



# PRACE in the EuroHPC era

## PRACE Position Paper and Perspectives

---

Serge Bogaerts

*PRACE Managing Director*



# Context and milestones

- ▶ EuroHPC Joint Undertaking (JU)
  - ▶ Formally established in October + starting JU operations (bodies) & calls (e.g. HE)
    - ▶ *Mobilized much of EC time and efforts; contacts with PRACE in standby*
- ▶ Important PRACE Publications
  - ▶ Scientific Case for Computing in Europe 2018 – 2026
    - ▶ *By the PRACE Scientific Steering Committee*
    - ▶ *In October*
  - ▶ PRACE in the EuroHPC Era
    - ▶ *PRACE Position paper*
    - ▶ *In December*
  - ▶ Both endorsed by the PRACE Council



# Position Paper Highlights

- ▶ EuroHPC JU strengthen the European HPC landscape by providing leadership-class supercomputers
- ▶ PRACE – Partnership for Advanced Computing in Europe with its 26 members has initiated and pursued the development of the European HPC ecosystem in the past 10 years
- ▶ PRACE aisbl and PRACE-IP projects are supporting – thanks to the coordination of numerous partners – an extensive set of services to the communities – Recognized as ESFRI Landmark
- ▶ Advocates for a strong partnership between EuroHPC and PRACE to ensure seamless integration for the benefit of science and industry in Europe



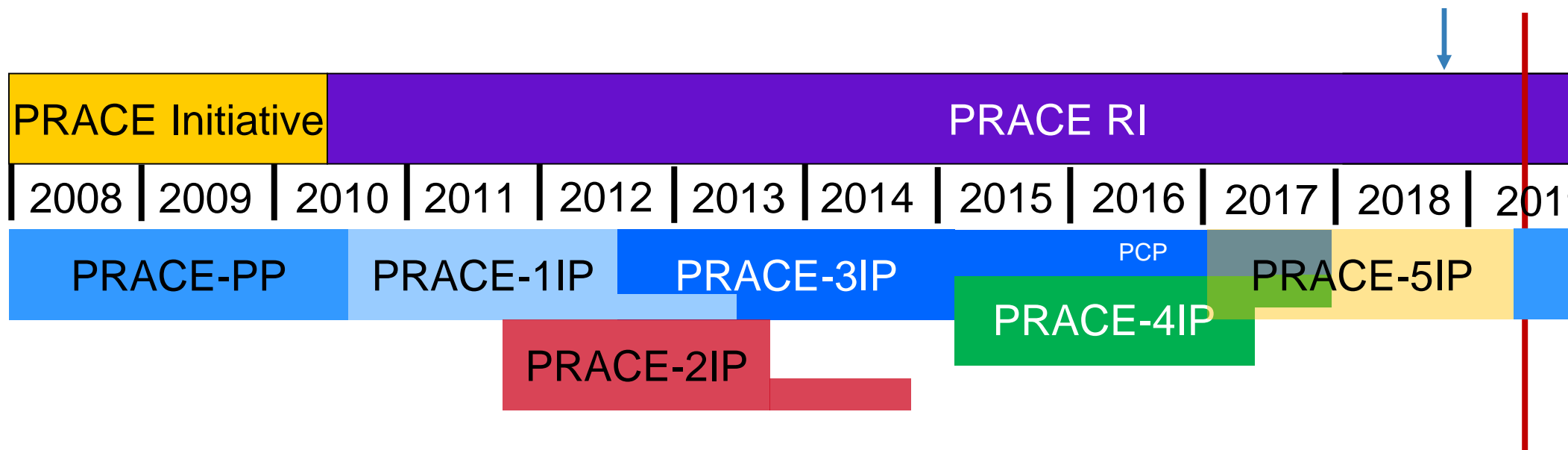
# PRACE | Milestones

- ▶ Ancestor 2002 – 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 Signature 2010 (Achim Bachem, D)
- ▶ PRACE 2 2017 (Anwar Osseyran, NL)





