

CENTRO DE SUPERCOMPUTACIÓN DE GALICIA

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CESGA

Javier García Tobío
(Managing Director, Galicia Supercomputing Centre)



ESTABLISHED IN 1993 IN SANTIAGO DE COMPOSTELA (SPAIN)



CESGA



SANTIAGO DE COMPOSTELA



MISSION STATEMENT

To provide high performance computing, communications resources and services to the scientific community of Galicia and to the National Research Council (CSIC), as well as, to institutions and enterprises with R&D activity.

To promote high quality research in Computational Science in close collaboration with the research community from Galicia as well as from other regions or countries all over the world; contributing in this way to the advancement of science, to transfer technology to industry and administrations , and as consequence, to the welfare of society as a whole.

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AREAS OF ACTIVITY

RESEARCH

CESGA - C²SRC

(CESGA – Computational Science Research Centre)

- Starting date: 2008
- Staff: 140 Researchers (recruiting)

ADVANCED SERVICES

- Starting date: 1.993
- Staff: 60, currently

BUDGET (2008-2012) : 75 M€

CESGA - C²SRC

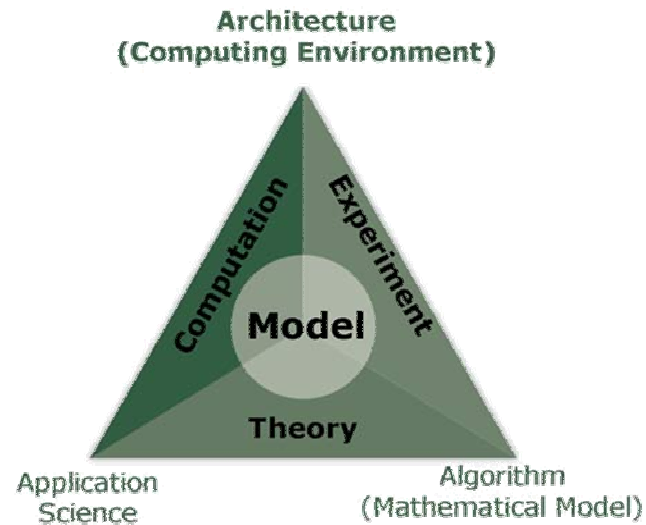
CESGA COMPUTATIONAL SCIENCE RESEARCH CENTRE



ERDF
European Regional
Development Fund



COMPUTATIONAL SCIENCE



Computational Science is the field of study concerned with constructing [mathematical models](#) and numerical solution techniques and using computers to analyze and solve [scientific](#), [social scientific](#) and [engineering](#) problems.

(Wikipedia)

C²SRC (CESGA – Computational Science Research Centre)

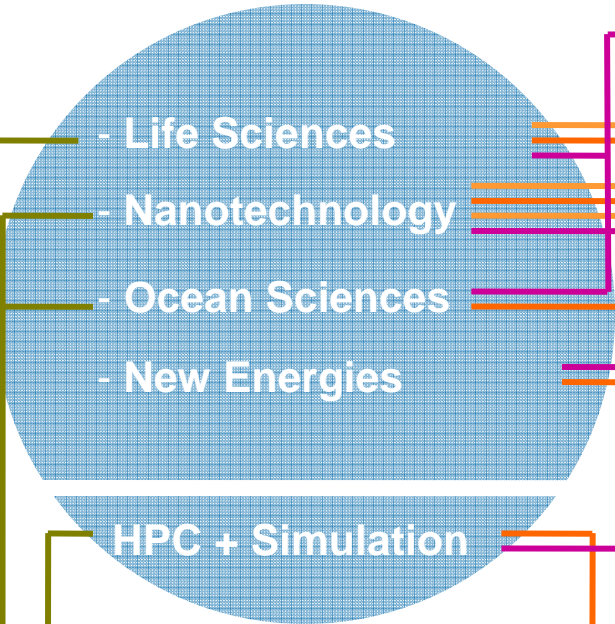
- **Application Areas:**
 - Strategic for Galicia.
 - High demand of HPC resources.
 - Research experience in Galicia and CSIC.
 - Singular in Galicia and CSIC.

CENTER STRUCTURE

R&D Galician Plan 2006-2010

R&D Excellence Centers

- Centro de Investigación en Ciencias del Mar.
- Centro de Investigación en Ciencias y Tecnologías de la Vida.
- Centro de Electrónica para Vehículos Inteligentes.
- Centro Hispano-Portugués de Investigación en Nanotecnología.



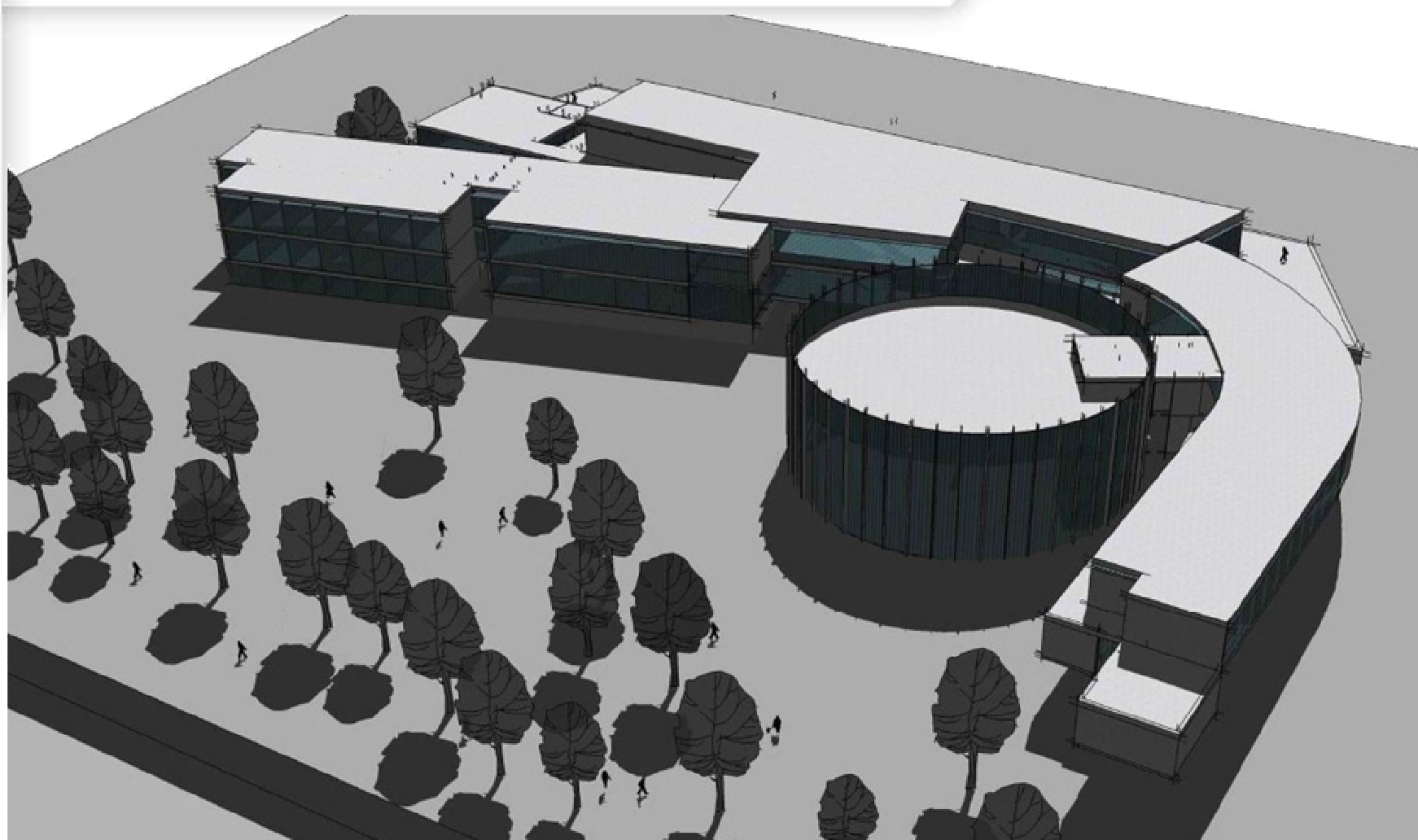
Strategic Actions R&D Spanish National Plan 2008-2011

- Biotechnology.
- Nanotechnology.
- ICT.
- New Energies.
- Health.
- Biotechnology.
- New Energies and Climate Change.
- ICT.
- Nanoscience and Nanotechnology.

