GRID-CSIC
A Production Infrastructure

Grids & e-Science 2009

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Introduction: the GRID-CSIC Project

- Origin:
  - CSIC experience in Grid projects
  - Potential collaboration area with CNRS (France)
  - Opportunity (National e-Science Network, National and European Grid Initiatives)
  - Strong Internal Support (CSIC VORI-VICYT-VRI)
- Objective: setup an advanced **distributed computing infrastructure** to support research projects requiring resources beyond the possibilities of a single user or research group.
- Support multidisciplinary projects and in particular those where several centers have to collaborate in the simulation, analysis, processing and distribution or access to large data volumes.
- e-Science examples:
  - Particle Physics Experiments (CDF, CMS, ATLAS, ILC…)
  - Phenomenology (SUSY models), Lattice
  - Space Missions (XMM, Planck…)
  - Astronomical Observations
  - Climate Models
  - Computational Chemistry
  - Bio computing

What is e-Science?

e-Science (*enhanced Science*) refers to scientific activities that are carried out by using resources distributed across Internet

'e-Science is about global collaboration in key areas of science, and the next generation of infrastructure that will enable it.'
John Taylor, Director General of Research Councils, Office of Science and Technology

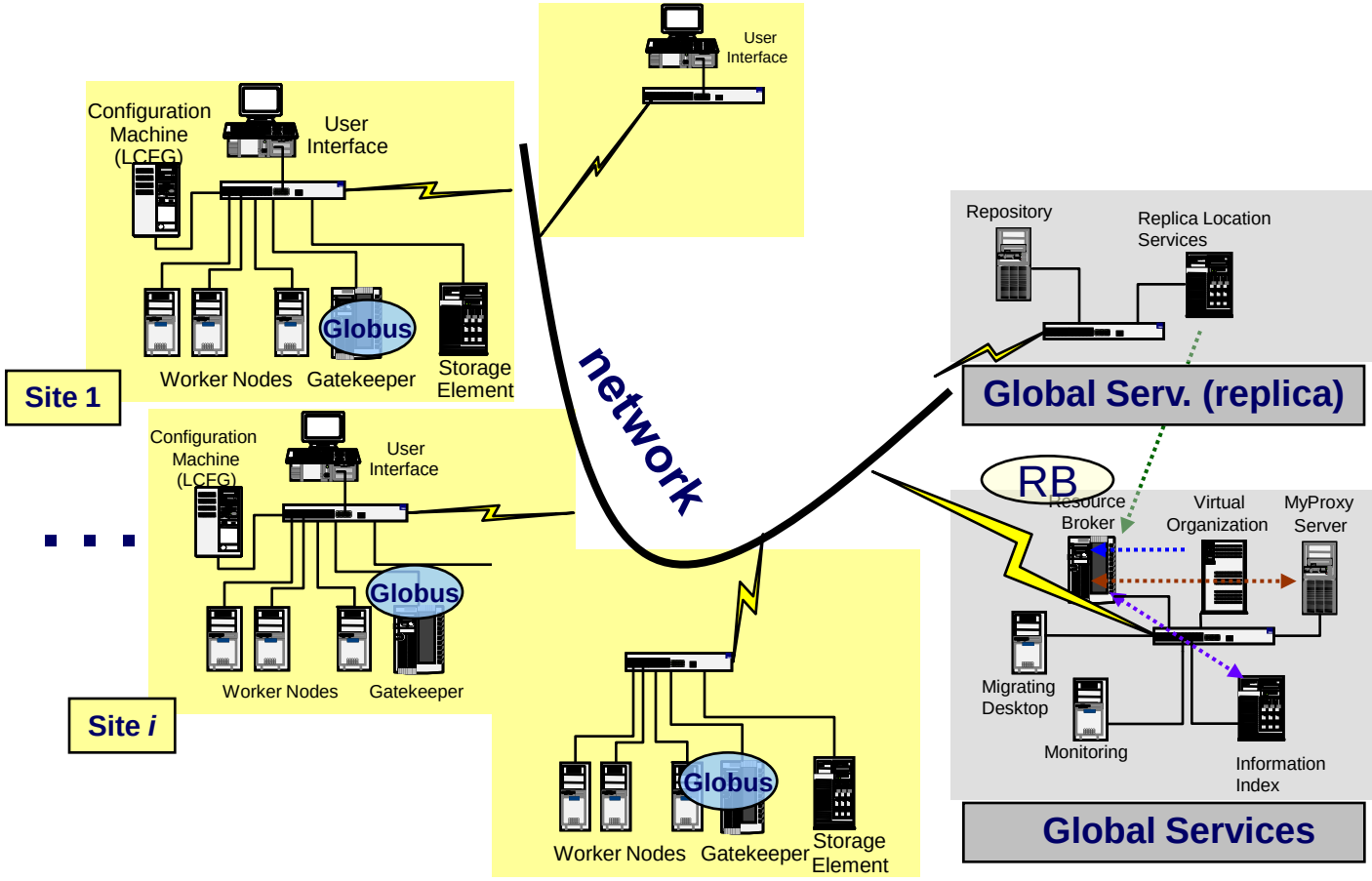
The use of distributed resources is both a **necessity and an added value**

