UNICORE

A European Grid Middleware

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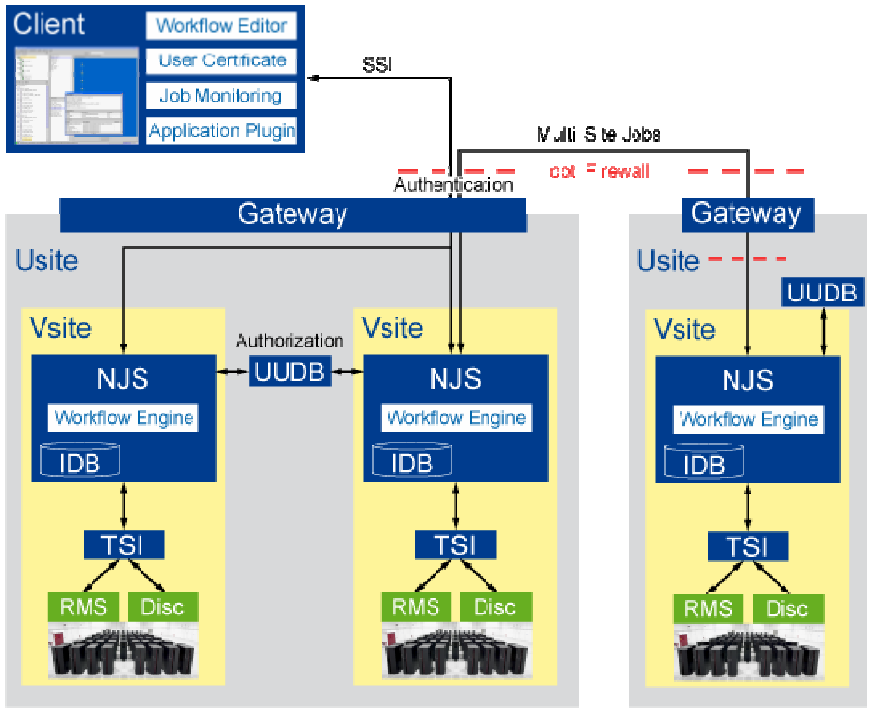
UNICORE History lesson

- UNiform Interface to COmputing Resources
  - seamless, secure, and intuitive
- Initial development started in two German projects funded by the German ministry of education and research (BMBF)
  - 08/1997 – 12/1999: UNICORE project
    - Results: well defined security architecture with X.509 certificates, intuitive graphical interface, central job supervisor based on Codine from Genias,
  - 1/2000 – 12/2002: UNICORE Plus project
    - Results: implementation enhancements (e.g. replacement of Codine by custom NJS), extended job control (workflows), application specific interfaces (plugins)
- Continuous development since 2002 in several European projects
- Core developers today from Europe: CINECA, ICM, Intel, FLE, FZJ