Application Areas
CESGA - C²SRC



NEW FACILITIES



PARTICIPACIÓN DE LAS UNIVERSIDADES GALLEGAS Y EL CSIC

- Incorporación de **140 Investigadores hasta el 2012** seleccionados en convocatorias internacionales.
- Participación de investigadores de las **Universidades** a través de:
 - Programa de intensificación de la investigación de la Xunta, tipo I3.
 - Plazas de intensificación financiadas por el propio Centro y reguladas con cada universidad según convenio.
 - Profesores adscritos a la Universidad y al centro concurrentemente (tipo IMDEA).
 - Proyectos coordinados Centro – Universidad
- Participación de investigadores del **CSIC**, mediante:
 - Incorporación de investigadores de plantilla
 - Dotar con plazas de nueva creación.
 - Becas de formación predoctoral y contratos a doctores de su convocatoria JAE.
 - Titulados Superiores y Titulados de Grado Medio así como técnicos de la convocatoria JAE para el Área de Servicios, Innovación y Gestión.

CENTRO DE SUPERCOMPUTACIÓN DE GALICIA

ADVANCED SERVICES



ERDF
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CURRENT CESGA's COMMUNITY OF USERS

- **Galician Universities**
- **Galician Regional Government Research Centres**
- **Spanish National Research Council (CSIC) Centres**
- **Other public or private organizations worldwide**
 - Hospital R&D Departments
 - Industries R&D Departments
 - Technological & Research Centres
 - Other Universities worldwide
 - Non-profit R&D organizations

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USERS' SERVICES

- **HPC, HTC & GRID Computing**
 - **User Data Storage**
 - **Advanced Communications Network**
 - **e-Learning & Collaboration Infrastructures**
 - **GIS (Geographical Information Systems)**
 - **Technology Transfer to Industry and e-Business**
- Innovation Support**

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SERVICES IN THE CENTER

DOCUMENTATION

- Scientific Library.
- Access to Electronic DDBB of Galician University Library Consortium (Bugalicia).

COMPUTING

- Supercomputers and GRID.
- Data Storage.
- Technical support.
- Information and training.

MULTIMEDIA

- Auditorium and Multimedia Facilities.
- Access Grid and Multimedia rooms.
- Virtual Reality

SERVICES IN THE CENTER

- **COMMUNICATIONS**

- RECETGA's main node, RedIRIS and Galnix.
- LAN: wireless and cable

- **COLLABORATIVE TOOLS**

- AcesoGrid and videoconference.
- Collaborative Web based tools.

