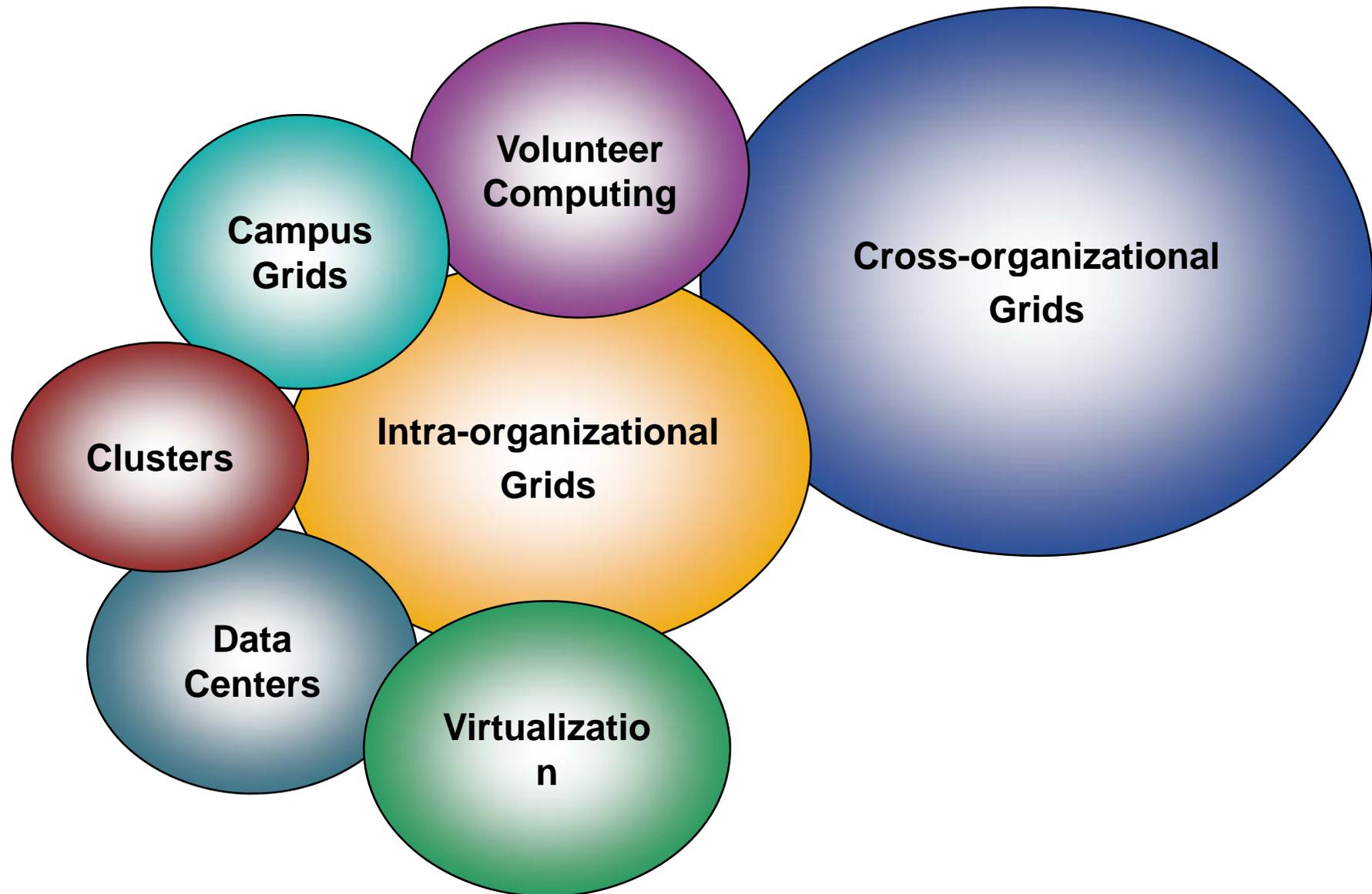# egee

Grid Interoperability: The Interoperations Cookbook

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CERN-IT-GD

CHEP 2007

