

DEISA : status, strategies, perspectives



Towards cooperative extreme computing in Europe

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DEISA objectives



- *To enable Europe's terascale science by the integration of Europe's most powerful supercomputing systems.*
- *Enabling scientific discovery across a broad spectrum of science and technology is the only criterion for success.*
- **DEISA is an European Supercomputing Service built on top of existing national services. This service is based on the deployment and operation of a persistent, production quality, distributed supercomputing environment with continental scope.**
- **The integration of national facilities and services, together with innovative operational models, is expected to add substantial value to existing infrastructures.**
- **Main focus is High Performance Computing (HPC).**

Participating Sites



BSC	<i>Barcelona Supercomputing Centre</i>	Spain
CINECA	<i>Consortio Interuniversitario per il Calcolo Automatico</i>	Italy
CSC	<i>Finnish Information Technology Centre for Science</i>	Finland
EPCC/HPCx	<i>University of Edinburgh and CCLRC</i>	UK
ECMWF	<i>European Centre for Medium-Range Weather Forecast</i>	UK (int)
FZJ	<i>Research Centre Juelich</i>	Germany
HLRS	<i>High Performance Computing Centre Stuttgart</i>	Germany
IDRIS	<i>Institut du Développement et des Ressources en Informatique Scientifique - CNRS</i>	France
LRZ	<i>Leibniz Rechenzentrum Munich</i>	Germany
RZG	<i>Rechenzentrum Garching of the Max Planck Society</i>	Germany
SARA	<i>Dutch National High Performance Computing and Networking centre</i>	The Netherlands

The DEISA supercomputing environment

(21.900 processors and 145 Tf in 2006, more than 190 Tf in 2007)

- IBM AIX Super-cluster
 - FZJ-Julich, 1312 processors, **8,9 teraflops peak**
 - RZG – Garching, 748 processors, **3,8 teraflops peak**
 - IDRIS, 1024 processors, **6.7 teraflops peak**
 - CINECA, 512 processors, **2,6 teraflops peak**
 - CSC, 512 processors, **2,6 teraflops peak**
 - ECMWF, 2 systems of 2276 processors each, **33 teraflops peak**
 - HPCx, 1600 processors, **12 teraflops peak**
- BSC, IBM PowerPC Linux system (MareNostrum) 4864 processeurs, **40 teraflops peak**
- SARA, SGI ALTIX Linux system, 416 processors, **2,2 teraflops peak**
- LRZ, Linux cluster (2.7 teraflops) moving to SGI ALTIX system (5120 processors and **33 teraflops peak in 2006, 70 teraflops peak in 2007**)
- HLRS, NEC SX8 vector system, 646 processors, **12,7 teraflops peak.**
- **Systems interconnected with dedicated 1Gb/s network – currently upgrading to 10 Gb/s – provided by GEANT and NRENs**

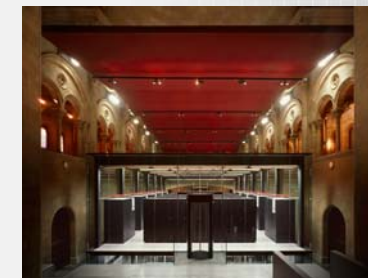
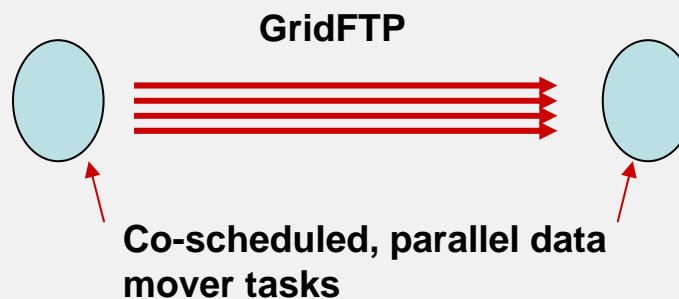
How is DEISA enhancing HPC services in Europe?



