

HPC Centres

Forschungszentrum Jülich (D)
Parallab – University of Bergen (N)
CNRS – IDRIS (F)
Warsaw University (PL)
Victoria University of Manchester (UK)
ETH Zürich - SCSC Manno (CH)

Users

Deutscher Wetterdienst (D)
GIE EADS CCR (F)

Assistant Partner:
T-Systems (D)

Integration

Pallas GmbH (D)

Assistant Partner:
Fujitsu European Centre for
Information Technology (UK)

Funded by EU



IST-1999-20247

Project Coordinator



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European Testbed for GRID Applications

The EUROGRID project (IST-1999-20247) is a Research and Technology Development project funded as part of the Information Society Technologies Programme by the European Commission. The project term is Nov 1, 2000 through Oct 31, 2003.

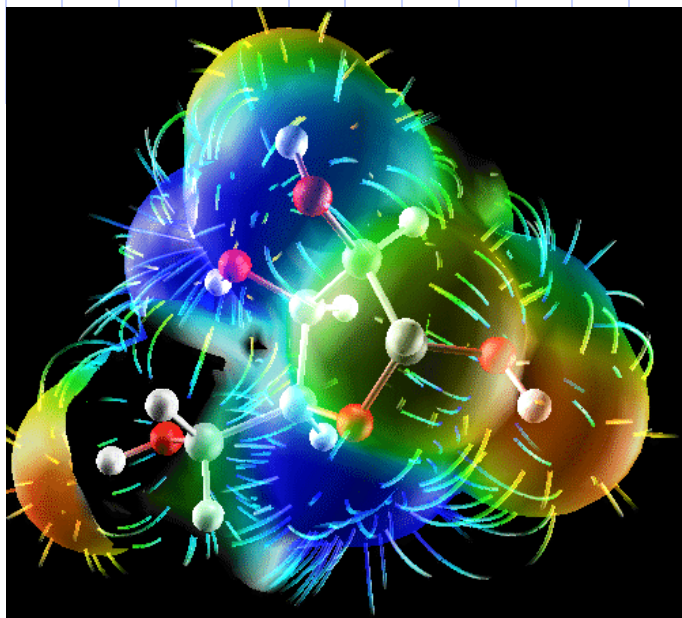
Leverage the GRID Potential

Computational GRIDs are increasingly becoming a cornerstone of future high-performance computing research and infrastructure. Within the US, European and Japanese computer science research community, the benefits of GRID technology have been amply demonstrated, and GRID systems are beginning to be phased into daily use at universities and research centres, for instance for remote experiments in material sciences, biology and astrophysics.

However, the uptake of GRID technology in the broad community of scientists that depend on computational simulation techniques for their work, has yet to happen, and industrial end-users are lagging even farther behind. The EUROGRID project will demonstrate the use of GRIDs in selected scientific and industrial communities, address the specific requirements of these communities, and highlight the benefits of using GRIDs. The choice of communities ensures that the results can be transferred to a much broader range of potential users.

Biomolecular Research

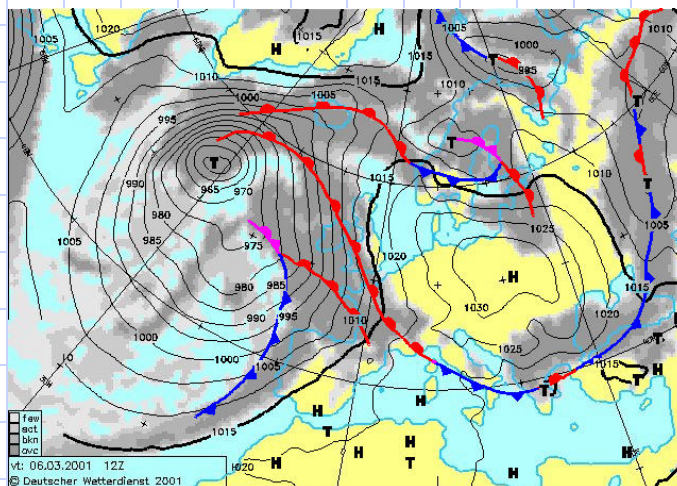
Scientists working in biomolecular research are regularly using a set of established simulation and visualization packages and associated molecule databases. While these do provide the essential functionality, the day-to-day use is complicated by incompatibilities between packages, radical differences in user interfaces and the need to become familiar with the HPC execution systems. In particular, non-experts have to face a steep learning curve before they can start to become productive.



In the BIO-GRID activity, EUROGRID will develop intuitive user interfaces for selected biomolecular packages, and compatibility interfaces between these applications and their databases. The results will be an integrated biomolecular toolkit that allows streamlined work processes, and a job execution component that makes all systems in the BIO-GRID available for simulation runs with a uniform and intuitive user interface.

Weather Prediction On-demand

Making effective use of today's HPC platforms for short- and medium-range weather predictions is now a very mature field. The results are readily available and precise general weather forecasts for large areas, that are necessarily limited both in spatial precision and in the modeling of microclimate effects.