www.eu-egee.org
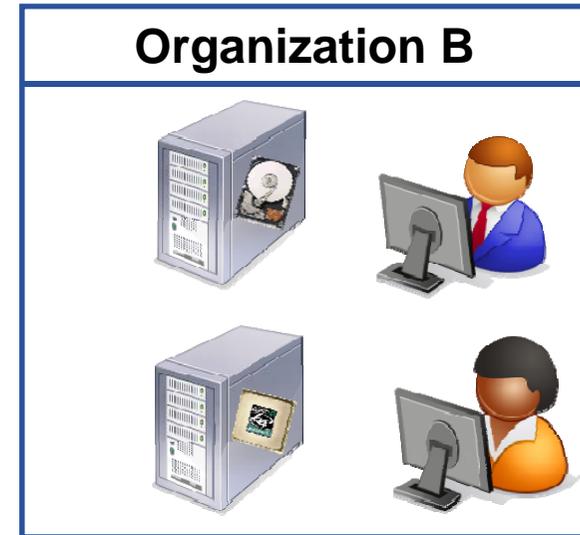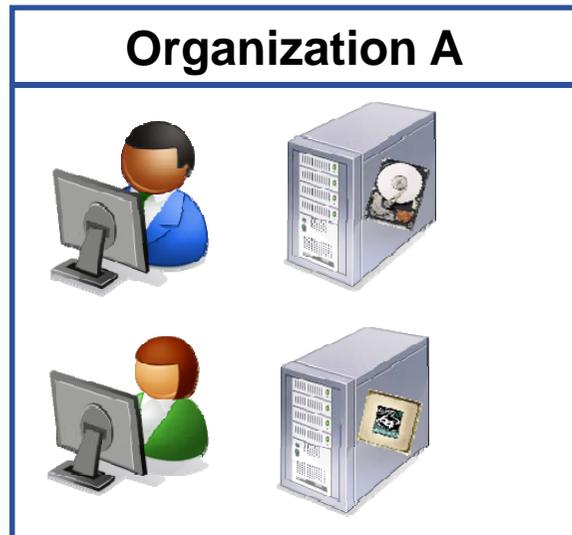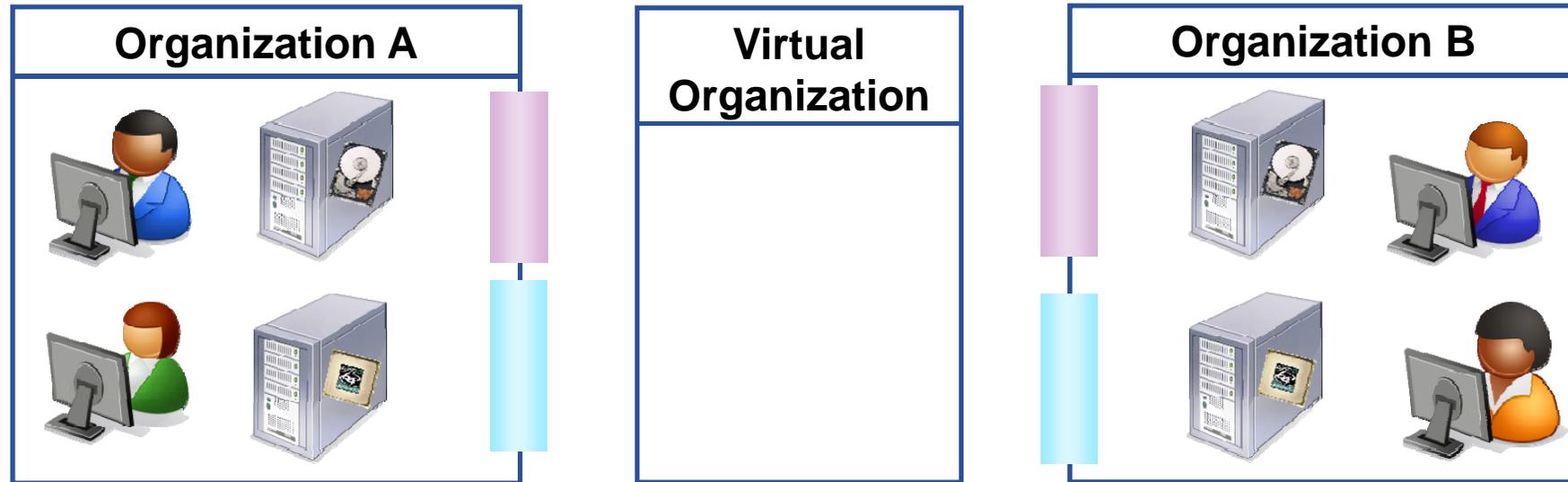
Information Society
and Media

