



Enabling Grids for E-science

Introduction to gLite

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With thanks to EGEE colleagues for many of these slides

www.eu-egee.org



- **EGEE – Enabling Grids for E-Science**
- **EGEE’s Grid middleware: gLite**
 - Introducing the core services that we will use in the practical
- **Sources of further information**



- **EGEE**

- 1 April 2004 – 31 March 2006
- 71 partners in 27 countries, federated in regional Grids

- **EGEE-II**

- 1 April 2006 – 31 March 2008
- 91 partners in 32 countries
- 13 Federations

- **Objectives**

- Large-scale, production-quality infrastructure for e-Science
- Attracting new resources and users from industry as well as science
- Improving and maintaining “gLite” Grid middleware



US partners in EGEE-II:

- Univ. Chicago
- Univ. South. California
- Univ. Wisconsin
- RENCI

- **Infrastructure operation**
 - Currently includes sites across 39 countries
 - Continuous monitoring of grid services & automated site configuration/management

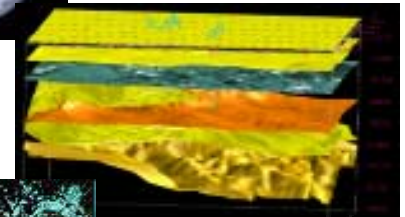
- **Middleware**
 - Production quality middleware distributed under business friendly open source licence

- **User Support - *Managed process from first contact through to production usage***
 - Training
 - Expertise in grid-enabling applications
 - Online helpdesk
 - Networking events (User Forum, Conferences etc.)

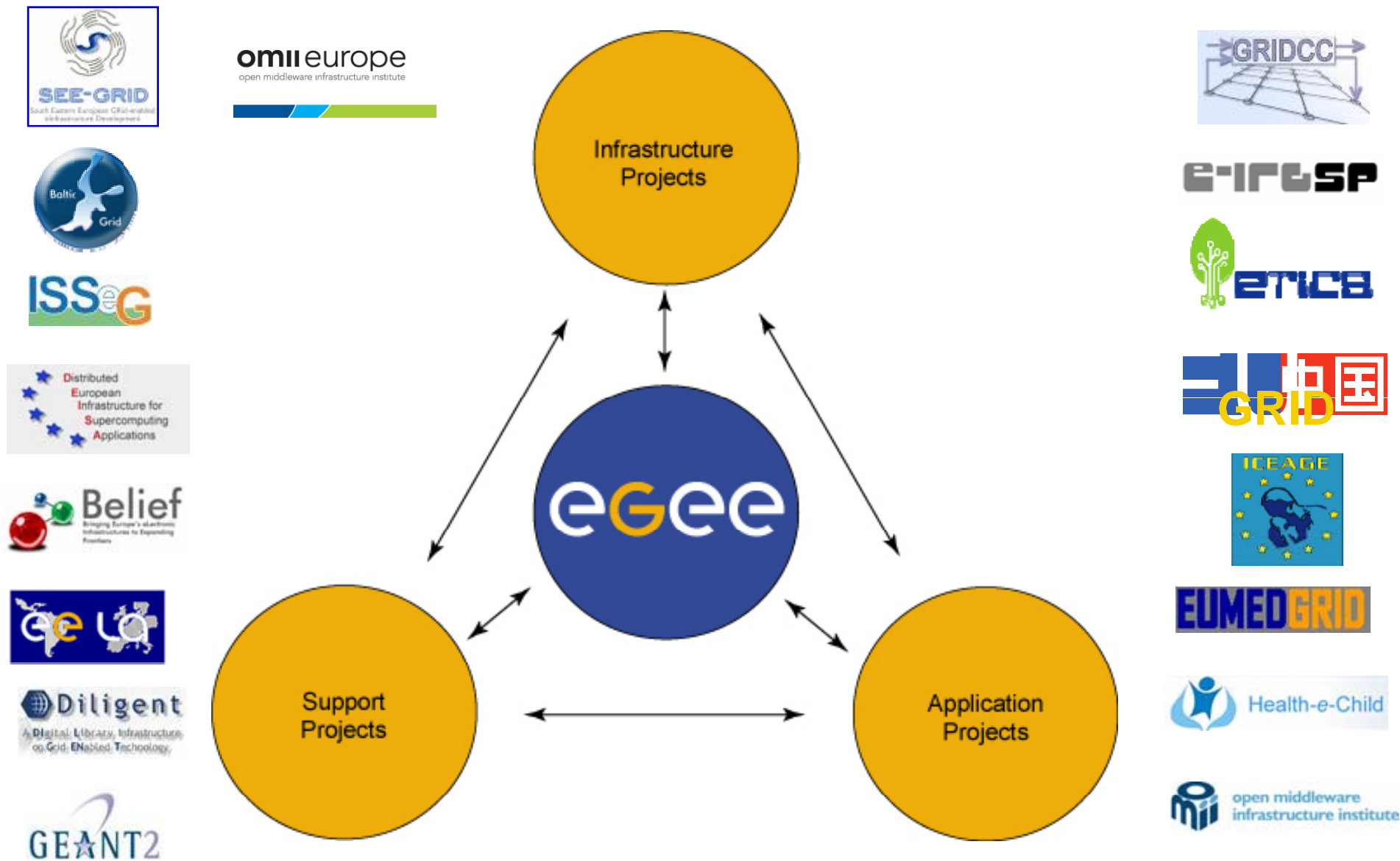
- **Interoperability**
 - Expanding geographical reach and interoperability with related infrastructures



