



Enabling Grids for E-science

Grid Interoperability and Interoperation

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- **Interoperability:**

“The ability to exchange information and to use what has been exchanged”

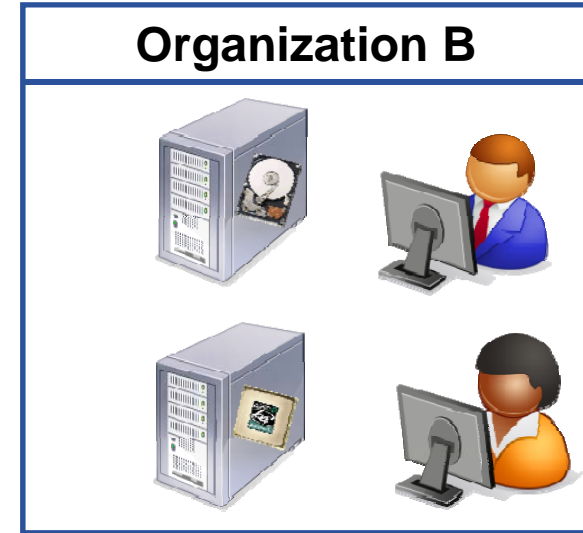
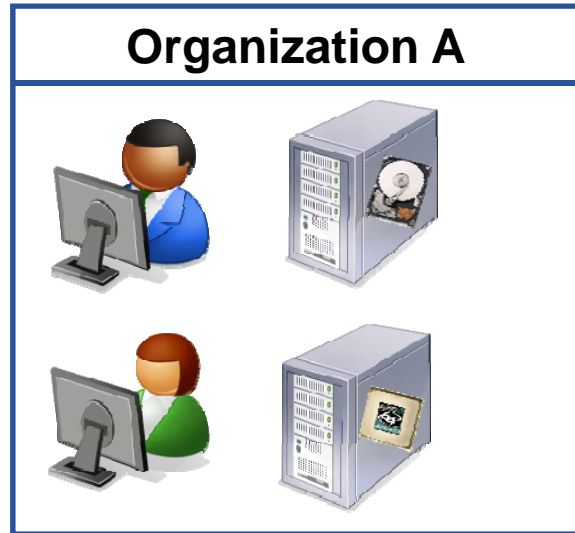
(software)

