

# HPC in Europe

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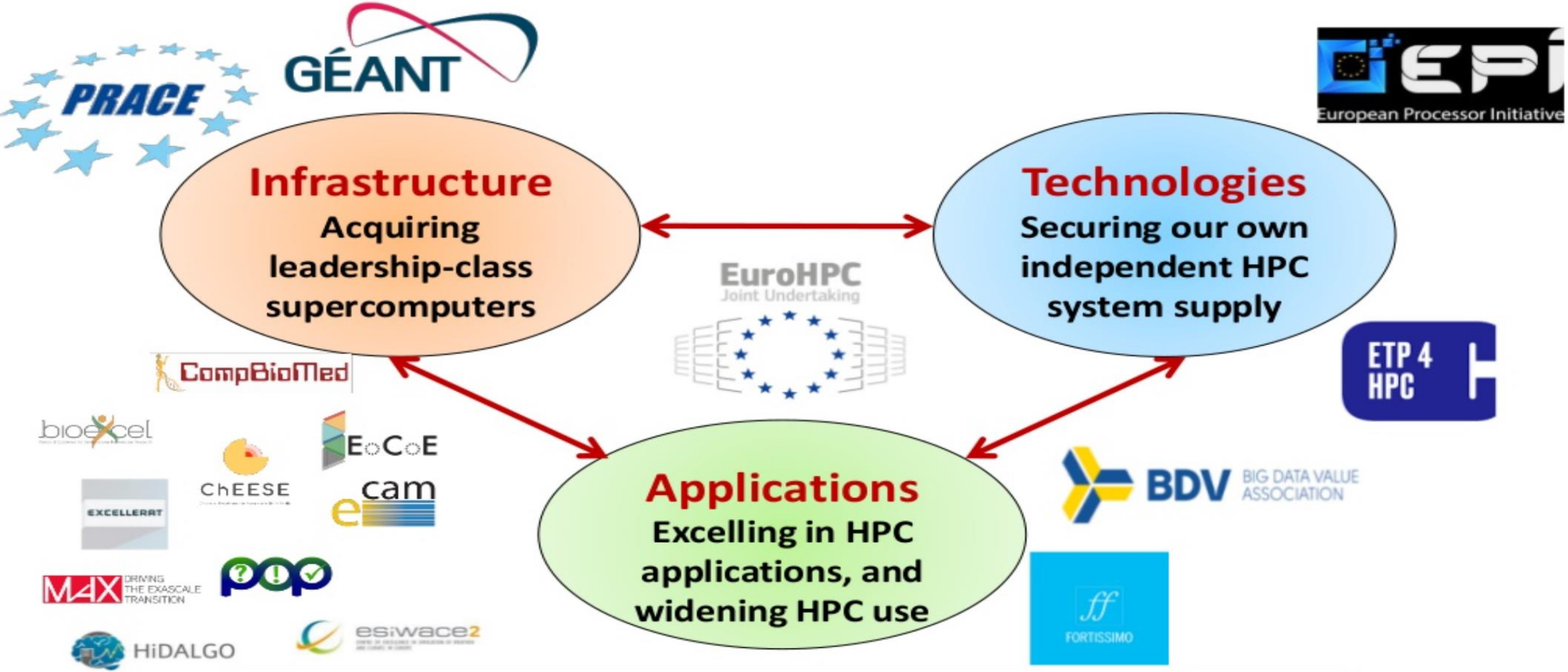
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Erasmus+ Programme  
of the European Union

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**Build a thriving European HPC Ecosystem**

