An overview of the EGEE project and middleware

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Information Society

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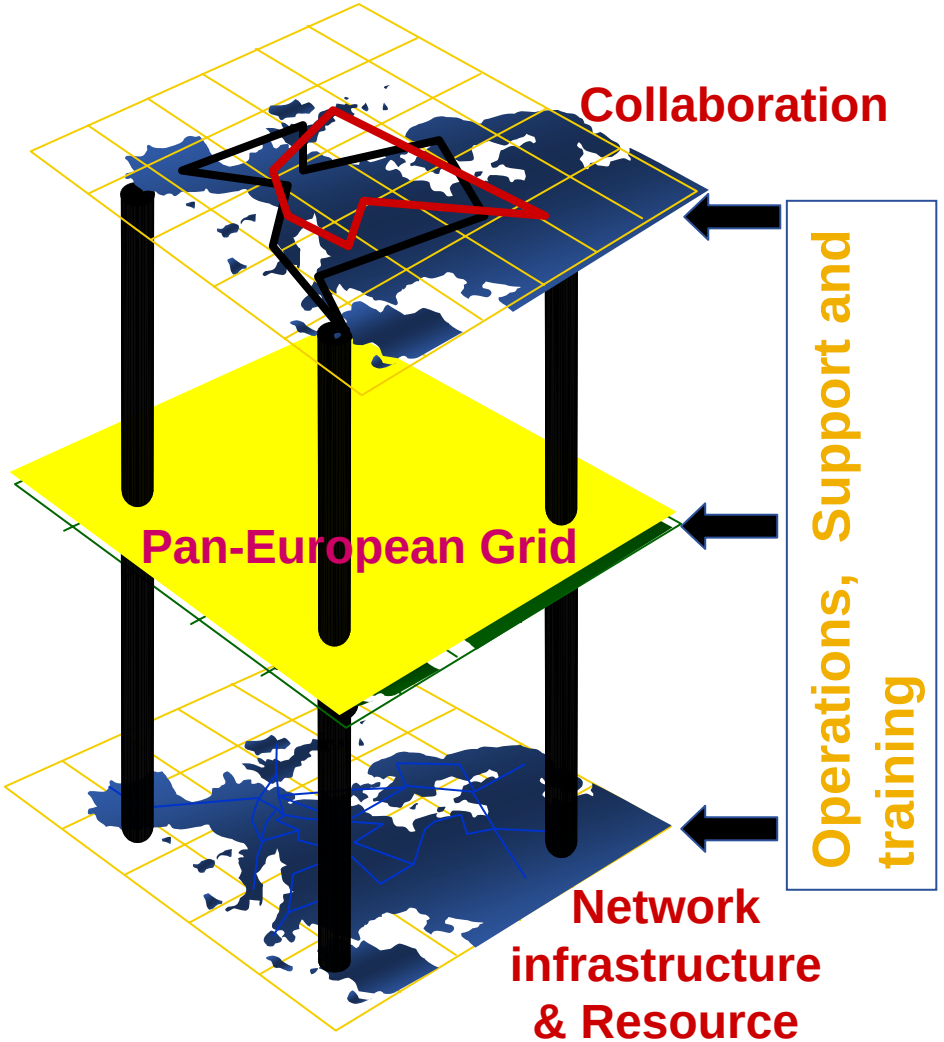
- **Sources of further information**

EGEE – international e-infrastructure

A four year programme:

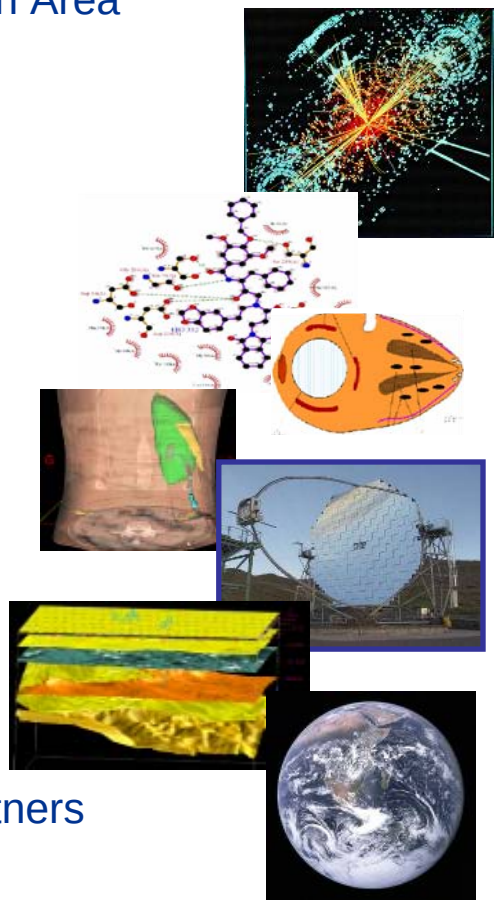
- **Build, deploy and operate a consistent, robust a large scale production grid service that**
  - Links with and build on national, regional and international initiatives
- **Improve and maintain the middleware in order to deliver a reliable service to users**
- **Attract new users from research and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



