



# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

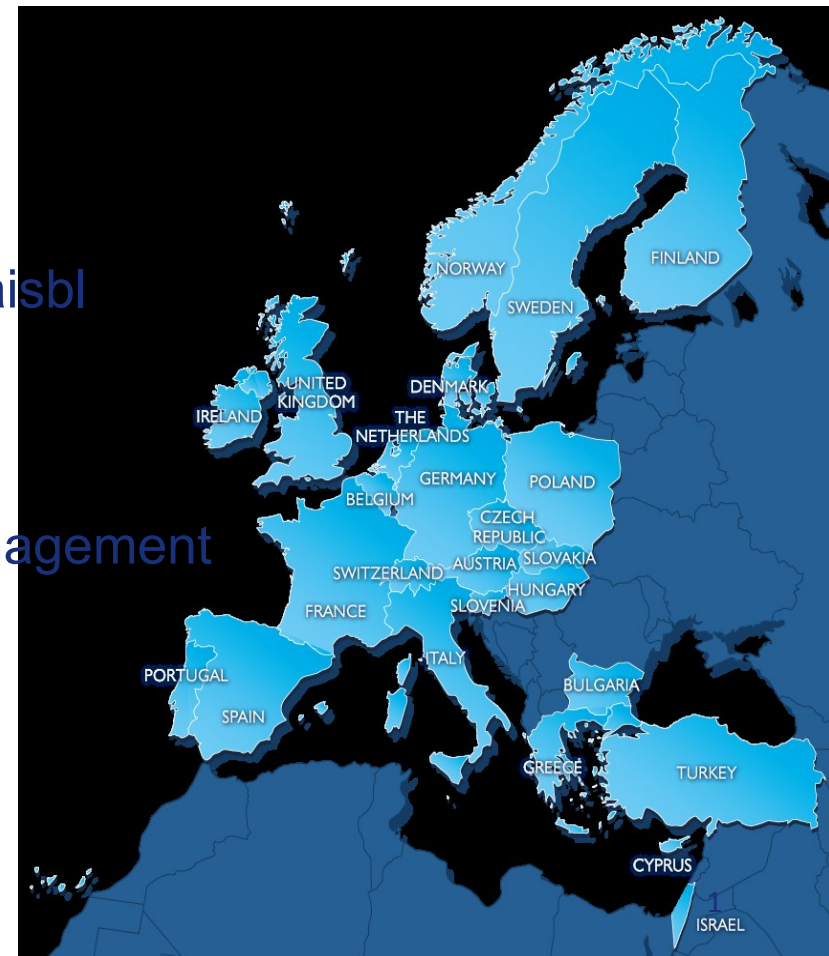
## Partnership for Advanced Computing in Europe

Florian Berberich

Member of the Board of Directors PRACE aisbl

CREMLIN WP2 Workshop on Big data Management

Moscow, 15-16 February 2017





# Content

- PRACE – the pan European HPC e-Infrastructure
- PRACE Access to HPC
- PRACE Training
- PRACE and Industry



