



**Barcelona
Supercomputing
Center**

Centro Nacional de Supercomputación

www.bsc.es

HPC Resources in the BSC and the RES “Red Española de Supercomputación”

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Operations Director and RES Coordinator
BSC-CNS

7èmes journées mésocentres
7 octobre 2014, Institut Henri Poincaré, Paris

Barcelona Supercomputing Center - Centro Nacional de Supercomputación

⌋ BSC-CNS objectives:

- R&D in Computer, Life, Earth and Engineering Sciences
- Supercomputing services and support to Spanish and European researchers

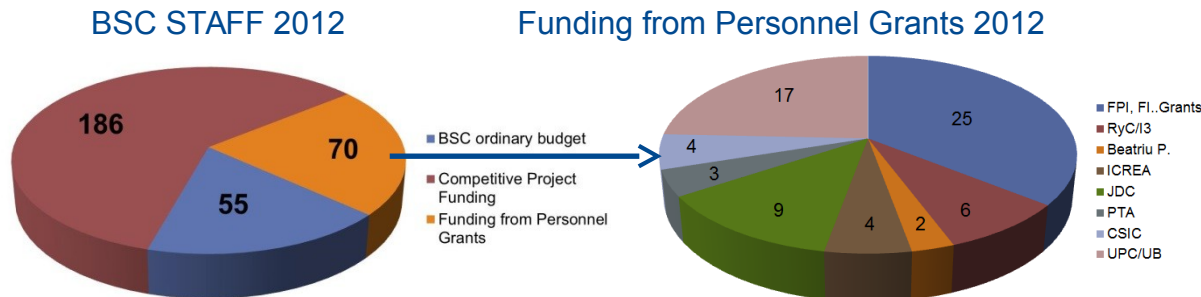


⌋ BSC-CNS is a consortium that includes:

- Spanish Government 51%
- Catalan Government 37%
- Universitat Politècnica de Catalunya (UPC) 12%



⌋ +300 people, 40 countries



Science today is about collaborating and competing internationally

BSC is involved in projects with partners from 43 countries

Argentina

Austria

Belarus

Belgium

Brazil

Bulgaria

Canada

Chile

China

Colombia

Cyprus

Czech Republic

Denmark

Estonia



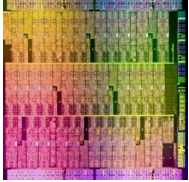
Science today is about collaborating and competing internationally

Staff from 40 different countries work together at BSC

Argentina
Austria
Belgium
Bosnia
Bulgaria
Canada
Colombia
Chile
China
Cuba
Denmark
Ecuador
France
Germany



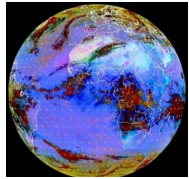
BSC-CNS: Research Departments



COMPUTER SCIENCES

Aim: To influence the way machines are built, programmed and used.

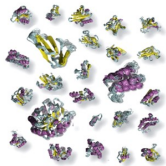
Topics: Programming models, performance tools, Big Data, computer architecture & Energy efficiency.



EARTH SCIENCES

Aim: To develop and implement global and regional state-of-the-art models for short-term air quality forecast and long-term climate applications.

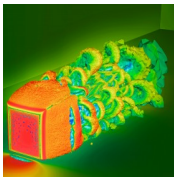
Topics: Air quality, Atmospheric modelling, Mineral dust & Climate modelling.



LIFE SCIENCES

Aim: To understand living organisms by means of theoretical and computational methods

Topics: Molecular modeling, Genomics & Proteomics.

