UNICORE 6

Role, Objectives and Migration Plans to the European Middleware Initiative (EMI)

http://www.unicore.eu

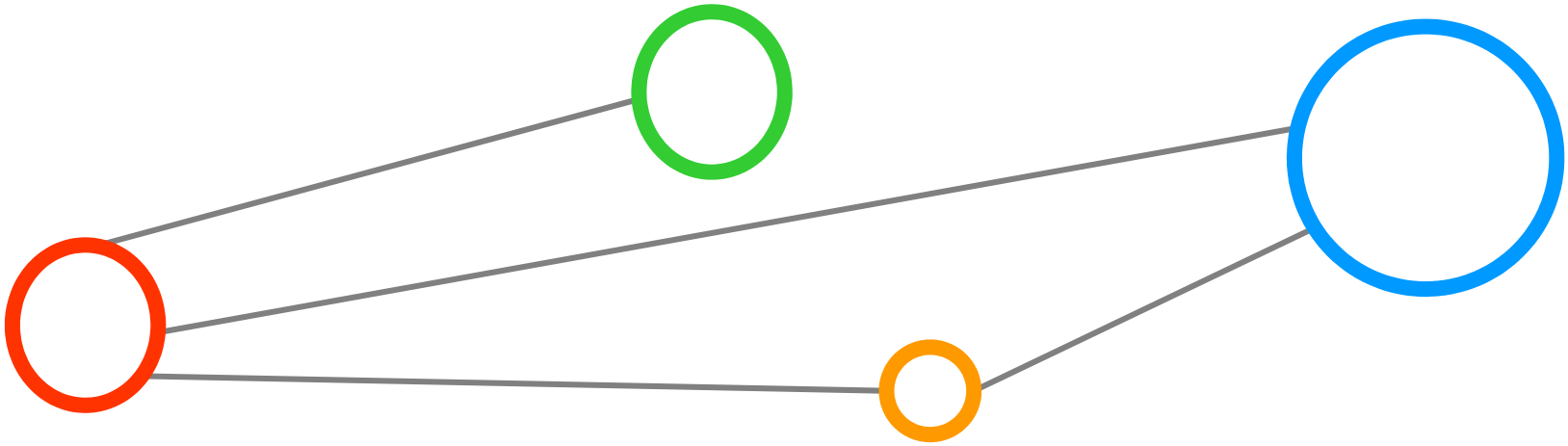
Morris Riedel
m.riedel@fz-juelich.de

Jülich Supercomputing Centre (JSC) & DEISA

JÜLICH FORSCHUNGSZENTRUM

Distributed European Infrastructure for Supercomputing Applications

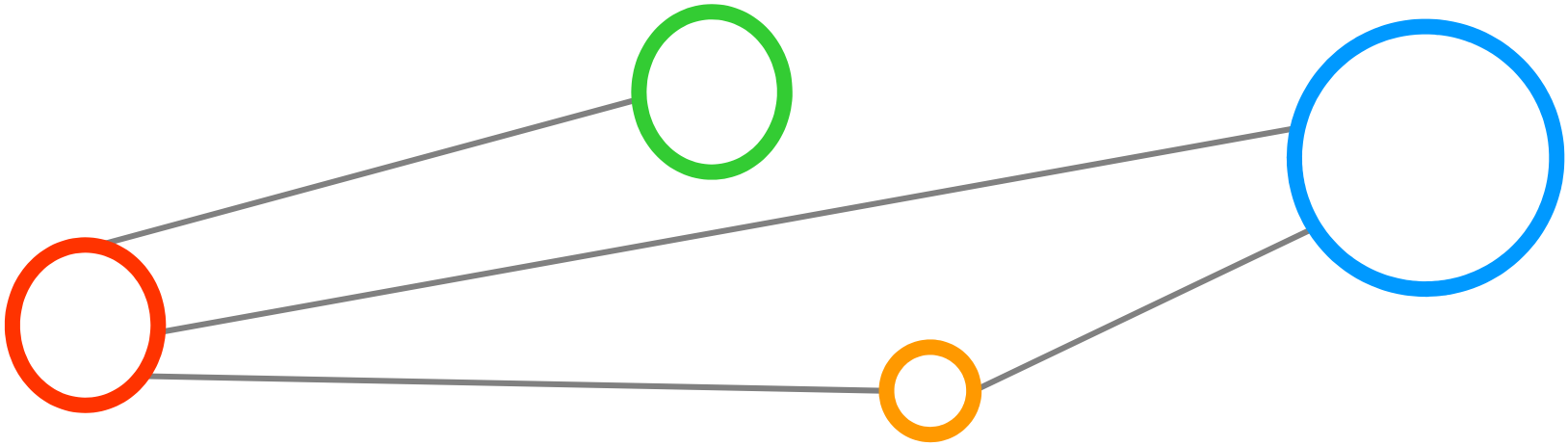
Outline



Outline

- UNICORE 101 & Usage Examples
- Role as HPC-driven Grid Middleware
  - Traditional role and emerging role in HTC
- Objectives and Migration Plans
  - Migration to Common Client API
  - Migration to Common EMI Security Infrastructure
  - Common Registry Service Objective
  - PGI-compliance for Compute and Data Objective
  - Common Attribute-based Authorization
  - ***Moving towards potential EMI Architecture***
  - Other Potential Objectives
- Summary

UNICORE 101



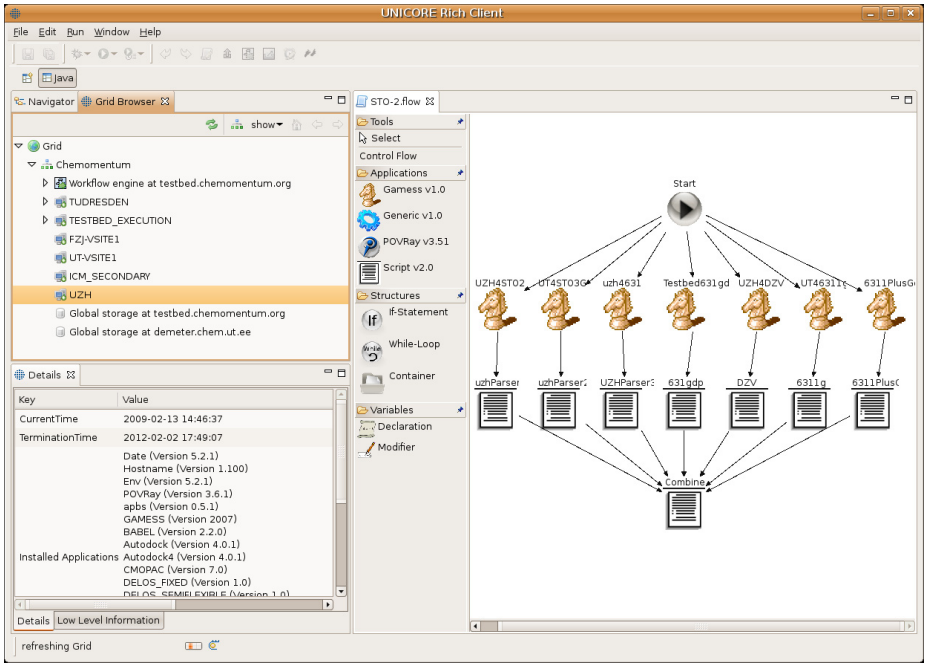
Guiding Principles, Implementation Strategies