# PRACE | RI (aisbl) & IP Projects



- ▶ PRACE-IP projects accelerate the implementation of the PRACE RI
- ▶ IP Projects supported by EC with >100 Million €





# PRACE | Tier-0 Systems 2018

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



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



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



**NEW ENTRY 2018/2019**  
**SuperMUC NG :** Lenovo  
cluster GAUSS @ LRZ,  
Garching, Germany #8  
Top 500



**MARCONI:** Lenovo  
CINECA, Bologna, Italy  
#19 Top 500



**NEW ENTRY 2018**  
**JOLIOT CURIE :** Bull Sequana  
GENCI/CEA, Bruyères-le-Châtel,  
France #40 Top 500

**Hazel Hen:** Cray  
GAUSS/HLRS,  
Stuttgart, Germany  
#30 Top 500



**Close to 110 Petaflops  
cumulated peak  
performance**



# PRACE | Services

- ▶ **Open access** to leadership HPC systems for EU researchers
- ▶ **Peer Review** at European level – science led (SSC)
- ▶ **Operation** of a unified set of services
- ▶ **Architectural variety** meeting all sorts of algorithmic needs
- ▶ **Support of Industry** on European HPC systems (... SHAPE)
- ▶ **Training** by PTCs, Seasonal Schools, SoHPC, etc
- ▶ **Application Enabling** by HLSTs, Preparatory Access, support for CoEs
- ▶ **Market Watch** on HPC procurement/prototyping, infrastructure workshops
- ▶ **Dissemination** conferences, documentation, collaborations





# Who is Servicing HPC ?



universität  
wien



POLITÉCNICA  
"Engineering the future"



