GRIP:Creating Interoperability between Grids

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Motivation

GRIP
GRid Interoperability Project

Moving towards THE GRID:

- Standardization
- Interoperability layer
- Applications

➡ Interoperation between UNICORE and Globus combining the unique strength of both systems

UNICORE Status

GRIP GRid Interoperability Project

Uniform **I**nterface to **Co**mputing **Re**sources

- Project UNICORE Plus (funded by BMBF, grant: 01 IR 001) successfully completed
- UNICORE Pro software marketed and supported by Intel Software & Solutions Group
- Software available as Open Source for R&D projects: http: //www.unicore.org/download
- Basis for a German HPC Grid
- Used in several EC funded Grid projects
- Selected by Japanese NAREGI project

UNICORE Highlights

GRIP GRid Interoperability Project

- System-independent creation and control of jobs
- Support for multi-system and multi-site jobs
- Dynamic flow control
- Integrated security using X.509 certificates
- Access to remote file systems and archives
- Extensible support for scientific & commercial applications
- Minimal intrusion into site autonomy

Globus Status

- Globus Toolkit (GT) 2.4 and 3.0.2
- Many GT 2.x based solutions available (IBM Grid Toolbox ...)
- Software is available as Open Source at http://www-unix.globus.org/toolkit/
- GT is used in projects & testbeds worldwide (DataGrid, NASA IPG ...)

Globus Highlights

GRIP
GRid Interoperability Project

- Set of extensible services and corresponding APIs
- Collection of commands to access services
- Services are Grid Security Infrastructure (GSI) enabled
- Commodity Grid Kits (CoG Kits) to build Grid portals
- OGSI compliant Grid implementation & Grid Services hosting environment

Objectives of GRIP

Grid **I**nteroperability **P**roject: EU grant IST-2001-32257

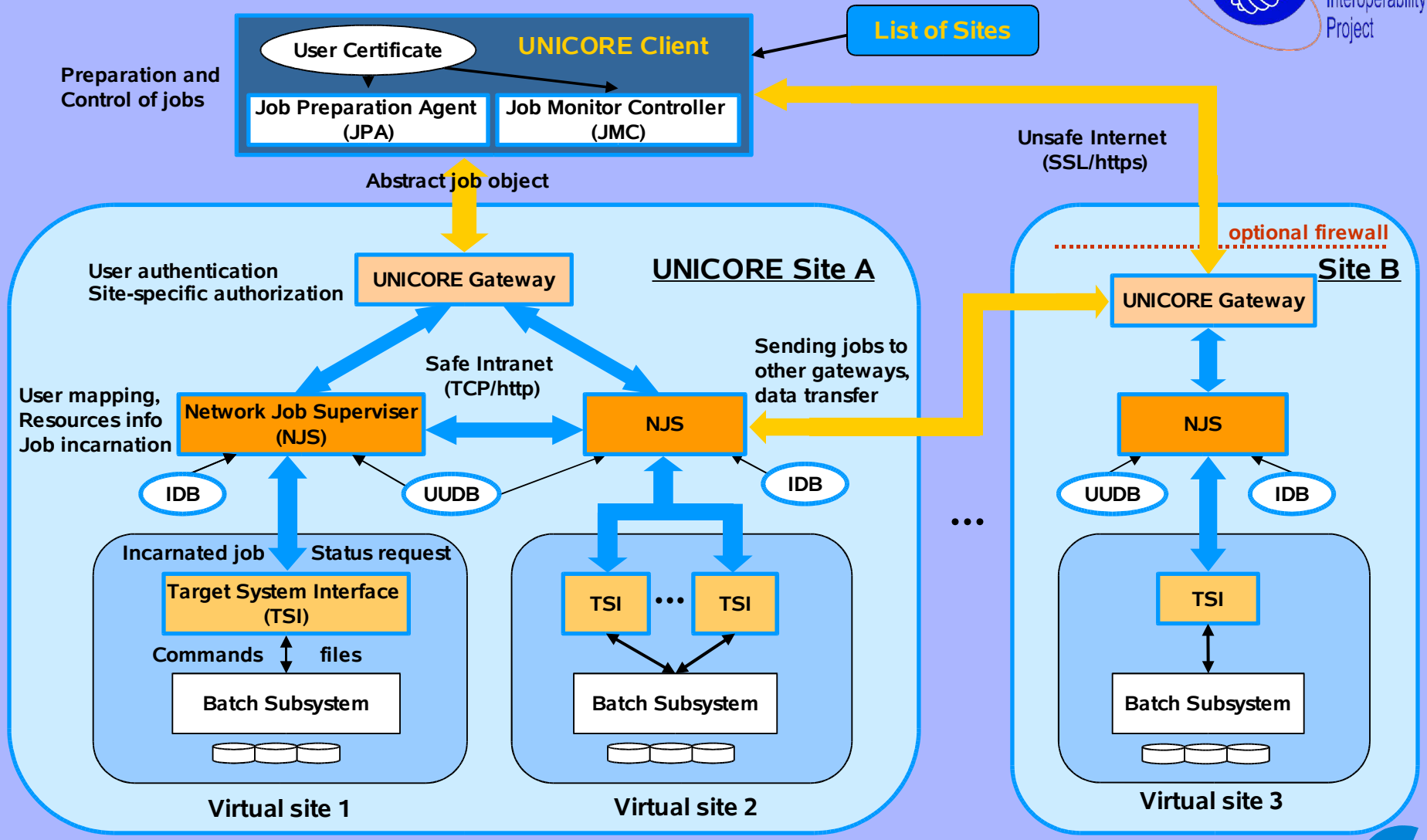
- Make Globus controlled resources available to UNICORE users
- Develop software to enable the interoperation of UNICORE and Globus
- Cross-Grid information brokerage
- Build and demonstrate biomolecular and meteorological inter-Grid applications
- Contribution to standarization efforts
- Evolve towards a service oriented Grid

