



Enabling Grids for E-science

# An overview of the EGEE project and middleware

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[www.eu-egee.org](http://www.eu-egee.org)

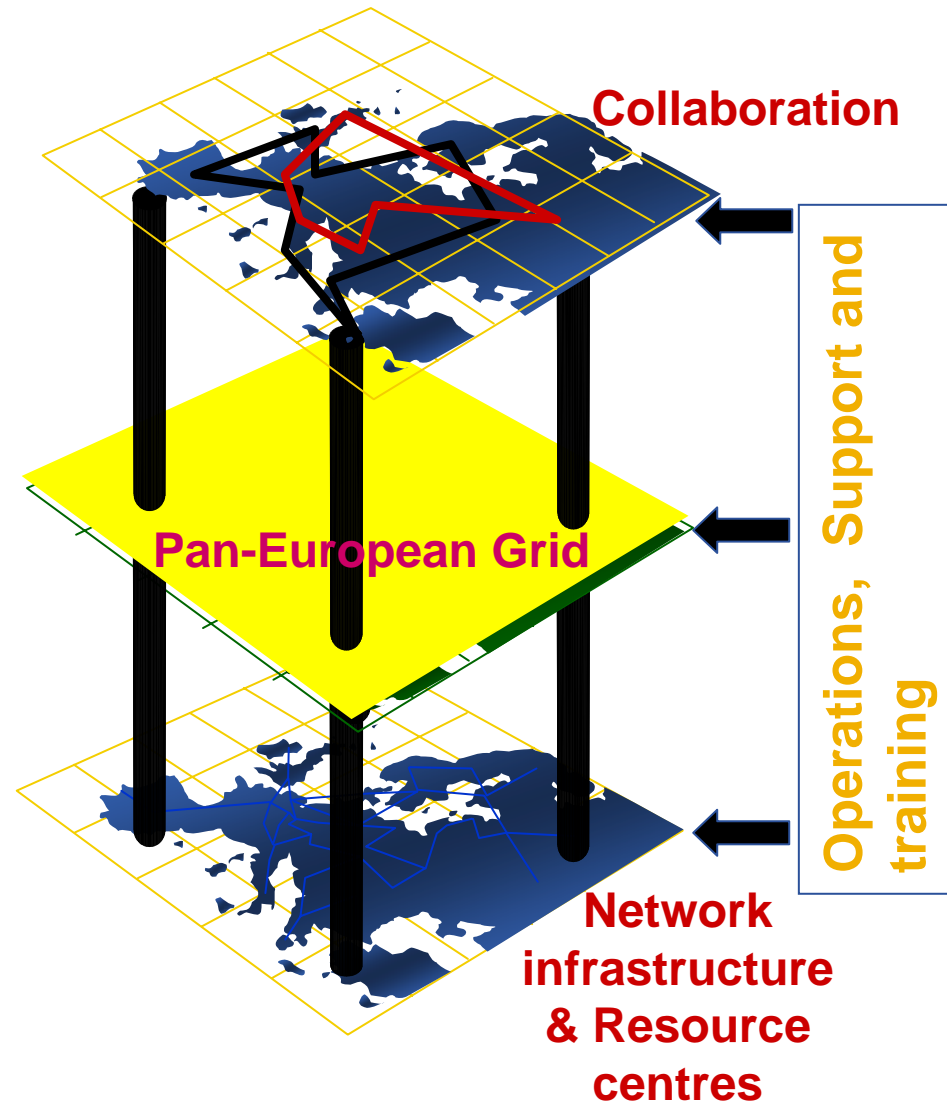


- **What is EGEE?**
  - Goals
  - Status
  - Activities
- **Grid services: gLite 3.0**
- **GILDA – the grid we will use in practicals**
- **Sources of further information**

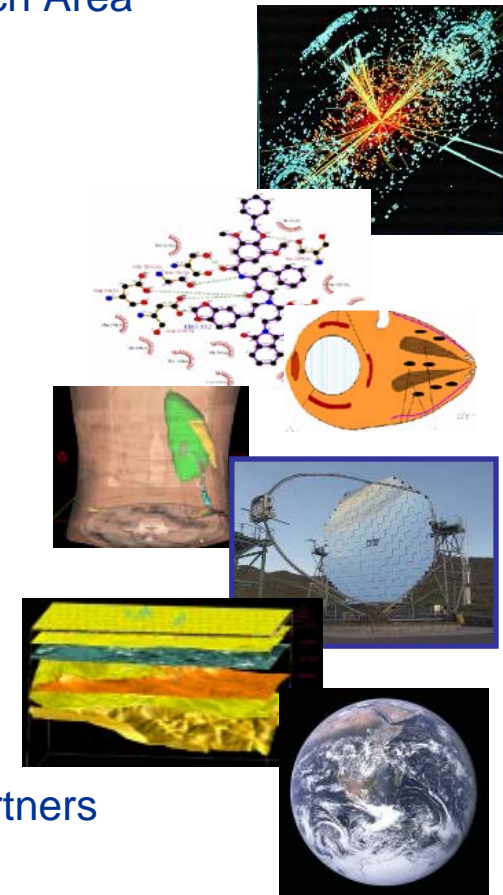


## A four year programme:

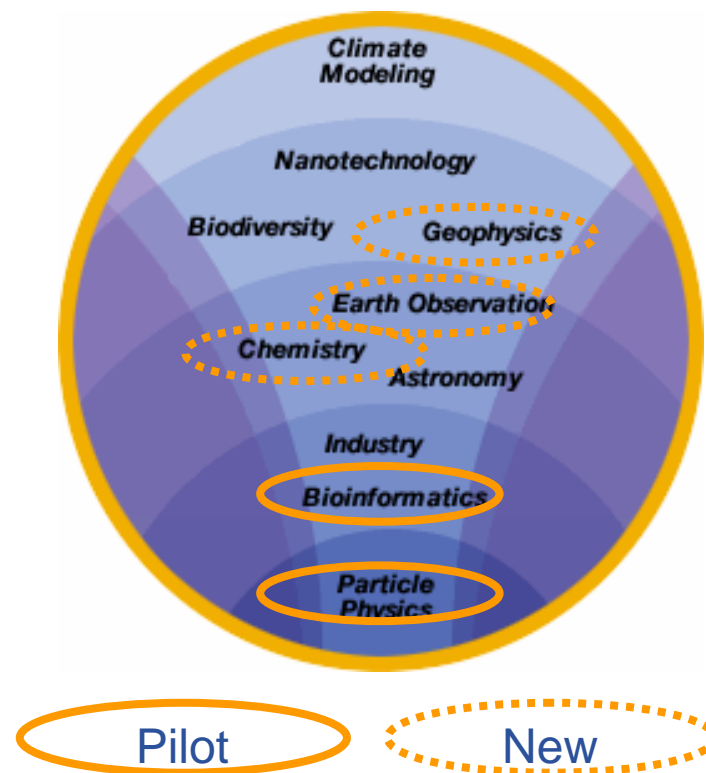
- **Build, deploy and operate a consistent, robust a large scale production grid service that**
  - Links with and build on national, regional and international initiatives
- **Improve and maintain the middleware in order to deliver a reliable service to users**
- **Attract new users from research and industry and ensure training and support for them**



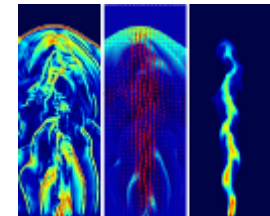
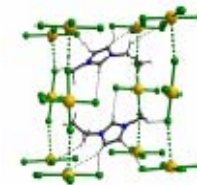
- **Infrastructure**
  - Manage and operate production Grid for European Research Area
  - Interoperate with e-Infrastructure projects around the globe
  - Contribute to Grid standardisation efforts
  
- **Support applications from diverse communities**
  - High Energy Physics
  - Biomedicine
  - Earth Sciences
  - Astrophysics
  - Computational Chemistry
  - Fusion
  - Geophysics
  - Finance, Multimedia
  - ...
  
