# press kit

**Barcelona Supercomputing Center**
*Centro Nacional de Supercomputación*

## The Barcelona Supercomputing Center - Centro Nacional de Supercomputación

Early in 2004 the Ministry of Education and Science (Spanish Government), Generalitat de Catalunya (local Catalan Government) and Technical University of Catalonia (UPC) took the initiative of creating a National Supercomputing Center in Barcelona. BSC (Barcelona Supercomputing Center – Centro Nacional de Supercomputación) is the National Supercomputing Facility in Spain and was officially constituted in April 2005. BSC manages MareNostrum, located at the Torre Girona chapel. MareNostrum has increased the calculation capacity of the supercomputer MareNostrum, until reaching 94.21 Teraflops (94.21 trillions of operations per second), doubling its previous capacity (42.35 Teraflops). It had 4.812 processors and has now 10.240 processors with a final calculation capacity of 94.21 Teraflops.

The mission of BSC is to research, develop and manage information technology in order to facilitate scientific progress. With this aim, special dedication has been taken to areas such as Computer Sciences, Life Sciences, Earth Sciences and Computational Applications in Science and Engineering.

All these activities are complementary to each other and very tightly related. In this way, a multidisciplinary loop is set up: our exposure to industrial and non-computer science academic practices improves our understanding of the needs and helps us focusing our basic research towards improving those practices. The result is very positive both for our research work as well as for improving the way we service our society.

Further to the own research and to the public research support, BSC develops innovative solutions in collaboration with leading private companies of the IT sector such as IBM, Microsoft and Repsol taking into consideration the industrial applicability. The BSC offers its resources to the business environment as a competitive tool. Two representative examples are the projects in collaboration with Repsol and Airbus.

Since 2011 the BSC-CNS manages MinoTauro, a new cluster with graphical accelerators which will be used to consolidate its research in programming models, tool development and application porting. This new Bull system, based on bullx nodes, each equipped with Intel processors and NVIDIA GPUs, tops the November 2011 edition of the Green500 List in Europe at 1266 MFLOPS/W. This international ranking measures the rate of computation that can be delivered by a computer for every watt of power consumed. In November 2011 MinoTauro was ranked nº 114 in the Top500 list of the most powerful supercomputers in the world. The combination of this new machine and the current MareNostrum system means that the public consortium has tripled the supercomputing resources provided to the Spanish scientific community.

In 2011, the BSC was recognized as a “Severo Ochoa Centre of Excellence”. The goals of BSC are focused on scientific excellence in computing science. It houses the MareNostrum supercomputer, one of the most advanced supercomputers in the world. The first edition of the Severo Ochoa programme, run by the Ministry of Science and Innovation to identify and support research of excellence being carried out in Spain, has selected 8 research centres and units in Spain as being among the best in the world in their respective fields.

## BSC's history

BSC has inherited the tradition of the well-known European Center for Parallelism of Barcelona (CEPBA):

- **1991:** In this year, EPBA starts its activities, gathering the experience and needs from different UPC departments. The Computer Architecture Department (DAC) provides experience in the lower level of a computing system (numerical kernels, operating systems, tools and architecture). Five other departments (Signal Theory and Communications, Strength of Materials and Structural Engineering, Computer Systems and Languages, Nuclear Physics and Engineering and Applied Physics) of UPC with high computation demand joined DAC to set up the CEPBA

- **From 1995 to 2000:** CEPBA coordinates the service activities with CESCA (Supercomputing Center of Catalonia) through the C4 (Computing and Communications Center of Catalonia) founded by the CIRIT, Catalan Research Foundation and UPC

- **2000:** CEPBA signs an agreement with IBM to launch the CEPBA-IBM Research Institute. The objectives of this agreement are joining research on topics related with Deep Computing and Architecture, and supporting local research in other areas of science and engineering. This Research and Development Partnership between UPC and IBM has an initial commitment for 4 years

- **2004:** The Ministry of Education (Spanish Government), Generalitat de Catalunya (local Catalan Government) and Technical University of Catalonia (UPC) takes the initiative of creating a National Supercomputing Center in Barcelona.