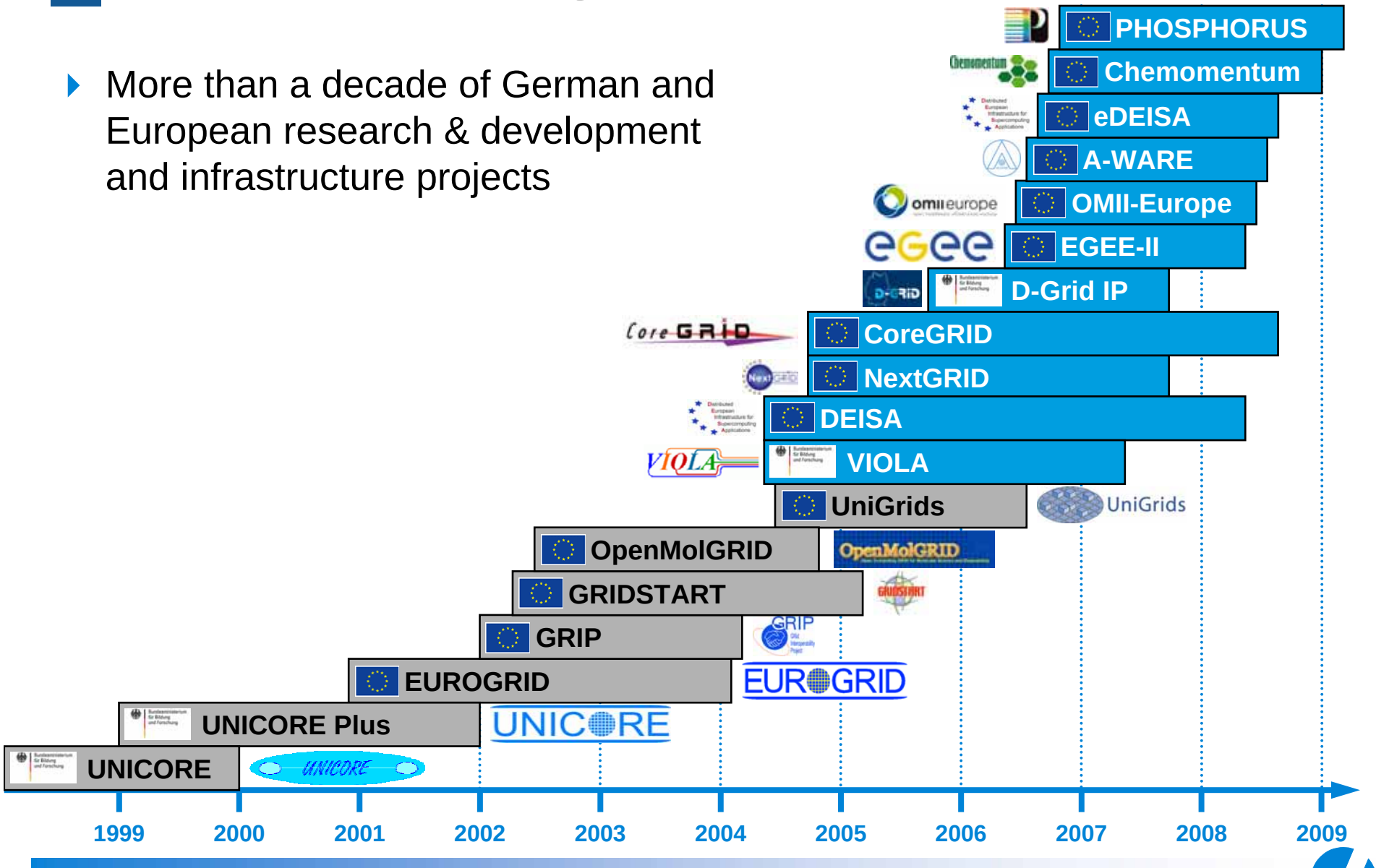
UNICORE Key features

- A vertically integrated Grid middleware system since 1997
- Provides seamless, secure, and intuitive access to distributed resources and data
- Used in production and projects worldwide
- Open Source under BSD license
- Features
  - intuitive GUI with single sign-on
  - X.509 certificates for AA and job/data signing
  - workflow engine for complex workflows
  - extensible application support with plug-ins
  - interactive access with UNICORE-SSH



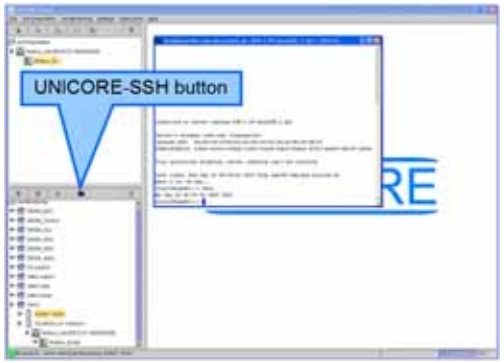
UNICORE Projects

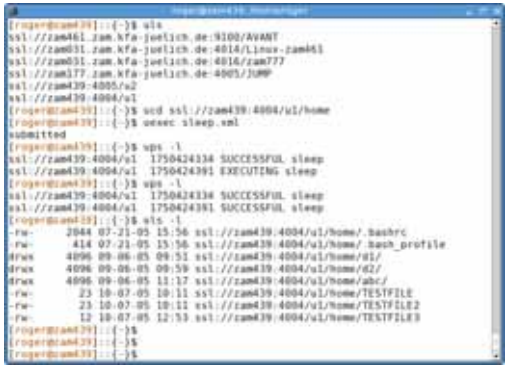
- More than a decade of German and European research & development and infrastructure projects

