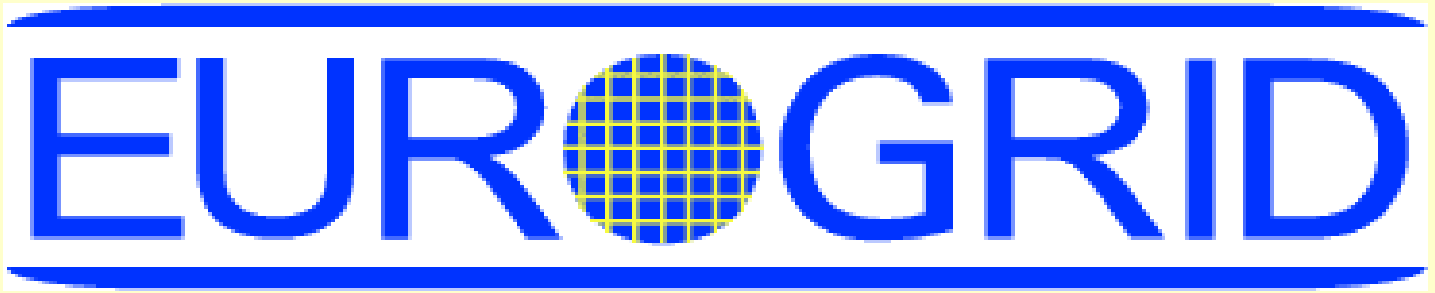


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EUROGRID

Cooperative effort of national HPC centres, major HPC users and technology providers, to contribute to the development of computational grid infrastructures in Europe.

Forschungszentrum Julich (D)

Victoria University of Manchester (UK)

CNRS - IDRIS (F)

Parallab - University of Bergen (N)

Warsaw University - ICM (PL)

ETH Zurich (SCSC Manno) (CH)

Deutscher Wetterdienst (D)

GIE EADS CCR (F)

Pallas GmbH (D) (Project coordination)

Associate contractors :

Fujitsu European Center for Information Technology (UK)

Debis Systemhaus (D)

National HPC Centres

Industrial Users

Technology Providers

# HPC Centres

- Contribute to the acceleration of scientific discovery, by the use of information technologies
- Provide high performance supercomputing environments for dealing with science's more challenging problems.
- Act as a technology transfer agent between R&D in information technologies, and computational science

# Targets for HPC in next decade

- Capture more physics in the simulation of complex systems
- Complex systems are characterized by multiple time and/or length scales
- Not easy to capture multiple scales in one code
- Code coupling for multi-physics applications is viable alternative in some conditions
- This leads naturally to computational grids
- Heterogeneous algorithms map naturally to heterogeneous grids.

# Project motivations and strategies

- Focus on heterogeneous, very high performance supercomputing environments.
- Use of grid technologies to provide a unified image and a transparent access to such environments
- Deploy an application testbed across Europe by the integration of partner's HPC environments
- Provide a major effort to develop and deploy distributed scientific applications (EUROGRID is roughly 2/3 applications development, 1/3 technology development)

# EUROGRID middleware

- CUSTOM
  - UNICORE
- COMMODITY
  - MPI (scientific standard, soon interoperable)
  - CORBA - JAVA (internet standard, has significant software engineering advantages, but not yet fully adapted to performance focused complex applications).
  - … (others)