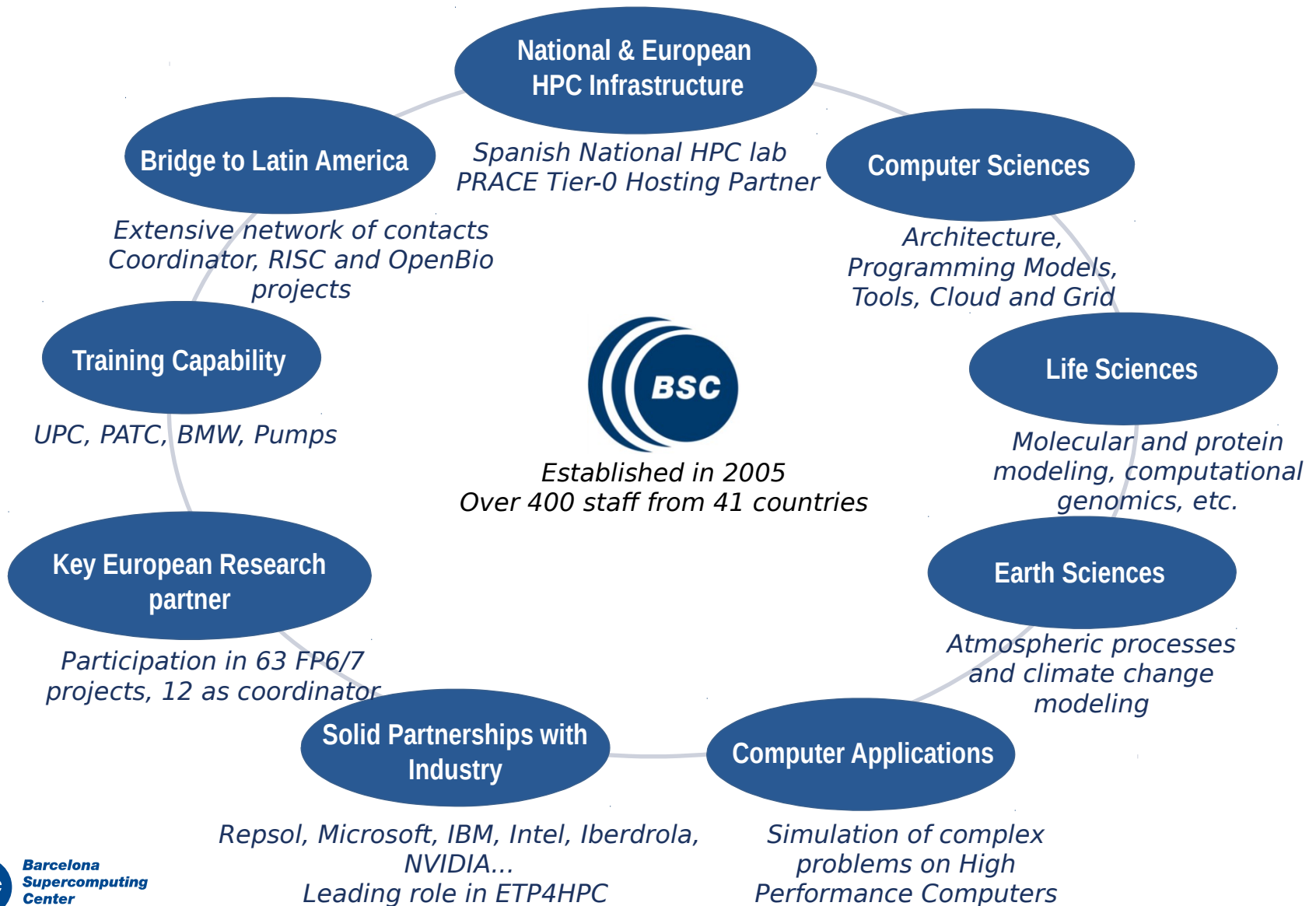


CASE

Aim: Develop scientific and engineering software to efficiently exploit HPC capabilities.

Topics: Biomedical, Geophysics, Energy & Social and Economic simulations.

BSC-CNS: At-a-glance

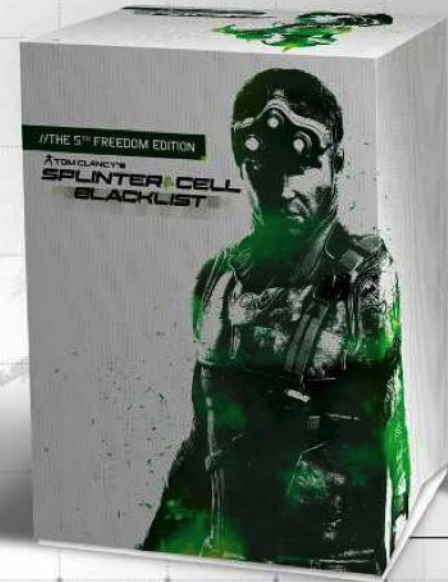


BSC-CNS: MareNostrum3



9th Supercomputer in Europe, 29th in the World (TOP500, June 2013)

HPC and videogames



COLLECTOR BOX

TOM CLANCY'S SPLINTER & CELL BLACKLIST THE 5TH FREEDOM EDITION



STEELBOOK



SAM FISHER
FIGURINE
Height: 24 cm



96 PAGE
GRAPHIC NOVEL



SINGLE PLAYER AND COOP MAPS



> DEAD COAST



> BILLIONAIRE'S YACHT



> 5 GEAR PIECES



> 5 SUITS



> 5 WEAPONS



WWW.SPLINTERCELL.COM



UBISOFT

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HPC and videogames



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HPC and videogames





RED ESPAÑOLA DE
SUPERCOMPUTACIÓN

SPANISH SUPERCOMPUTING NETWORK

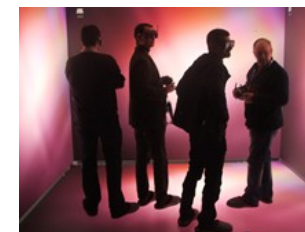
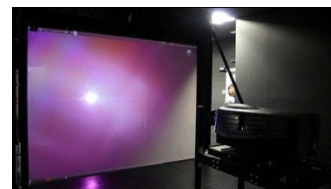
RES: A national alliance

The **RES** is a distributed virtual infrastructure.
An interconnection of **supercomputers** that manage their computing capacity and **provide service to researchers.**



« El Centro de Supercomputación de la Villa de Madrid desde 2007:

- Proporciona equipos de supercomputación y visualización interactiva.
- Fomenta el uso de la supercomputación de y de técnicas de visualización avanzadas en todos los ámbitos científicos, empresariales y de la administración.
- Realiza actividades de investigación relacionadas con la generación de software especializado para la explotación de la supercomputación y visualización en diversos dominios de la ingeniería, la energía y el medioambiente.
- Entre sus proyectos destaca **Cajal Blue Brain**.



