Welcome

- Let me start by thanking the organizers for inviting me to welcome everyone in this opening session.

- It is a real pleasure to share this session with Ms. Catherine Rivière, President of PRACE Council and Mr. Mateo Valero, BSC Director.

- Let me congratulate the organizers on the scope of this meeting and the work being done to ensure interaction between research and industry.

- This model is strongly supported by Europe as a whole and Spain in particular, and will enhance our competitiveness.

- I have also noticed that alongside this the PRACE user forum met yesterday. These kinds of initiatives are a must in order to ensure our research infrastructures are used at their maximum capacity and evolve to meet demands of users.

- I especially wish to thank the nearly 200 participants from Academia and Industry. This figure is a clear indication of keen interest and in the sessions and topics addressed here.

Introduction – The role of research infrastructures and Spanish relations with ESFRI projects

- Spain is strongly committed to the development of the European Research Area (ERA), a crucial instrument for maintaining and improving not only our scientific and technological level, but also for increasing European economic competitiveness, employment and attracting talent.

- Large research infrastructures have a very relevant role in the development of ERA, as they centralize research and training activities, while demanding technological developments for their construction and operation which are at the fore-front of present knowledge, and attracting industry in their developments and applications.

- As a result, Spain greatly appreciates the efforts that are performed to implement the projects of research infrastructures included in the roadmap of the European Scientific Forum on Research Infrastructures (ESFRI).

  - My country is doing its best to help fulfil the objective proposed in the Europe 2020 Flagship Initiative “Innovation Union” to have completed or launched 60% of the European Research Infrastructures included in the ESFRI roadmap.

  - In fact, we are proud to have already contributed to the implementation of several ESFRI infrastructures such as PRACE and six other facilities.

  - In addition, Spain is strongly committed to LifeWatch (by hosting its administrative and ICT hubs), and leads the preparatory phase of EU-SOLARIS.

  - We are following with interest the progress of ten other ESFRI projects which have already been implemented or are currently being implemented.
• We very much aware of the role research infrastructures play in the development of sound R&D and in the innovation landscape. Therefore, we have explicitly included them in one of the four pillars of the Spanish Strategy for Science, Technology and Innovation (2013-2020) – “Excellent Science” - well-aligned with Horizon 2020.

• In this framework, we are about to formally approve a new Spanish roadmap of Singular Scientific and Technological Infrastructures. This is the instrument we have developed at the national level to support and upgrade Spanish research infrastructures, adopting a similar procedure to ESFRI at the European level.

• This roadmap will especially support distributed infrastructures in those fields where it is possible to integrate several facilities which are geographically distant, as in the case of High Performance Computing (HPC).

• Spain has invested great efforts in the last few years to host world-class infrastructures such as the Barcelona Supercomputing Center, ALBA synchrotron, the Large Telescope of the Canary Islands and the Solar Platform in Almeria, among others. In many instances these initiatives were supported by regional governments, by co-funding associated construction and operating costs.

• Many of these national infrastructures are related to ESFRI initiatives. This is the case of BSC, a “hosting member” of PRACE, the Doñana Biological Reservation – related to LifeWatch, and the Solar Platform in Almeria – associated to EU-SOLARIS.

Relevance of e-infrastructures for R&D and Innovation

• We celebrated the Internet World Day just four days ago. R&D and innovation activities have experienced a significant transformation following Internet developments. As a result, data access, and the connectivity of researchers and industrial companies to process, analyze and exploit them have dramatically increased.

• Similarly, the production of relevant data for R&D and Innovation activities has exponentially increased following deployment of a huge number of devices and sensors that automatically receive and send information using different formats.

• Both processes demand great coordination effort in order to enable:
  – Data availability
  – Access and interoperability
  – Bit-rate enhancement
  – Increased capacity to store, process and interconnect data for simultaneous analysis
  – High-level security
  – And the protection of intellectual property rights

• These items converge in the BIG DATA paradigm, which combined with the Virtual Research Environments, are innovative forms of e-Science. They are developed in an increasing distributed and international context following the e-Infrastructures supporting them.