PARTNERSHIP FOR  
ADVANCED COMPUTING IN EUROPE

# PRACE – THE PAN EUROPEAN HPC INFRASTRUCTURE



# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

## Partnership for Advanced Computing in Europe

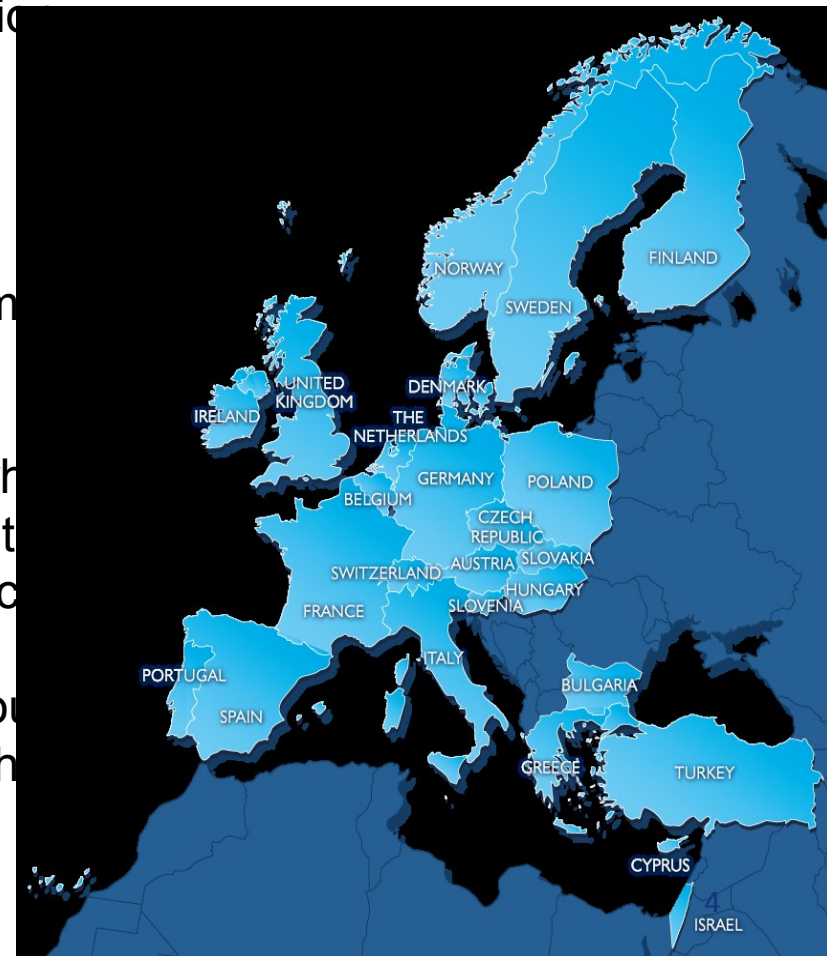
**PRACE** is an international not-for-profit association under Belgian law, with its seat in Brussels.

**PRACE** counts 25 members and 2 observers.

The **PRACE** Hosting Members are France, Germany, Italy, Spain, and Switzerland.

**PRACE** is governed by the **PRACE** Council in which each member has a seat. The daily management of the association is delegated to the Board of Directors.

**PRACE** is funded by its members as well as through a series of implementation projects supported by the European Commission.







# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

## 5 Hosting Members offering core hours on 7 world-class machines



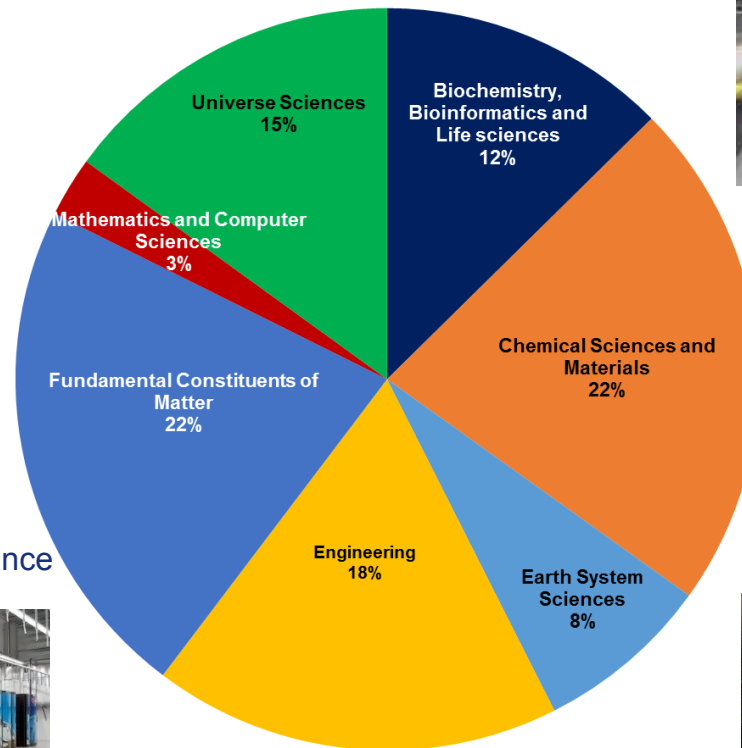
**MareNostrum:** IBM  
BSC, Barcelona, Spain