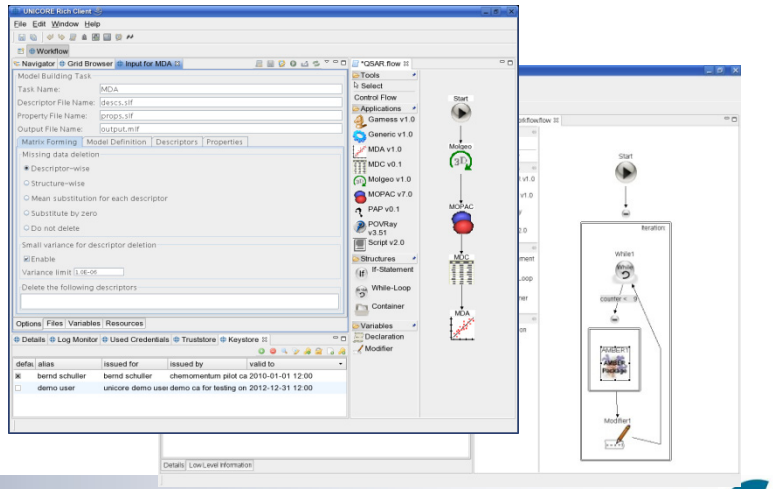
- **Open source** under BSD license with software hosted on SourceForge
- **Standards-based**: OGSA-conform, WS-RF 1.2 compliant
- Open, extensible **Service-Oriented Architecture** (SOA)
- **Interoperable** with other Grid technologies
- Seamless, secure and intuitive following a vertical end-to-end approach
- Mature **Security**: X.509, proxy and VO support
- **Workflow** support tightly integrated while being extensible for different workflow languages and engines for domain-specific usage
- **Application integration** mechanisms on the client, services and resource level
- Variety of **clients**: graphical, command-line, API, portal, etc.
- Quick and **simple installation** and configuration
- Support for many operating systems (Windows, MacOS, Linux, UNIX) and batch systems (LoadLeveler, Torque, SLURM, LSF, OpenCCS)
- Implemented in **Java** to achieve platform-independence

Clients & APIs

```
>ucc -h
UCC version 1.2-SNAPSHOT
Usage: ucc <command> [OPTIONS] <args>
The following commands are available:
Data management:
 ls                    - list a storage
 copy-file-status      - check status of a copy-file
 get-file              - get remote files
 find                  - find files on storages
 resolve               - resolve remote location
 copy-file             - copy remote files
 c9m-get-file          - get remote files
 put-file              - puts a local file to a remote server
General:
 connect               - connect to UNICORE
 list-applications     - lists applications on target systems
 list-jobs             - list your jobs
 list-sites            - list remote sites
 c9m-system-info       - Checks the availability of services.
Job execution:
 run                   - run a job through UNICORE 6
 get-status            - get job status
 abort-job             - abort a job
 batch                 - run ucc on a set of files
 get-output            - get output files
Other:
 shell                 - Starts an interactive UCC session
 loadtest              - load tests services
 issue-delegation      - Allows to issue a trust delegation assertion
 wsrf                  - perform a WSRF operation
 run-groovy            - run a Groovy script
Workflow:
 c9m-submit            - submit a workflow to Chemomentum
 c9m-trace             - trace info on a workflow in Chemomentum
 c9m-control           - control a workflow in Chemomentum
 c9m-workflow-info     - lists info on workflows in Chemomentum
Enter 'ucc <command> -h' for help on a particular command.
>
```

UCC





HiLA

Usage in Supercomputing

Distributed European Infrastructure for Supercomputing Applications

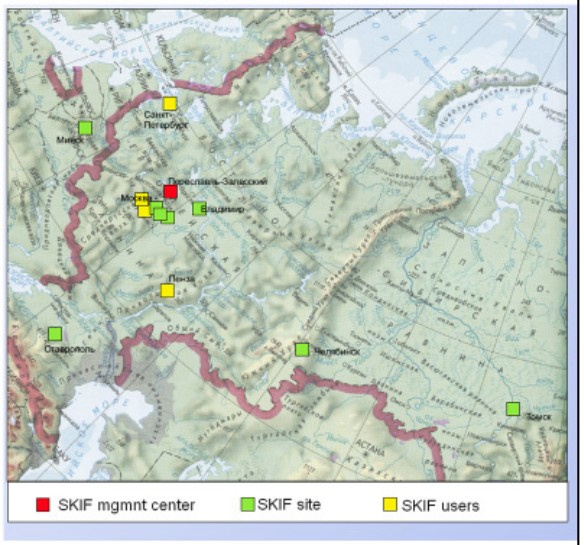
Distributed European Infrastructure for Supercomputing Applications

- Consortium of leading national HPC
- Deploy and operate a persistent, pr
  heterogeneous HPC environment
- UNICORE as Grid Middleware
  - On top of DEISA's core services:
    - Dedicated network
    - Shared file system
    - Common production environment at all sites
  - Used e.g. for workflow applications