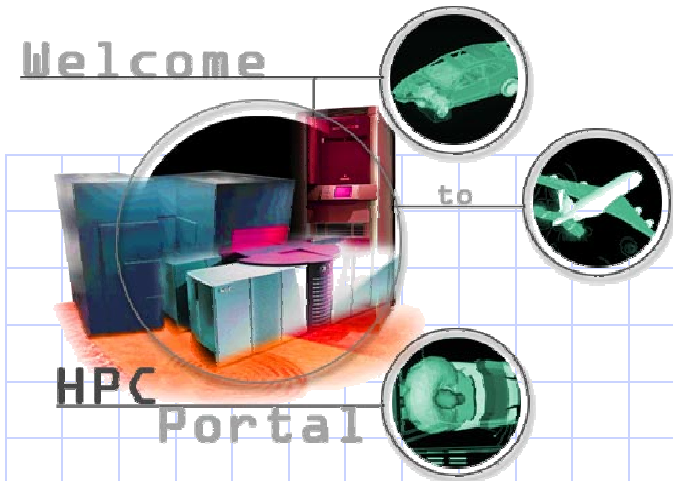
For many uses, precise meso- or microscale predictions are required: agriculture, pollution prediction, traffic and public event planning depend on precise localized weather data. To accommodate these users, a flexible framework for on-demand localized weather prediction is being developed in EUROGRID by the German weather service (DWD): using a GUI from a workstation somewhere on the Internet, a customer requests a localized prediction from DWD, which schedules a run of a special local weather model based on regular forecast data, and automatically transfers the result datasets to the customer. The UNICORE GRID technology takes care of transferring requests and results, and runs the local forecast on the next available machine in the meteorological GRID.

CAE Users in Industry

The use of CAE simulation packages has become standard practice amongst construction engineers in industry. These users often require considerable computing power for their simulation runs that is typically not available within their respective organizations. Thus, these jobs need to be run at an external computing centre, or computing resources internal to their organizations have to be combined to provide enough performance. EUROGRID will demonstrate the use of GRID technology in two key areas: code coupling and ASP-type services.

The coupling of several CAE codes, each one simulating different aspects of a system's behaviour, is emerging as a key technology to accelerate design and construction of complex systems, reducing prototyping and testing time and costs. A general mechanism for the coupling of







simulation packages will be integrated in the EUROGRID system, and its use will be demonstrated with real-world applications from EADS CCR.



Many industrial companies, in particular small and medium enterprises, lack in-house access to sufficiently powerful HPC systems, yet are increasingly depending on CAE systems and simulation packages. For them, the application service provider (ASP) scheme offers an attractive solution: instead of having to buy and maintain HPC systems and the necessary software licenses, an external provider of computing power runs their jobs and bills them according to the system time actually used. Key issues here are the confidentiality and security of input and output data, assured availability of services, accuracy of billing and the use of standard access methods that do not require special equipment at the customer sites. Within EUROGRID, former debis Systemhaus (now T-Systems) will integrate ASP-specific functions and demonstrate an ASP system for the leading CAE packages on top of EUROGRID.

HPC Users in Research

The HPC centres in EUROGRID will form a trans-European computational GRID for their users, making available part of their local resources for the EUROGRID users in science and industry.

 Linux Intel Cluster (36 PE) CRAY T3E – 1200 (512 PE) CRAY T3E – 600 (512 PE)	 SGI Onyx2 (4 PE) SGI O2000 (128 PE)
 IBM SP3 (8 PE) NEC SX5 (40 PE) IBM Power4 (256 PE) COMPAQ Alpha Linux (24 PE)	 CRAY T3E – 900 (32 PE) NEC SX 4B/2A Compaq Linux Cluster (4 PE)
 CRAY T3E – 1200 (128 PE) FUJITSU VPP 300 (8 PE) SGI O2000 (128 PE) SGI O3000 (512 PE)	 NEC SX 5 (10 PE)

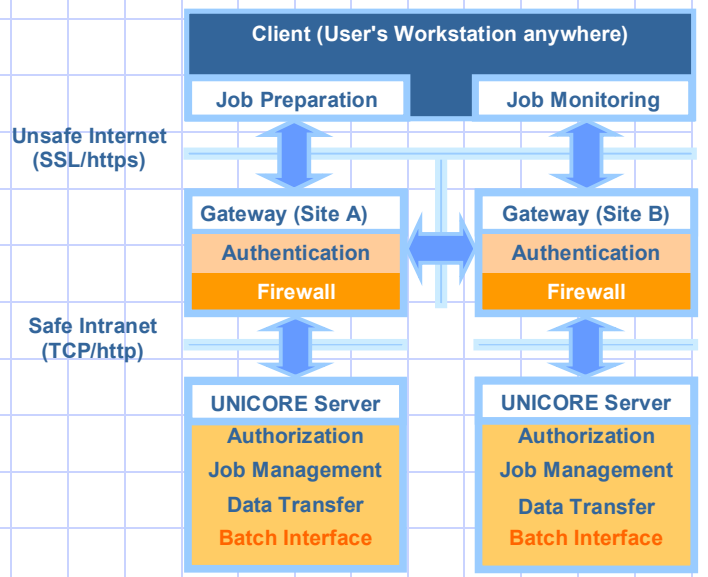
This GRID will serve as a test-bed for the development of distributed applications, the integration of full production systems in a GRID environment, and for the close cooperation between sites operating a wide range

of different HPC platforms. This part of EUROGRID will concentrate on the application domains not represented in the domain-specific activities discussed above. The distributed applications that will have the biggest added value for scientific research are those concerned with multi-physics simulations relying on complex computational chains. These demand the coherent and complementary use of different computational resources, and map very naturally to a heterogeneous GRID environment.