Peak perf:	103,4 TFLOPS
Processor:	3.920 IBM Power7 3.3
Memory:	8,7 TB
Disk	190 TB
Networking:	Infiniband, GbE
OS:	Linux

« El Instituto de Física de Cantabria creado en 1995:

- Tiene como objetivo fundamental desarrollar investigación científica de alta calidad en los ámbitos de la Astrofísica y la Estructura de la Materia.
- Destaca entre su labor, la coordinación de la **ES-NGI** que pretende integrar recursos computacionales con el objetivo de crear una Infraestructura de computación virtual y distribuida, que utilizando la tecnología Grid, permita la interconexión de centros de recursos computacionales en España



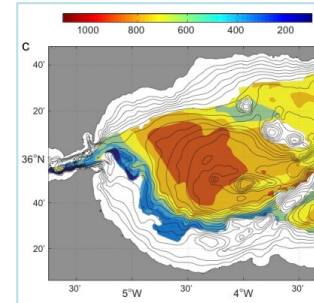
Peak perf.: 52 TFLOPS/s
Processor: 316 Intel Xeon CPU E5-2670
2.60GHz
Memory: 10,1 TB
Disk: 14 TB
Network: IB
OS: Scientific Linux 6.2



UMA - SCBI – Nodo Pablo

« El centro de Supercomputación y Bioinformática de la Universidad de Málaga ofrece desde 2007:

- Soluciones y servicios a investigaciones en biología que tengan necesidad del supercomputación o de software especializado.
- Desarrollo de algoritmos y herramientas propias.
- Desarrollan proyectos como el la **identificación de cambios en genoma de *Escherichia Coli*** (UMA, CNRS) y el **Apoyo al estudio estadístico en muestras humanas de pacientes con cáncer de colon** (UMA, Hospital Granada).



Peak Perf.: 63 TFLOPS/s
Processor: 82 AMD Opteron 6176, 96 Intel E5-2670,
56 Intel E7-4870, 32 GPUS Nvidia Tesla
M2075
Memory : 21 TB
Disk: 600 TB lustre + 260TB
Network: Infiniband, GbE
OS: SUSE Linux

El Instituto de Biocomputación y Física de Sistemas Complejos de la UZ es miembro de la RES desde finales de 2006. El BIFI cuenta con cuatro áreas de investigación:

- Bioquímica y Biología Celular y Molecular
 - Biofísica
 - Computación
 - Física
- Son destacables sus proyectos *IberCivis* y *JANUS*, además de su participación en *Piregrid* y *Aragrid*.

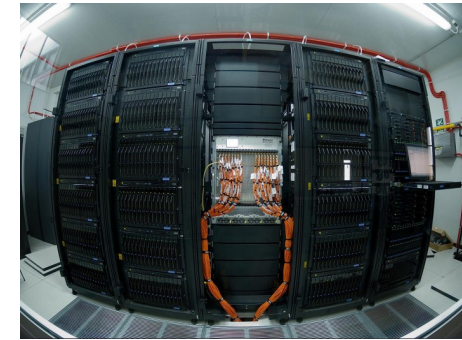


Peak Perf. : 25,8 TFLOPS/s
Processor: 3072 AMD Opteron 6272 a 2.1 GHz
Memory: 12,5 TB
Disk: 36 TB
Network: Infiniband
OS: Scientific Linux

Universitat de València – Nodo Tirant

« La Universidad de Valencia es miembro de la RES desde enero de 2008. A través del Servicio de Informática proporciona:

- Gestión y mantenimiento de Infraestructuras y redes, Sistemas de Información y otros sistemas.
- Desarrollo de aplicaciones.
- Administración y explotación de datos.
- Proporciona soporte a los usuarios.
- Son remarcables las colaboraciones del Servicio de Informática con proyectos de Astronomía, Química y Física de investigadores de la UV.



Peak perf.: 18,8 TFLOPS/s
Processor: 2048 PowerPC 970 2.3 GHz
Memory: 2 TB
Disk: 56 + 40 TB
Network: Myrinet, GbE, 10/100
OS: SuSe Linux

El Instituto Astrofísico de Canarias

tiene como objetivos fundamentales desde 1982:

- La investigación astrofísica
- El desarrollo de instrumentación científica ligada a la astronomía
- La formación de personal investigador
- La administración del Observatorio del Teide y del Observatorio del Roque de los Muchachos
- La divulgación de la ciencia
- Entre sus proyectos se incluye la colaboración **SDSS-III** que recientemente publicó el mayor mapa del Universo en 3D o su participación en el desarrollo de un instrumento del telescopio espacial Euclid de la ESA.