IDRIS – CNR
Germany), C
CSC (Helsink
BSC (Barcel

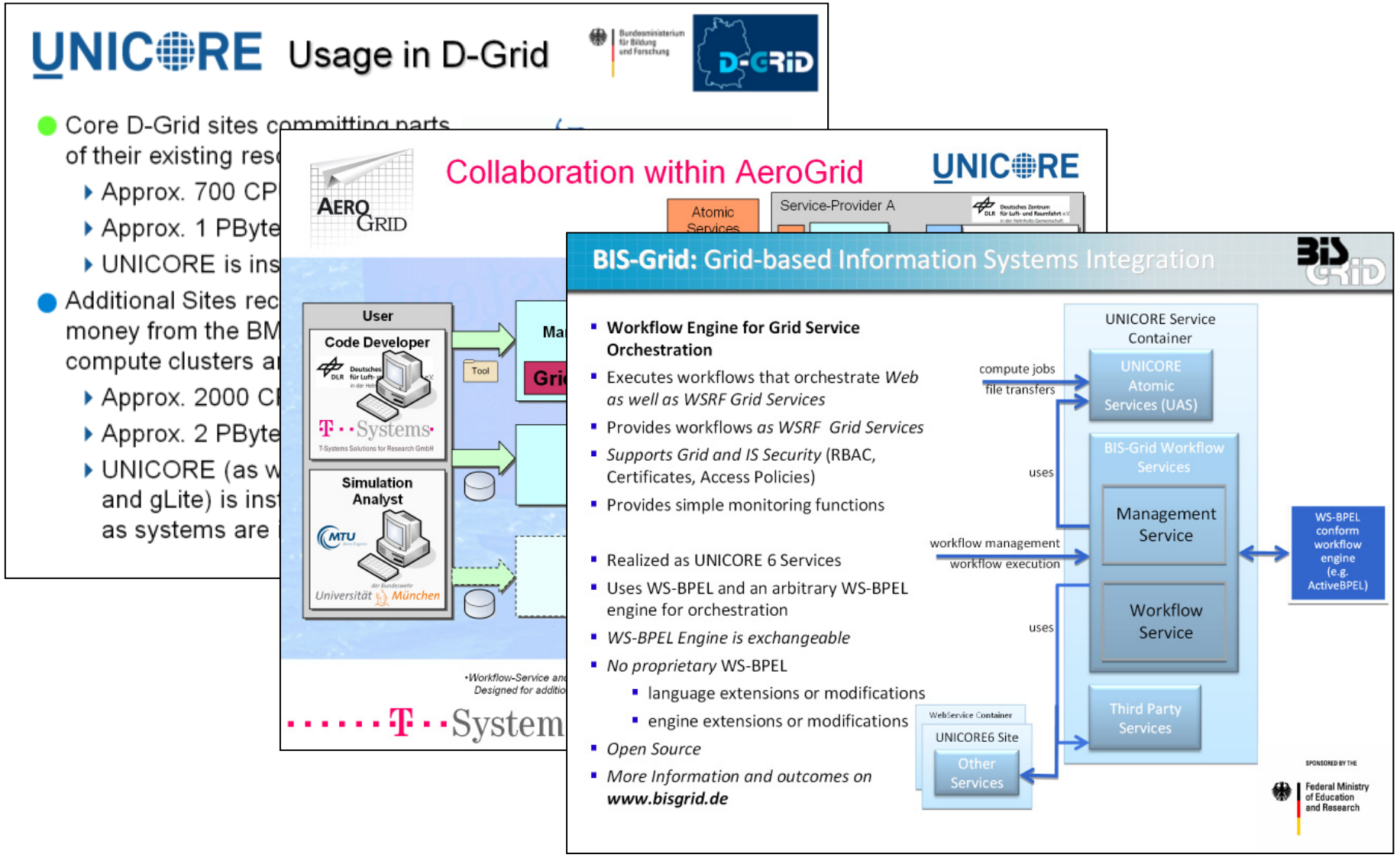
SKIF-GRID federation

- **Joint Russian-Belarus project**
- **Federation of 8 HPC centers**
  - UNICORE middleware
  - 3 computers in the current Jun'08 Top 500
  - ~100 TFlops peak
  - Research program in HPC services



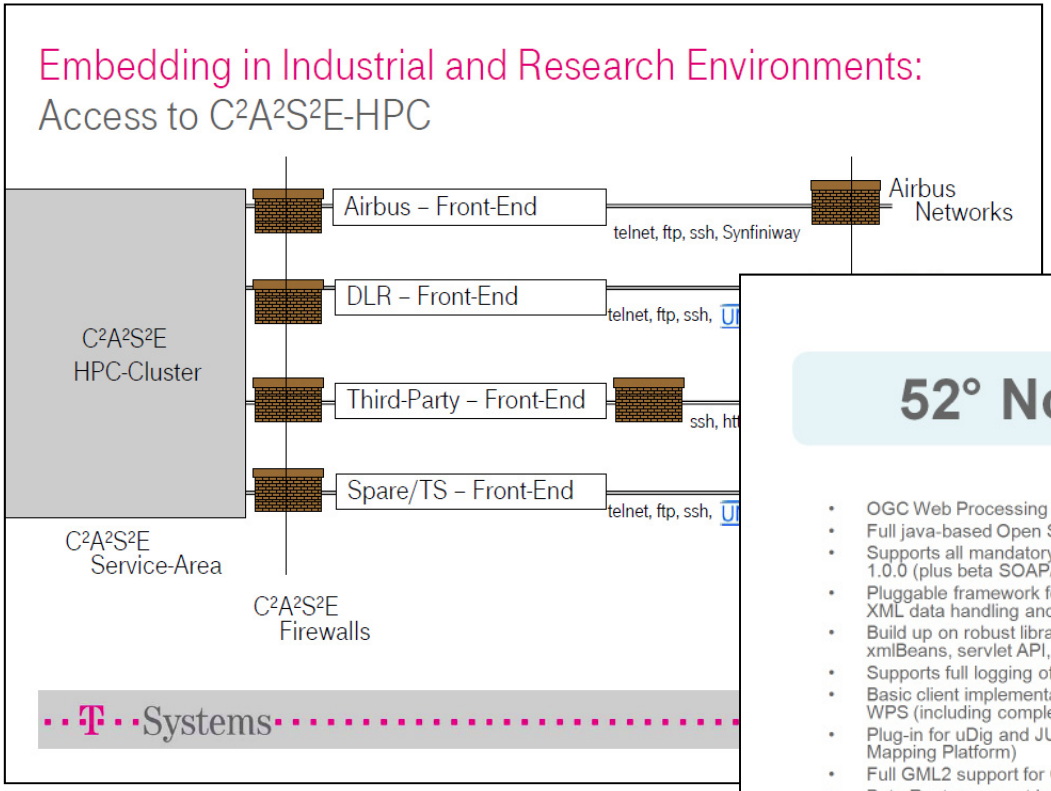
Slide courtesy of Alexander Moskovsky (Moscow State University)

Usage in National Grids



Slide courtesy of André Höing (TU Berlin)

Usage in Commercial Areas



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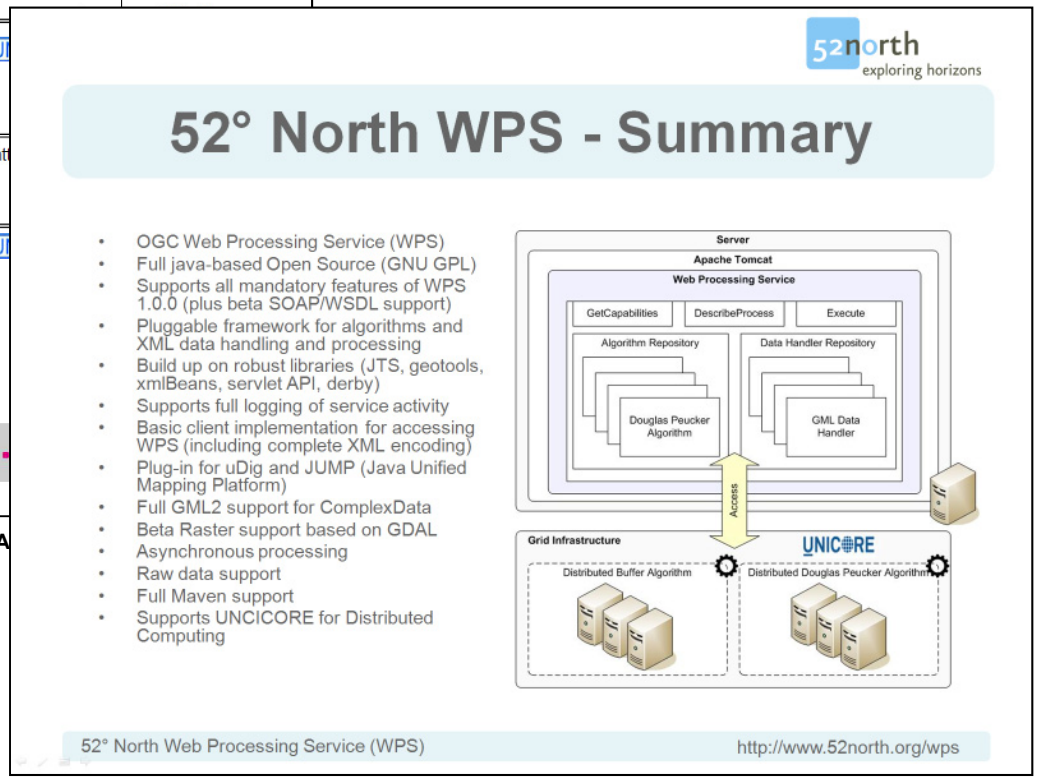