EGEE Mission

- **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
  - …

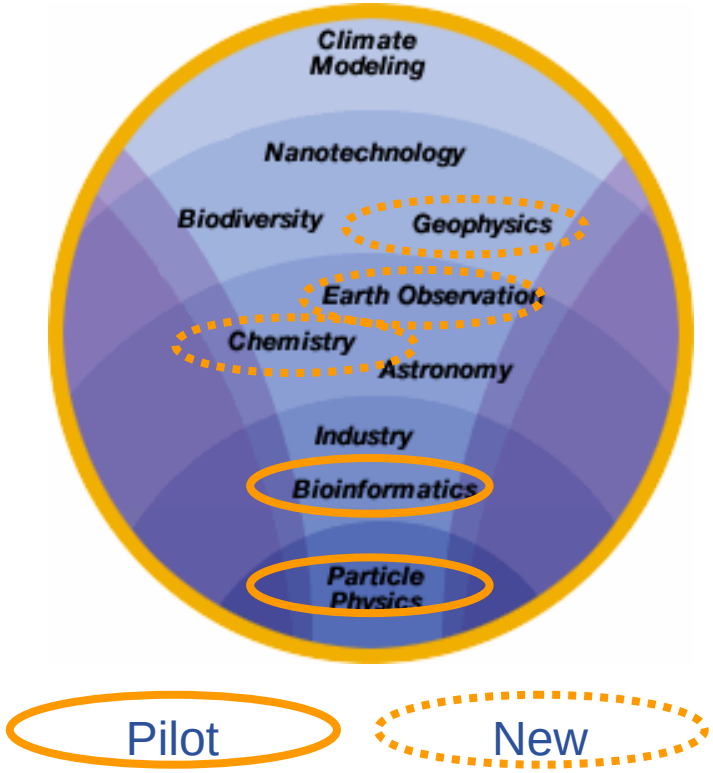


- **Business**
  - Forge links with the full spectrum of interested business partners

+ Disseminate knowledge about the Grid through training
+ Prepare for sustainable European Grid Infrastructure

In the first 2 years EGEE

- **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

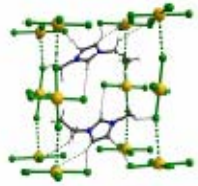
- establishing operations

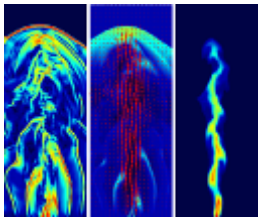
NA: network activities

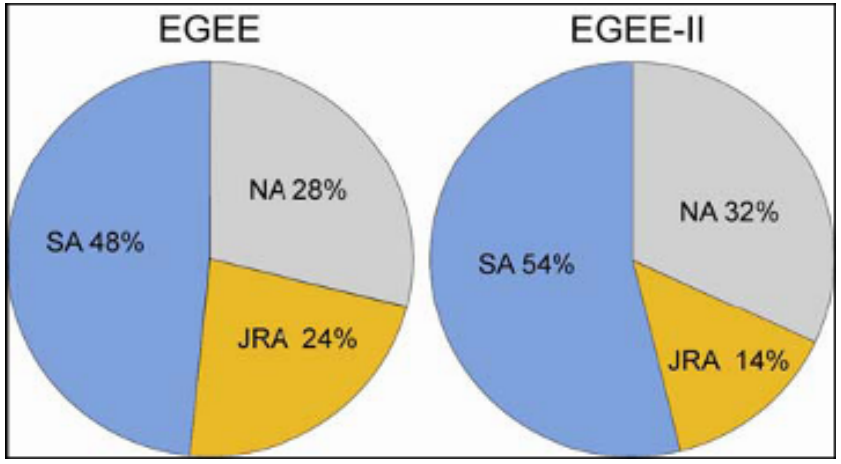
- supporting VOs

JRA: “joint research activities”

