GRIP: the Evolution of UNICORE Towards a Service Oriented Grid

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Outline

- Introduction
- Web/Grid Services
- Project GRIP
- UNICORE
- Architectural evolution
- Summary

Motivation

Today: "I need a Grid *Service*" -> "I deploy a Grid *System*"

Future: "I need a Grid *Service*" -> "I deploy a Grid *Service*"

- **Usage**: Deployment time vs. usage time ratio is unacceptable (days vs. Hours?)
- **Boundaries**: Virtual Organisations (VOs), within VOs (different CAs, ...), Grid systems (including protocols, ...)
- **Market**: Move from batch model to a service/market-oriented approach (Web Services, OGSA, Business Grid, ...)

Next Generation Grid Wishlist

- Transparent and reliable
- Open to wide user and provider communities
- Pervasive and ubiquitous
- Secure and provide trust across multiple administrative domains
- Easy to use and to program
- Persistent
- Based on standards for software and protocols
- Person-centric
- Scalable
- Easy to configure and manage

Taken from “Next Generation Grid(s)”, European Grid Research 2005 – 2010, Expert Group Report

So does a Service Oriented approach help to fulfil this ?

Integration of Web Services: Lots of talk about paradigm shift, but maybe it's true ...

- Currently: custom protocols, layered often closed architectures.
- With WS/GS: Distributed, open architecture - ***Standardised Grid protocols, in a web services framework***

Challenges

Service detection, orchestration, dynamic federation, semantic grid ... and still the old: languages, interoperability, ...

Web/Grid Services

Designed for loosely-coupled distributed computing

WSDL – service description, **SOAP** – service invocation

Extensible SOAP Header carrying supporting information

Security : WS-Security (XML-Certificate, XML-Encryption)

Routing : WS-Routing, **Community security** : SAML, XKMS

OGSI

- ***stateful*** web services
- OGSI provides ***service data*** – remote instance variables for web services
- Construction of interfaces from other interfaces – ***interface inheritance***

The *Gr*id *I*nteroperability *P*roject

… to realise the interoperability of **UNICORE** and **Globus** and to work towards standards for interoperability at the Global Grid Forum

- Development of an interoperability layer between the two Grid systems
- Interoperable applications
- Contributions made to the Global Grid Forum
- UNICORE towards Grid Services

www.grid-interoperability.org

www.unicore.org

Partners

Two year project funded by the E.U. with the following partners :

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

Project completes March 2004.

UNICORE today

- Full control over the jobs through a graphical user interface.
- Multi-system and multi-site jobs with UNICORE synchronising the jobs and staging data
- Secure & co-operates well with firewalls
- Abstraction of system functions, commands, and user actions to achieve system and installation independence. Software Resources. Plugins
- Retain full administrative autonomy at participating centres