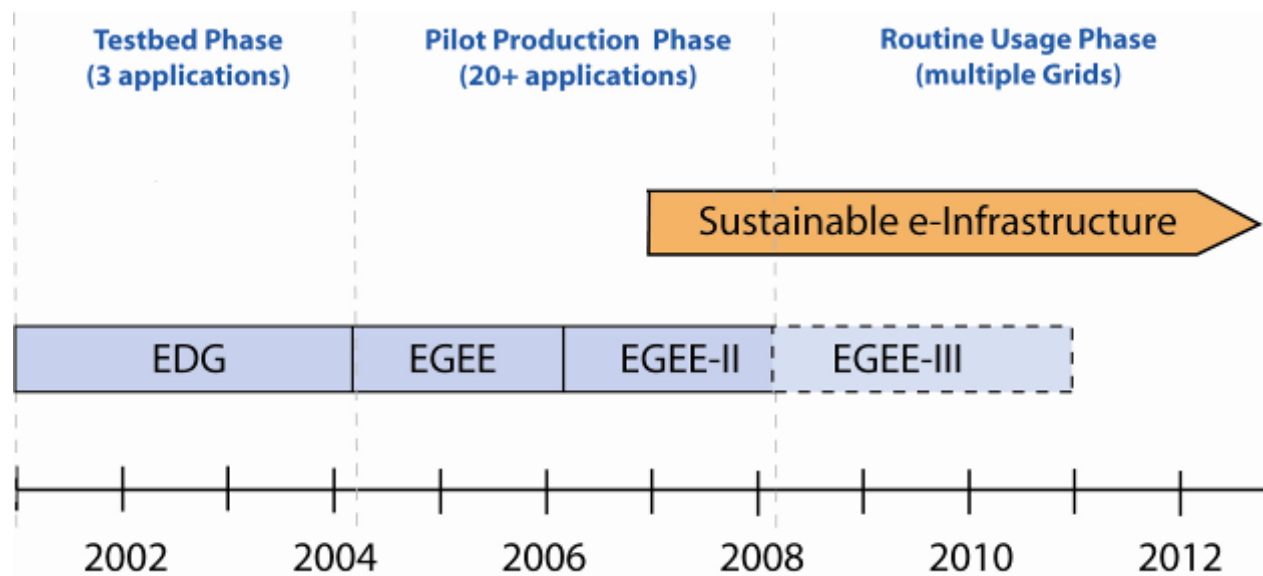
- Applications from an increasing number of domains
 - Astrophysics
 - Computational Chemistry
 - Earth Sciences
 - Financial Simulation
 - Fusion
 - Geophysics
 - High Energy Physics
 - Life Sciences
 - Multimedia
 - Material Sciences
 - ...



Book of abstracts: <http://doc.cern.ch//archive/electronic/egEE/tr/egEE-tr-2006-005.pdf>



- **Need to prepare for permanent Grid infrastructure**
 - Ensure a reliable and adaptive support for all sciences
 - Independent of short project funding cycles
 - Infrastructure managed in collaboration with national grid initiatives



Test-beds & Services

Certification testbeds (SA3)

Pre-production service

Production service

Infrastructure:

- Physical test-beds & services
- Support organisations & procedures
- Policy groups

Support Structures

Operations Coordination Centre

Regional Operations Centres

Global Grid User Support

EGEE Network Operations Centre (SA2)