- **Business**
  - Forge links with the full spectrum of interested business partners
  
- + **Disseminate knowledge about the Grid through training**
- + **Prepare for sustainable European Grid Infrastructure**



- **Established production quality sustained Grid services**
  - 3000 users from at least 5 disciplines
  - Goal was to integrate 50 sites into a common infrastructure → currently 180
  - offer 5 Petabytes ( $10^{15}$ ) storage
- **Demonstrated a viable general process to bring other application communities on board**
- **Secured a second phase from April 2006**



- **Natural continuation of EGEE**
  - Expanded consortium
  - Emphasis on providing an infrastructure
    - increased support for applications
    - interoperate with other infrastructures
    - more involvement from Industry



SA: service activities

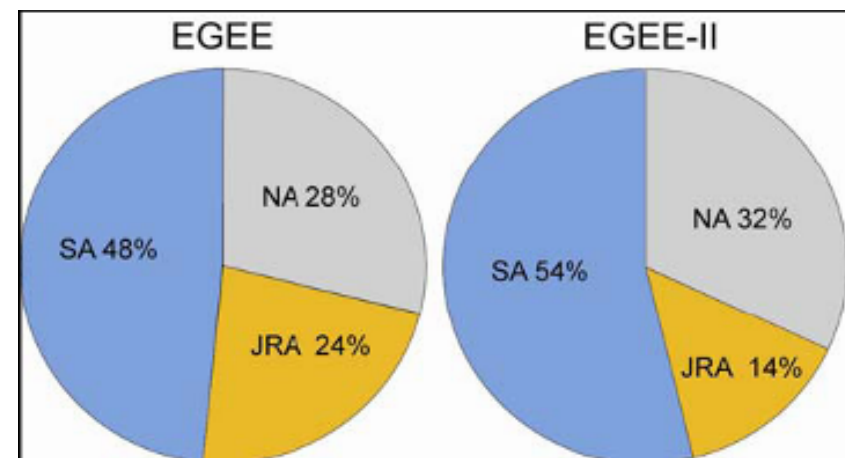
- establishing operations

NA: network activities

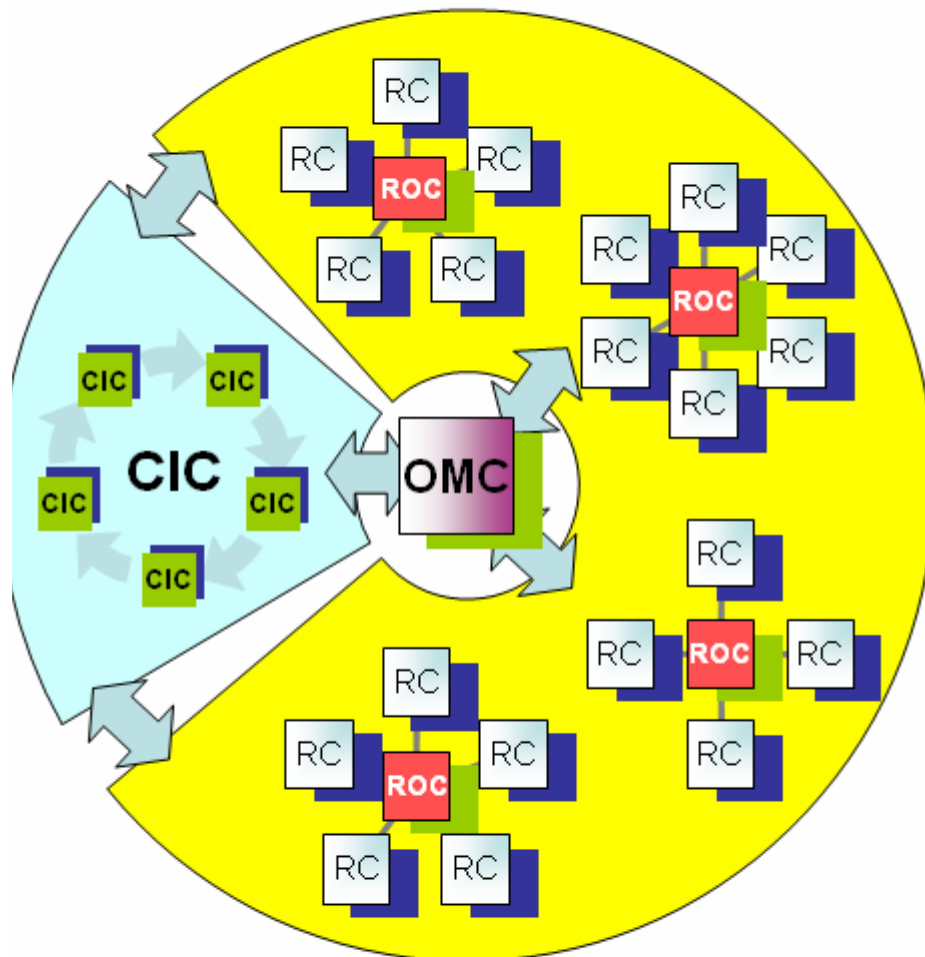
- supporting VOs

JRA: “joint research activities”

- e.g. hardening middleware







RC = Resource Centre  
 ROC = Regional Operations Centre  
 CIC = Core Infrastructure Centre  
 OMC = Operations Management Centre

- **CICs act as a single Operations Centre**
  - Operational oversight (*grid operator*) responsibility
  - rotates weekly between CICs
  - Report problems to ROC/RC
  - ROC is *responsible* for ensuring problem is resolved
  - ROC oversees regional RCs
- **ROCs responsible for organising the operations in a region**
  - Coordinate deployment of middleware, etc
- **CERN coordinates sites not associated with a ROC**
- **Global Grid User Support**

- More than 90 partners
- 32 countries
- 12 federations
- ➔ Major and national Grid projects in Europe, USA, Asia