**CURIE:** Bull Bullx  
GENCI/CEA,  
Bruyères-le-Châtel, France



**Piz Daint:** Cray XC30 system,  
CSCS, Lugano, Switzerland



Research Domain Pie Chart up to and including Call 13



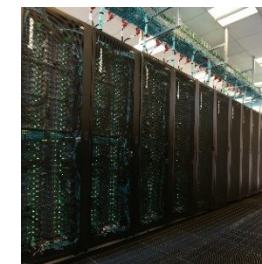
**SuperMUC:** IBM  
GAUSS/LRZ  
Garching, Germany



**JUQUEEN:** IBM  
BlueGene/Q, GAUSS/  
FZJ, Jülich, Germany



**Hazel Hen:** Cray  
GAUSS/HLRS,  
Stuttgart, Germany

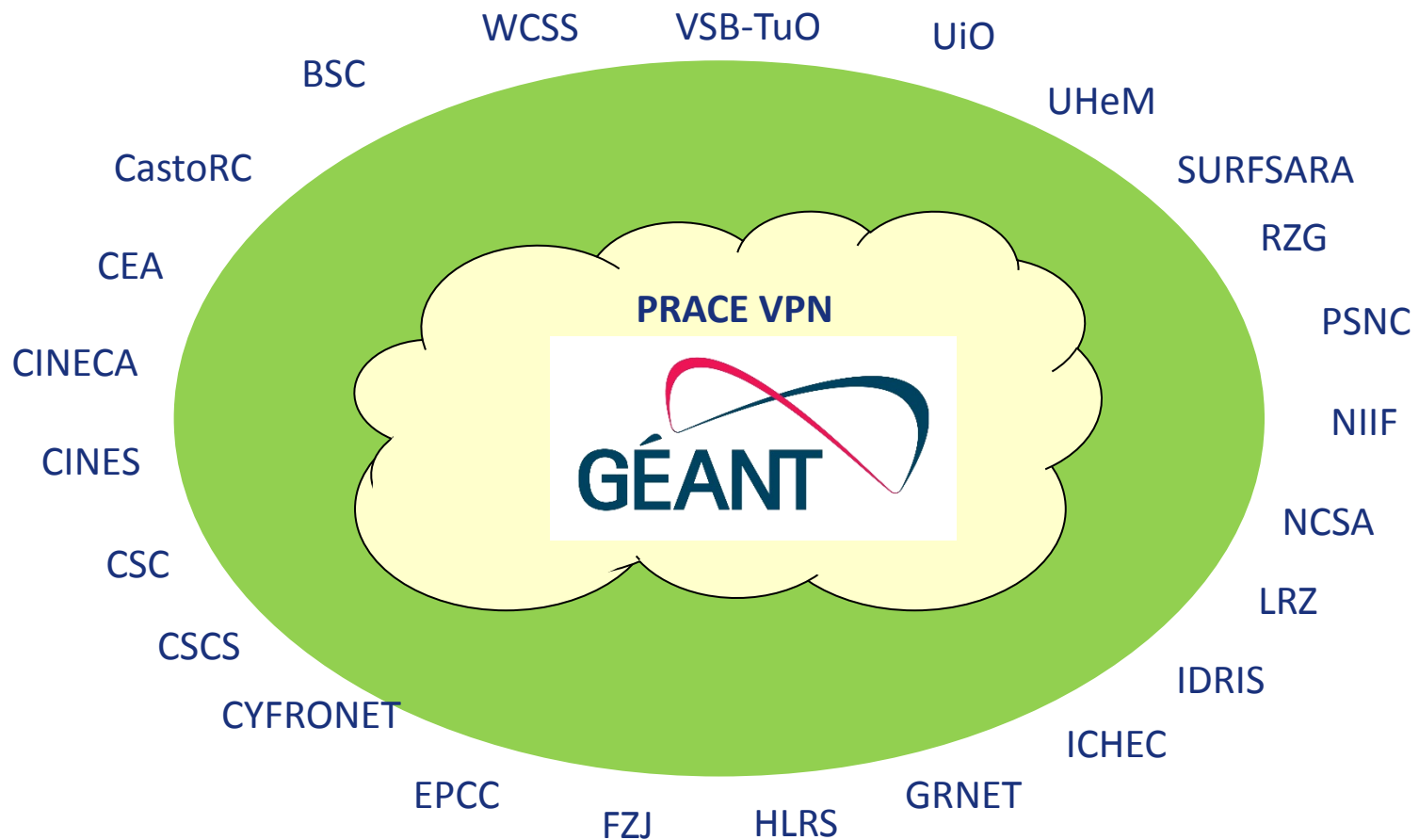


**MARCONI:** Lenovo  
CINECA, Bologna, Italy



# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

## The PRACE Network Infrastructure





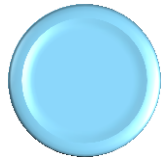
## PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE



**465** scientific projects **enabled**



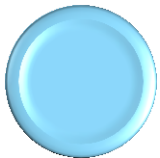
**12.2 thousand million** core hours awarded since 2010 with peer review, main criterion is **scientific excellence**. **Open R&D** access for **industrial users** with **>50 companies** supported



**>7 350** people trained by **6 PRACE Advanced Training Centers** and others events



**40 Petaflops** of peak performance on **7 world-class systems**



**530 M€** of funding for **2010-2015**, access **free at the point of usage**



**25 members**, including **5 Hosting Members** (France, Germany, Italy, Spain and Switzerland)



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# PRACE – ACCESS TO HPC