Partners

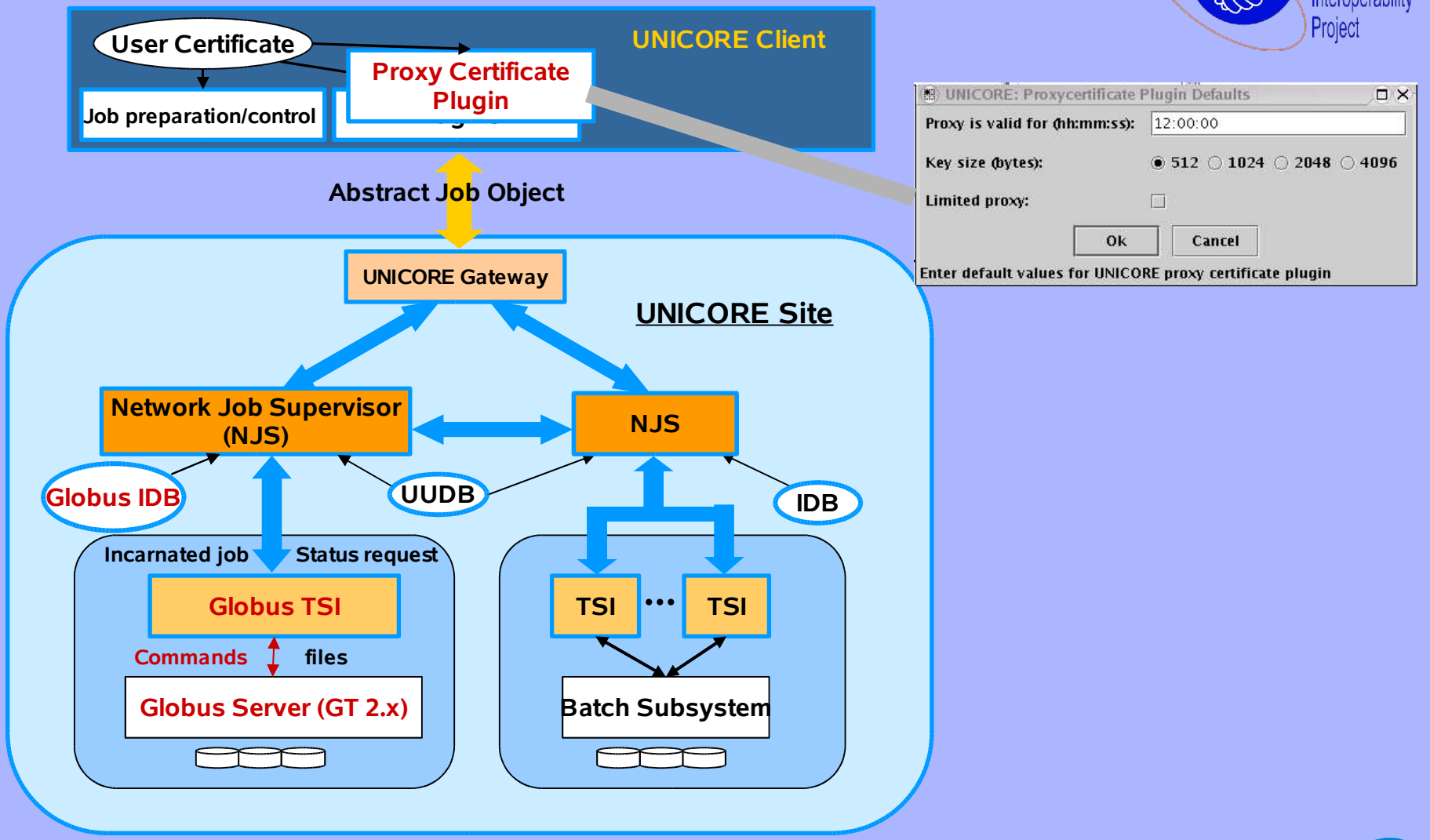
GRIP
GRid Interoperability Project

- Forschungszentrum Jülich (DE)
- Pallas (DE)
- Deutschen Wetterdienst (DE)
- ICM (PL)
- Fujitsu (UK)
- University of Manchester (UK)
- University of Southhampton (UK)
- Argonne National Laboratory (US)