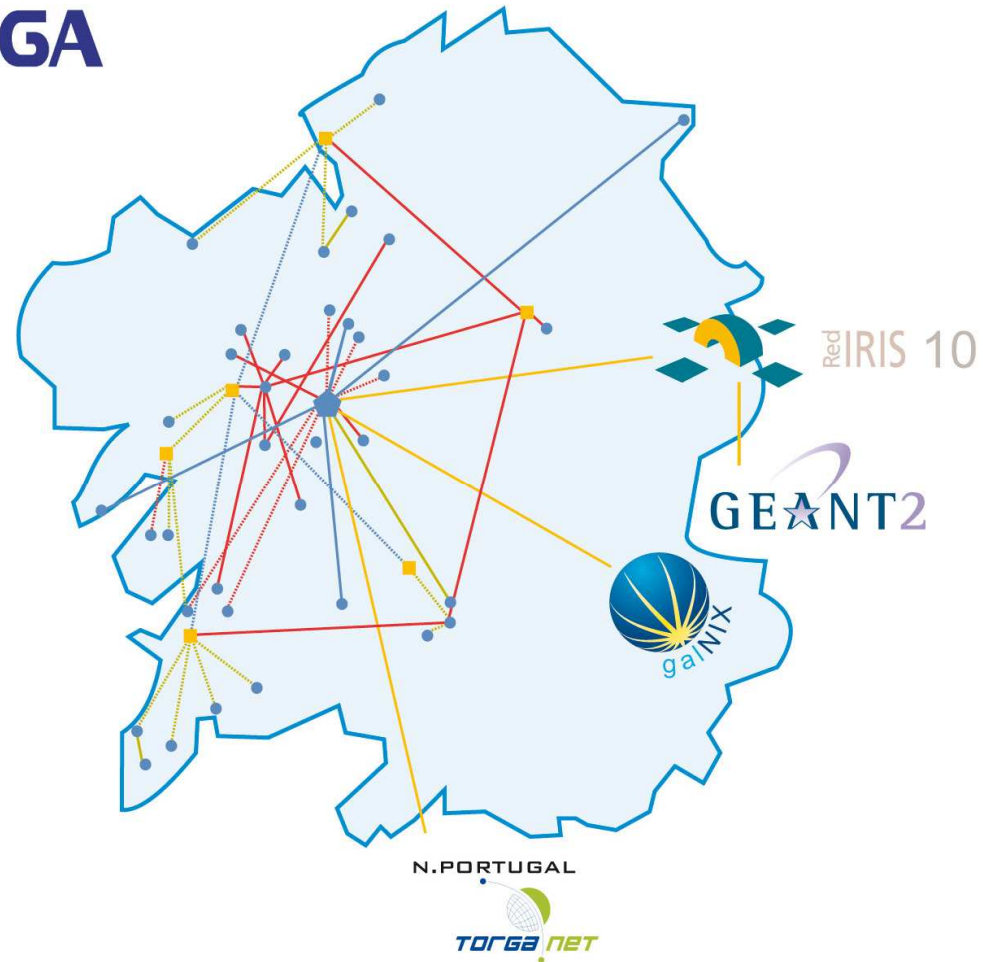
- **TECHNOLOGY TRANSFER DEPARTMENT**

- **PR & COMMUNICATION DEPARTMENT**

- **MANAGEMENT DEPARTMENT**

GALICIAN' SCIENCE & TECHNOLOGY NETWORK

 **RECETGA**



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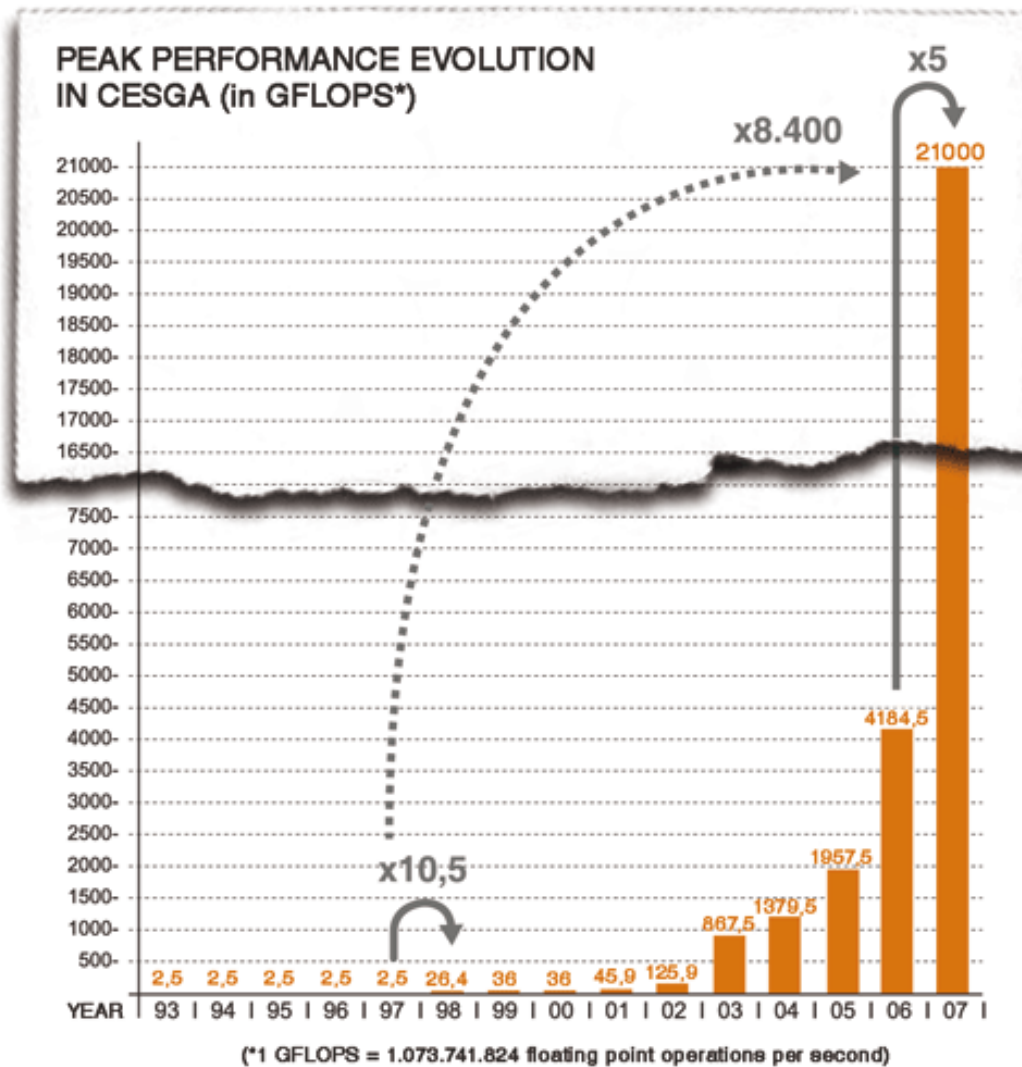
CESGA's SERVERS 2006

HIGH PERFORMANCE COMPUTING SERVERS			
SERVERS	YEAR INSTALLED	ARCHITECTURE	PROCESSORS, MEMORY, PEAK PERFORMANCE
COMPAQ HPC320	2002	CLUSTER	32 CPU's, 80 GB MEMORY, 64 GFLOPS
FINIS TERRAE	2008	SMP (NUMA) CLUSTER	2.500 CORES, 19 TB, 16 TFLOPS
HIGH PERFORMANCE COMPUTING SERVERS			
SERVERS	YEAR INSTALLED	ARCHITECTURE	PROCESSORS, MEMORY, PEAK PERFORMANCE
SVG	2001-2006	DISTRIBUTED PC CLUSTER	50 CPU's, 0,5 -1 GB MEMORY CPU, 9,9 GFLOPS , 110 CPU, 300 GFLOPS (2004)
COMPAQ BEOWULF	2002	BEOWULF CLUSTER	16 CPU, 8 GB MEMORY, 16 GFLOPS
SVG DELL	2004	PC CLUSTER	80 CPU, 80 GB MEMORY, 512 GFLOPS
SVG BLADES	2006	BLADE CLUSTER	292 CORES, 148 GB MEMORY, 2.227 GFLOPS
IN-HOUSING SERVERS			
SERVERS	YEAR INSTALLED	ARCHITECTURE	PROCESSORS, MEMORY, PEAK PERFORMANCE
METEOGALICIA	2004	2 SUN NODOS	20 CPU, 40 GB MEMORY, 48 GFLOPS
LHCb-USC	2002-2007	PC CLUSTER	339 CORES, 312 GB MEMORY, 1600 GFLOPS

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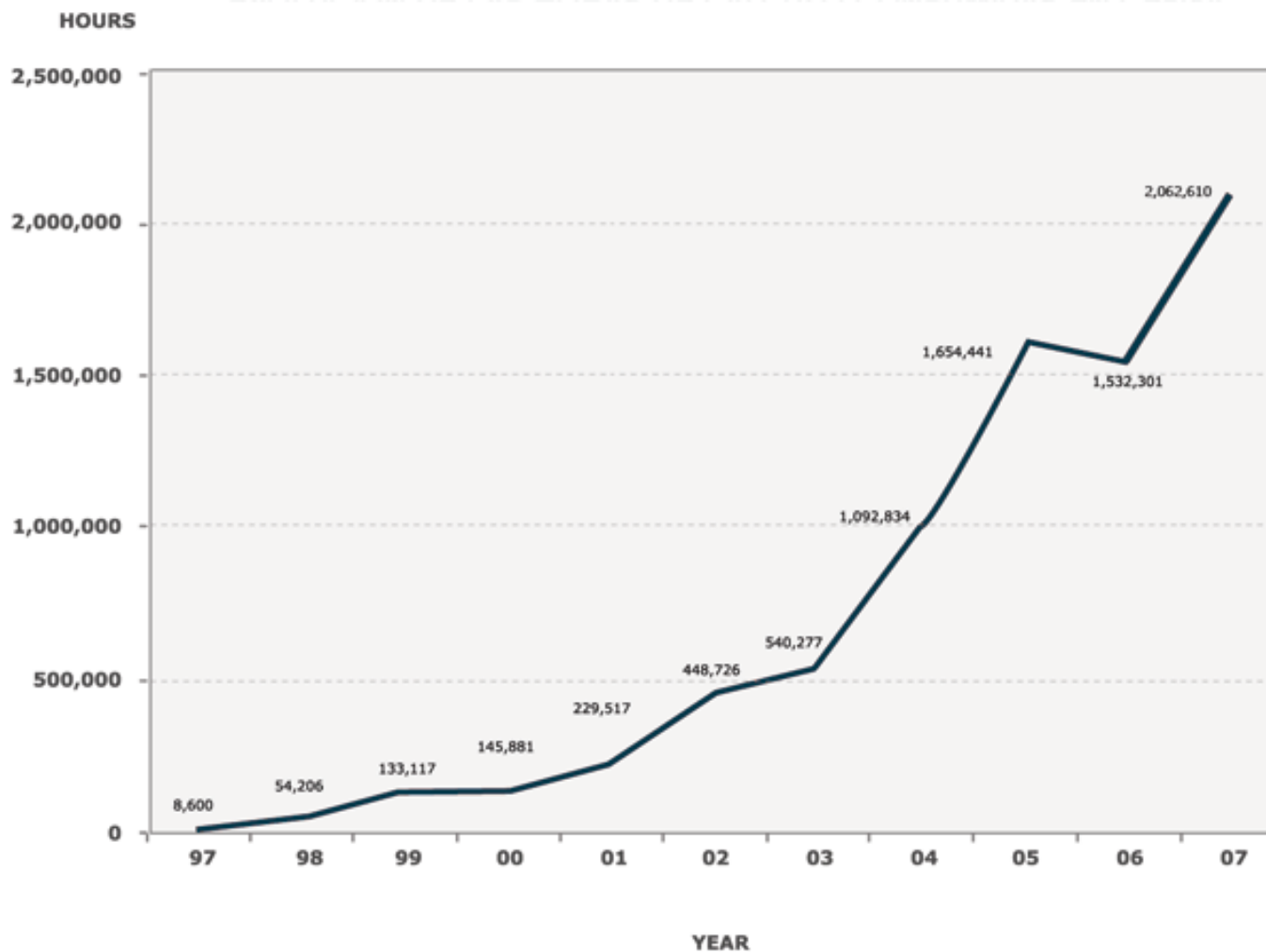
CESGA's PEAK PERFORMANCE EVOLUTION



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USER'S CPU TIME CONSUMED SINCE 1997