Peak perf.: 9,4 TFLOPS/s
Processor: 1024 PowerPC 970 2.3 GHz
Memory: 2 TB
Disk: 14 + 10 TB
Network: Myrinet, GbE, 10/100
OS: SUSE Linux

« El Instituto Tecnológico de Canarias fue fundado en 1992 con la finalidad de:

- Fomentar la Investigación, Desarrollo e Innovación, en el ámbito regional del Archipiélago canario
- Dar soporte a la Agencia Canaria de Investigación, Innovación y Sociedad de la Información (ACIISI) del Gobierno de Canarias para el desarrollo de su programa de actuaciones para potenciar la innovación tecnológica en las empresas canarias.
- Uno de sus proyectos es **Venturi**, una solución para resolver los problemas de vertidos de desaladoras y depuradoras con difusores y que ha generado la patente de los diseños.



Peak Perf.: 3,1 TFLOPS/s
Processor: 336 PowerPC 970 2.3 GHz
Memory: 672GB
Disk: 93 TB
Network: Myrinet, GbE, 10/100
OS: Linux

☞ Distribution of resources

- 80% for own usage (distributed on their own policy)
- 20% assigned by Access Committee (24% for BSC)

☞ Single Access Committee

- Core Team:
 - ANEP, MINECO, Experts in Supercomputing (BSC and RES)
- 40 international Scientists
- 4 panels
 - Astronomy, Space and Earth Sciences
 - Biomedicine and life sciences
 - Mathematics, Physics and Engineering
 - Chemistry and New materials
- Access every 4 months, 4 months duration

Intranet available at
www.bsc.es/RES

Information required:

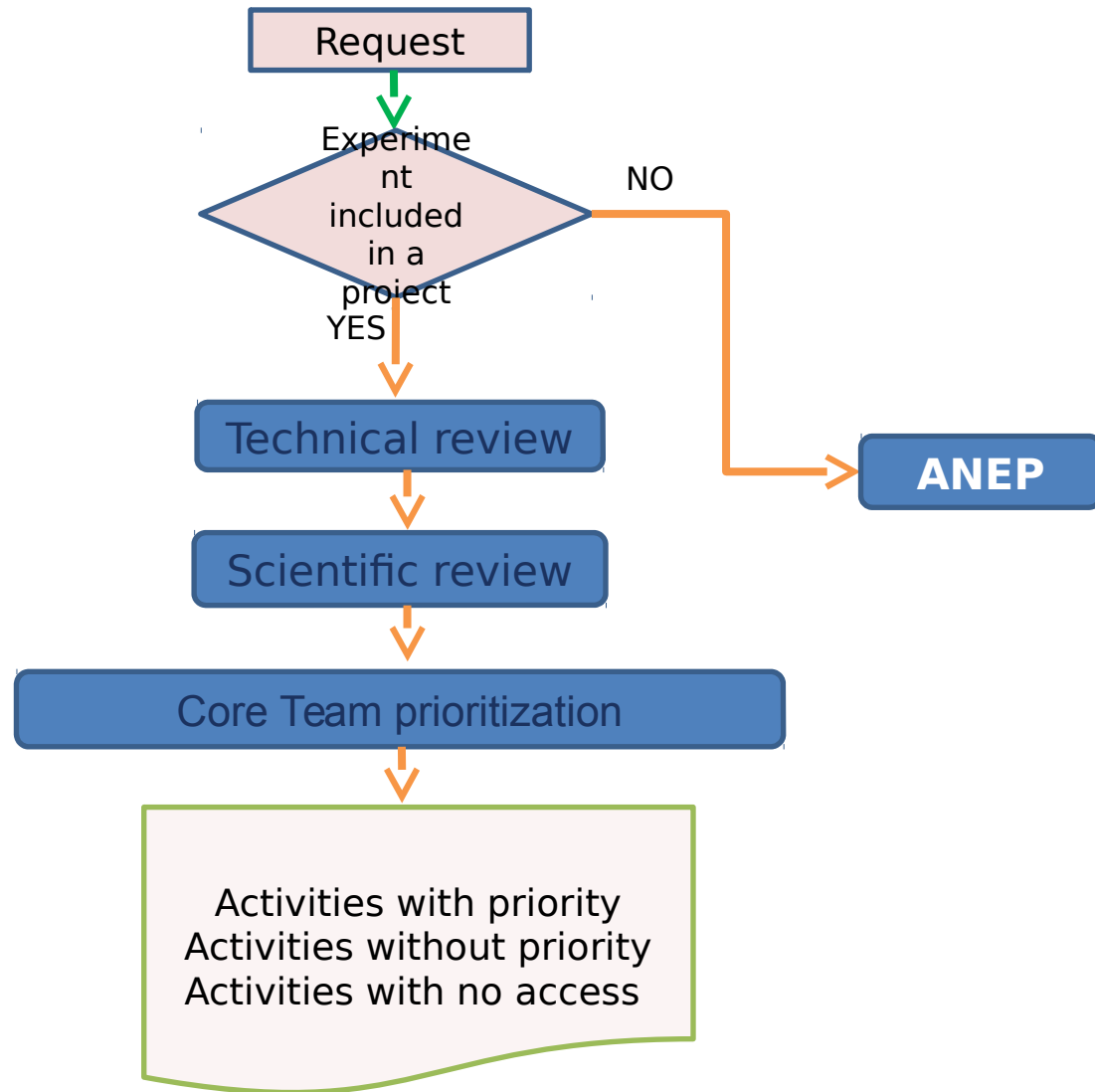
Projects description and experiment explanation