UPPSALA  
UNIVERSITET



UNIVERSIDADE  
DE COIMBRA



Inter-University  
Computation Center



IT4Innovations  
national  
supercomputing  
center



Fakulteta za  
informacijske študije  
Faculty of information studies



THE CYPRUS  
INSTITUTE



NCSA  
NATIONAL CENTRE FOR  
SUPERCOMPUTING  
APPLICATIONS

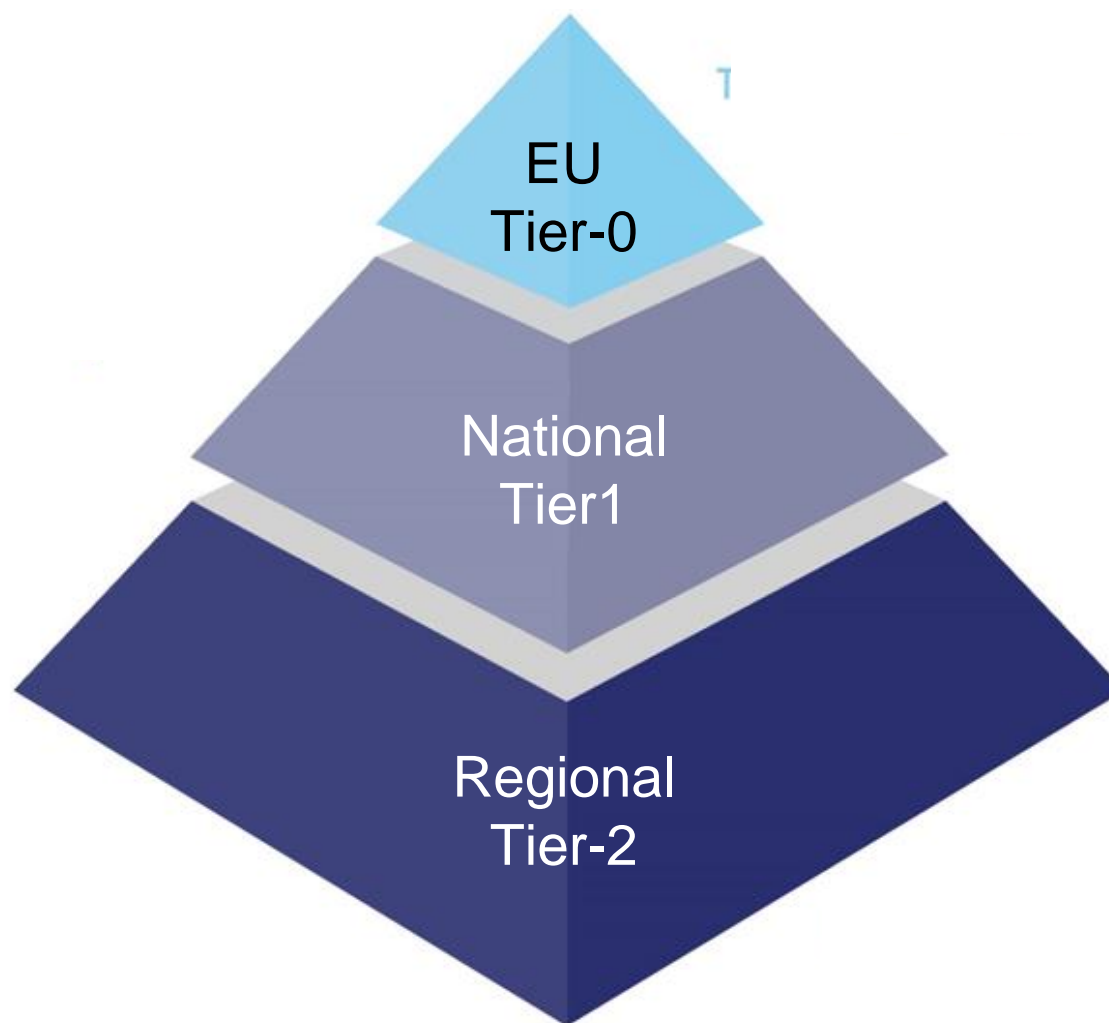


KØBENHAVNS  
UNIVERSITET





# European Provisioning Pyramid



# The European HPC Systems Map (t.b.p.)



**26 PRACE  
Members**

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

France  
Germany  
Italy  
Spain  
Switzerland



# PRACE | Achievements

- ▶ 688 scientific projects enabled
- ▶ 110 Petaflops of peak performance on 7 Tier-0 systems
- ▶ >21 billion since 2010 - 63% led by PI not from HM
- ▶ >50 companies supported
- ▶ >12 000 people trained through PRACE Training





# PRACE | Impact

- ▶ PRACE as a competitive programme vs US, China, Japan
- ▶ Significant support to communities
  - ▶ Pan-European collaboration and overall quality of scientific proposals
  - ▶ Through substantial resources allocations, incl. to ERC and LSF-related projects
- ▶ Shaped the European HPC ecosystem for more than 10 years
  - ▶ Impact at national level (Tier-1) and at regional level (Tier-2)
- ▶ Closely linked to related initiatives
  - ▶ European Flagship (Human Brain Project, ...)
  - ▶ FENIX Europe-wide federated data infrastructure
  - ▶ EUDAT
- ▶ Scientific Steering Committee and Industrial Advisory Committee
  - ▶ Ensure proper accounting of the need/requirements of the (user) communities