- **2005:** BSC is officially constituted and started its activities. MareNostrum is built as the most powerful machine in Europe

- **2006:** MareNostrum doubles its calculation capacity and is ranked again as the most powerful supercomputing in Europe

- **2007:** The Ministry of Education and Science (Spanish Government) creates the Spanish Supercomputing Network (Red Española de Supercomputación, RES), a distributed structure of supercomputers to provide support to the Spanish research community. It consists of seven nodes. BSC coordinates the Spanish Supercomputing Network

- **2008:** Microsoft Research Centre (http://www.bscmsrc.eu/) will focus on the way microprocessors and software for the mobile and desktop market segments will be designed and interact over the next 10 years and beyond

- **2010:** BSC named first CUDA Research Center in Spain

- **2011:** Repsol and BSC create a joint research center in Spain, the Repsol-BSC Research Center.

- **2011:** BSC is recognized as a "Severo Ochoa Centre of Excellence"

- **2011:** BSC in association with Universitat Politecnica de Catalunya. Barcelona Tech (UPC) has been awarded by NVIDIA as a CUDA Center of Excellence (CCOE)

- **2011:** Intel Corporation and BSC signed a multi-year agreement to create the Intel and BSC Exascale Laboratory in Barcelona

## The composition of the consortium

The main Governance board of the BSC Consortium are the Board of Directors and Executive Commission, formed by members of the three shareholders institutions of the Consortium: Ministerio de Ciencia e Innovación (Spanish Ministry of Science and Innovation), the former Ministry of Education and Science, the Departament d'Economia i Coneixement de la Generalitat de Catalunya (Economy and Knowledge Ministry of the Local Government) and Universitat Politècnica de Catalunya (Polytechnical University of Catalonia).

To advice on scientific and business matters, the Scientific Advisory Board and the Business Board are being created. The Scientific Advisory Board is integrated by international prestigious scientists. The decision about the scientific use of MareNostrum is taken over by the Access Committee, formed by 44 prestigious Spanish scientists external to the BSC.

The Access Committee is constituted by four members:

- a BSC external manager with wide experience in Innovation Management
- an ANEP representative, a Supercomputing expert
- external to BSC a Supercomputing expert
- member of BSC

The Access Committee is advised by an Experts Panel composed by prestigious Spanish scientists, external to BSC. This Experts Panel is divided into four groups, according to the established classification from the Spanish Foundation of Science and Technology (FECYT – Fundación Española de Ciencia y Tecnología): Astronomy, Space and Earth Sciences, Biomedicine and Health Sciences, Physics and Engineering, Chemistry and Materials Science and Technology. The Experts Panel is composed by scientists of outstanding career and experience in the management of research projects, mainly managers of National Programs or of the ANEP. Each of the above areas represented by the Experts Panel is chaired by a group leader, who acts as a coordinator, an assistant, and between 4 - 8 experts in the area. Half of these experts are chosen by the ANEP. The Experts Panel can request the peer to peer review mechanism of the ANEP. The Experts Panel prioritises the activities of its respective areas and sends its recommendations to the Access Committee who publishes the final report in the BSC website.

## The main research areas of BSC

The organization of BSC has a main scientific structure divided into four Departments:

- **Computer Sciences:** focuses its research activities in a set of areas covering low level system software and hardware for future supercomputer systems as well as optimization of kernels and applications for these systems.

- **Earth Sciences:** devoted to modelling and understanding the behaviour of the Earth System, mainly focusing on climate and atmospheric processes.

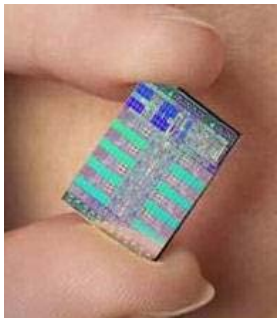
- **Life Sciences:** focused in the use of computational tools in the understanding of life processes.

- **Computer Applications in Science & Engineering:** focuses its research activities in developing, adapting and optimizing numerical applications for scientific problems in present and future supercomputer systems.

## Computer Sciences

The Computer Sciences department is managed by Professor Jesús Labarta, as the department's director, and Professor Eduard Ayguadé, as the department associate director.