- **Interoperation**

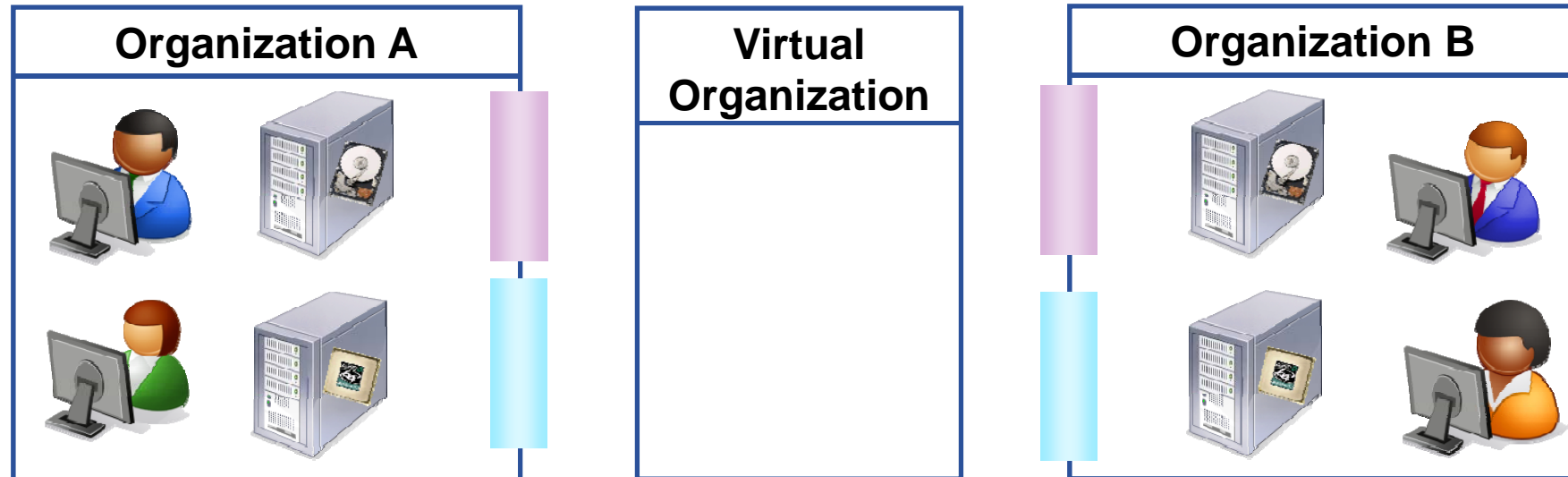
“The use of interoperable systems“

(Infrastructures)

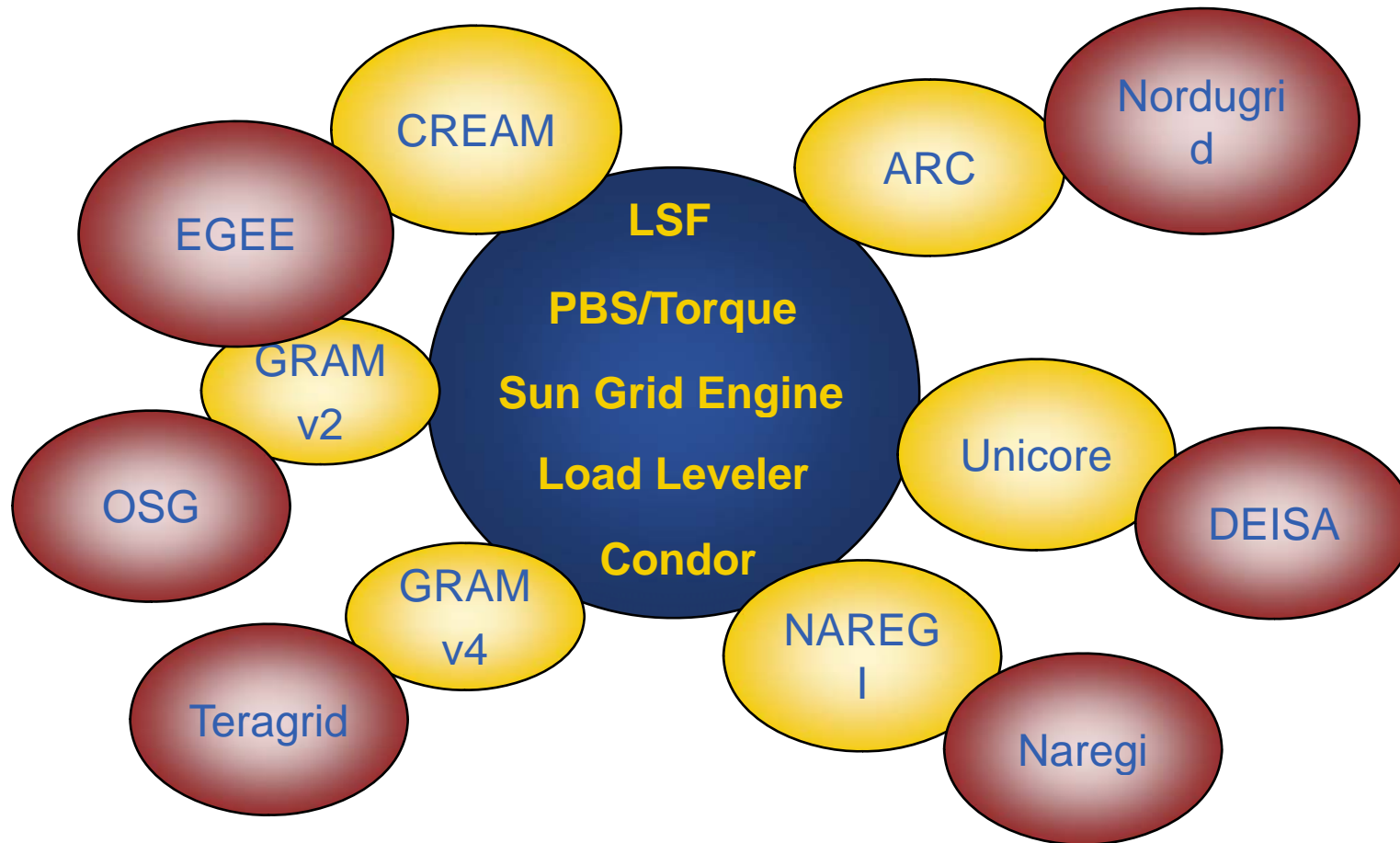
What is the problem?