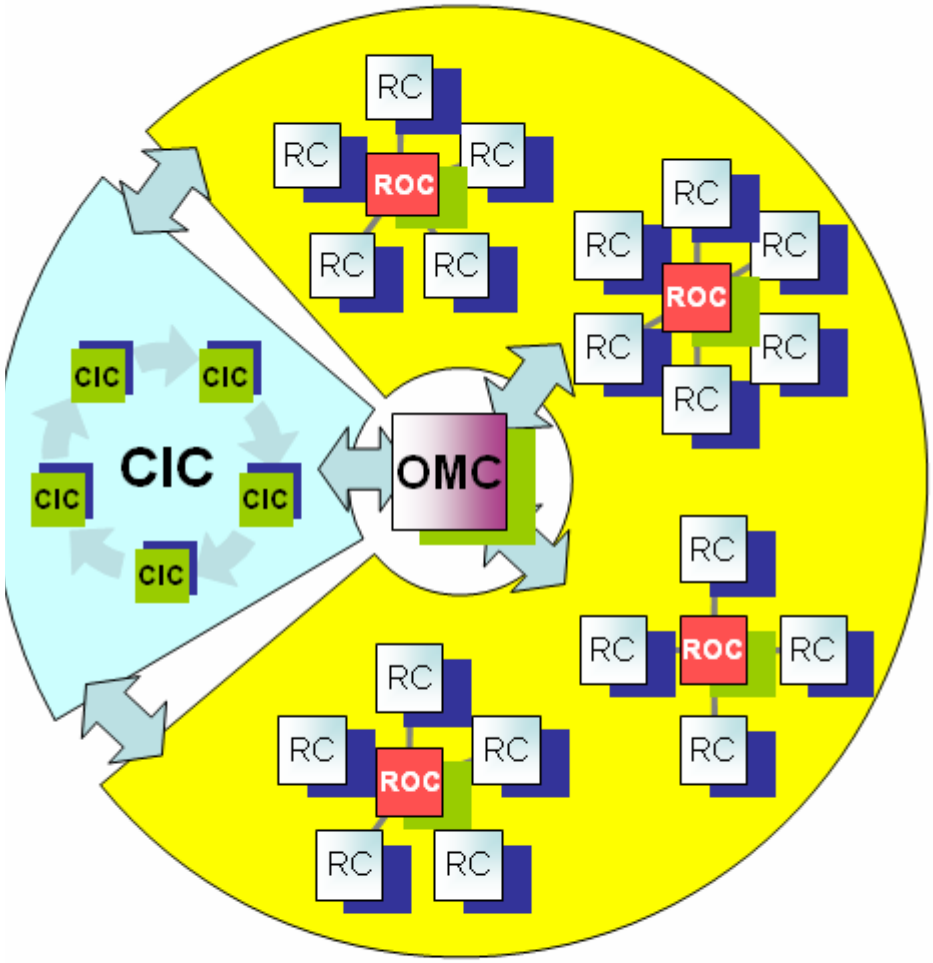
- e.g. hardening middleware







Grid Operations



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**

EGEE-II: Expertise & Resources

- More than 90 partners
- 32 countries
- 12 federations

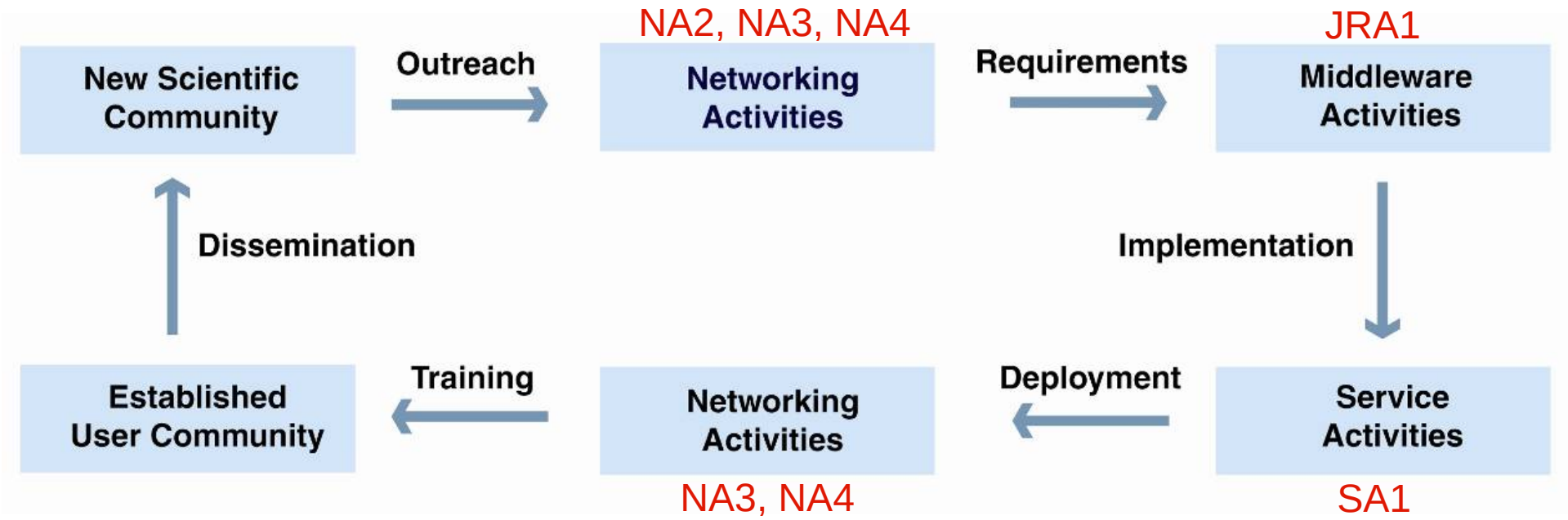
→ Major and national Grid projects in Europe, USA, Asia

+ 27 countries through related projects:
  - BalticGrid
  - SEE-GRID
  - EUMedGrid
  - EUChinaGrid
  - EELA

Related projects: infrastructure, engineering, education

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

The EGEE Virtuous Cycle



Building effective user communities

Training courses

- 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 ?