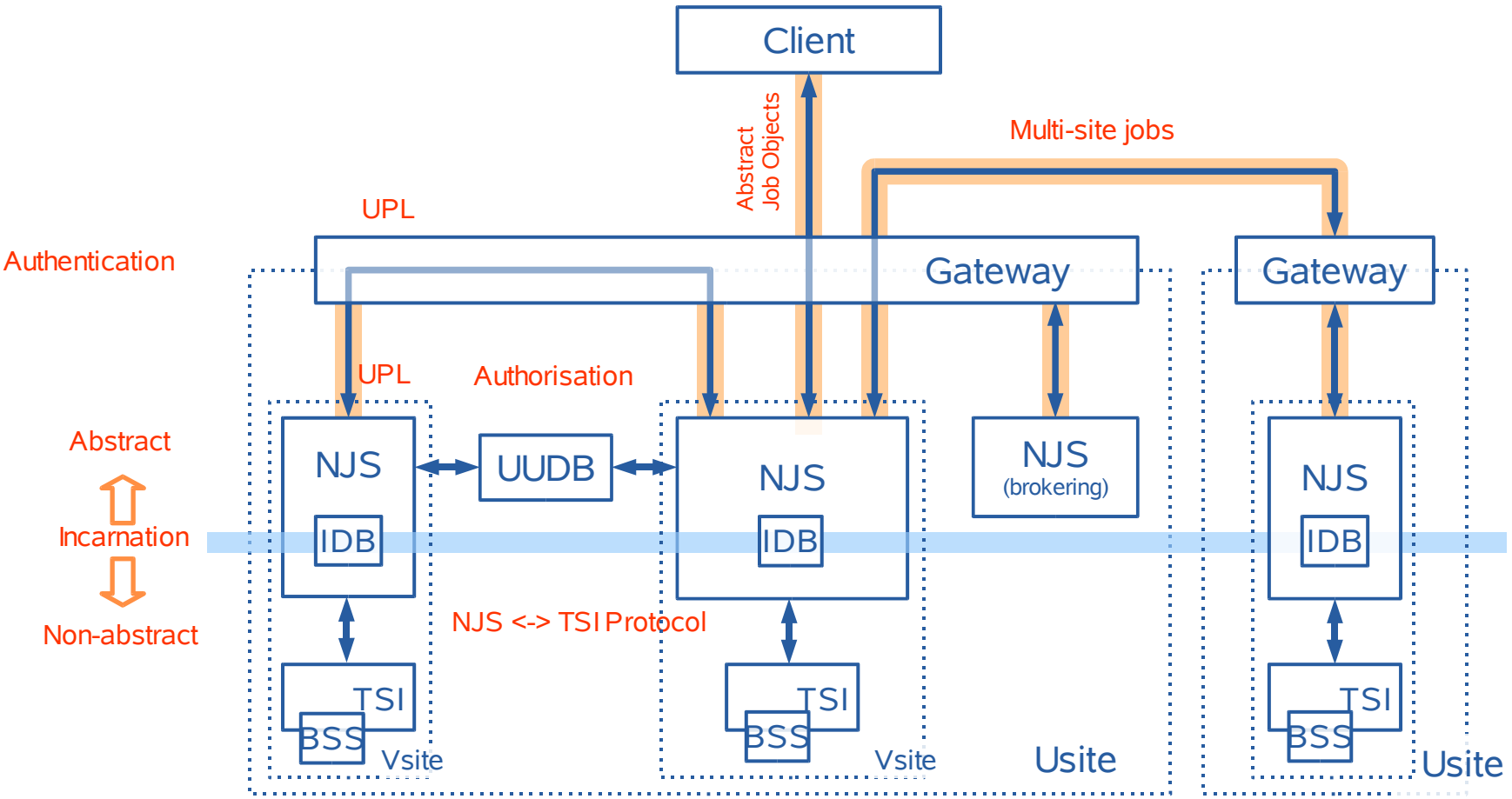
What about the cons ??

- More difficult to use it as the basis for exotic Grid applications/services.
- Lack of delegation –> some restrictions

Technical points and issues

- Vertically integrated architecture
- Security based on X509 certificates and ssl. No delegation
- Java based, although Perl sometimes used for target systems
- Abstract Job Object (AJO)
  - Carries a ***workflow*** of jobs
  - Jobs described in an ***abstract*** form
  - Workflow can also contain some ***control*** constructs