More effective when associated to a global collaboration than at the individual level

e-Science is supported by e-Infrastructures: new generation of research infrastructures based on information and communication technologies



Grid enabled e-Infrastructure

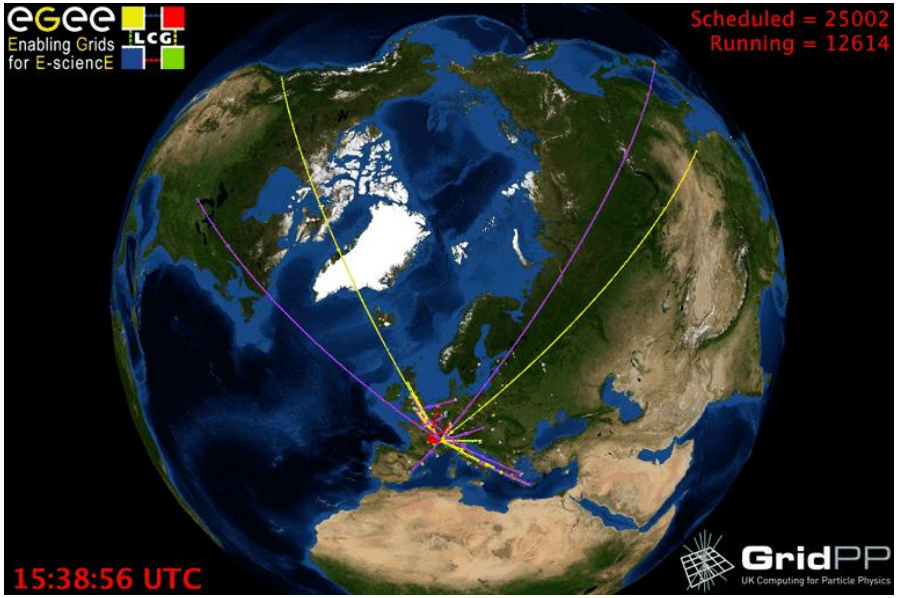


n computing centres
(distributed across many sites)
Replicated Global Services

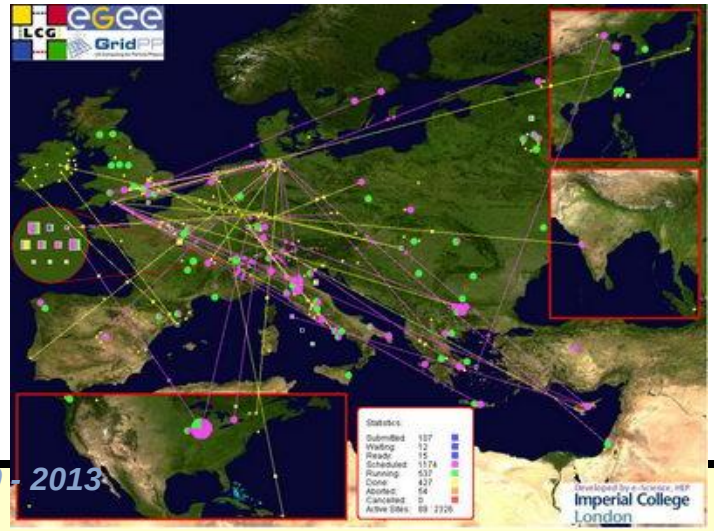
Sequential & Parallel Jobs
(applications using distributed MPI)
Running Across Sites

