



TUTORIAL

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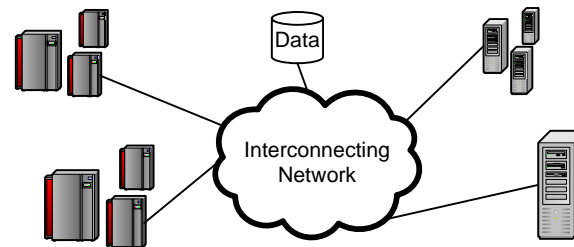
UNICORE SUMMIT 2006

Outline

- ▶ Motivation & History
- ▶ Production UNICORE 5
 - ▶ Features
 - ▶ Architecture
 - ▶ Example deployments within DEISA and T-Systems
- ▶ UNICORE 6
 - ▶ Improved Features
 - ▶ Architecture & Higher Level Services
 - ▶ Future Developments
- ▶ UNICORE as Open Source
- ▶ UNICORE Forum
- ▶ Summary

Motivation: Scientists & Parallel Computing

- ▶ Scientists need computational and storage related resources



Motivation: Scientists & Parallel Computing

- ▶ Supercomputers are managed by Resource Management Systems (RMSs) that handle the scheduling
- ▶ But: There are many RMSs available
- ▶ All proprietary way of job submit
 - ▶ IBM Loadleveler → `lsubmit...`
 - ▶ Torque Resource Manager → `qsub...`
 - ▶ Different job description languages...
(# of nodes, memory requirements,...)

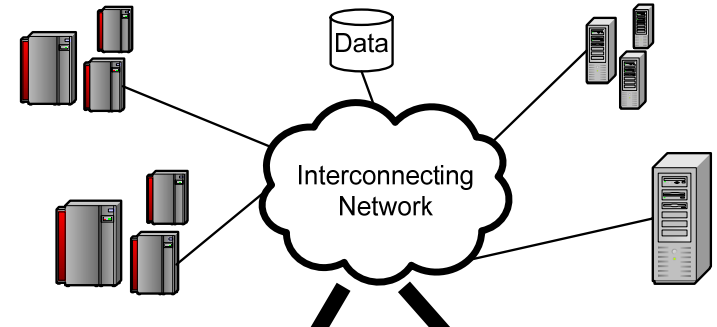


Resource Management System



Motivation: Scientists & Parallel Computing

- ▶ Solution: Grid System UNICORE
- ▶ Define job workflows in abstract manner
- ▶ Immediate portability of job definitions for other systems with other architectures
- ▶ No 'learn overhead' if a new RMS is used
- ▶ Applications across multiple supercomputers/clusters → 'going meta'



Initial UNICORE developments

▶ UNICORE 08/1997-12/1999



▶ UNICORE Plus 01/2000-12/2002



▶ EUROGRID 11/2000-01/2004



▶ GRIP 01/2002-02/2004



▶ OpenMolGRID 09/2002-02/2005



From Testbed to Production

2002

- ▶ Different communities
- ▶ Different computing resources (super computers, clusters, ...)
- ▶ Know-how in Grid middleware

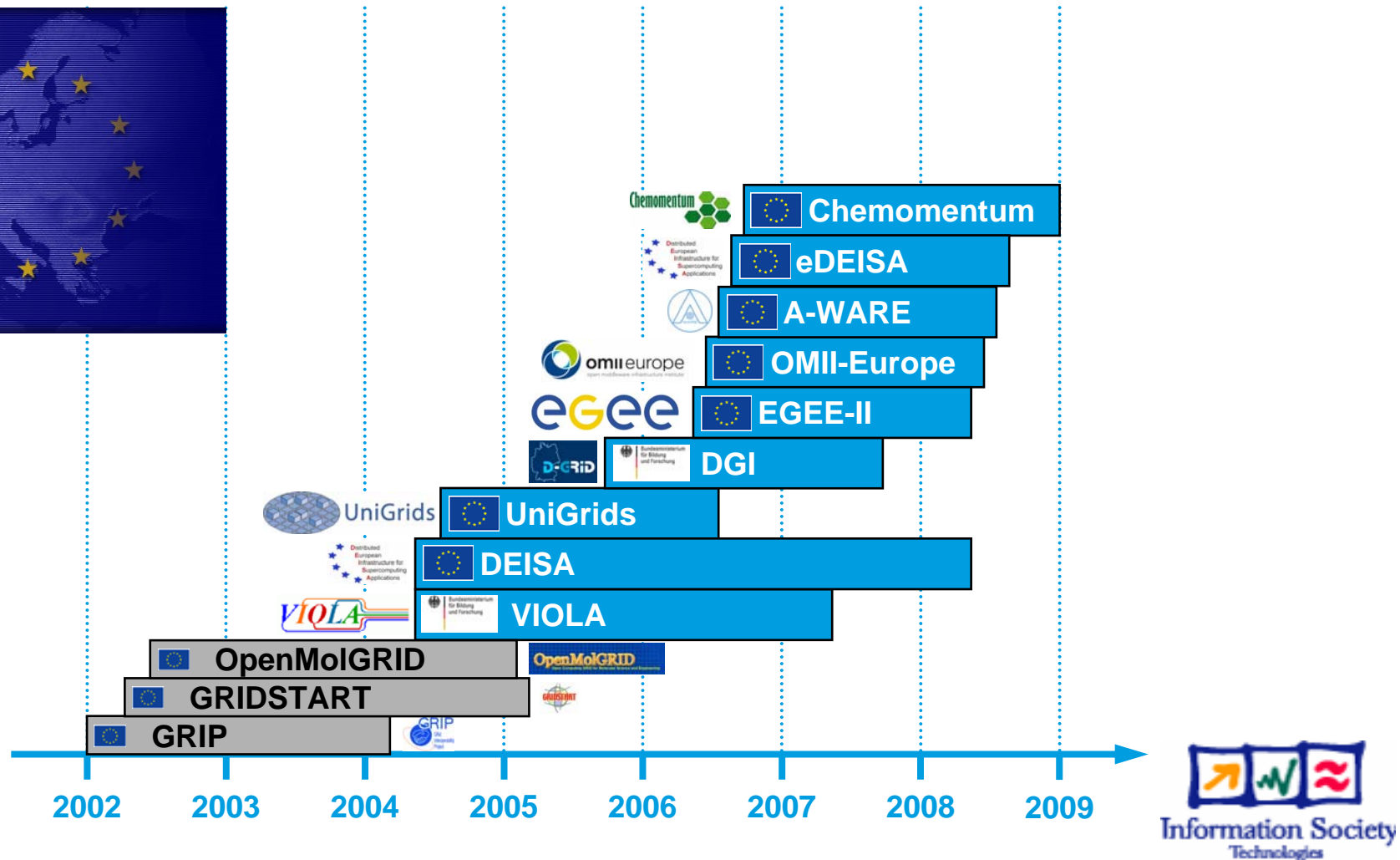


Success factor: VERTICAL INTEGRATION

2006

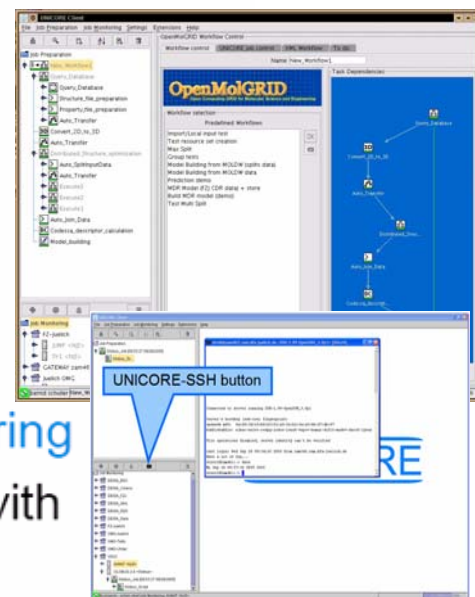


UNICORE in (mostly) European Projects



Production UNICORE Features

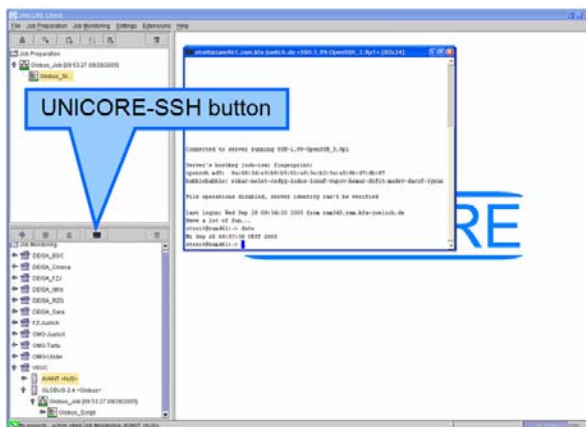
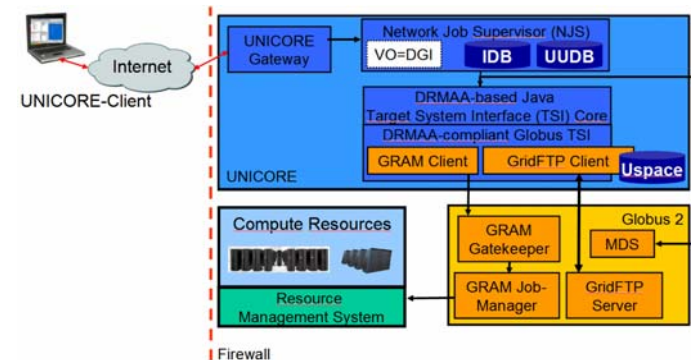
- ▶ A **vertically** integrated Grid middleware system
- ▶ Provides **seamless**, **secure**, and **intuitive** access to distributed resources and data
- ▶ Used in production and projects worldwide
- ▶ Features
 - ▶ **intuitive GUI** with single sign-on
 - ▶ **X.509** certificates for AA and job/data signing
 - ▶ only **one opened port** in firewall required
 - ▶ **workflow** engine for complex multi-site/multi-step workflows
 - ▶ **extensible** application support with plug-ins
 - ▶ matured **job monitoring**
 - ▶ interactive access with **UNICORE-SSH**
 - ▶ integrated secure **data transfer**
 - ▶ resource management
 - ▶ **full control** of resources remains
 - ▶ **production quality**, ...



```
Configuration install quit
Host zow285.zaw.kfa-juelich.de
Host Name zow285.zaw.kfa-juelich.de
NJS NJS-Gateway-Port 3926
Admin Port 3956
TSI
IDB Trusted Cfg /cert/projects-ca-fz-juelic
UDB Identity /unicore/njs_identity.p12
Password *****
Installation Dir /unicore
java /usr/bin/java
perl /usr/bin/perl
Logging Level Configuration
Keep Update false
Operation Mode full
Gateway SSL false
NJS SSL true
Memory reclaimer
Save completed ADJ false
Change Log Files 24
TSI Worker Limit 5
TSI Update Interval 5000
Thread Incarnation 3
```

Recent Developments

- ▶ OGSA-based and **WSRF-compliant UNICORE 6** alpha
- ▶ Interactive access → UNICORE-SSH
- ▶ High-level API for programming Grids
- ▶ DRMAA-based access to RMSs
- ▶ Comfortable configuration tool



```

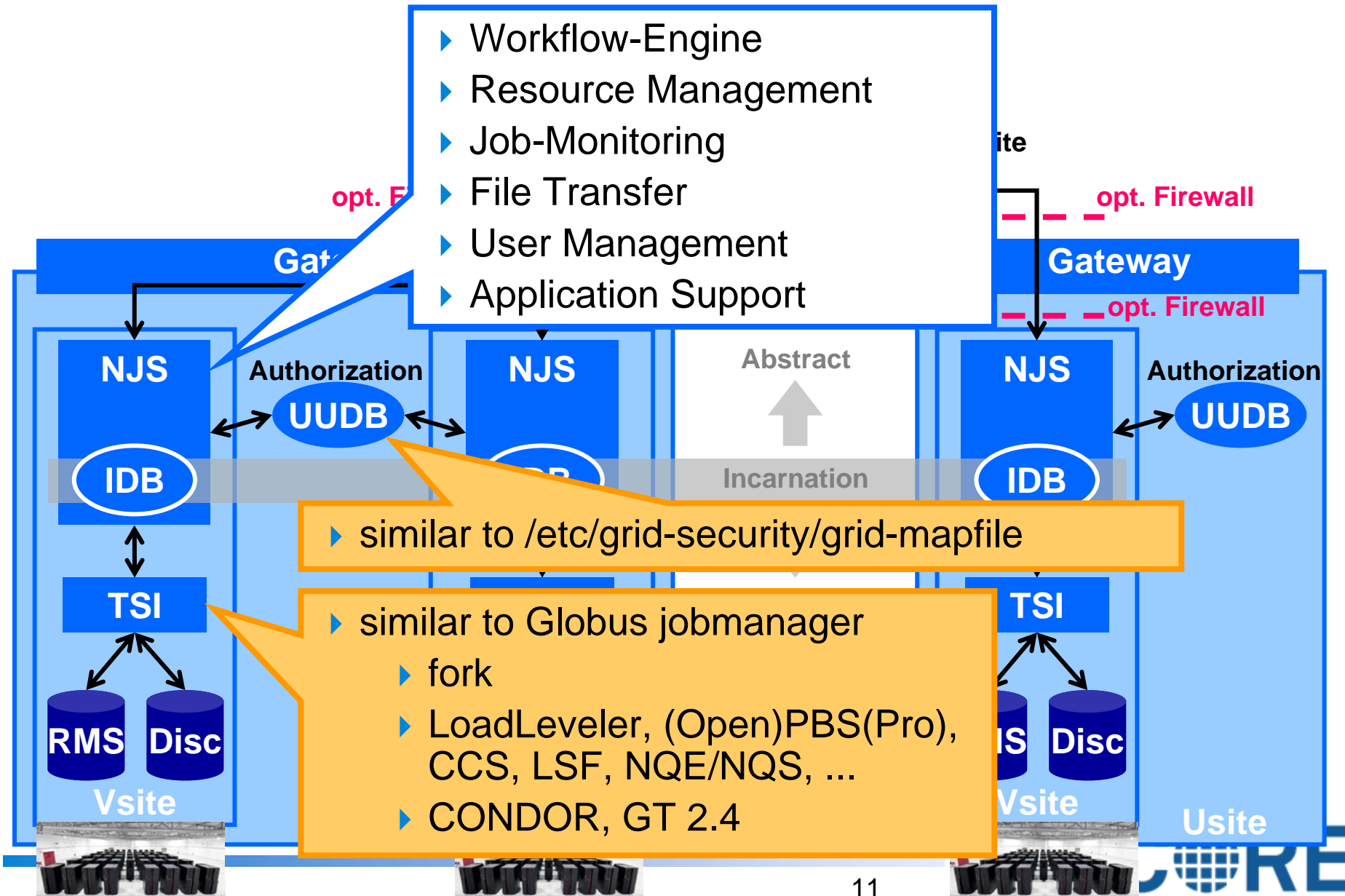
Configuration  Install  Quit
Gateway       Host       zam285.zam.kfa-juelich.de
NJS           Vsite Name Fermat
              NJS-Gateway-Port 3826
              Admin Port      3956
              Trusted CAs      /cert/projects-ca-fz-juelich
              Identity          /unicore/njs_identity.p12
              Password          *****
              Installation Dir  /unicore
              java              /usr/bin/java
              perl              /usr/bin/perl
              Logging Level     Configuration
              Keep Uspacore     false
              Operation Mode    full
              NJS SSL           false
              Memory            remember
              Save completed AJO false
              Change Log Files  24
              TSI Worker Limit  5
              TSI Update Interva 5000
              Thread Incarnatio  3
Configure UNICORE -- Press Alt + <key> for menu entries
    
```

```

[roger@zam439:~]$ uls
ssl://zam461.zam.kfa-juelich.de:9100/AVANT
ssl://zam031.zam.kfa-juelich.de:4014/Linux-zam461
ssl://zam031.zam.kfa-juelich.de:4016/zam777
ssl://zam177.zam.kfa-juelich.de:4005/JUMP
ssl://zam439:4005/u2
ssl://zam439:4004/u1
[roger@zam439:~]$ ucd ssl://zam439:4004/u1/home
[roger@zam439:~]$ uexec sleep.xml
submitted
[roger@zam439:~]$ uls -l
ssl://zam439:4004/u1 1750424334 SUCCESSFUL sleep
ssl://zam439:4004/u1 1750424391 EXECUTING sleep
[roger@zam439:~]$ uls -l
ssl://zam439:4004/u1 1750424334 SUCCESSFUL sleep
ssl://zam439:4004/u1 1750424391 SUCCESSFUL sleep
[roger@zam439:~]$ uls -l
-rw- 2044 07-21-05 15:56 ssl://zam439:4004/u1/home/.bashrc
-rw- 414 07-21-05 15:56 ssl://zam439:4004/u1/home/.bash_profile
drwx 4096 09-06-05 09:51 ssl://zam439:4004/u1/home/d1
drwx 4096 09-06-05 09:59 ssl://zam439:4004/u1/home/d2
drwx 4096 09-06-05 11:17 ssl://zam439:4004/u1/home/abc/
-rw- 23 10-07-05 10:11 ssl://zam439:4004/u1/home/TESTFILE
-rw- 23 10-07-05 10:11 ssl://zam439:4004/u1/home/TESTFILE2
-rw- 12 10-07-05 12:53 ssl://zam439:4004/u1/home/TESTFILE3
[roger@zam439:~]$
[roger@zam439:~]$
[roger@zam439:~]$
    
```