Software and libraries required

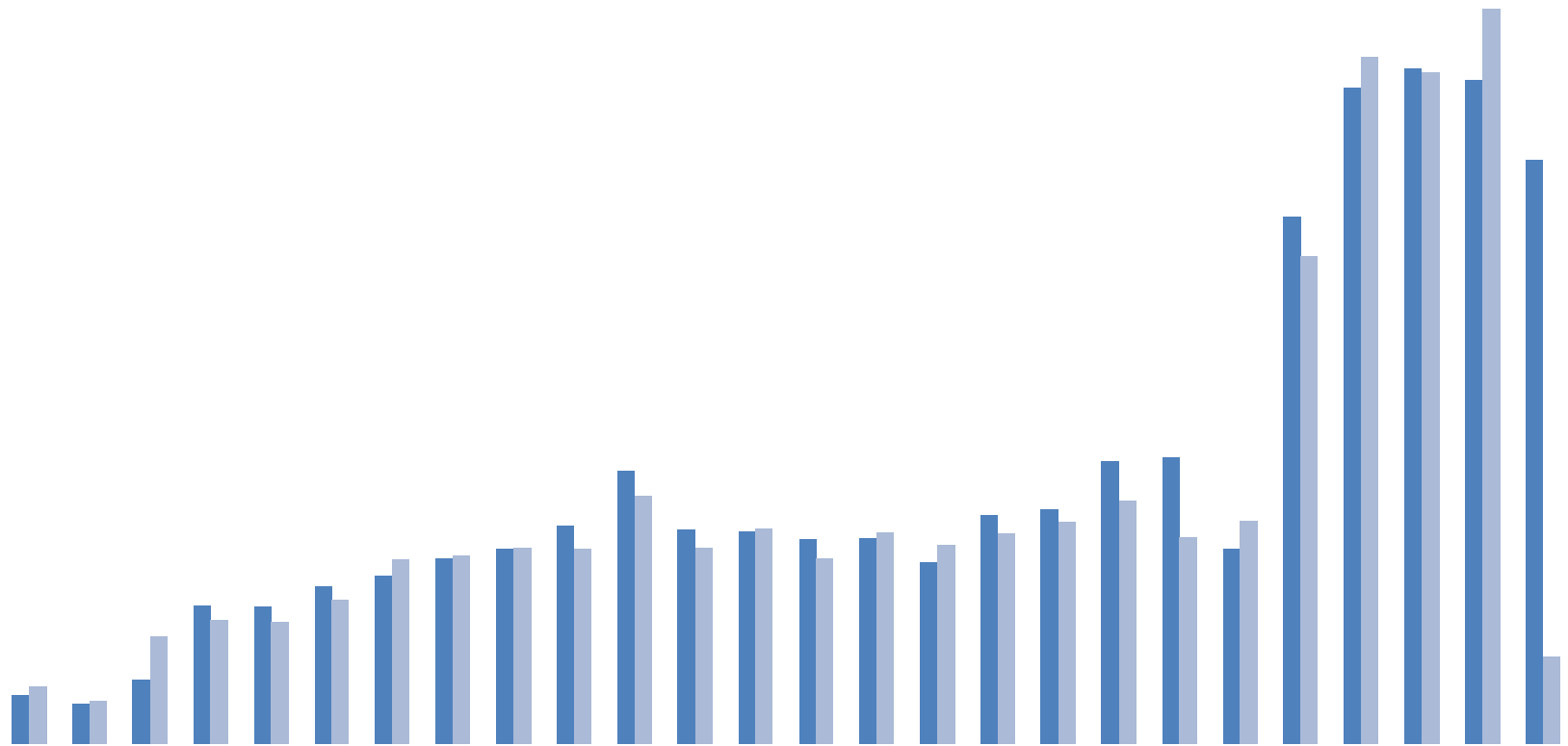
Research team description

Resources required (hours, memory, disk)

RES: Review process



RES: Evolution of awarded and consumed zettaFLOPS(10^{21})



■ Awarded ■ Requested

RES User Committee

History

- Established February 2010

Objectives

- The purpose of CURES is to provide advice and feedback to the RES management and technicians (Red Española de Supercomputación) on the current state and future delivery of RES resources and services.
- CURES is to promote the effective use of the high performance computing facilities at RES by sharing information about experiences in using the facility, suggesting new research and technology directions in scientific computing, and voicing user concerns. To this end CURES will maintain communications through appropriate means, such as regular meetings, shared databases, and webpages.