The project Enabling Grids for E-sciencE EGEE (I, II and III) (2004 - 2010)

EGEE supports the largest distributed infrastructure **for distributed computing in the world**



- **Evolution from the project DATAGRID** and High Energy Physics related projects
  - **EGEE-II and III has extended the outreach to Biomed, Earth Sciences, Quantum Chemistry, Fusion,…**
- The **Middleware** that glues together the infrastructure in EGEE is called ***glite*** **, *and is based on the Globus Toolkit (Standard) and web services***
- Supports the **massive submission of mono processors jobs in batch mode**



GRID-CSIC Project Basis

- The project is based in the use of Grid technology to share and access to geographically distributed resources in a transparent way through the use of a middleware. Interoperability with other European Grid infrastructures, like those of the EGEE and Interactive European Grid (***i2g)*** projects (this last one coordinated by CSIC).
- The infrastructure will be shared within the IberGrid initiative being developed with Portugal, and with the Institut des Grilles infrastructure (CNRS, France), through collaboration agreements.
- The project aims to deploy a total power of around 8.000 cores and an on-line storage capacity of around 1.000 Terabytes (1 Petabyte).
- The infrastructure is being deployed in three phases:
  - Along the first year, the pilot phase includes three centers with experience in grid projects **(IFCA, IFIC, e IAA)**
  - A second phase extends the project this year (2009) to Barcelona and Palma, and next year to Madrid.
  - A consolidation phase will complete the coverage map at national level.

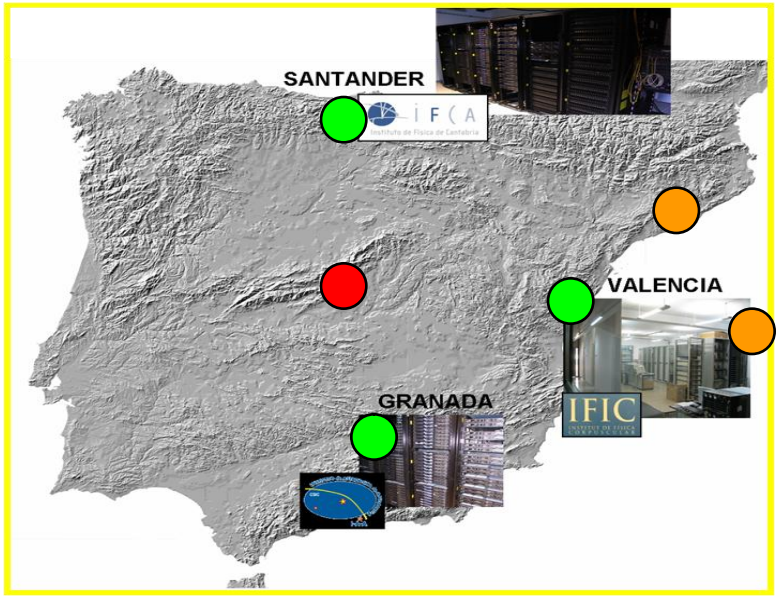
Project Structure

- The project is structured in three main areas:
  - Infrastructure
    - Setup and operation of the computing resources and integration in the Grid framework
  - Development and Application Support
    - Support the integration of the applications and specific middleware adaptations
  - Coordination
    - Management, internal organization and dissemination.
- Initial Teams:

Center		Personnel
IFCA	Instituto de Física de Cantabria	*J.Marco, I.Campos, R.Marco, E.Fernández, I.Silanes, I.Cabrillo, P.Orviz, Á.López, I. Díaz, I.Coterillo, M.Campo…*
IFIC	Instituto de Física Corpuscular	*J.Salt, S.González ,J.Sánchez, A. Fernández, G. Amorós, A, Lamas, V.Méndez…*
IAA	Instituto de Astrofísica de Andalucía	*J. Ruedas, W. More, JR.Rodón…*
ICMAB-CIN2	Instituto de Ciencias de Materiales de Barcelona	*P.Ordejón, A.García, L.García Tarrés*
IFISC	Instituto de Física Interdisciplinar y Sistemas Complejos	*P.Colet…*