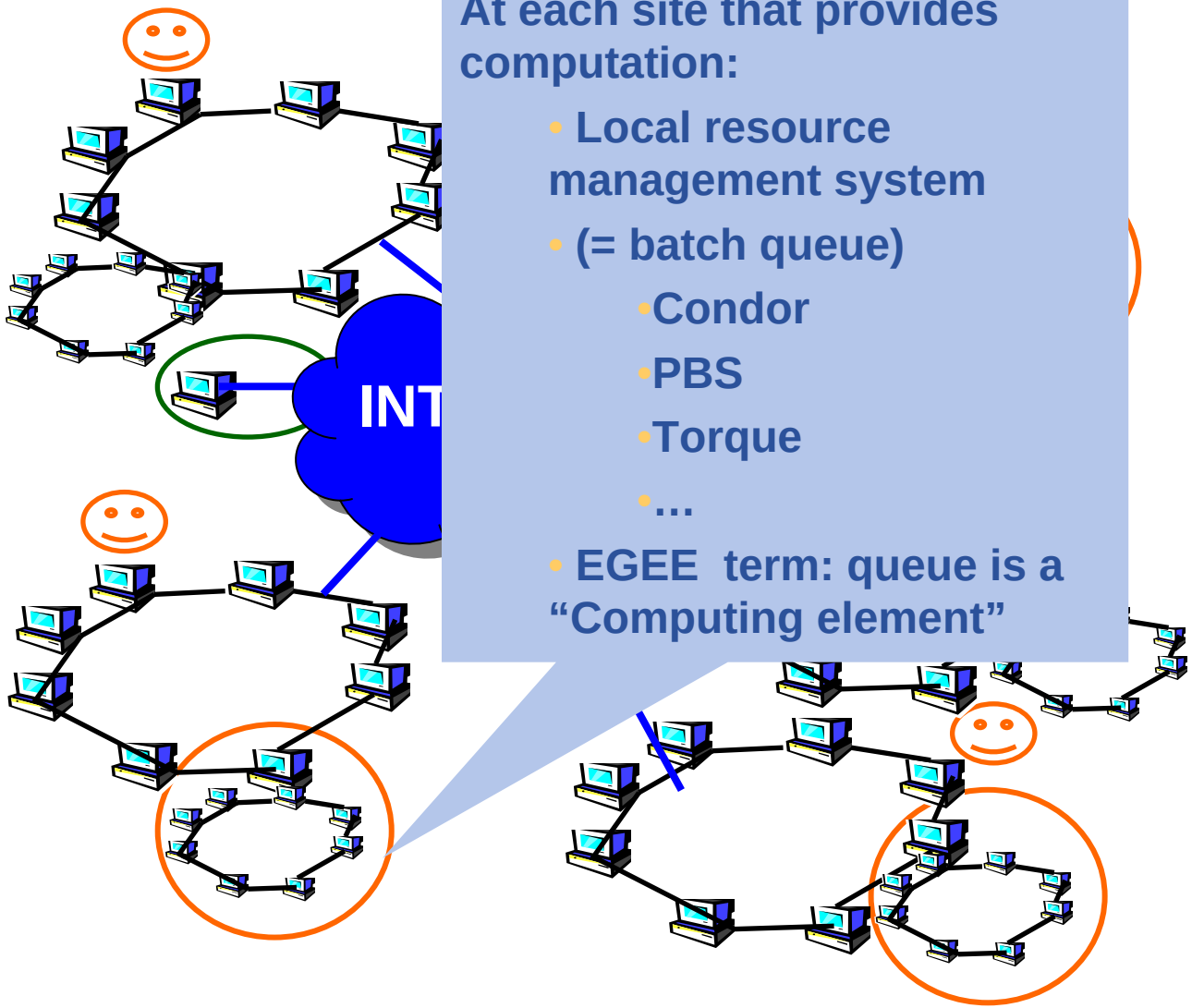
Grid Middleware

- **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**

Typical current grid

- **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"**

Authorisation, Authentication (AA)

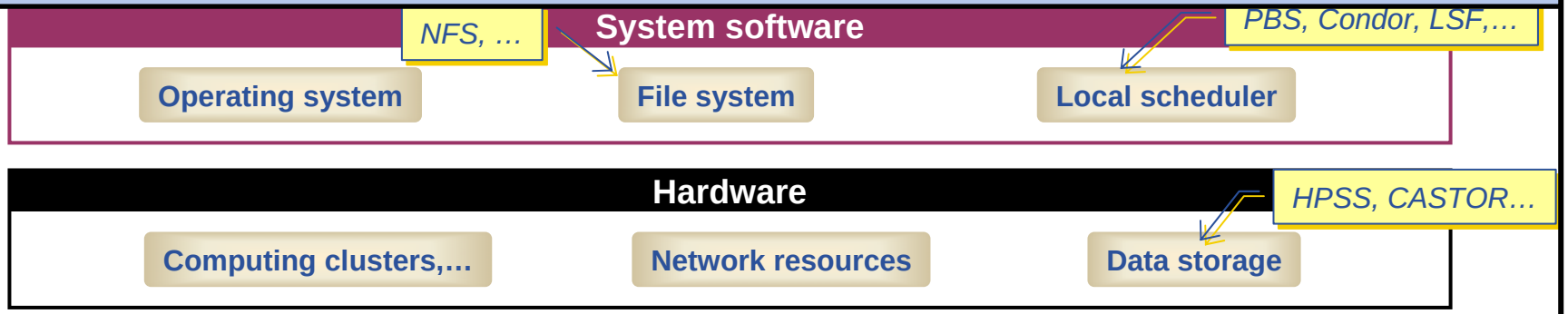
Users in many locations and organisations