• The European Union has taken upon itself to invest significant coordination efforts, starting with the Digital Agenda for Europe, another Europe 2020 Flagship Initiative to enhance European competitiveness.
When revised in 2012, it was identified as a tool that could enable a 5% increase in European GDP in the next eight years, subject to full completion of the actions identified in the Agenda. These included increasing investments in the ICT sector, improving the population skills related to these technologies and supporting innovation in the public sector.

One of the actions proposed in the Fifth Pillar of the Digital Agenda (“Research and Development”) is to invest in High Performance Computing (Action 132 of the Agenda).

Corresponding to the efforts globally performed in Europe, Spain has also devoted significant resources to increase bit rate and computation capacity.

In this regard, the following investments should be highlighted:
- The new network RedIRIS NOVA (connected to the pan European academic and research network GÉANT), which enables the transmission of data for scientific purposes at a speed of 10 Gps in a network covering 12,000 km. 103 M€ were devoted to upgrade this network.
- Since their creation BSC and the Spanish Network for High Performance Computing have received investments of 55 M€.

We hope to maintain these investments by allocating funds from structural funds and H2020 resources.

**High Performance Computing (HPC), BSC and the Spanish Network on HPC**

- HPC may address many of the technical challenges mentioned related to computing capabilities.
- On the other hand, fast progress in HPC technological developments requires experience and demand significant and continuous investments over time.
- As a result, those investments exceed the individual capacity of a single country. Europe has become aware of this and Member States have joined efforts to gain the relevant infrastructures.
- PRACE is the instrument we have collectively implemented to maintain European competitiveness in HPC.
  - Spanish participation in PRACE is coordinated by the Barcelona Supercomputing Center, which also leads the HPC activities in my country, through the Spanish Network on HPC (RES).
  - This network is composed by BSC and other 7 centers located throughout Spain. Other centers could join this network in the future and jointly contribute to the design and implementation of “National Strategy on High Performance Computing” closely associated to the European Strategy and PRACE.

**Opportunities derived from High Performance Computing for R&D and innovation activities – Need for public-private cooperation.**

- HPC enables us to study complex phenomena by using more precise simulations. This requires the combined analysis of large datasets, demanding great computing power to perform an immense number of calculations, and usually requires international and interdisciplinary cooperation.
• As such, HPC is very applicable to many scientific and technological disciplines. For instance, it has been successfully applied to the European FET Flagship initiative “Human Brain” and to work on the the European Genome and Phenome database (EGA).

• It is also a very suitable tool for research and development to solve some of the world’s most important societal challenges, such as Energy, Climate Change, Food and Health.

• HPC is also a useful instrument for Industry as it enables companies to develop new products and technologies, such as new chemicals and materials, at lower costs and in less time.

• HPC has enormous potential to enhance European competitiveness, considering both the role of specialized companies in performing HPC-related ICT developments and the applicability of HPC services for industry.

• HPC also poses two important technological challenges:
  – Processing speed should increase from the scale of petaflops of the present decade to the exaflop scale in the coming decade.
  – Associated energy consumption should not increase at the same proportion it has experienced until now. This would prevent large-scale implementation of this new stage of HPC.

• Public-Private cooperation is needed to address these technological challenges and maintain its potential for R&D and innovation. In Spain, we are already enjoying the results of this fruitful cooperation:
  – BSC and REPSOL have cooperated since 2007 to process underground images through HPC, enabling this oil company to increase reserves at a rate of almost five times faster than before.
  – BSC and IBERDROLA have worked together to reduce investment risks associated with wind farms.

• It is good news that this High Performance Computing Public Private Partnership has been launched. Available estimates indicate that each invested euro could result in a leveraged effort of up to 4 € in the European economy, partly associated to the commercialization of products and services.

• The Spanish system of R&D and innovation is very interested in further development of HPC and its applications. In fact, we have a very competitive ICT sector, as indicated in our successful participation in FP7. Therefore, Spain has invested significantly in HPC in the past and will continue doing so in the future.

Closing

• Today’s and tomorrow’s presentations clearly show the potential of HPC for science, technology and industry.

• I wish you a great success during these PRACE days and encourage everyone to continue searching for what science, technology and industry have in common and together, can achieve for society’s benefit.