# PRACE | **Impact example**

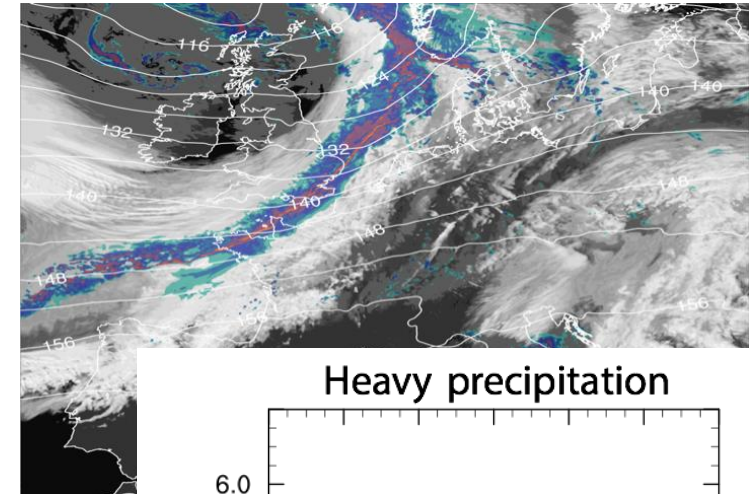
## Convection Resolving Climate Simulations



**CSCS**

Centro Svizzero di Calcolo Scientifico  
Swiss National Supercomputing Centre

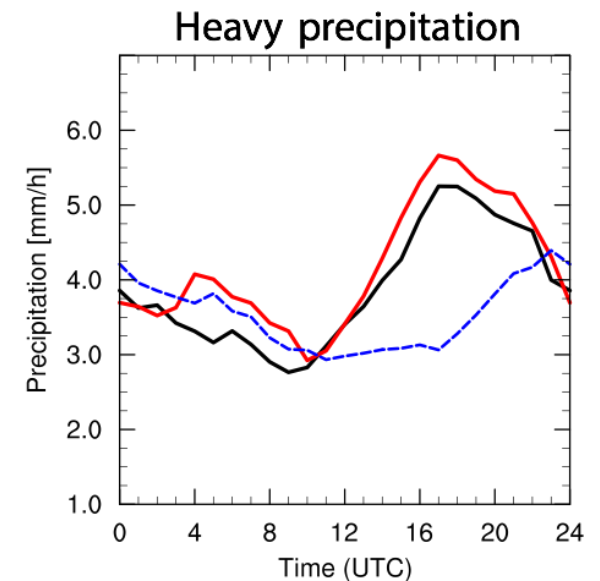
- ▶ Convection needs km-scale resolution
- ▶ Significant improvements in representation of diurnal cycle, heavy precipitation and clouds
- ▶ COSMO model scales to 5300 GPU accelerated nodes, runs 2-3x faster than on TaihuLight (present #3 on Top500)
- ▶ PI: Christoph Schaer, ETH, gpuCLIMATE, 170 Million core-hours



**OBS**

$\Delta = 12$  km

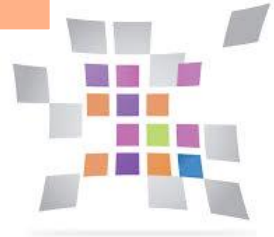
$\Delta = 2$  km





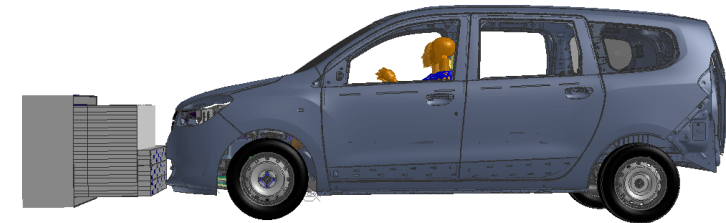
# PRACE | **Impact example** Biggest Crash Optimization Ever

Push Competitiveness  
of European Industry



GENCI

- ▶ Renault: New optimization methods based on 20 million d.o.f. finite elements meshes with 200 different parameters
- ▶ Anticipate new security rules (EuroNCAP6)
- ▶ 42 million core hours allocated on the CURIE Tier-0 (GENCI)
- ▶ Impossible with existing industrial actor R&D facilities
- ▶ World premiere, 5 years lead