The **Computer Sciences** department has three main objectives:



- Firstly, the department aims to make advance in the hardware and software technologies available to build and efficiently use supercomputing infrastructures, bridging the gap between computer architecture and application requirements. The department is proposing novel architectures for processor, memory hierarchy and their interconnection, programming models and their efficient implementation, tools for performance analysis and prediction, resource management at different levels in the system (processor, memory, storage) and for different execution environments, including Grid and e-Business platforms, as well as application optimization

- Secondly, doing research in collaboration with computing system providers. In this direction, the BSC has signed agreements with IBM Research, Microsoft Research and Sun Microsystems, and defined specific projects in areas related with computer architecture, tools for performance analysis, programming models, autonomic systems and application optimization using architecture-specific capabilities

- Finally, the Computer Sciences department wants to keep a very close interaction between the different departments of the BSC. The department will bring the technologies developed to the application departments and groups in the BSC and will favour its efficient use. This synergy, along with the available experience in the optimization of applications (both numeric and non-numeric) will reduce significantly the huge simulation times normally required. In addition, new applications for future supercomputers with many more processors will be investigated. On the other hand, the application groups at BSC will show their needs that will drive the research at hardware level for the future supercomputers (processors, memory, and their interconnection following performance, cost, and power consumption criteria), at base-software level (tools, compilers, and programming models that will ease the programming and optimization of applications), as well as the basic-algorithm level that is the building block for applications.

More information on page: www.bsc.es/computer-sciences

## Earth Sciences

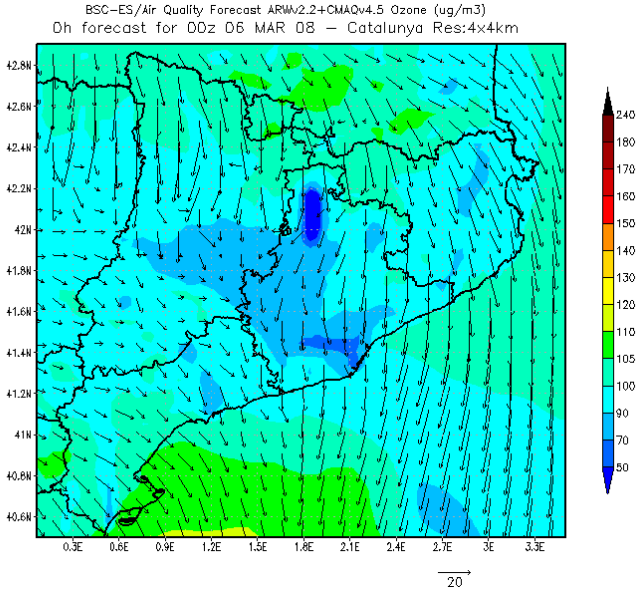
The Earth Sciences department, managed by Professor José María Baldasano, as the department's director, has the following main goals:

- Changes in the composition of the atmosphere can affect the habitability of the planet by modified the air quality at the ground and altering long-term climate. Research in this area is concerned with the development, implementation and refinement of global and regional state-of-the-art models for short-term air quality prediction and long-term climate applications
- Issues related to atmospheric dynamics, natural and anthropogenic emissions, improvement of air quality forecasts, the transport and dispersion of pollutants in complex terrain, urban air quality, aerosol optical properties, aerosol radiative effects and the feedback between

meteorology and air pollution shapes the research agenda of the group. Together with the advances in the parallelization of air quality model codes, have allowed such high-resolution simulations

- The high performance capabilities of MareNostrum allows to increase the spatial and temporal resolution of atmospheric modelling systems, in order to improve our knowledge on dynamic patterns of air pollutants in complex terrains and interactions and feedbacks of physico-chemical processes occurring in the atmosphere

- The group also maintains daily operational air quality and mineral dust forecasts for scientific purposes and to support national initiatives for air quality prevention




Furthermore, the following list defines the research lines and teams in the Earth Science department:

- Air quality: is a major environmental and health problem affecting developed and developing countries around the world. The main objective of the research line is the development and implementation of high resolution emission-meteorology-chemistry modelling systems to understand the physico-chemical processes taking place in the atmosphere

- Meteorological modelling: the evolution of the atmosphere governs a large number of processes that may impact directly to our society as severe-weather situations leading to high rainfall rates or atmospheric conditions that contribute to modify the air quality. The main focus of the research line is the improvement of the skills of mesoscale meteorological models for a deeper understanding of the mesoscale phenomena occurring in the atmosphere, with special attention to the boundary layer processes