Operational Security Coordination Team

Security & Policy Groups

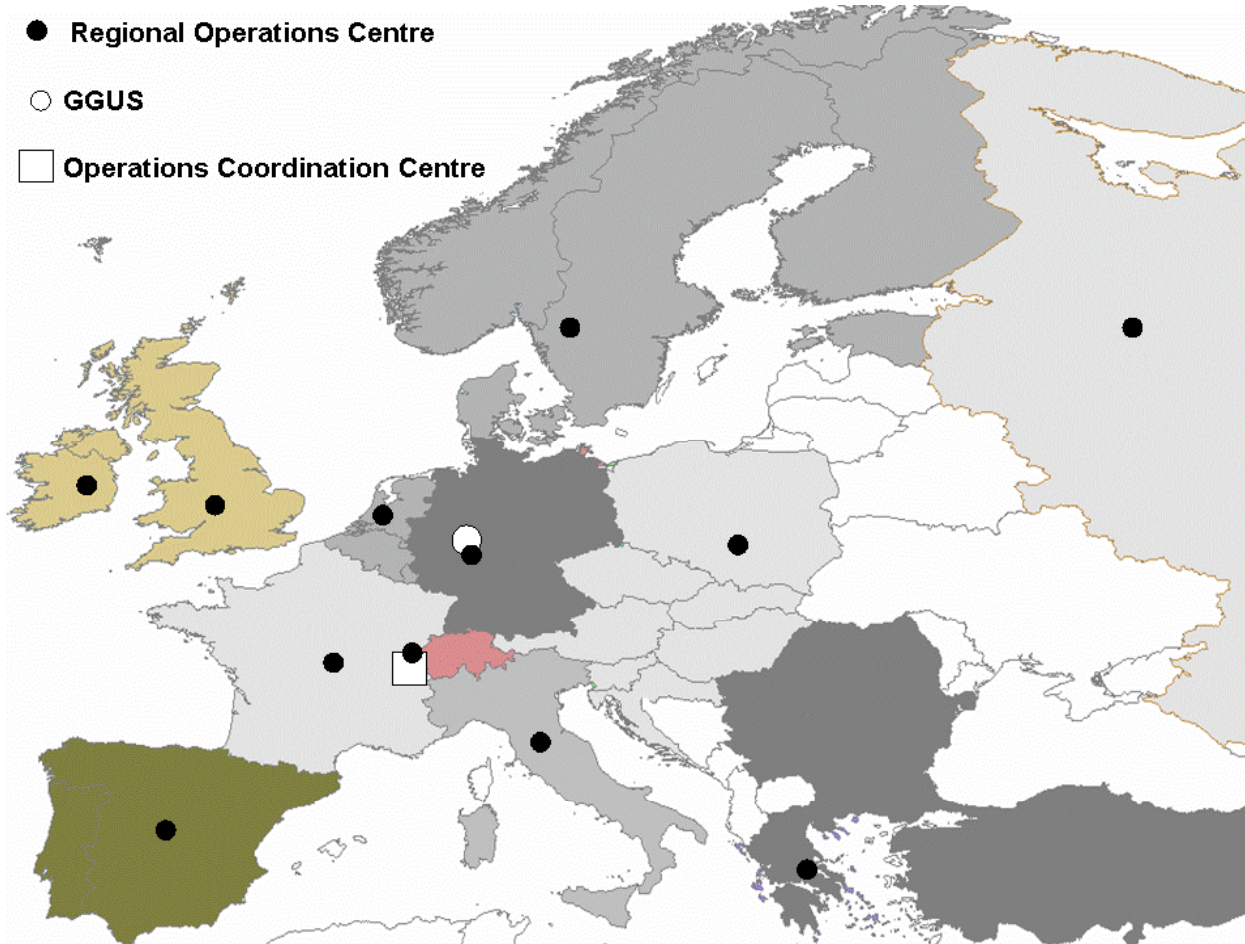
Joint Security Policy Group

EuGridPMA (& IGTF)

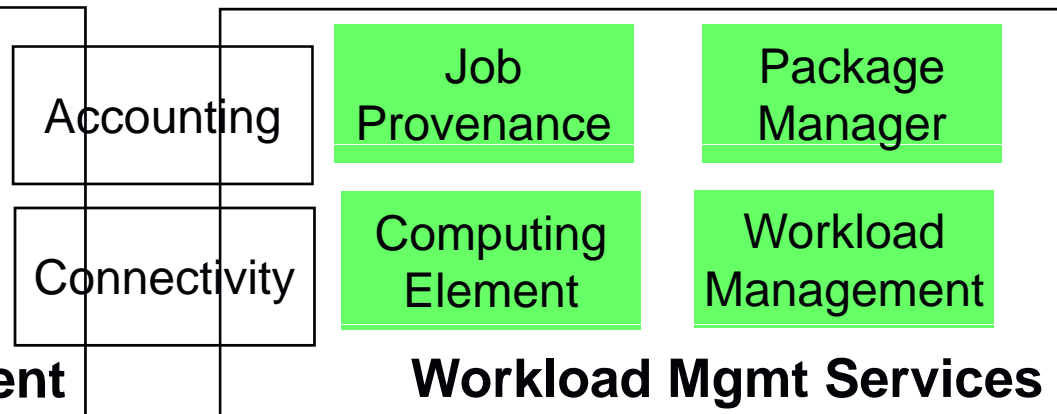
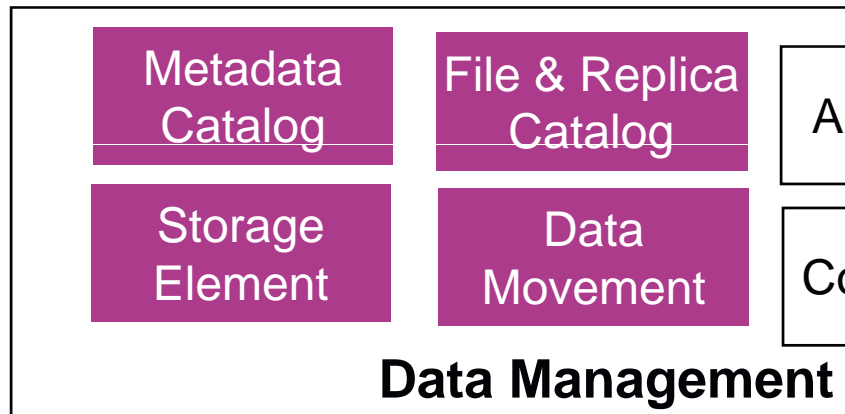
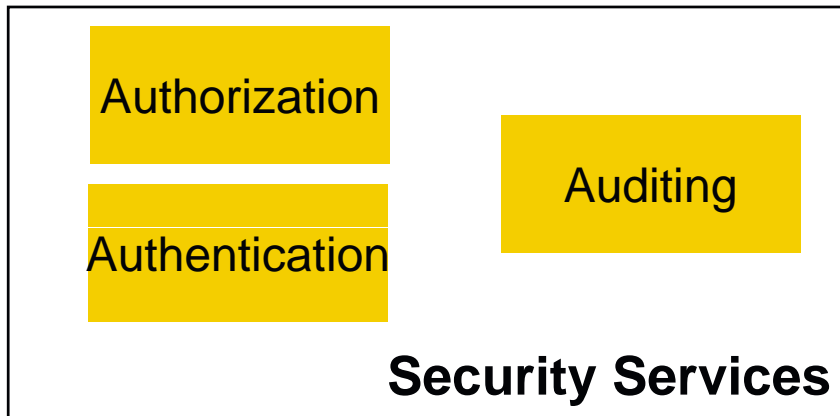
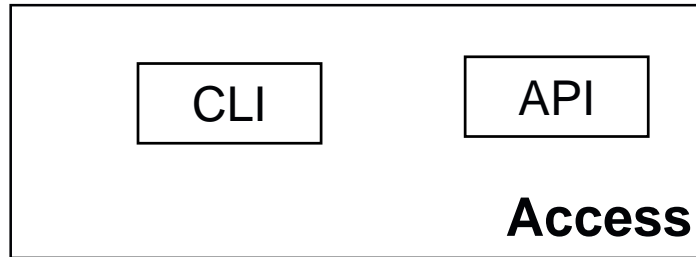
Grid Security Vulnerability Group

Operations Advisory Group (+NA4)

- Regional Operations Centre
- GGUS
- Operations Coordination Centre



- **Operations Coordination Centre (OCC)**
 - management, oversight of all operational and support activities
- **Regional Operations Centres (ROC)**
 - providing the core of the support infrastructure, each supporting a number of resource centres within its region
 - **Grid Operator on Duty**
- **Resource centres**
 - providing resources (computing, storage, network, etc.);
- **Grid User Support (GGUS)**
 - At FZK, coordination and management of 9





User Interface (UI):

The place where users logon to the Grid



Resource Broker (RB): Matches the user requirements with the available resources on the Grid



