



Enabling Grids for E-science

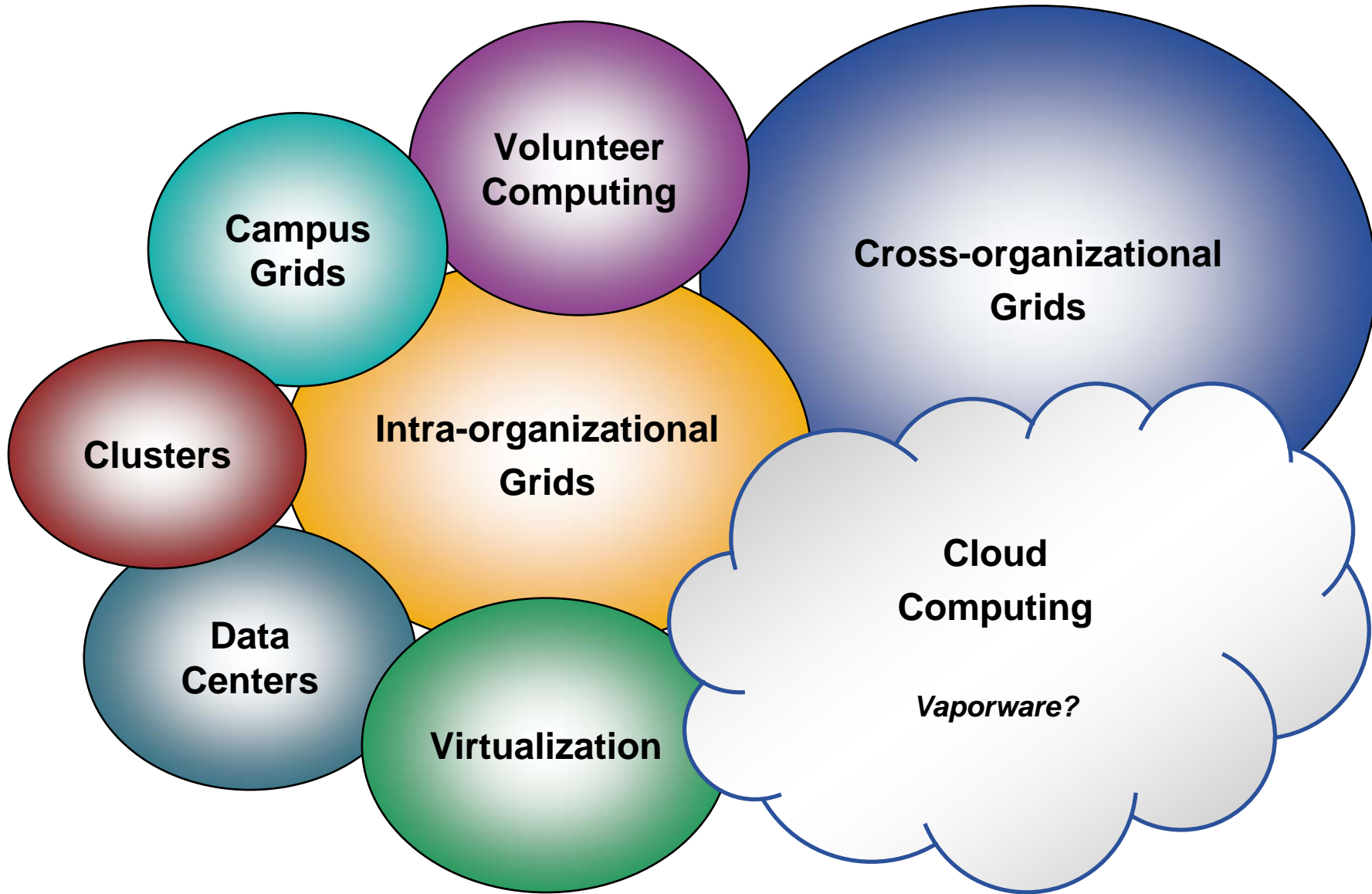
EGEE and Interoperation

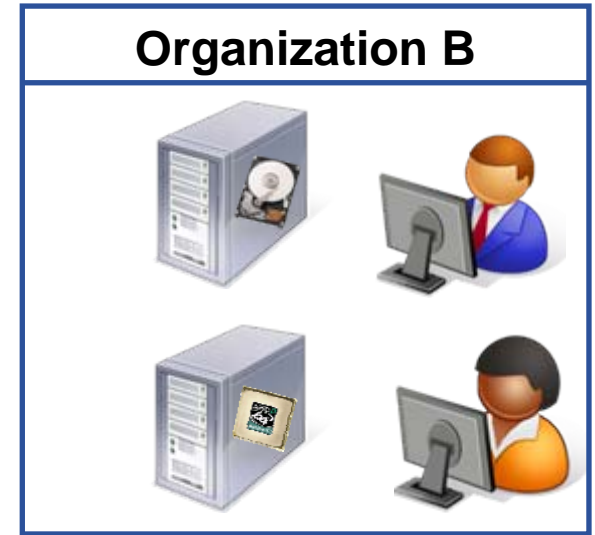
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www.eu-egee.org