- Mineral dust: A large portion of atmospheric particulate matter is derived from arid regions of the Earth and is distributed all over the globe. The most prominent example of this transport is the export of mineral dust from the Saharan desert. The main focus of this research line is to understand and model the atmospheric life cycle of mineral dust in order to assess and predict its impacts on air quality and climate

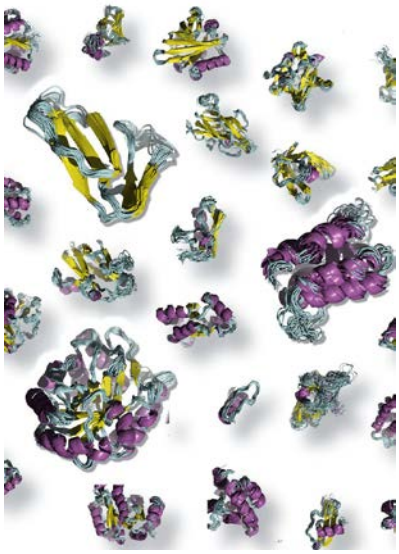
- Climate change: The horizontal resolution of coupled Global Circulation Models (GCM) is still too coarse to capture the effects of local and regional forcings in complex areas. The main focus of this research line is the development and testing of regional climate downscaling models for the generation of high-resolution regional climate information from coarse-resolution GCM simulations

More information on page: www.bsc.es/earth-sciences

## Life Sciences

The Life Sciences department is managed by Professor Modesto Orozco, as the department's director and its research program integrates different independent research leaded by senior scientists who work in different aspects of computational biology, ranging from bioinformatics for genomics to computational biochemistry.

The department's main goal is to gain a deep insight into the origin, evolution and function of living organisms using theory and computation. Its focus goes from a global analysis of living entities understood as complex systems to detailed studies of key interactions at the sub-atomic level. Overall, its objective is to make theory and simulation as one of the driving forces to the advance of research in life sciences.



There are five research lines in Life Sciences:

- Molecular Modelling and Bioinformatics: The fundamental goal of this group is the theoretical study of biochemical systems, from general methodological development, to the analysis of specific problems of special biological relevance. For instance, we are using molecular dynamics and statistical mechanics to study anomalous forms of nucleic acids. Particular attention is paid to the study of conformational transitions in DNA, drug-DNA interactions, and the analysis of triple helices and other structures of potential impact in antigene or antisense therapies. We are also interested in the understanding of the basis of protein interactions, including those of pharmacological importance, and have also made several studies on very basic aspects of enzymatic reactivity, protein folding and docking. In this context, we have created the MODEL (Molecular Dynamics Extended Library) library of molecular dynamics trajectories for all the representative proteins. The project, the largest of this type in the world, provide us with a complete picture of protein dynamics and help us in drug-design projects

- Computational Genomics: The main objective is to take advantage of computing resources to contribute to the general understanding of the biology of genomes. We are focused in the design, development, and use of bioinformatic protocols and tools in the context of comparative genomics and analyses of gene and protein collections. These approaches are designed to answer questions related to the modifications of genes and regulatory regions during evolution and their impact in the physiology of the organisms, as well as to understand the evolution of biological systems

- INB-Computational Node 2: The key aim of the INB is to generate and apply bioinformatics solutions to special requirements emerging from the development and execution of national research projects with a genomic or proteomics focus. Within INB the mission Computational Node 2 is to provide computational resources, including hardware specifically intended to the INB, biological databases, and generic analysis applications to the bioinformatics community

- Protein interactions and docking: Focuses on theoretical and computational approaches to protein interactions. The first aim is to develop and optimize computational algorithms for characterizing and understanding protein-protein association, which remains one of the most important challenges in Structural Biology. The ultimate goal is to understand the subtle

determinants of the specificity of protein-protein binding, which in turn will help us to make more accurate predictions of complexes of biological and therapeutical interest. All this knowledge will also help to predict the interaction of small molecules with protein-protein interfaces, with the goal of designing compounds capable of inhibiting protein interactions of therapeutical interest

- Electronic and atomic protein modelling: The main goal of this research area, leaded by Víctor Guallar, is the study of complex biochemical processes both at an electronic, by means of quantum mechanics, and atomic, by means of classical mechanics, theoretical detail. First, they place particular on the application of such methods, with emphasis on protein-ligand interactions. The second area involves the development of new methodological components, focused in obtaining long time protein dynamics by means of a kinetic Monte Carlo scheme.