Information System: Characteristics and status of CE and SE
(Uses “GLUE schema”)



Computing Element (CE): A batch queue on a site’s computers where the user’s job is executed



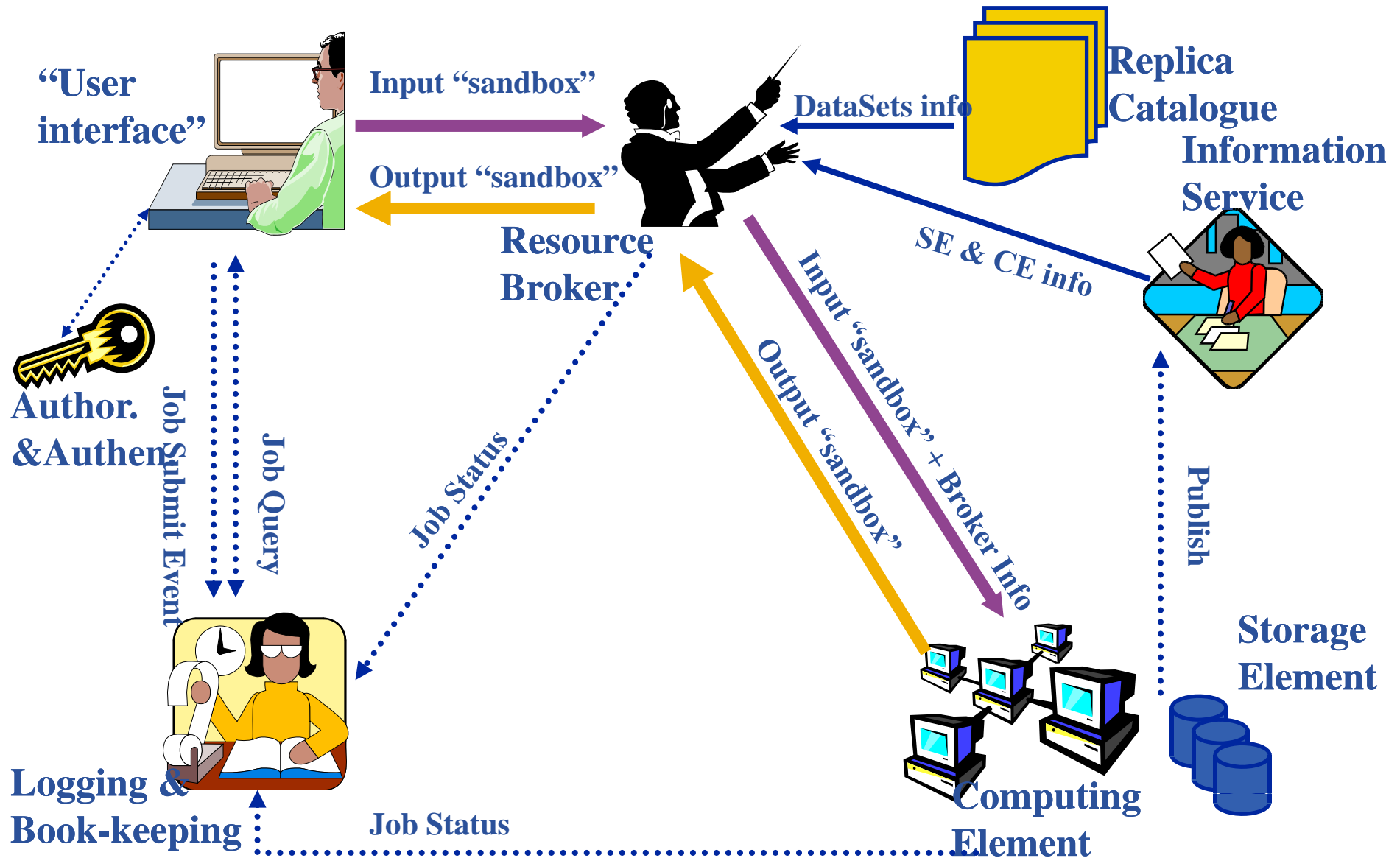
Storage Element (SE): provides (large-scale) storage for files



GSI with VOMS: authentication and basis for authorisation

- **VOMS: VO Management**
- **Workload Management System (“Resource Broker”):**
 - Receives job description from user
 - Match-makes with available resources
 - Sends job to Compute Element (batch queue)
- **Information System**
 - Is used by services including the Resource Broker
- **Data management (files)**
 - Catalogue that maps logical filenames to physical instances of file on storage elements
 - Data transfer, storage and access services