# PRACE | Scientific Case 2018

- ▶ PRACE scientific and industrial cases
  - ▶ Strategic importance of HPC
    - ▶ *Fundamental Sciences*
    - ▶ *Climate, Weather, and Earth Sciences*
    - ▶ *Life Sciences & Medicine*
    - ▶ *Energy*
    - ▶ *Infrastructure & Manufacturing*
    - ▶ *Chemistry & Materials Science*
  - ▶ Traditional modelling increasingly complemented by data-driven approaches and artificial intelligence
  - ▶ PRACE SSC listing infrastructure requirements and making recommendations
- ▶ Invest to avoid Europe to fall behind US & Asia, and brain drain





## PRACE | Scientific Case 2018 (1)

- ▶ To be competitive with the rest of the world, Europe needs a European infrastructure & community for computing, support and research – with the agenda focused on solving the most challenging problems
- ▶ Future infrastructures need to have involvement of leading academic and industrial researchers in direct government – not merely providing advice – because they are the ones that vouch for the requested funding



## PRACE | Scientific Case 2018 (2)

- ▶ Future Infrastructures and operations will need to be much more diverse to support HPC, Data Science and different types of accelerators - but we also need to avoid fragmentation. Suggested to focus on **TWO** architectures.
- ▶ Investments in hardware must be paired with similar investments (reserve 10%) in algorithms, software, and workforce education, or the applications will not be able to use next-generation computers.