For further information, visit www.bsc.es/life-sciences

## Computer Applications in Science & Engineering (CASE)

The Computer Applications in Science & Engineering (CASE) is managed by Professor José María Cela, as the department's director. The main objective of the department is to support user communities in science & engineering that are potential users of HPC. To accomplish this objective the department has some in house developments that can be reused in several scientific areas. Moreover, this group collaborates with other scientific groups in order to improve their software developments. The CASE department is a bridge between the different e-Science areas and the most advanced computer science technologies.

The second objective of the department is to perform a proactive technology transfer with the industry. For this reason we develop an important part of our research in relevant engineering problems in industrial sectors like aerospace, automotive, energy, medical.

The following list defines the research teams in the Computational Sciences department:

- Physical and Mathematical Modelling
- High Performance Computational Mechanics
- Molecular and Atomic Simulations
- Geophysics
- Numerical Kernels & Performance Evaluation
- Visualization

For further details, visit www.bsc.es/computer-applications

## MareNostrum and MinoTauro, tools at the service of the scientific community

BSC hosts **MareNostrum** one of the most powerful machines in Europe and holds the number 170 in the world, according to the June 2011 Top500 list (www.top500.org).

In November 2006 its capacity was been increased due to the large demand of scientific projects. MareNostrum increased its calculation capacity, until reaching 94.21 Teraflops (94.21 trillions of operations per second), doubling its previous capacity (42.35 Teraflops). It had 4.812 processors and has now 10.240 processors with a final calculation capacity of 94.21 Teraflops.

MareNostrum is a supercomputer based on processors PowerPC, the architecture BladeCenter, a Linux system and a Myrinet interconnection. These four technologies configure the base of an architecture and design that will have a big impact in the future of supercomputing.

See below a summary of the system:

- Peak Performance of 94,21 Teraflops
- 10240 IBM Power PC 970MP processors at 2.3 GHz (2560 JS21 blades)
- 20 TB of main memory
- 280 + 90 TB of disk storage
- Interconnection networks:
    - Myrinet and Gigabit Ethernet
- Linux: SuSe Distribution

MareNostrum has provided support to 2,000 research projects in areas such as Earth Sciences, Biomedicine, Chemistry, Materials Sciences, Physics, Engineering, Earth Sciences and Astronomy Space. For example, MareNostrum has helped to study the interactions between protein-protein and protein-ligand in order to improve the design of new drugs, it has helped to understand how the physical properties of DNA modulates the biological functions of molecules, to find similarities among different genomes (such as the human and rat genomes), to predict the air quality of the Iberian Peninsula, to model the emission and transport of natural dust from the Saharan desert until the European continent, to study the impact and consequence of the climate change in Europe, to simulate the universe formation, to study the turbulences in an airplane wing inside the turbines, to investigate in the hadrons properties, to design nanofibres structurally stabled, to study the plasma physics confined magnetically or to optimize and scale monitoring, analysis and visualization tools in order to understand the behaviour of the parallel applications in supercomputers such as MareNostrum.

**MinoTauro** is the new cluster with graphical accelerators which will be used to consolidate its research in programming models, tool development and application porting. This new cluster is the highest ranked European machine in the November 2011 edition of the Green500 List, at 1266 MFLOPS/W. This international list measures the rate of computation delivered for every watt of power consumed by a supercomputer. In November 2011 MinoTauro was ranked nº 114 in the Top500 list of the most powerful supercomputers in the world.

The Green500 list rates MinoTauro as the seventh most energy-efficient supercomputer in the world and the first in Europe. Furthermore, its architecture, based on bullx nodes, each equipped with Intel processors and NVIDIA GPUs, comes in third in energy-efficiency, behind the Blue Gene/Q and ATI

solutions. MinoTauro has an efficiency of 1266 MFLOPS/W, while the top ranked machine, at IBM-Rochester, has a ratio of 2026 MFLOPS/W.

Green500 caculates energy efficiency by dividing millions of floating operations per second (MFLOPS) by the number of Watts (W) consumed by a supercomputer, giving the metric MFLOPS/W.

