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# **Grid Interoperability: Joining Grid Information Systems**

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# Outline

- Need for Interoperability
- Interoperability Status
- Information Systems
- Information System Interoperability
- Conclusions



# Motivation

- **Grid projects, with regional** character, create “islands”
- “**Bridges**” between islands **required** in many cases, e.g.:
  - production for LHC has already started, demand will increase with LHC startup in 2008
  - thousands of scientists, hundreds of institutes spread all over the world participating in different grids
  - **goal: overcome separation** of production / processing / storage / ... caused by artificial grid boundaries
- **Interoperability** aims at seamlessly connecting different grid infrastructures and enable global resource sharing



# Participating Grid Infrastructures

- The Grid Interoperability Now (GIN) Group in OGF is **focusing** on interoperability between the the following grid **infrastructures**:

Project	Description
<b>EGEE</b>	EU-Project for scientists, in particular for the LHC
<b>OSG</b>	infrastructure for scientists in the USA
<b>NDFG</b>	infrastructure for scientists in the nordic countries
<b>Teragrid</b>	collaboration of nine large computing centres in the USA
<b>NAREGI</b>	national Japanese Grid project
<b>PRAGMA</b>	universities/institutes in Asia, Australia and the Americas
<b>DEISA</b>	collaboration of national supercomputing centres in Europe
<b>NGS</b>	infrastructure for researchers in the UK
<b>APAC</b>	national Australian Grid for research



# Interoperability Goals

- **long-term goal:** establish **universal protocols** and formats (like HTTP and HTML for the world wide web)
  - cannot be imposed on different grid projects, have to **start** small: **bi-/multilateral interoperability** initiatives
- goals:**
- proof-of-concept for future standards
  - production-ready solution for the present
- the **Grid Interoperability Now (GIN)** group is trying to build upon these initiatives



# Bilateral Interoperability Activities

- **LHC use case** requires as first step that EGEE, OSG and NDGF act as one infrastructure
- **EGEE / OSG** interoperability is successful (2005):
  - Today, a job submitted by a user e.g. via an EGEE interface may be processed at an OSG site without the user even noticing
- **EGEE / NDFG** in advanced stage
  - Working on interoperability since summer 2005
- **EGEE/NAREGI**
  - First steps and proof of concept done



# GIN

- **Grid Interoperability Now (GIN)** activities started in summer 2005
- **aim:**
  - support & learn from **bilateral activities**
  - initiate new interoperability projects
  - long term: **multi-grid interoperability, standardization**



# GIN Activities

- **GIN activities** focus on the following **corner stones**:
  - **Security Model**

GSI (based on X.509) already a quasi-standard  
VO Management System (VOMS), not yet used by all  
infrastructures
  - **Computing Interface**

Many different types of job submission interfaces  
and ways of job description
  - **Storage Interface**

Storage Resource Management (SRM) with gridFTP is  
widely used, but in several different versions
  - **Information System**



# Information System (IS)

- **main tasks:**
  - service discovery
  - service selection
  - service monitoring
- **jobs can only be pushed to adequate resources by using the information retrieved & indexed by the IS**



# MDS

- Initially most grids deployed **MDS 2** (Metacomputing Directory Service) from the **Globus Toolkit**
- **MDS Contains:**
  - Information Provider: obtains information about local services
  - GRIS (Grid Resource Information Services): executes the IP
  - GIIS (Grid Information Index Services): queries registered GRIS
- **Data model:** based on LDAP

# The Different Systems

- **MDS did not meet the scalability and robustness requirements for large scale-production grids**
  - Grid projects modified or replaced it

PROJECT	CONNECTION PROTOCOL	SCHEMA	DATA MODEL
EGEE	LDAP	GLUE	LDIF
NDGF	LDAP	Nordugrid	LDIF
TeraGrid	WS-RF	GLUE	XML
NAREGI	WS	CIM+NVE	XML
OSG	LDAP	GLUE	LDIF
PRAGMA	WS	WebSIM	XML
DEISA	WS	GLUE	XML
NGS	LDAP	MDS	LDIF
APAC	LDAP	GLUE	LDIF