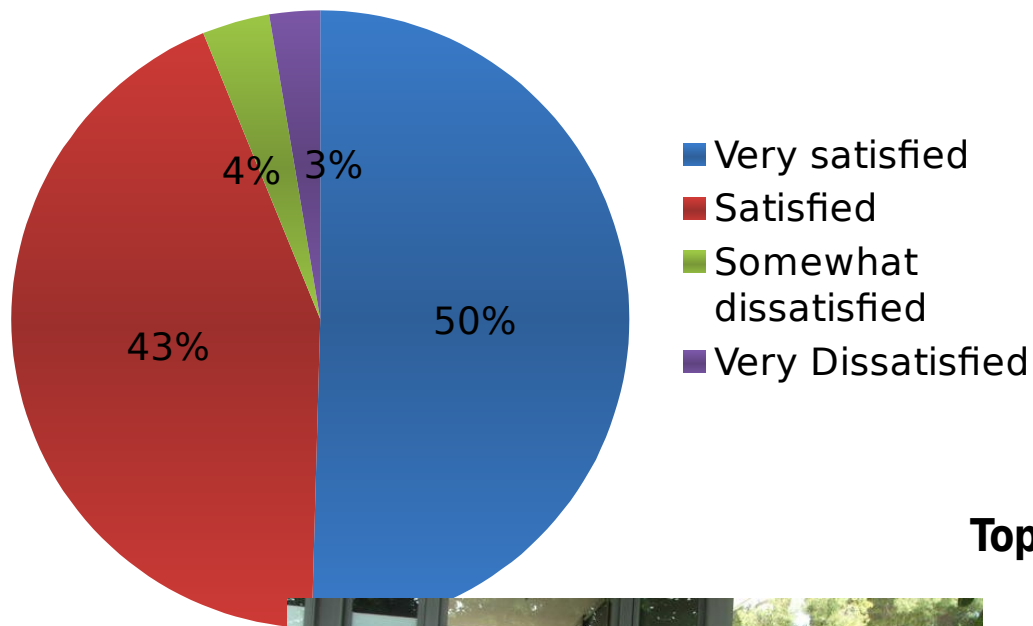
CURES members

- 8 scientists (2 per area), should be PIs of past activities.
- Technical support from RES administration