# The key players



**EuroHPC**  
Joint Undertaking



**NORDUGRID**

*Grid Solution for Wide Area  
Computing and Data Handling*



**CLARIN.SI**



*CECAM, CERN, Belle2, Pierre Auger ...*



Fakulteta za  
informacijske študije  
Faculty of information studies



Univerza v Ljubljani



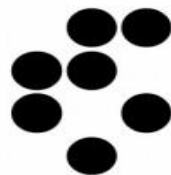
FGG  
FMF  
FRI  
MF  
FS



National Institute  
of Chemistry



REPUBLIKA SLOVENIJA  
MINISTRSTVO ZA JAVNO UPRAVO



Jožef Stefan Institute





## Hosting Members

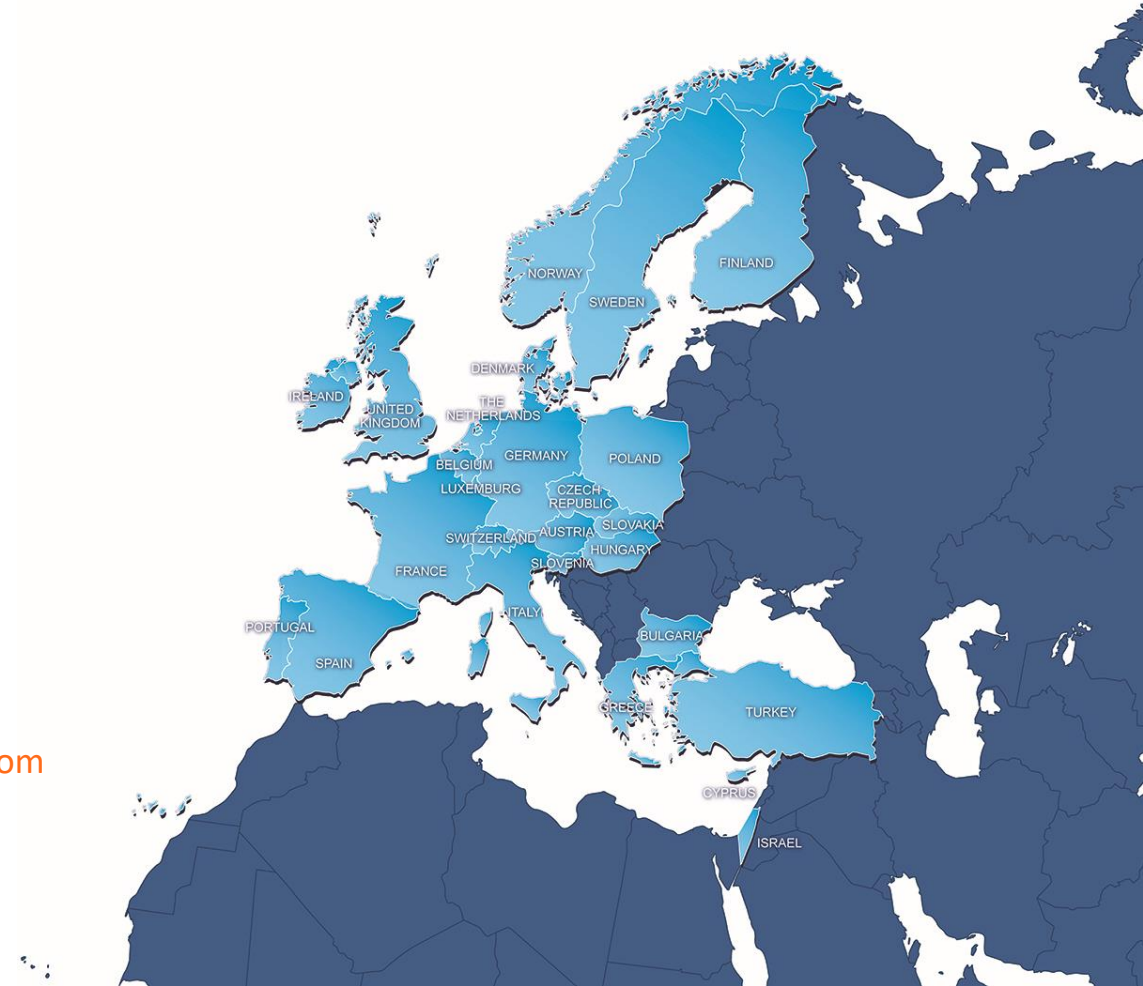
- ▶ France
- ▶ Germany
- ▶ Italy
- ▶ Spain
- ▶ Switzerland

## Observers

- ▶ Croatia
- ▶ Romania

## General Partners (PRACE 2)

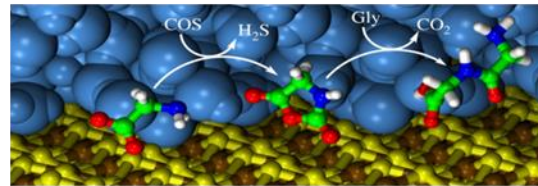
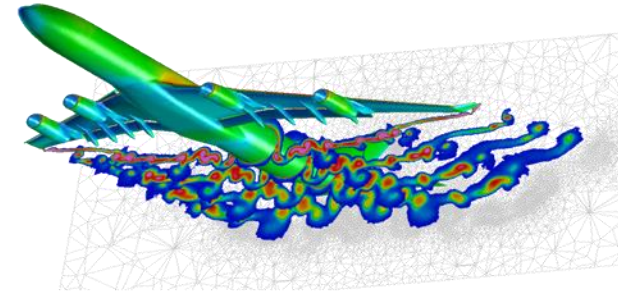
- ▶ Austria
- ▶ Belgium
- ▶ Bulgaria
- ▶ Cyprus
- ▶ Czech Republic
- ▶ Denmark
- ▶ Finland
- ▶ Greece
- ▶ Hungary
- ▶ Ireland
- ▶ Israel
- ▶ Luxembourg
- ▶ Netherlands
- ▶ Norway
- ▶ Poland
- ▶ Portugal
- ▶ Slovakia
- ▶ Slovenia
- ▶ Sweden
- ▶ Turkey
- ▶ United Kingdom