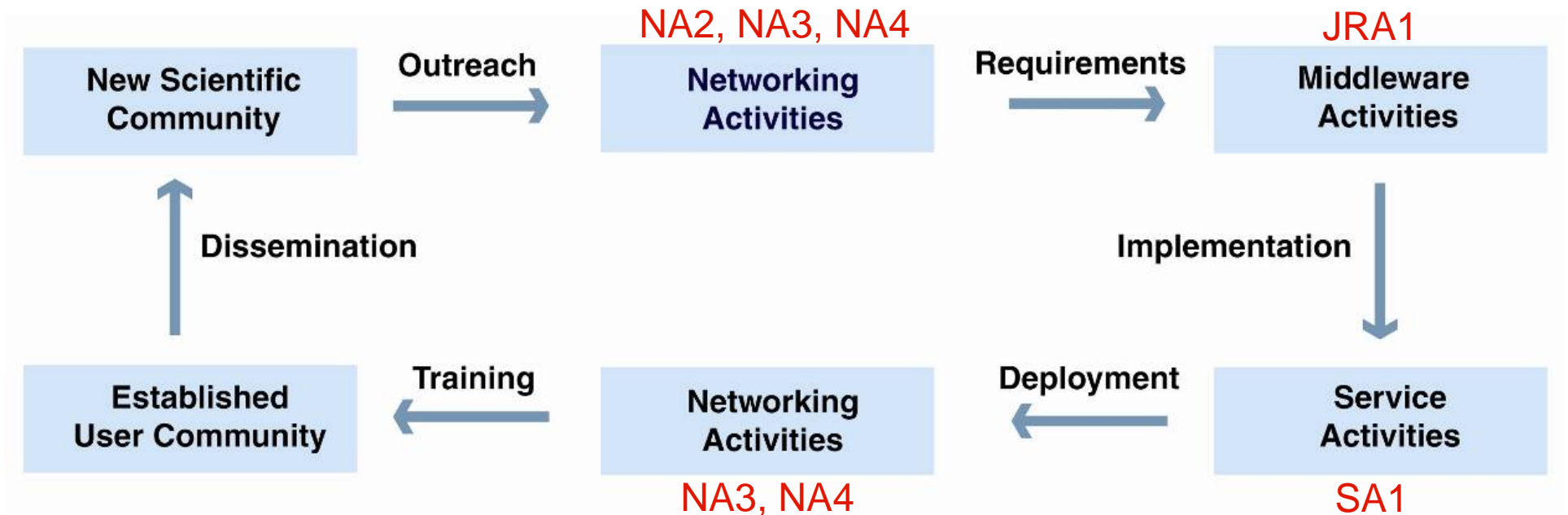
**+ 27 countries through related projects:**

- BalticGrid
- SEE-GRID
- EUMedGrid
- EUChinaGrid
- EELA





<i>Name</i>	<i>Description</i>
<b>BalticGrid</b>	EGEE extension to Estonia, Latvia, Lithuania
<b>EELA</b>	EGEE extension to Brazil, Chile, Cuba, Mexico, Argentina
<b>EUChinaGRID</b>	EGEE extension to China
<b>EUMedGRID</b>	EGEE extension to Malta, Algeria, Morocco, Egypt, Syria, Tunisia, Turkey
<b>ISSeG</b>	Site security
<b>eIRGSP</b>	Policies
<b>ETICS</b>	Repository, Testing
<b>OMII-Europe</b>	to provide key software components for building e-infrastructures;
<b>BELIEF</b>	Digital Library of Grid documentation, organisation of workshops, conferences
<b>BIOINFOGRID</b>	Biomedical
<b>Health-e-Child</b>	Biomedical – Integration of heterogeneous biomedical information for improved healthcare
<b>ICEAGE</b>	International Collaboration to Extend and Advance Grid Education



## Building effective user communities

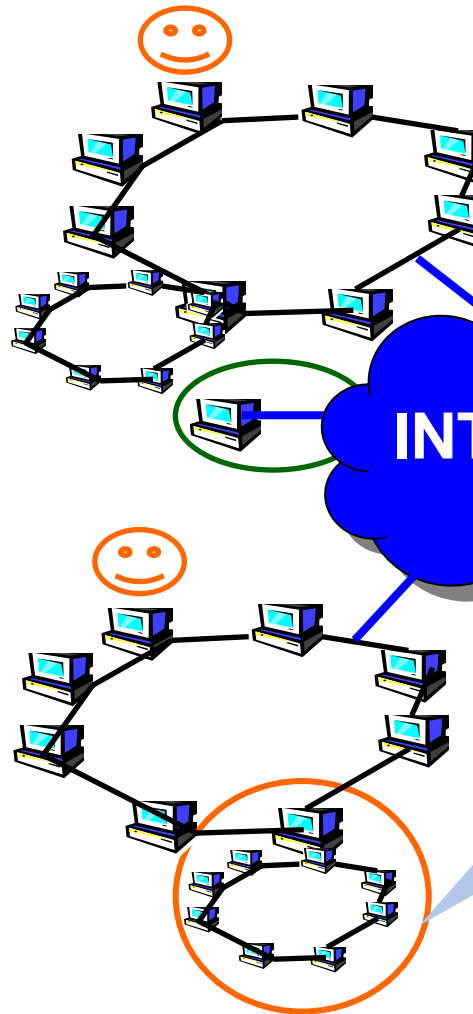
- <http://www.egee.nesc.ac.uk/schedreg>

## Grid services

**How can EGEE middleware support collaboration and resource sharing within and between many diverse VO's ?**

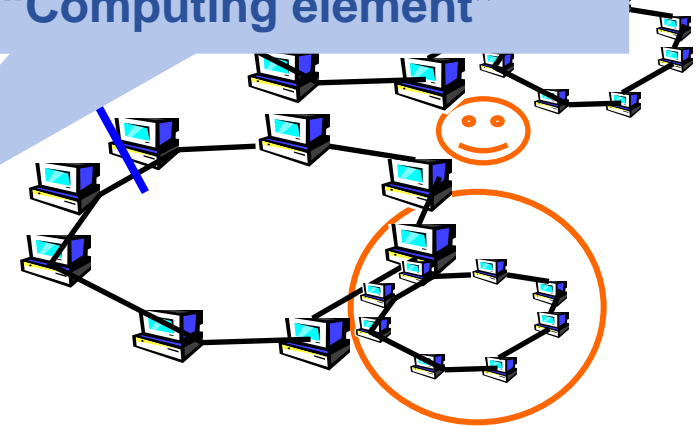
- **When using a PC or workstation you**
  - Login with a username and password (“Authentication”)
  - Use rights given to you (“Authorisation”)
  - Run jobs
  - Manage files: create them, read/write, list directories
- **Components are linked by a bus**
- **Operating system**
- **One admin domain**
- **When using a Grid you**
  - Login with digital credentials (“Authentication”)
  - Use rights given you (“Authorisation”)
  - Run jobs
  - Manage files: create them, read/write, list directories
- **Services are linked by the Internet**
- **Middleware**
- **Many admin domains**

- **Grid middleware runs on each shared resource**
  - Data storage
  - (Usually) batch queues on pools of processors
- **Users join VO's**
- **Virtual organisation negotiates with sites to agree access to resources**
- **Distributed services (both people and middleware) enable the grid, allow single sign-on**



At each site that provides computation:

- Local resource management system
- (= batch queue)
  - Condor
  - PBS
  - Torque
  - ...
- EGEE term: queue is a "Computing element"