UNICORE Architecture

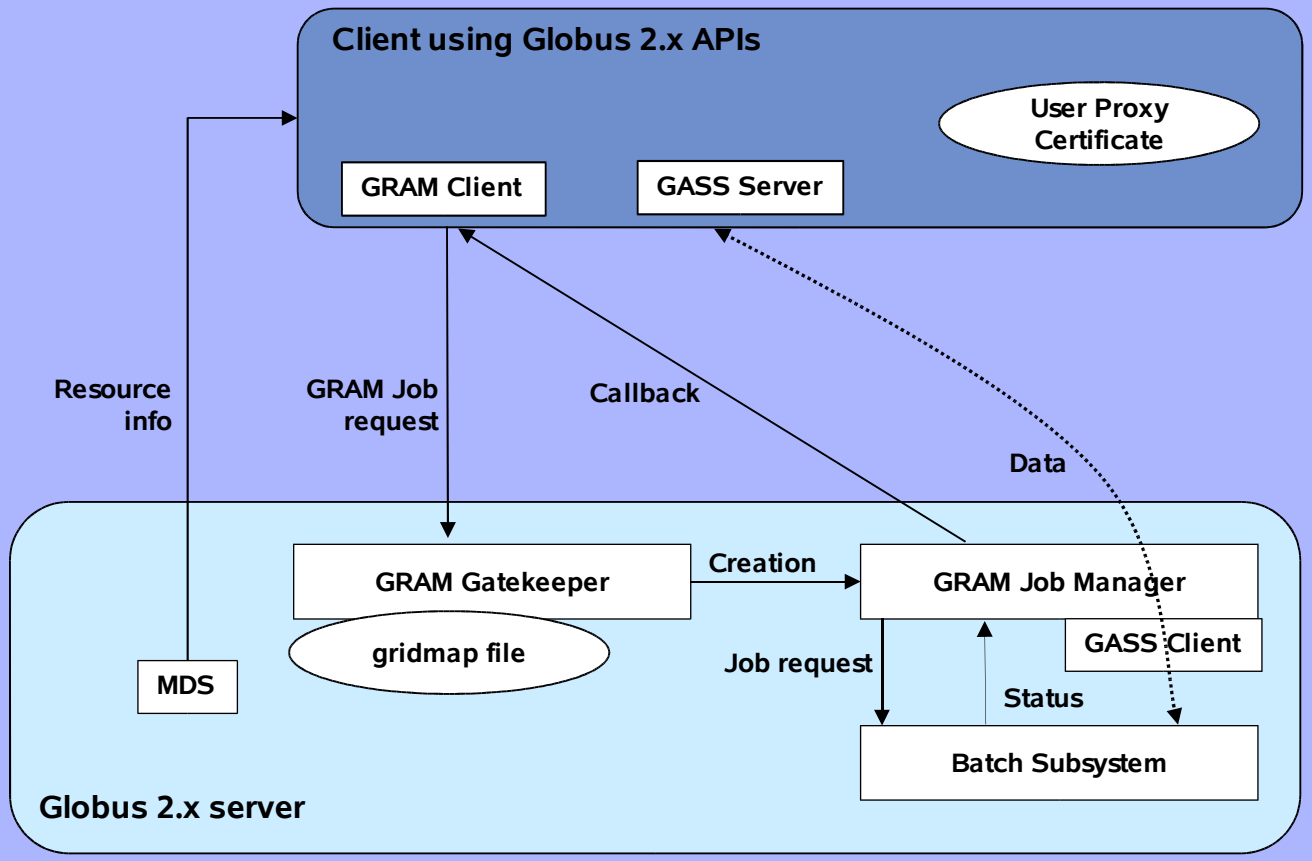


GRIP Architecture



Globus Architecture

Components relevant for GRIP



Interoperability Components

Discussed in this presentation:

- Security
- Resource provisioning & brokerage
- Applications support

Others:

- Resource description mapping
- Job submission & monitoring
- Data transfer

Security

- Both systems use PKIs utilizing X.509 certificates
- UNICORE
  - End-to-end security
  - Certificates for user & server authentication and signing of jobs
  - Authorization entity: UNICORE user database
- Globus
  - Proxy delegation
  - Proxies are used for user & server authentication
  - Authorization entity: gridmap-file

Security (cont)

- GRIP
  - Client generates proxy certificates
  - Proxy transferred via SSL within (signed) job as a SSO (site specific object), and not stored in between
  - Proxy stored in user's filespace
  - Proxy is removed after job execution
  - Proxies are signed by users UNICORE certificate (issued by GRIP CA)
  - Globus site must trust GRIP CA