- ▶ Precursor                    The DEISA Project (Victor Alessandrini, F)
- ▶ First Ideas                    2003 – HPC-Euro Interest Group (Hugh Pilcher Clayton, UK)
- ▶ Closing in                    2006 – HPC in Europe Task Force (HET) (Kimmo Koski, FL)
- ▶ ESFRI                         2006 – HPC on the Roadmap
- ▶ PRACE MoU                    2007 (Alain Lichnewsky, F, Achim Bachem, D)
- ▶ PRACE Signing                2010 (Achim Bachem, D)
- ▶ PRACE II                      2016 (Anwar Osseyran, NL)

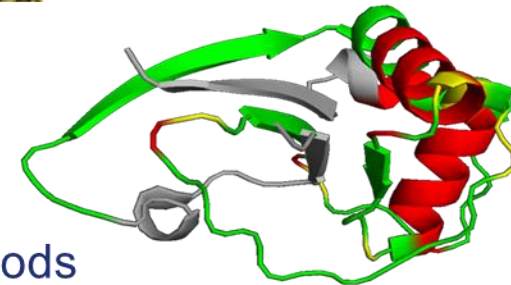
## ▣ Constraints and limitations

- ▣ Too difficult (construct bigger wind tunnel)
- ▣ Too expensive (construct one-way aircraft)
- ▣ Too slow (wait for the climate change)
- ▣ Too dangerous (drugs, climate, ...)



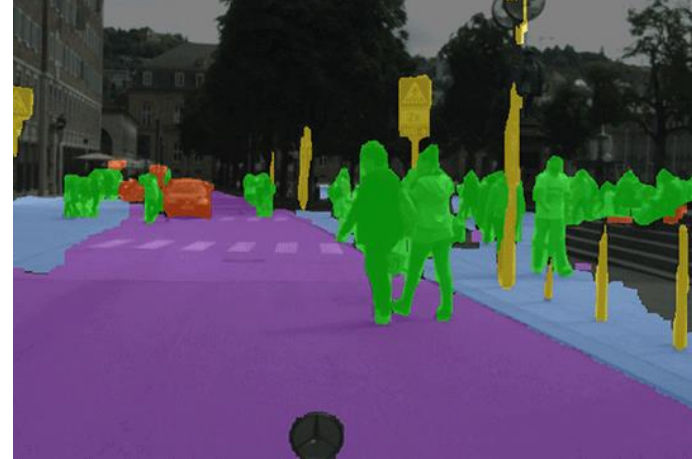
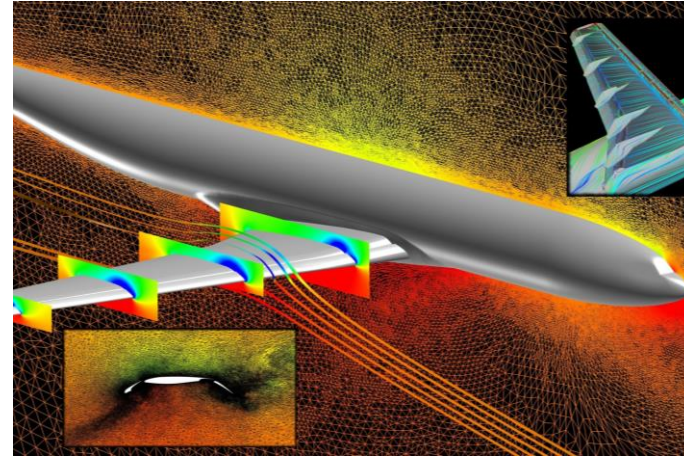
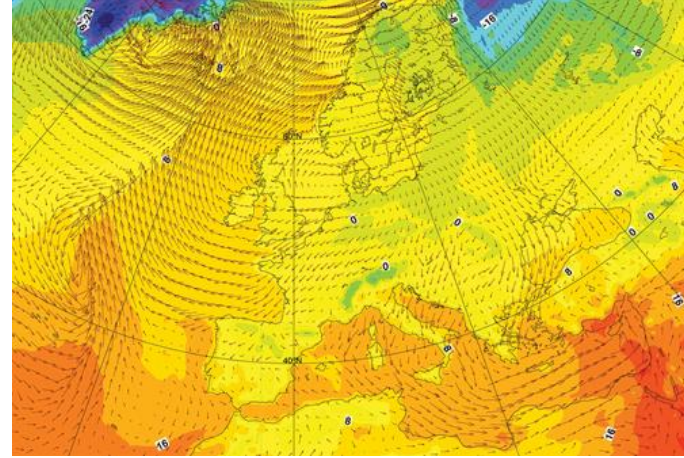
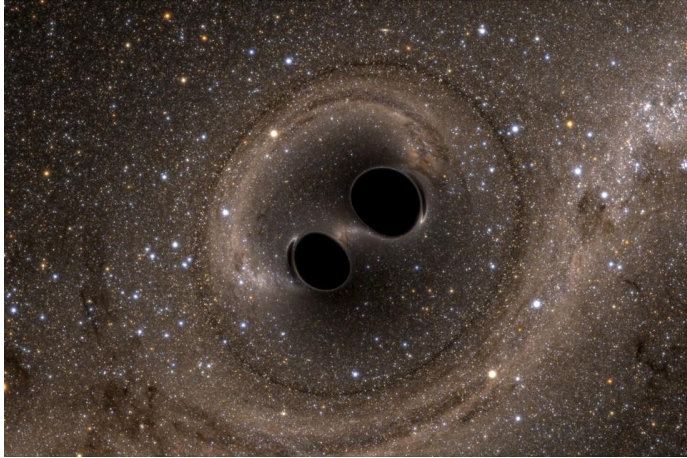
## ▣ „Computational Science“ Paradigm