Built on Proven GRID Technology

EUROGRID relies on a proven GRID infrastructure originally developed for the leading German supercomputer centres in the UNICORE project. The UNICORE GRID system consists of three distinct software tiers: **clients** interacting with the user and providing functions to construct, submit and control the execution of computational jobs, **gateways** acting as point-of-entry into the protected domains of the HPC centres, and finally **servers** that schedule and run the jobs on the HPC platforms that they control. All components are written in Java, and the protocols between the components are also defined using Java mechanisms.

The system emphasizes strong authentication and data security relying on X.509 certificates and SSL. The server uses contains platform-specific incarnation databases to adapt to the multitude of current HPC systems, with the other components being designed for portability.



Technology Development

Within EUROGRID, new functionality will be introduced into the base GRID system, depending on the requirements of the domain-specific activities and of the HPC-GRID. Areas of extension are

- ◆ **efficient data transfer**
- ◆ **dynamic resource brokering**
- ◆ **ASP accounting and billing services**
- ◆ **application coupling**
- ◆ **interactive steering and access**

The EUROGRID Consortium

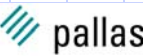

The EUROGRID consortium contains a balance of premier European computer centres and GRID technology experts and commercial companies.

Computer centres

	Research Centre Jülich www.fz-juelich.de
	German Weather Service www.dwd.de
	CNRS IDRIS www.idris.fr/indexeng.html
	CSCS www.cscs.ch
	University of Manchester www.man.ac.uk
	Parallab www.parallab.no
	ICM www.icm.edu.pl

Among themselves, the participating centres represent the leading European expertise in vector and RISC high-performance computing for applications in physics, chemistry, meteorology, biology and astrophysics. Several thousand scientists depend on the centre's platforms for their daily work.

GRID technology experts

	Pallas GmbH www.pallas.com
Assistant Partner:	
	fecit www.fecit.co.uk

Pallas and FECIT (Fujitsu European Centre for Information Technology) are well-known experts for high-performance tools and applications; in cooperation, both companies have built and deployed the GRID technology base for the German UNICORE and UNICORE Plus projects.

Industrial end-users

	EADS CCR www.eads-nv.com
Assistant Partner:	
	T-Systems www.t-systems.de

As the premier research and development centre for the European Aeronautic Defence and Space Company, EADS CCR conducts complex aerodynamic and electromagnetic simulations for the Airbus development.

T-Systems (former debis Systemhaus) is the leading German provider of computing services for industry, with a focus on automotive and aerospace industries.

Further Information

For more detailed information on EUROGRID, please refer to <http://www.eurogrid.org>.

For information on the base technology, please refer to the UNICORE web site at <http://www.unicore.de>.

Related Projects and Initiatives

The UNICORE Plus Project

The GRID system used by EUROGRID is being developed in the German R&D project UNICORE Plus¹. This project is establishing a uniform GRID infrastructure for the leading German HPC centers. During the project period (2000–2002), this GRID software is being extended and improved to fulfill the requirements of day to day operational use in large computing centers.

The UNICORE Forum

The UNICORE Forum has been created to foster the use and development of the UNICORE technology as a generally accepted way for access to HPC computers via the Internet. It is a non-profit organization independent of any research and development project. It publishes the external interfaces for the UNICORE GRID system and will update the specifications according to future developments. In addition, the Forum provides support for certifying that implementations comply with the latest UNICORE standards. At the end of 2001, the UNICORE Forum has 25 members, including the leading vendors of HPC systems.

The Grid Forum Initiative

The Grid Forum started as a US initiative to promote the development of standards amongst the plethora of GRID-related projects. A number of working groups are discussing important aspects of GRID systems, among them security, resource modelling and user-level environments. The Grid Forum has since assumed global scope, and representatives from UNICORE and EUROGRID are actively participating in the discussions.

The DATAGRID Project

The DATAGRID (IST-2000-25182) project works on storing and providing access to scientific data, in particular for the experiment data from CERN's upcoming LHC collider. Because of the huge data volume, a multi-tiered distributed architecture of data centres will be setup and demonstrated. EUROGRID and DATAGRID have complimentary objectives and are keeping close contact with each other.

The DAMIEN Project

The DAMIEN project (IST-2000-25406) focuses on middleware for distributed applications, such as parallel programs running simultaneously on several machines. EUROGRID is liaising with DAMIEN to ensure that the DAMIEN middleware is compatible with the GRID system employed by EUROGRID.

¹ UNICORE Plus is funded in part by the Germany Ministry for Education and Research (BMBF) under grant 01-IR-001.