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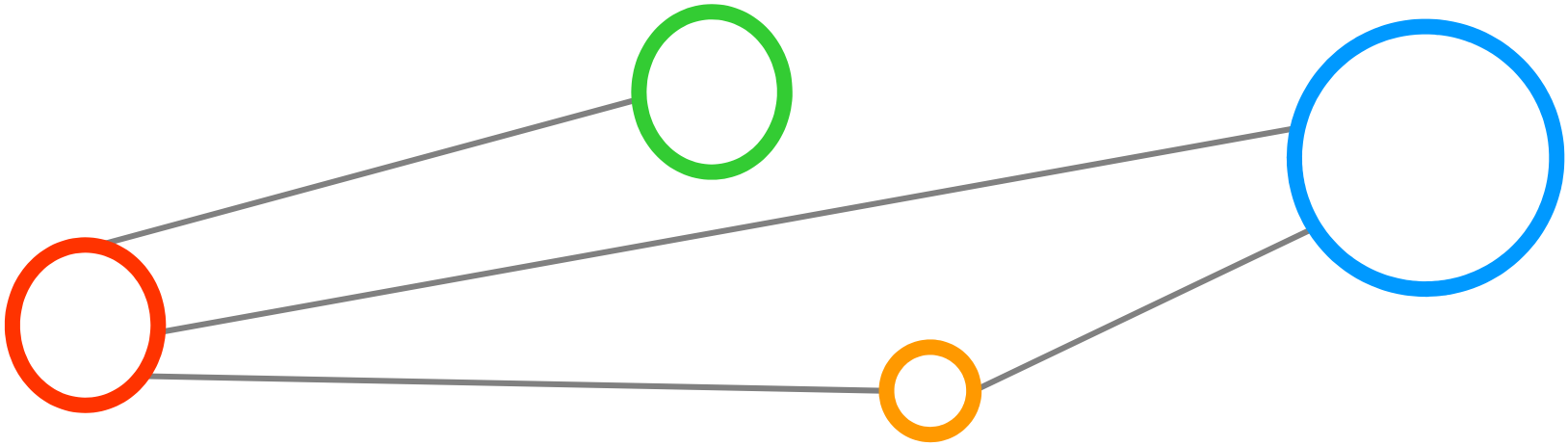
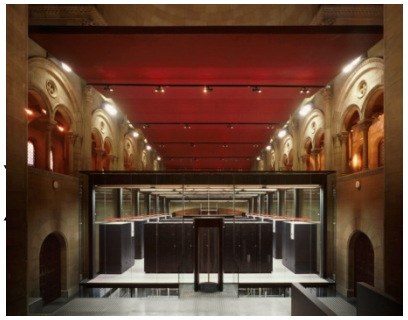
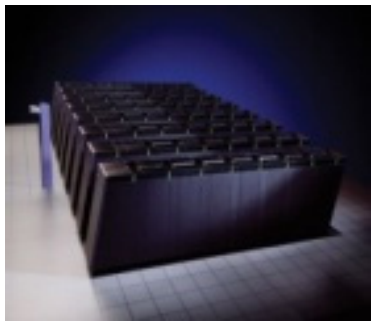
Role as HPC-Driven Grid Middleware



Grid driving High Performance Computing (HPC)

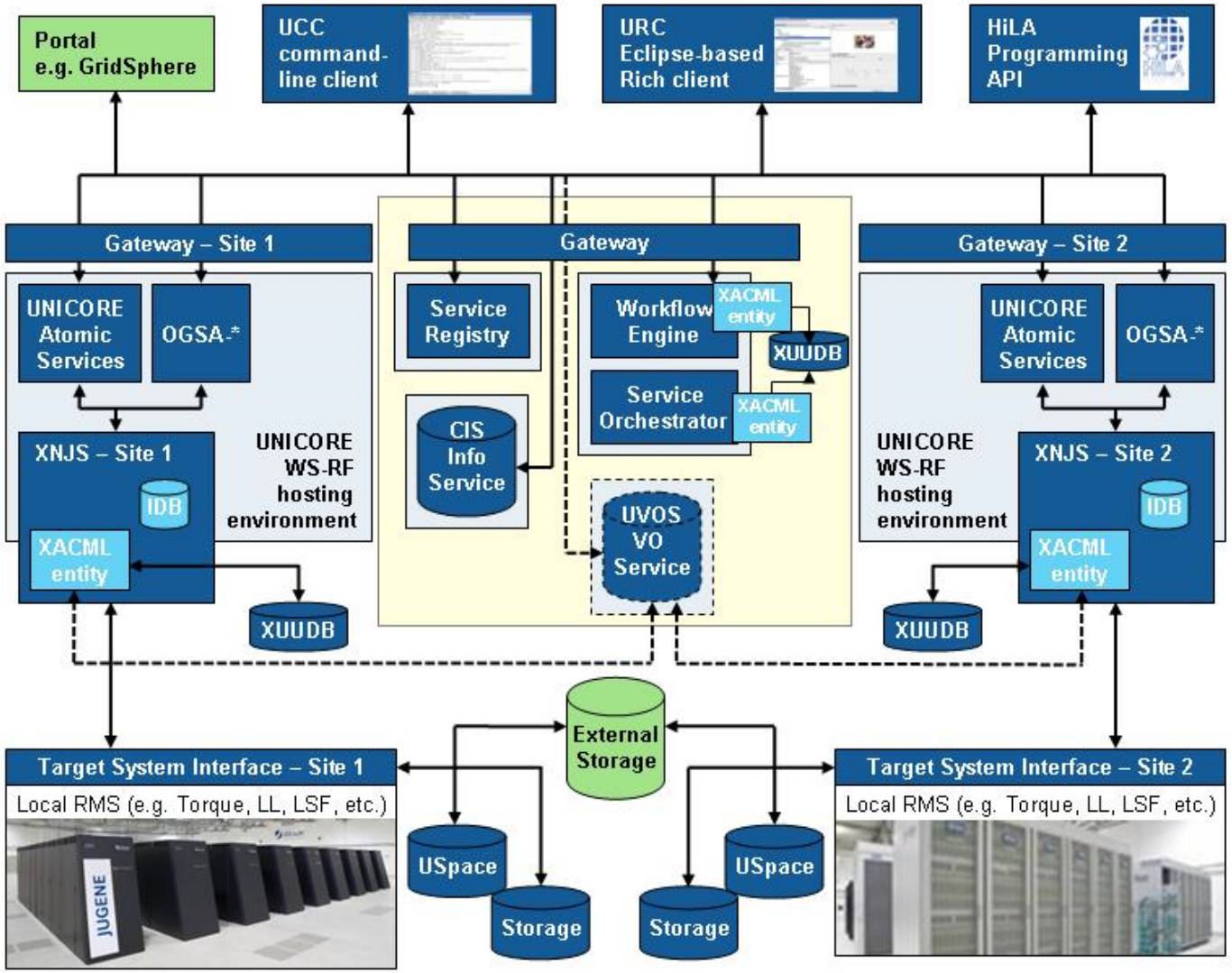
- Used in
  - DEISA (European Distributed Supercomputing Infrastructure)
  - National German Supercomputing Center NIC
  - Gauss Center for Supercomputing
    (Alliance of the three German HPC centers & official National Grid Initiative for Germany in the context of EGI)
  - PRACE (European PetaFlop HPC Infrastructure) – starting-up
- Traditionally taking up major requirements from i.e.
  - HPC users (i.e. MPI, OpenMP)
  - HPC user support teams
  - HPC operations teams
  - …and via SourceForge Platform