1. Use of HPC resources for **simulation** of the phenomenon  
... based on known physics laws and efficient numerical methods



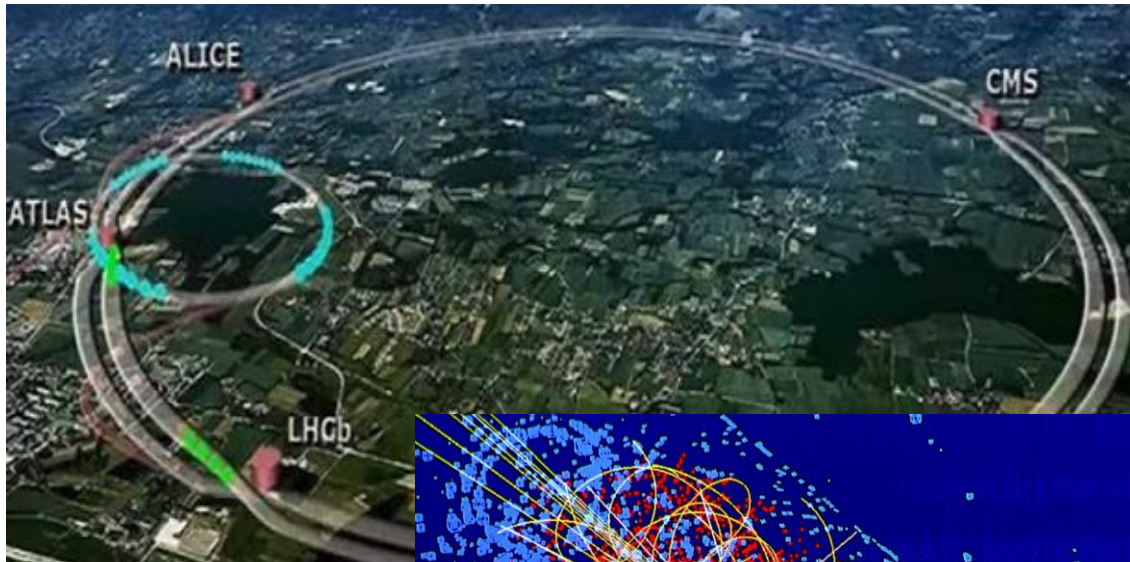


# PRACE solves Societal Challenges

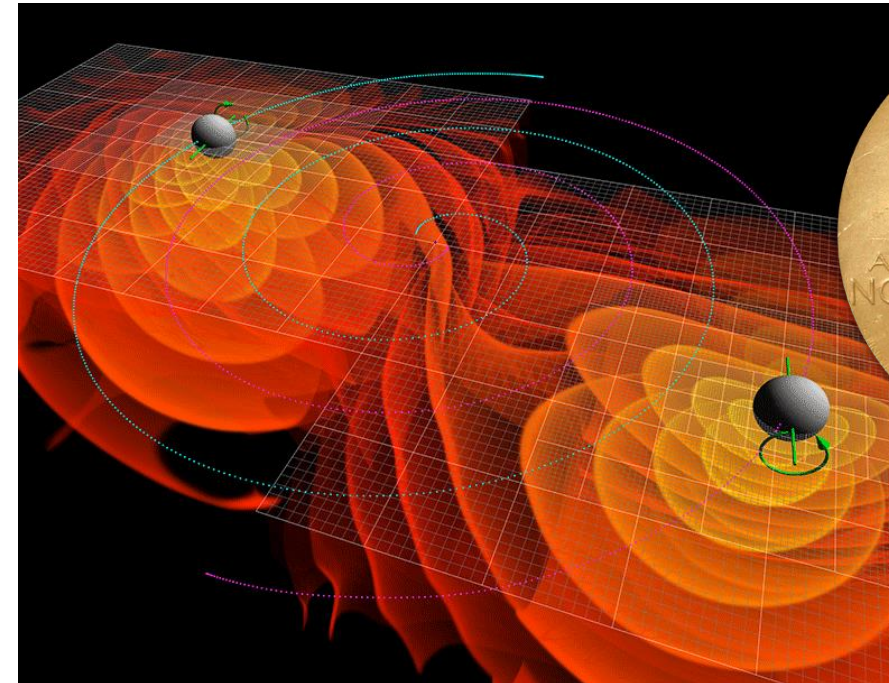
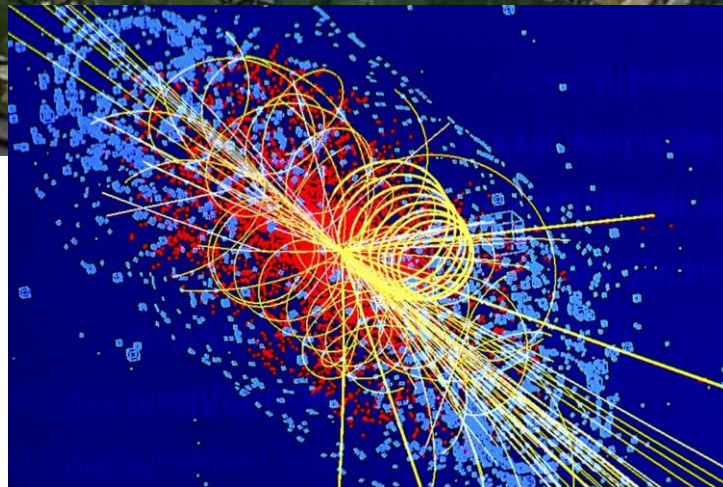


*PRACE's goal is to help solve these challenges. The days when scientists did not have to care about the hardware are over, and so are the days when compute centers did not have to worry about the scientific application!*





Simulation of traces  
producing Higgs  
Boson (Nobel Prize  
2013)



LIGO gravitational wave interference  
(Nobel Prize 2017)



- ▶ **Open access** to world-class HPC systems to EU scientists and researchers
- ▶ **Variety of architectures** to support the different scientific communities
- ▶ High standards in **computational science** and engineering
- ▶ **Peer Review** at European level to foster scientific excellence
- ▶ Robust and persistent **funding scheme** for HPC supported by national governments and European Commission (EC)
- ▶ Support the development of intellectual property rights (**IPR**) in Europe by working with industry and public services