Current production middleware

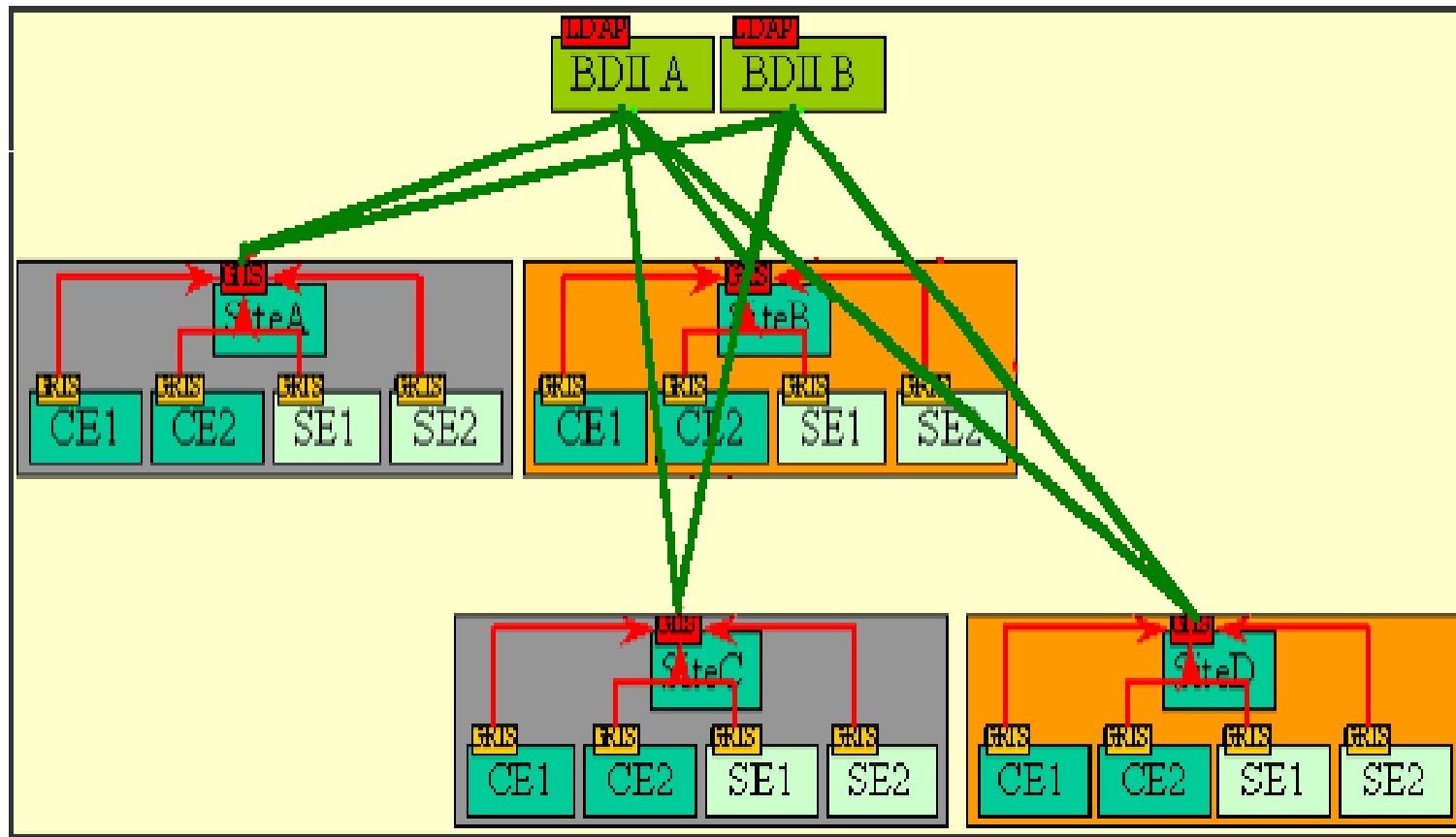


- The data published in the Information System (IS) conforms to the GLUE (Grid Laboratory for a Uniform Environment) Schema. The **GLUE Schema** aims to define a common conceptual data model to be used for Grid resources.

<http://infforge.cnaf.infn.it/glueinfomodel/>

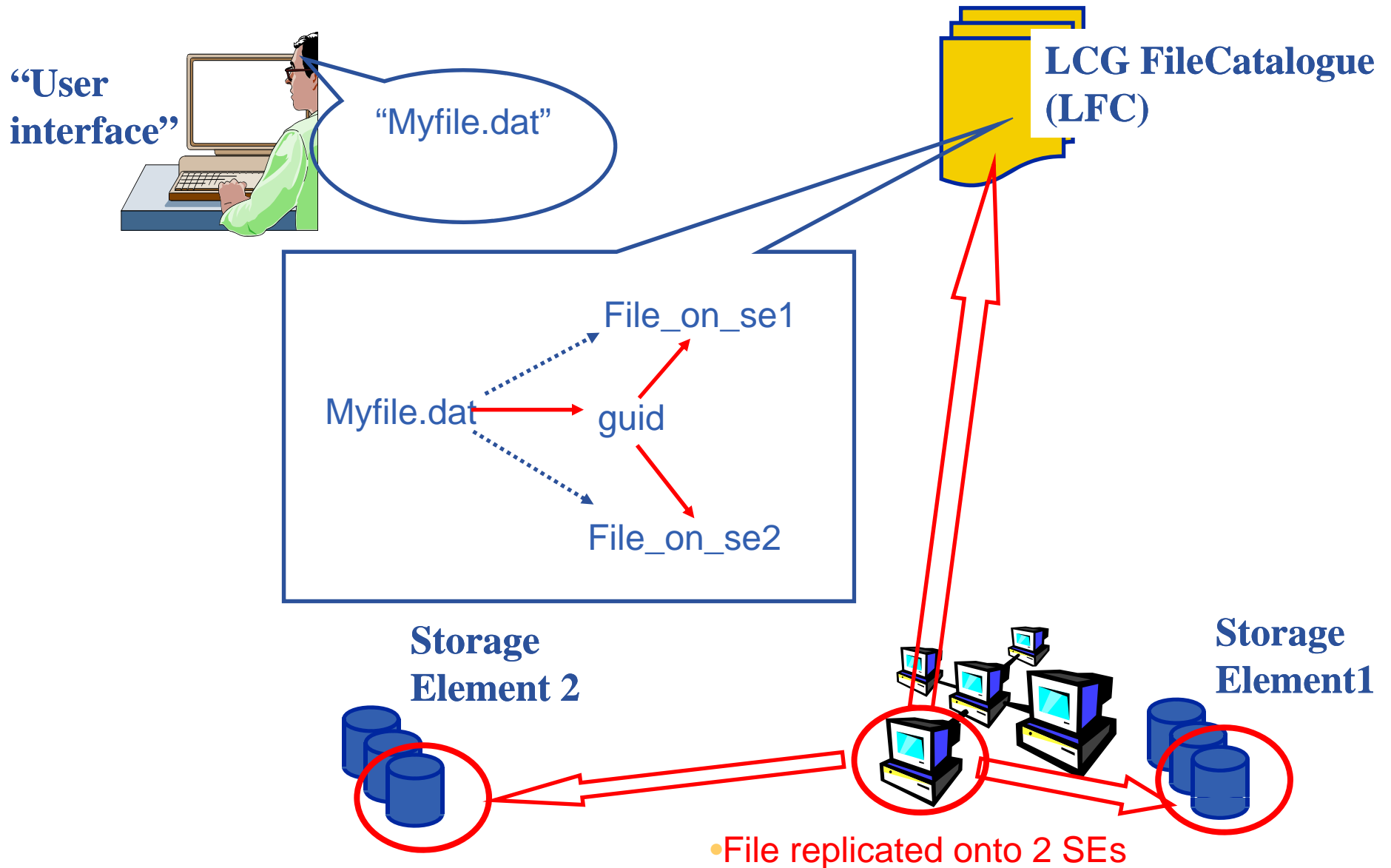
- The BDII (Berkeley DB Information Index), based on an updated version of the Monitoring and Discovery Service (MDS), from Globus, is adopted as main provider of the Information Service.