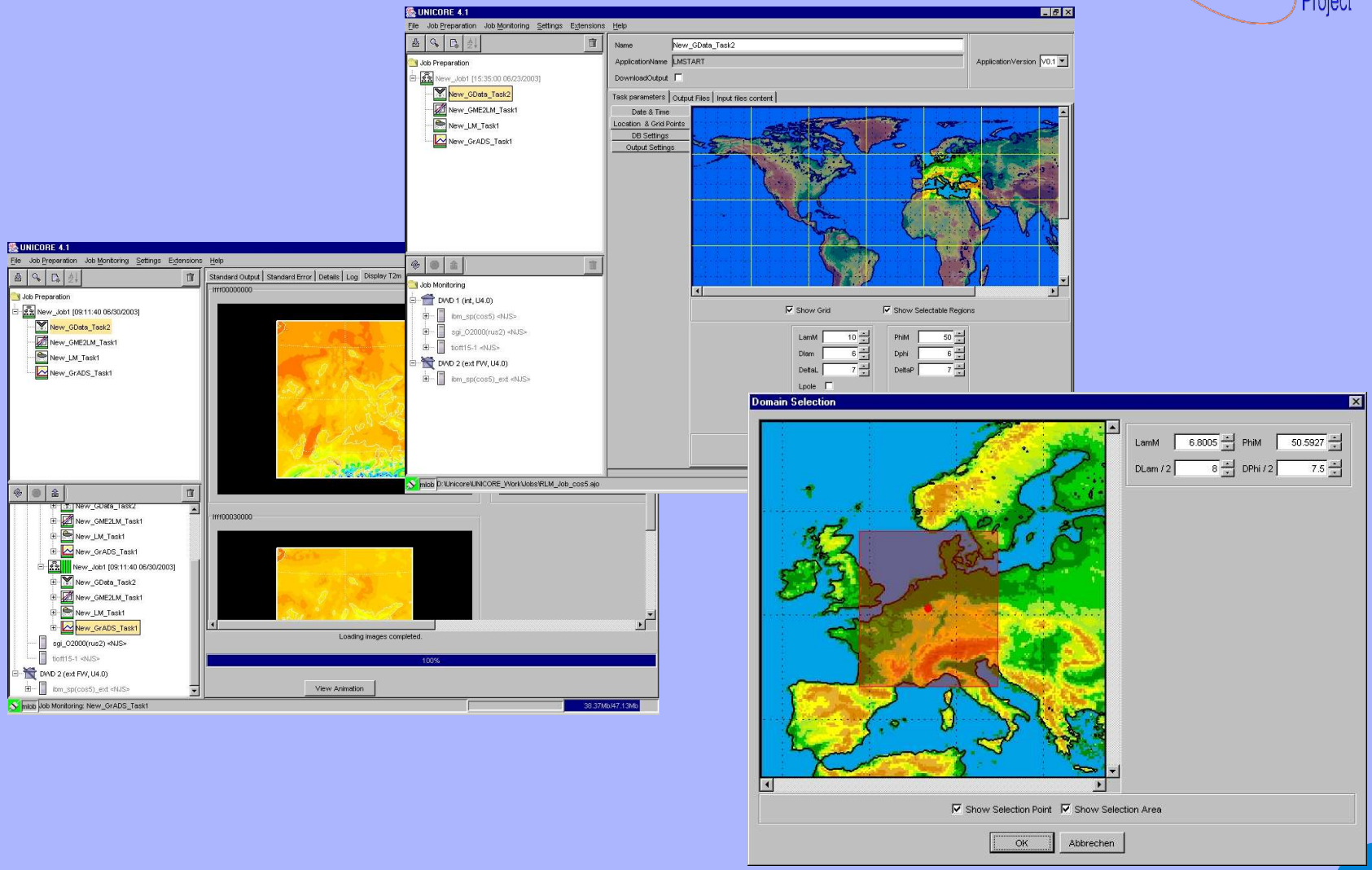
Resource Management

- UNICORE
  - Distributed database (IDB) for each target system
  - Resource info automatically provided to client
  - Software is also a resource in the database
- Globus
  - Monitoring & Discovery Service (MDS) using LDAP
  - Client API to query MDS
  - No software resources

Resource Management (cont)

- GRIP:
  - Initially manual & static mapping of Globus resource description to UNICORE database
- Work in progress:
  - Cross-Grid resource broker
  - Ontology to translate resource descriptions automatically
  - Extensible broker architecture

Applications



Applications

- UNICORE:
  - Plugins and Software Resources to support user written and commercial applications
- Globus:
  - Globus library calls in application
  - Usage of CoG Kits to build portals

Applications (cont)

- GRIP:
  - Wrappers for applications to allow them to execute transparently either on Globus or on UNICORE
  - Hopefully only a temporary solution till applications become Grid Services

GRIP Issues & Challenges

- Administration
- Management
- Interoperability Challenges

Administration

- No major additional administration for UNICORE & Globus sites
- Maintain UNICORE user database to authorize access to Globus Virtual site
- Globus site installs a Globus TSI on a dedicated system or the target system
- Enable GSI to use GRIP CA signed proxies

Management

- Management is distributed in UNICORE and GRIP
- Organizations retain their autonomy
- Coordination is a must
  - Acceptance of CAs
  - Expiration of certificates (esp. for servers)
  - Management of user mappings
  - Interoperability between software versions
  - Dependency on other software (e.g. Java version)
- Additional: Dependency on Globus versions and policies