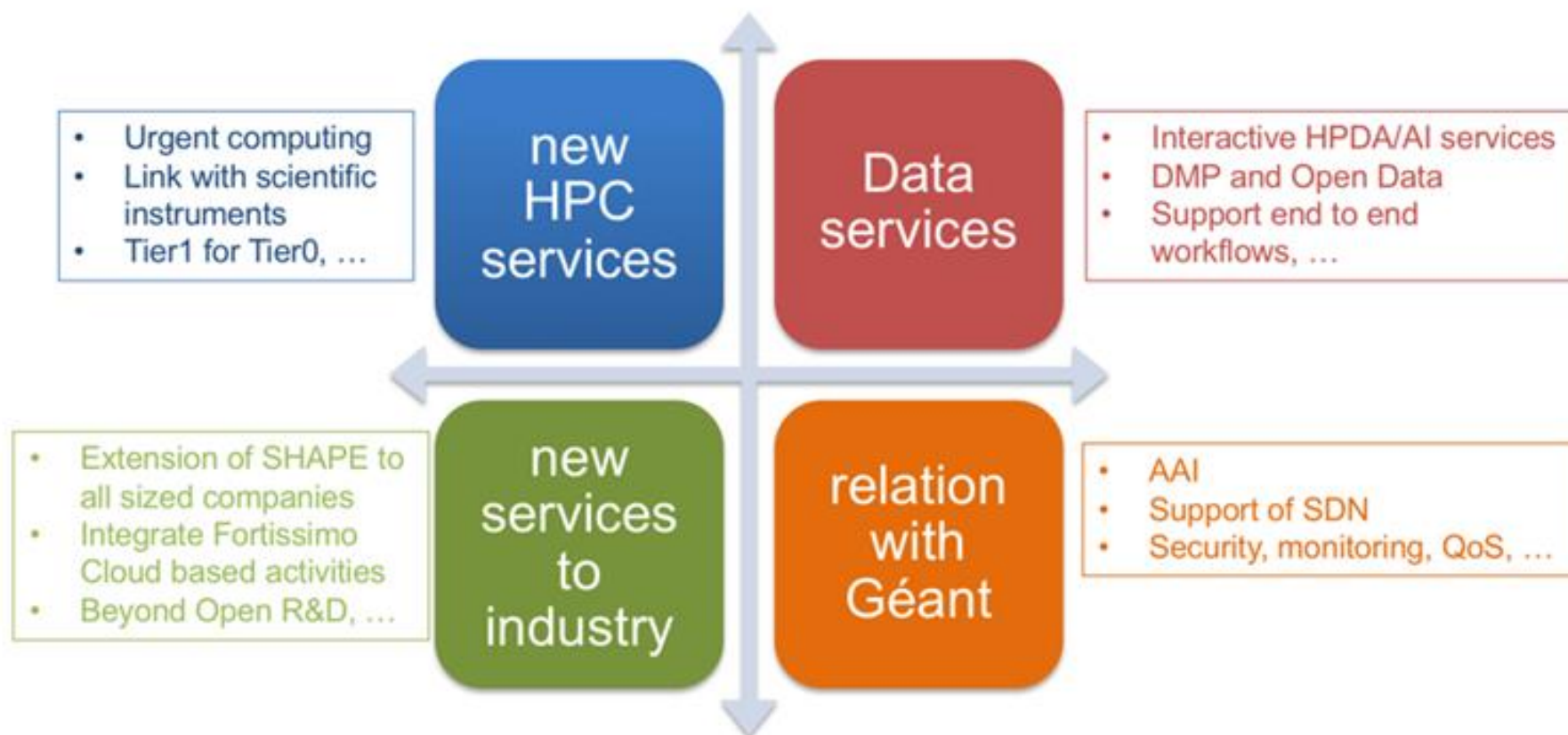




## PRACE | Scientific Case 2018 (3)

- ▶ Centres of Excellence appear to work very well for some communities, but compared to the US we frequently put too much emphasis on short-term deliverables in Europe. Help them focus on the real long-term goals!
- ▶ Integrate infrastructure staff better in key user communities, both to get them involved in software development and aid communities that do not have any Centre of Excellence.

# Future PRACE Services





# Future | New **HPC Services**

- ▶ Urgent & interactive computing
- ▶ Increased support to EU Flagship and ESFRIs

→ New Access Models and further integration of Tiers





# Future | New **Big Data Services**

- ▶ Adding a pan-European federated data management to PRACE
  - ▶ Supporting converged HPDA/AI
    - ▶ Interactive stream/batch data services
    - ▶ End-to-end workflows (from edge to tape)
    - ▶ Portal services for Open Data projects
- Based on infrastructure services like ICEI/Fenix and EUDAT
- Link with EOSC



# Future | New **Services to Industry**

- ▶ Complete European integrated services offer to industry
  - ▶ HPC / HPDA / AI evangelisation
  - ▶ Open R&D
  - ▶ Link to commercial (cloud) services