- ▶ Collaborate with European HPC **industrial** users and suppliers

- ▶ **779** scientific projects enabled
- ▶ **>25** billion core hours awarded since 2010
- ▶ Of which **63%** led by another PI nationality than the HM
- ▶ R&D access to industrial users with **>65** companies supported
- ▶ **>17 000** people trained through PRACE Training
- ▶ **~110** Petaflops of total peak performance on **7** world-class systems
- ▶ **28** PRACE members, including **5** Hosting Members  
(France, Germany, Italy, Spain and Switzerland)
- ▶ PRACE is the **only** e-infrastructure Landmark on the ESFRI Roadmap 2016



# PRACE Tier-0 Systems in 2020



**MareNostrum:** IBM  
BSC, Barcelona, Spain  
#38 Top 500



**Piz Daint:** Cray XC50  
CSCS, Lugano, Switzerland  
#10 Top 500



**NEW ENTRY 2018/2019**  
**SuperMUC NG** : Lenovo  
cluster GAUSS @ LRZ,  
Garching, Germany #13  
Top 500

**NEW ENTRY 2018**  
**JUWELS (Module 1):**  
Atos/Bull Sequana  
GAUSS @ FZJ, Jülich,  
Germany #39 Top 500



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**NEW ENTRY 2018**  
**JOLIOT CURIE** : Atos/Bull Sequana  
X1000; GENCI @ CEA, Bruyères-le-  
Châtel, France #34 Top 500