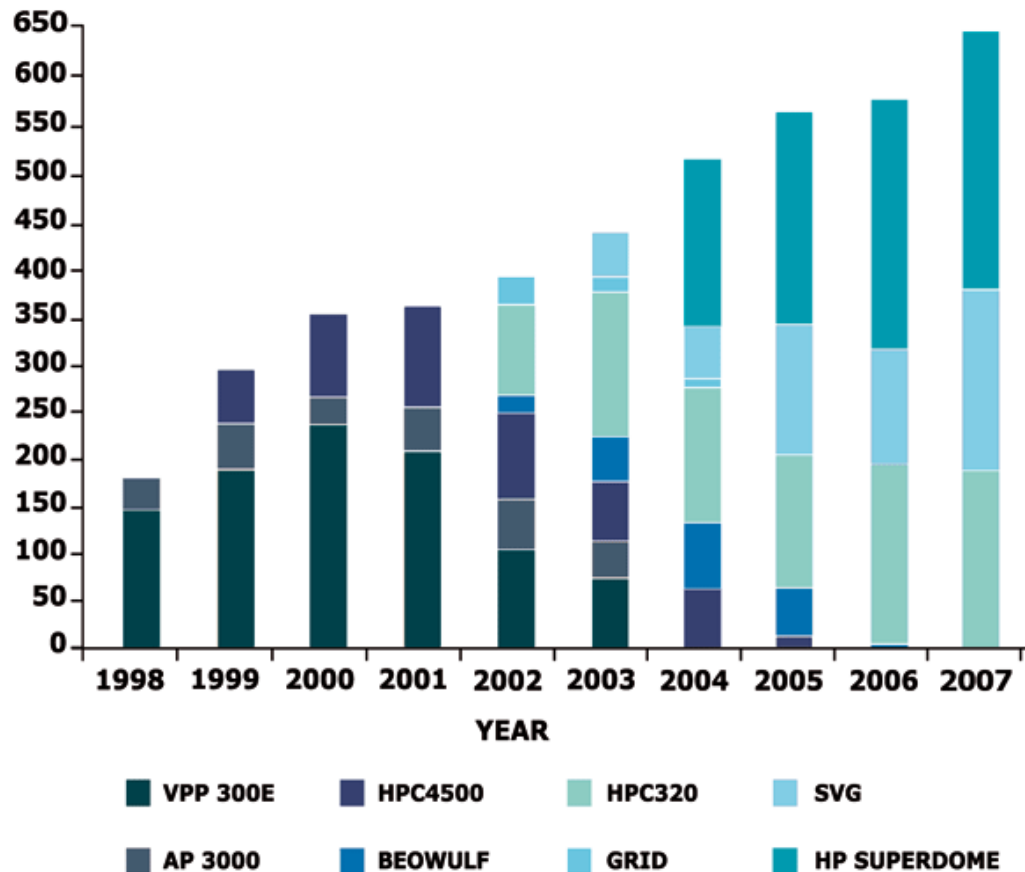


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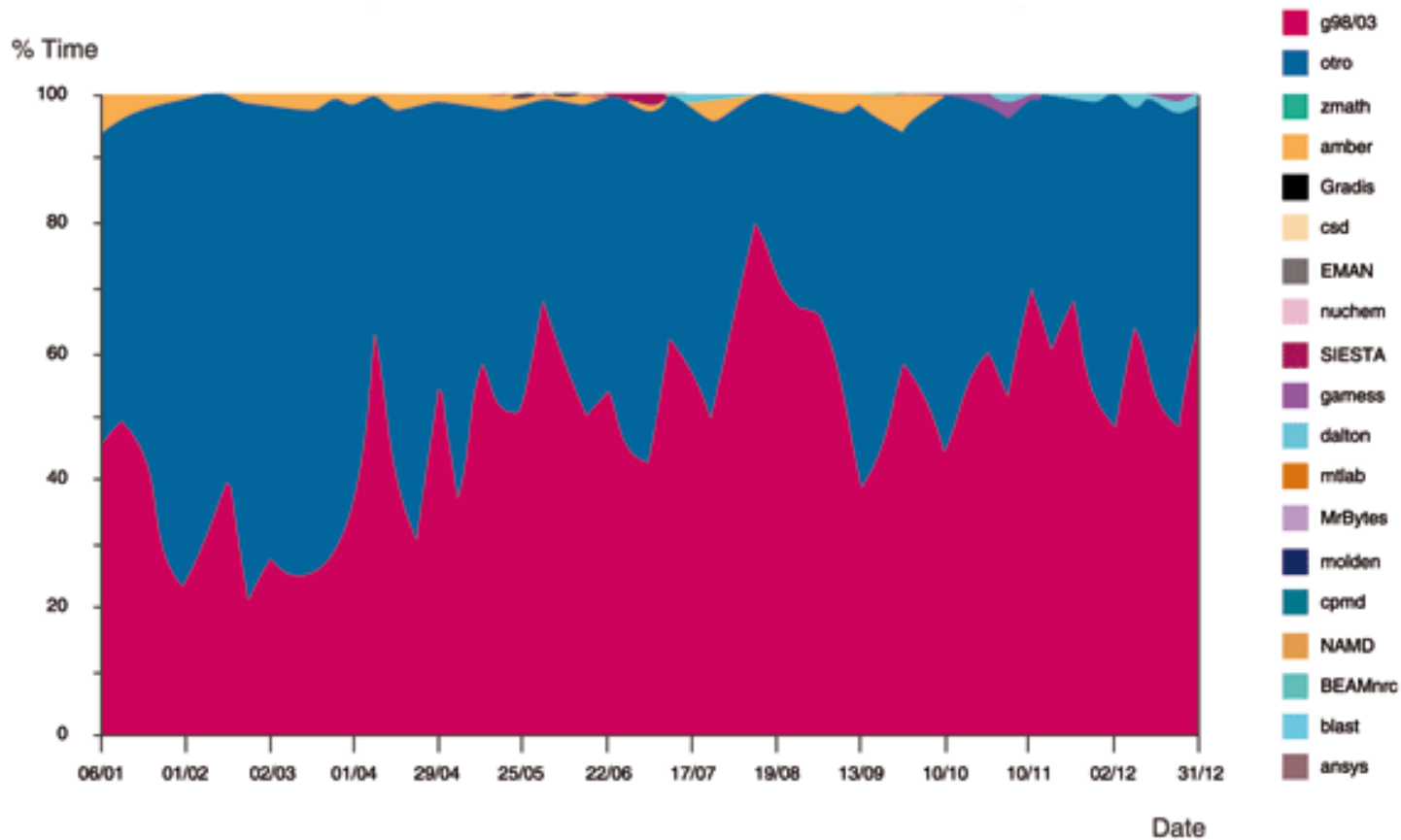
DEMAND OF COMPUTING RESOURCES AT CESGA