Users in many locations and organisations

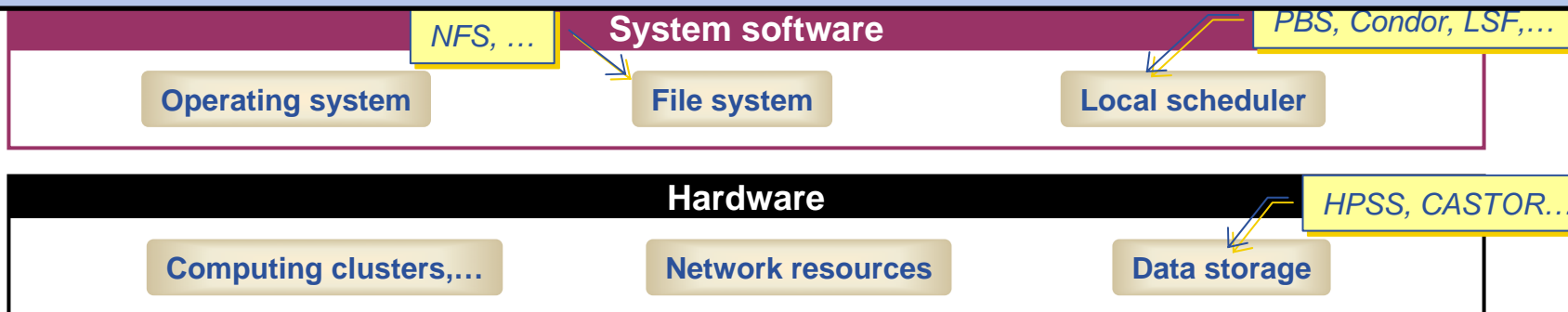


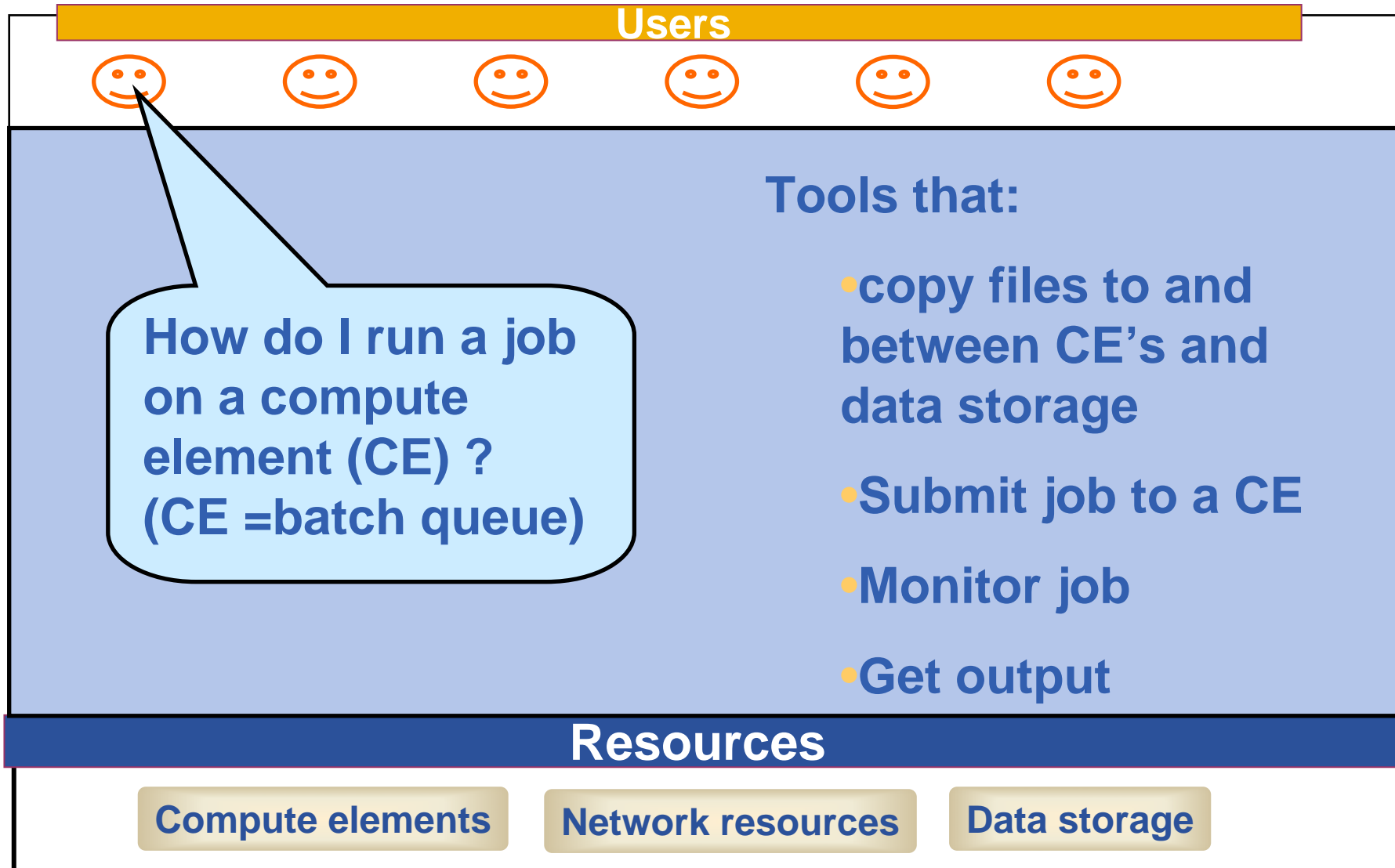
Access services (“user interface”) :  
logon, upload credentials, run m/w commands