- **The grid problem definition**
- **GLite and EGEE**
- **The interoperability problem**
- **The interoperation problem**
- **Interoperation activities in EGEE**
- **Grid Interoperability Now!**
- **The need for standards**





- **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

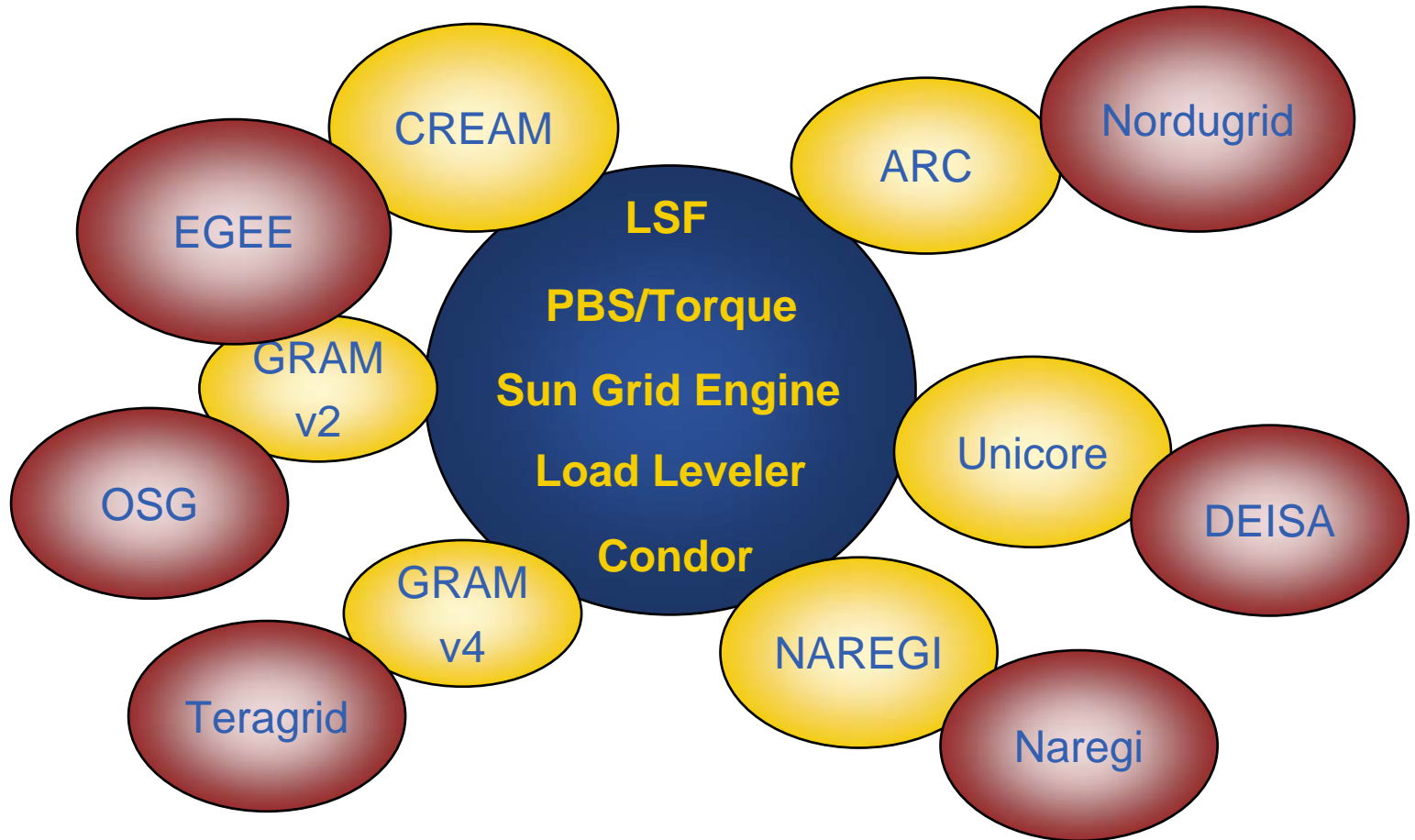


- **The Users from A and B create a Virtual Organization**
 - Users have a unique identify but also the identity of the VO
- **Organizations A and B support the Virtual Organization**
 - Place “grid” interfaces at the organizational boundary
 - These map the generic “grid” functions/information/credentials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