NUMBER OF USER ACCOUNTS PER SYSTEM PER YEAR



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APPLICATION AREAS AT CESGA

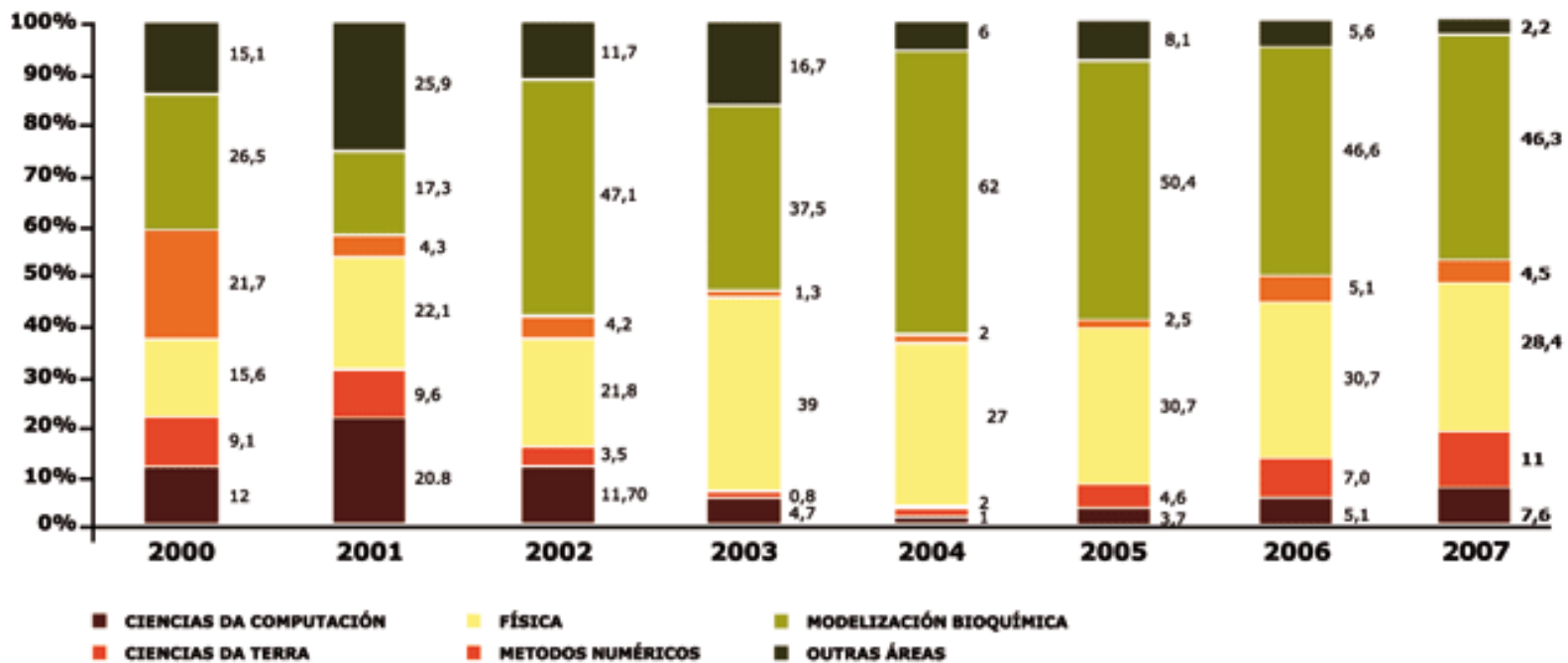


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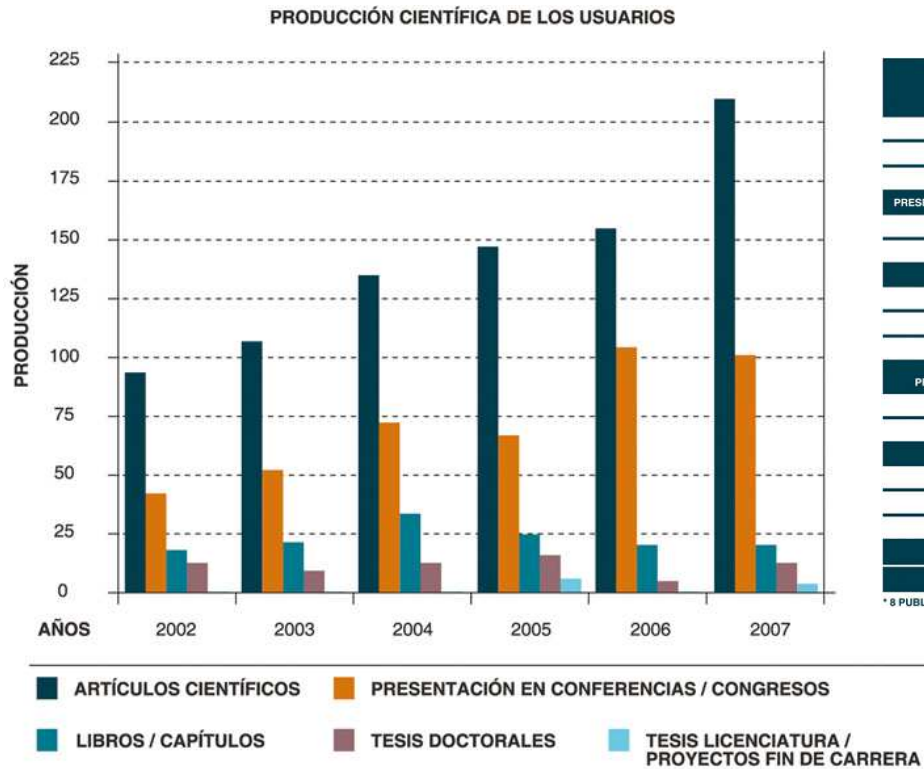
APPLICATION AREAS AT CESGA

CPU USE DISTRIBUTION PER AREA



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comparativa producción científica declarada por los usuarios cesga 2002-2007



PRODUCTO	2002	2003	2004	2005	2006	2007
ARTÍCULOS CIENTÍFICOS	93	107	134*	147	154	208
ACEPTADOS	4	8	20	16	26	19
ENVIADOS	16	29	26	27	23	24
PUBLICADOS	73	70	91	104	105	165
PRESENTACIONES EN CONFERENCIAS	42	52	72*	65	105	101
PRESENTACIONES	33	40	53	37	53	46
POSTERS	9	12	35	28	52	47
TESIS DOCTORALES	17	21	32	24	18	18
DEFENDIDAS	9	4	5	9	10	11
PRESENTADAS	0	0	0	0	3	5
EN PROCESO	8	17	27	15	5	2
TESIS LICENCIATURA PROYECTOS FIN DE CARRERA	12	9	12	14	5	10
DEFENDIDAS	6	4	5	13	3	8
EN PROCESO	6	5	7	1	2	2
LIBROS / CAPÍTULOOS	ND	ND	ND	5	ND	3
ACEPTADOS / IN PRESS	ND	ND	ND	4	1	1
ENVIADOS	ND	ND	ND	1	0	2
PUBLICADOS	ND	ND	ND	0	3	0
OTROS	5	5	6	5	15	11
TOTAL	169	194	256	260	301	351