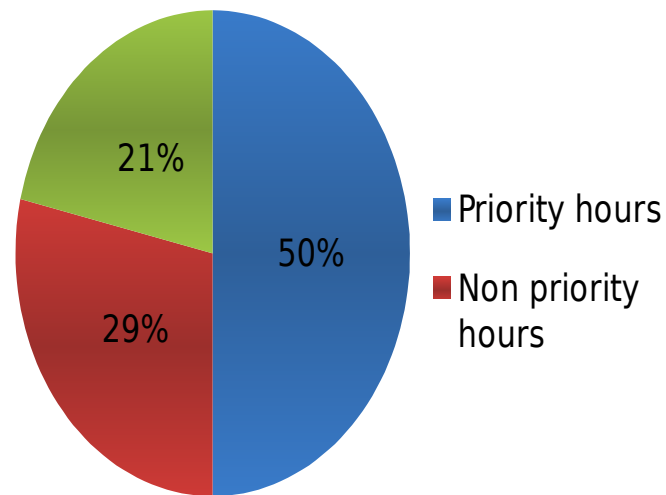
Example: Survey on Quality of Service

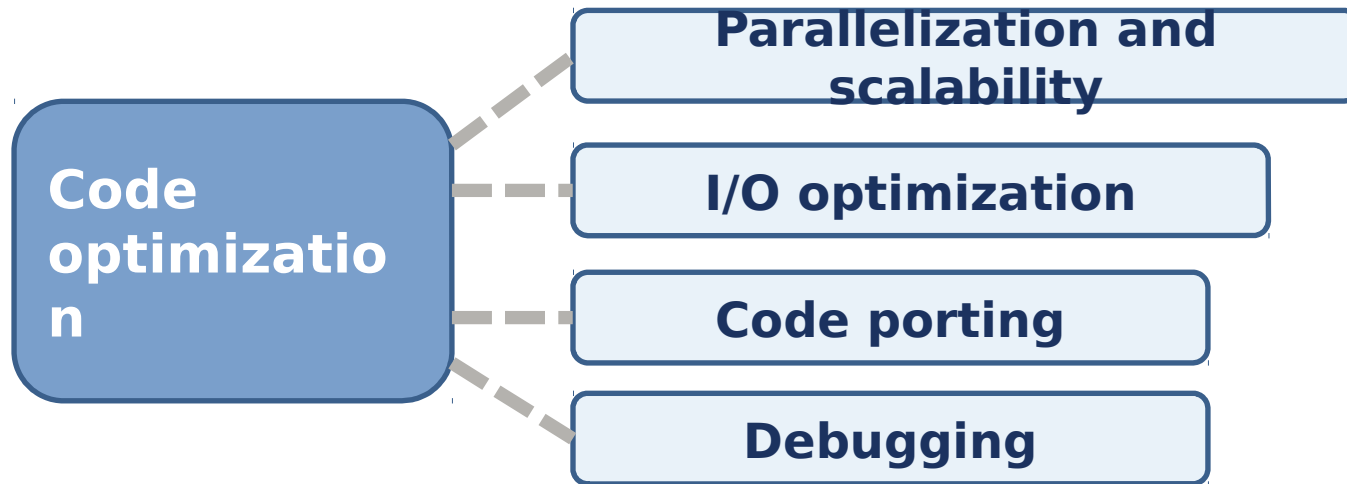
RES, user survey results

Overall Satisfaction



Topology of Access Awarded of responders





Data Storage

Test activities

Scientific dissemination

Seminars, training and workshops

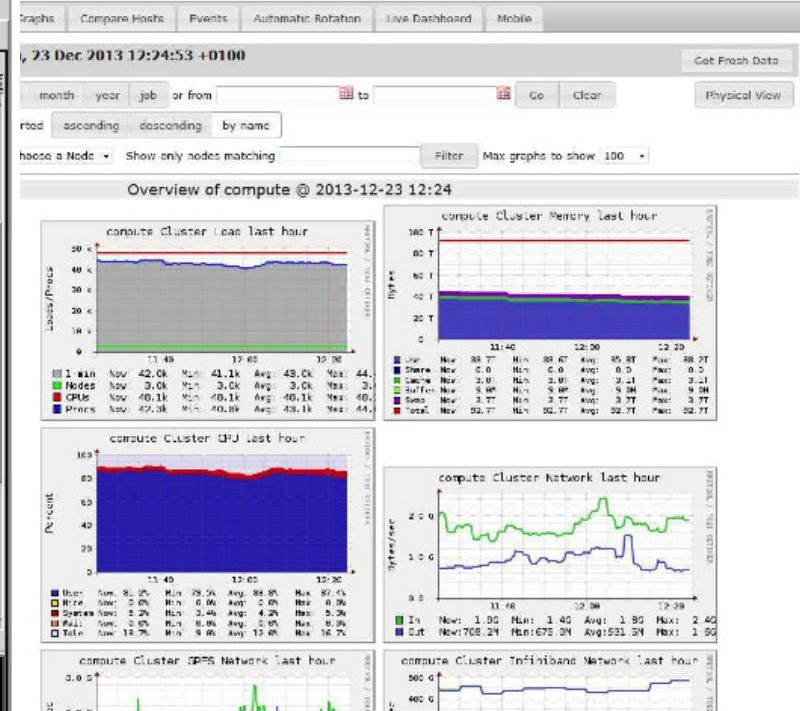
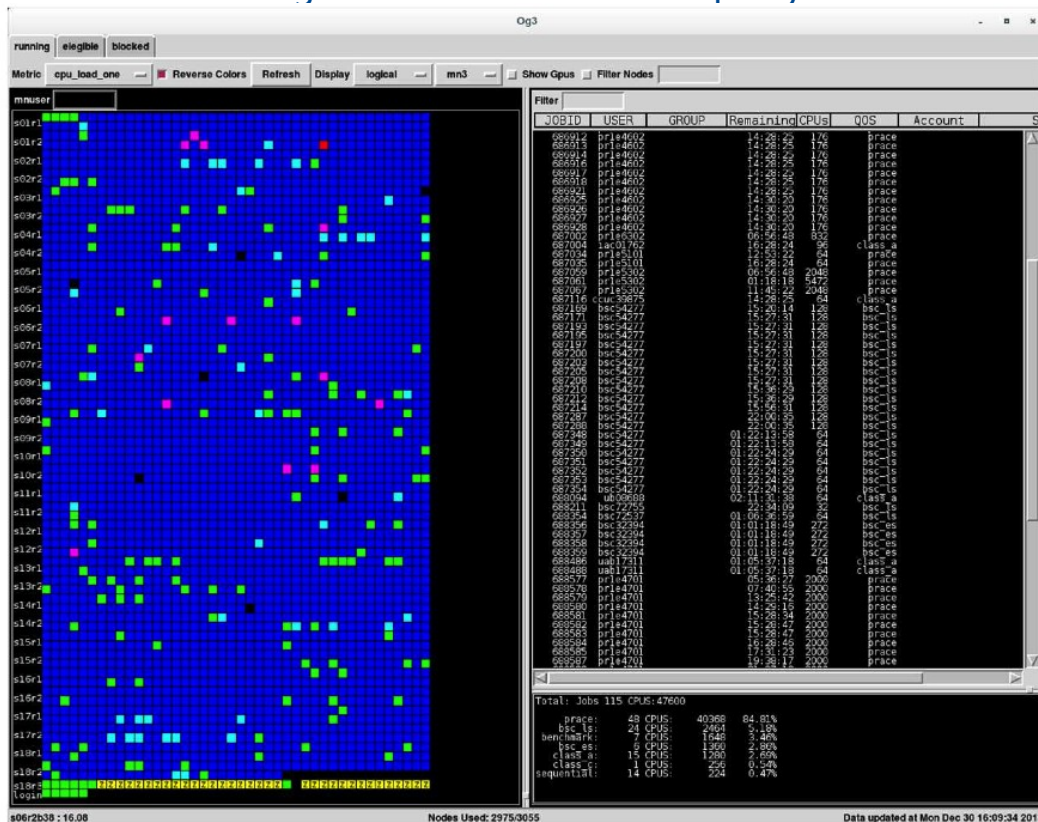
System monitoring