UNICORE Architecture Overview



UNICORE Client

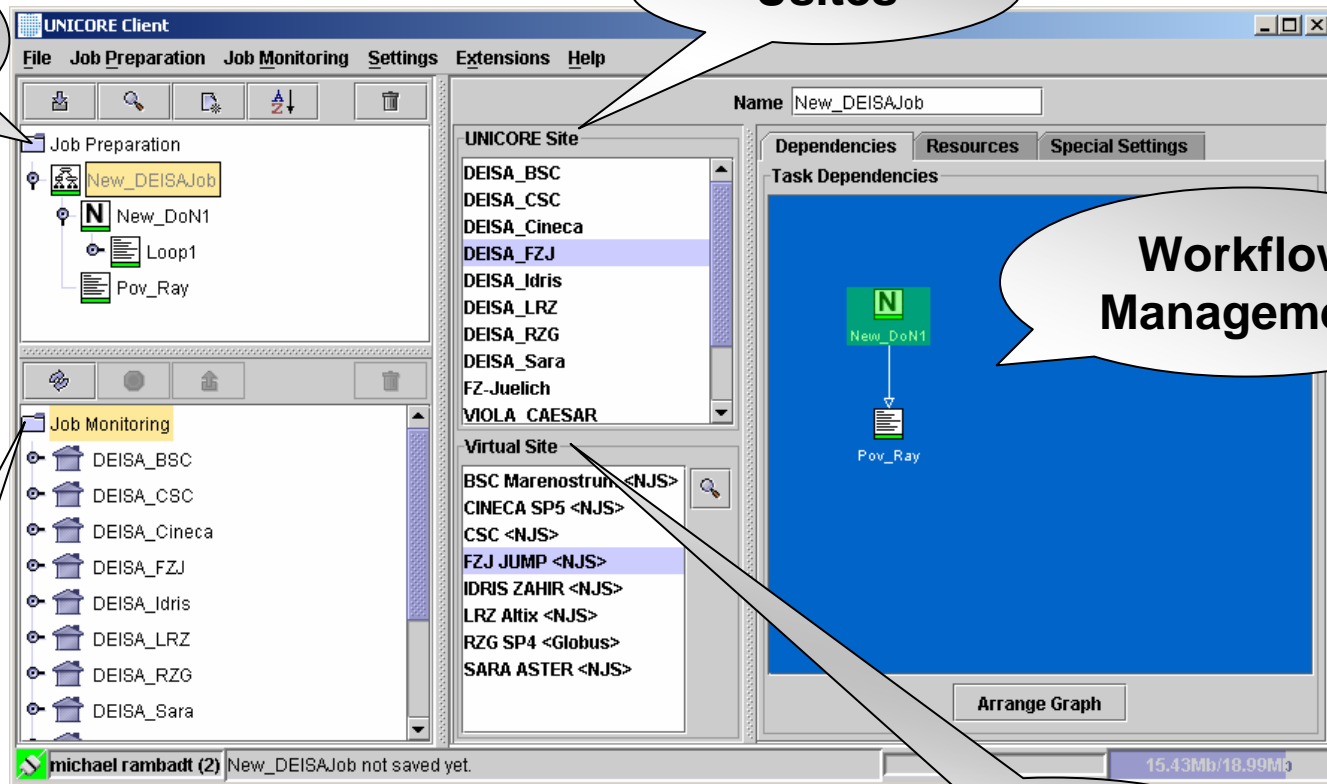
**Job
Preparation**

Usites

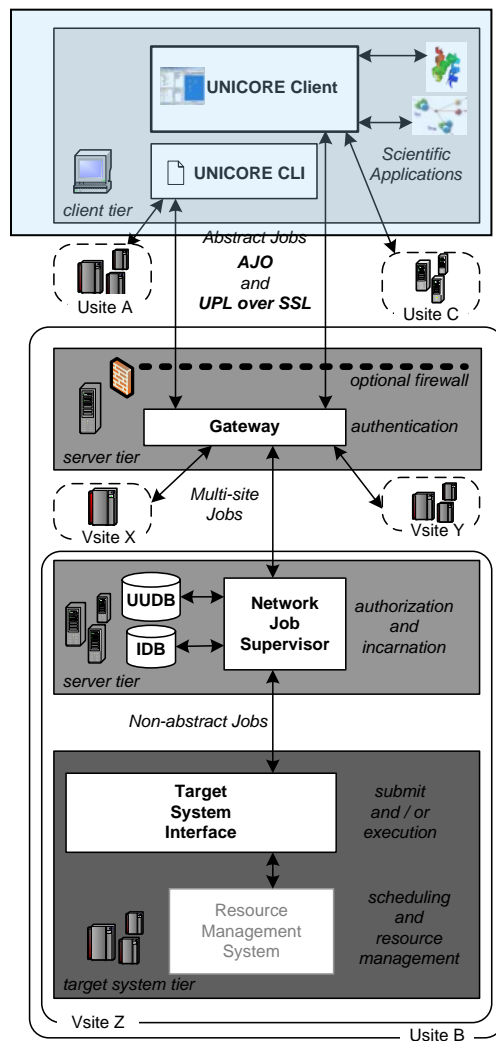
**Workflow
Management**

**Job
Monitoring**

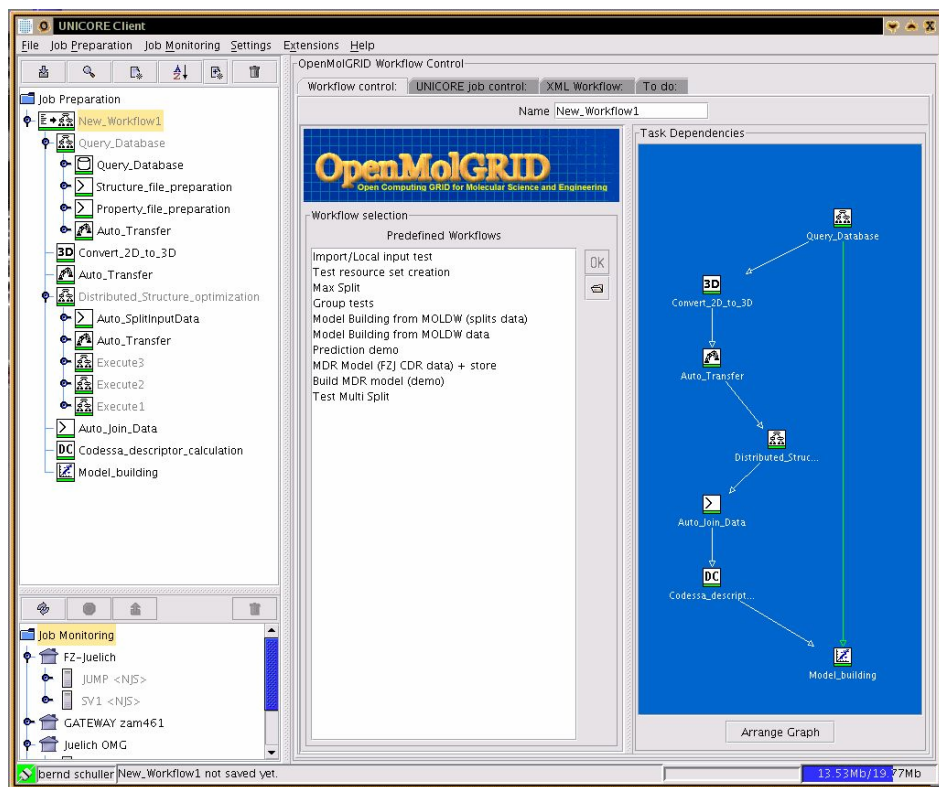
Vsites



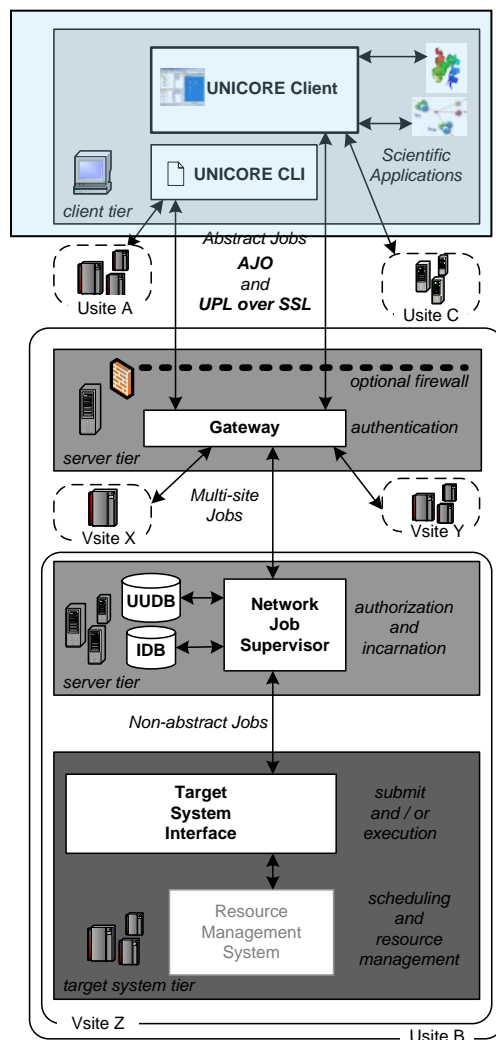
UNICORE 5 Architecture (1)



- ▶ Definition of abstract Jobs (not machine-specific)
- ▶ Creation of complex workflows (e.g. multi-site jobs for geographically dispersed supercomputers)



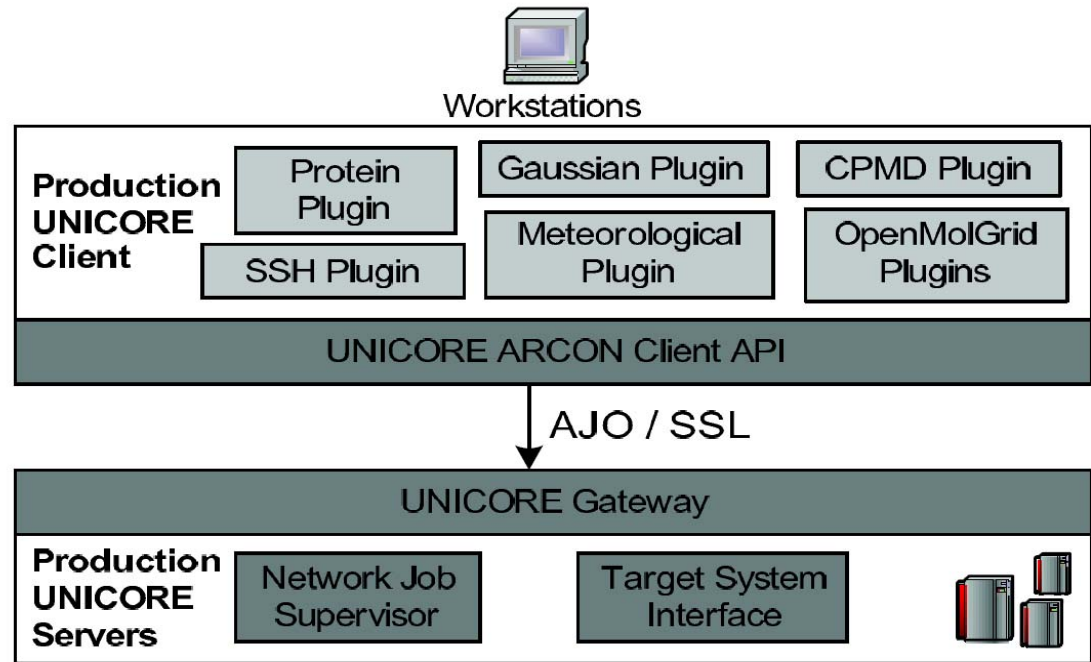
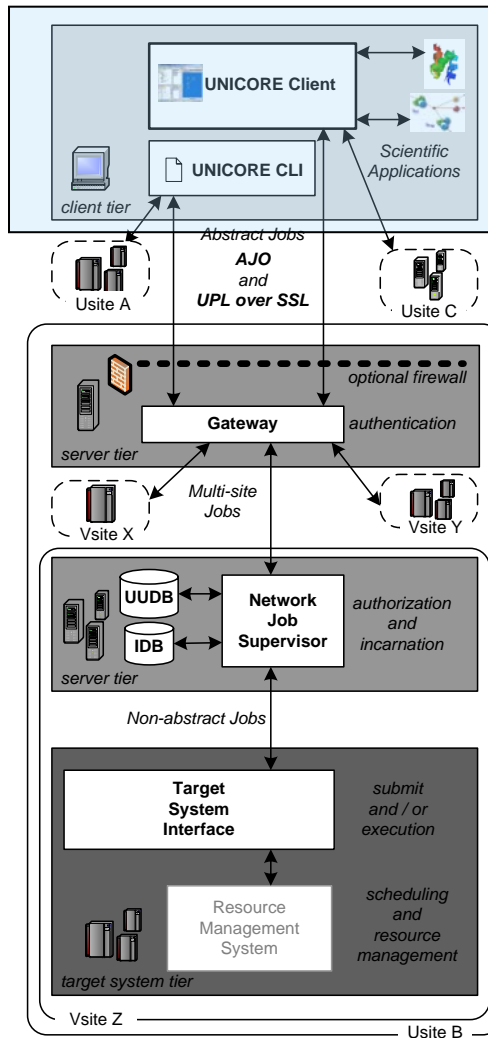
UNICORE 5 Architecture (2)



- ▶ Client extensions via application-specific plugins
 - ▶ Car-Parrinello Molecular Dynamics Plugin (speed up quantum chemical computations)
 - ▶ Fluent, Gaussian, MSC Nastran Plugins
 - ▶ OpenMolGrid – Plugins (Molecular Science)
- ▶ UNIX-Style Command-Line Interface (CLI)

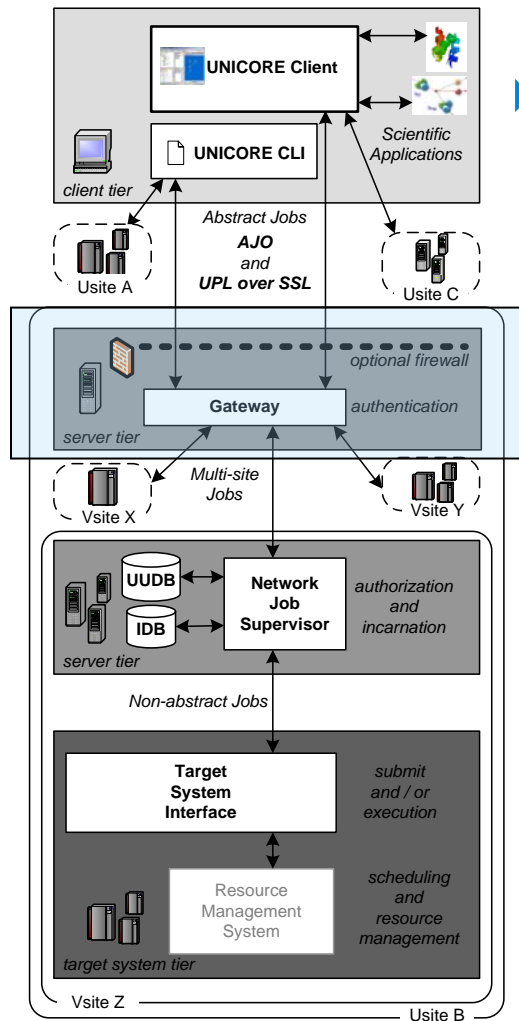
```
[roger@zam439]::{~}$ uls
ssl://zam461.zam.kfa-juelich.de:9100/AVANT
ssl://zam031.zam.kfa-juelich.de:4014/Linux-zam461
ssl://zam031.zam.kfa-juelich.de:4016/zam777
ssl://zam177.zam.kfa-juelich.de:4005/JUMP
ssl://zam439:4005/u2
ssl://zam439:4004/u1
[roger@zam439]::{~}$ ucd ssl://zam439:4004/u1/home
[roger@zam439]::{~}$ uexec sleep.xml
submitted
[roger@zam439]::{~}$ ups -l
ssl://zam439:4004/u1 1750424334 SUCCESSFUL sleep
ssl://zam439:4004/u1 1750424391 EXECUTING sleep
```


UNICORE 5 Architecture (3)



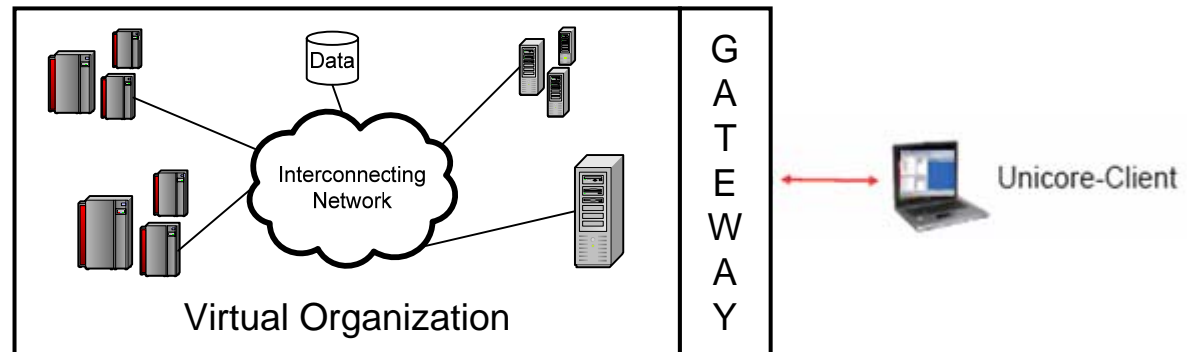
- ▶ Various plugins have been developed the last years
- ▶ Base upon the Arcon Client API (Java - API)