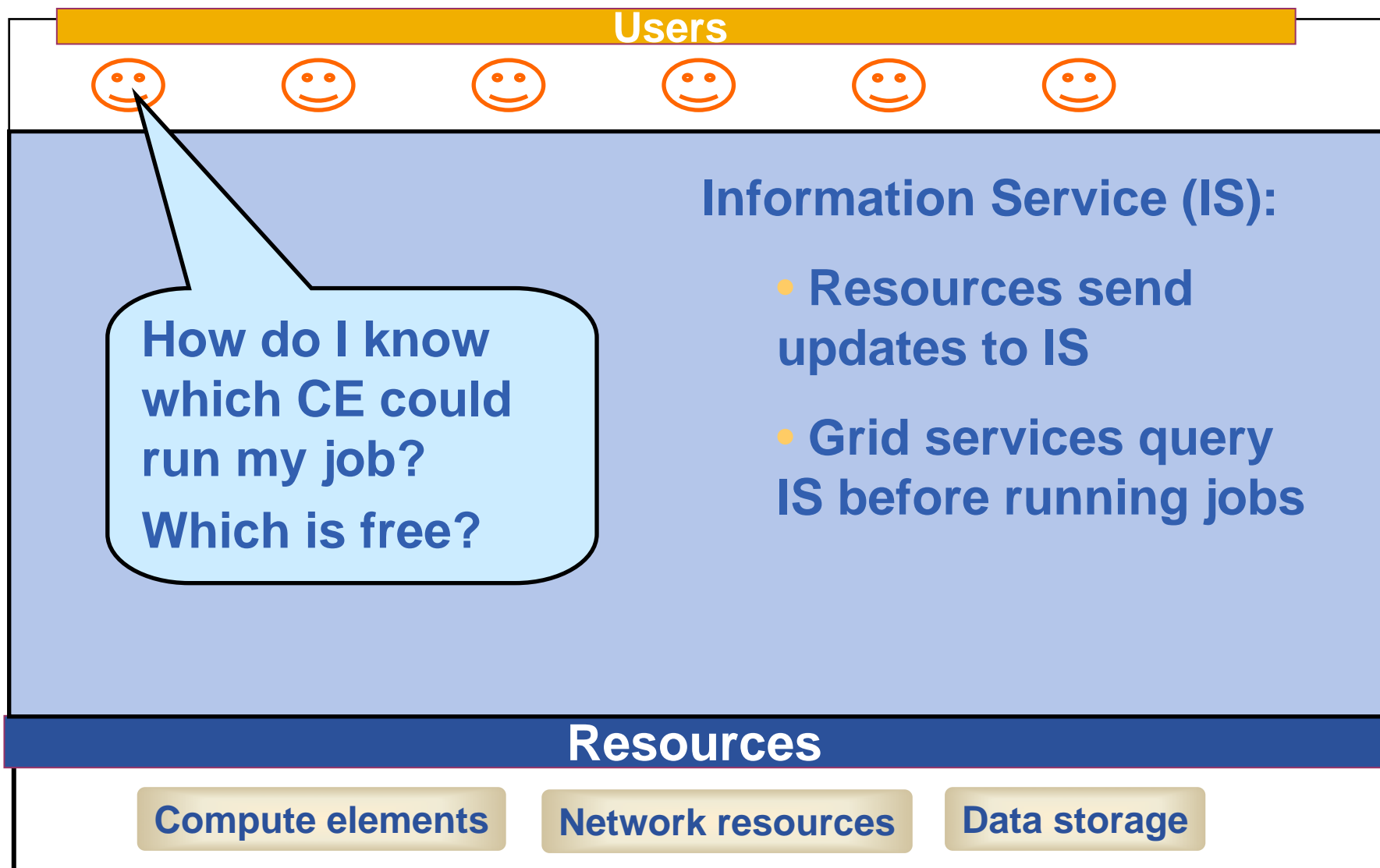
## GRID SERVICES

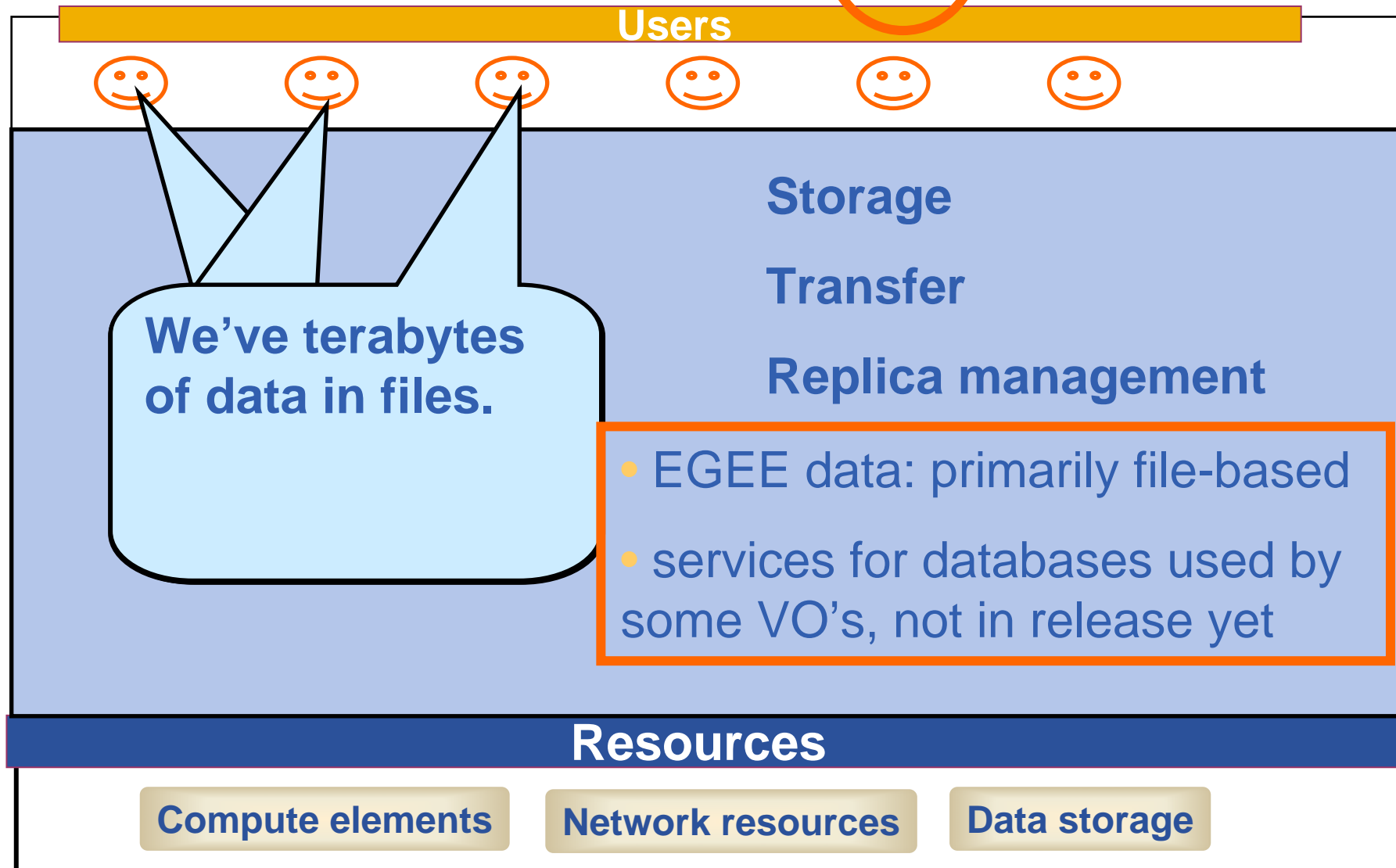
Build on Grid Security Infrastructure

“Gate keeping”:  
map user’s credential to local user id / account











**User Interface (UI):**

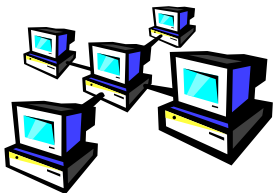
The place where users logon to the Grid



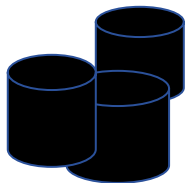
**Resource Broker (RB):** Matches the user requirements with the available resources on the Grid