**MARCONI-100:** IBM  
CINECA, Bologna, Italy  
#9 Top 500

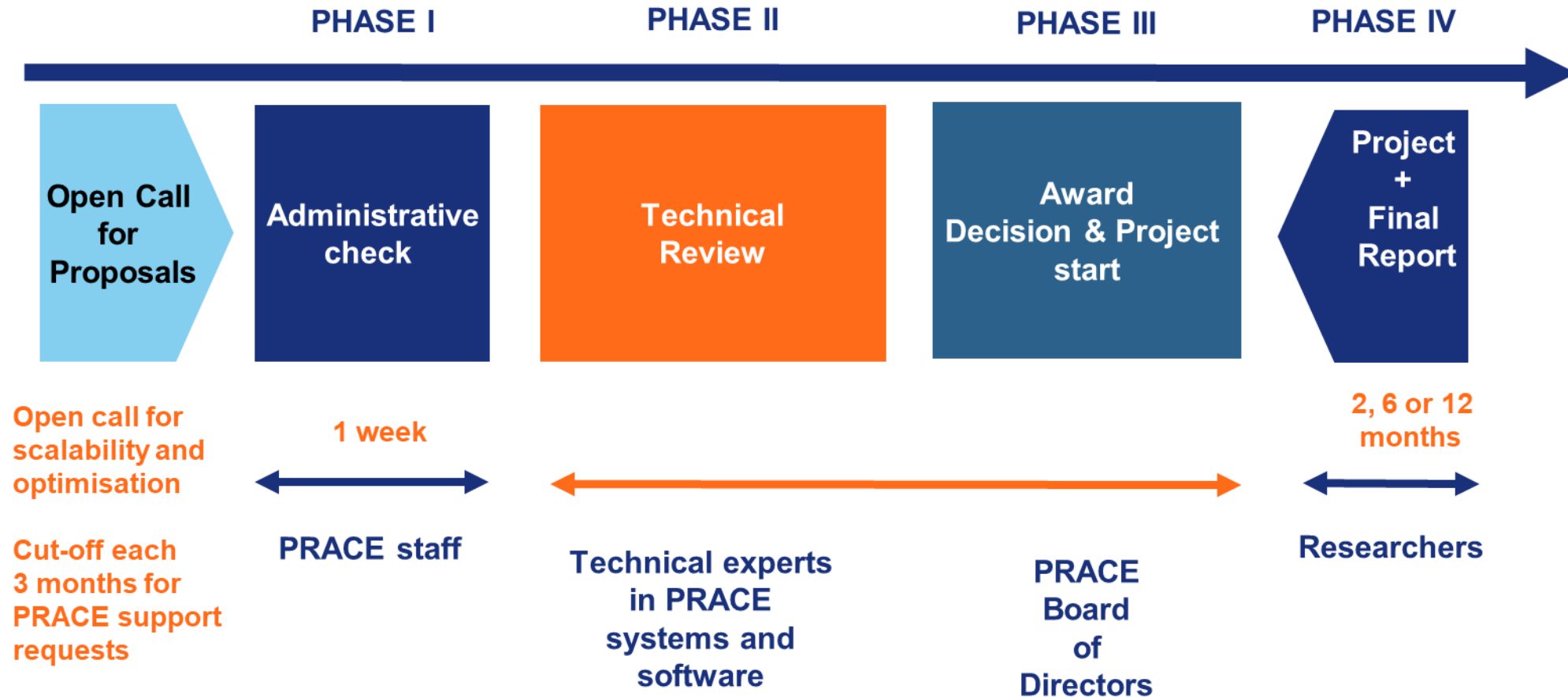
**NEW ENTRY 2020**  
**HAWK:** HPE Apollo  
GAUSS @ HLRS,  
Stuttgart, Germany



© by Ben Derzian for HLRS

Close to 110 Petaflops  
total peak performance







**Criterion:  
Scientific  
Excellence**

- ▶ **SME HPC Adoption Programme in Europe**
  - ▶ Equip European SMEs with expertise to take advantage of the innovation possibilities of HPC
  - ▶ Increasing competitiveness
  - ▶ Enable development of new products or services
  - ▶ Create new business opportunities



a **sustained, high-quality** training and education service for the European HPC community

Different **levels** of training

- Basic, intermediate, advanced **HPC**
- Parallel programming
- Accelerators
- Performance optimisation

**Domain-specific** topics

- Simulation software
- Visualisation
- Data intensive computing

6 PRACE Advanced **Training Centres**

8 PRACE Training Centres

PRACE **Training Events**: Seasonal Schools, International HPC Summer School, On-demand training events

PRACE Training and Events portal

**Code Vault**

Massive Open Online Courses  
(**MOOCs**)

**Summer of HPC**

(Programme for undergraduate and postgraduate students)

## #EuroHPC (high performance computing) Joint Undertaking

The European High Performance Computing Joint Undertaking (EuroHPC JU) will pool European resources to develop top-of-the range exascale supercomputers for processing big data, based on competitive European technology.

Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Montenegro, the Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and Turkey.