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

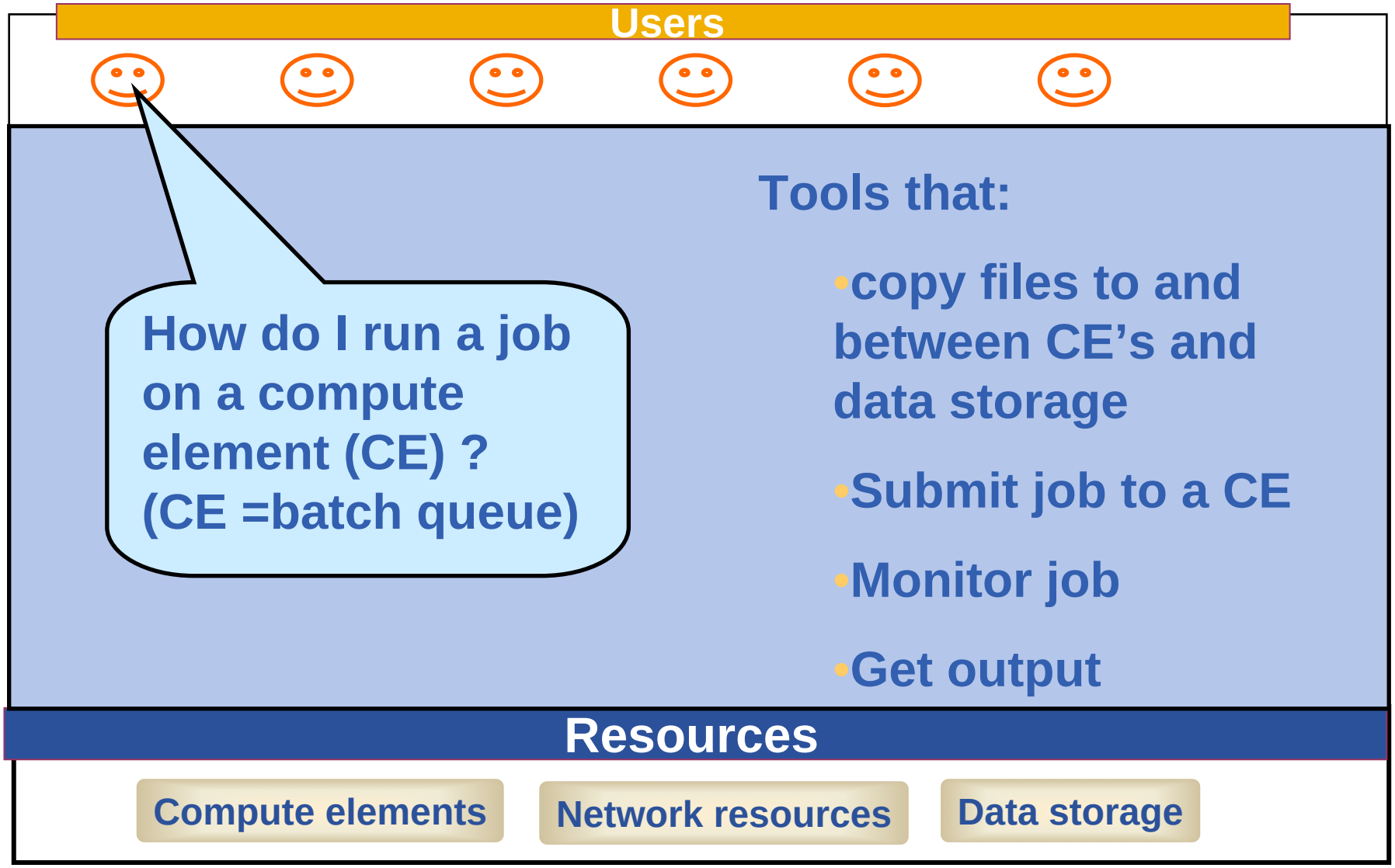
GRID SERVICES

Build on Grid Security Infrastructure

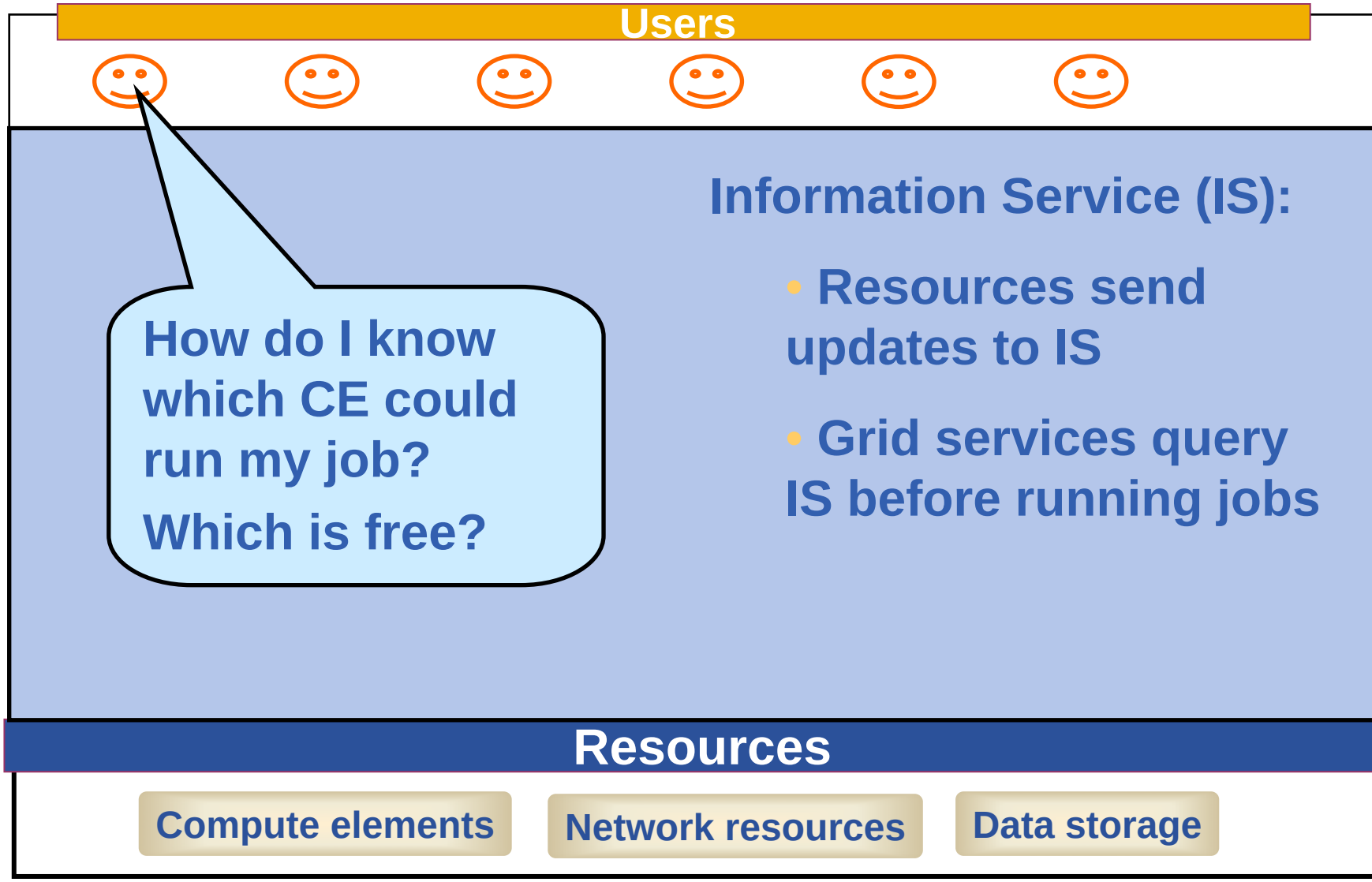
“Gate keeping”:
map user’s credential to local user id / account