* 8 PUBLICACIONES Y 16 CONGRESOS CON AUTORES DE MÁS DE UNA INSTITUCIÓN

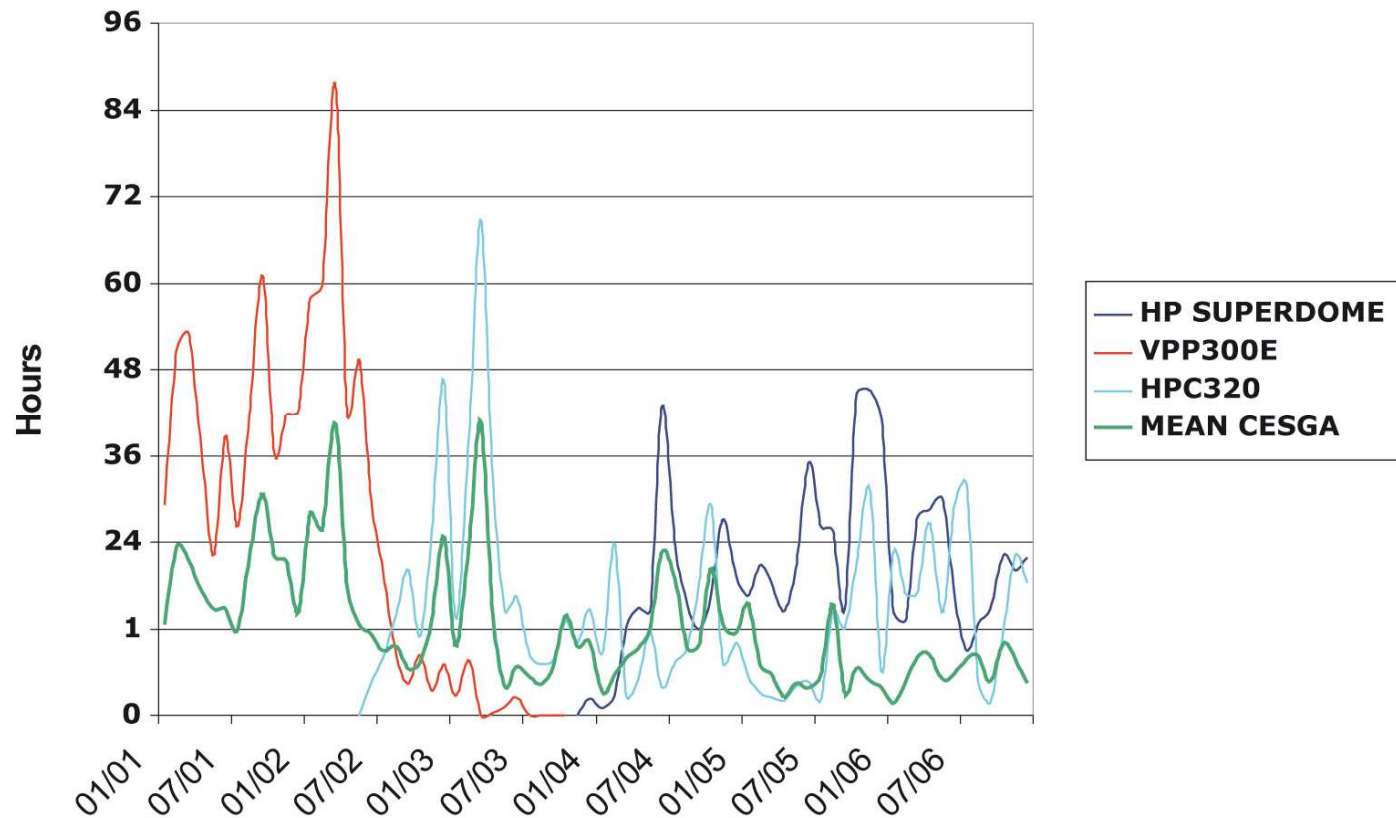
NUMBER OF PROJECTS 2007

- **European Comision:** 9
- **Central Government:** 10
- **Autonomas Government:** 20

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ANALYSIS OF THE DEMANDS FOR COMPUTING RESOURCES AVAILABLE AT CESGA

JOB WAITING PERIOD EVOLUTION (01/2001 – 12/2006) IN CAPABILITY SERVERS AND COMPARISON WITH THE MEAN FOR ALL CESGA'S SERVERS



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APPLICATION AREAS AT CESGA

SOME CURRENT PROJECTS

- **Project: Study of the phase separation in magnetic oxides combining theory and experiment**

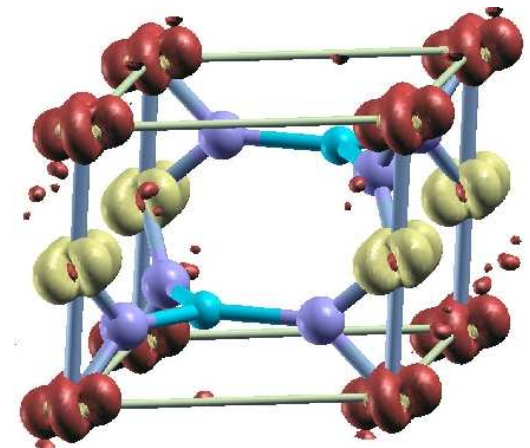
- Dr. Daniel Baldomir Fernández (USC)
- Simulations of magnetic materials (using DFT).

- **Applications:**

Predicting electromagnetic properties at nanometric scale. Very useful in materials design to be used in: data storage, memories, drug administration systems, health monitoring, computer science, etc.

- **Computing requirements:**

284 GB of memory
128 processors



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APPLICATION AREAS AT CESGA

SOME CURRENT PROJECTS

- **Project: Research in nanostructured Materials**

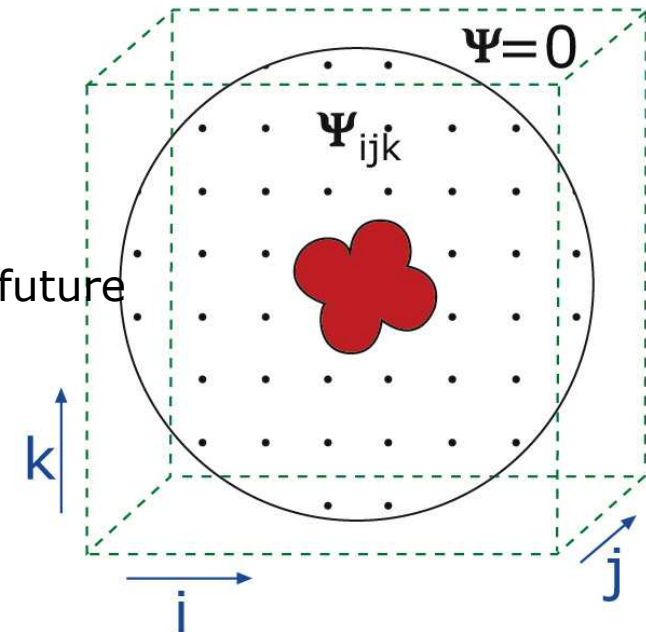
- Dr. Manuel María González Alemany (USC)
- Study of structural, electronic and optic properties of physical systems of technological interest by means of simulation techniques from first principles

- **Applications:**

Predicting the structural properties and electronic of nanostructured material like nanowire, which have big technological implications. The nanowires could be the future materials of semiconductor industry

- **Computational requirements:**

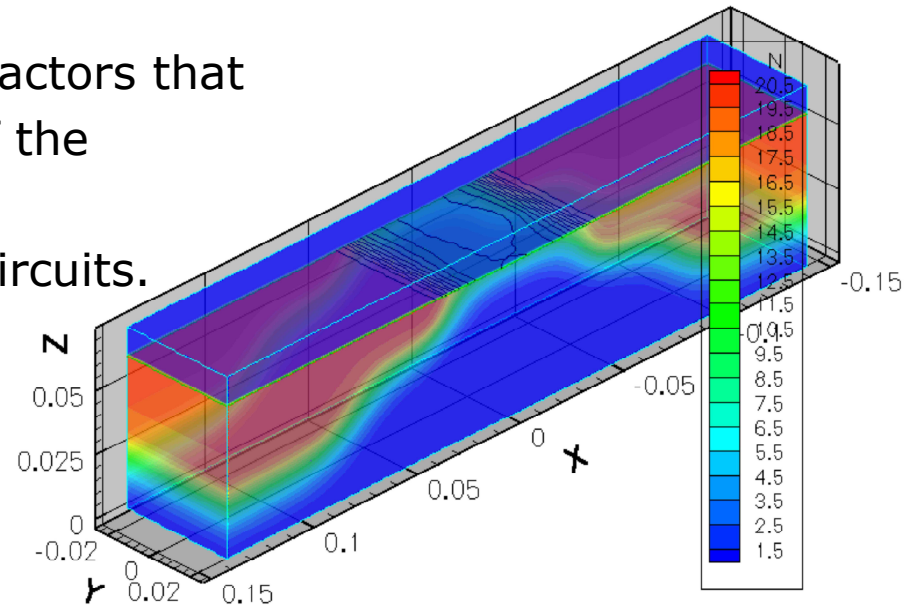
64 GB shared memory
32 processors



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APPLICATION AREAS AT CESGA SOME CURRENT PROJECTS

- **Project: Fluctuations in nanometric MOSFET devices**
 - Dr. Antonio Garcia Loureiro (U. Santiago) & A. Asenov (U. Glasgow)
 - Simulations of semiconductors including quantum effects (FEM and Monte Carlo)
- **Applications:**
 - Prediction of the dominant factors that degrade the performance of the transistors below 100nm.
 - Development of electronic circuits.
- **Computing requirements:**
 - 80 GB of memory
 - 64 processors x 200 runs