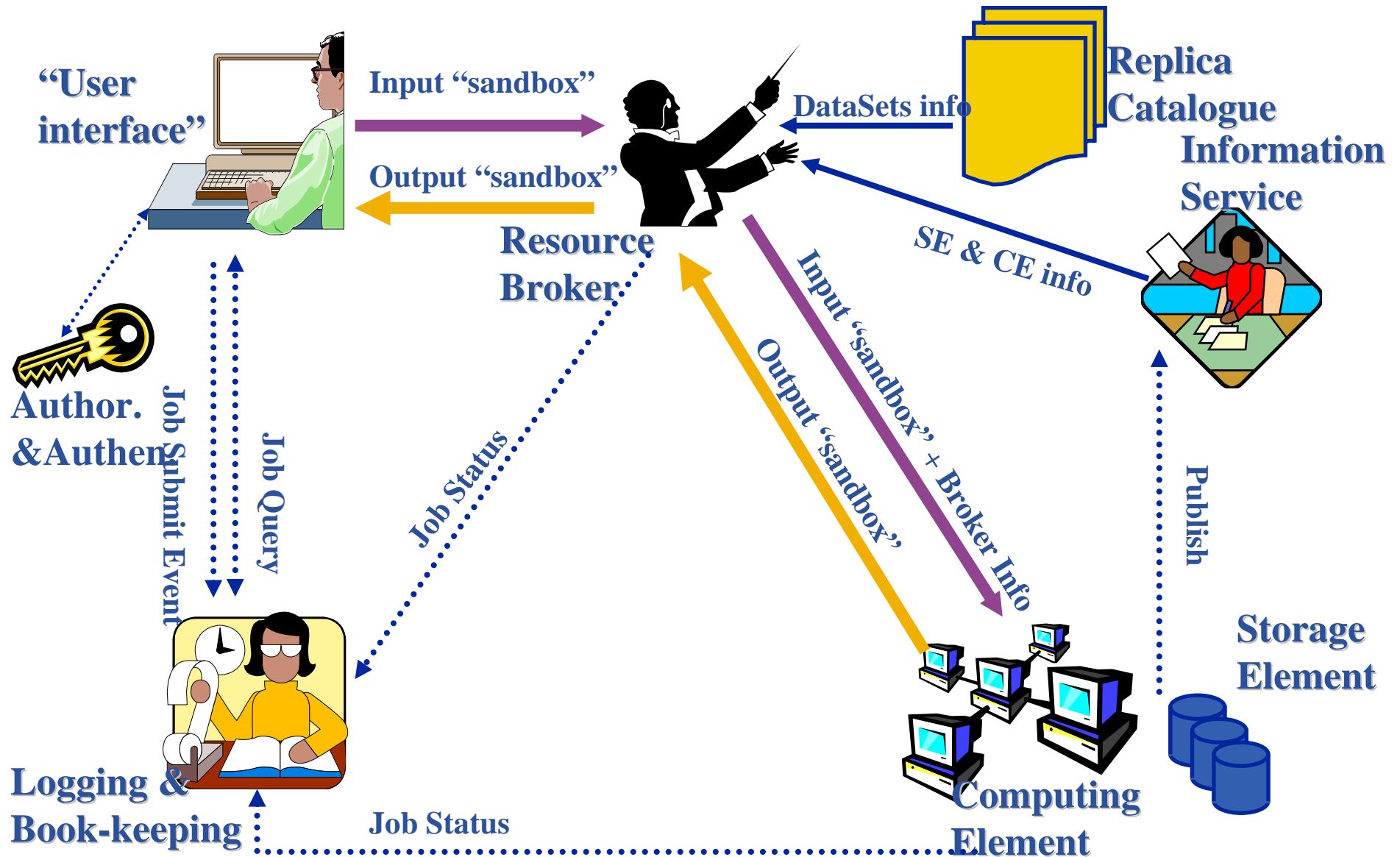
**Information System:** Characteristics and status of CE and SE  
(Uses “GLUE schema”)



**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





- Submit job to grid via the “resource broker (RB)”,
- `glite_job_submit my.jdl`  
Returns a “job-id” used to monitor job, retrieve output

## Example JDL file

```
Executable = "gridTest";
StdError = "stderr.log";
StdOutput = "stdout.log";
InputSandbox = {"/home/joda/test/gridTest"};
OutputSandbox = {"stderr.log", "stdout.log"};
InputData = "lfn:testbed0-00019";
DataAccessProtocol = "gridftp";
Requirements = other.Architecture=="INTEL" && \
               other.OpSys=="LINUX";
Rank = "other.GlueHostBenchmarkSF00";
```

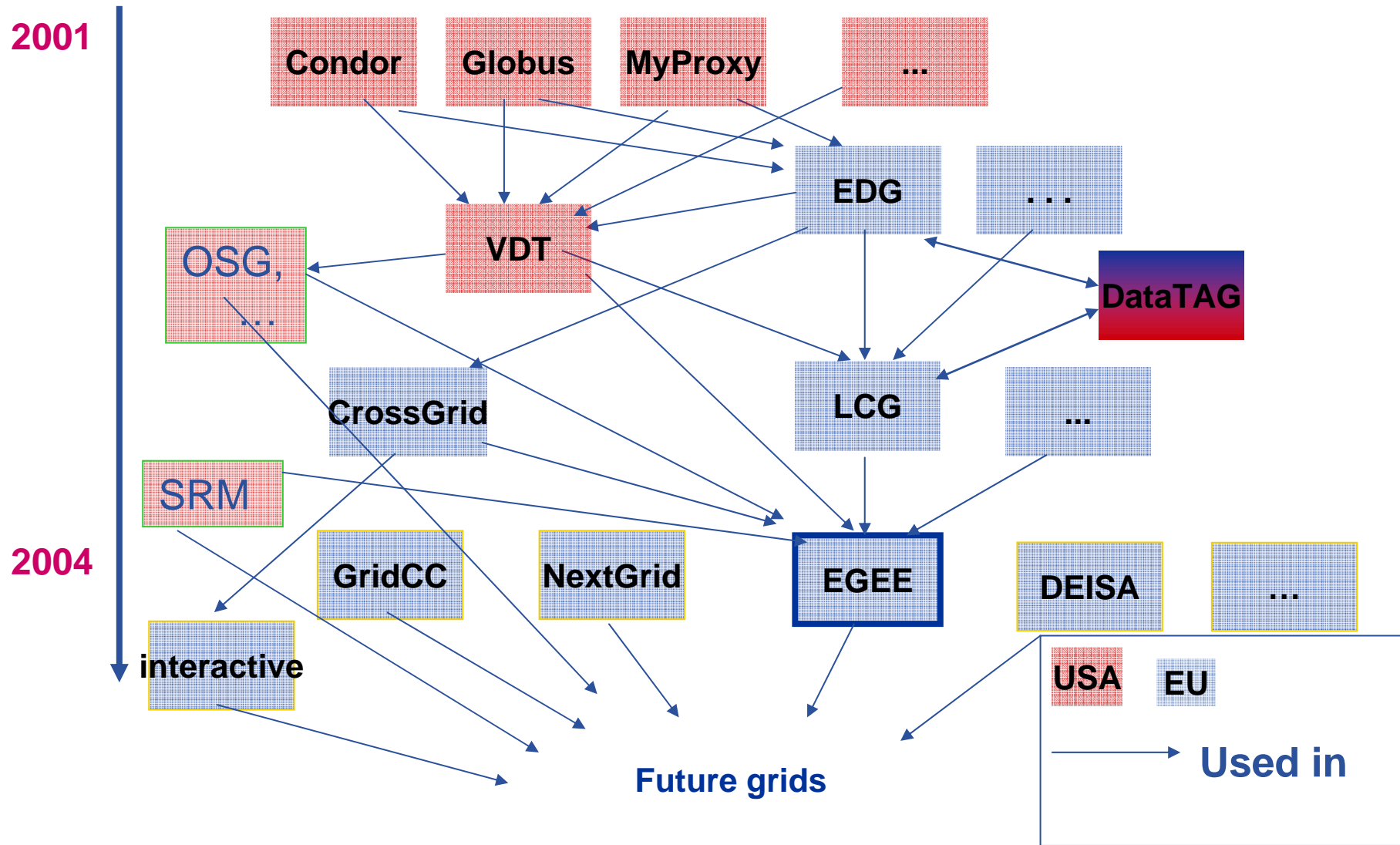
# Who provides the resources?!