Enabling Grids for E-sciencE

- **The Grid Interoperation Problem**

- **The Different Approaches**

- **Interoperations Activities**

- **The Emerging Standards**

Enabling Grids for E-sciencE

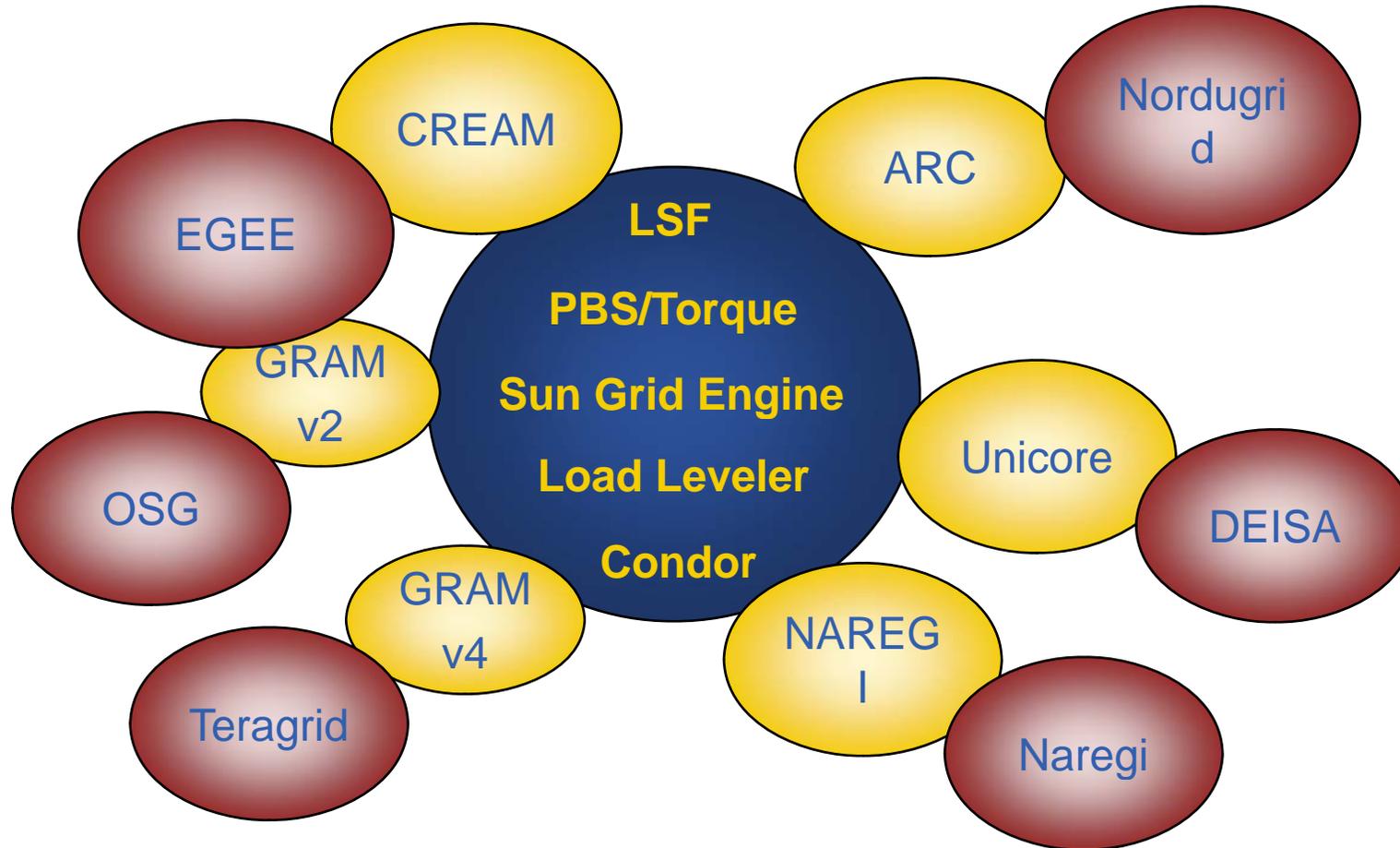| Organization A | Organization B |

- **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

Organization A	Virtual Organization	Organization B

- **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**

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Enabling Grids for E-sciencE

CREAM

Nordugrid

ARC

EGEE

LSF

PBS/Torque

GRAM v2

Sun Grid Engine

Load Leveler

Unicore

OSG

Condor

DEISA

GRAM v4

NAREGI

Teragrid

Naregi

•There are as many Computing Interfaces as Batch Systems!

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Enabling Grids for E-sciencE

Grid A	Virtual Organization	Grid B

- **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

Enabling Grids for E-sciencE

- **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

- **Interoperability:**

    "The ability to exchange information and to use what has been exchanged"

    (software)

- **Interoperation**

    "The use of interoperable systems"

    (Infrastructures)

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Enabling Grids for E-sciencE

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

Enabling Grids for E-sciencE

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

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

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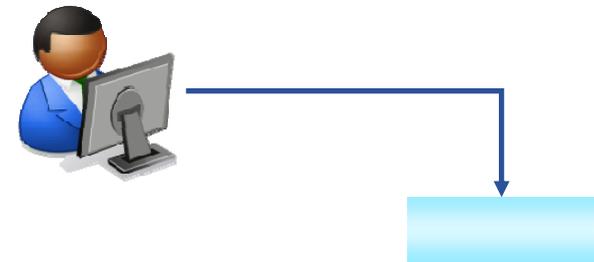 - Parallel Infrastructures
    - User driven
    - Site driven