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APPLICATION AREAS AT CESGA SOME CURRENT PROJECTS

- **Project: HEMCUVE++ Hybrid electromagnetic Code Universities of Vigo and Extremadura:**

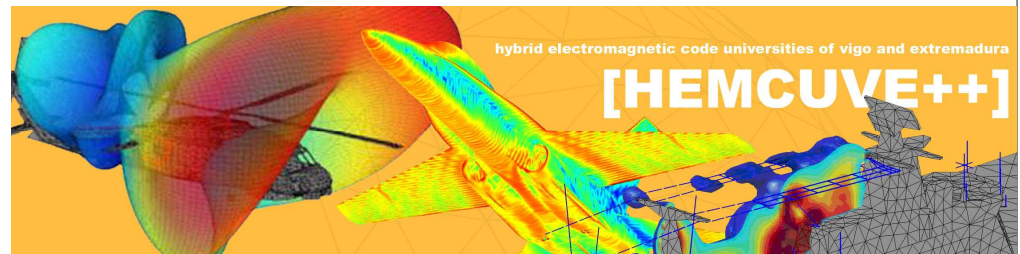
- Fernando Obelleiro Basteiro (UVIGO)
- Luis Landesa Porras (UNEX)

- **Applications:**

- Electromagnetic compatibilities studies (EMC), interferences (EMI), and risky radiation levels for radiating systems on board real platforms (cars/planes/ships).
- Surface Equivalent Radar (SER) prediction for real targets. Analysis and design of practical antenna problems involving wire antennas, arrays, broadband antennas, etc

- **Computing requirements:**

- 0.5-1 TB of memory
- 500-1000 processors
- 1-10 CPU days.



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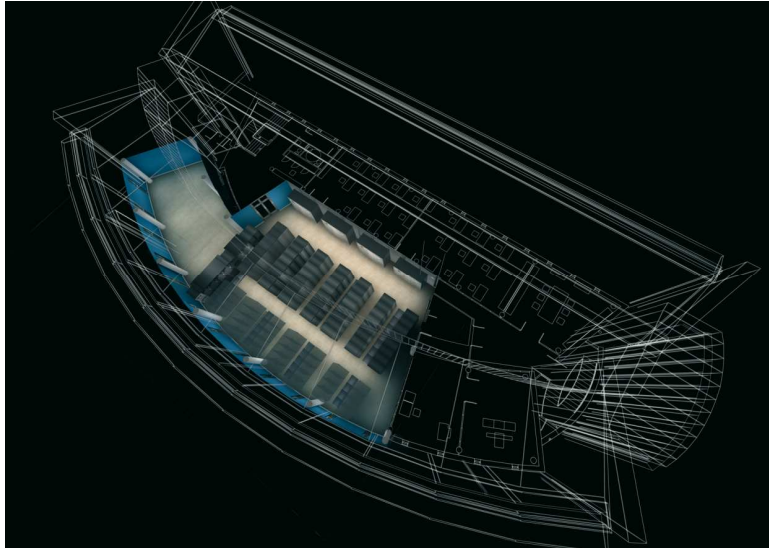
FINIS TERRAE

EXPANDING
THE
FRONTIERS OF KNOWLEDGE

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FINIS TERRAE (2007)



New HPC Supercomputer 2008

More than: 16,000 GFLOPS

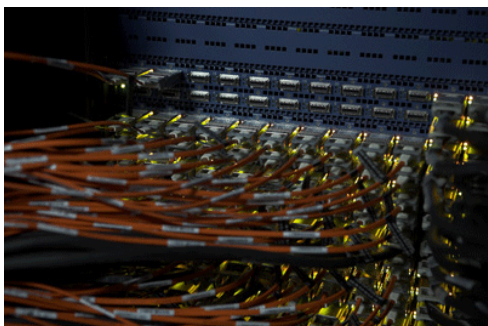
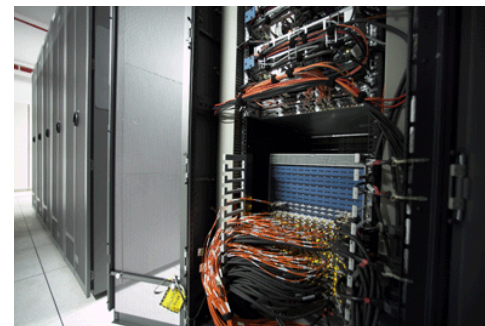
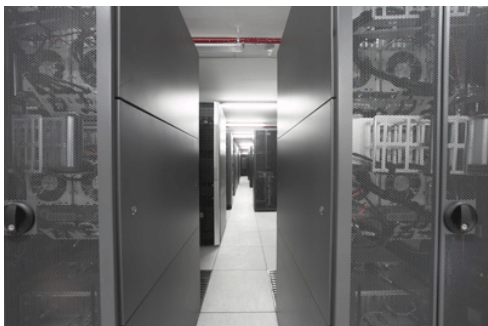
2,580 CPUs