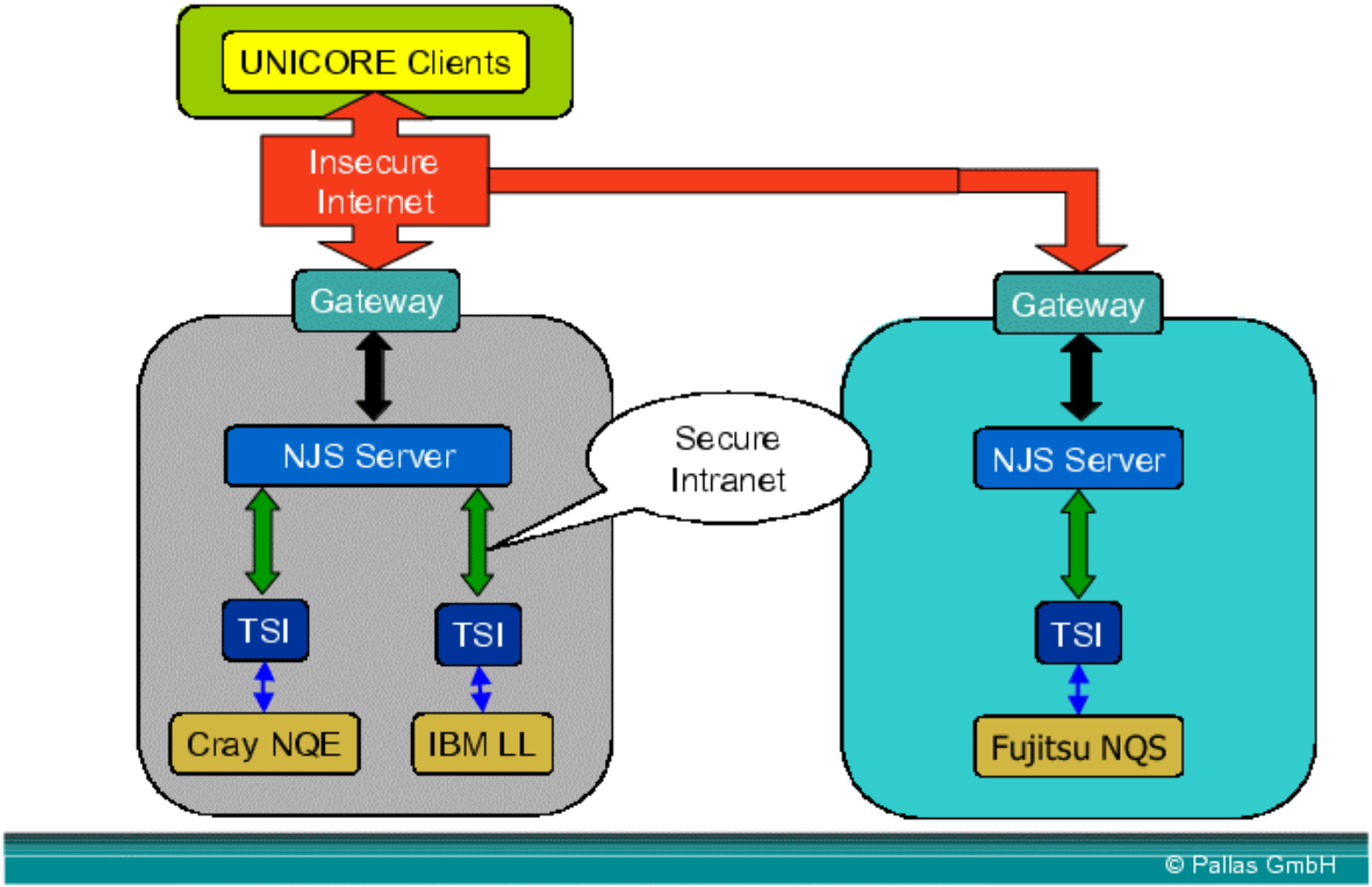
# UNICORE partners

- Forschungezentrum Julich (FZJ, project leader)
- Rechenzentrum Universitat Stuttgart (RUS)
- Deutscher Wetterdienst Offenbach (DWD)
- Konnrad-Zuse-Zentrum Berlin (ZIB)
- Leibniz Rechenzentrum Munchen (LRZ)
- Rechenzentrum Universitat Karlsrhue (RUKA)
- Padenborn Center for Parallel Computing (PC2)
- Technische Universitat Dresden (TUD)
- Pallas GmbH Bruhl (Pallas)
  - Fecit, subcontractor to Pallas

# UNICORE goals

- UNICORE develops a seamless, secure, intuitive software infrastructure to HPC resources
- Provides consistent batch access to heterogeneous remote systems …
- … with minimal intrusion into the Centers
- Supports multi-site and multi-systems applications for one job
- Exploits existing and emerging technologies