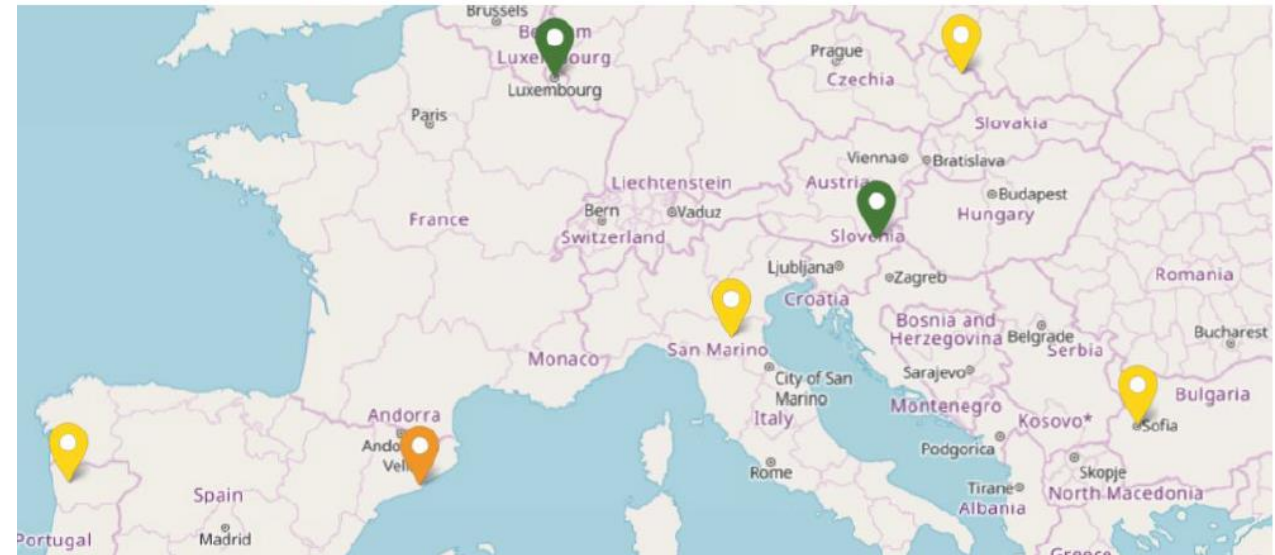
**EuroHPC**  
Joint Undertaking





- **Mission:** development of a supercomputer infrastructure that will be cutting edge worldwide
- **Activities:**
  - development and maintenance of an innovative European supercomputer ecosystem;
  - promoting European supercomputer supply chains (from low power processors to software and their integration into supercomputer systems);
  - providing access to supercomputer resources for every scientific domain, and business;

- Three operational (Vega, MeluXina, Deucalion)
- 4 under construction:
  - LUMI, Leonardo - 350/250 PFlops, coming 2021/22
  - Karolina, Discoverer





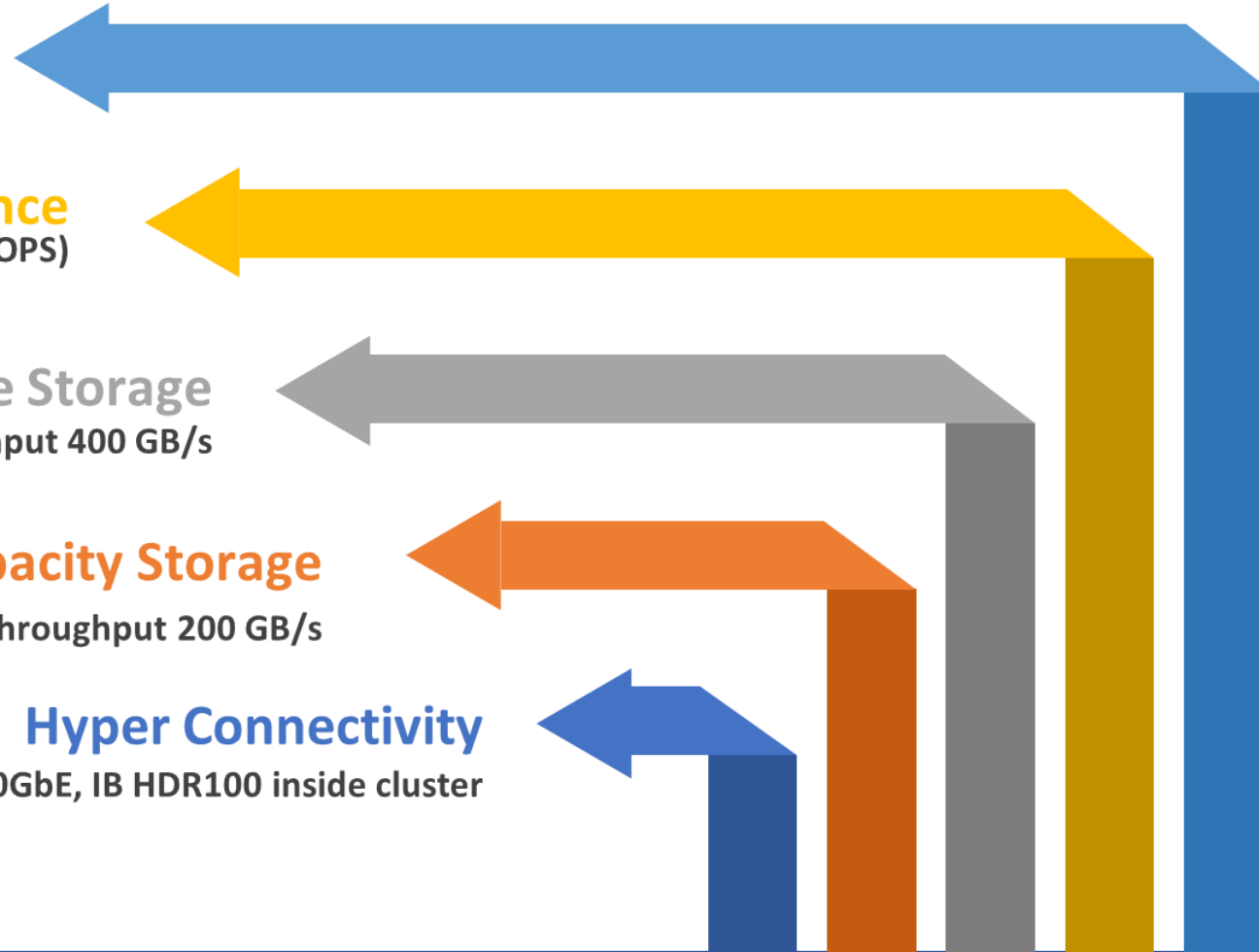
**CPU Performance**  
HPL  $R_{\max}$ : 3.8 PFLOPS ( $R_{\text{peak}}$  5.4 PFLOPS)