**Schema:** defines mandatory and optional entries for a site to publish



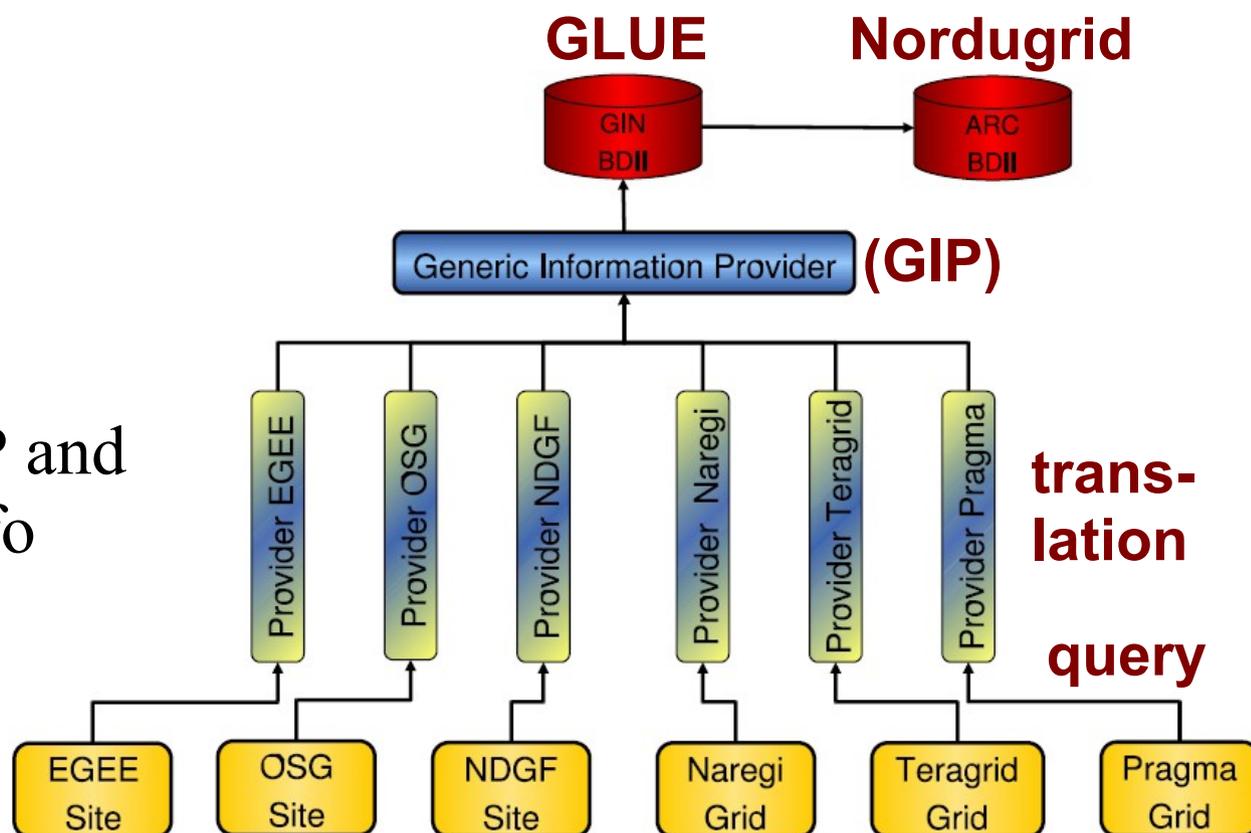
# Information System Interoperability

- **tasks for information exchange between grids:**
  - **set up a communication channel** (setting up an environment such that one can query the IS of the other)
  - **translation** (schema1, format1 → schema2, format2)
- **EGEE/OSG**: done, tested successfully in production
- **EGEE/NDGF**: done, tested for simple use cases
- **EGEE/Naregi, EGEE/Teragrid, EGEE/PRAGMA**: at least prototype completed, first simple use cases

# GIN BDII

- **Architecture** used:

- The **Information Providers** for the different grids are plugged into the GIP and deliver translated info
- **GIP** populates a **database** with info in **GLUE schema**



- the database (GIN-BDII) can be queried via ldapsearch
- the info is also transferred to the **ARC-BDII** where it is translated into the **Nordugrid schema**



# NDGF Information Provider

- **Example: Information Provider NDGF**
  - **query** a web page for the most recent **list of the NDGF GIIS**
  - parallel **queries** (ldapsearch) to all these **NDGF GIIS**
  - **translation** of the query result from Nordugrid schema LDIF to GLUE schema LDIF
  - write information to one temporary file per GIIS
  - **add values missing** in Nordugrid schema from a static file (e.g. GlueSiteLocation)
  - **return all the information**



# Problems

- **Encountered Problems:**
  - **mapping is not 1:1**, no unique solution – large scale-testing is needed to identify problems, optimize solutions  
e.g.: at entity level, GlueSite, GlueCluster, GlueSubCluster & GlueCE correspond to nordugrid-cluster & nordugrid-queue
  - **some entries don't exist in one schema**—have to be hard-coded  
e.g.: GlueSiteLocation (City, Country) & GlueSiteLatitude/Longitude (geographical coordinates), while the Nordugrid schema only offers a postal code  
most missing entries are grid project-specific and not essential
- Working **solutions** have been **found**, but **need to be tested in a production environment**





# Conclusions

- **Information system interoperability is possible**
- **GIN-BDII** already provides information according to the GLUE schema for various grid projects.
- **Some problems encountered with mapping**
- Different schemas are the limiting factor for interoperation
- The **standardization** of a common schema is required
- Note: Since this work, the Glue Schema activity is now an official OGF working group



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