sourceforge FIND AND DEVELOP OPEN SOURCE SOFTWARE

UNICORE Architecture Overview

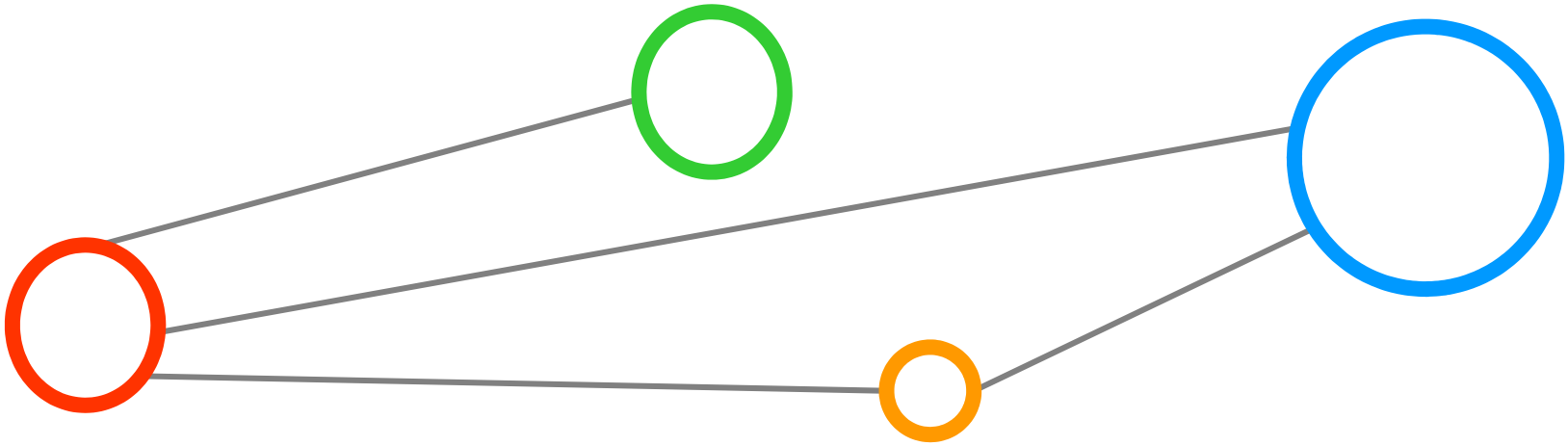


EMI and High Throughput Computing (HTC)

- UNICORE can be used in non HPC-focussed environments
  - German National Grid D-Grid and some of there communities
  - High Throughput Computing (HTC) possible with UNICORE
  - EMI will be possibly deployed on many HTC-driven Grids
- Role towards the European Middleware Initiative (EMI)
  - Stronger support for distributed data and storage technologies
  - Aligning with the key features of other EMI middleware such as ARC & gLite (e.g. pool accounts)
  - Integrate requirements arising from HTC-driven environments



Objectives and Migration Plans



Often Used Functional Emerging Standards

GIN Interoperation demonstrations from numerous world-wide projects

SC07 is the International Conference for High Performance Computing, Networking, Storage and Analysis

OpenGridForum
OPEN FORUM | OPEN STANDARDS

SC08 is the International Conference for High Performance Computing, Networking, Storage and Analysis

Work with emerging open standards on real production Grid applications

WISDOM

EUFORIA

Virtual Physiological Human network of excellence

International Grid Interoperability & Interoperation Workshops 2007, 2008 & Grid Computing Journal Special Issue Interoperability 2009

GridFTP
OGF Specification GFD

Storage Ressource Manager (SRM)
OGF Specification GFD

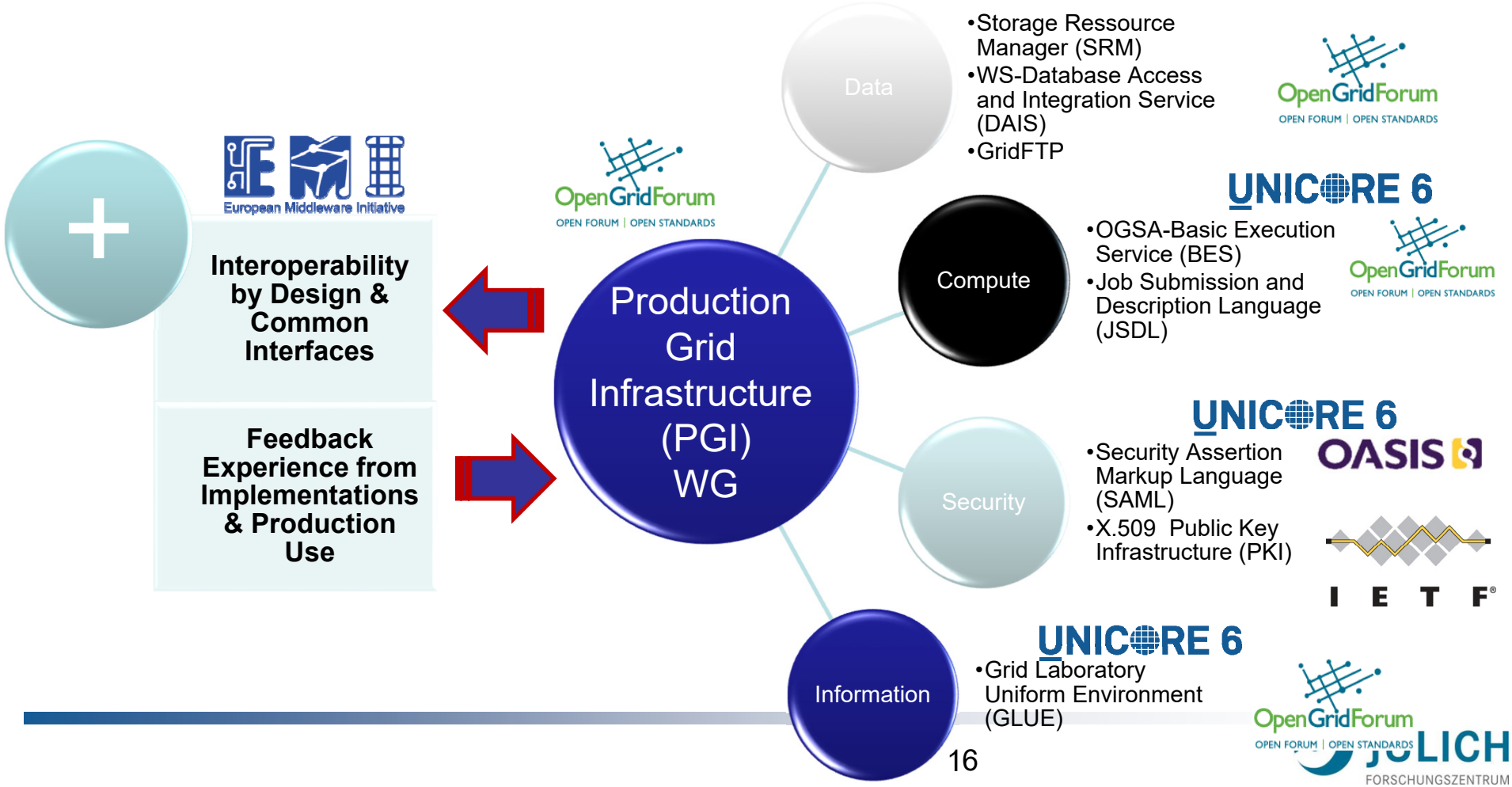
OGSA – Basic Execution Service (BES)
OGF Specification GFD

Job Submission & Description Language (JSDL)
OGF Specification GFD

WS-Data Access&Integration Service (DAIS)
OGF Specification GFD

General Paradigm: Adopting Open Standards

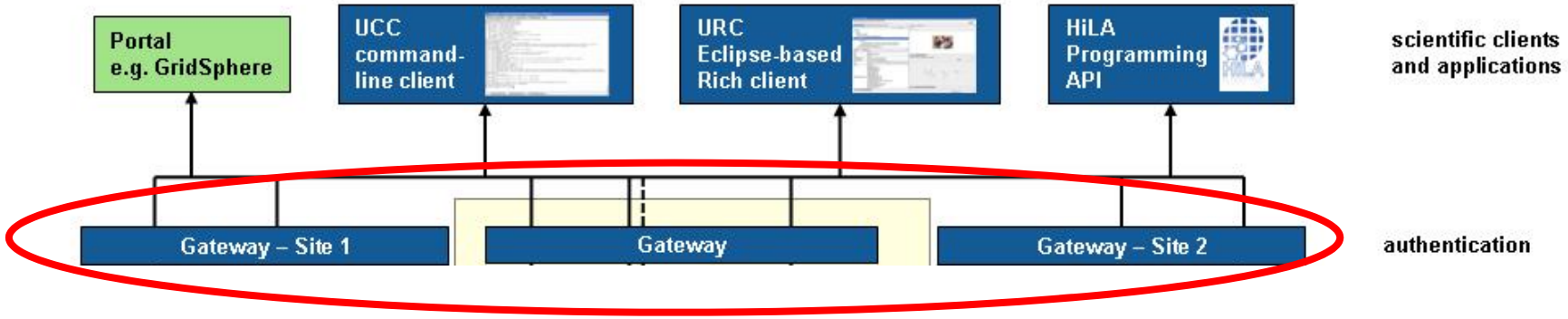
- Adopt and drive efforts of the OGF PGI-WG