UNICORE 5 Architecture (4)

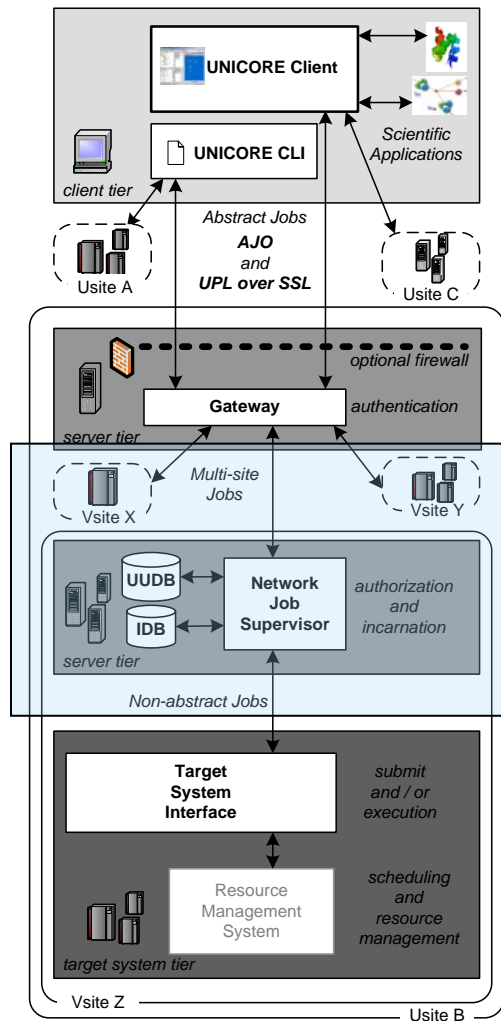


► Gateway

- Single entry-point for UNICORE Sites (Usites)
- Contains n Virtual Sites (Vsites) (e.g. provides access to n supercomputers)
- Only **ONE OPEN PORT** in firewall
- Authentication of users via X.509 certificates
- Perfect base to group resources and access within Virtual Organizations (VOs)

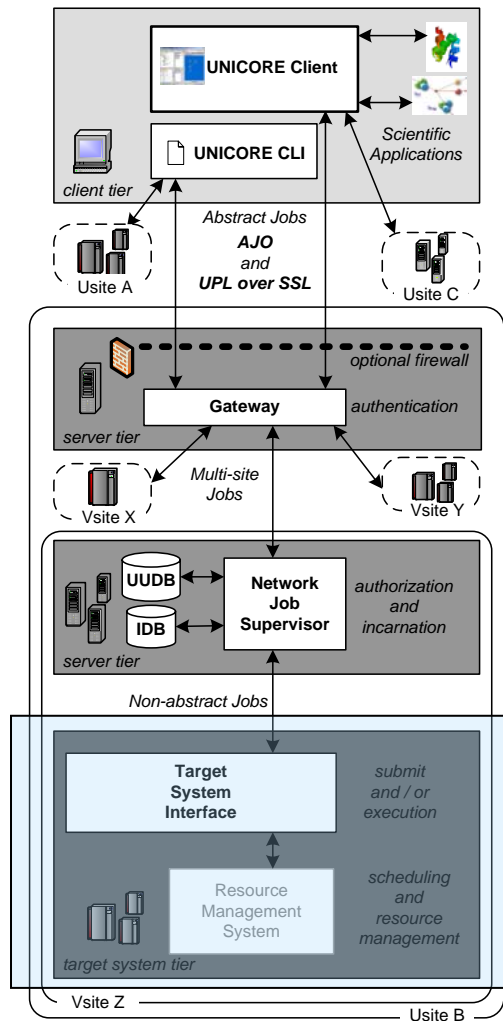


UNICORE 5 Architecture (5)



- ▶ Network Job Supervisor (NJS)
 - ▶ Analyse defined Workflows (workflow engine)
 - ▶ Multi-site, multi-step Jobs
 - ▶ Directed Acyclic Graphs
- ▶ Submit of sub-jobs to other sites over Gateway
- ▶ Job Incarnation via Incarnation Database (IDB)
 - ▶ turn abstract-jobs into machine-specific jobs
 - ▶ E.g. location of preinstalled software packages
- ▶ Authorization via Unicare User Database (UUDB)
 - ▶ turn X.509 user certs to users xlogin of machine
 - ▶ The complete certificate is checked (not only DN)

UNICORE 5 Architecture (6)



▶ Target System Interface

- ▶ Represents a real Target System (e.g. a supercomputer or storage server)



▶ Interaction with Resource Management Systems

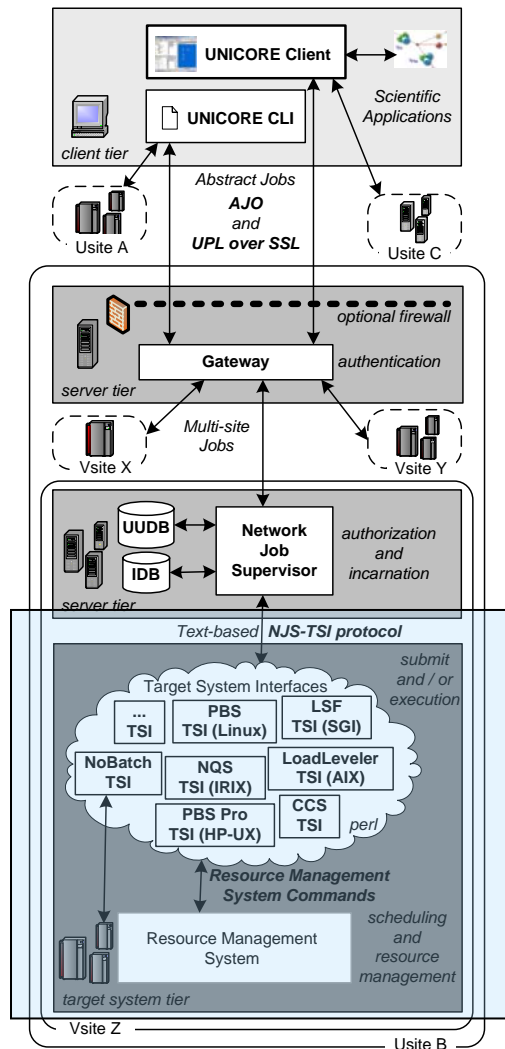
- ▶ Torque, PBS Pro, Load Leveler, (UNIX fork), ...
- ▶ Job submit to Resource Management System
- ▶ Scheduling via Resource Management System
- ▶ Retrieve job results and job output
- ▶ Manage workspace

▶ Access to pre-defined Applications

- ▶ e.g. a massive parallel simulation for collaborative visualization & steering via UNICORE



TSI & Resource Management



▶ Target System Tier

- ▶ Consists of one Target System Interface
- ▶ Interactions with underlying RMSs

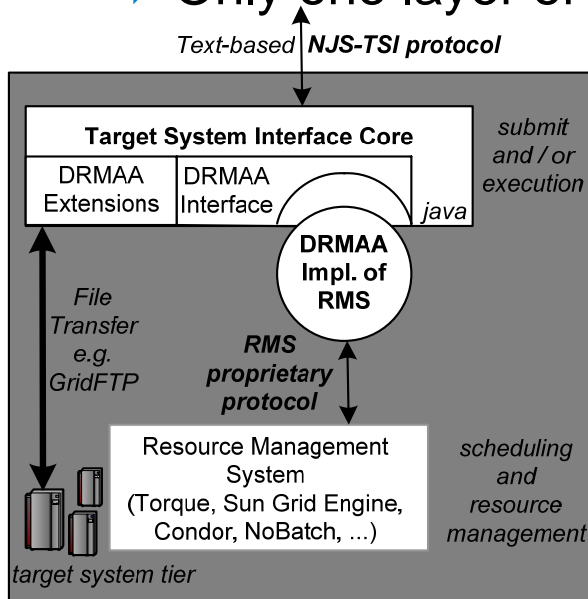
▶ Target System Interface

- ▶ Each supported RMS is used in conjunction with a target system-specific TSI impl. in perl
- ▶ Perl TSI implementations are stateless daemons
- ▶ Statically configured before startup (RMS admin)
- ▶ Various TSI implementations
PBS TSI (Linux), LSF TSI (SGI), PBS-Pro (HP-UX), NQS (IRIX), LoadLeveler TSI (AIX), ...

TSI Framework using DRMAA



- ▶ Base upon Open Source SUN Grid Engine DRMAA impl.
 - ▶ Java Bindings of DRMAA specification are used
- ▶ Java-Based Target System Interface Core
 - ▶ Only one layer of UNICORE is exchanged → protocols still the same



- ▶ Platform & RMS command independent
- ▶ DRMAA - API “only” provides Interfaces for job submission & management
 - ▶ Additional DRMAA Extensions for file transfer
 - ▶ Transfer over Unicore Protocol Layer (UPL)
 - ▶ Optional transfer over GridFTP
- ▶ UNICORE 5/6

UNICORE in DEISA (1)



- Consortium of leading national HPC centers in EU



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

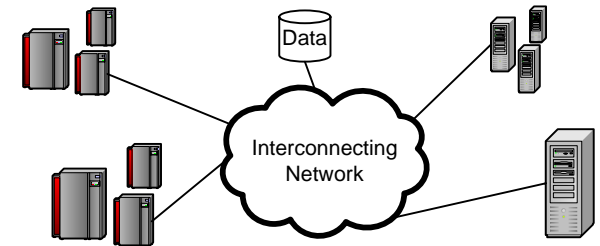
UNICORE in DEISA (2)



- ▶ Deploy and operate a persistent, production quality, distributed, heterogeneous supercomputing environment



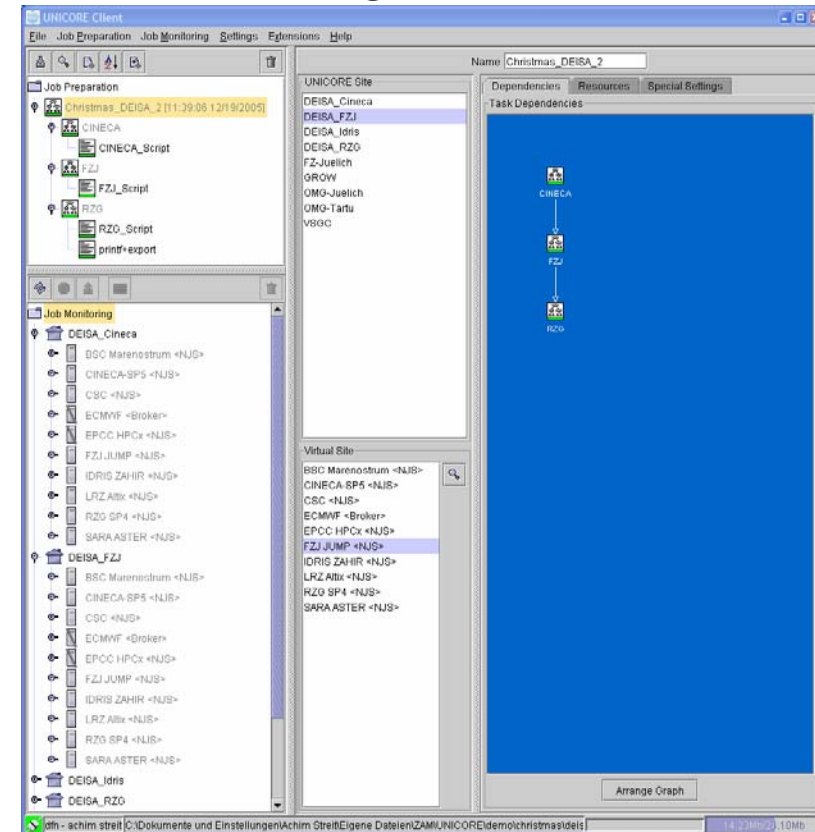
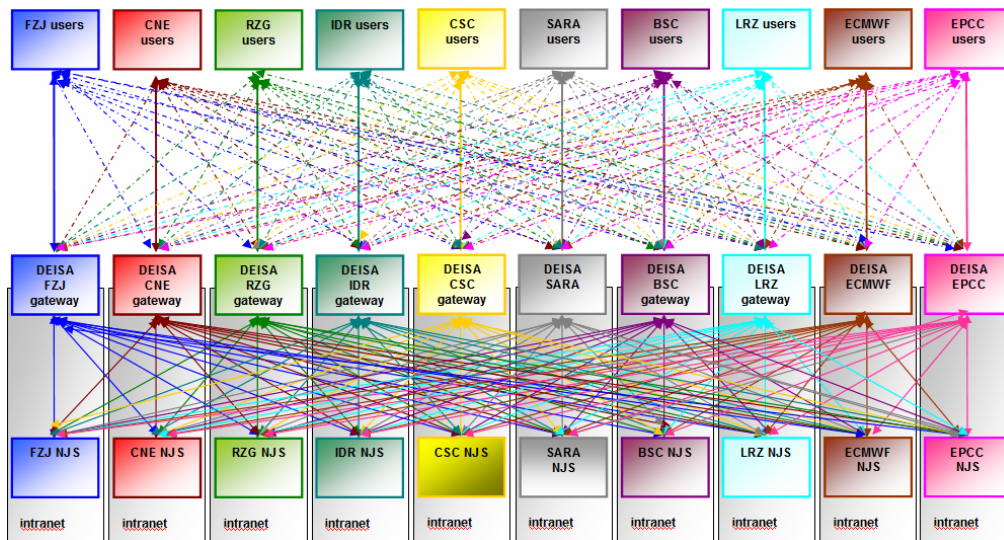
UNICORE



UNICORE

UNICORE in DEISA (3)

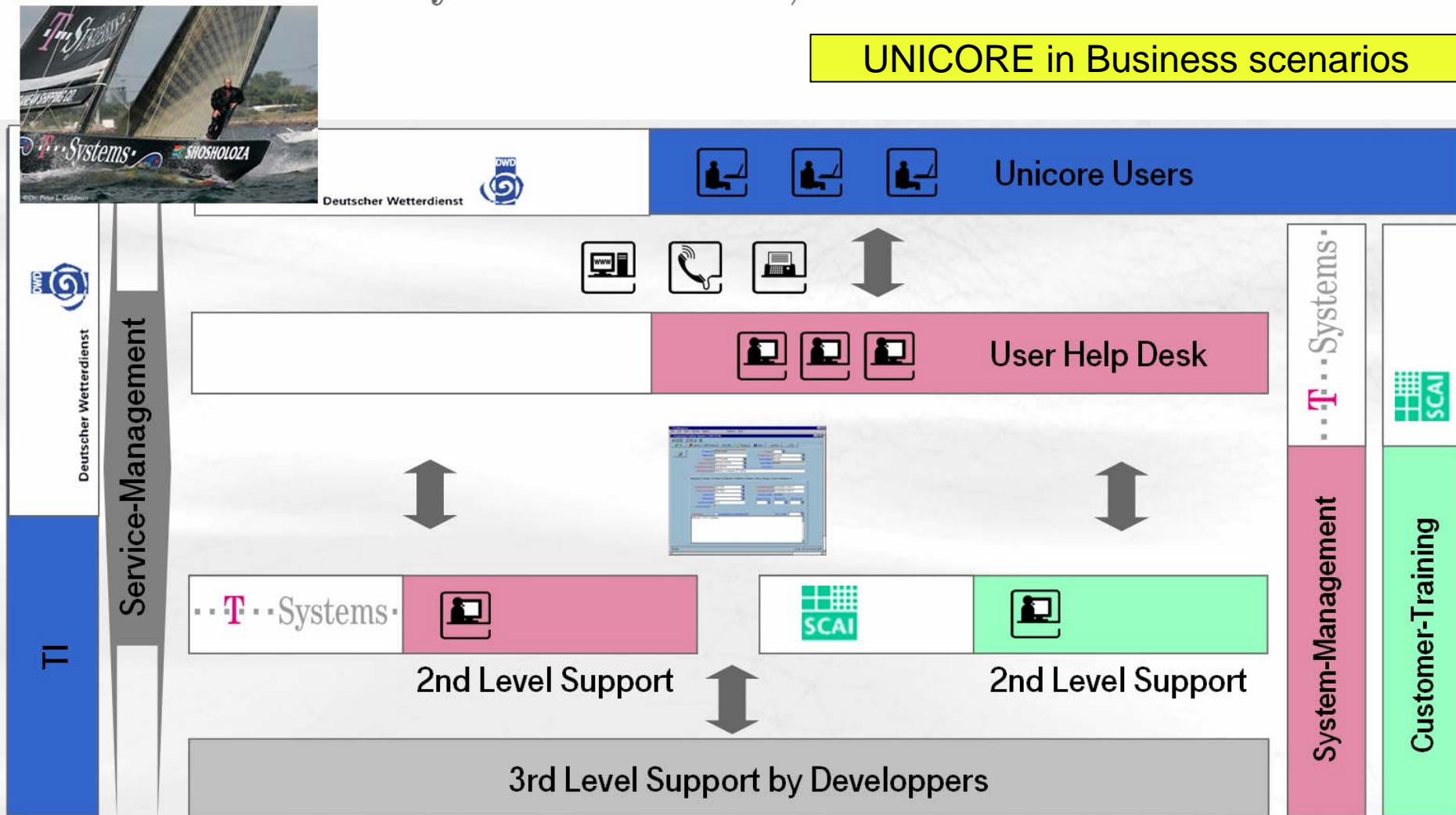
- ▶ Fully-meshed UNICORE infrastructure among partners
- ▶ Complex multi-site workflows easily possible
- ▶ Heavily used by DECI projects



UNICORE based Access to Computing-Resources.