- **Organization A and B are administrative domains**
 - Independent policies, systems and authentication mechanisms
- **Users have local access to their local system using local methods**
- **Users from A wish to collaborate with users from B**
 - Pool the resources
 - Split tasks by specialty
 - Share common frameworks



- **The Users from A and B create a Virtual Organization**
 - Users have a unique identify but also the identity of the VO
- **Organizations A and B support the Virtual Organization**
 - Place “grid” interfaces at the organizational boundary
 - These map the generic “grid” functions/information/credentials
 - To the local security functions/information/credentials
- **Multi-institutional e-Science Infrastructures**



• There are as many Computing Interfaces as Batch Systems!



- **Multiple grid infrastructures have evolved**
 - Using different interfaces at the organizational boundary
- **Users have grid access to their grid systems using grid methods**
- **A grid itself can be seen as an organizational domain**
 - Independent policies, systems and authentication mechanisms
- **VOs from Grid A wish to use resources in grid B**
 - Pool the resources
 - Split task by specialty
 - Share common frameworks

- **Required common interfaces**
 - We now have multiple "common" interfaces
- **Tried to solve one problem**
 - But we created another
- **Reasons:**
 - The infrastructures were developed independently
 - Initially there were no standards
 - Standards take time to mature
 - We need to build the infrastructures now!
 - Good standards require experience
 - Experimentation with different approaches



1. Understand both middleware stacks
2. Identify the “common” interfaces
3. Create an interoperability matrix

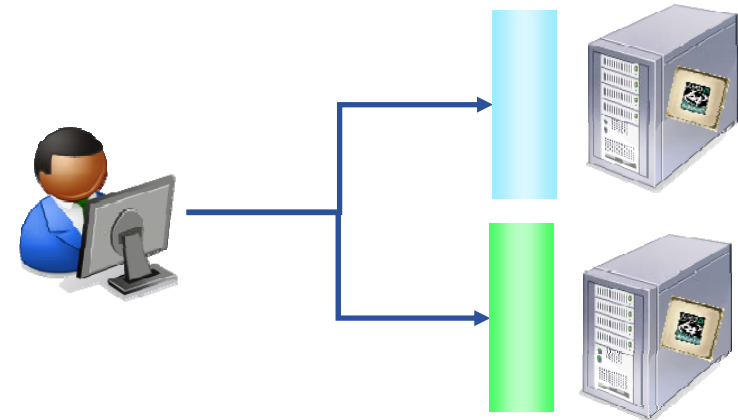
	ARC	OSG	EGEE
Job Submission	GridFTP	GRAM	GRAM
Service Discovery	LDAP/GIIS	LDAP/GIIS	LDAP/BDII
Schema	ARC	GLUE v1	GLUE v1.2
Storage Transfer Protocol	GridFTP	GridFTP	GridFTP
Storage Control Protocol	SRM	SRM	SRM
Security	GSI/VOMS	GSI/VOMS	GSI/VOMS

- **Long term solution**
 - Common interfaces
 - Standards

- **Medium term solutions**
 - Gateways
 - Adaptors and Translators

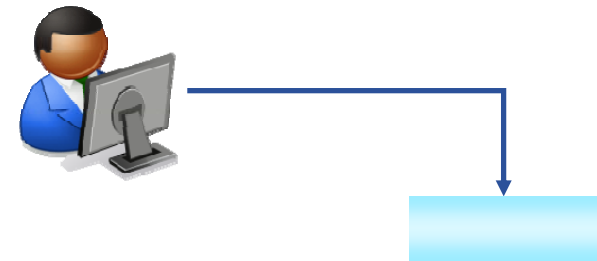
- **Short term solutions**
 - Parallel Infrastructures
 - User driven
 - Site driven

- **User Driven**
 - The user joins both grids
 - Uses different clients
 - *Depending on which interface*
 - More work for the User
 - Required for each infrastructure
 - Keyhole approach
 - Restricts functionality
 - Method initially used by ATLAS
 - Split workload between grids