<u>Service</u>	<u>Provider</u>	<u>Note</u>
<u>Access service</u>	User / institute / VO	Computer with client software
<u>Resource Broker (RB)</u>	VO	
<u>Information System:</u>	Grid operations	
<u>Computing Element (CE)</u>	VOs	Scalability requires that VOs provide resources to match average need
<u>Storage Element (SE)</u>	VOs	

“VO”: virtual organisation

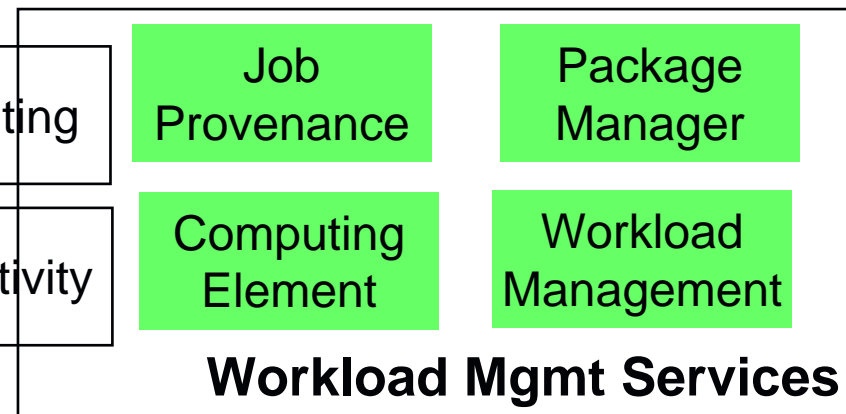
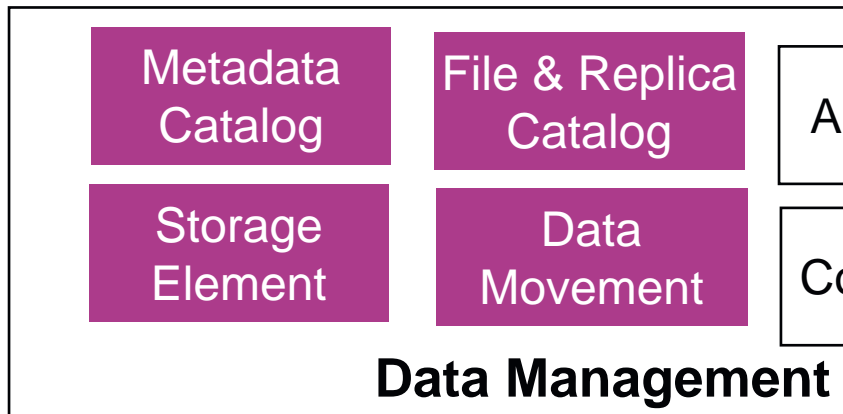
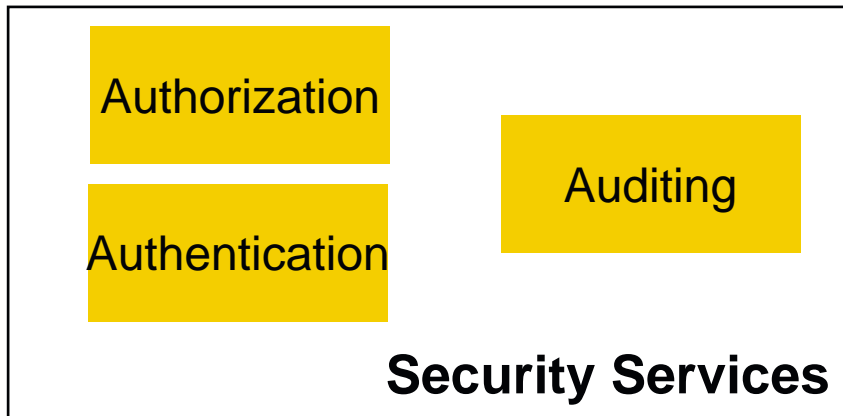
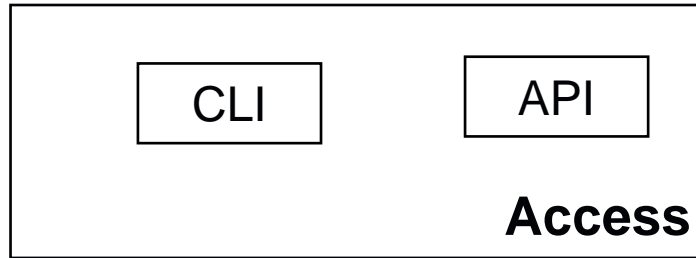
“Grid operations”: funded effort

# Parts of the Grid “ecosystem”



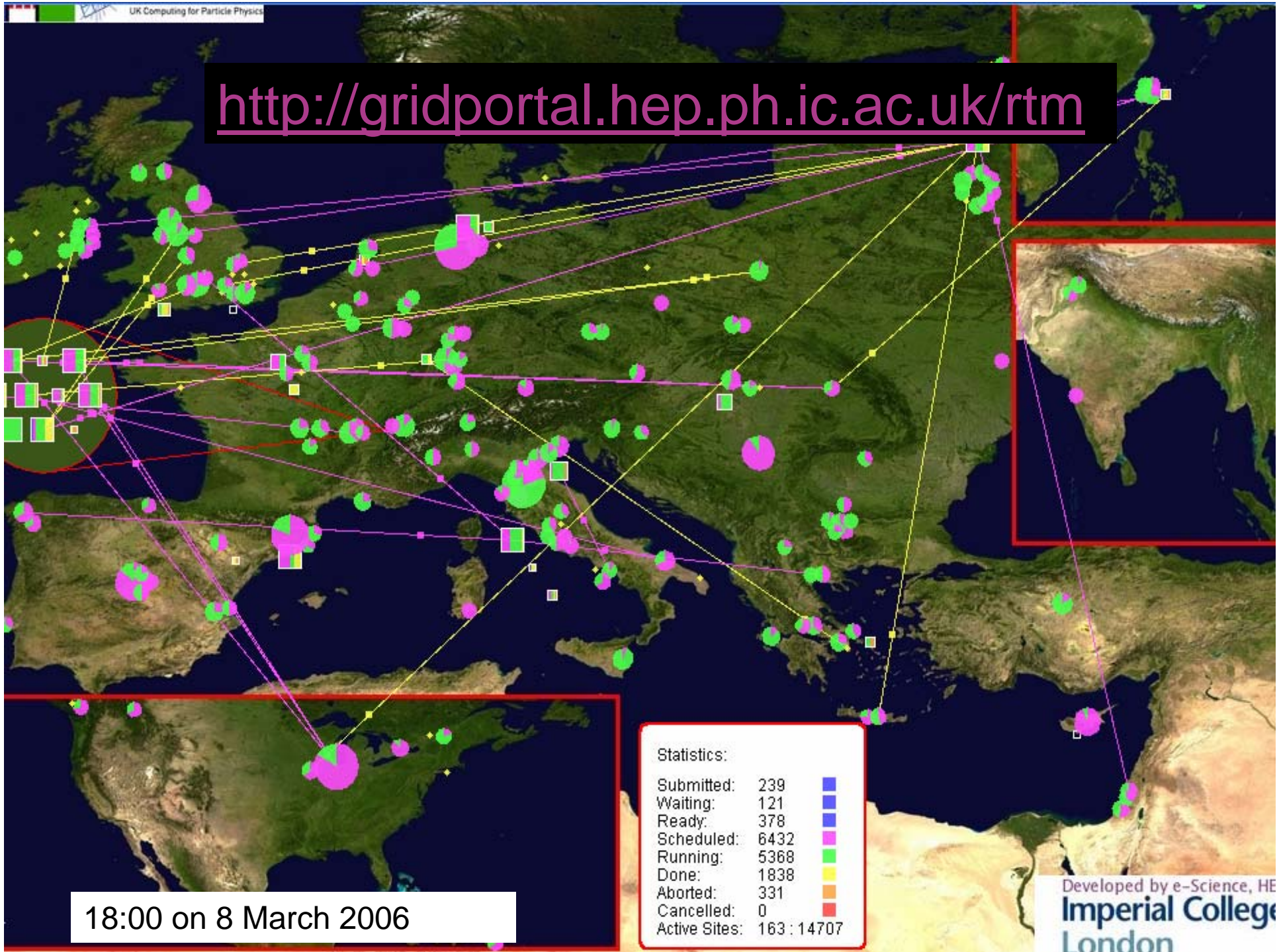
- **Runs on various Linux releases**
  - “Scientific Linux” most common
  - Ports to other Operating Systems in progress
- **Being deployed on EGEE production Grid now**
- **History**
  - During last 2 years, some new services were created in releases of new middleware, up to gLite 1.5, has been in pre-production use
  - A subset of these is deployed with some of the previous middleware (LCG 2.7)
    - All components already in LCG 2.7.0 plus upgrades
      - *this already includes new versions of VOMS, R-GMA and FTS*
    - The Workload Management System (with LB, CE, UI) of gLite 1.5.0