19,600 GB Memory

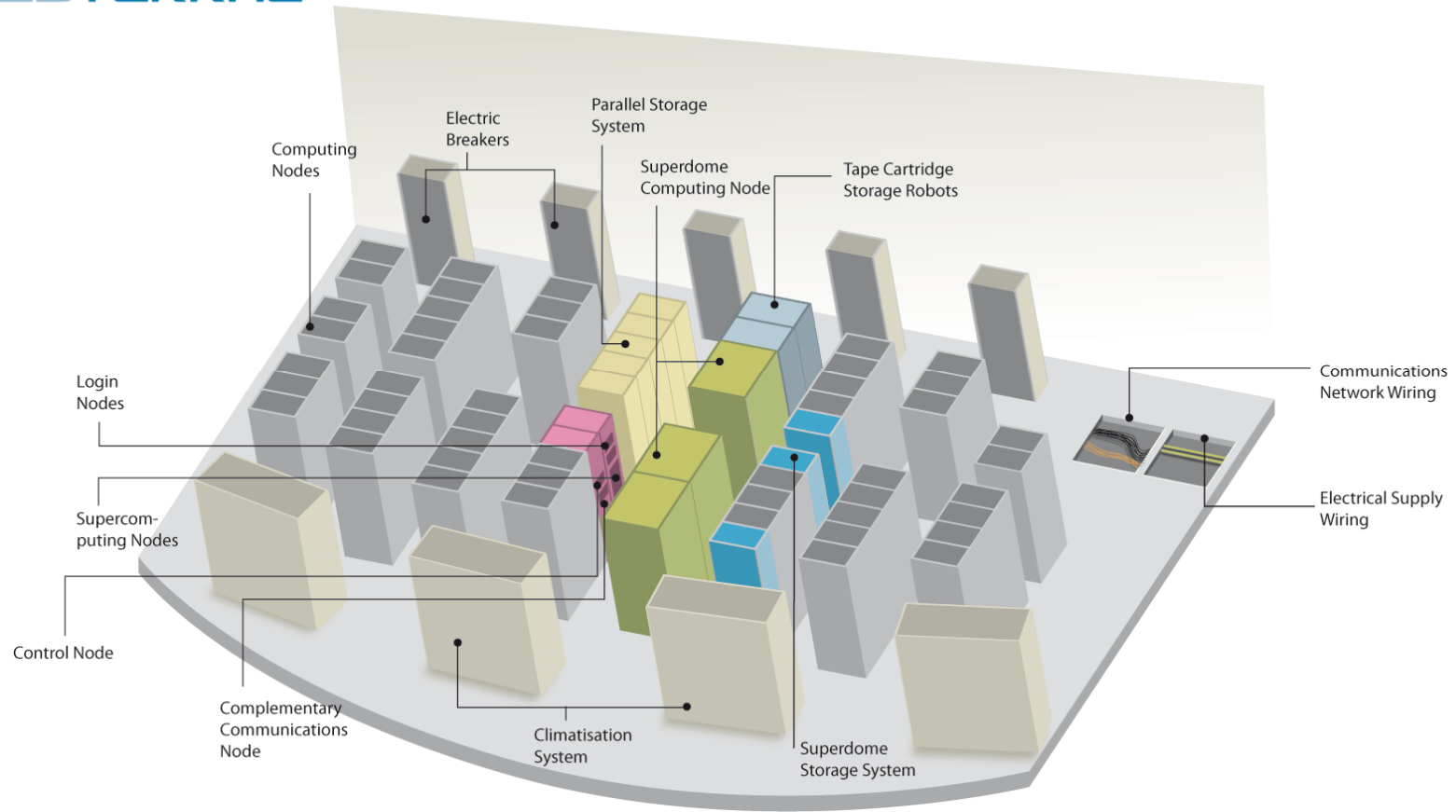
LINUX, UNIX, WINDOWS

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TECHNICAL INFRASTRUCTURE

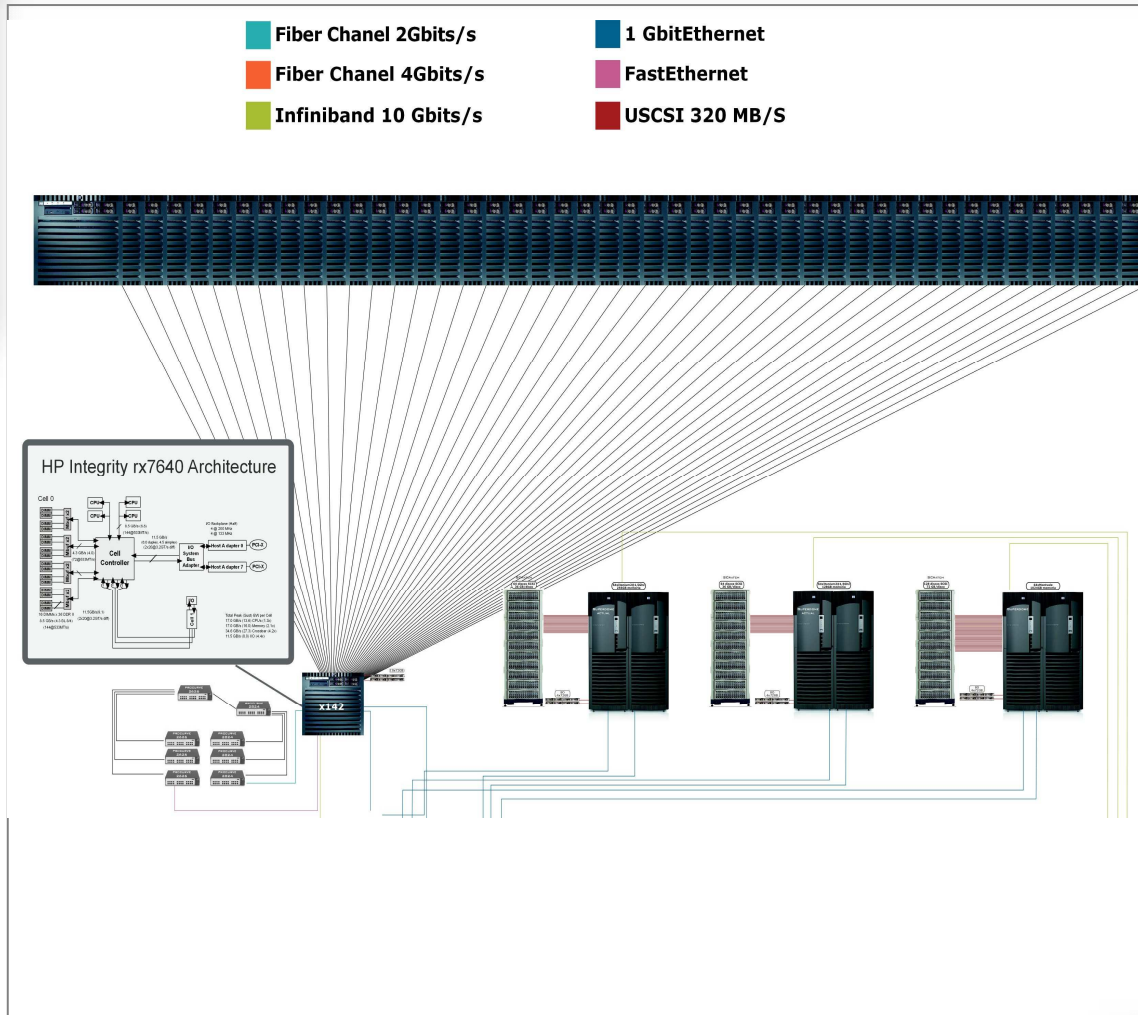


FINISTERRAE



FINIS TERRAE – COMPUTING NODES

- Fiber Chanel 2Gbits/s
- Fiber Chanel 4Gbits/s
- Infiniband 10 Gbits/s
- 1 GbitEthernet
- FastEthernet
- USCSI 320 MB/S



SUPERCOMPUTING NODES:

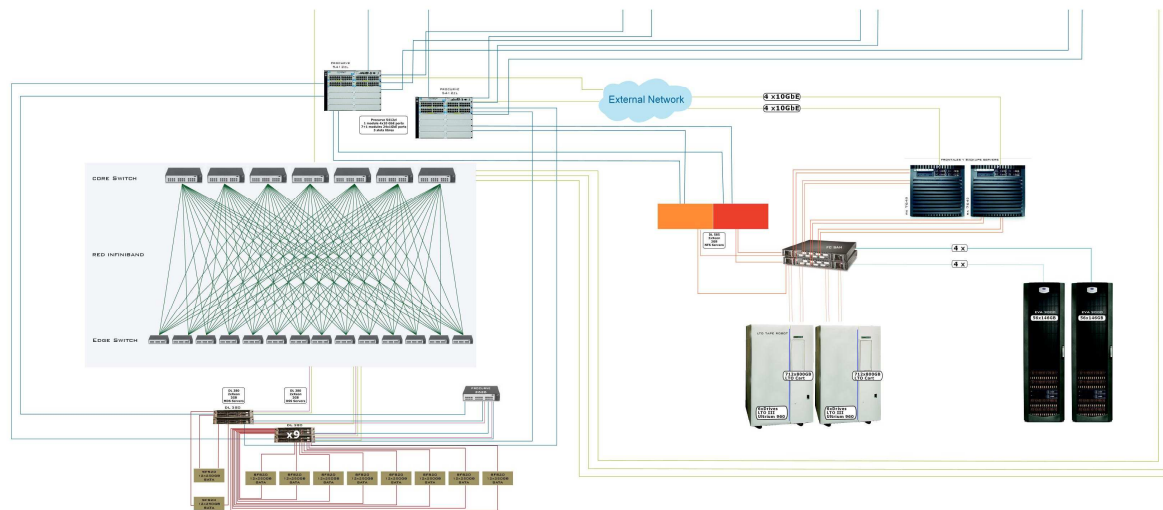
147 cc-NUMA Nodes with Itanium CPUs connected through a high efficiency INFINIBAND network

- **1 node: 128 cores, 1,024 GB memory**
- **2 nodes: 64 CPUs, 128+256 GB memory**
- **142 nodes: 16 cores, 128 GB memory**
- **2 nodes: 4 cores, 4 GB memory for testing**

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FINIS TERRAE – DATA STORAGE RESOURCES

- Fiber Chanel 2Gbits/s
- Fiber Chanel 4Gbits/s
- Infiniband 10 Gbits/s
- 1 GbitEthernet
- FastEthernet
- USCSI 320 MB/S



DATA STORAGE:

- 22 nodes with 44 cores for storage management.
- 390 TB on disk.
- 2,2 PB Robot Tape Library.

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FINISTERRAE

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THANK YOU

FOR YOUR ATTENTION

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