Migration to Common Client API

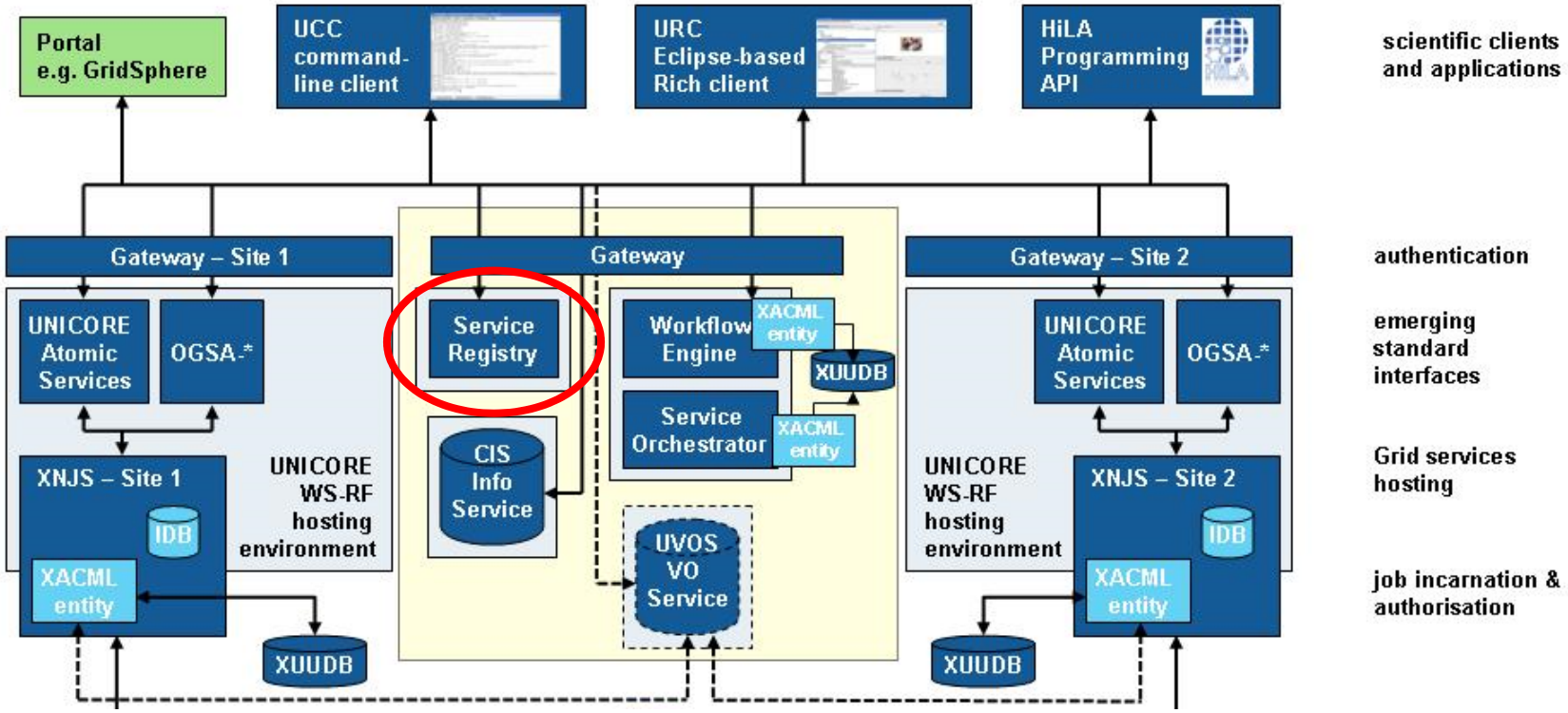
- Offer Higher Level Application Programming API (HILA) as potential common client API in EMI
  - Easy programming API with non UNICORE-based Grid abstractions (e.g. Grid, Site, etc.)
  - Potential integration of emerging standards of the OGF Production Grid Infrastructure (PGI) working group
  - Access to all PGI-compliant Grid middlewares and thus to ARC (e.g. A-Rex) and gLite (e.g. computing element) once PGI is adopted
- Potential access of PGI-compliant middleware (UNICORE, ARC, gLite, …) from other available clients as well

Migration to Common EMI Security Infrastructure



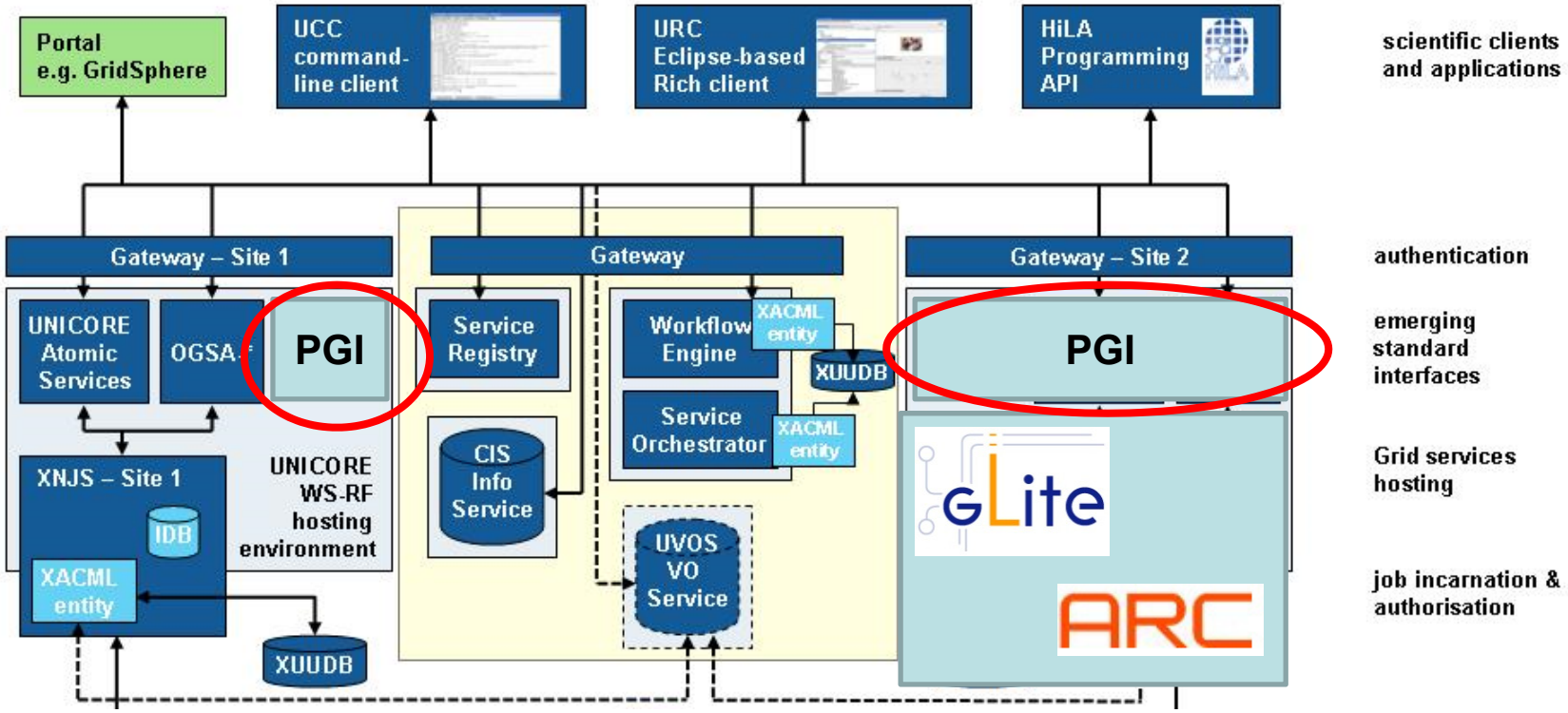
- Take up of common EMI security infrastructure
  - Aligned with efforts of the OGF PGI working group
  - Move away from Grid Security Infrastructure (GSI)
  - Enables a broader access from non-Grid environments (i.e. Web) & broader support for tooling to satisfy industry needs
- Offer Gateway as a common EMI authentication component
  - Potentially merging functionality with gLite trust manager, etc.
  - Exploring potentials for Shibboleth-based EMI federations