- a user or a service can query
 - the BDI (usual mode)
 - LDAP servers on each site

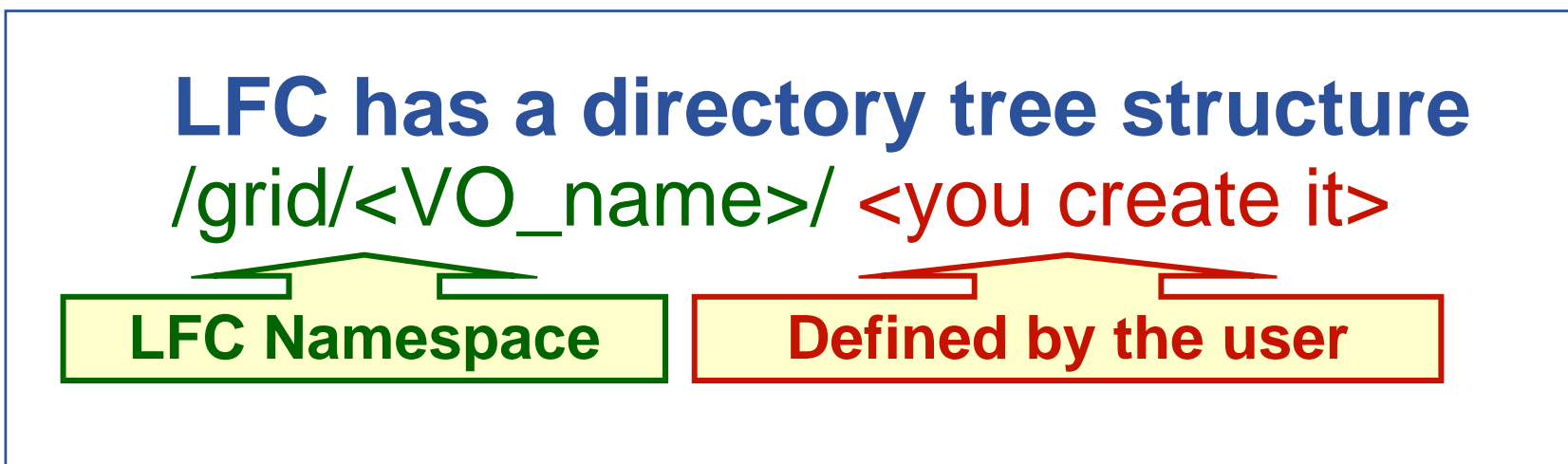


- **Files are write-once, read-many**
 - If users edit files then they manage the consequences!
- **Middleware supporting**
 - **Replica files**
 - to be close to where you want computation
 - For resilience
 - **Logical filenames**
 - **Catalogue:** maps logical name to physical storage device/file
 - **Virtual filesystems,**
POSIX-like I/O
- **Services provided:**
 - storage
 - transfer
 - catalogue that maps logical filenames to replicas.

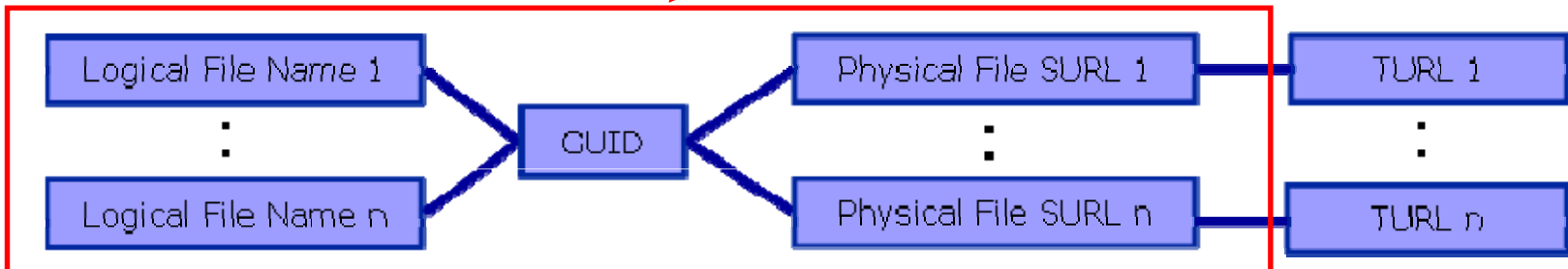
Data management example



- Users primarily access and manage files through “logical filenames”