Delivery-Model for DWD, GRS and Team Shosholoza

UNICORE in Business scenarios



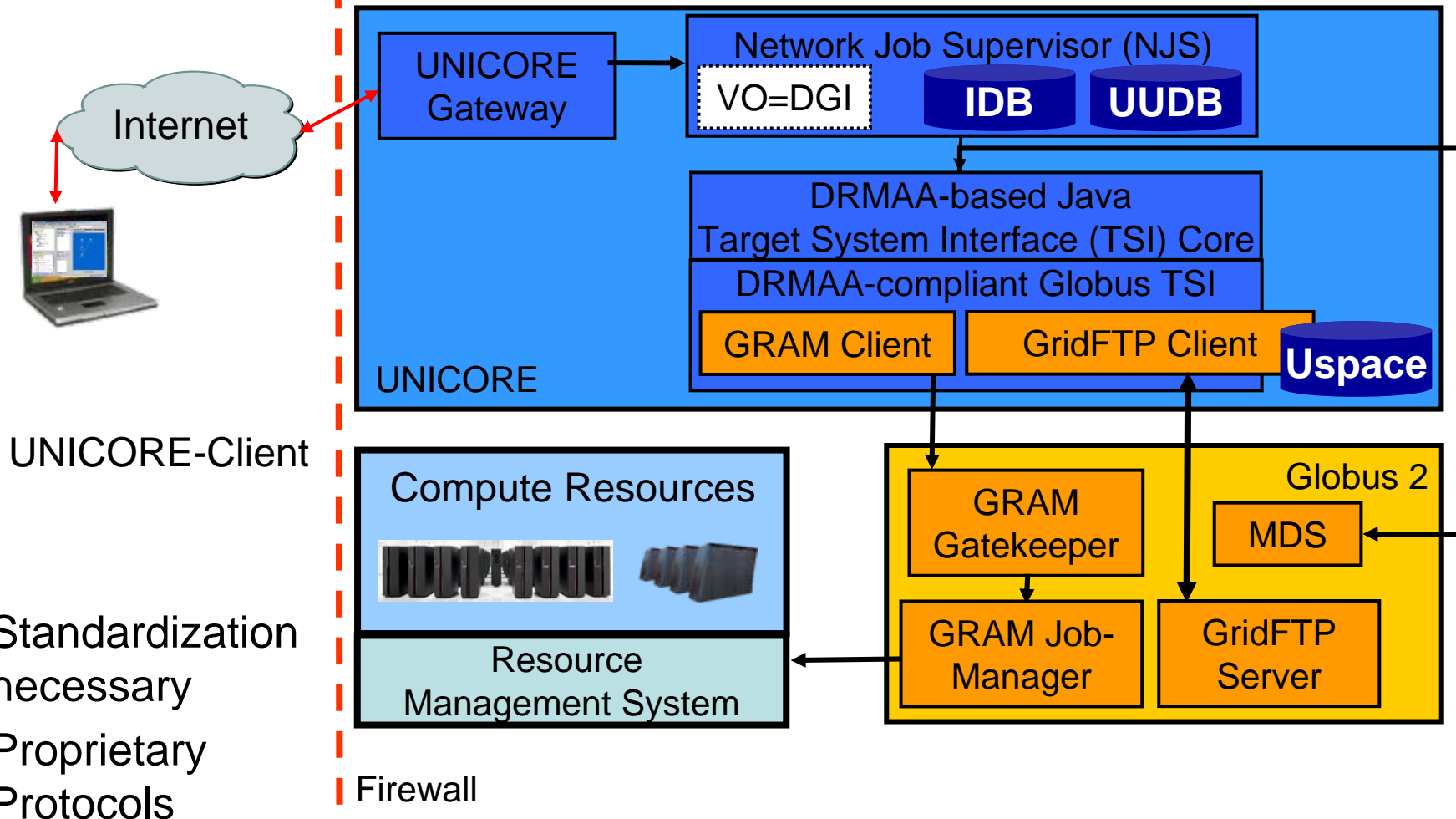
UNICORE - LIFE - CD

- ▶ Complete “out-of-the-box” usage of UNICORE 5
- ▶ Bootable Linux OS with UNICORE 5 pre-installed
- ▶ Does not harm your system → Sandbox scenario
- ▶ For testing, evaluating, ...



**AVAILABLE HERE
AND AT THE
GRID VILLAGE
UNICORE BOOTH**

Initial Interoperability UNICORE & Globus 2.4



- ▶ Standardization necessary
- ▶ Proprietary Protocols

- ▶ UNICORE AJO/UPL, Globus RSL

Emerging Grid Standards (1)

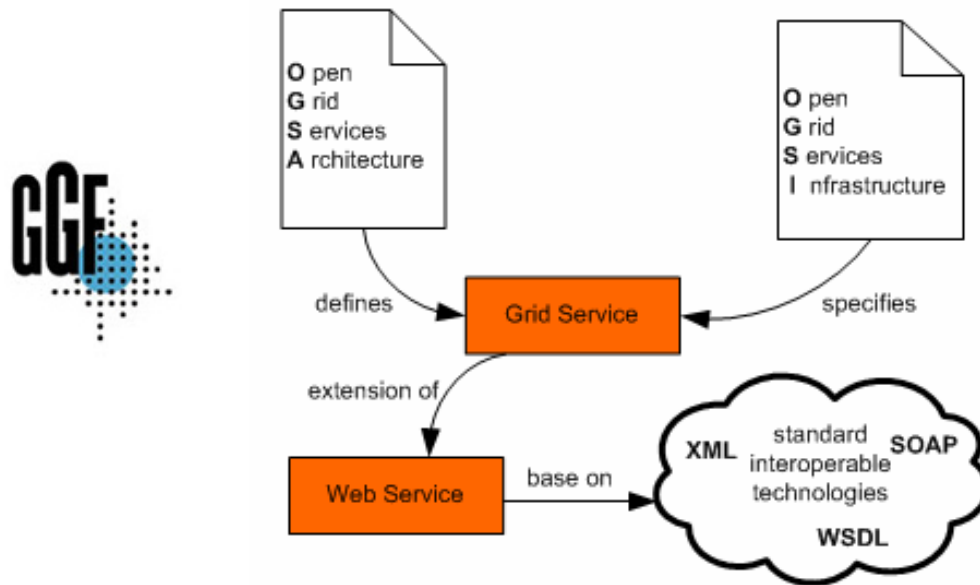
- ▶ OGSA – Open Grid Services Architecture
 - ▶ “The Physiology of the Grid”, GGF - GFD30
 - ▶ Resources shared via services in Grids
 - ▶ Lifecycle management for Web Services necessary
- ▶ OGSI – Open Grid Services Infrastructure
 - ▶ Globus Toolkit 3 provides early implementation
 - ▶ (US Projects using Globus are better funded by US – Gov)
- ▶ WS-RF - Web Services Resource Framework
 - ▶ Re-factors and evolves OGSI to exploit WS-* technologies
 - ▶ Same functionality as OGSI, but separated Specifications



Emerging Grid Standards (2)

- ▶ Change of Terminology

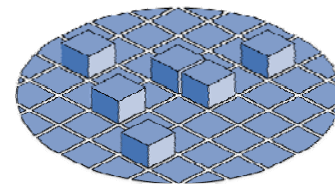
- ▶ From **Grid Services** ...



- ▶ ...to **stateful Web Services**

OASIS

UNICORE 6



UniGrids

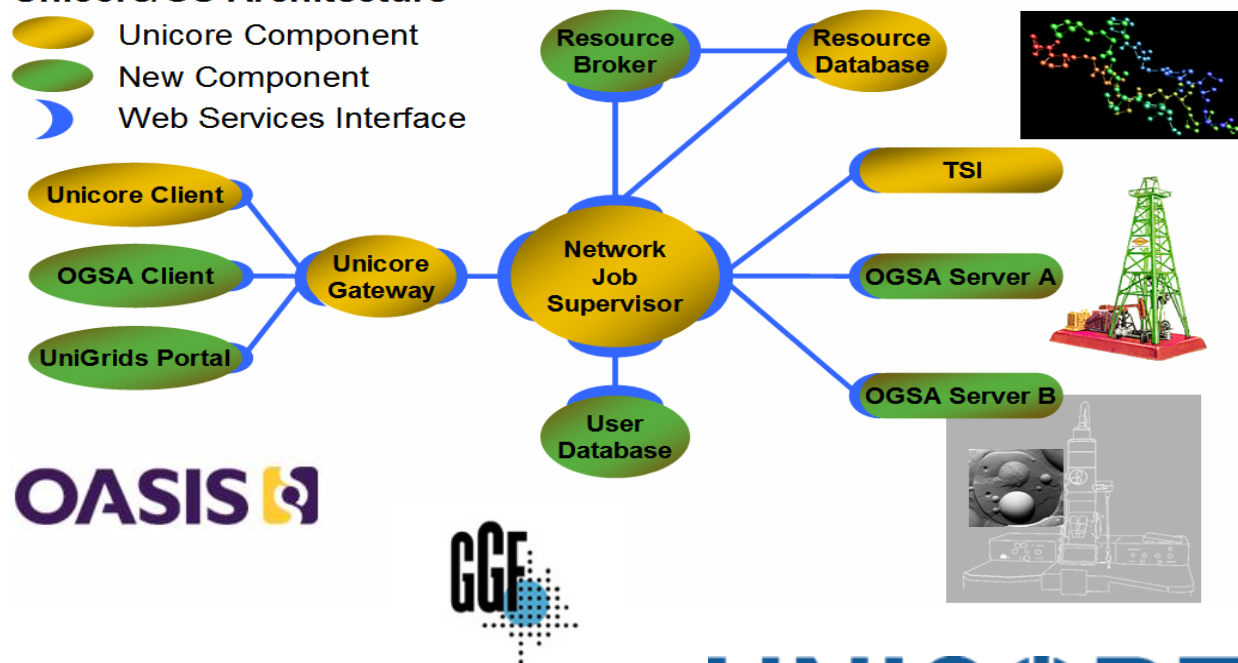
- ▶ Development of next generation of UNICORE called UNICORE 6 based on OGSA and compliant with WS-RF
 - ▶ Broader vision of interoperability between different Grid middleware
 - ▶ Interoperable infrastructures through standards



Funded by EU grant: IST-2002-004279

Unicore/GS Architecture

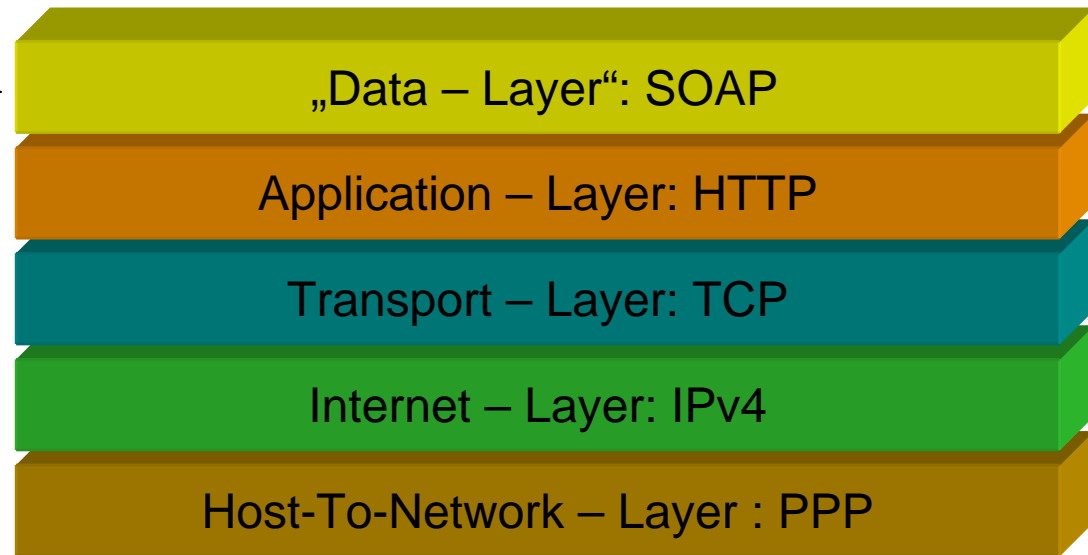
- Unicore Component
- New Component
- Web Services Interface



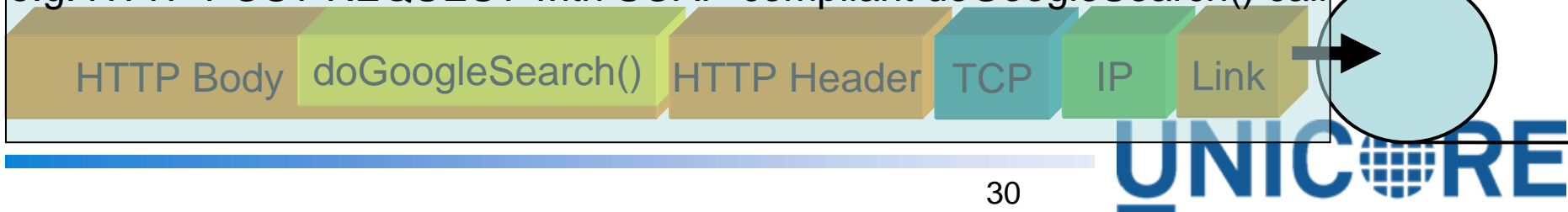
Understanding SOAP & WS-RF (1)

► Using WSDL description for XML tags of doGoogleSearch()

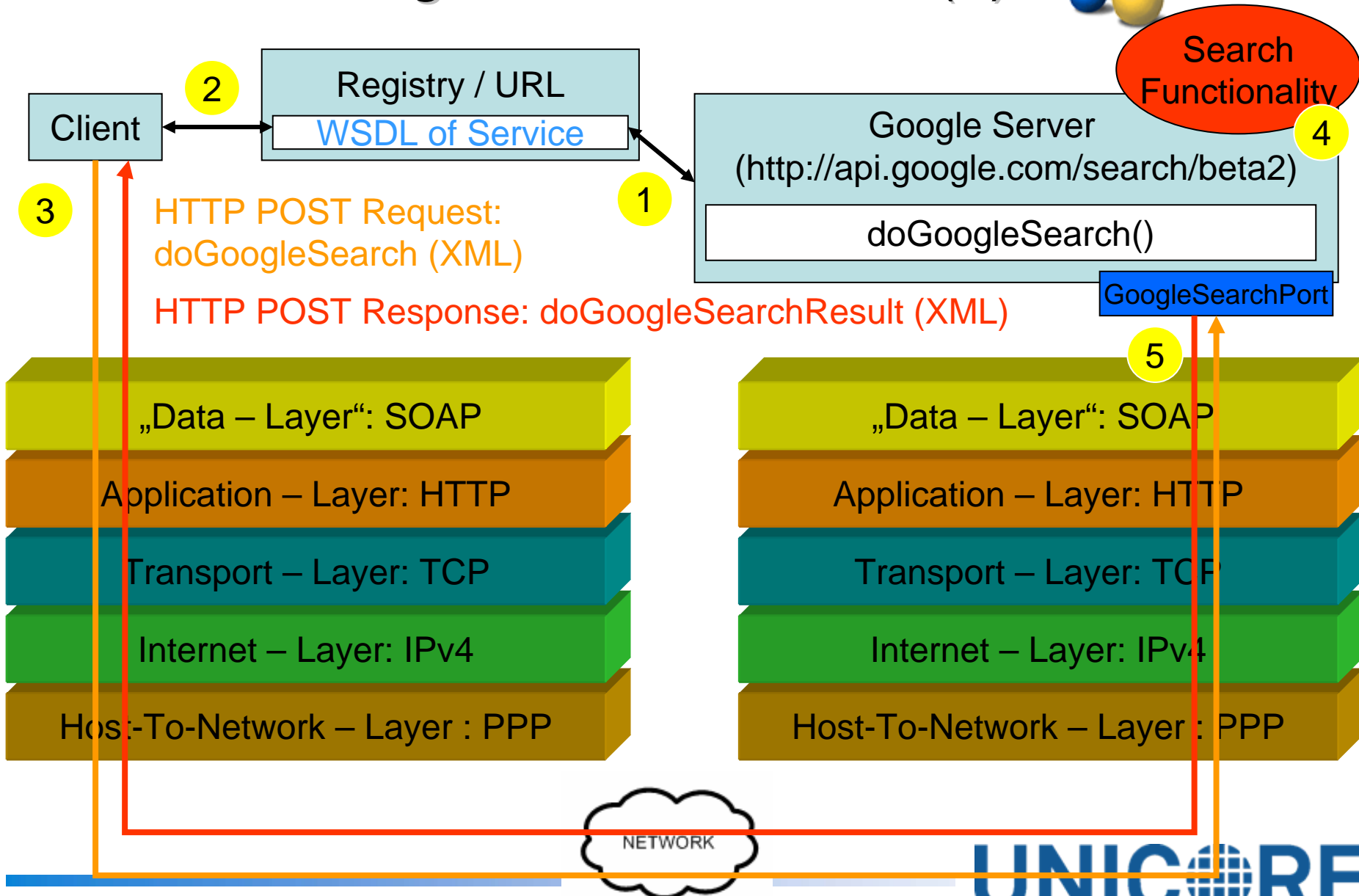
```
<soap>  
<soap:header>  
  http://api.google.com/  
  search/beta2  
</soap:header>  
<soap:body>  
  doGoogleSearch( key = ,Grid' )  
</soap:body>  
</soap>
```