Based on open source tools

- Ganglia, Nagios, rrdtools

Improvements developed to increase scalability: ggcollector

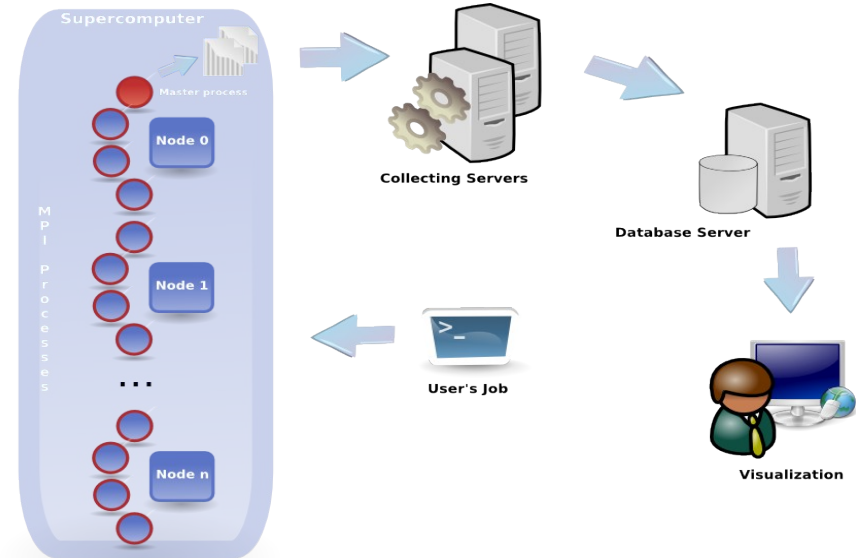
- Threaded server that collects metrics from different sources
- Clients being able to subscribe or query certain metrics



Automatic Performance Engine: application monitoring

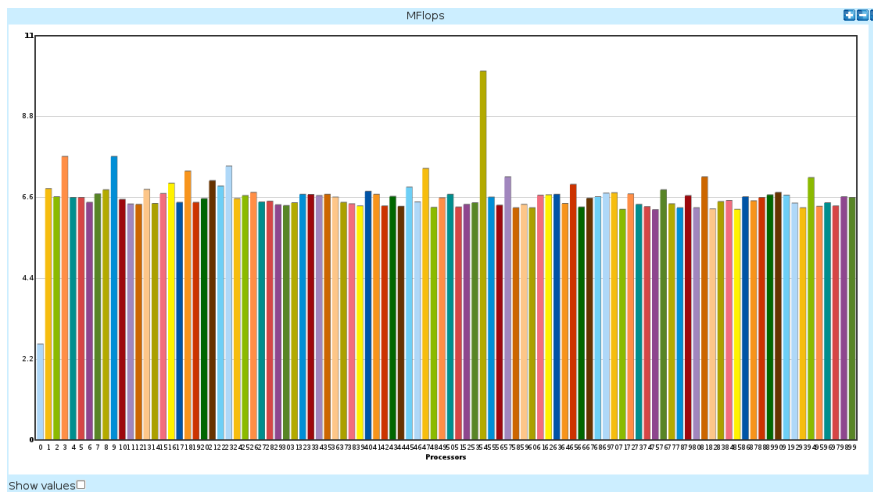
Global application performance infrastructure:

- Transparent extraction of ALL jobs in the system
- Scalable gathering and storage of performance information
- Analysis at job/application level or cluster-wide



Examples of global analysis:

- Average job characterization (cpus, memory consumption,...)
- Top of applications in terms of real MFLOPS obtained across runs.
- Given an application, analysis of the best runs, users that make best use of it, etc.



Mobility

Test activities

- Allows code testing on a RES computes to test and optimize before submission
- Special request at RES: www.bsc.es/RES



Mobility ICTS

- Site visit, to have personal support for application tuning and paralelization.
- Information at : www.bsc.es/ayuda-mobilidad-icts



HPC- Europa2 (not available now)

- European scientific collaboration and access to RES HPC systems
- Information at : www.hpc-europa.eu

Technical and scientific seminars/workshops

« Annual User meeting

- 8 meetings organized until now
- Now, jointly with the HPC Advisory Council Spain Conference

« Trainings

- Including PATC since 2 years

« Scientific Seminars

« Technical training for RES system admin and support team.



Suscripción RSS en <http://www.bsc.es/hpc-events-trainings.xml>

Scientific dissemination

« BSC-CNS web pages



« Annual report



« Publications on most relevant magazines





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Thanks for your attention!