Enabling Grids for E-sciencE

- **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
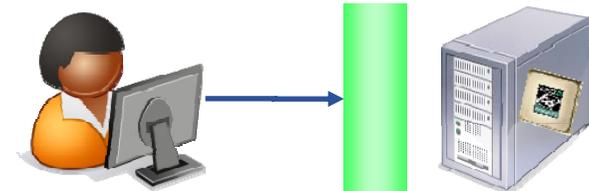
Enabling Grids for E-sciencE

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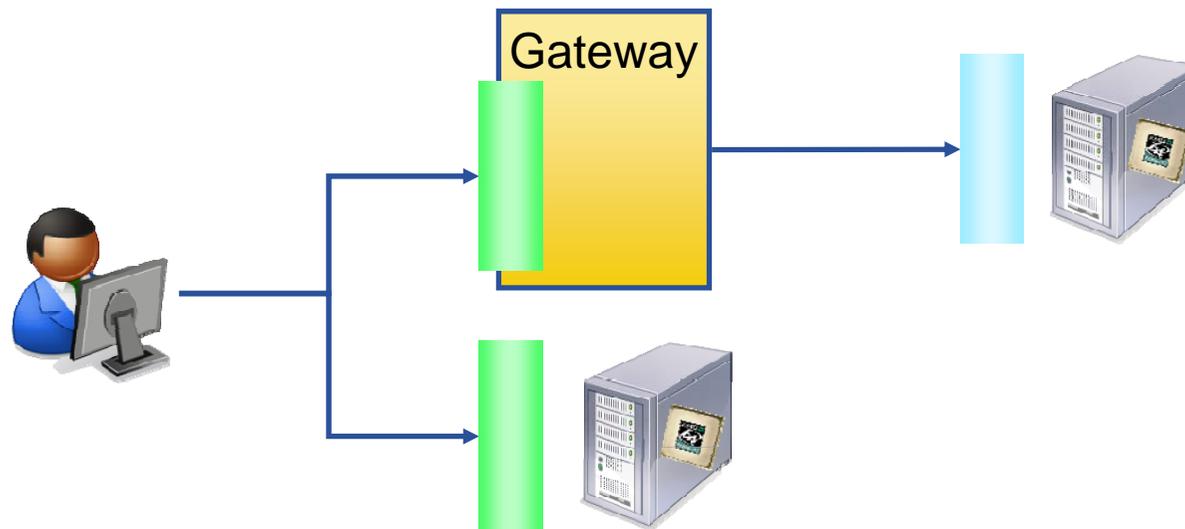 - User only sees their grid interface

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

  - Use By FZK
    - Participating in EGEE, Nordugrid and D-grid

Enabling Grids for E-sciencE

- **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 to discuss interoperation
  - Problem assessed
    - Created Interoperability Matrix
      - *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**
  - Interoperability achieved
- **August 2005**
  - Month of focussed activity on operations issues
  - First OSG site available

Example Interoperations Activity

Enabling Grids for E-sciencE

- **November 2005**
  - First user jobs from GEANT4 arrived on OSG sites
- **March 2006**
  - Operations Progress
    - Information system bootstrapping
    - Routing of trouble tickets
    - Joint operations VO
    - Joint operations meetings (including weekly phone conference)
- **Summer 2006**
  - CMS successfully taking advantage of interoperations
    - Without being aware of it!
- **Summer 2007**
  - Joining software certification Ttestbeds
    - To ensure interoperability is maintained

- **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

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Enabling Grids for E-sciencE

Glue

GIN
BDII

ARC
BDII

Generic Information Provider

Translators

Provider EGEE

Provider OSG

Provider NDGF

Provider Naregi

Provider Teragrid

Provider Pragma

EGEE
Site

OSG
Site

NDGF
Site

Naregi
Grid

Teragrid
Grid

Pragma
Grid

eGee

Enabling Grids for E-sciencE

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.

Enabling Grids for E-sciencE

- **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.

Enabling Grids for E-sciencE

- **Separate content and interface**

- **Schema defines the content.**
  - Glue Schema created to facilitate interoperation
    - Currently v1.3
  - Now and OGF working group
    - Definition of v2.0 ready by October 2007

- **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

- **OGF OGSA-WG investigating**

Enabling Grids for E-sciencE

- **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.

Enabling Grids for E-sciencE

- **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**

Enabling Grids for E-sciencE

- **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