**Criterion:  
Scientific  
Excellence**

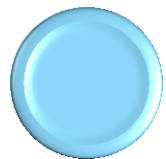
## Access through PRACE Peer Review



**Free-of-charge** required to publish results at the end of the award period  
Open to **international (PRACE 1)** projects



**Project Access** (*every 6 months*) **award period 1 to 3 years**  
Individual researchers and groups  
**No restriction on nationality (PRACE 1)** for both researcher and centre  
Required to demonstrate technical feasibility of project



**Preparatory Access** (*cut-off date every 3 months*)  
Optional support from PRACE experts  
Prepare proposals for Project Access



# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

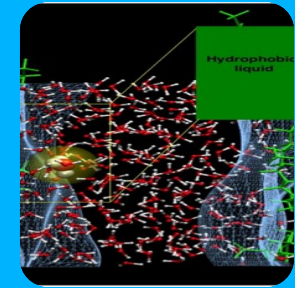
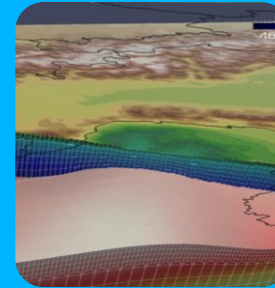
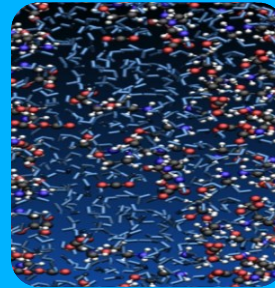
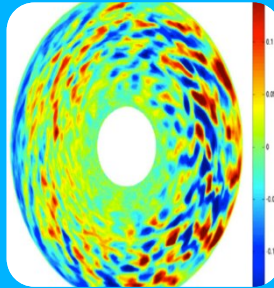
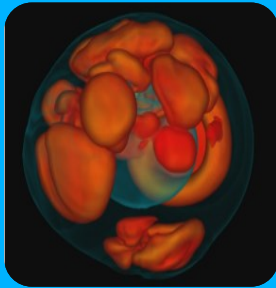
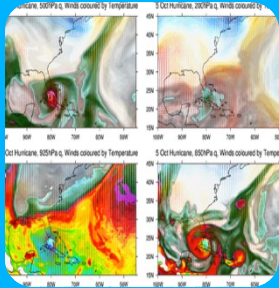
## Project Access



[www.prace-ri.eu/call-announcements/](http://www.prace-ri.eu/call-announcements/)



# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE



## 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 decent  
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 JUQUEEN (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.