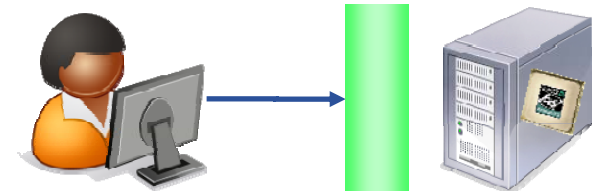


- **Site Driven**

- The site joins both grids
 - Deploys both interfaces
- User only sees their grid interface



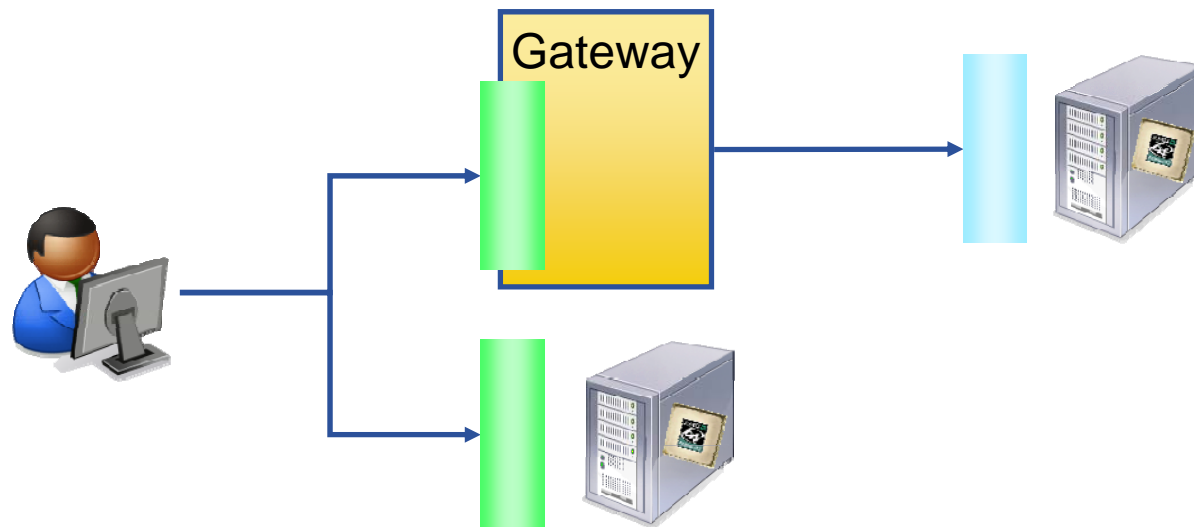
- More work for the site
 - Can only be supported by large sites
 - *Reduced resources*