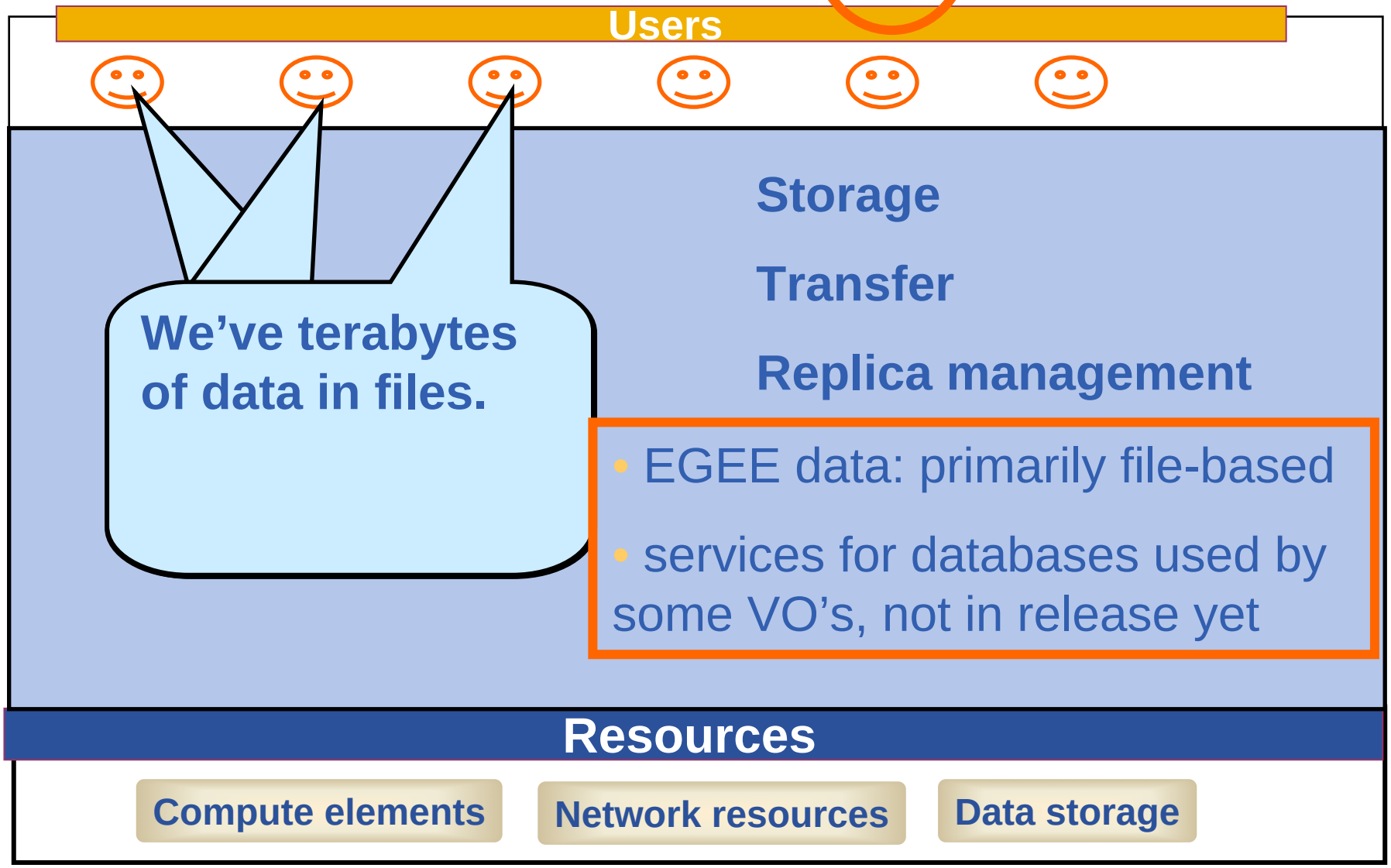
Basic job submission



Information service (IS)



File management

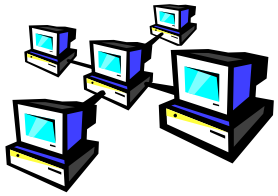


Main components

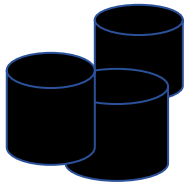
User Interface (UI): The place where users logon to the Grid

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”)