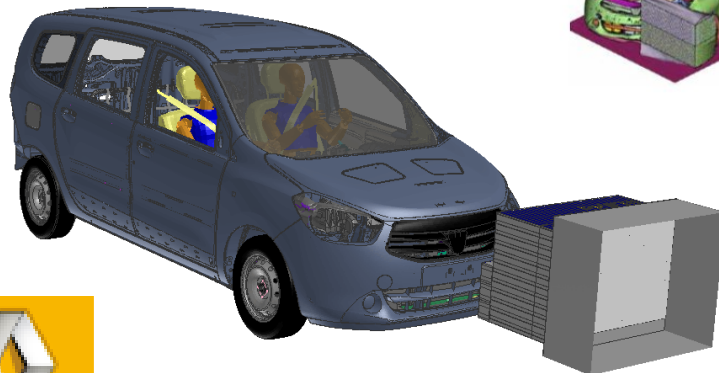
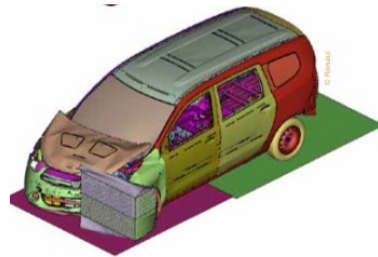
# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

Example  
Automotive

42 million core hours awarded  
on PRACE hosting partner  
GENCI, Curie (France) using  
PAM-CRASH software



Renault performed on PRACE Tier-0 systems  
**the first-ever biggest crash  
optimisation study.** Numerical simulations  
can take the place of real-time crash tests as  
well as of prototypes.



**Team:** Marc Pariente of Renault  
SAS, France with ESI Group  
and Ecole Mines Saint Etienne

## Goals:

- better model the behaviour of a car body when impacted
- anticipate future safety regulation
- improve competitiveness of Renault





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# PRACE TRAINING



## Seasonal Schools

- Have been running since 2008
- Offering top-quality face-to-face training events
- Organised around / all over Europe
- Topics range from generic intermediate to advanced
- From programming techniques to more specialised topical schools

### Upcomming Seasonal Schools

- 10 – 12 April 2017  
PRACE Spring School 2017, Sweden - HPC in the Life Sciences
- 25 - 27 April 2017  
PRACE 2017 Spring School joint event with VI-SEEM, Cyprus - System Administration and Data/Computational Services for Scientific Communities





# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

## PATC Programme 2016-2017

- 79 courses, 215 training days
- New courses on forward-looking topics
  - New hardware and programming paradigms
  - Data science
- Collaboration with CoEs on several courses



### PRACE Advanced Training Centres (PATCs)

BSC - Barcelona Supercomputing Center (Spain)  
CSC - IT Center for Science (Finland)  
CINECA - Consorzio Interuniversitario (Italy)

EPCC at the University of Edinburgh (UK)  
GCS - Gauss Supercomputing Center (Germany)  
MdS - Maison de la Simulation (France)

### Programme: August 2016 to January 2017

#### August 2016

- Advanced OpenMP [EPCC]
- GPU Programming with CUDA [EPCC]

#### September 2016

- High Performance Molecular Dynamics [CINECA]
- Introduction to CINECA HPC System [CINECA]
- Introduction to High Performance Computing with C [CSC]
- Introduction to High Performance Computing with Fortran [CSC]
- Advanced MPI [EPCC]
- Object-Oriented Programming with Fortran [EPCC]
- Single node performance optimisation [EPCC]
- Advanced Fortran topics [GCS]