Current Status

- First year equipment installed:
  - IFCA
    - Computación:
      - IBM blades, 182 (dual quad: 1456 cores)
      - 70 + 14 con Infiniband
      - Conexiones a red 3 x 10G
    - Almacenamiento:
      - Cabinas Discos SATA (~175 Terabytes)
      - 4 servidores GPFS
  - IFIC
    - Computación:
      - HP + DELL
    - Almacenamiento:
      - SUN
  - IAA
    - Computación:
      - servidores IBM x3850 M2, con tecnología de 4ª generación X-Architecture, que permite escalar desde 4 hasta 16 procesadores (Intel Quad Core Xeon X7350), y hasta 1TB de memoria RAM en la configuración de 16 procesadores
    - Almacenamiento:
      - DELL



- Second year equipment tendering soon:
  - IFISC, ICMAB
    - ~600 cores, HPC, ~100 TB SAN

- New personnel contracts launched, previsions made for 2010-2013 (+10 people)

CPD IAA

CPD IFIC

CPD IFCA

http://gridmap.cern.ch/gm/

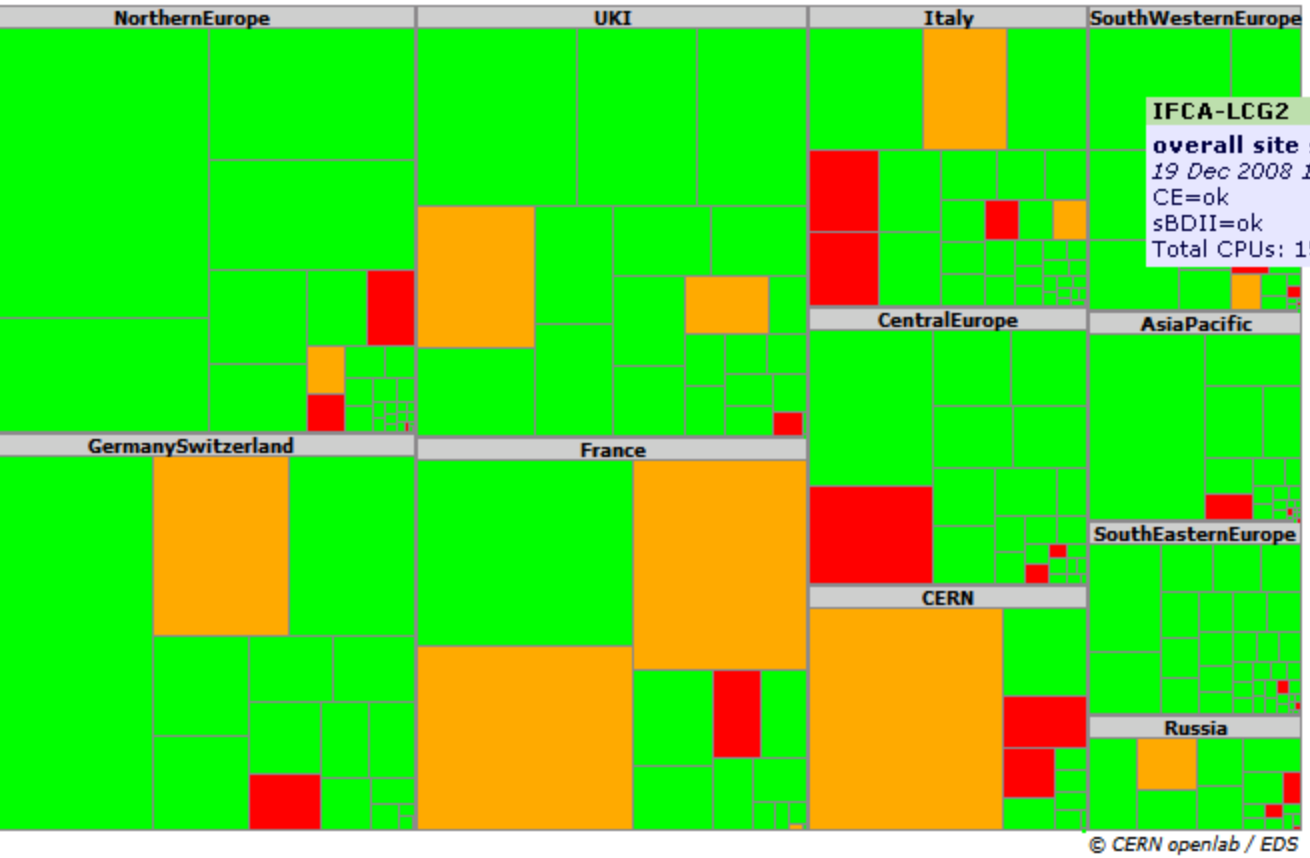
Edición Ver Favoritos Herramientas Ayuda