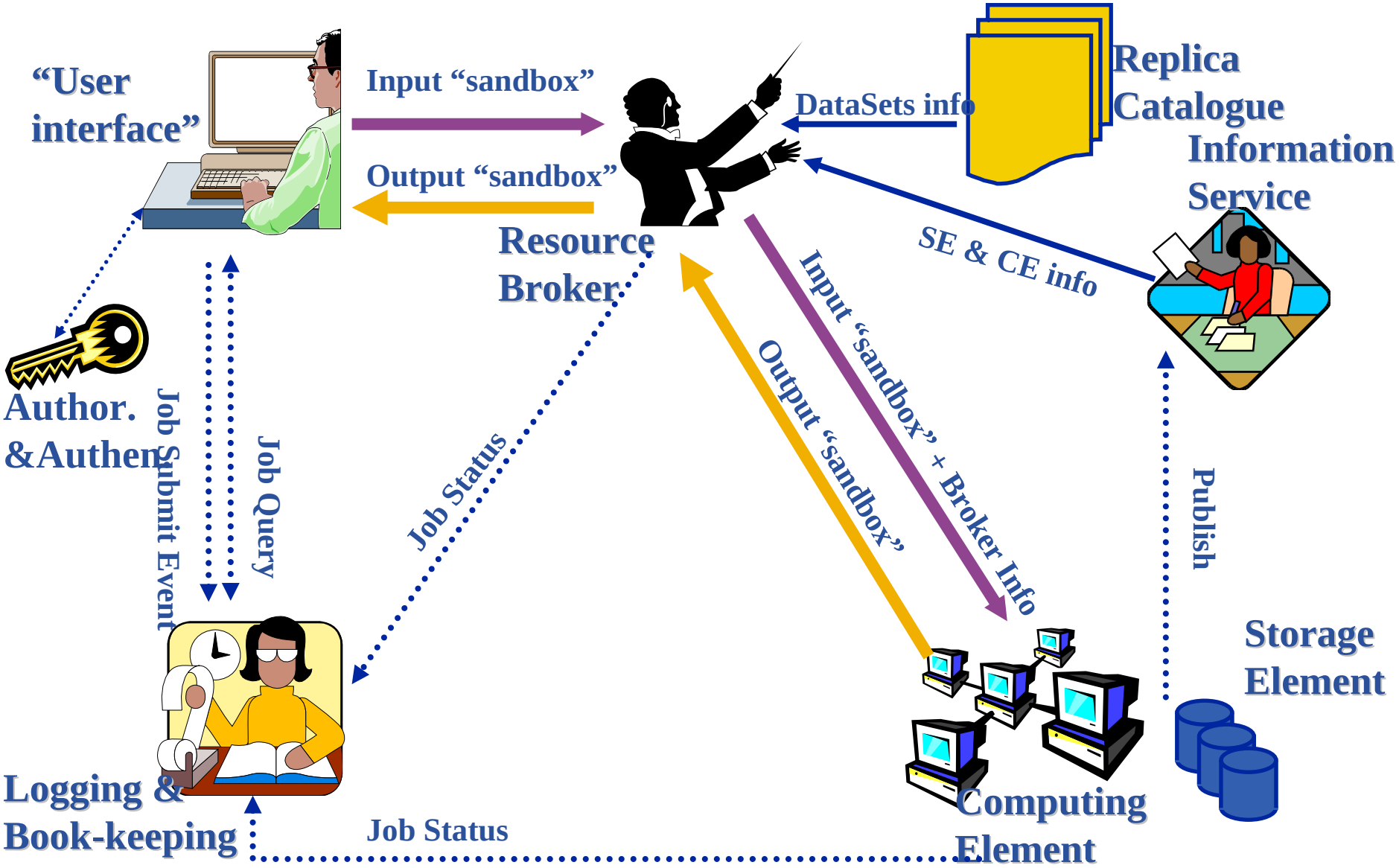


Computing Element (CE): A batch queue on a site’s computers where the user’s job is executed



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

Current production middleware



Building on basic tools and Information Service