#### October 2016

- Parallel Programming Workshop [BSC]
- Python for computational science [CINECA]
- Data Intensive Analyses [CSC]
- Introduction to Parallel Programming [CSC]
- Practical Software Development [EPCC]
- Advanced Parallel Programming with MPI 3.1 [GCS]
- VI-HPS Tuning Workshop [GCS]
- Code optimization and debugging [MdS]

#### November 2016

- Earth science simulation environments [BSC]
- Debugging and Optimization of Scientific Applications [CINECA]
- HPC Methods for Computational Fluid Dynamics and Astrophysics [CINECA]
- Introduction to Parallel Computing with MPI and OpenMP [CINECA]
- Hybrid MPI/OpenMP Programming [MdS]

#### December 2016

- GPU Programming with OpenACC [CSC]
- Node-level Performance Engineering [GCS]
- Programming on GPUs [MdS]

#### January 2017

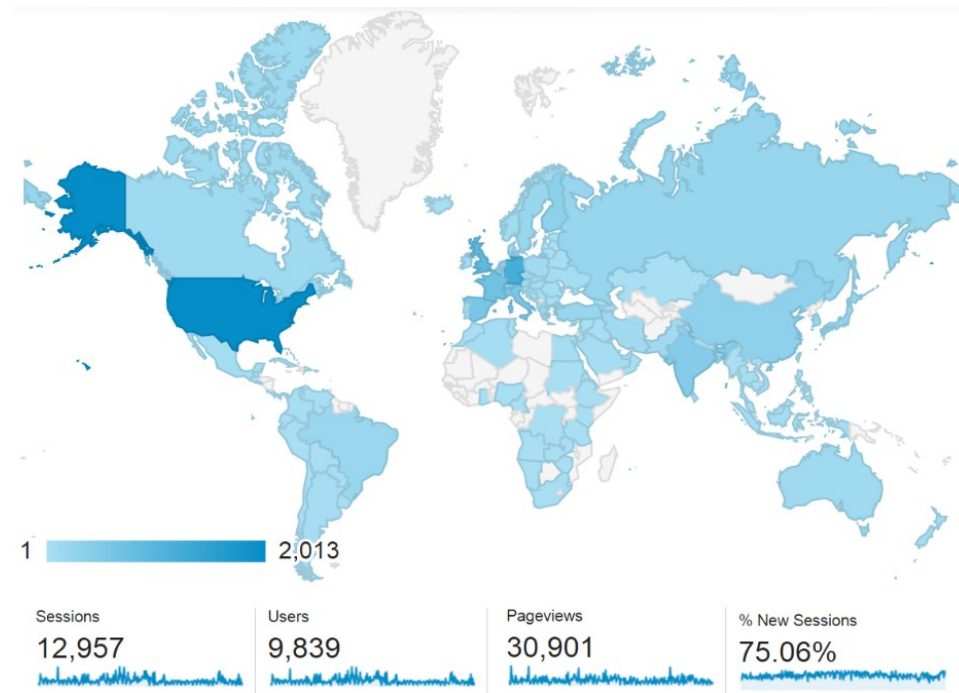
- Administration of Petaflop Machine [BSC]
- Material science codes on innovative HPC architectures: targeting exascale [CINECA]
- Python in High-Performance Computing [CSC]
- Efficient Parallel IO on ARCHER [EPCC]
- Introduction to hybrid programming in HPC [GCS]
- Advanced Visualization with Paraview [MdS]
- Parallel linear algebra [MdS]

[www.prace-ri.eu](http://www.prace-ri.eu)

The Implementation Phase of PRACE receives funding from the EU's Seventh Framework Programme (FP7/2007-2013) under grant agreement RI-312763 and from the EU's Horizon 2020 Research and Innovation Programme (2014-2020) under grant agreement 653838.