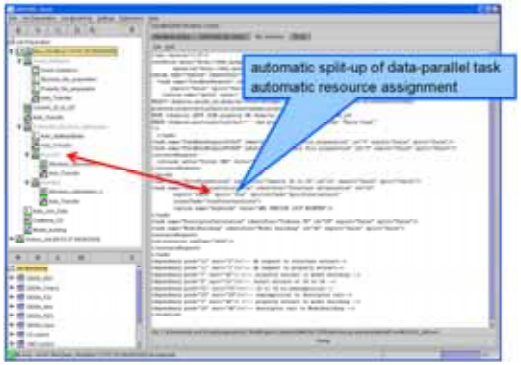


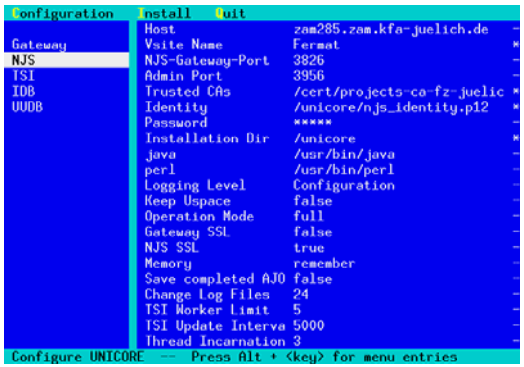
Recent Developments

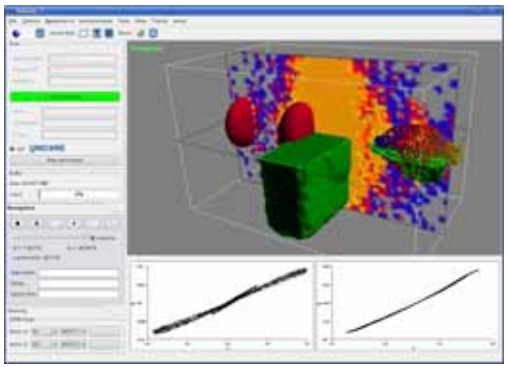
- Interactive access (UNICORE-SSH)
- Improved workflow capabilities (MetaPlugin for Workflows)
- High-level API for programming Grids (Roctopus)
- DRMAA-based TSI
- Collaborative Online Visualization and Steering (COVS)
- Comfortable configuration tool
- Site Functionality Monitoring Tool (SIMON)