e.g. HTTP POST REQUEST with SOAP-compliant doGoogleSearch() call



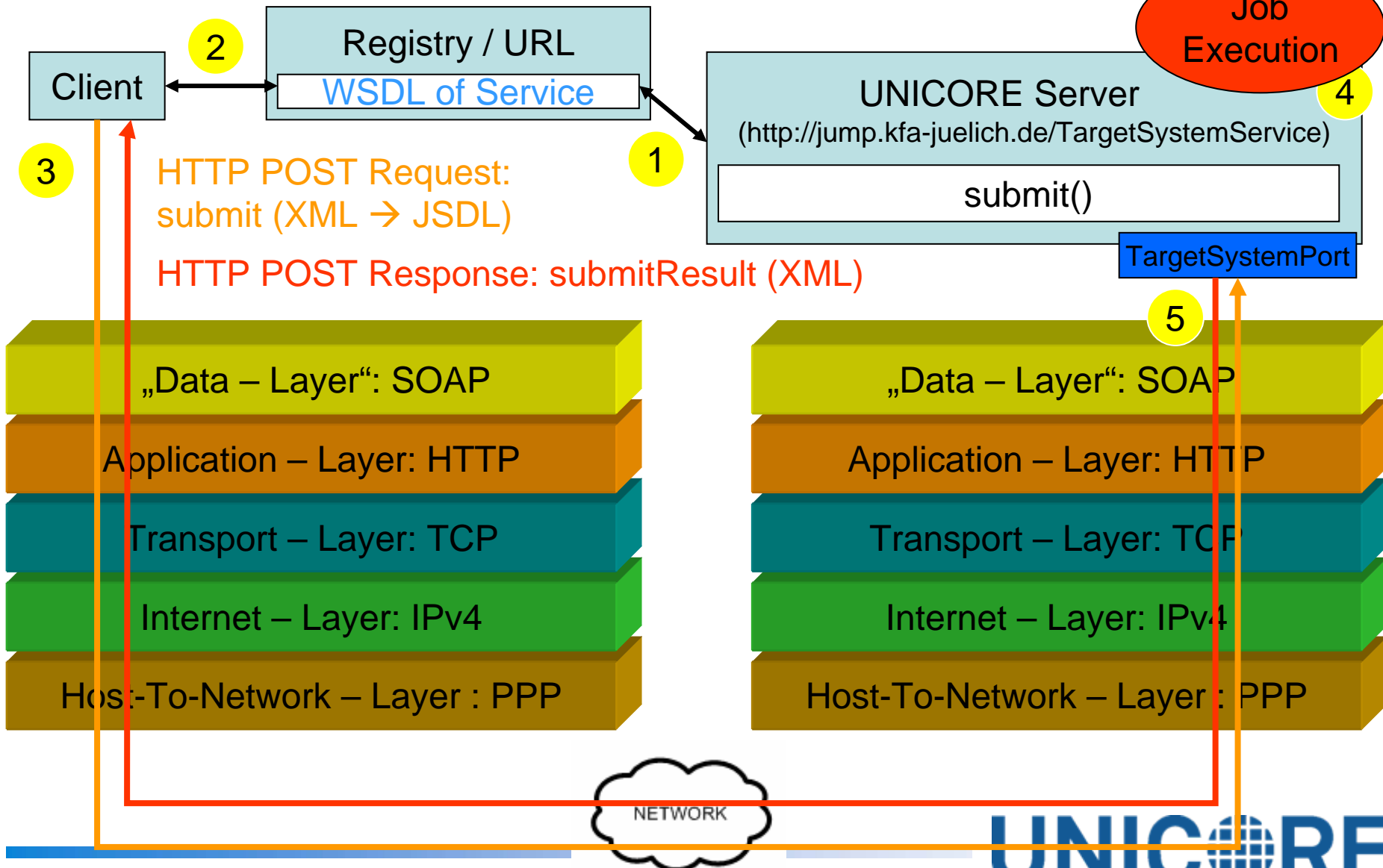
Understanding SOAP & WS-RF (2)



Understanding SOAP & WS-RF (3)



Job
Execution

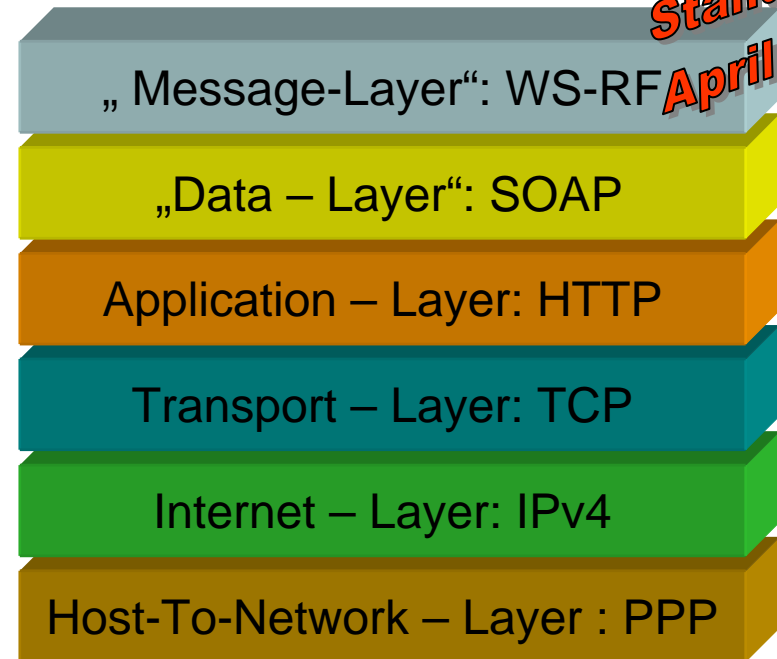


Standardization for interoperability

- ▶ Web Services Resource Framework (WS-RF) protocol
 - ▶ Add **semantics & syntax** to operations (GetResourceProperties)
 - ▶ Get a list of properties that the service is offering
 - ▶ A Web Service itself is typically Stateless → WS-RF stateful
 - ▶ Grids need access to **stateful resources**
 - ▶ jobs, supercomputers, telescope, collider,...
- ▶ Autonomic behaviour
 - ▶ **Services know how they can interact**
 - ▶ **Standardized operations & properties**

OASIS

Standard
April 2006



- ▶ Base for others WS-Notifications, WS-Agreement, ...
- ▶ Five Specifications (public comment - Version 1.2)
 - ▶ **WS - Resource**
 - ▶ Relationship Web service and resource
 - ▶ **WS – Resource Lifetime**
 - ▶ Lifecycle of a WS-Resource, TerminationTime, etc.
 - ▶ **WS – Resource Properties**
 - ▶ Getters/Setters/Queries of Properties
 - ▶ **WS - BaseFaults**
 - ▶ Base set of information that appear in fault messages
 - ▶ **WS – Service Groups**
 - ▶ Collections of WS or WS-Resorces

A WS-RF message via SOAP (use of WS-Addressing&Security)

TCPMonitor

Admin Port 8080 Port 8090

Stop Listen Port: 8090 Host: 127.0.0.1 Port: 8088 Proxy

State	Time	Request Host	Target Host	Request...
Done	2006-07-04 14:03:45	localhost	127.0.0.1	POST /axis/services/RegistryService HTTP/1.1
Done	2006-07-04 14:03:50	localhost	127.0.0.1	POST /axis/services/RegistryService HTTP/1.1
Done	2006-07-04 14:04:08	resend	127.0.0.1	POST /axis/services/RegistryService HTTP/1.1
Done	2006-07-04 14:04:23	localhost	127.0.0.1	POST /axis/services/RegistryService HTTP/1.1

Remove Selected Remove All

User-Agent: Axis/1.2.1
Host: 127.0.0.1:8090
Cache-Control: no-cache
Pragma: no-cache
SOAPAction: "http://docs.oasis-open.org/wsrf/rpw-2/GetResourceProperty/GetResourcePropertyRequest"
Content-Length: 5103
Connection: close

<?xml version="1.0" encoding="UTF-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:wsa="http://www.w3.org/2005/08/addressing" >
 <soapenv:Header>
 <ResourceDisambiguator soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next" soapenv:mustUnderstand="1" xmlns="http://com.fujitsu.arcon.addressing">default_registry</ResourceDisambiguator>
 <Security soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next" soapenv:mustUnderstand="1" xmlns="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-wssecurity-secext-1.0.xsd">
 <BinarySecurityToken ValueType="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-x509-token-profile-1.0#Base64Binary" EncodingType="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-x509-token-profile-1.0#Base64Binary" Value="MIIDBTAdBgkqhkiG9w0BBQwwRAIgP9PKIPatv1" />
 <BinarySecurityToken ValueType="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-x509-token-profile-1.0#Base64Binary" EncodingType="http://docs.oasis-open.org/wss/2004/01/oasis-200401-wss-x509-token-profile-1.0#Base64Binary" Value="MIIDBTAdBgkqhkiG9w0BBQwwRAIgP9PKIPatv1" />
 <ns1:User ID="0CE2FDD0-0B55-11DB-9FE4-C1E28A60E8B8" xmlns:ns1="http://unresolved.fujitsu.com/axis/services/RegistryService" />
 <ns2:Consignor ID="0D0B1F40-0B55-11DB-9FE4-C70E54A191D8" xmlns:ns2="http://unresolved.fujitsu.com/axis/services/RegistryService" />
 <ns3:Endorser ID="0D2473A0-0B55-11DB-9FE4-9E87153A1612" xmlns:ns3="http://unresolved.fujitsu.com/axis/services/RegistryService" />
 </Security>
 </soapenv:Header>
 <soapenv:Body>
 <GetResourceProperty xmlns="http://docs.oasis-open.org/wsrf/rpw-2" xmlns:ns4="http://docs.oasis-open.org/wsrf/sg-2">ns4:Entry</GetResourceProperty>
 </soapenv:Body>
</soapenv:Envelope>

HTTP/1.1 200 OK
Date: Tue, 04 Jul 2006 12:04:23 GMT
Server: Jetty/5.1.10 (Linux/2.6.8-24-default i386 java/1.5.0_03)
Connection: close
Content-Type: text/xml; charset=utf-8

<?xml version="1.0" encoding="utf-8"?>
<soapenv:Envelope xmlns:soapenv="http://schemas.xmlsoap.org/soap/envelope/" xmlns:xsd="http://www.w3.org/2001/XMLSchema" xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xmlns:wsa="http://www.w3.org/2005/08/addressing" >
 <soapenv:Header>
 <wsa:Action soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next" soapenv:mustUnderstand="1" xmlns="http://docs.oasis-open.org/wsrf/rpw-2">http://docs.oasis-open.org/wsrf/rpw-2/GetResourceProperty/GetResourcePropertyRequestResponse</wsa:Action>
 <wsa:MessageID soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next" soapenv:mustUnderstand="1" xmlns="http://www.w3.org/2005/08/addressing/role/anonymous">http://localhost:8090/axis/services/RegistryService</wsa:MessageID>
 <wsa:To soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next" soapenv:mustUnderstand="1" xmlns="http://www.w3.org/2005/08/addressing/role/anonymous">http://localhost:8090/axis/services/RegistryService</wsa:To>
 <wsa:From>
 <wsa:Address>http://localhost:8090/axis/services/RegistryService</wsa:Address>
 </wsa:From>
 <wsa:RelatesTo RelationshipType="wsa:Response" soapenv:actor="http://schemas.xmlsoap.org/soap/actor/next" soapenv:mustUnderstand="1" xmlns="http://schemas.xmlsoap.org/soap/actor/next">http://localhost:8080/axis/services/TargetSystemFactoryService</wsa:RelatesTo>
 </soapenv:Header>
 <soapenv:Body>
 <GetResourcePropertyReturn xmlns="http://docs.oasis-open.org/wsrf/rpw-2">
 <ns1:Entry xmlns:ns1="http://docs.oasis-open.org/wsrf/sg-2">
 <ns1:ServiceGroupEntryEPR>
 <wsa:Address>http://localhost:8080/axis/services/ServiceGroupEntryPortType</wsa:Address>
 <wsa:ReferenceParameters>
 <ns2:ResourceDisambiguator xmlns:ns2="http://com.fujitsu.arcon.addressing">775159C0-06BC-11DB-94F3-D00194B17DDD</ns2:ResourceDisambiguator>
 </wsa:ReferenceParameters>
 </ns1:ServiceGroupEntryEPR>
 <ns1:MemberServiceEPR>
 <wsa:Address>http://localhost:8080/axis/services/TargetSystemFactoryService</wsa:Address>
 <wsa:ReferenceParameters>
 <ns3:ResourceDisambiguator xmlns:ns3="http://com.fujitsu.arcon.addressing">default_tsf</ns3:ResourceDisambiguator>
 </wsa:ReferenceParameters>
 </ns1:MemberServiceEPR>
 </ns1:Entry>
 </GetResourcePropertyReturn>
 </soapenv:Body>
</soapenv:Envelope>

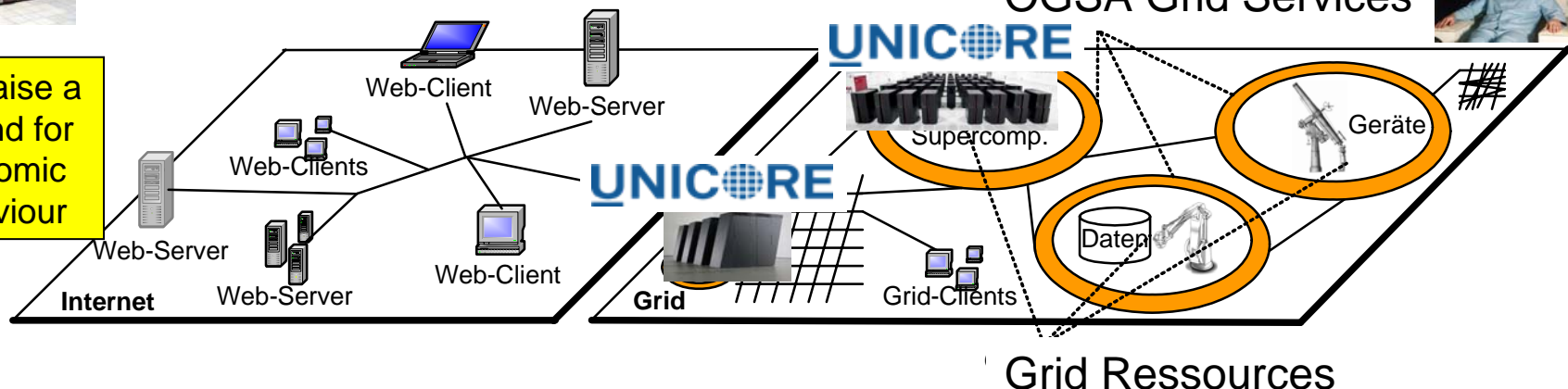
XML Format Numeric Save Resend Switch Layout Close

Stateful Web Services & Grids with UNICORE

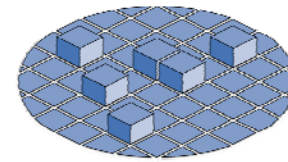
- ▶ ‚Grid Services‘ – Web Services that implement Grid patterns
- ▶ Open Grid Services Architecture (OGSA)
 - ▶ WS-RF is one implementation of OGSA concepts
 - ▶ Access and management of Grid **resources of interest**
 - ▶ Web Services with standardized state interactions
 - ▶ **State of a supercomputer** (memory, applications, etc.)
 - ▶ **State of submitted jobs** on resources