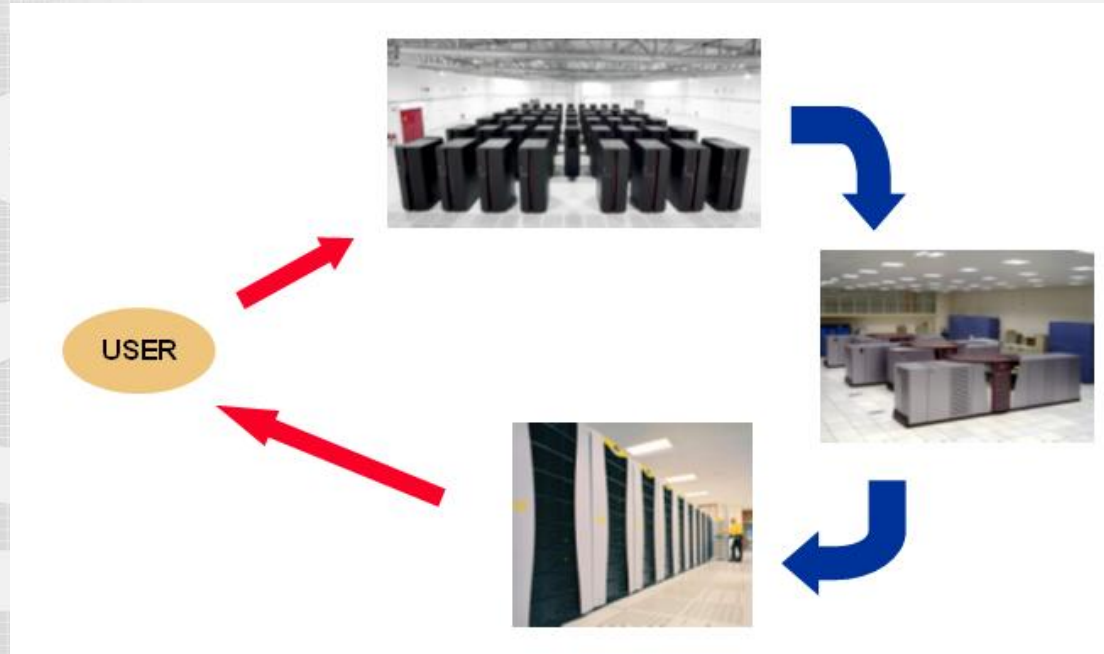
- **Running larger parallel applications** in individual sites, by a cooperative reorganization of the global computational workload on the whole infrastructure, or by the operation of the **job migration service** inside the AIX super-cluster.
- Enabling **workflow applications** with UNICORE (complex applications that are pipelined over several computing platforms)
- Enabling coupled multiphysics Grid applications (when it makes sense)
- Providing a **global data management** service whose primordial objectives are:
 - Integrating distributed data with distributed computing platforms
 - **Enabling efficient, high performance access to remote datasets** (with Global File Systems and stripped GridFTP). We believe that this service is critical for the operation of (possible) future European petascale systems
 - Integrating hierarchical storage management and databases in the supercomputing Grid.
- **Deploying portals** as a way to hide complex environments to new users communities, and to interoperate with another existing grid infrastructures.

The most basic DEISA services

- **UNified access to COmputing REsources (UNICORE).** Global access to all the computing resources for batch processing, including **workflow applications** (in production)
- **Co-scheduling service.** Needed to support grid applications with synchronous access to resources, as well as high performance data movement
- **Global data management.** Integrating distributed data with distributed computing platforms, including hierarchical storage management and databases. Major highlights are:
 - **High performance remote I/O and data sharing** with global file systems, using full network bandwidth (in production)
 - **High performance transfers of large data sets**, using full network bandwidth (ends 2006)



Basic services: workflow simulations using UNICORE



UNICORE supports complex simulations that are pipelined over several heterogeneous platforms (workflows).

UNICORE handles workflows as a unique job and transparently moves the output – input data along the pipeline.

UNICORE clients that monitor the application can run in laptops.

UNICORE has a user friendly graphical interface. DEISA has developed a command line interface for UNICORE.

UNICORE infrastructure including all sites has full production status.

DEISA Global File System integration in 2006

(based on IBM's GPFS)



AIX IBM domain

ECMWF (UK)

RZG (DE)

IDRIS (FR)

Linux SGI

SARA (NL)

LRZ (DE)

CSC (FI)

High Performance Common Global File System
various architectures / operating systems
High bandwidth (up to 10 Gbit/s)

BSC (ES)

CINECA (IT)

FZJ (DE)

LINUX Power-PC

Enabling science



- **The DEISA Extreme Computing Initiative:** identification, deployment and operation of a number of « flagship » applications in selected areas of science and technology.
- Applications are selected on the basis of scientific excellence, innovation potential and relevance criteria (the application must require the extended infrastructure services)
- European call for proposals: May-June every year (first one took place in 2005)
- Evaluation June -> September.
- We had in 2005 **56 Extreme Computing Proposals**
- **29 projects were retained for operation in 2005-2006.** Full information on DEISA Web server (www.deisa.org).

Extreme Computing proposals

- **Bioinformatics** 4
- **Biophysics** 3
- **Astrophysics** 11
- **Fluid Dynamics** 6
- **Materials Sciences** 11
- **Cosmology** 3
- **Climate, Environment** 5
- **Quantum Chemistry** 5
- **Plasma Physics** 2
- **QCD, Quantum computing** 3

Profiles of applications in operation in 2005 – 2006

- **Huge parallel applications running in single remote nodes (dominant)**
- **Data Intensive applications of different kinds.**
- **Workflows (about 10%)**

Conclusions



- DEISA is reexamining its operational model to adapt to the expected evolution of HPC in Europe in the next few years.
- *The big challenge is always enabling new, first class computational science.*
- DEISA aims at deploying a **persistent**, basic European infrastructure for general purpose high performance computing.
- Our next challenge is **establishing an efficient organization embracing all relevant HPC organizations in Europe.**
- Interfaced with other grid-enabled complementary infrastructures, DEISA expects to contribute to a global European infrastructure for science and technology.