- Mapping by the “LFC” catalogue server



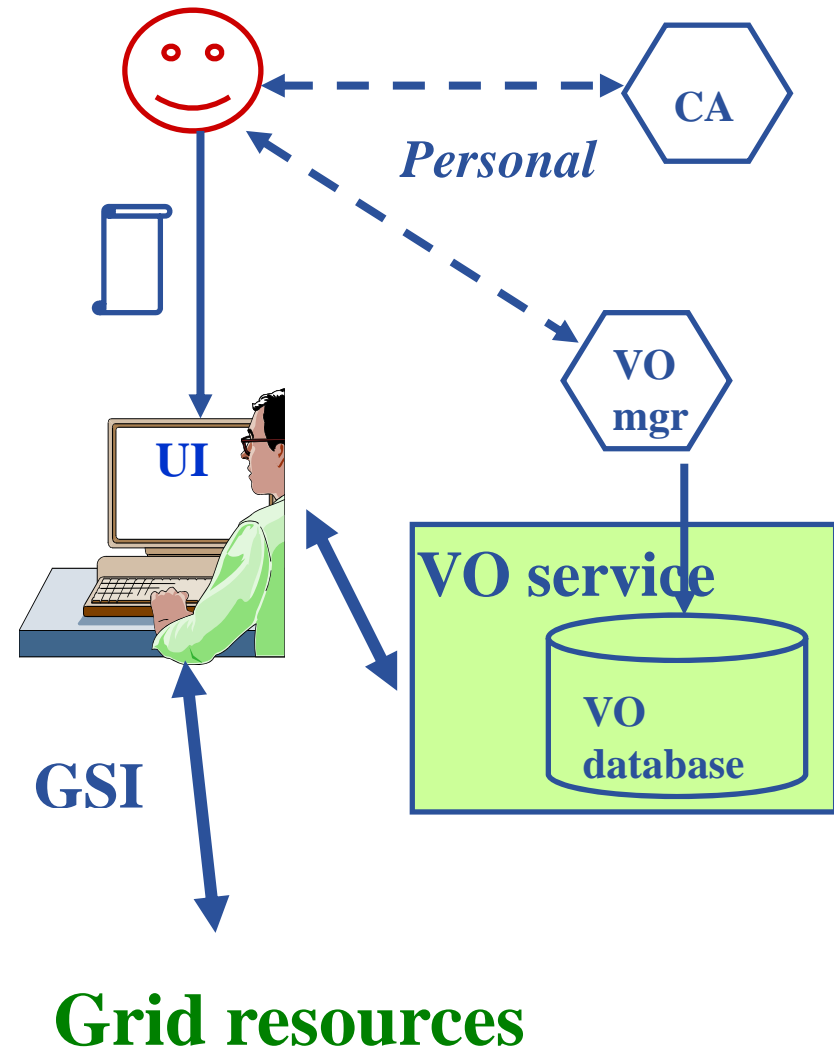
<http://gridportal.hep.ph.ic.ac.uk/rtm>

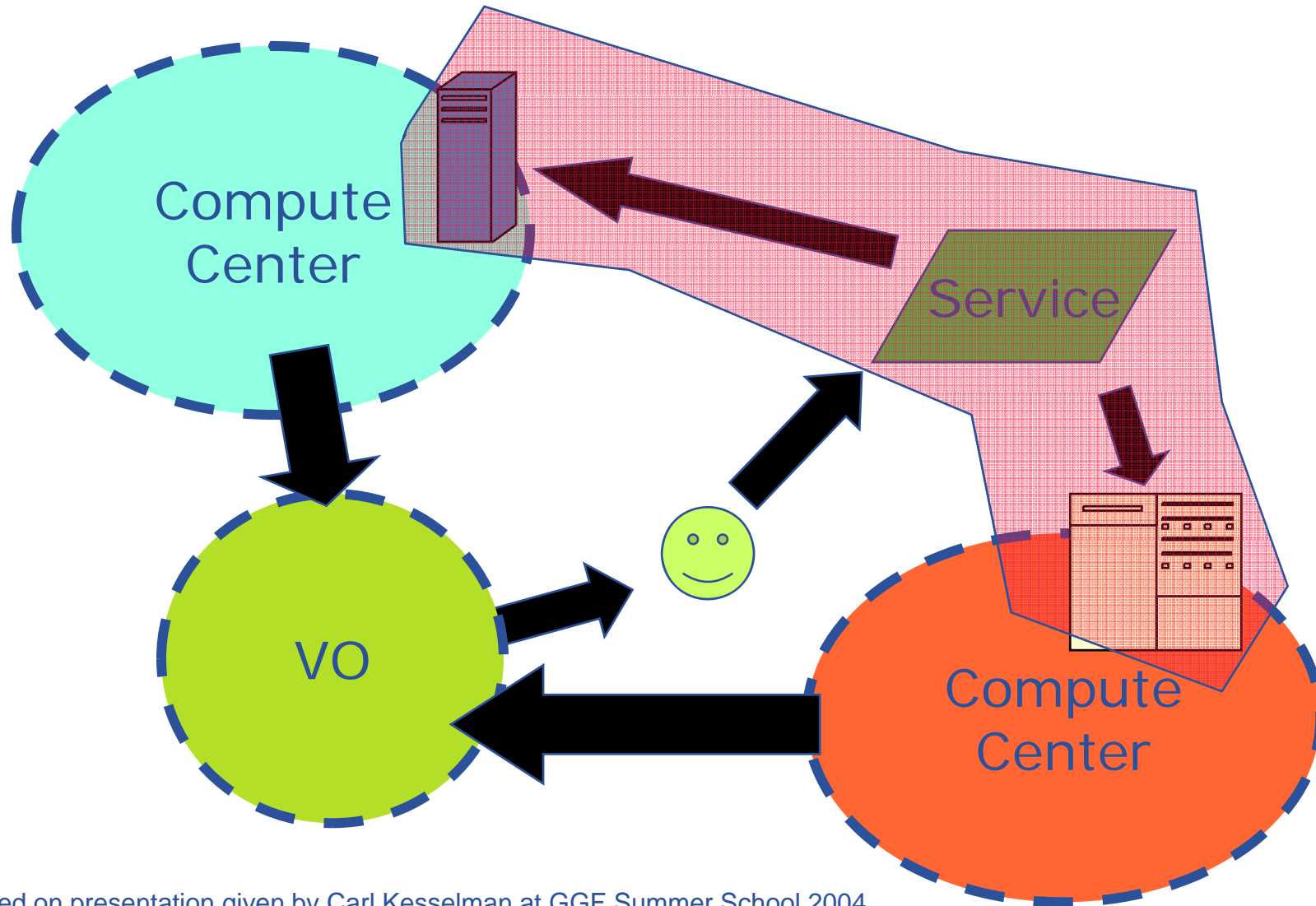
- **Authentication**

- User obtains certificate from Certificate Authority
- Connects to UI by ssh
- Downloads certificate
- Single logon – to UI - create proxy
- then **Grid Security Infrastructure** uses proxies to identify users to other machines