- **Converge from LCG and gLite to a single middleware stack called gLite. The first version is gLite 3.0.0**
  - Process controlled by the **Technical Coordination Group**
  - gLite 1.5.0 and LCG 2.7.0 have been the last independent releases
- **Components in gLite 3.0.0**
  - Certified:
    - All components already in LCG 2.7.0 plus upgrades
      - *this already includes new versions of VOMS, R-GMA and FTS*
    - The Workload Management System (with LB, CE, UI) of gLite 1.5.0
  - Tested to some degree and with limited deployment support:
    - The DGAS accounting system
    - Data management tools as needed by the Biomed community
      - *Hydra, AMGA, secure access to data*





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



18:00 on 8 March 2006

Statistics:

Submitted:	239	■
Waiting:	121	■
Ready:	378	■
Scheduled:	6432	■
Running:	5368	■
Done:	1838	■
Aborted:	331	■
Cancelled:	0	■
Active Sites:	163 : 14707	

- **Why t-infrastructure?**
  - Training is necessary!
  - e-Infrastructure for production
  - t-Infrastructure for training
- **Need guaranteed response for tutorials; limit the vulnerability of production systems**
  - use training grid
  - have training CA
  - able to change middleware to prepare participants for future releases on production system
  - need safe resources for installation training
  - easy entry point for new communities



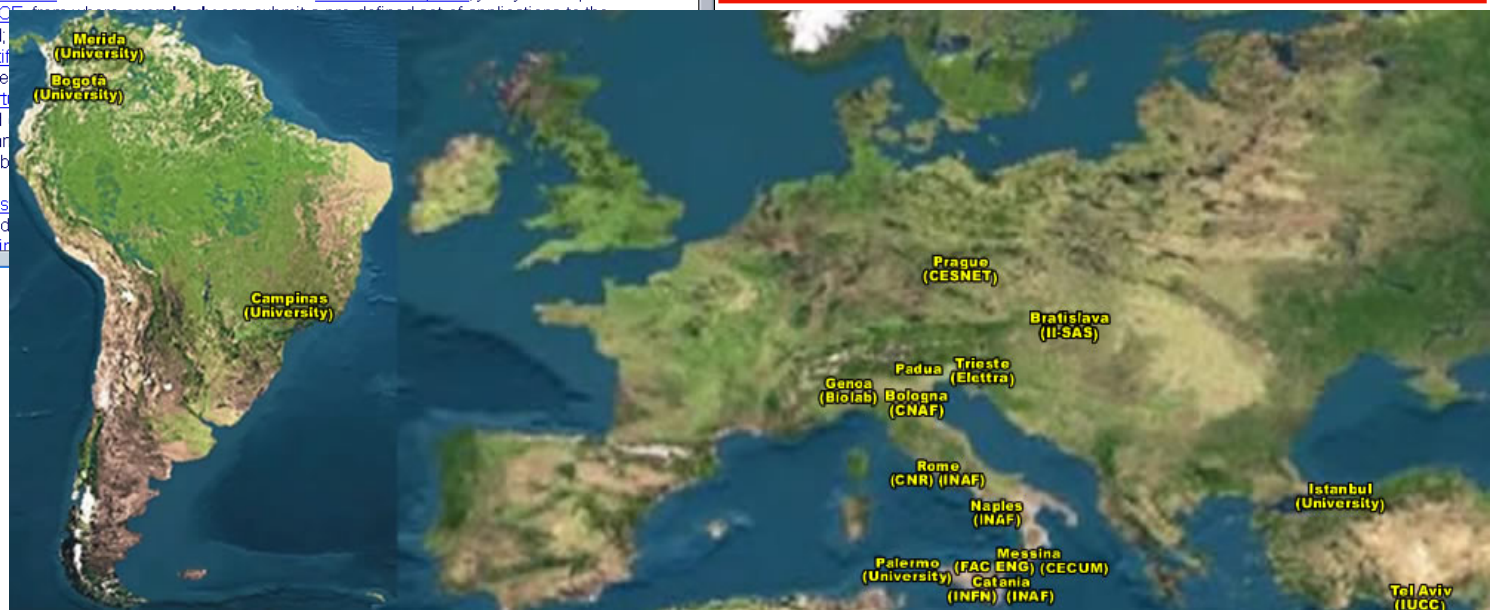


**GILDA (Grid Infn Laboratory for Dissemination Activities)**  
is a virtual laboratory to demonstrate/disseminate the strong capabilities of grid computing.

GILDA consists of the following elements:

- the [GILDA Testbed](#): a series of sites and services (Resource Broker, Information Index, Data Managers, Monitoring tool, Computing Elements, and Storage Elements) spread all over Italy and the rest of the world on which the latest version of both the [INFN Grid](#) middle-ware (fully compatible with [LCG](#) middle-ware) and the [gLite](#) middle-ware are installed;
- the [Grid Demonstrator](#): a customized version of the full [GENIUS web portal](#), jointly developed by INFN and NIC
- GILDA Testbed;
- the [GILDA Certificate](#): X.509 certificate
- the [GILDA Virtual Organization](#): experience grid computing with the Virtual Organization
- the [Grid Tutor](#): basic and advanced tutorials;
- the [monitoring system](#): monitoring tool of the infrastructure
- the [GILDA mailing list](#)

- 19 sites in 3 continents
- > 3000 certificates issued, >15% renewed at least once
- > 100 tutorials and demos performed in 23 months
- > 1,000,000 hits (> 50,000 unique visits) on (of) the web site from 10's of different countries
- > 0.6 TB of training material downloaded from the web site



- **EGEE is running the largest multi-VO grid in the world!**
- **gLite 3.0 production middleware**
  - **Upon which can be built toolkits and services for new application communities**
- **Supporting effective new user communities**
- **t-Infrastructure for training**
  - **GILDA**
- **Next 2 years: progress towards**
  - **Federated Grid**
  - **Sustainable organisation**

- **EGEE Conference: 25-29 September 2006**  
<http://www.eu-egee.org/news/registration-open-for-egee201906-conference-September-2006-geneva/>
- **EGEE digital library:** <http://egee.lib.ed.ac.uk/>
- **EGEE** [www.eu-egee.org](http://www.eu-egee.org)
- **EGEE: 1<sup>st</sup> user Forum**  
<http://egee-intranet.web.cern.ch/egee-intranet/User-Forum>
- **gLite** <http://www.glite.org/>
- **LCG** <http://lcg.web.cern.ch/LCG/>
- **Open Grid Forum** <http://www.gridforum.org/>
- **Globus Alliance** <http://www.globus.org/>
- **VDT** <http://www.cs.wisc.edu/vdt/>