→ Further integration of PRACE and PRACE partners activities



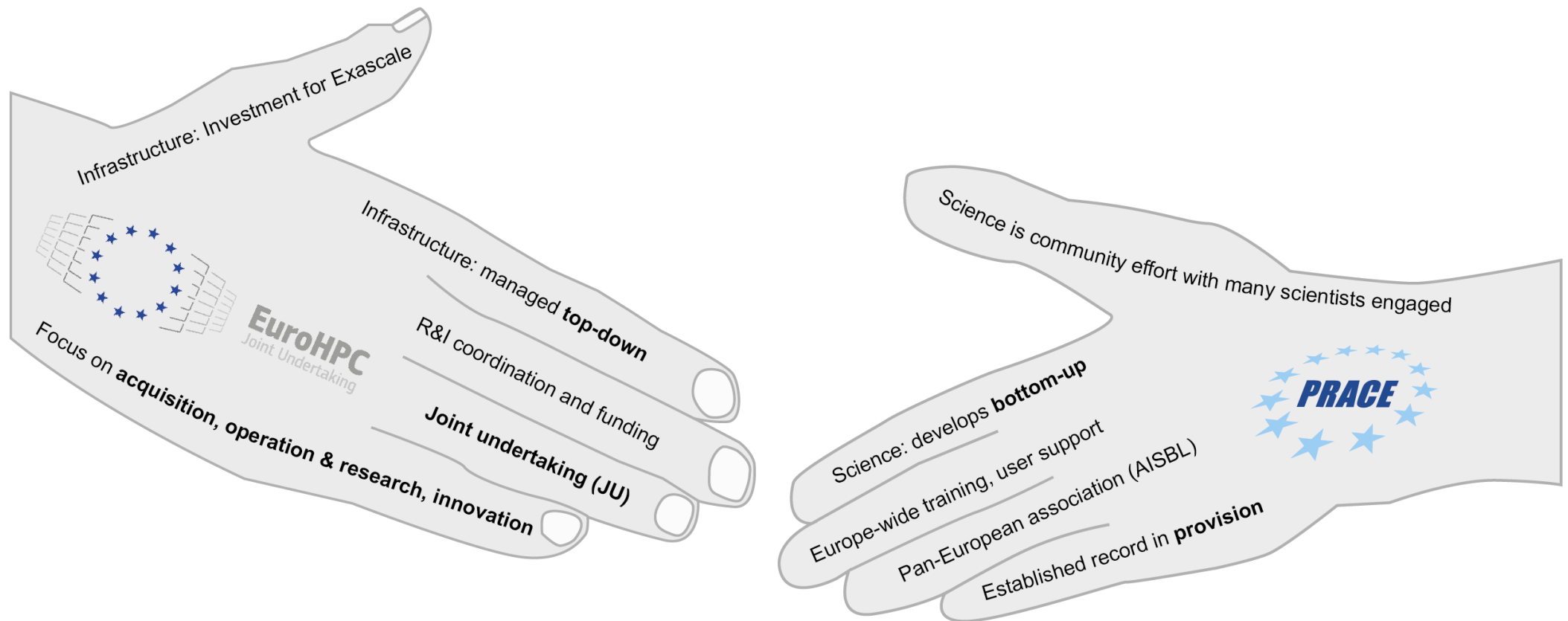
# Future | Strengthened Relation to GÉANT

- ▶ Advanced network services (SDN, QoS, ...)
- ▶ Striving for one single way to connect and to manage
  - Resource management and federation services (AAI)





# EuroHPC – PRACE Partnership





# EuroHPC Top-Down & PRACE Bottom-Up

## EuroHPC JU

- ▶ Funding agency HPC HPDA AI
- ▶ Policy maker and interface between EC and MS
- ▶ Infrastructure Investment
- ▶ Fund Research and Innovation
- ▶ Fund HPC operation and user support

- ▶ Infrastructure: provide access to MS-funded resources & EC-funded services

- ▶ Science driven (SSC)

**PRACE**



# Realisation of a Partnership

- ▶ PRACE to detail which processes and activities it can offer as a partner of EuroHPC
- ▶ Discuss and establish agreement(s)
  - ▶ Scope of services provided by PRACE in the future
  - ▶ Leverage PRACE high-quality services
  - ▶ Benefit from experience of all 26 PRACE members
  - ▶ Enable EuroHPC JU to focus on its core mission
- ▶ Explore and establish appropriate funding models
  - ▶ Secure sustained operation of PRACE services and IP-Project culture





# Next steps

- ▶ PRACE & EuroHPC Consultations starting
  - ▶ PRACE SSC & IAC meeting EuroHPC INFRAG & RIAG
  - ▶ High-level meeting of EuroHPC and PRACE planned in June
- ▶ Establishing Working Groups
  - ▶ Access
  - ▶ Training
  - ▶ Applications
  - ▶ Funding
  - ▶ and more
- ▶ PRACE planning extension of PRACE 2



# Publications are available

- ▶ Position Paper – **PRACE in the EuroHPC Era**

<http://www.prace-ri.eu/postitionpaper-eurohpc-prace-2019/>

- ▶ The Scientific Case for Computing in Europe 2018 – 2026

<http://www.prace-ri.eu/third-scientific-case/>

- ▶ Contact PRACE Communications Officer

- ▶ Questions, paper copies ...

<http://www.prace-ri.eu/contact-prace>





# THANK YOU FOR YOUR ATTENTION

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