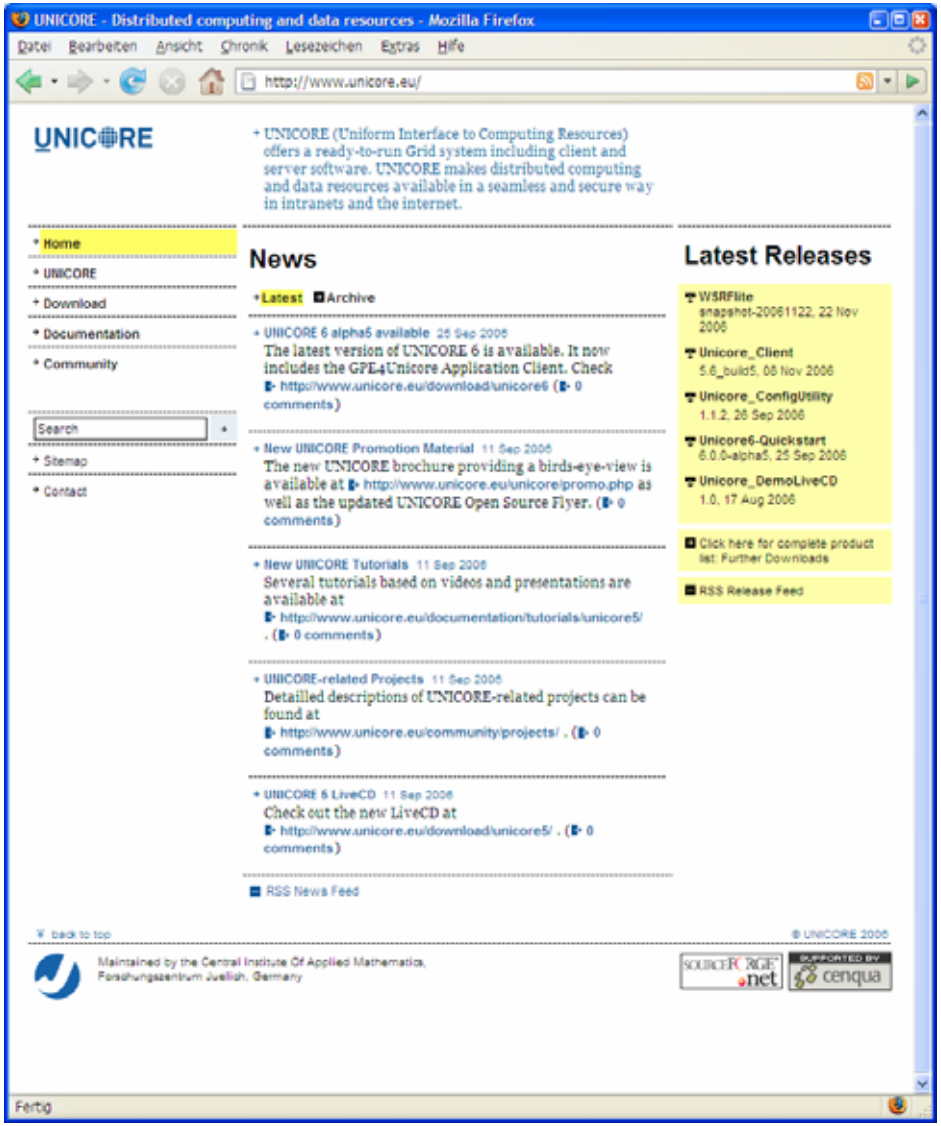


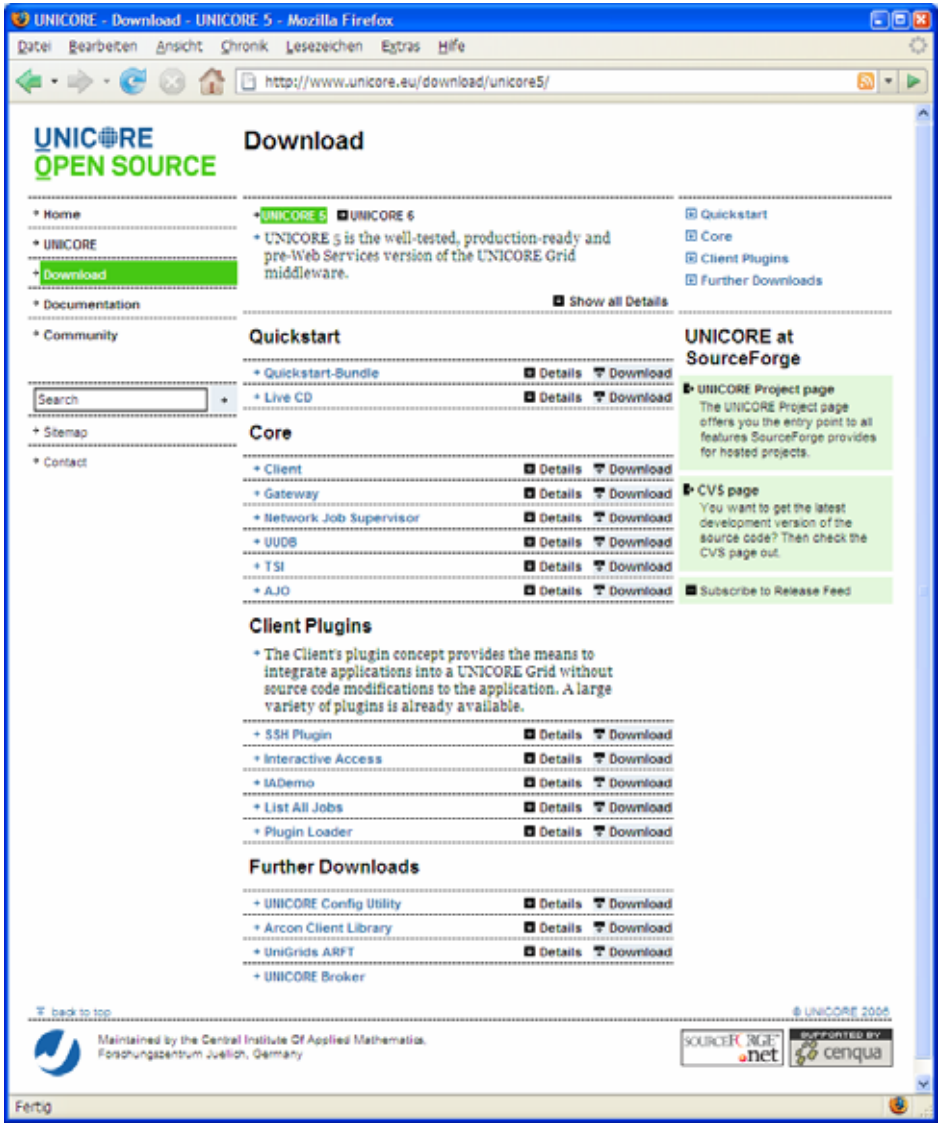






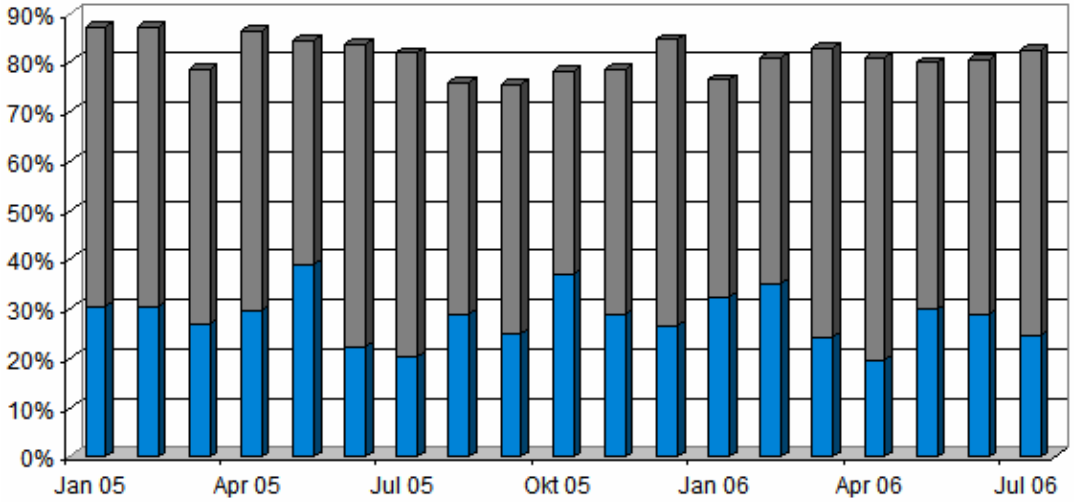
UNICORE Website: http://www.unicore.eu





Usage in the National German HPC center NIC

- About 450 users in 200 research projects
  - ¼ of them uses UNICORE
- Access via UNICORE to
  - IBM p690 eSeries Cluster (1312 CPUs, 8.9 TFlops)