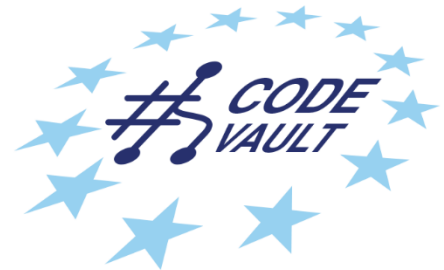
## Training and Events Portal

- [www.training.prace-ri.eu](http://www.training.prace-ri.eu)
- Single hub for the PRACE training events, training material and tutorials
- Number of page views increased by 25% and number of users by 45% since 2014



## CodeVault and More

- Repository of Open Source code samples
  - <https://gitlab.com/PRACE-4IP/CodeVault>
  - Examples and model solutions of common HPC programming tasks
    - Possible to utilise in training and as building blocks of real-world applications
  - Anonymous read access
- Best Practice Guides
  - <http://www.prace-ri.eu/best-practice-guides/>
- White Papers
  - <http://www.prace-ri.eu/white-papers/>







# Future Training Activities



- On-demand events addressing the needs of the CoEs
  - Needs for basic, intermediate, and advanced training
- Launch of Massive Open Online Courses (MOOCs)
  - Introduction to HPC, coordinated by EPCC  
<https://www.futurelearn.com/courses/supercomputing>
  - Management of massive data, coordinated by Univ. Ljubljana
- PRACE Training Centres (PTCs)
  - Cover basic and advanced needs across Europe





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# PRACE SUMMER OF HPC



# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

## PRACE Summer of HPC (SoHPC)

Goal: To inspire the next generation of software engineering, system administrators, and general users of HPC

### Summer of HPC

Partnership for Advanced Computing in Europe (PRACE)

Want to spend the summer working abroad at a European High Performance Computing Centre?

Then the Summer of HPC is for you!

Applications open January 25th 2013

Like, join or follow us on Facebook, LinkedIn or Twitter to get the latest announcement

[More](#)

**CALLING LATE STAGE UNDERGRADUATES AND EARLY STAGE POSTGRADUATES**

**Would you like to spend the summer working abroad at a European High Performance Computing (HPC) Centre?**

**Have you got an interest in programming and are eager to improve your skills?**

**Have you a passion for visualising data in novel ways to grab the attention of the general public?**

**Have you a desire to learn and share your knowledge of HPC through blogging, video creation and use of social media?**

If you have answered yes to any of these questions then the Summer of HPC is for you. Read on to find out more information about the programme.

The countries where students may be placed are:

Country	Organisation
Czech Republic	VSB-TUO
Denmark	UCPH
Germany	BIT
Ireland	ICHEC
Italy	CINECA
Switzerland	EPFL
Sweden	RISE
Spain	UNED
Turkey	EPSC

**ABOUT SUMMER OF HPC**

Summer of HPC is a PRACE programme that offers summer placements at HPC centres across Europe. Up to twenty 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 produce a visualisation or video of their results. The programme will run from July 1st to August 30th, with a kick-off training week in Edinburgh attended by all participants. Flights, accommodation and a stipend will be provided to all successful applicants, all you need to bring is your interest in computing and some enthusiasm! Prizes will be awarded for the best participants.

**PARTICIPATING IN SUMMER OF HPC**

Applications are welcome from all disciplines. Previous experience in HPC is not required, as training will be provided. Some coding knowledge is a prerequisite but the most important attribute is a desire to learn, and share, more about HPC. A strong visual flair and an interest in blogging, video blogging or social media are desirable. Applications will open at the end of January 2013.

**ABOUT PRACE**

The Partnership for Advanced Computing in Europe (PRACE) is an international non-profit association with its seat in Brussels. The PRACE Research Infrastructure (RI) provides a persistent world-class High Performance Computing (HPC) service for scientists and researchers from academia and industry. The Implementation Phase of PRACE receives funding from the EU's Seventh Framework Programme (FP7 2007-2013) under grant agreement of 603240 and is co-funded by the governments of the member states.