**GPU Performance**  
HPL FP64  $R_{\max}$ : 3.0 PFLOPS ( $R_{\text{peak}}$  4.7 PFLOPS)

**High Performance Storage**  
Net capacity 1 PB, throughput 400 GB/s

**Large Capacity Storage**  
Net capacity 18 PB, throughput 200 GB/s

**Hyper Connectivity**  
WAN - several 100GbE, IB HDR100 inside cluster





Access currently (the pre-production period) available to

- user groups that have access to Slovenian HPC systems through the SLING infrastructure;
- For the others, access is granted to upon positive decision by the SLING board

Access Mode	Extreme Scale	Regular	Benchmark	Development	Academic Fast Track	Industry Fast Track
<b>Duration</b>	1y renewable	1y renewable	2 to 3 months	1y renewable	< 6 months	1y renewable
<b>Periodicity</b>	Continuous calls, bi-yearly cut-offs	Continuous call, cut-offs every four months (3 cut-offs per year).	Continuous call, monthly cut-offs	Continuous call, monthly cut-offs	Continuous call, cut-offs ev. 2w/1m	Continuous call, cut-offs ev. 2w/1m
<b>Share of resources</b>	~70% Mostly pre-exascale	20 to 30% Mostly multi-petascale	Few % All systems	Few % All systems	~5% All systems	~5% All systems
<b>Data storage needs</b>	Large storage for medium to long term	Large storage for medium to long term	Limited	Data processing environment and platform		



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- HPC Access ▾
- PRACE for Industry ▾
- Training & User Support ▾
- Infrastructure Support ▾
- Events ▾
- News & Media ▾

## EuroHPC



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## EuroHPC Access

[Calls For Proposals](#)

[COVID-19](#)

## EuroHPC JU Benchmark And Development Access Calls

The Call for Proposals for EuroHPC JU Benchmark and Development Access Modes are continuously open calls, with a maximum time-to-resources-access (start-date) of two weeks after the date of submission.

The next cut-off dates for proposals are:

- 1 May 2021 – 11:00 AM CEST
- 1 June 2021 – 11:00 AM CEST
- 1 July 2021 – 11:00 AM CEST

The following table shows EuroHPC JU Petascale systems and their current availability for Benchmark and Development Access.

System	Architecture	Site (Country)	Benchmark	Development
Vega CPU Standard	BullSequana XH2000	IZUM Maribor (SI)	√	√
Vega CPU Large Memory	BullSequana XH2000	IZUM Maribor (SI)	√	√
Vega GPU	BullSequana XH2000	IZUM Maribor (SI)	√	√

The indicative schedule of the EuroHPC JU Calls for Proposals for Benchmark and Development Access are as follows.

Thank you for your attention!

<http://sctrain.eu/>

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TECHNISCHE  
UNIVERSITÄT  
WIEN



VSB TECHNICAL  
UNIVERSITY  
OF OSTRAVA

IT4INNOVATIONS  
NATIONAL SUPERCOMPUTING  
CENTER



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