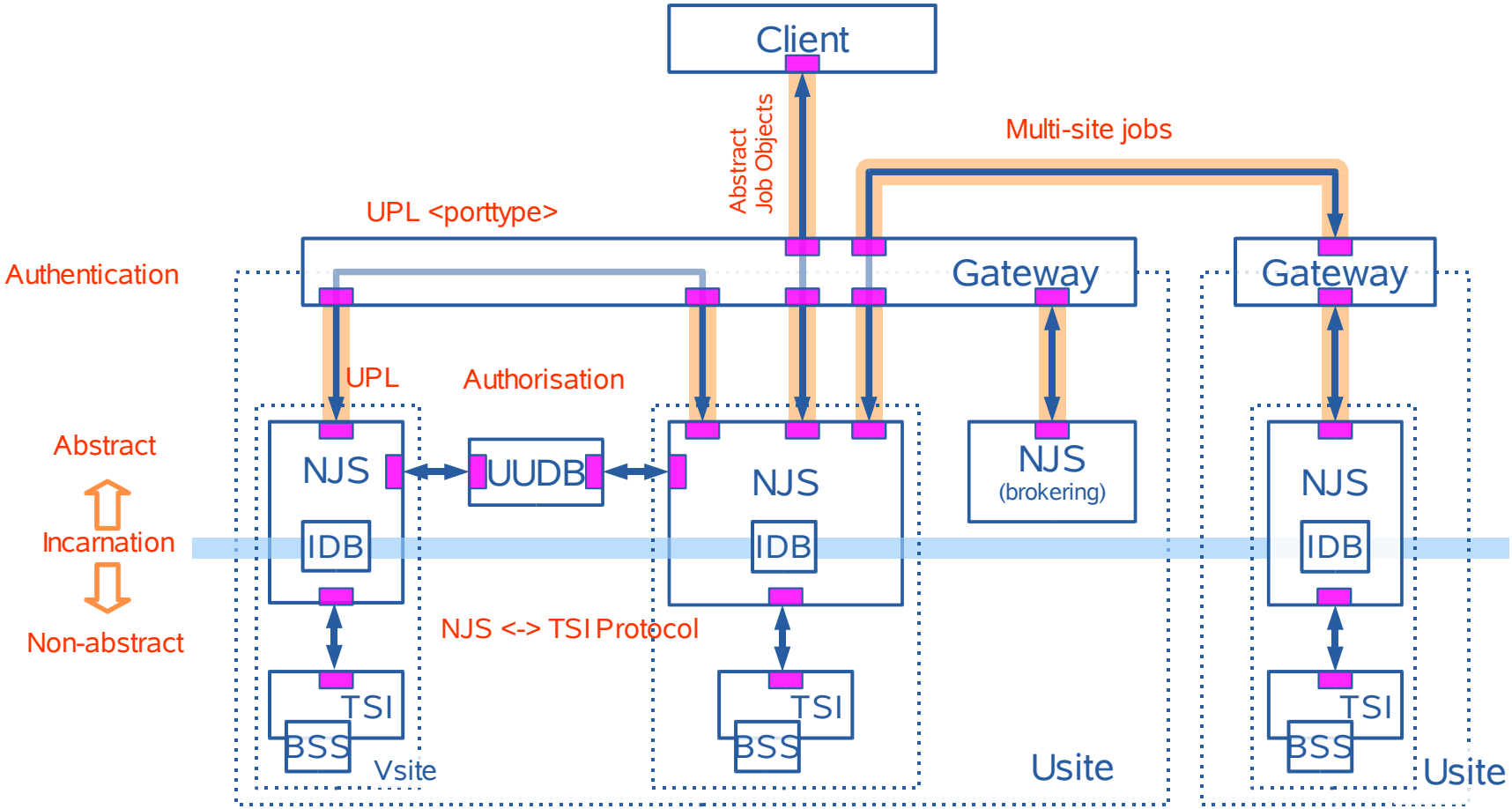
UNICORE Architecture



TSI – Target System Interface
NJS – Network Job Supervisor
IDB – Incarnation Database
UUDB – UNICORE User Database
Usite – UNICORE site
UPL – UNICORE Protocol Layer

Indicates SSL transport

Architecture proposed during the GRIP Project



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Grid/Web service <porttype>

Existing and proposed <porttypes> ...

UPL <porttype> ✔

consignment of jobs

retrieve outcome

list of Vsites

IDB <porttype>

incarnation, site specific, software resources data

exposed as service data (?)

Broker <porttype>

making functionality of the GRIP broker available as a Grid service

NJS-TSI (Job Manager) <porttype>

executing incarnated 'atomic' jobs

including file staging functionality

UUDB <porttype>

read only authorisation decisions (using SAML?)

separate porttype for administration

Architecture comparison

UNICORE

vertically integrated architecture

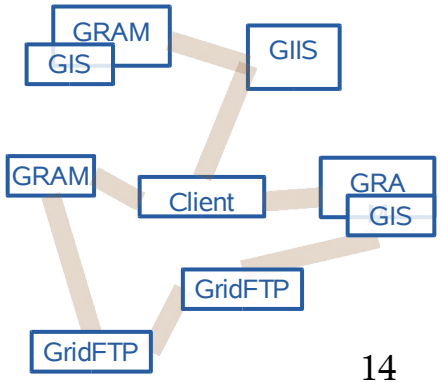
'traditional' 3-tier architecture fits better for deployment in a 'regular' environment.

- grouping of Vsites arranged into Usites and a UNICORE grid consists of a collection of Usites.

Globus

dispenses with 'infrastructure' components. It operates on a “node-to-node” basis, and assumes that each machine is directly accessible.

- groupings of nodes to create VO structures.



Security

Biggest influencing factor on the design of Grid architectures ?

Providing a delegation mechanism for a resource to access another resource *on behalf of a user* is both challenging and controversial

Lots of **web service security** specifications :

- SOAP header is extensible to support security, routing, policy, etc
- Message-level security
- Multiple signatures on a document describing a workflow