Marcadores 1071 bloqueados Configuraci

Altamira Web | DEPARTAMENTO DE PO... | GridMap

Página Herramientas

GridMap – Visualizing the "State" of the Grid



atest SAM results, Site Status, for 'OPS' VO, 19 Dec 2008 16:22 TC.
ize of site rectangles is number of CPUs from BDII.
ertified Production sites, grouped by regions.

Down Degraded Ok

CERN openlab

EDS an HP company

Topology View

tiers pps all

w sitenames

y:

CPUs (GStat)

use historical CPU numbers

CPUs (BDII) Running Jobs

use VO specific information show SI2k

SAM Results

Virtual Organization:

OPS Alice Atlas CMS

LHCb

Services:

Site CE SE SRM

sBDII

more...

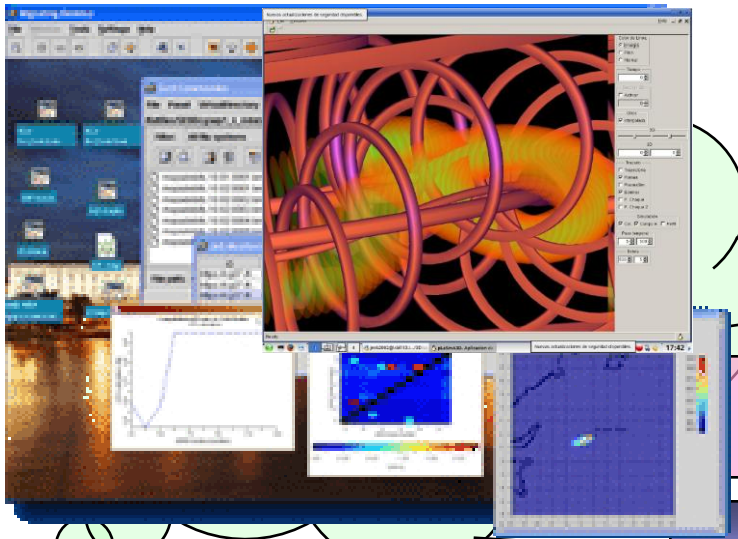
Current Status:

latest SAM test results

Infrastructure indicators

- **Three nodes in CPDs at IFCA, IFIC, IAA**
  - In total >4000 cores, ~300 Tb
  - Interconnected at 2.5 Gbps
- **Users:**
  - Local: IFCA / IFIC / IAA (~80 users)
  - Institutional: CSIC (~110 users)
  - National: National Grid Initiative (~50 users)
  - European: EGEE and related projects & EGI (~200 users)
- **Execution Service**
  - Sequential Batch
  - Parallel MPI
  - **Interactive Jobs**
- **Technology:**
  - Parallel computing (MPI) in Grid framework.
  - Interactive and Parallel jobs broker.
  - Friendly user interface to Grid framework (MD/RAS) with support for workflows, interactivity and visualization.
  - Large data transfer and storage.
  - AAA (Authentication, Authorization and Accounting) services in Grid.

An OPEN (Inter) Operational Model!