- SoftComp Cluster (264 CPUs, 1 TFlop)
- Cray XD1 (120 CPUs + FPGAs, 528 GFlops)

Distributed European Infrastructure for Supercomputing Applications

Distributed European Infrastructure for Supercomputing Applications

- Consortium of leading national HPC centers in EU
- Deploy and operate a persistent, production quality, distributed, heterogeneous HPC environment

IDRIS – CNRS, France
FZJ, Jülich, Germany
RZG, Garching, Germany
CINECA, Bologna, Italy
EPCC, Edinburgh, UK
CSC, Helsinki, Finland
SARA, Amsterdam, NL
HLRS, Stuttgart, Germany
BSC, Barcelona, Spain
LRZ, Munich, Germany
ECMWF, Reading, UK

Distributed European Infrastructure for Supercomputing Applications

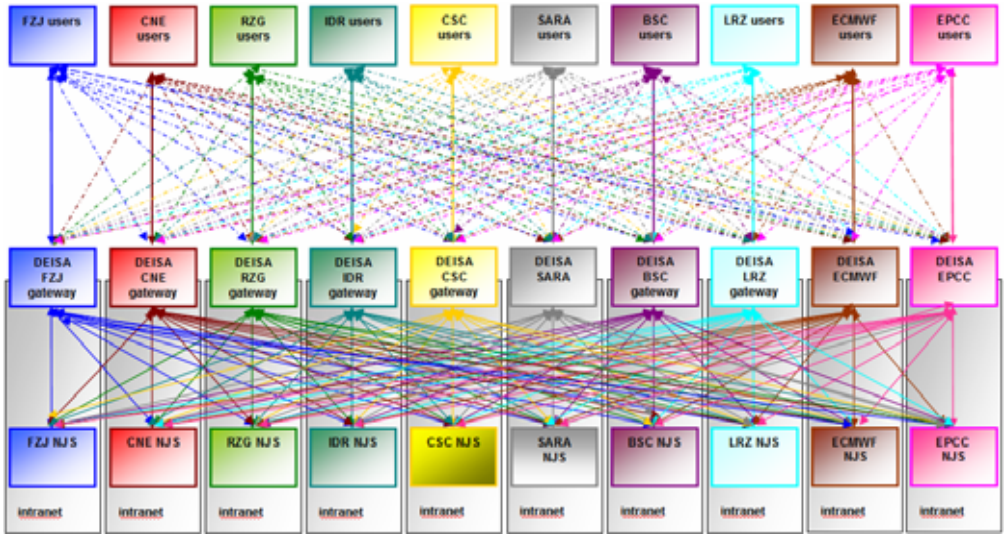
Services

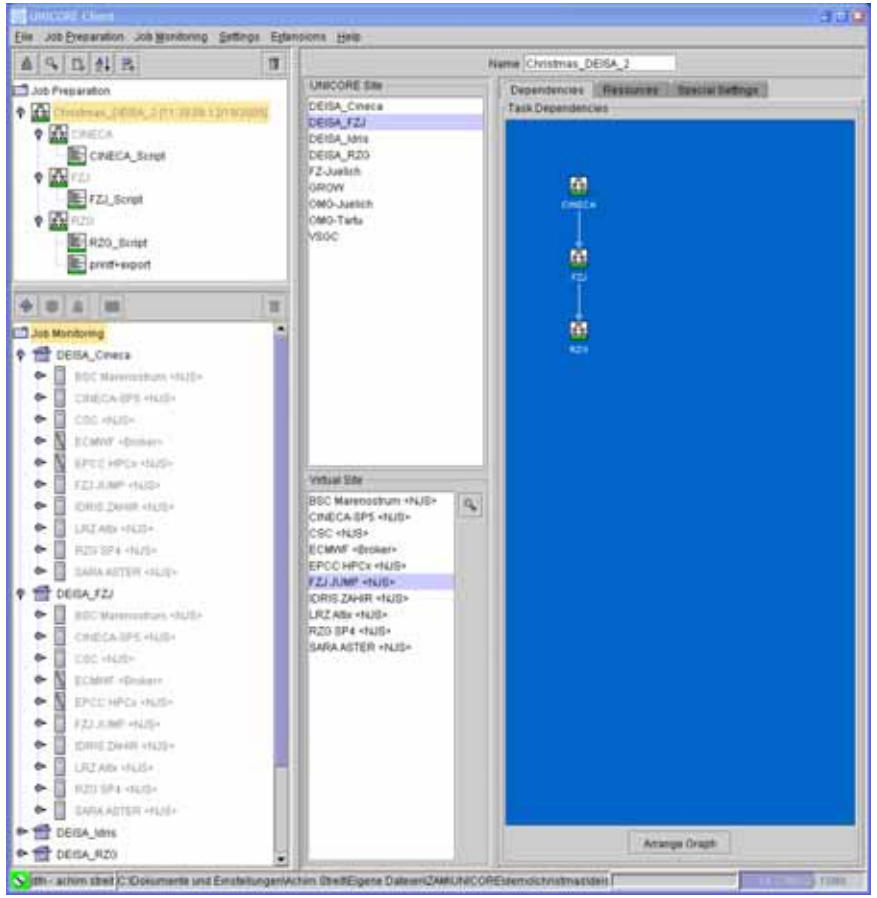
- Dedicated 1 Gb/s network as a basis
- High performance datagrid via GPFS
  - Extended to non-AIX Linux like SGI Altix, Mare Nostrum
- Common Production Environment on all sites
- Job migration across sites
  - Used to load balance the global workflow when a huge partition is allocated to a DEISA project in one site
- UNICORE as Grid Middleware for workflow applications
- Co-allocation for applications running on multiple sites at the same time
- Global data management to include tertiary storage and hierarchical data management system
- Science Gateways and Portals to facilitate the access of new, non traditional users communities

UNICORE Usage in DEISA

Distributed European Infrastructure for Supercomputing Applications

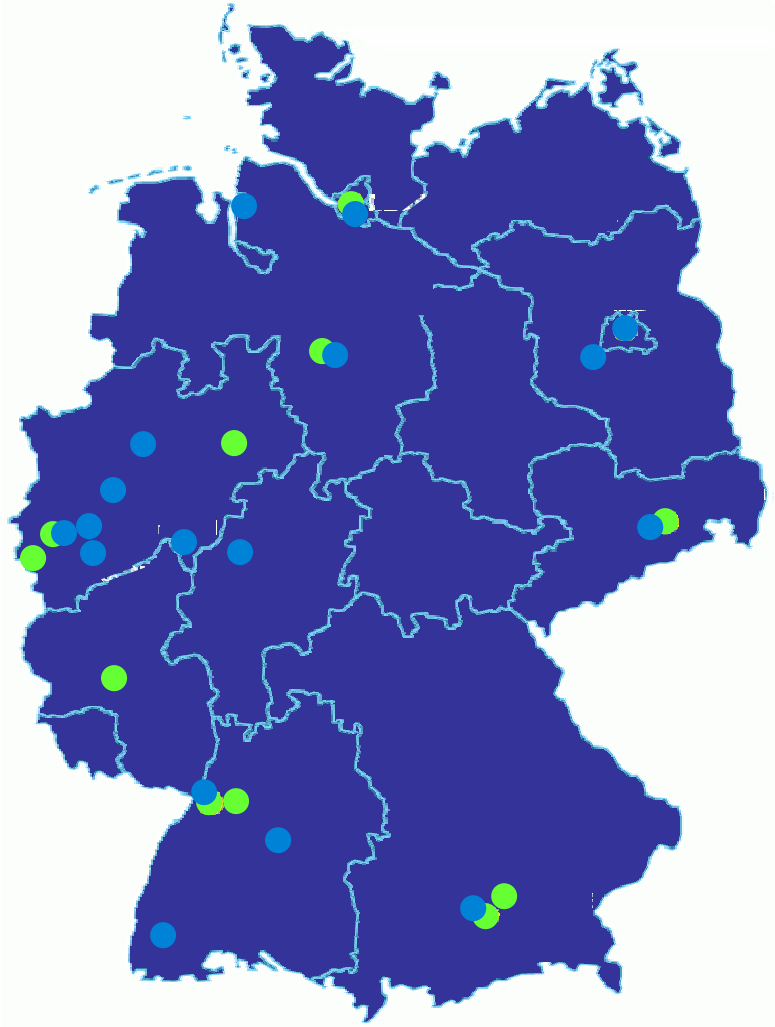
- fully-meshed UNICORE infrastructure
- complex multi-site workflows easily possible
- heavily used by DECI (DEISA Extreme Computing Initiative) projects/jobs