Virtualisation and Job Abstraction

GRIP
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Software resources

- Applications as services, not via scripts

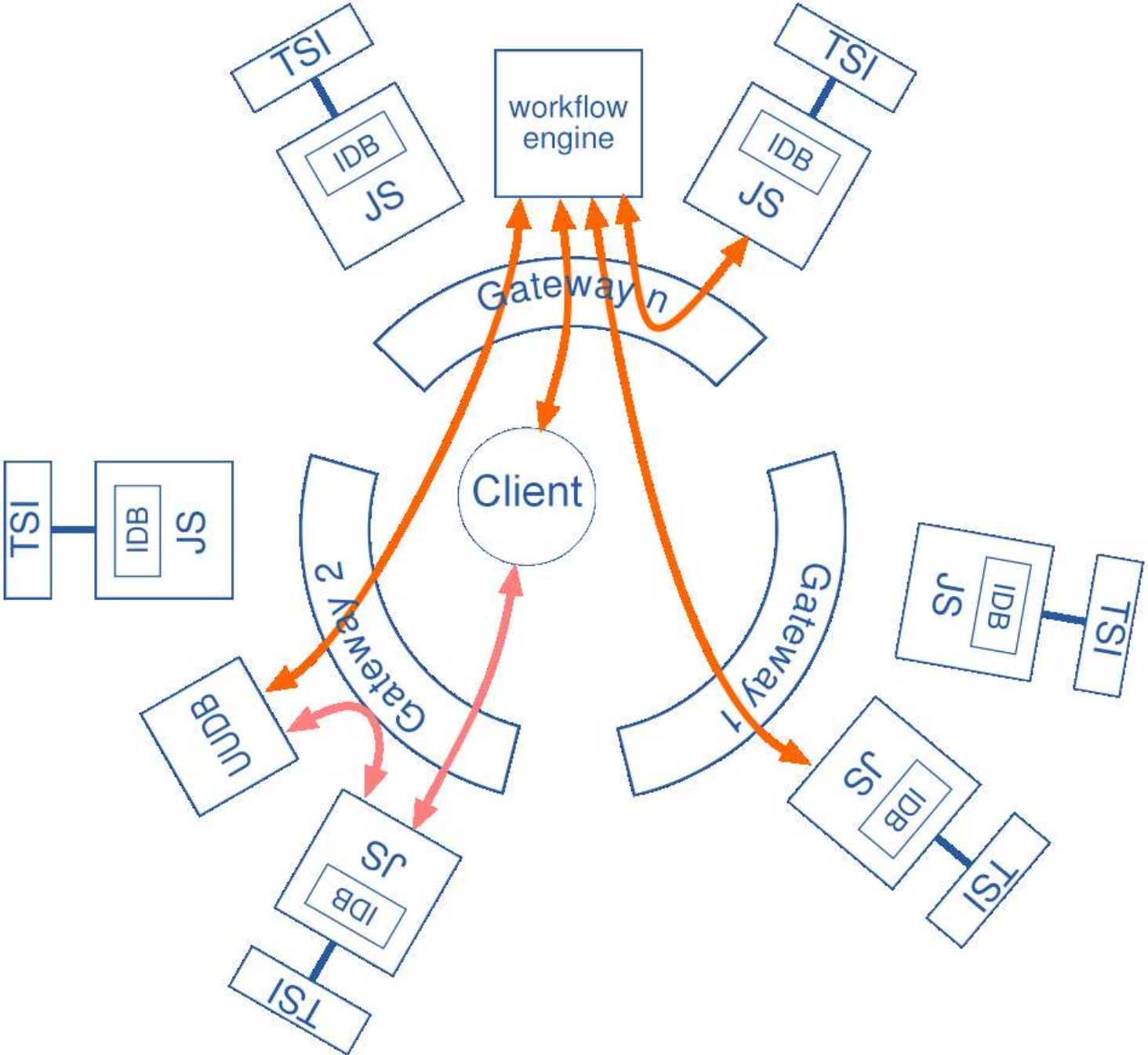
Already exists in UNICORE. Implement as web services

- Derive a new 'software resource' porttype exposing the contents of the Incarnation Database (IDB) as service data
- Use operation extensibility of OGSI to parametrise the request of the software resource

A possible evolution

- A Grid comprising of distributed services
- **Virtualisation** - the UNICORE software resource concept maps to application specific web services
- Interoperability between different Service providers
- **Dynamic higher level services** built out of other services. Job workflow, for example, but also viewing security, authorisation, etc, as services, from which other aggregated services can be built

UNICORE Architecture from another perspective



Status of standardisation work

Most work taking place at the Global Grid Forum

Some interesting working groups :

OGSA : documentation of requirements, functionality, priorities, and interrelationships for OGSA services

CMM : define a Common Management Model and a set of OGSI porttypes for the standardised management of resources and services

OGSI-Agreement : agreement negotiation for the usage of services according to policy

OGSA-Sec : grid service security framework

GridIR : information retrieval system on the OGSA Grid - document collection management, indexing/searching, query processing

Summary

- Using web services is a natural direction for UNICORE project to take, and a sound move for the future
- With the advent of OGSA, we view *interoperability in a broader sense and not just interoperability with Globus*
- A Grid composed of services from multiple (including non-UNICORE) services
- Service aggregation to build the functionality needed

Forms the basis of the current work in GRIP.

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Questions & comments ?

www.grid-interoperability.org

www.unicore.org

www.unicorepro.com