# EUROGRID–0 Components



# UNICORE Plus Project (2000 - 2002)

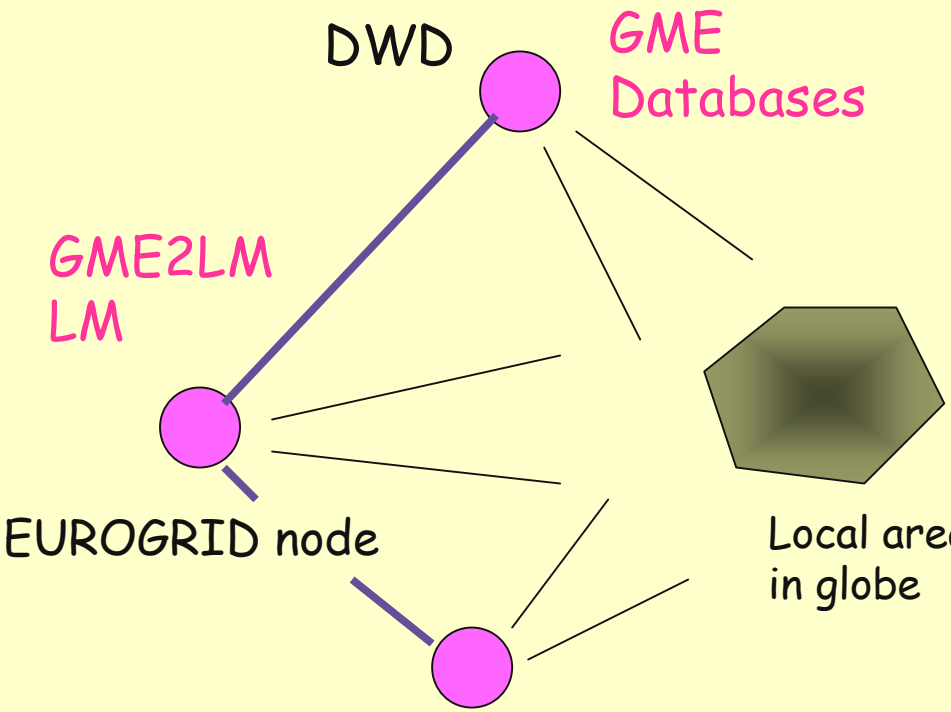
- Resource Modelling (ZIB, Berlin)
- Data Management Enhancements (RUS, Stuttgart)
- Extended Job Control (DWD, Offenbach)
- Application Specific Interfaces (FRZ, Julich)
- Co-sheduling (PC2, Paderborn)
- MPI and PACX integration (RUS, Stuttgart)
- Vampir extensions (TUD, Dresden)
- Advanced administration (FRZ, Julich)

# WP1 : Bio-Grid (ICM leading partner)

- Computation portal to bio-molecular applications
- Build interfaces to well known bio-molecular applications, simplify access to databases.
- Integrate interfaces within EUROGRID software.

# WP2 : Meteo Grid (DWD leading partner)

Ubiquitous access to local weather prediction software, developped at DWD




GME : mesh 60 Km
31 layers
LM : mesh 25 Km x 2 Km
typically 48 hs.

# WP3 : CAE Grid (EADS leading partner)

- Focuses on industrial CAE applications
- Code coupling and multi-physics optimisations to improve system design.
- ASP - type services :
  - User interfaces to hide the complexity of HPC systems to industrial users
  - Supercomputing as an e-business : accurate cost prediction of CAE simulations

# WP4 : HPC-GRID (IDRIS leading partner)

- Targets :
- The establishment, by the HPC centres partners of EUROGRID, of an application testbed for general purpose HPC distributed applications
- The installations and tests of EUROGRID software releases
- The development of new relevant GRID applications, using existing middlewares, in scientific areas not covered by WP1 to WP3.

# HPC - GRID

CRAY T3E 900 (32 PE)
NEC SX4B/2A
Linux Cluster (4 PE)

SGI
SGI O2000 (128 PE)

FZJ 

Linux Intel Cluster (36 PE)
CRAY T3E - 600 (512 PE)
CRAY T3E - 1200 (512 PE)

CRAY T3E - 1200 (816 PE)
FUJITSU VPP300 (8 PE)
SGI O2000 (128 PE)
SGI O3000 (256 PE)

IBM SP3 (8 PE)
NEC SX5 cluster (40 PE)
IBM Power4 (256 PE, 1.3 TFLOPS)
COMPAQ Linux Cluster (24 PE)

# WP4 : some prospects on applications

- Interactive monitoring and steering of complex simulations (running in batch mode), using JAVA - CORBA technology.
- Coupling of atmospheric and hydrological models
- Fluid-structure coupling for space propulsion
- Direct numerical simulation of turbulent combustion.
- …many others to come in the area of electrodynamics, material sciences, quantum chemistry, ...

# WP5 : Technology developments

- Efficient file transfer (FECIT leading partner)
  - Optimisations of transfer bandwidth and cost
  - Fail-safe and encripted transfer
  - Overlap of transfer and processing
  - Emphasis on quality of service.
- Resource broker (UoM leading partner)
  - Must handle static and dynamic information to match the user's computational requirements
  - Builds on CSAR past experience.

# WP5 : Technology developments

- ASP infrastructure (DEBIS leading partner)
  - Supercomputing as an e-business?
  - Build browser-based job submission GUI
  - Build tools for cost-estimation, accounting and Web-based billing of services.
- Interactive access (Parallab leading partner)
  - Deals with all kinds of issues related to simulation steering by visualized output.
  - Integrate these facilities in EUROGRID software.

# WP6 : (Pallas leading partner)

- Maintain working versions of EUROGRID software
- Integrate domain specific extensions (WP1 to WP4) and new technology (WP5).
- EUROGRID 0.0 : UNICORE today
- EUROGRID 0.5 :
  - Data transfer, application couplings, interactive access
- EUROGRID 1.0 :
  - Resource broker, ASP infrastructure
- EUROGRID 2 : final version

# Conclusions :

- Integration of modern grid software technologies in European supercomputing infrastructures
- Major effort in distributed application development in science and technology