HPC is the application of the world's fastest computers (super computers) to computationally intensive problems. Some common applications include astrophysics, climatology, health sciences, biomedical science, and engineering.

Further information on the application process will be delivered through the Summer of HPC Blog [www.summerofhpc-prace-ri.eu](http://www.summerofhpc-prace-ri.eu), Facebook: [www.facebook.com/SummerofHPC](http://www.facebook.com/SummerofHPC) and Twitter: [www.twitter.com/SummerofHPC](http://www.twitter.com/SummerofHPC).



# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

## PRACE Summer of HPC (SoHPC)

### SoHPC 2016

- 10 Partners/sites
- 110 applications
- 21 students chosen
- Training week in Juelich
- 2 month internship
- 2 Award winners



### SoHPC 2017

- Programme & Application open date: 04 January 2017
- Call for Applications: 11 January 2017
- Call for Applications closes: 19 February 2017
- 21 Projects proposed





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# PRACE AND INDUSTRY

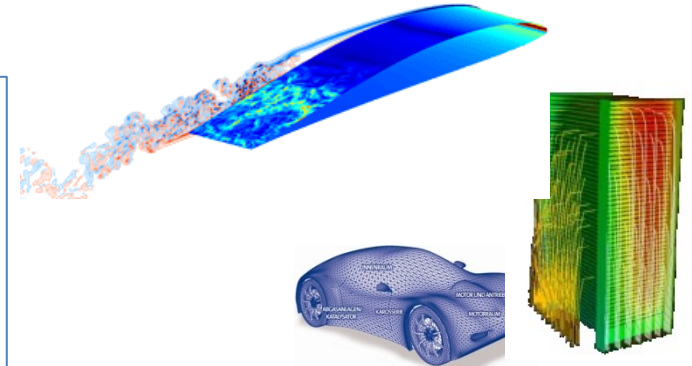




## PRACE offers services to the Industry

### Access to leading edge resources

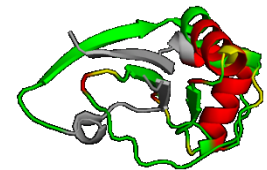
- To assess the scalability on a wide number of HPC architectures
- To give access to HPC resources based on scientific excellence, free of charge, alone or in collaboration with labs



### Access to high value services

- Training (PRACE Advanced Training Centers, opened to industrial users)
- Code enabling (Open Source codes for industry, etc)

- To foster technology transfer between academia and industry
- To access to the competences enabling to build new methodologies (multiscale, multi physics, disruptive, uncertainties...)







# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE



# **SHAPE**

*SME HPC Adoption Programme in Europe*

(1/2)

Pan-European, PRACE-based, programme supporting HPC adoption by SMEs.

- Raise awareness and equip European SMEs with the expertise necessary to take advantage of the innovation possibilities opened up by HPC thus increasing their competitiveness.
- Overcome the barriers to HPC adoption:
  - Lack of expertise in knowledge of the possibilities of HPC and advanced numerical simulation;
  - Lack of resources to facilitate the HPC adoption process;
  - The entry costs of implementing new technologies.
- SHAPE facilitates the process of defining a workable solution based on HPC
- SHAPE helps to define an appropriate business model.



# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE



**SHAPE**  
*SME HPC Adoption Programme in Europe*

(2/2)

- The main focus is to work on a one-to-one basis with SMEs willing to adopt a new HPC-supported solution
- Based on an integrated set of services:
  - **networking,**
  - **training in PRACE Centres**
  - **expertise provided by HPC and domain-specific experts,**
  - **access to PRACE HPC systems (R&D model)**
  - **support for identifying funding sources**
- Support SMEs up to a **proof-of-concept**



# Possible Cooperation with Russian RI

Some ideas for future cooperations in HPC:

- Exchange of Experience
  - Network
  - Operation
  - ...
- Training
- Applications Enabling



# PARTNERSHIP FOR ADVANCED COMPUTING IN EUROPE

## Questions ???