Common Registry Service Objective



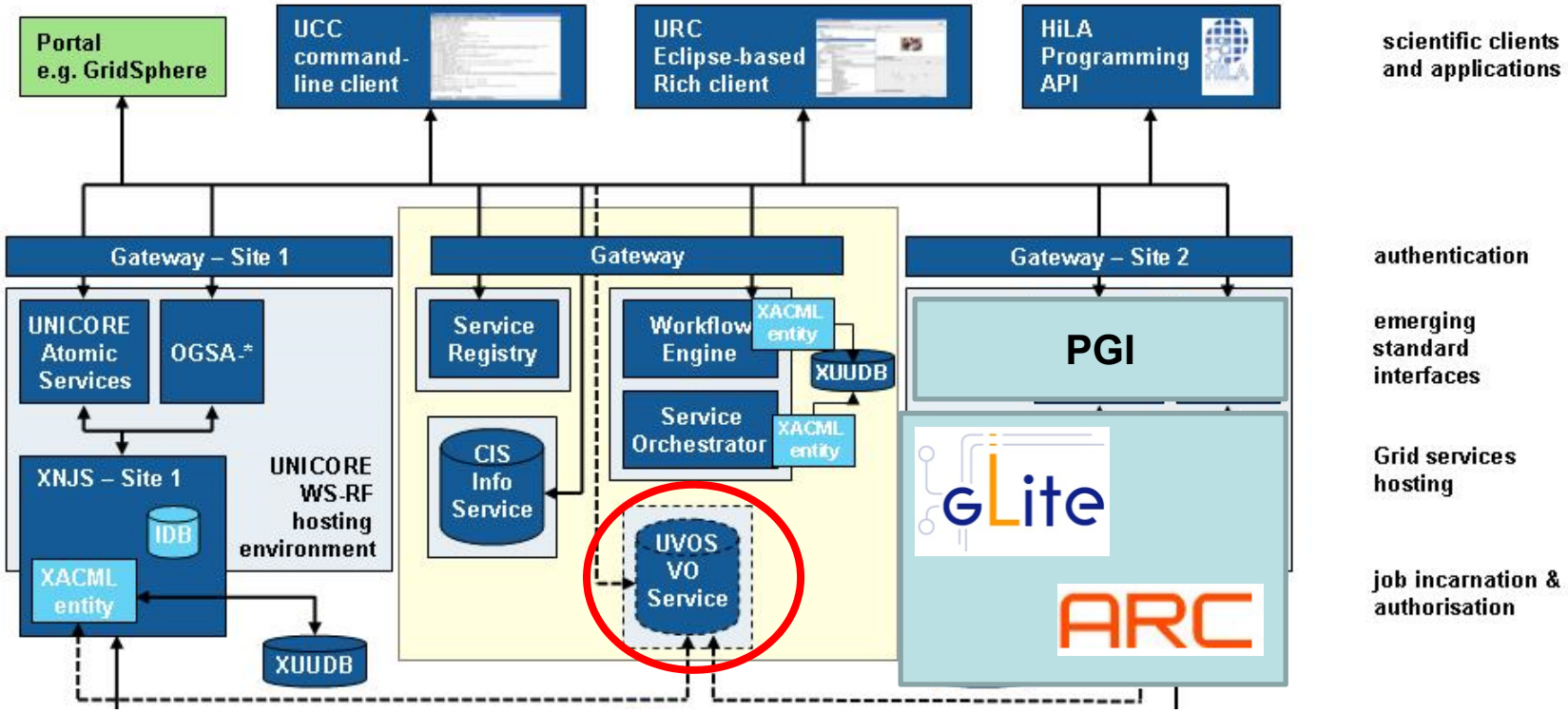
- Goal: common registry service for UNICORE, ARC & gLite
  - Outphasing of the WS-RF-based UNICORE Service Registry

PGI-compliance for Compute & Data Objective



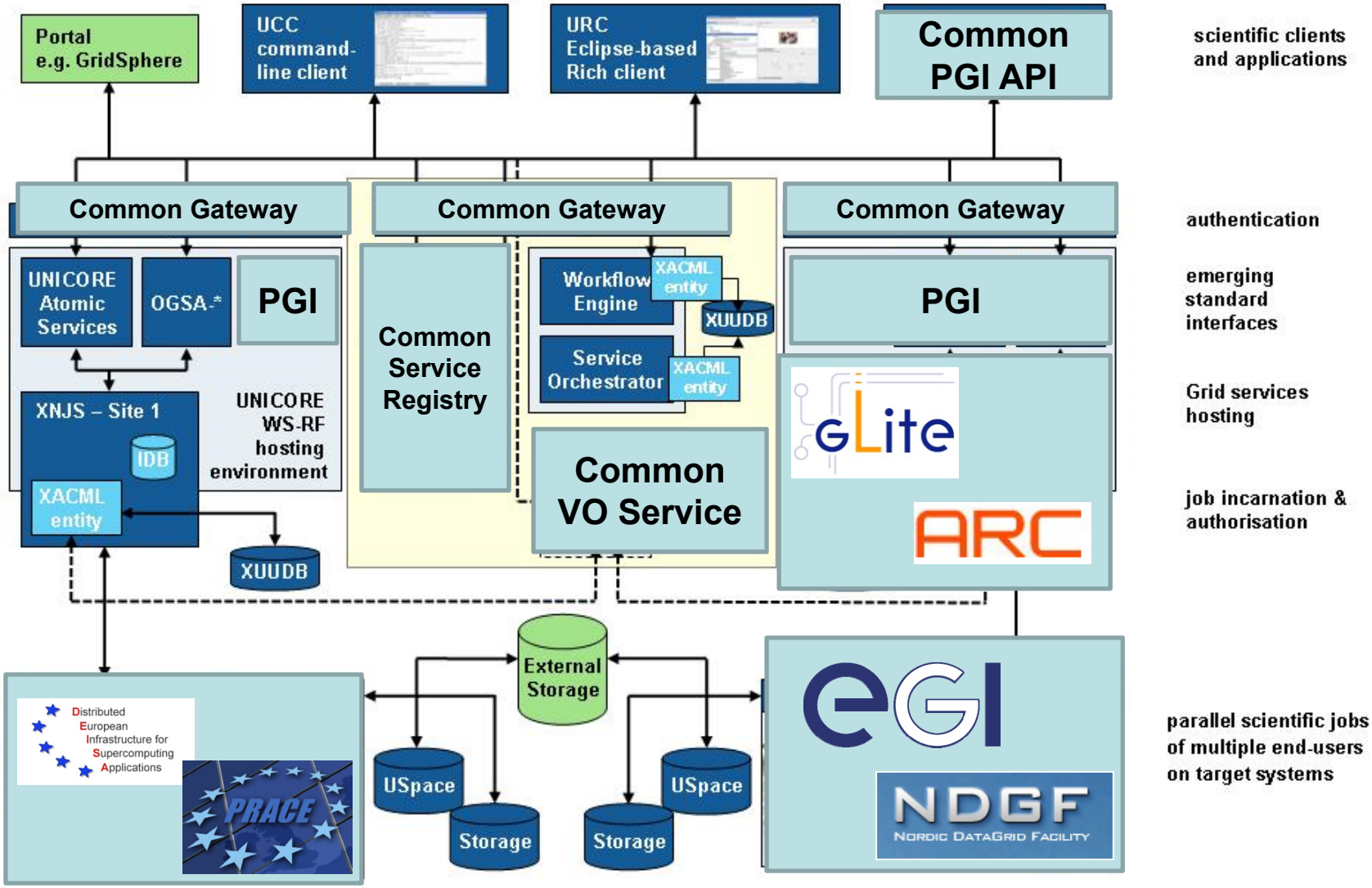
- Take up of emerging PGI standards driven by EMI for compute and data interfaces to access also gLite & ARC
  - Parallel Interfaces to proprietary UNICORE Atomic Services