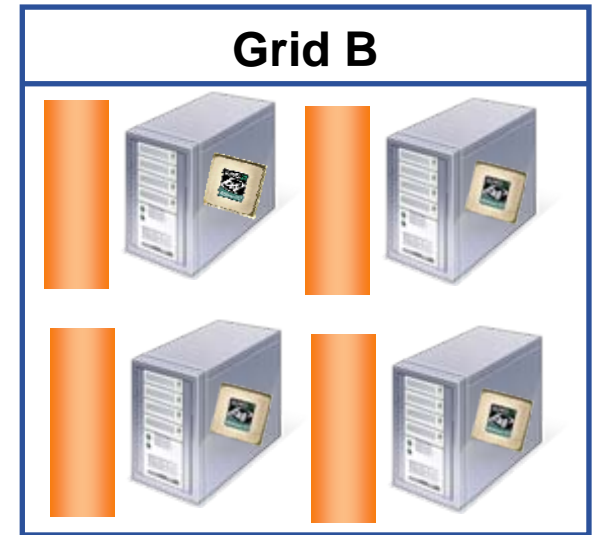
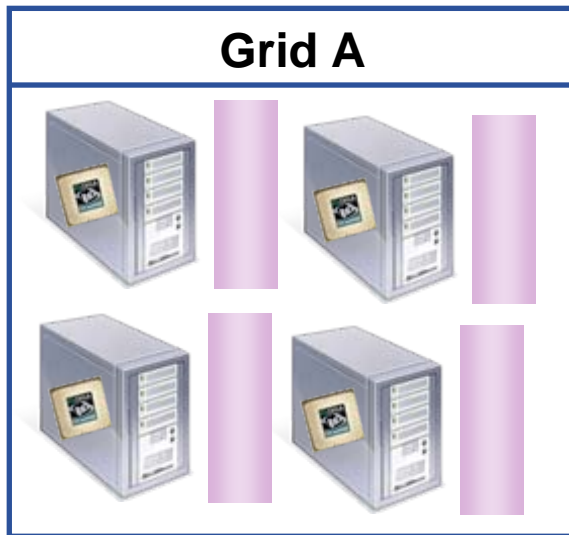
- *GLite is an integrated middleware distribution that provides the abstract interfaces required for building a grid infrastructure which enables resource sharing across administrative domains.*
- *The distribution consists of software repositories containing validated components from multiple software providers, including components from gLite, with the documentation and tools required for deploying this as a production quality service.*
- *The release procedure for the gLite distribution follows the same release methodology used by many Linux distributions; A major baseline release to which updates are continually added.*
- *The standard tools for the reference operating system are leveraged to create the software repositories which are logical separated by service to allow them to evolve independently.*
- *The latest major release is 3.1, which is available for the reference OS SL4 in both 32 and 64 bit flavors. Availability for other OS' is a high priority and the order the priority is driven by demand.*

<http://glite.web.cern.ch/glite/>

- **The Enabling Grids for E-Science (EGEE) Project**
 - 139 partner institutes from over 32 countries
 - Providing a service grid infrastructure of ~50000 CPUs and ~ 5 PB disk (5 million Gigabytes) of disk storage + tape MSS
 - Distributed across 260+ sites in 48 countries
 - Which is available to more than 7500 users
 - Organized over 200 Virtual Organizations across 10 applications domains
 - Who run are running more than 190K jobs per day
 - 24 hours-a-day, 7 Days a week, 365 days a year



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**
 - Now have multiple "common" interfaces
 - Tried to solve one problem, but created another
- **Reasons:**
 - The infrastructures were developed independently
 - Funding based on regions and application domains
 - Grid infrastructures are based on different middleware
 - Experimentation with different approaches
 - Initially there were no standards
 - Standards take time to mature
 - We need to build the infrastructures now!
 - *The infrastructures outpaced standardization*
 - Good standards require experience



- **Interoperability:**

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

(software)

- **Interoperation**

“The use of interoperable systems“

(Infrastructures)