- **Authorisation**

- User joins Virtual Organisation
- VO negotiates access to Grid resources
- Authorisation tested on receipt of credentials:





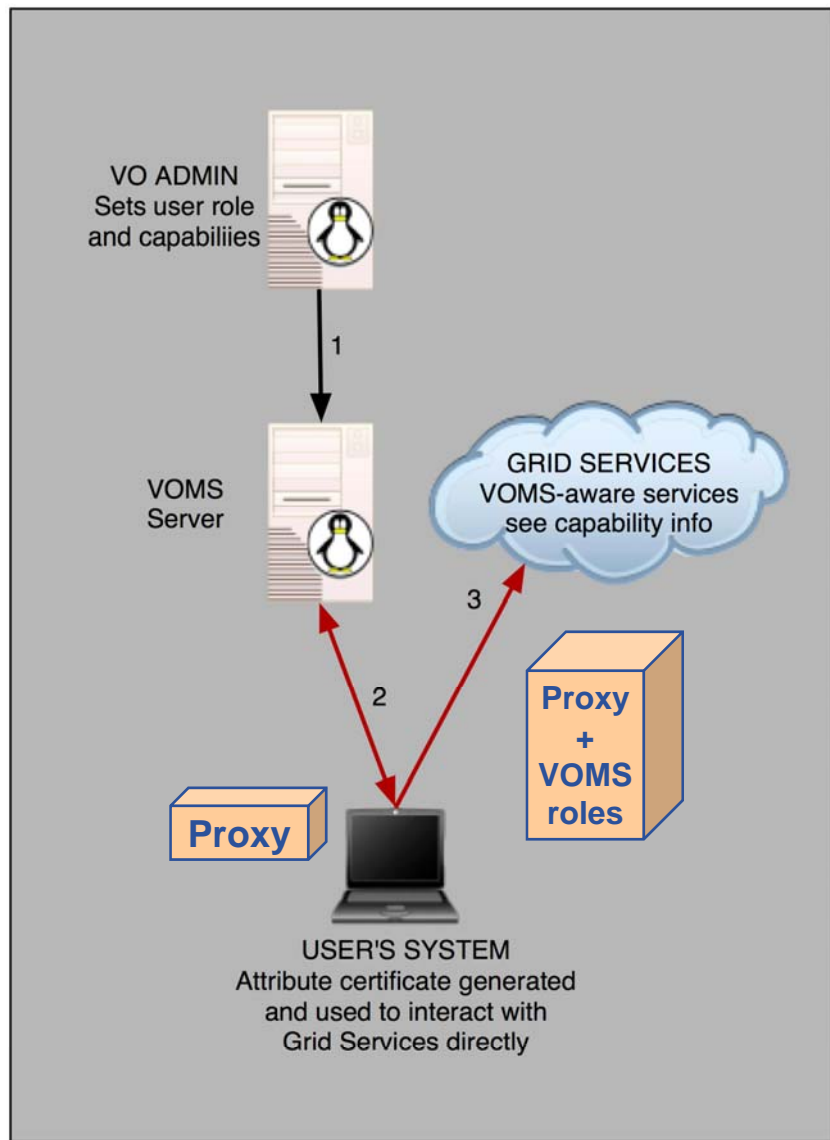
slide based on presentation given by Carl Kesselman at GGF Summer School 2004

Before VOMS

- All VO members have same rights
- Grid user identities are mapped onto local user accounts statically
- User is authorised as a member of a single VO (no aggregation of roles)
- grid-proxy-init

VOMS

- VO can have groups
 - Different rights for each
 - Different groups of experimentalists
 - ...
 - Nested groups
- VOMS has roles
 - Assigned to specific purposes
 - E.g. system admin
 - When assume this role
- User can be in multiple VOs
 - Aggregate roles
- Proxy certificate carries the additional attributes
- voms-proxy-init



- **A community-level group membership system**
- **Database of user roles**
 - Administrative tools
 - Client interface
- **voms-proxy-init**
 - Creates a proxy locally
 - Contacts the VOMS server and extends the proxy with a role

voms-proxy-init –voms omiieurope

- **Allows VOs to centrally manage user roles**

- **VOMS is a grid attribute system that allows a client to embed an attribute certificate in a well known certificate extension. Since the embedded attribute certificate is signed by a VOMS server, a VOMS enabled service can parse and verify this extra certificate and treat the data therein as extra information about the client to use in an authorization decision**
- **At a glance**
 - **A VOMS server, typically one for each VO, contains information about a user**
 - **The VOMS server, when requested, will digitally sign an assertion stating that a particular DN has some particular attributes**
 - **A client may embed this in its own proxy certificate to "push" it to the service when accessing resources**
 - **The service, trusting a particular set of VOMS servers for attribute information, can use the attributes to make authorization decisions**
- **Using a distributed attribute system relieves services of needing to know every detail about the connecting clients.**

Practical

- **Using OMII-Europe Evaluation Infrastructure to gain experience of basic services**
 - In future, will have OMII-Europe components added to the basic gLite services
- **Connecting to moss-g1.man.poznan.pl**
- **Do tutorials *in order given* on gLite link from <http://training.omii-europe.org/>**
 - Do VOMS practical first!
 - **Its your “single sign-on”**

- **EGEE** www.eu-egee.org
- **gLite** <http://www.glite.org/>
- **EGEE digital library:** <http://egee.lib.ed.ac.uk/>
- **EGEE'07 Conference 1-5 October 2007, Budapest, Hungary.**