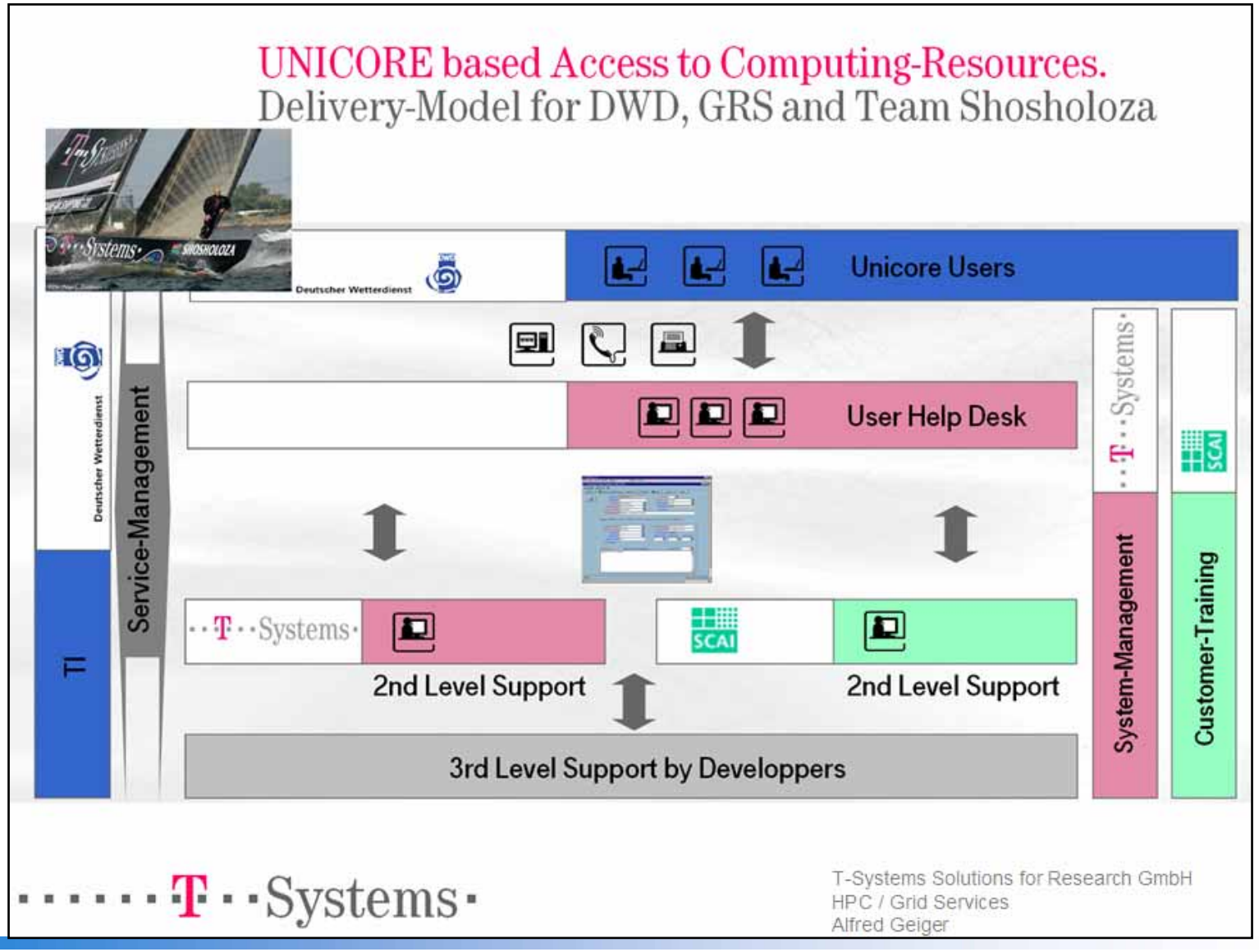


UNICORE Usage in D-Grid

- Core D-Grid sites committing parts of their existing resources to D-Grid
  - Approx. 700 CPUs
  - Approx. 1 PByte of storage
  - UNICORE is installed and used
- Additional Sites receiving extra money from the BMBF for buying compute clusters and data storage
  - Approx. 2000 CPUs
  - Approx. 2 PByte of storage
  - UNICORE (as well as Globus and gLite) will be installed as soon as systems are in place