- **Understanding the differences**
 - Compatibility matrix
- **Domains that have to be linked for interoperability**
 - Security
 - Information Services
 - Job Management
 - Data Management
- **For interoperation you have to add**
 - Monitoring
 - Accounting
 - Operational links and joint policies
 - Trouble ticket systems
 - Operational security

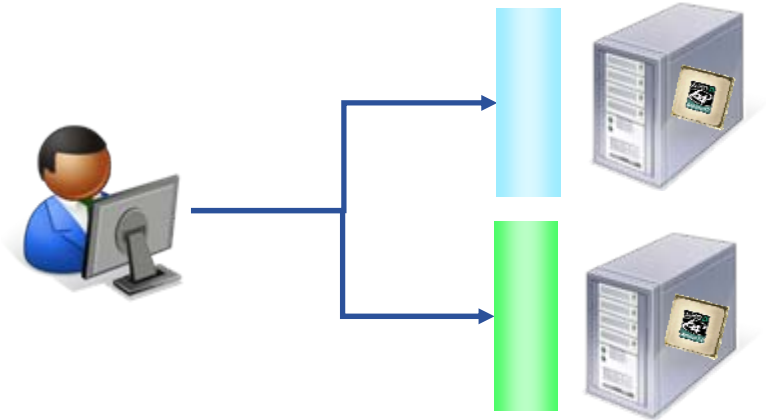
1. Understand both middleware stacks
2. Identify the “common” interfaces
3. Create an interoperability matrix

