ~ 1 year**
  - Programme access – resources managed by a community
- Free-of-charge

### Funding

- Mainly national funding through partner countries
- European contribution
- Access model has to respect national interests (ROI)

## Project access calls for proposals

- Access to PRACE resources is open to researchers from European academic institutions and industry
- The first combined call for Tier-0 and Tier-1 resources was open
  - The main target of the PRACE-2IP project is to merge Tier-1 services into the PRACE Research Infrastructure; these were previously provided by the DEISA projects (Distributed European Infrastructure for Supercomputing Applications).
- Find out more at

<http://www.prace-ri.eu/hpc-access>

## DECI calls for TIER-1

- DECI enables European researchers to obtain access to the most powerful national (Tier-1) computing resources in Europe, regardless of their country of origin or work and to enhance the impact of European science and technology at the highest level. Proposals must deal with complex, demanding, innovative simulations that would not be possible without Tier-1 access.
- Please note that in addition to offering access to computing resources, applications-enabling assistance from experts at the leading European HPC centres is offered to enable projects to be run on the most appropriate Tier 1 platforms in PRACE.



## DECI call Proposal Form

- General information
  - Names
  - Contacts
  - Descriptions
  - summary
- Requests
  - Computer resources (CPU hours)
  - Architecture (BlueGene, Cray, X86 Cluster, GPU)
  - Software (GRID middleware, parallel I/O libs)
  - Data (amount, long term storage needs, sources/targets)
  - Code status (bottlenecks, parallelization approach)
  - Confidentiality/dissemination informations

## Current DECI-8 call

Opening date: 2nd November 2011

Closing date: 10th January 2012, 1600 CEST

Start date: 1st May 2012

Allocation period: 1 year

Type of access: Project access

Find out more at:

<http://www.prace-ri.eu/PRACE-Project-Access-4th-call-for>

## TIER-1 systems in DECI-8 I

- **Cray XT4/5/6 and Cray XE6** – four large Cray XE and XT systems are available at EPCC (UK), KTH (Sweden), CSC (Finland), and CSCS (Switzerland). **The largest** of these machines has a peak performance of **829 TeraFlops** and a **total of 90,112 cores**. **50 million compute core hours** are available on this architecture (normalized to Power 4+).
- **IBM Blue Gene/P** – two BG/P systems are available at IDRIS (France) and RZG (Germany). **The largest** of these machines has a peak performance of **139 TeraFlops** and a **total of 40,960 cores**. **3 million compute core hours** are available on this architecture (normalized to Power 4+).
- **IBM Power 6** – three IBM Power 6 systems are available at RZG (Germany), SARA (Netherlands), and CINECA (Italy). **The largest** of these machines has a peak performance of **8 TeraFlops**. **10 million compute core hours** are available on this architecture (normalized to Power 4+).

## TIER-1 systems in DECI-8 II

- **Clusters** – clusters are available at FZJ (Germany, Bull Nehalem cluster), LRZ (Germany, Xeon cluster), HLRS (Germany, NEC Nehalem cluster plus GP/GPU cluster), CINES (France, SGI EX8200), CINECA (Italy, Westmere cluster plus GPGPU), PSNC (Poland, AMD plus GPGPU cluster), WCNS (Poland, HP cluster), ICHEC (Ireland, SGI EX8200), IPB (Serbia, AMD plus GPGPU cluster), and UYBHM (Turkey, Nehalem cluster). **The largest cluster has a peak performance of 267 TeraFlops and a total of 23,040 cores.**

**38 million compute core hours are available on this architecture (normalized to Power 4+).**

## DECI-9 call

Start date: 1st November 2012

Allocation period: 1 year

Type of access: Project access

First DECI call with Czech republic TIER-1 system participation.

## Past project access calls for proposals

- **PRACE Early Access call**  
May 10 – June 10, 2010
  - **10 proposals were granted a 332 million core hours**
- **PRACE Project Access - 1st call for proposals**  
June 15 – August 15, 2010
  - **9 proposals requesting 362 million core hours were granted access**
- **PRACE Project Access – 2nd Call for Proposals**  
November 1, 2010 – January 11, 2011
  - **17 proposals requesting 397.8 million core hours were granted access**
- **PRACE Project Access – 3rd Call for Proposals**  
May 2, 2011 – November 1, 2011
- **PRACE Project Access – 4th Call for Proposals**  
November 2, 2011 – May 1, 2012

## Preparatory access calls for proposals

- Continuously open with cut-off every 3 months
- 3 types of preparatory access
  - Type A – **Code scalability testing** (max 100.000 core hours JUGENE, 50.000 core hours CURIE)
  - Type B - **Code development and optimization by the applicant** (max 250.000 core hours JUGENE, 200.000 core hours CURIE, max 2 months, max 6 months)
  - Type C - **Code development with support from experts** (max 250.000 core hours JUGENE, 200.000 core hours CURIE, max 6 months)

		Type A			Type B			Type C		
	Description	4 <sup>th</sup> cut-off	5 <sup>th</sup> cut-off	6 <sup>th</sup> cut-off	4 <sup>th</sup> cut-off	5 <sup>th</sup> cut-off	6 <sup>th</sup> cut-off	4 <sup>th</sup> cut-off	5 <sup>th</sup> cut-off	6 <sup>th</sup> cut-off
	Requests	14(3)	8	7	4	5	1	8	0	2
Awarded	JUGENE	5(2)	3(1)	1(1)	3(1)	0	1(1)	3(2)	0	0
	CURIE	7(2)	6(1)	6(1)	2(1)	4	1(1)	4(2)	0	2
	HERMIT	NA	NA		NA	NA	0	NA	NA	
KHours	JUGENE	500	300	100	600	0	250	600	0	0
	CURIE	350	300	300	500	800	200	1000	0	400
	HERMIT	NA	NA		NA	NA		NA	NA	

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# Thank you for your attention!

[www.it4i.cz](http://www.it4i.cz)

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**Kick-off meeting**

**November 29th, 2011**