Size raise a demand for autonomic behaviour

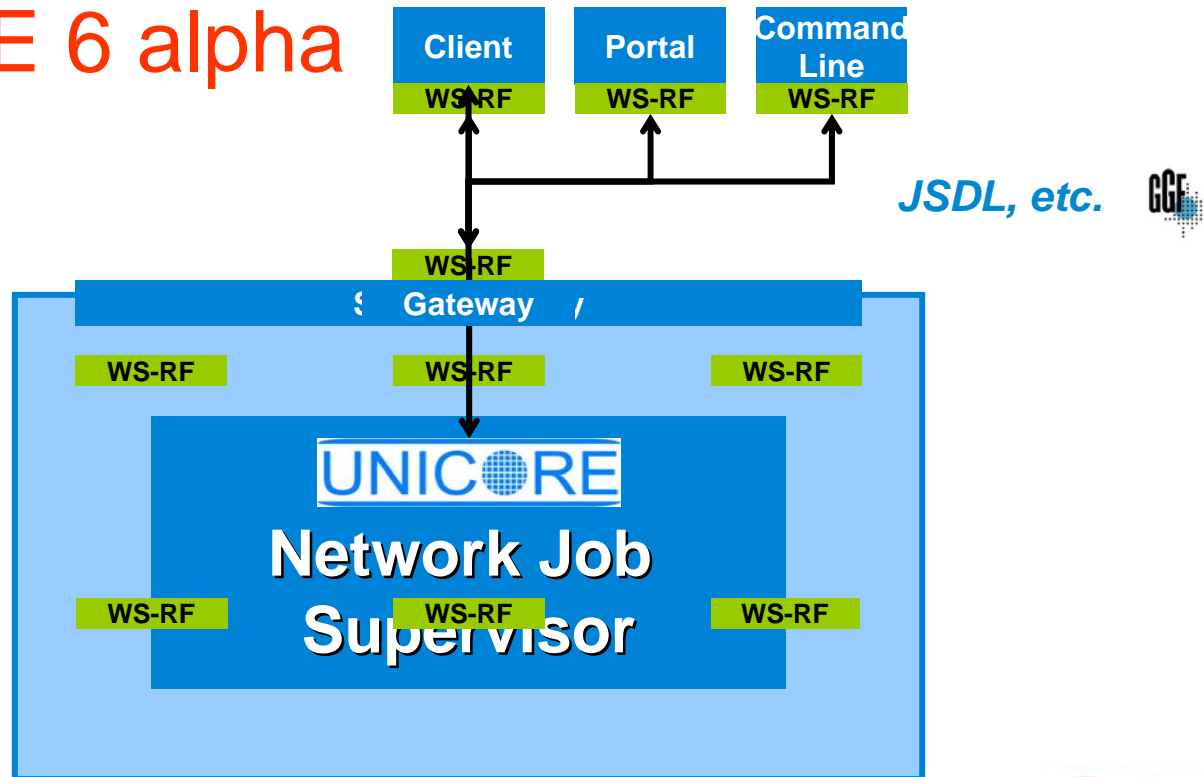


Transforming UNICORE

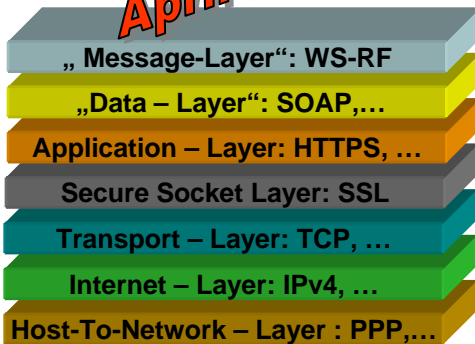


UniGrids

► Developments of **UNICORE 6 alpha**



**Standard
April 2006**



OASIS

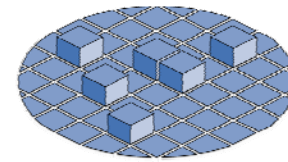
Job Submission Description Language Example



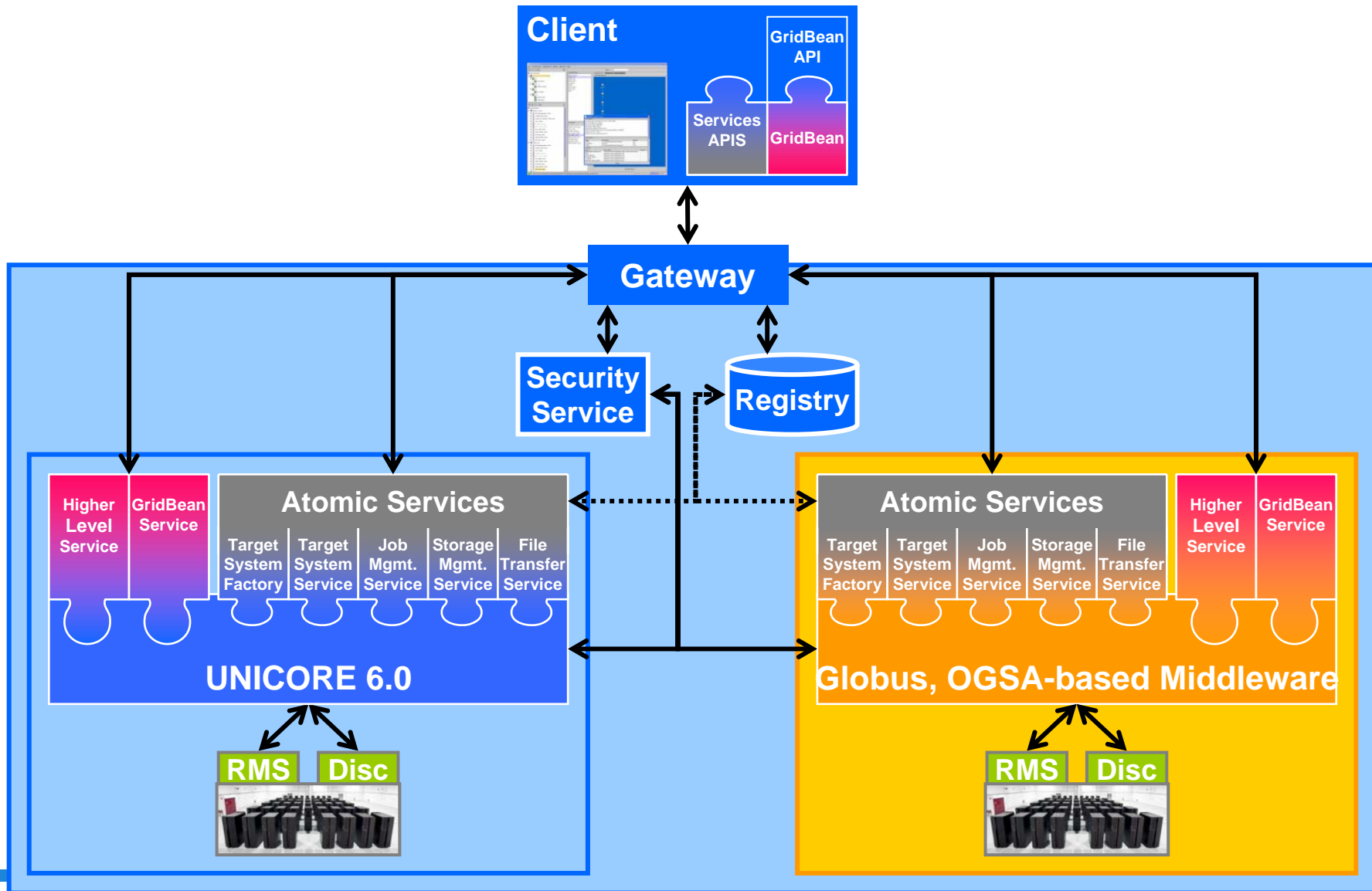
```
<?xml version="1.0" encoding="UTF-8"?>
<JobDefinition xmlns="http://schemas.ggf.org/jsdl/2005/11/jsdl">
  <JobDescription>
    <Application>
      <POSIXApplication xmlns="http://schemas.ggf.org/jsdl/2005/11/jsdl-posix">
        <Executable>/bin/echo</Executable>
        <Argument>hello world</Argument>
      </POSIXApplication>
    </Application>
  </JobDescription>
</JobDefinition>
```

- ▶ JSDL Specification → GFD.56
 - ▶ November 2005 - Published as GGF Recommendation

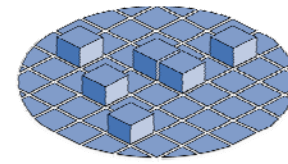
Architecture of UNICORE 6.0



UniGrids

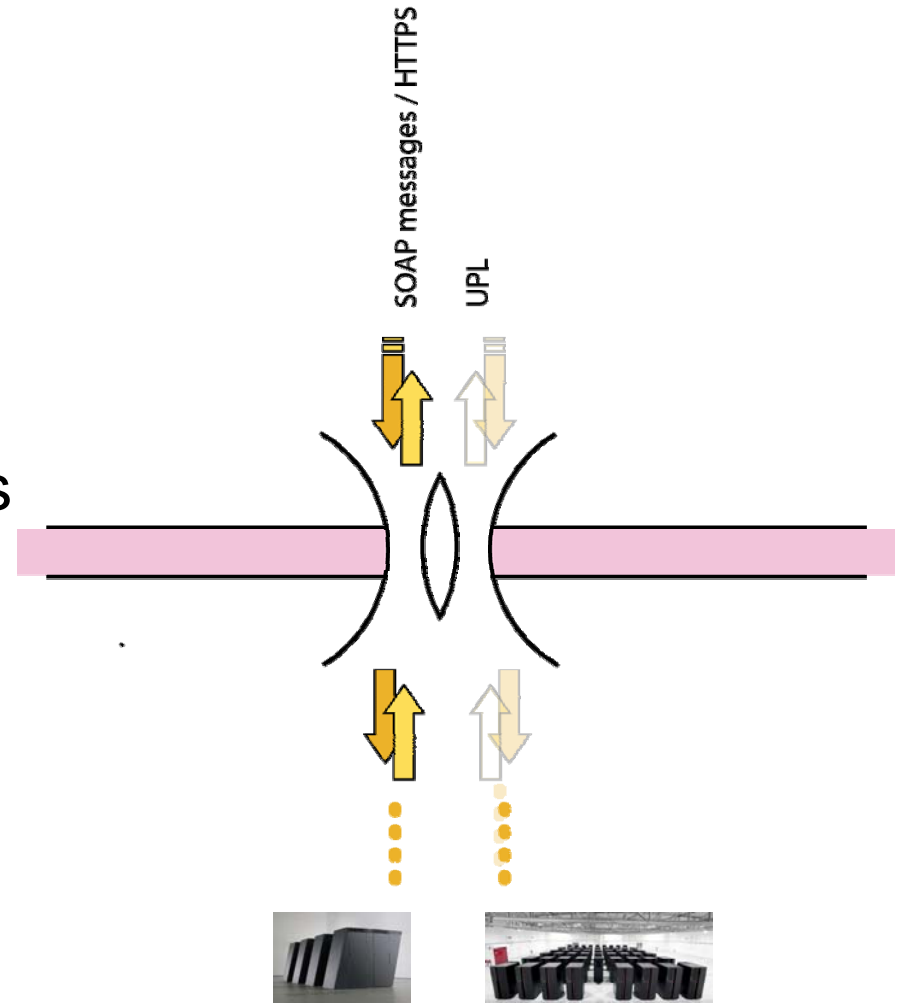


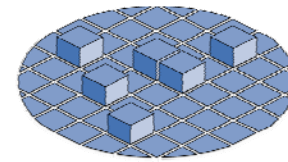
New Gateway of UNICORE 6



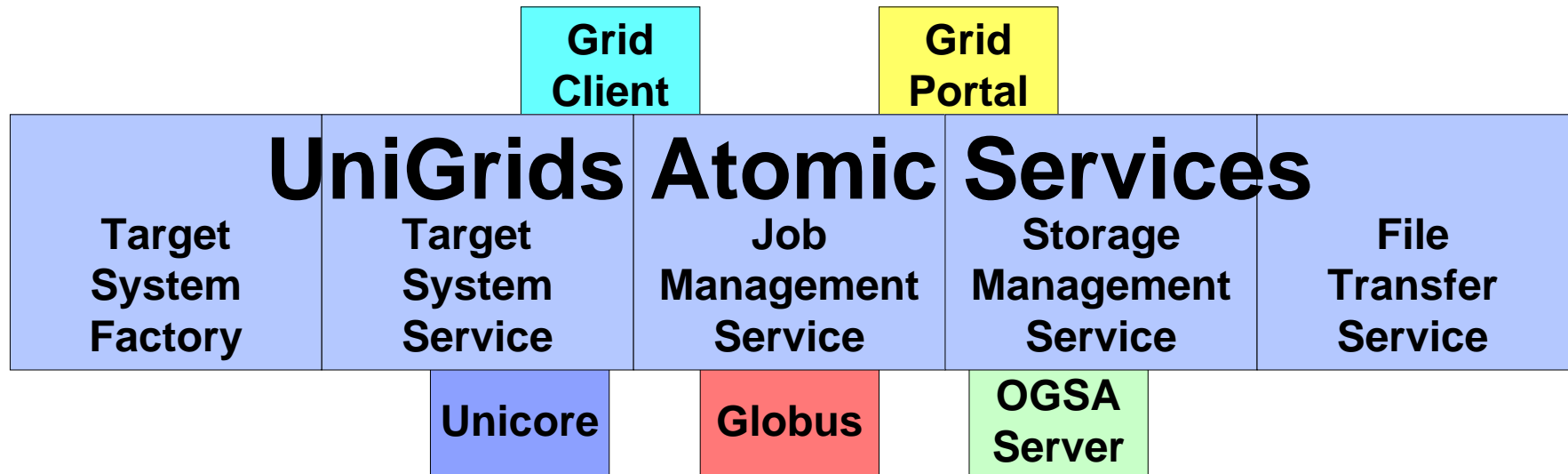
UniGrids

- ▶ Multiple Protocol Support
- ▶ Supports UPL
 - ▶ For Production UNICORE Installations
- ▶ Supports WS-* technologies
 - ▶ WS-Addressing
 - ▶ SOAP messages / HTTPS
- ▶ Retains Unicore Security (!)
 - ▶ Single point of entry
 - ▶ Client Authentication
 - ▶ SSL Connections

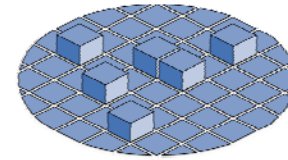




- ▶ Interoperability between OGSA based Grid systems
- ▶ Cross-authentication for UNICORE and Globus



- ▶ Enable cross-Grid resource brokering
- ▶ Workflows over different Grid Systems



UniGrids Atomic Services				
Target System Factory	Target System Service	Job Management Service	Storage Management Service	File Transfer Service

UNICORE and Globus developers



- ▶ Feed in standardisation process of GGF via OGSA Basic Execution Services (BES) Working Group

Job Submission Standards UniGrids

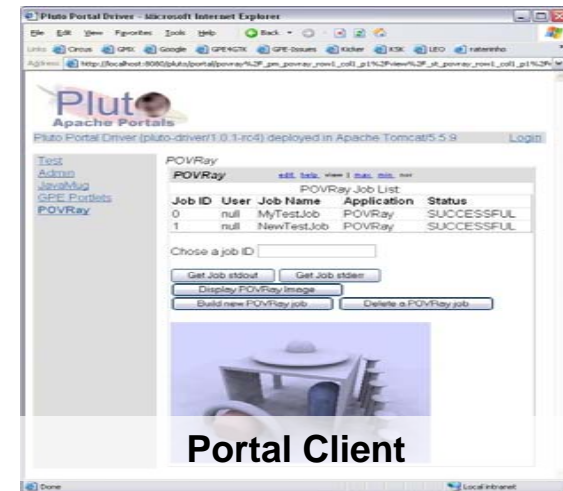
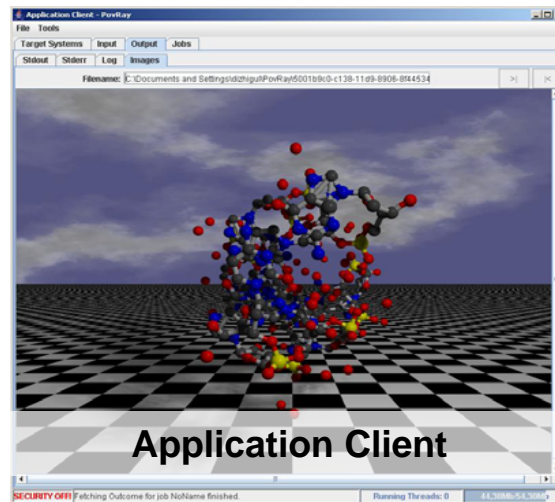
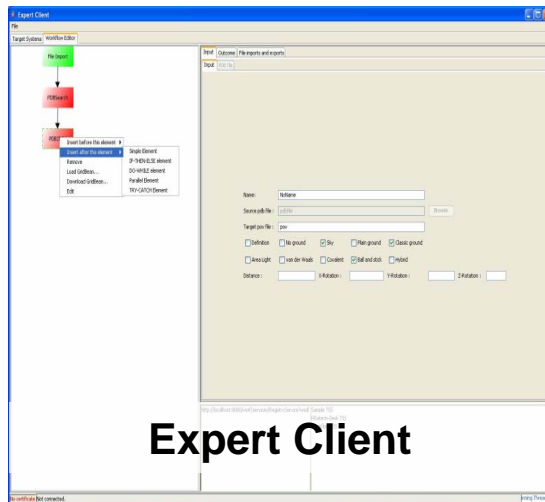
- ▶ OGSA - Basic Execution Services (BES)
- ▶ Unigrids (Uniform Interface to Grid Services)
 - ▶ Developed WS-RF- based UniGrids atomic services (UAS)
 - ▶ UAS: basic interfaces for job/file management in UNICORE 6 alpha

Target System Factory	Target System Service	Job Management Service	Storage Management Service	File Transfer Service
--------------------------------------	--------------------------------------	---------------------------------------	---	--------------------------------------