	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

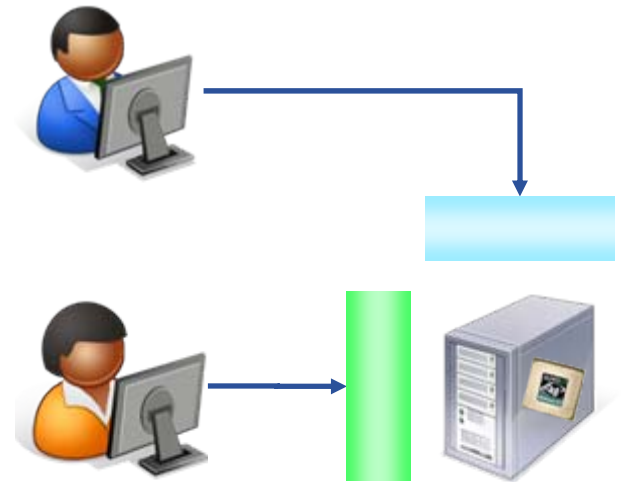
- **User Driven**

- 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

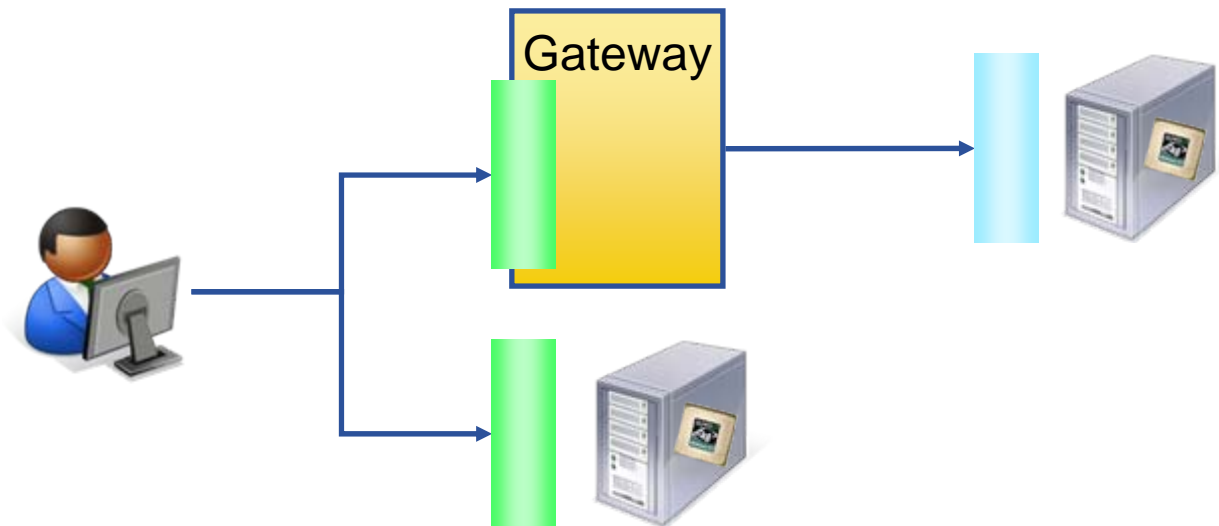


- **Site Driven**

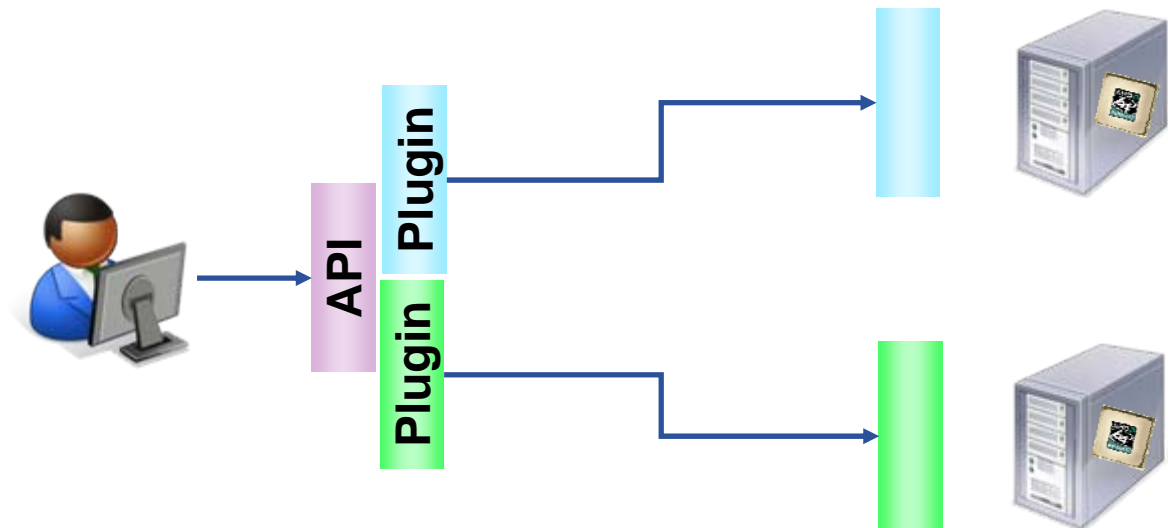
- The site joins both grids
 - Deploys both interfaces
- User only sees their grid interface
- More work for the site
 - Can only be supported by large sites
 - *Reduced resources*
- Use By FZK
 - Participating in EGEE, Nordugrid and D-grid