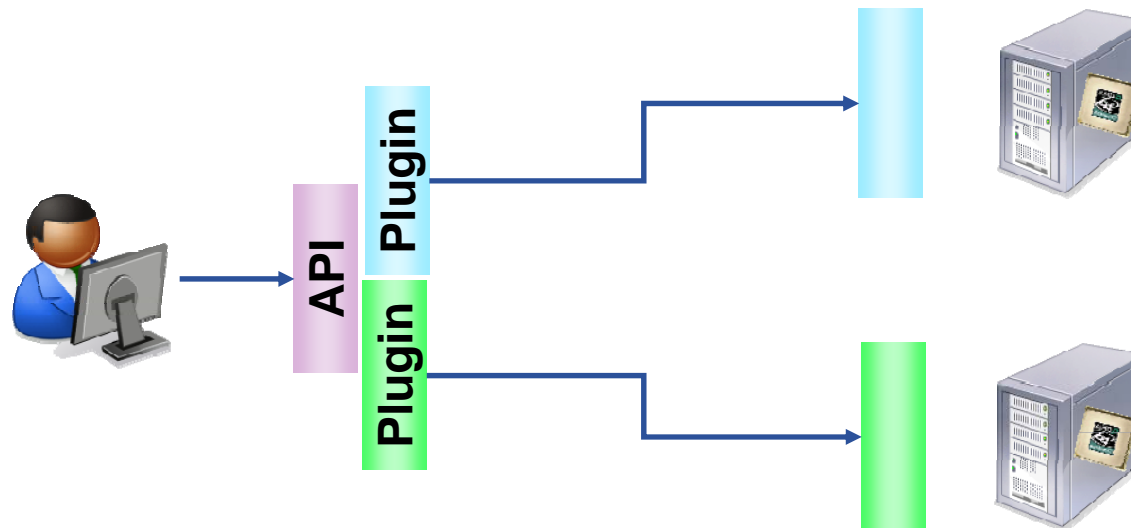
- Use By FZK

- Participating in EGEE, Nordugrid and D-grid

- **A gateway is a bridge between grid infrastructures**
 - Single point of failure
 - Gateway breaks, grid disappears
 - Scalability bottleneck
 - All the load through one service
- **Useful as a proof concept and to demonstrate the need**
- **NAREGI approach using glite-CE**



- **Adaptors allow connection**
- **Translators understand/modify information**
- **They are built into the middleware**
 - The middleware can then work with both interfaces
 - Useful feature even when using standards!
- **Requires modification to the grid middleware**
 - Existing service interfaces can still be used
- **Using in the GIN information System**



- **November 2004 - Initial meeting with OSG**
 - Only the information schema was different
 - Use a common schema, Glue v1.2
- **January 2005 - Proof of concept was demonstrated**
 - Small deployment differences found and overcome
- **Modifications to the software releases**
- **August 2005 - Month of focussed activity**
 - First OSG site available
- **November 2005**
 - First user jobs from GEANT4 arrived on OSG sites
- **March 2006 - Operations Progress**
- **Summer 2006 - CMS successfully taking advantage**
- **Summer 2007 - Joining software certification Testbeds**
 - To ensure interoperability is maintained

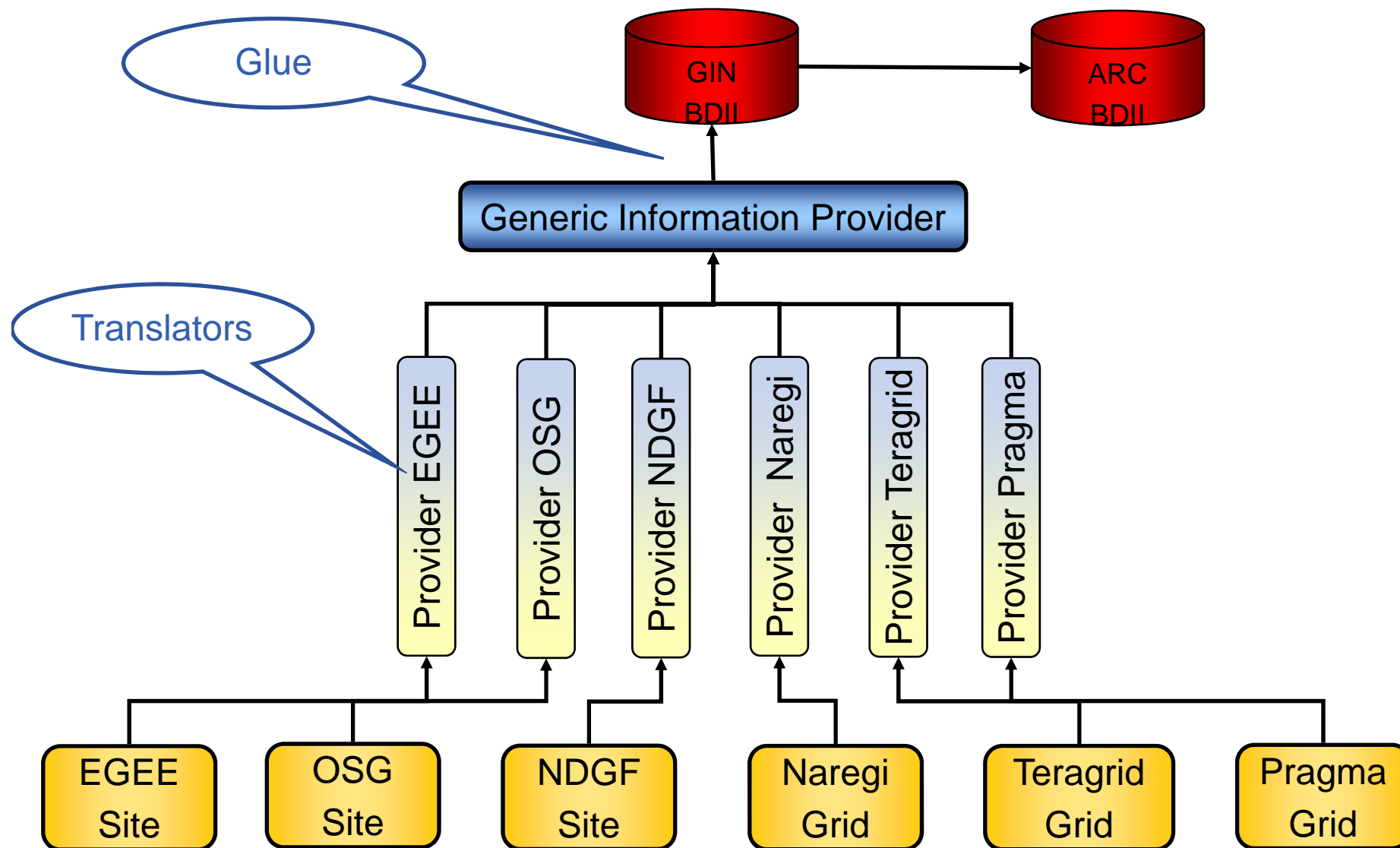
- **August 2005 - Initial meeting with ARC**
 - Different Schema and CE
 - Create Information System Gateway
 - Modify the WMS to use condor submitter
- **Feb 2006 – Information System Gateway ready**
 - Condor testing underway
- **April 2006 official EGEE activity started**
 - UKBH to test condor and adapt the WMS
- **May 2007 - Condor tested but WMS stalled**
 - Building problems
- **Sept 2006 – Alternative approach**
 - Investigating CE gateway approach
 - WMS developers adapting WMS
 - Very good progress
- **On going operations discussions**
 - Nordugrid integrated into the operations process.