In November 2006, the Spanish Ministry of Education and Science (currently the Spanish Ministry of Science and Innovation) created the Spanish Supercomputing network that consists in a distributed structure of supercomputers in order to provide support to the supercomputing needs of the different Spanish research groups. The Scientific research progress in several areas is being possible thanks to a close interaction between a Scientific-theoric base, the experiments and the computer simulation. Having enough calculation capacity is the key for the scientific and technological development of a country. The initial nodes of this network are located at the BSC, in the Universidad Politécnica de Madrid, in the IAC (Instituto de Astrofísica de Canarias), in the ITC (Instituto Tecnológico de Canarias) as well as in the Spanish Universities of Cantabria (UC), Málaga (UMA) and Zaragoza (UZ).

## Technology Transfer

Further to BSC own activities and its public research support, BSC develops innovative solutions together with leading IT companies. In addition, BSC collaborates in the following projects:

- **IBM**: the main aim of the MareIncognito project between IBM and BSC is to define features and design of the new generation of supercomputers that will reach a calculation power more than 10 Petaflops/s (10 trillions of operations per second). The objective is to have supercomputers 100 times more powerful than the current MareNostrum, that will be equivalent to more than 100 million of PCs

- **Microsoft Research**: the Barcelona Supercomputing Center and Microsoft Corp create the BSC - Microsoft Research Centre, which will focus on the way microprocessors and software for the mobile and desktop market segments will be designed and interact over the next 10 years and beyond. Computer architecture experts at BSC have teamed up with computer scientists at Microsoft Research Cambridge (MSRC) in the United Kingdom to look for innovative solutions to the challenges and opportunities that massively parallel processing represents. The vision of the centre is of a top-down computer architecture in which software requirements drive the hardware innovation forward rather than letting the hardware design condition software development. In addition to fundamental and applied research in transactional memories, a promising technology that facilitates writing of parallel programs for multi-core processors, hardware support for managed runtimes will be conducted in the initial research projects

- **Repsol-BSC Research Center**: This center makes it possible to tackle multiple research projects to develop advanced technology applicable to hydrocarbon exploration and other areas of interest for Repsol. The center has been created in order to enhance and strengthen co-operation between Repsol and the BSC. The two entities have been working together since 2007 on R&D projects in seismic imaging applied to hydrocarbon exploration.

- **The Spanish National Agency of Meteorology (AEMET):** is developing the implementation, dissemination and validation of the operational predicting system of the North African air dust to the Iberian Peninsula and the Canary Islands. BSC is also developing the modelling, detection, follow-up systems of the atmospheric particles

- **Sun Microsystems:** it represents a relevant progress in the development of future server processors. In particular, the project will deal with representative tasks of the network in Sun Niagara T2 architectures as well as in capacities such as virtualization and logic domains

- **Airbus**: BSC started working with Airbus to improve its eLSA code (fluid dynamics) which was initially developed by ONERA in France and is currently used worldwide by Airbus. The design of the next generation chip multiprocessor will clearly impact how computers look ten years from now and beyond. BSC worked and continues to work with Microsoft to explore potential chip designs for general purpose and the personal mass computer market. At this time, the project focuses primarily on architectural ideas, with an understanding of the importance of total system integration with software

- **Nvidia**: BSC was named by NVIDIA as a 2010 CUDA Research Center, the first in Spain. The CUDA Research Center Program recognizes and fosters collaboration with research groups at universities and research institutes that are expanding the frontier of massively parallel computing. This new research center will bring new equipment, a seed program for new NVIDIA GPU releases, software licenses, and training and collaboration opportunities with CUDA partners worldwide and with NVIDIA. In 2011 BSC in association with Universitat Politecnica de Catalunya. Barcelona Tech was awarded by NVIDIA as a CUDA Center of Excellence (CCOE). BSC and UPC currently offer a number of courses covering CUDA architecture and parallel computing and became the first NVIDIA CUDA Research Center in Spain, in 2010. BSC/UPC Prof. Mateo Valero is Principal Investigator for the Center, and Prof. Nacho Navarro, is acting director of the actual BSC CUDA Research Center. Now as a CUDA Center of Excellence, BSC-CNS will utilize GPU computing equipment and grants provided by NVIDIA to support a growing number of research and academic programs.