- **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**



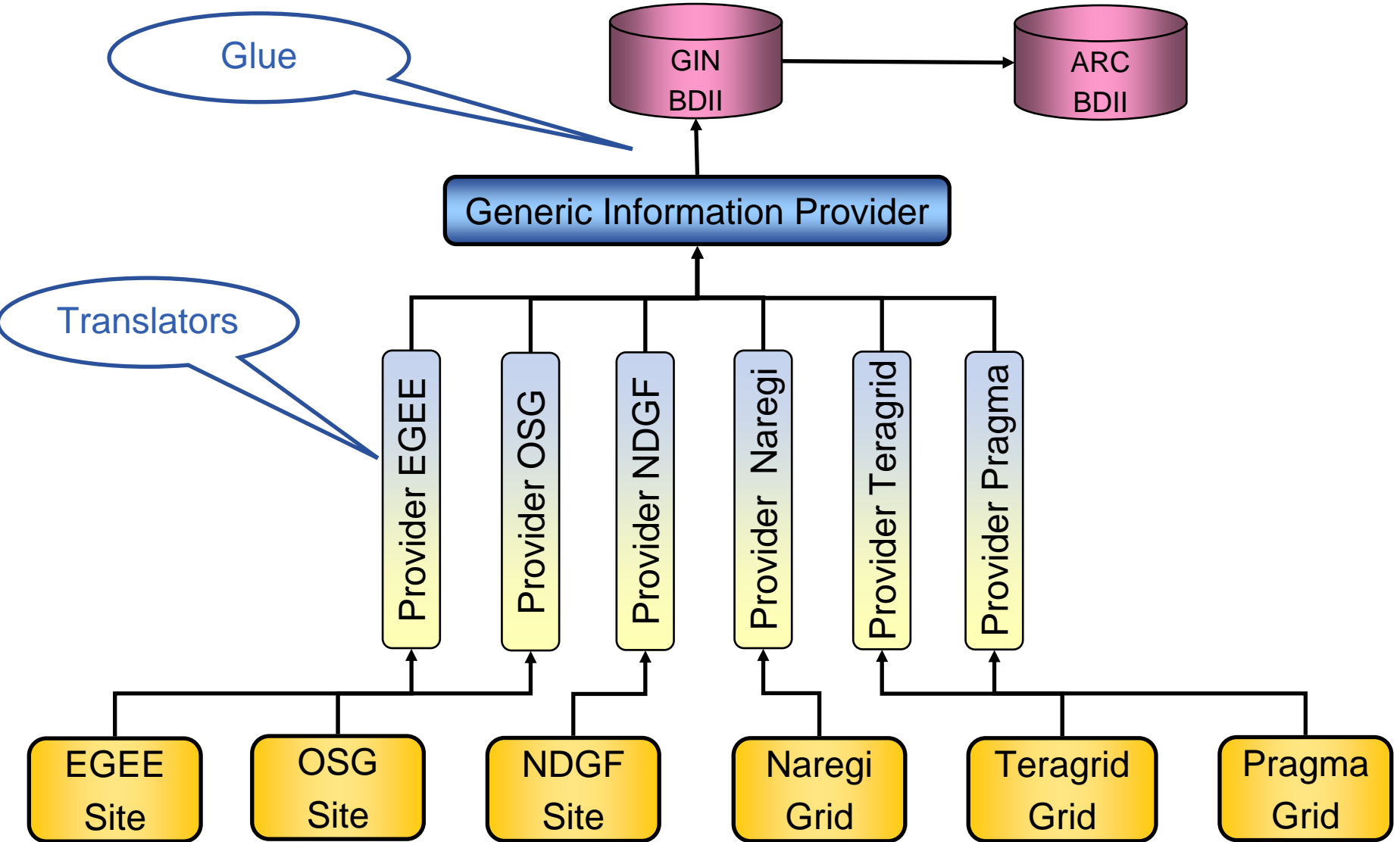
- **Adaptors allow connection**
- **Translators understand/modify information**
- **They are built into the middleware**
 - The middleware can then work with both interfaces
 - Useful feature even when using standards!
- **Requires modification to the grid middleware**
 - Existing service interfaces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



- **EGEE / OSG**
 - Already interoperating since Autumn 2005
- **EGEE /NDGF**
 - Working on interoperability since Summer 2005
 - Anticipated completion May 2008
- **EGEE/Unicore**
 - Started Summer 2006
 - Prototype components available
- **EGEE/Naregi**
 - Working on interoperability with EGEE since winter 2006
 - Interoperable components available
- **EUCHINAGrid**
 - Separate project
- **EGEE/Garuda**
 - See talk in the next session!

- 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







EGEE
OSG
Naregi
Teragrid
Pragma
Nordugrid



- **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.

- **Security is the fundamental aspect**
 - Users belong to a VO and do work on behalf of the VO
 - Their identity is their experiment, not their institution
- **Require a common security mechanism**
 - All other standards will inherit from this one
- **Most grids use X509 credentials**
 - Already an existing standard 😊
 - This has significantly reduced interoperability problems
 - Roots of trust, CAs, coordinated by the IGTF
- **Require common methods for VO policy management**
 - Groups and roles within a VO
 - Capabilities etc.

- **Separate content and interface**
- **Schema defines the content.**
 - Glue Schema created to facilitate interoperation
 - Currently v1.3
 - Now and OGF working group
 - Draft of v2.0 ready now!
- **LDAP is the dominant interface**
 - 55% grids, 95% sites provide an LDAP interface
 - Grids and sites participating in GIN
 - Various web service interfaces
 - These all have problems with large query results

- **GridFTP**
 - Supported in most grid infrastructures
 - Reduced interoperability problems
- **Storage Resource Manager**
 - Is proposed interface to storage
 - Problems with different interpretations of the specification
 - Incompatible implementations
 - With a huge amount of effort it has taken 18 months to get right
- **The Storage Resource Broker (SRB)**
 - An alternative which is widely used.

- **Job Description Language**
 - JSDL as defined by the OGF
- **Computing Interface**
 - As many interfaces as batch systems!
 - Need to agree on a common interface
 - OGSA-BES is the current candidate
- **OGSA-BES**
 - V1.0 draft document
 - A number of prototypes exist but unproven in production
 - Cream CE and KnowARC CE will implement BES
- **Need to think about accounting**

- **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



- **We need to put “Grids” into context**
 - What problem you are addressing?
 - Multi-institutional e-Science Infrastructures
- **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 a we agree
 - Existing use cases will ensure the standards work