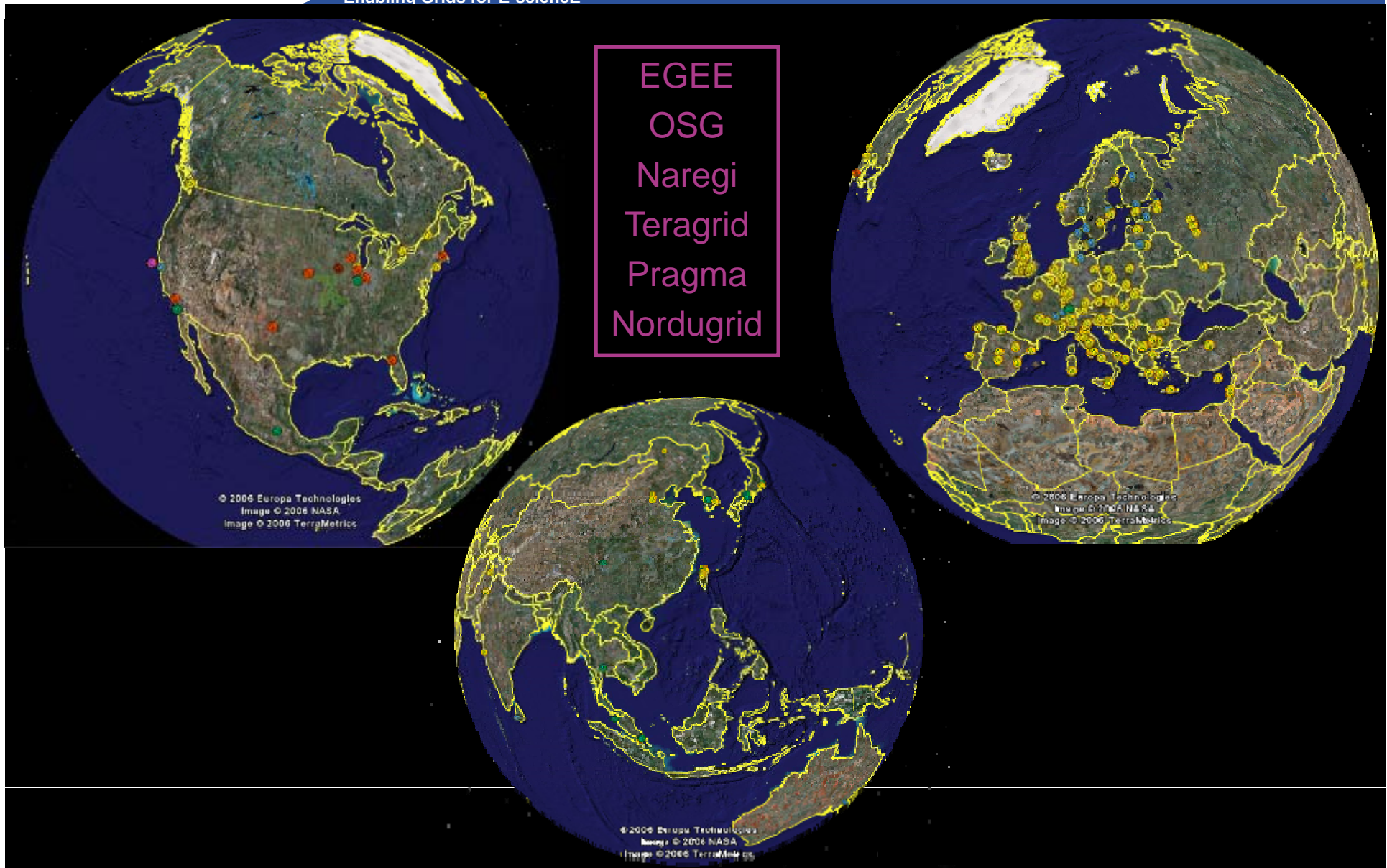
- **August 2006 – Initial Meeting**
 - Official EGEE activity
 - Very different software stack (CE + UI + GUI)
- **Investigate Condor submission**
 - Try WMS adaptation
 - Waiting on Nordugrid experience
- **May 2007 – Condor submission working**
 - Reluctant to attempt WMS modification
- **Jun 2007 – Attempt CE gateway approach**
- **Oct 2007 – Prototype demonstrated at EGEE 07**