Common Attribute-based Authorization



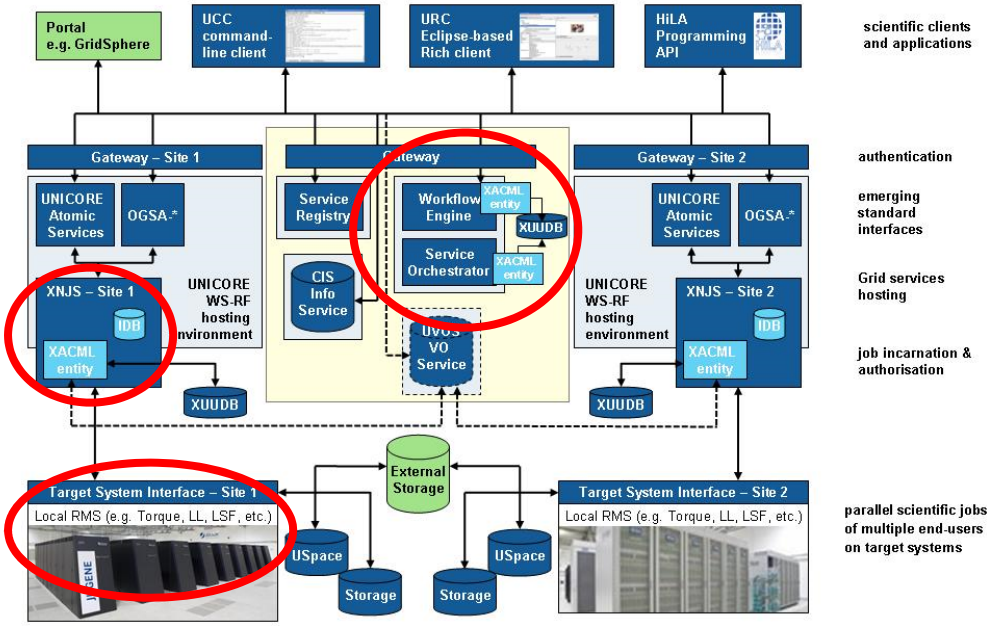
- Take up of a common EMI attribute-based authorization service support and open interfaces for Virtual Organizations
  - Push of Security Assertion Markup Language (SAML) usage

Moving towards potential EMI Architecture



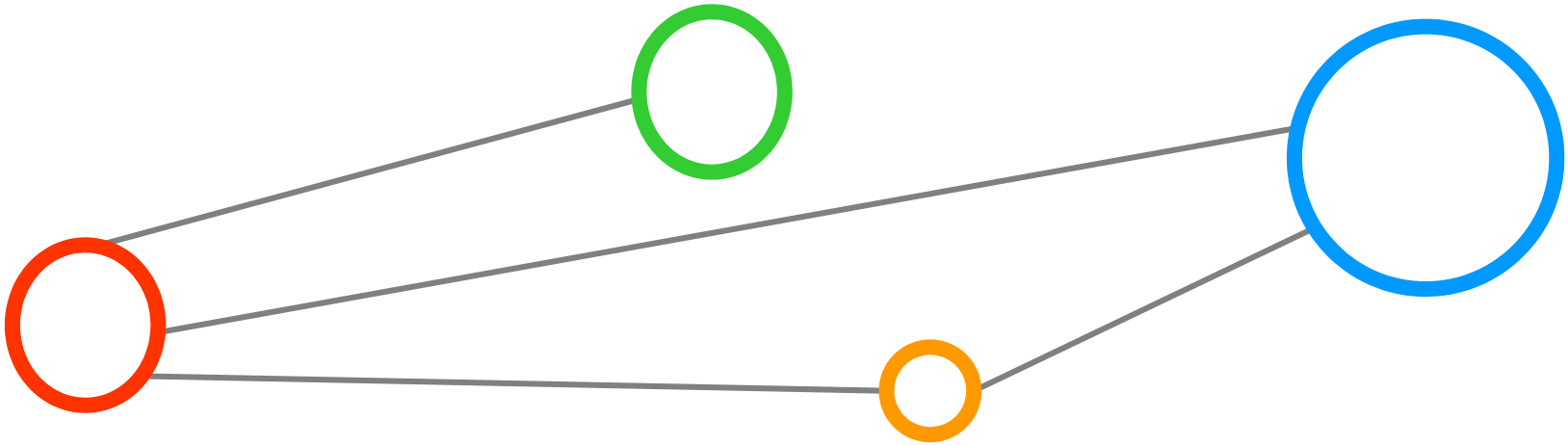
Other Potential Objectives

- Workflow (maybe out of EMI scope, but important)
  - Workflow functionality make job chains possible across multiple sites
  - Workflow Engine & Service Orchestrator good base for EMI



- Strong execution backend XNJS and TSI
  - Provide support for many operating and batch systems with continued development since ~10 years
  - Strong MPI support may (will) become highly relevant for EMI in the “economy of scales” → we reached peta-scale already…

Summary



Summary of Components of Interest for EMI

- All components are subject to be harmonized
- Security
  - UNICORE Gateway (i.e. authentication)
  - UNICORE VO Service (UVOS) (i.e. Attribute Authority)
  - XACML Entity (i.e. attribute-based authorization decisions)
- Compute
  - XNJS, UNICORE Atomic Services & OGSA-BES (i.e. execution)
  - Workflow Engine to be compliant with EMI execution interface
- Information
  - Service Registry (i.e. information about available Grid services)
- Data
  - UNICORE Atomic Services (i.e. data)

General Summary

- UNICORE is a ready-to-run European Grid Technology including client and server software highly relevant for EMI
- Provides a seamless, secure, and intuitive access to different distributed computing and data resources
- All components are available as open source under BSD License on SourceForge & support for science and industry
- Traditional role as HPC-driven middleware and more recently also usable in Grid environments (i.e. High Throughput Computing)
- Commitment to open standards to support a common set of interfaces and protocols of emerging components of the EMI

software, source code, documentation, tutorials, mailing lists, community links, and more:

http://www.unicore.eu