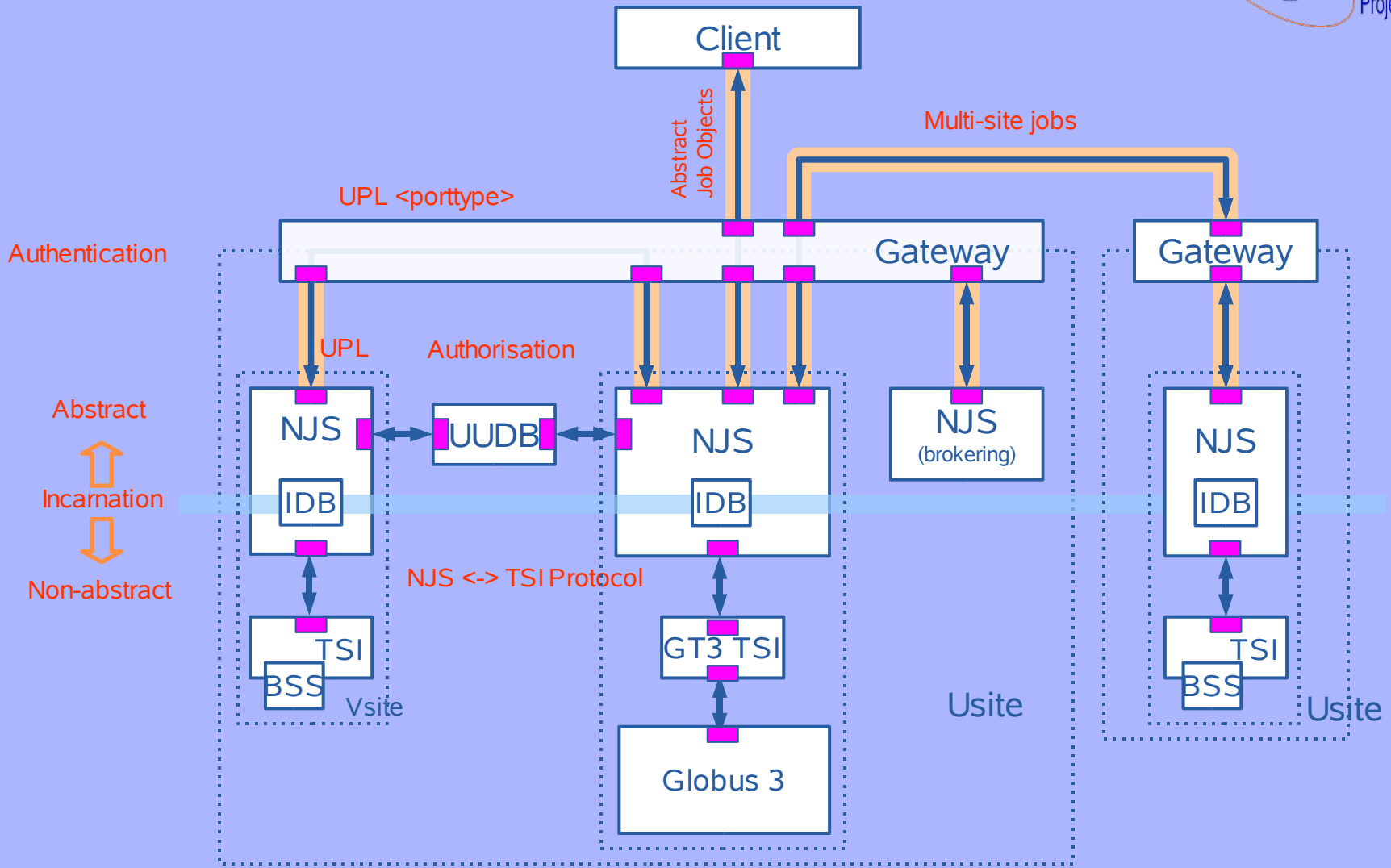
Interoperability Challenges

- Interoperability between UNICORE and Globus is technically solved
- Different security models needed additional work
  - UNICORE: end-to-end
  - Globus: proxy certificates
- Resource models are not fully compatible
  - Software resources missing in Globus
  - Different semantics
- Evolution towards Grid Services

GRIP and OGSI/A

- UNICORE is extended implementing internal/external OGSI interfaces
- Re-factorization of UNICORE/GRIP specific components to become Grid Services
- TSI Grid Service to interface with GT 3
- OGSI is not enough, standards needed for protocols, languages ...
- Web Service security mechanisms need integrating

GRIP and OGSI/A (cont)



Selected GGF Contributions

- "Open Grid Services Architecture (OGSI) v. 1.0", Grid Forum Document GFD.15
- "An Analysis of the UNICORE Security Model", Grid Forum Document GFD.18
- "Grid Scheduling Dictionary of Terms and Keywords", Grid Forum Document GFD.11

... and participation in many groups at http://forge.gridforum.org/

Recommended Reading

- Grid Interoperability Project:
  http://www.grid-interoperability.org
- UNICORE Forum:
  http://www.unicore.org
- UNICORE Plus Final Report:
  http://www.unicore.org/documents/UNICORE Plus-Final-Report.pdf
  (Good intro to UNICORE)
- The Globus Alliance:
  http://www.globus.org