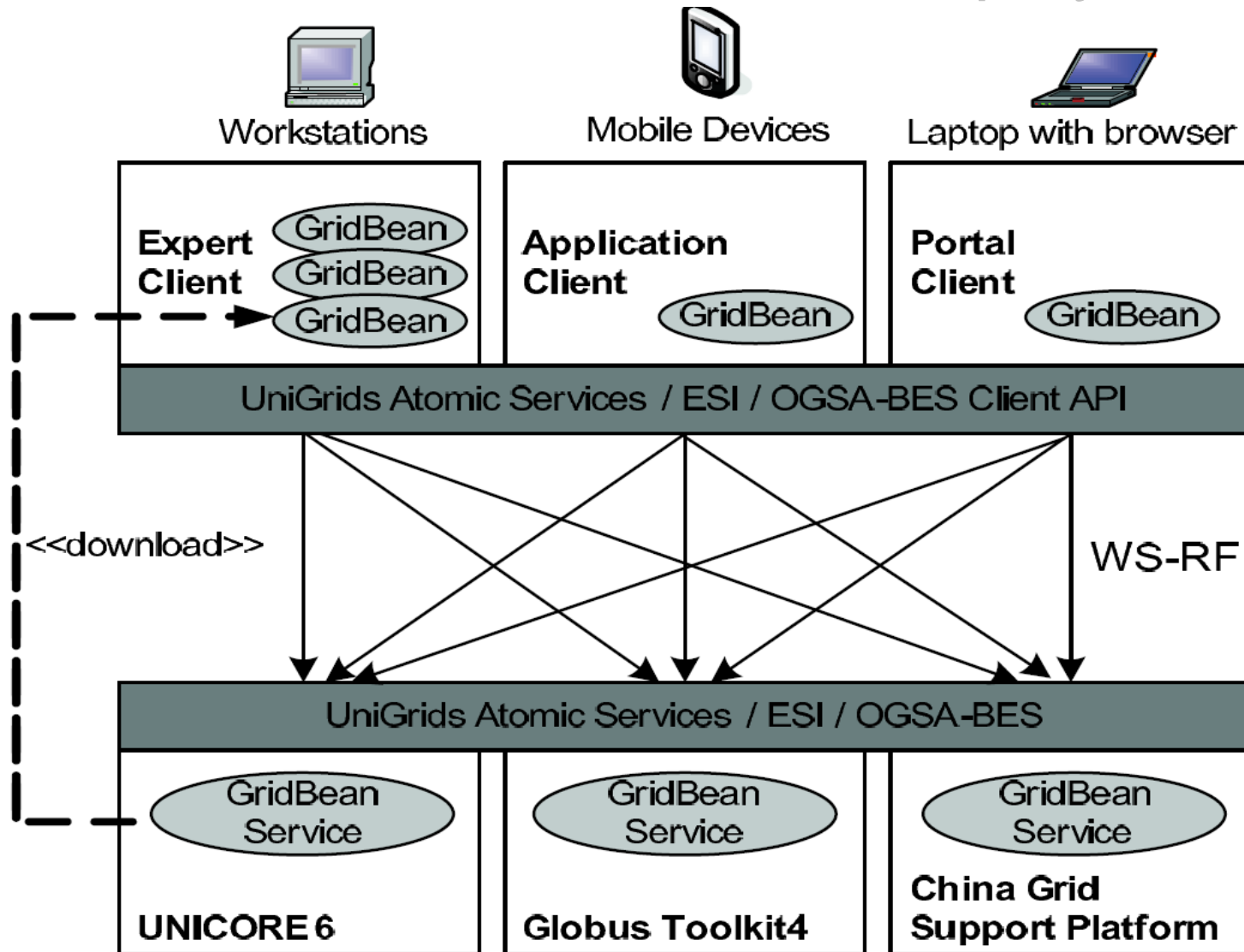
- ▶ Execution Services Interface
 - ▶ Draft by Argonne (Globus) and Fujitsu (UNICORE)
 - ▶ Consists of UAS input and Globus GRAM demands
 - ▶ Input to the OGSA - BES GGF working group
- ▶ Refactoring of UAS when OGSA-BES is revised

Grid Programming Environment (GPE) Clients

- ▶ GPE consists of a set of Grid tools
- ▶ e.g. GPE Client Framework for UNICORE 6
 - ▶ Client-side for UNICORE 6 and other Grid systems
 - ▶ Three different clients for three different usages
 - ▶ GridBeans as scientific-area specific Plugins

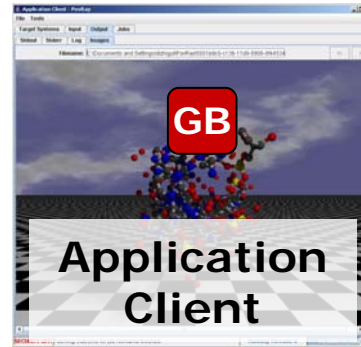
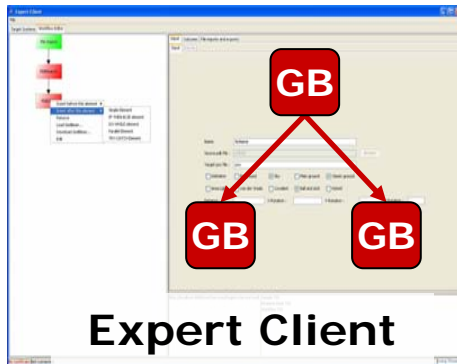


GPE Clients and GridBean Deployments



Portable Clients and GridBeans

GB GridBean

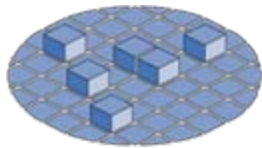


- ▶ GPE Clients work on top of Unicore/GS, GTK4 or ChinaGrid
 - ▶ Only requirement: Atomic Service interfaces
- ▶ GridBeans are portable without modifications
 - ▶ Client API hides underlying infrastructure details

Database Access: OGSA - DAI

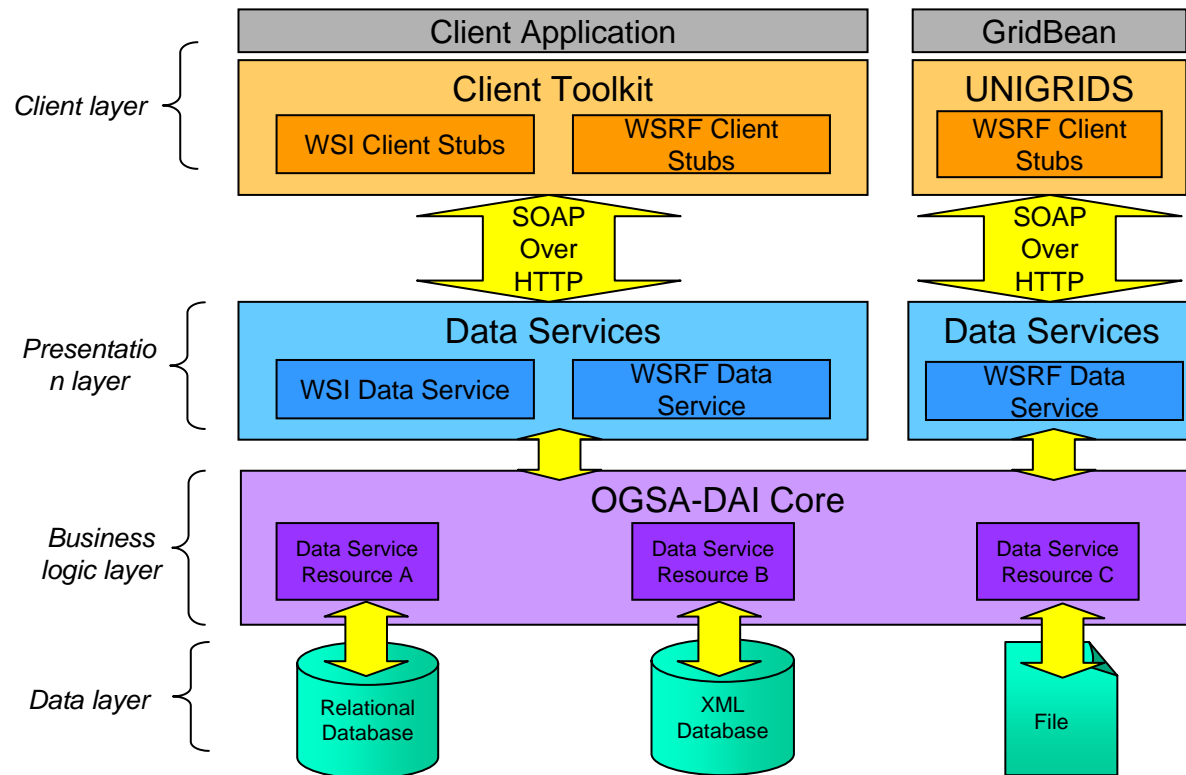
▶ OGSA – Database Access and Integration Services

- ▶ Initially implemented within UniGrids



- ▶ Re-engineering of OGSA-DAI alpha implementation within EU Project OMII - Europe

- ▶ OGSA – DAI services hosted in UNICORE 6



Database Access: OGSA-DAI GridBean



GPE Client - OGSA-DAI GridBean

File Tools

Target Systems OGSA-DAI GridBean Job Outcome Files

OGSA-DAI input

Available data resources:

DataResource

refresh

Run query

Resource info

Service address: <https://stanislaw.studmat.uni.torun.pl:62011/v1/axis/services/ConfigurableDataService>

Version: OGSA-DAI WSRF4UnicoreGS 2.1 (SQL)

Name: DataResource

SQL query:

```
SELECT * FROM littleblackbook LIMIT 5
```

Result:

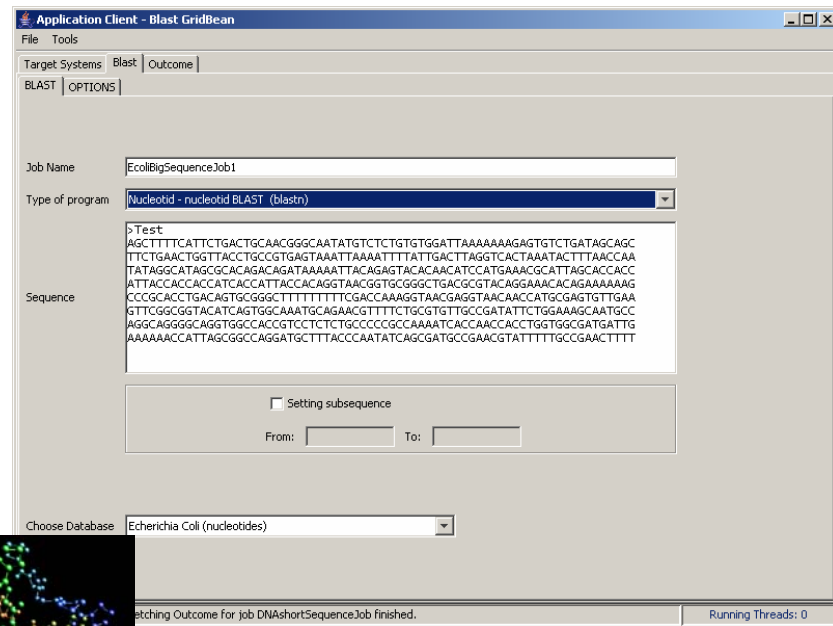
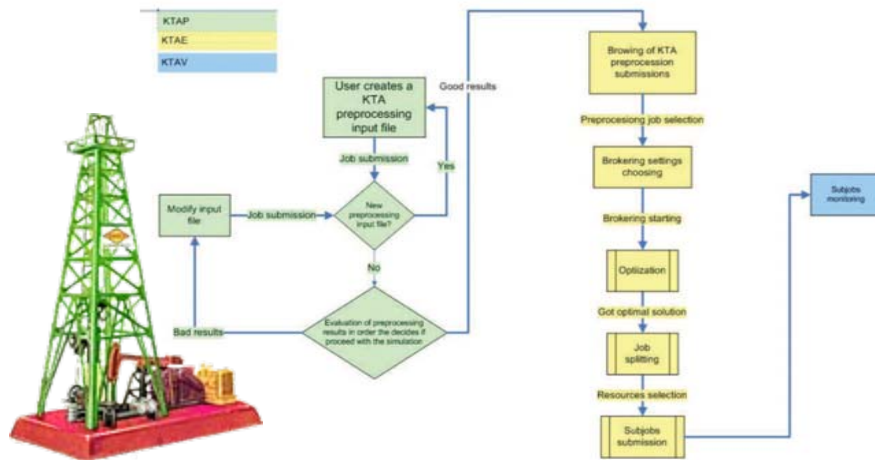
```
<column\value>Aliy Antonioletti</column\value>
<column\value>826 Hume Crescent, Southampton</column\value>
<column\value>016700612448</column\value>
</column\value></column\value>
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</column\value></column\value>
<column\value>38</column\value>
<column\value>Andrew Borley</column\value>
<column\value>354 Jackson Road, Edinburgh</column\value>
<column\value>010570751668</column\value>
</column\value></column\value>
<column\value>48</column\value>
<column\value>Charaka Chue Hong</column\value>
<column\value>750 Pearson Crescent, Southampton</column\value>
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</column\value></column\value>
<column\value>58</column\value>
<column\value>Dave Hardman</column\value>
<column\value>063120546248</column\value>
</column\value></column\value>
```

Query invocation was successful

piotr s. bala/emailaddress=bala@mat.uni.torun.pl Loading GridBean C:\Program Files\GPE4Unicore Client\gridbeans\OGSADAIGridBean.jar Running Threads: 0

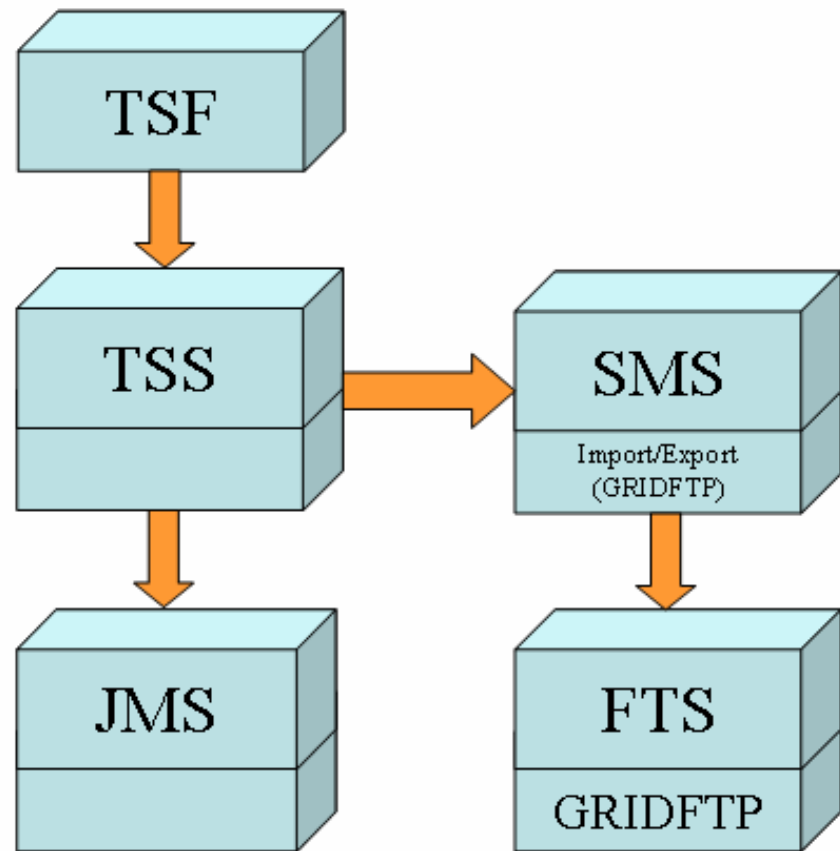
Other Grid Beans for Applications

- ▶ BLAST GridBean used by molecular biology scientists to determine the structure and sequence of DNA
- ▶ KTA GridBeans provide solutions for an industrial application
 - ▶ Application named as the PreStack Depth Migration (PSDM)
 - ▶ Application belongs to the Kirkhoff True Amplitude (KTA) methods class for seismic signal processing
 - ▶ Runs on machines with MPI

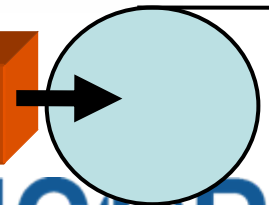


GridFTP File Transfer Service Architecture

- ▶ Client – Server transfers
- ▶ Server – Server transfers
 - ▶ Including SRB
- ▶ GFTS GridBean available for clients



Data Transfer of huge files via GridFTP



Collaborative Visualization & Steering (1)

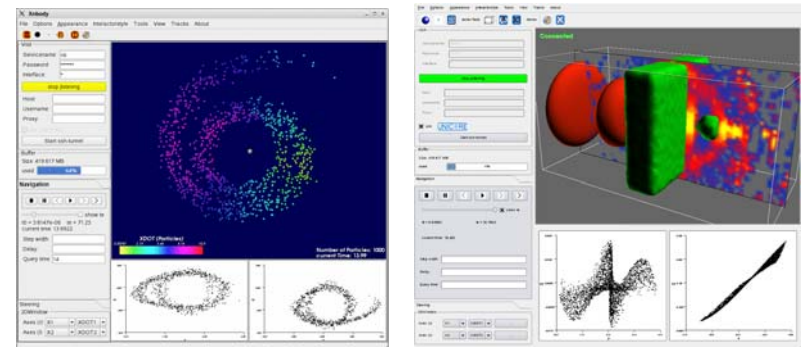
▶ VISualization Interface Toolkit (VISIT)