**The future of Supercomputing in Europe**

**PRACE:** The vision of the Partnership for Advanced Computing in Europe (PRACE) is to enable and support European global leadership in public and private research and development.
PRACE seeks to realize this vision by contributing to the advancement of European competitiveness in industry and research through provisioning of world leading persistent computing and data management resources and services.

The PRACE AISBL (Partnership for Advanced Computing in Europe-Asociacion International Sans But Lucratif) is a pan-European infrastructure seated in Brussels and established as an international non-profit association of European government representative organizations responsible for High-Performance Computing resources and services for public research. Named 'Partnership for Advanced Computing in Europe AISBL', it currently has 20 members, representing Austria, Bulgaria, Cyprus, Czech Republic, Finland, France, Germany, Greece, Ireland, Italy, The Netherlands, Norway, Poland, Portugal, Serbia, Spain, Sweden, Switzerland, Turkey and the UK. These partners are creating a pan-European world class computing and data management infrastructure, providing access to resources at the highest performance level including sophisticated services for scientific simulations in all fields of science and engineering.

The PRACE research infrastructure (RI) is open to all European researchers and their collaborators for research with potential for high European and international impact. Applications for access are subject to peer review overseen by the PRACE Scientific Steering Committee comprised of leading European researchers.

The PRACE leadership systems form the apex of resources for large-scale computing and data management for scientific discovery and engineering research and development for the benefit of Europe and are well integrated into the European HPC ecosystem. PRACE is funded by member

governments through their representative organizations and EU's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° RI-261557. The first PRACE computer systems and their operations are funded by the governments of the representative organizations hosting the systems.

More information on www.prace-ri.eu

**Mont-Blanc:** The Mont-Blanc project brings together a purely European consortium gathering industrial technology providers and supercomputing research centres. Energy efficiency is already a primary concern for the design of any computer system and it is unanimously recognized that future Exascale systems will be strongly constrained by their power consumption. This is why the Mont-Blanc project, which was launched on 14th October in Barcelona with a kick-off meeting, has set itself the following objective: to design a new type of computer architecture capable of setting future global High Performance Computing (HPC) standards that will deliver Exascale performance while using 15 to 30 times less energy.
More information on www.montblanc-project.eu/

## Mateo Valero, BSC's director

Mateo Valero, http://personals.ac.upc.edu/mateo/, obtained his Telecommunication Engineering Degree from the Technical University of Madrid (UPM) in 1974 and his Ph.D. in Telecommunications from the Technical University of Catalonia (UPC) in 1980. Since 1974 he is a professor in the Computer Architecture Department at UPC, in Barcelona and since 1983 he is full professor. His research interests focuses on high performance architectures. He has published approximately 600 papers, has served in the organization of more than 300 International Conferences and he has given more than 400 invited talks. He is the director of the Barcelona Supercomputing Centre, the National Centre of Supercomputing in Spain.

Dr. Valero has been honoured with several awards. Among them, the Eckert-Mauchly Award, by the IEEE and the ACM, the IEEE Harry Goode, two Spanish National awards, the "Julio Rey Pastor" to recognize research on IT technologies and the "Leonardo Torres Quevedo" to recognize research in Engineering, by the Spanish Ministry of Science and Technology, presented by the King of Spain and the "King Jaime I" in research by the Generalitat Valenciana presented by the Queen of Spain. He has been named Honorary Doctor by the University of Chalmers, by the University of Belgrade, by the Universities of Las Palmas de Gran Canarias and Zaragoza in Spain and by the University of Veracruz in Mexico. "Hall of the Fame", selected as one of the 25 most influents European researchers in IT during the period 1983-2008.

In December 1994, Professor Valero became a founding member of the Royal Spanish Academy of Engineering. In 2005 he was elected *Correspondant Academic* of the Spanish Royal Academy of Science and in 2006, member of the Royal Spanish Academy of Doctors and member of the "Academia Europaea", the "Academy of Europe". He is a Fellow of the IEEE, Fellow of the ACM and an Intel Distinguished Research Fellow. In 1998 he won a "Favourite Son" Award of his home town, Alfamén (Zaragoza) and in 2006, his native town of Alfamén named their Public College after him.

More information about his profile: http://people.ac.upc.es/mateo

For more information:

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