RC B

LCG Broker

LCG CE

VOMS

RC A

CrossBroker

VO

Applications

Users

Cluster Manager

LCG CE

Int.eu.grid CE

SE SRM

Access

- **Based on Service Agreements with Virtual Organizations (VO)**
  - Users from research communities organize into VO
  - A Service Agreement is established with the VO
  - Grid middleware is able to handle:
    - Authentication
    - Authorization
    - Accpunting
- **How are the Service Agreements set?:**
  - (Real) Example: ESA Planck Mission team at IFCA negotiates peaks of 500 cores for two weeks for 2010 to process express data
  - They are encouraged to apply at relevant levels EGI/NGI/CSIC/Local
  - The Access Committee gives green light
  - Post-execution "scientific" inform has to be reported (+technical)
- **Advantages:**
  - More flexible
  - Can handle peaks and special demands **(interactivity)**
- **KEY POINT: FAIR RETURN**
- **Assessment and external committees**
  - Compromise with Spanish and European Grid/Computing Committees
  - A Scientific advisory board
  - A Technical advisory board

Analysis

- SWOT:
  - SIGNIFICANT INFRASTRUCTURE
  - POSITION IN THE NATIONAL GRID INITIATIVE
  - INVOLVMENT IN THE SPANISH SUPERCOMPUTING NETWORK
  - EXPERIENCE IN COLLABORATION AT INTERNATIONAL LEVEL AND LEADING INVOLVEMENT IN EUROPEAN PROJECTS.
  - HIGH QUALIFICATION OF THE PERSONNEL
  - NEED FOR CONSOLIDATION OF GRID MIDDLEWARE
  - NEW MULTIDISCIPLINARY PROJECTS REQUIRING e-SCIENCE
  - POSSIBILITIES OF COLLABORATION WITH THE INDUSTRY
  - SUPPORT TEAM DIMENSION

- Strategy:
  - CONSOLIDATE A CORE TEAM
  - REINFORCE THE EXISTING COLLABORATION at national and European level
  - PROMOTE THE TRANSFER OF KNOWLEDGE IN APPLICATION AREAS
  - ASSURE PARTICIPATION IN NEW MULTIDISCIPLINARY PROJECTS

Objectives

- **Operation:**
  - Minimum service levels will be satisfied according to service agreements with the different VOs, having in mind that GRID-CSIC operates in attended mode 9am-20pm from Mo-Fri, labor days, and in unattended mode but with request through alert at any other time.
  - As an example of such an agreement corresponding to the LCG project, the maximum delay in responding to operational problems in labor time will be 2 hours, and the **average availability measured on an annual basis will be above 95%.**
  - The total number of processor cores after the first phase (2009) will be above 4000, and the raw storage space above 300 Tb. By the end of 2009, with the two new nodes at Palma and Barcelona such capacity will be increased by 30%, and an additional 30% will come by 2010 after installation of two additional nodes, one in Madrid.

- **Participation in European projects and initiatives:**
  - The main objective is to continue the involvement in European projects, like currently in EGEE, DORII or EUFORIA.
  - As a transition from EGEE towards an EGI (European Grid Initiative) is planned by May 2010, the involvement in EGI will be reinforced.
  - CSIC will collaborate as close as possible within the Spanish NGI with the EGI.eu project and central organization (in Amsterdam)

Objectives

- **Outreach :**
  - GRID-CSIC has been directly present at the largest GRID events in the last months, like EGEE'09, and several others in different countries in the framework of existing projects.
  - This level will be maintained, and improved with France (through CNRS) and Portugal (through LIP).
  - At national level the NGI initiative has two large annual meetings, and in addition smaller focused workshops/meetings are organized.
  - At CSIC level dissemination will be more structured, by analyzing computing requests in projects and defining the suitability of GRID-CSIC to satisfy them.
  - Finally, at general dissemination level, personnel in GRID-CSIC is typically very active organizing presentations, talks, and even open-day journeys oriented to young students. These activities will be maintained.
- **Training :**
  - The new CSIC framework for participation in Masters is being considered.
  - At least the current involvement in postgraduate courses will be kept, meaning a minimum of 90 hours per year.
  - GRID-CSIC has a reasonable record on attracting students to courses like this one **(GRID & e-Science)**.

And your objectives ?

- Learn about e-Science
  - Applications
  - Projects
- Learn about Grid
  - Middleware
  - Infrastructure
- Make contacts, discuss with experts…
- HOPE YOU ENJOY!