- **March 2006 – Initial Meeting**
 - Very different software stack
 - But similar components
- **EGEE acting in consultancy capacity**
- **November 2006 – Prototypes demonstrated at SC 06**
- **July 2007 - Visit of the Japanese grid site managers**
 - Naregi software stack is still in the development phase
 - Large scale production rollout envisaged end of 2008
 - Further work on interoperation will have to wait
 - prototypes will remain untested in a production environment

- Building upon the many bi-lateral activities
- Started at GGF-16 (now OGF) in Feb 2006
- Demonstrate what we can for SC 2006
 - Applications, Security, Job Management
 - Information Systems, Data Management







- **Identified areas where standards are needed**
 - From the various interoperation activities
- **Common interfaces**
 - Critical interfaces at the organizational boundary
 - Security
 - Information
 - Computing
 - Storage
- **Standards are less important for higher level services**
 - Problem constrained within the VO
 - Chose one solution and somewhere to host it.

- **The problem of grid interoperation**
 - A second attempt at the original problem
- **The solution is common interfaces**
 - Most crucially at the site boundary
 - The only way forward is real standards
- **The most important part is to agree**
 - Production feedback will ensure it works!
 - The initial choice only select the starting point
- **Interoperability can be overcome short term**
 - But only standards are sustainable in the long term



- **Needs clear drive and direction by a user community**
 - Focus is maintained and the tasks are seen as critical
 - The main motivation is to gain access to additional resources
 - Need to identify a pilot VO
- **Interoperation affects all areas of the project**
 - The activity needs to be pervasive
 - Work needs to be done by individuals who are the experts
 - A separated interoperation activity is not affective
- **Requires coordination of many different tasks**
 - Vital to have a specific coordination role for interoperation
 - Interoperation is an activity between to grid infrastructures
 - A technical consultant who can liaise with other infrastructure

- **Grid Interoperability is an avoidable problem**
 - Grid Interoperation is not!
- **More focus is needed on the interfaces**
 - Less focus required on specific implantations
- **Standards are critical for the future**
 - It doesn't matter what they are as long as we agree
 - Existing use cases will ensure the standards work
- **Interoperation requires coordination**
 - Between different areas of the project
 - Between the different infrastructures