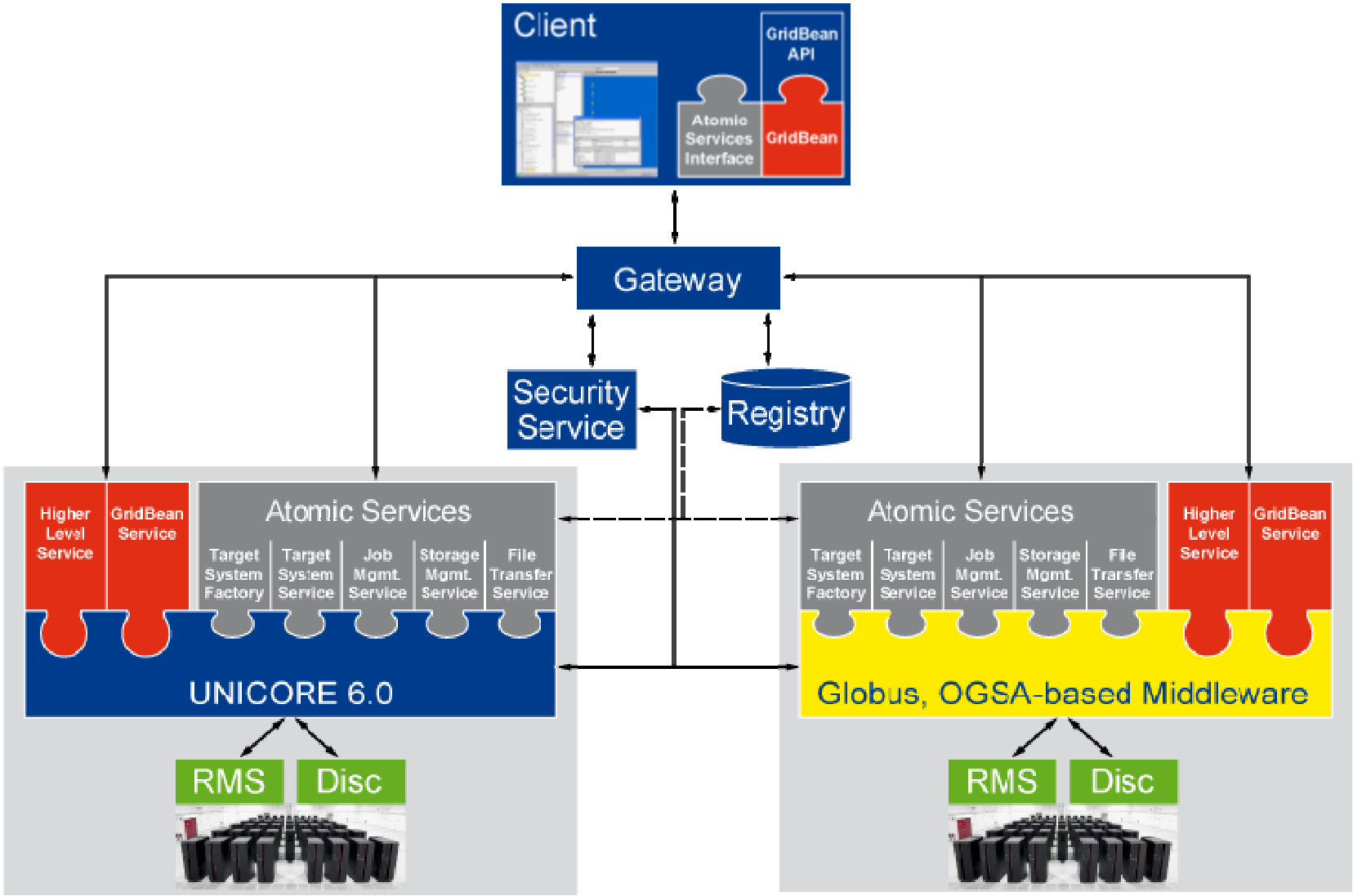
Usage in Industry and Commercial Support



Roadmap to UNICORE 6.0

- New infrastructure based on web services
- Preserved traditional “User-level” features
  - Atomic: simple tasks, such as „Execute script“
  - Client: workstation GUI
  - Workflow: edit, run and monitor graphs of atomic tasks
- Additional “User-level” features
  - Portal: web based portal client
  - Streaming: client-server streaming support (for visualization or media applications)
- Application development features
  - Software license management
  - Simplified application deployment
- Deployment features
  - User and virtual organization (VO) management

UNICORE Architecture of Version 6.0



A use case of UNICORE 6

- Collaborative Online Visualization and Steering (COVS)
  - Implemented as a higher level service of UNICORE
    - WS-RF compliant for session management
    - ssh-based “data transfer” with visualization on the client
  - Collaboration server + multiplexer for geographically dispersed clients
  - Usage of UNICORE security infrastructure for single sign-on
- COVS is a real application of WS-RF based UNICORE
  - Collaboration server and multiplexer are the resources
  - Controlled through a UNICORE service
- COVS is a framework for scientific simulations & visualizations
  - In addition to usual post-processing (offline) techniques
  - Enables to view the actual status (online) of parallel simulations
  - Based on the communication library VISIT
  - Works with all VISIT-enabled scientific visualizations

http://www.fz-juelich.de/zam/visit/

A use case of UNICORE 6

- Gridbean for UNICORE Clients
  - Manages the collaborative visualization and steering sessions (participants, collaboration server, and multiplexer
    - Who is/is not participating?
    - Who is able to steer the simulation?
    - Who is just watching?
  - Monitors performance of connections (detection of bottlenecks)
- Successfully demonstrated at OGF18, Europar'06, SC'06, …