- ▶ Light-weight library that supports bi-directional data exchange between visualizations and parallel applications
- ▶ Visualisation application acts as a server:
All operations have to be initiated by the simulation
- ▶ SSH Tunnel for using the VISIT protocol for secure communications with short latency (UGSF optionally)

▶ VISIT / GS Family

- ▶ A higher level service family for collaborative visualizations
- ▶ Hosted within the Unicore/GS WS-RF hosting environment
- ▶ Parallel to the atomic services



Collaborative Visualization & Steering (2)

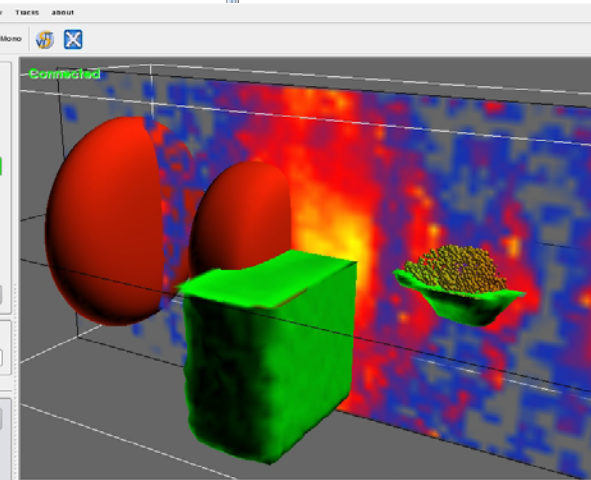
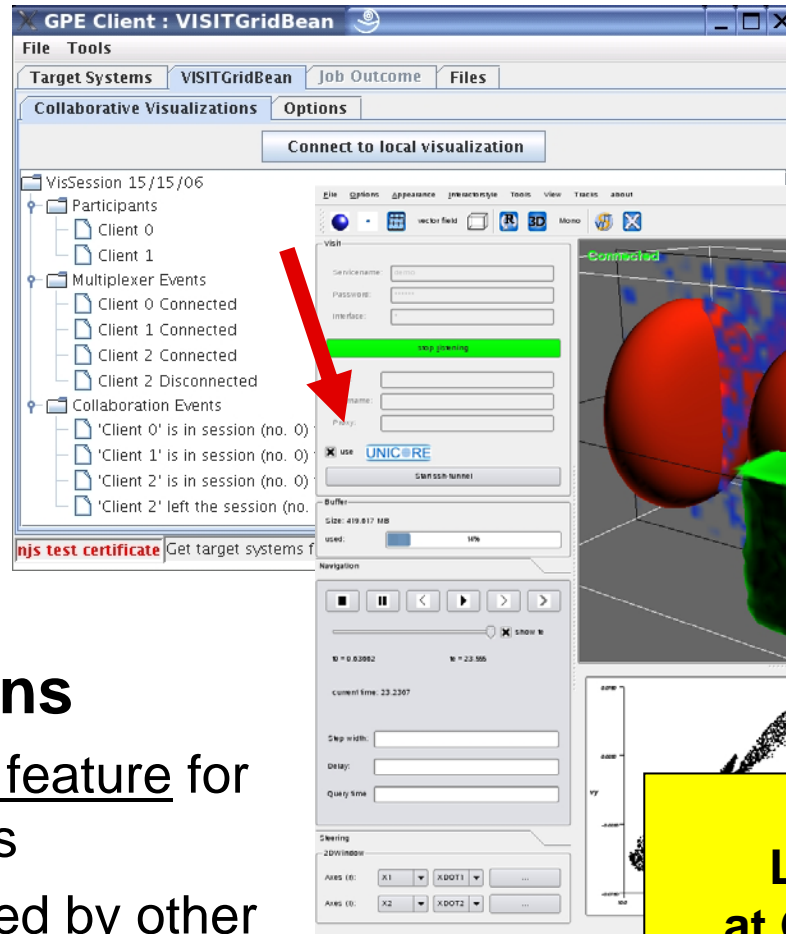


▶ VISIT GridBean

- ▶ Manage participants of visualization sessions via VISIT / GS family

▶ Framework works with all VISIT - enabled applications

- ▶ Unique Unicore/GS feature for interactive scenarios
- ▶ Not naturally provided by other Grid middleware, e.g. Globus, gLite
- ▶ Used in Astrophysics (nBody), Laser-Plasma Physics (PEPC),...



**Life Demo
at Grid Village**

Initial Portal Clients & Services (1)

testAppleta - Mozilla Firefox

Plik Edycja Widok Przejdź Zakładki Narzędzia Pomoc

https://alfred.studmat.uni.torun.pl/PovRayWeb/ Idź

Pierwsze kroki Aktualności Kraj - Gazeta.pl Nowości Toruń - Gazeta Wybo... DZIENNIK INTERNAU...

File Tools

Target Systems POVRayGridBean Outcome: POVRay1

	JobID	Application	State	TerminationTime
localhost	POVRay1	POVRay	SUCCESSFUL	06.07.06 14:00
stanislaw.studmat.uni.torun.pl	No1	hostname	SUCCESSFUL	06.07.06 14:01

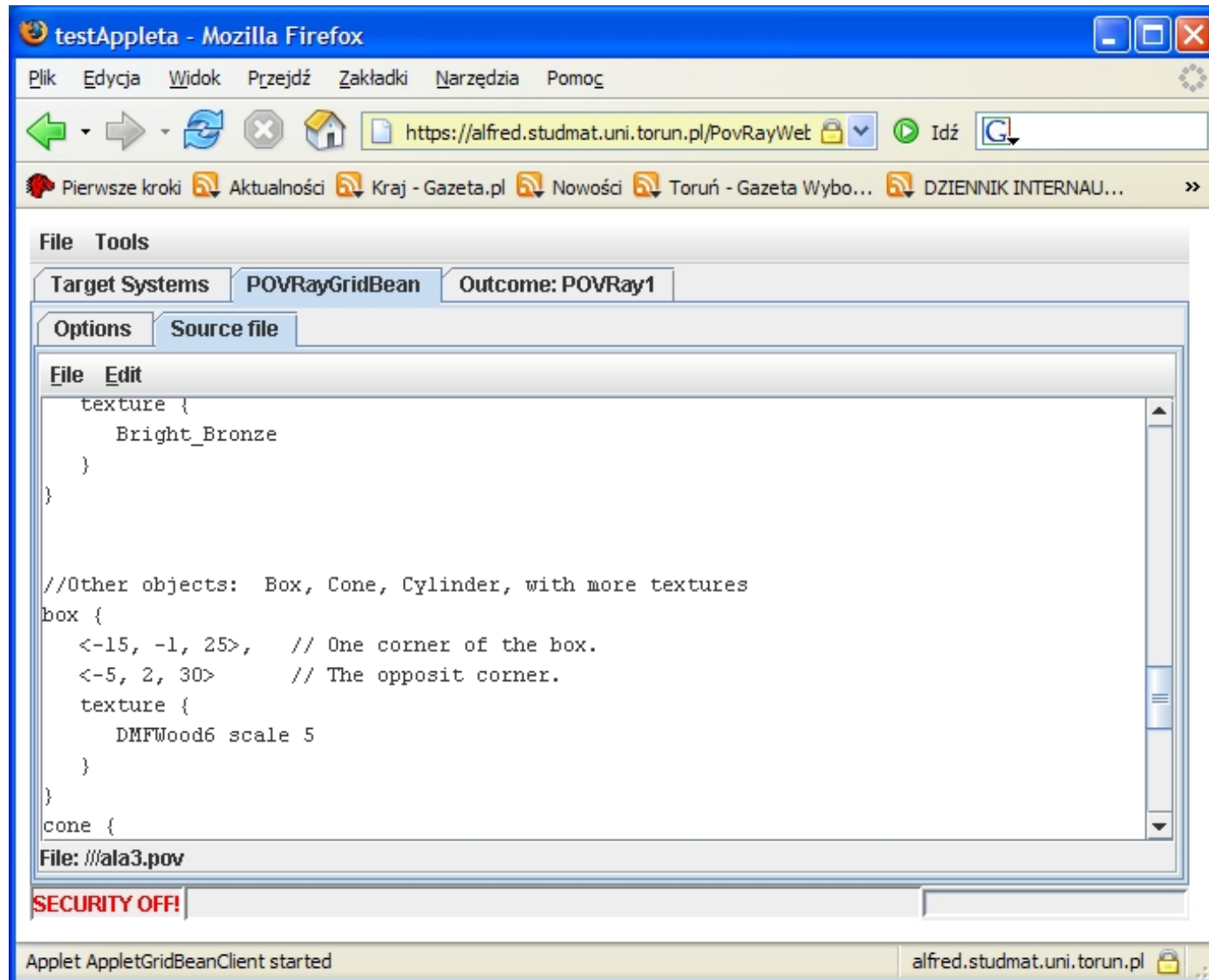
stanislaw_unicoregs

SECURITY OFF!

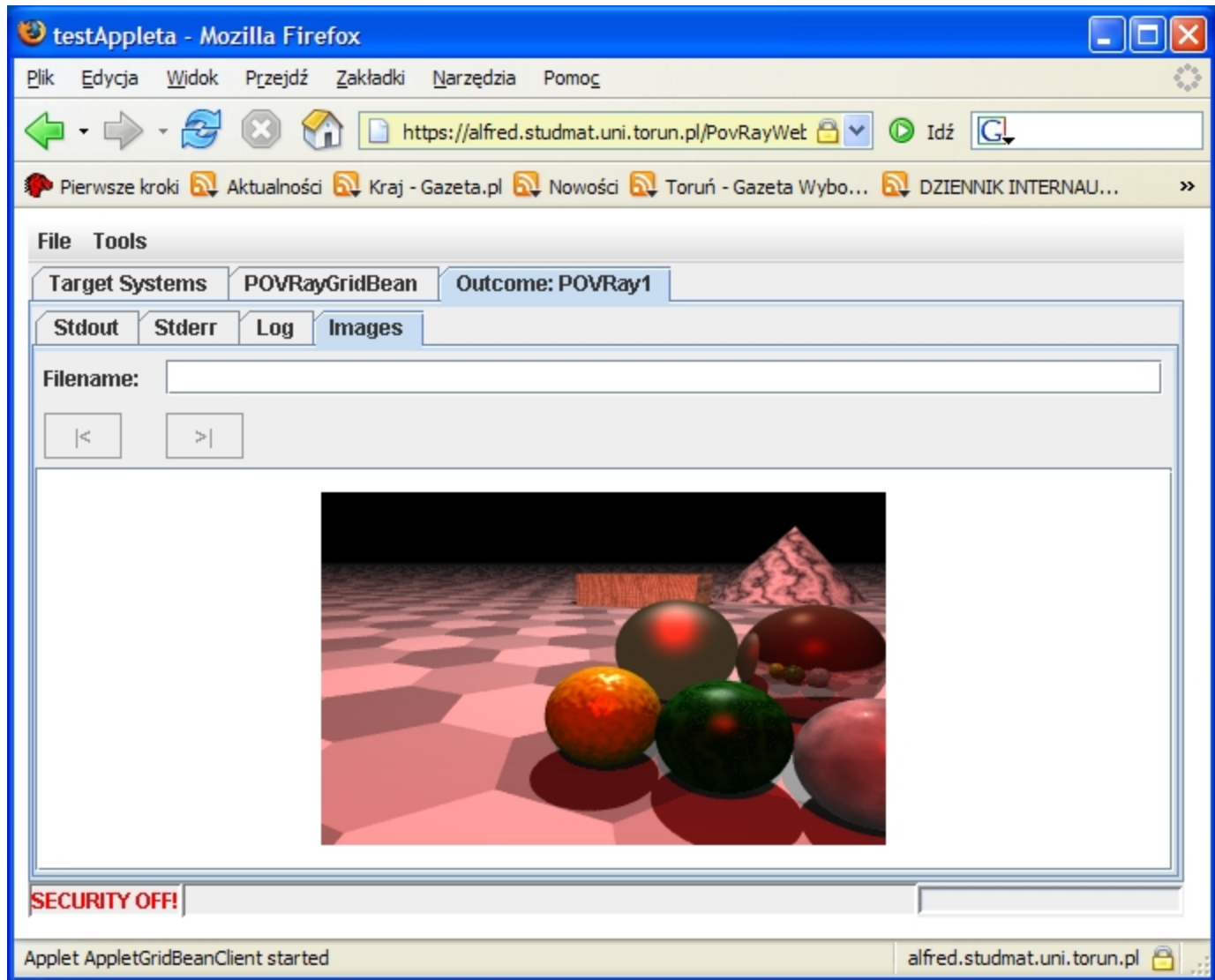
Applet AppletGridBeanClient started

alfred.studmat.uni.torun.pl

Initial Portal Clients & Services (2)



Initial Portal Clients & Services (3)



Roadmap to UNICORE 6 Production Quality

- ▶ New infrastructure based on Web services
 - ▶ OGSA-based and WS-RF-compliant
 - ▶ Heavily committed to Open Standards from GGF & OASIS
 - ▶ Various useful and modern higher level services (e.g.streaming)
- ▶ Alpha was released at the end of July 2006
 - ▶ <http://unicore.sourceforge.net>
 - ▶ TBD: Name des Bundles!
- ▶ Beta in July 2007
- ▶ Final in End 2007 (production quality)

Some Future Developments

- ▶ Improving the knowledge oriented scientific/industrial workflow capabilities & usability



- ▶ Improving the maturity of atomic and higher level services

- ▶ Job Submission → OGSA - BI
- ▶ Data Access → OGSA – DAI
- ▶ Accounting → RUS and UR
- ▶ VO Management → VOMS
- ▶ Portals → GridSphere



- ▶ Improving Interoperability & Interoperation with other Grid systems



UNICORE OPEN SOURCE

► <http://unicore.sourceforge.net>

► Open Source under BSD license

► Ready-to-use for research and industry

► Strong security

► Easy installation & configuration

Configuration	Install	Quit
Gateway	Host	zam285.zam.kfa-juelich.de
NJS	Vsite Name	Fermat
TSI	NJS-Gateway-Port	3826
IDB	Admin Port	3956
UUDB	Trusted CAs	/cert/projects-ca-fz-juelich
	Identity	/unicore/njs_identity.p12
	Password	*****
	Installation Dir	/unicore
	java	/usr/bin/java
	perl	/usr/bin/perl
	Logging Level	Configuration
	Keep Uspace	false
	Operation Mode	full
	Gateway SSL	false
	NJS SSL	true
	Memory	remember
	Save completed AJO	false
	Change Log Files	24
	TSI Worker Limit	5
	TSI Update Interva	5000
	Thread Incarnation	3
Configure UNICORE -- Press Alt + <key> for menu entries		

UNICORE OPEN SOURCE

► <http://unicore.sourceforge.net>

- Academic support by FZJ
 - Integration of own results and from other projects
 - Release management
 - Problem tracking, assistance
 - CVS, Subversion, mailing lists, docs

- Viable basis for many other projects



An easy Way to Access grid REsources



UNICORE FORUM

- ▶ Founded by developers, leading EU HPC centres, and supporting hardware vendors as a non-profit association
- ▶ Foster the distribution and use of UNICORE, organize workshops, support presentations at conferences, publish and maintain the specifications, coordinate further development, certify implementations and extensions

intel.



RWTH AACHEN UNIVERSITY

sgi

NEC

Platform

RZG
Rechenzentrum - Garching

NCAR



CINECA
Consorzio Interuniversitario

PC²
PADERBORN
CENTER FOR
PARALLEL
COMPUTING

FUJITSU
COMPUTERS
SIEMENS

FUJITSU

Technische
Universität
Dresden

Fraunhofer
Institut
Algorithmen und Wissen-
schaftliches Rechnen

SCAI

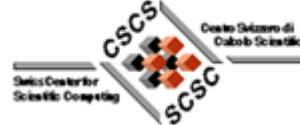
Fraunhofer



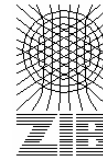
R|R|Z|N|



H L R I S





IBM



T-Systems

UNICORE

Summary

- ▶ UNICORE is a Grid System from Europe, is open-source and is used in production worldwide (e.g. DEISA)
- ▶ UNICORE 6 base upon OGSA concepts 
- ▶ Emerging standards such as WS-RF implement OGSA
- ▶ UNICORE 6 is compliant with the WS-RF OASIS Standard
- ▶ UniGrids Atomic Service as basic set for job management
- ▶ UniGrids Atomic Service contribute to ESI & OGSA-BES 
- ▶ UNICORE 6 massively commits to emerging Grid standards
 - ▶ OASIS WS-RF&WSN, GGF JSDL, W3C WS-Addressing
- ▶ **UNICORE OPEN SOURCE** ... under BSD license
- ▶ **UNICORE FORUM** ... supports activities after projects
- ▶ **UNICORE SUMMIT** ... to meet the UNICORE community

UNICORE SUMMIT



**VISIT THE
GRID VILLAGE
UNICORE BOOTH**

- ▶ <http://summit.unicore.org/2006/index.html>
- ▶ <http://summit.unicore.org/2005/index.html>