- 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”;
```

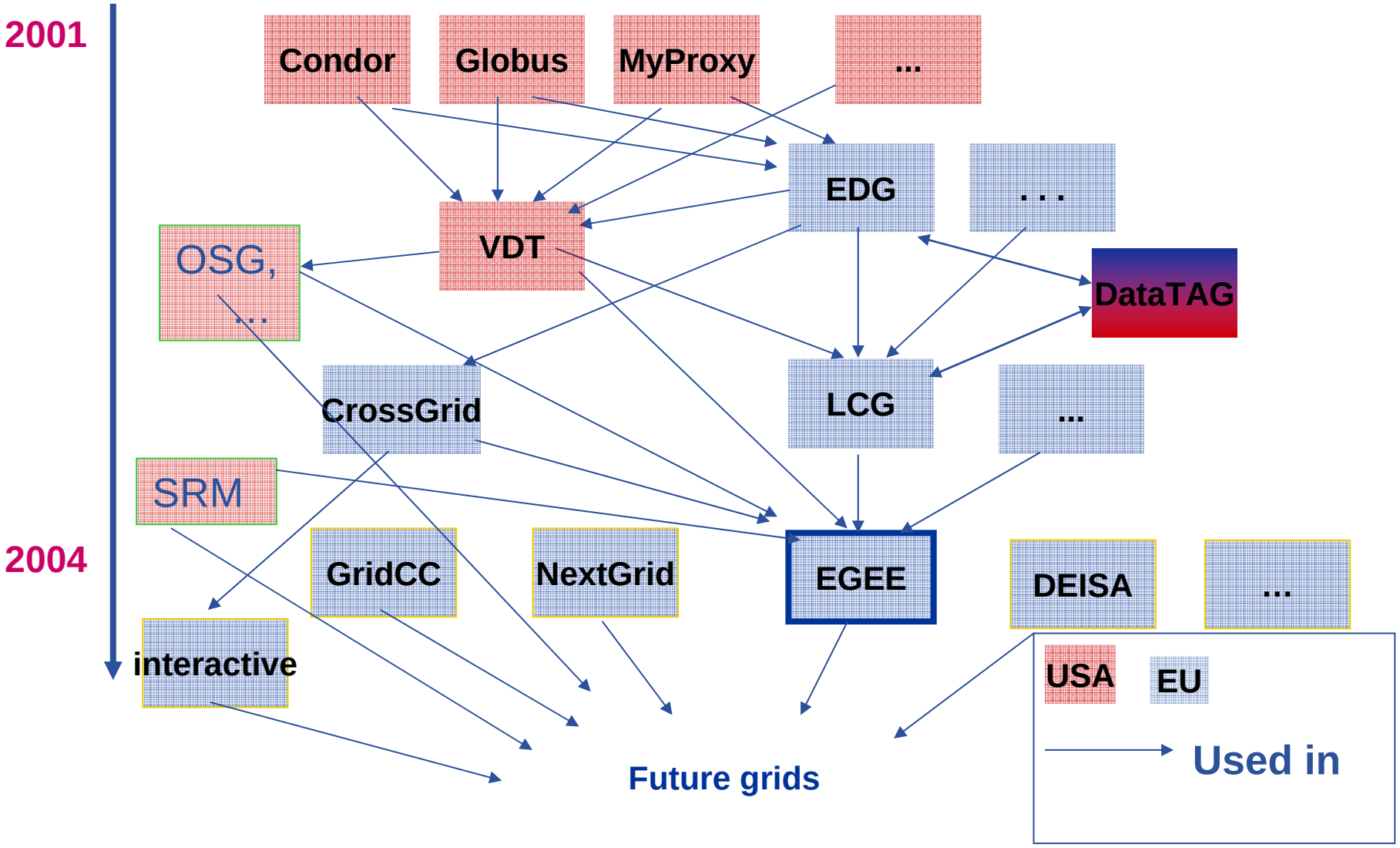
Who provides the resources?!

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

"VO": virtual organisation

"Grid operations": funded effort

Parts of the Grid “ecosystem”



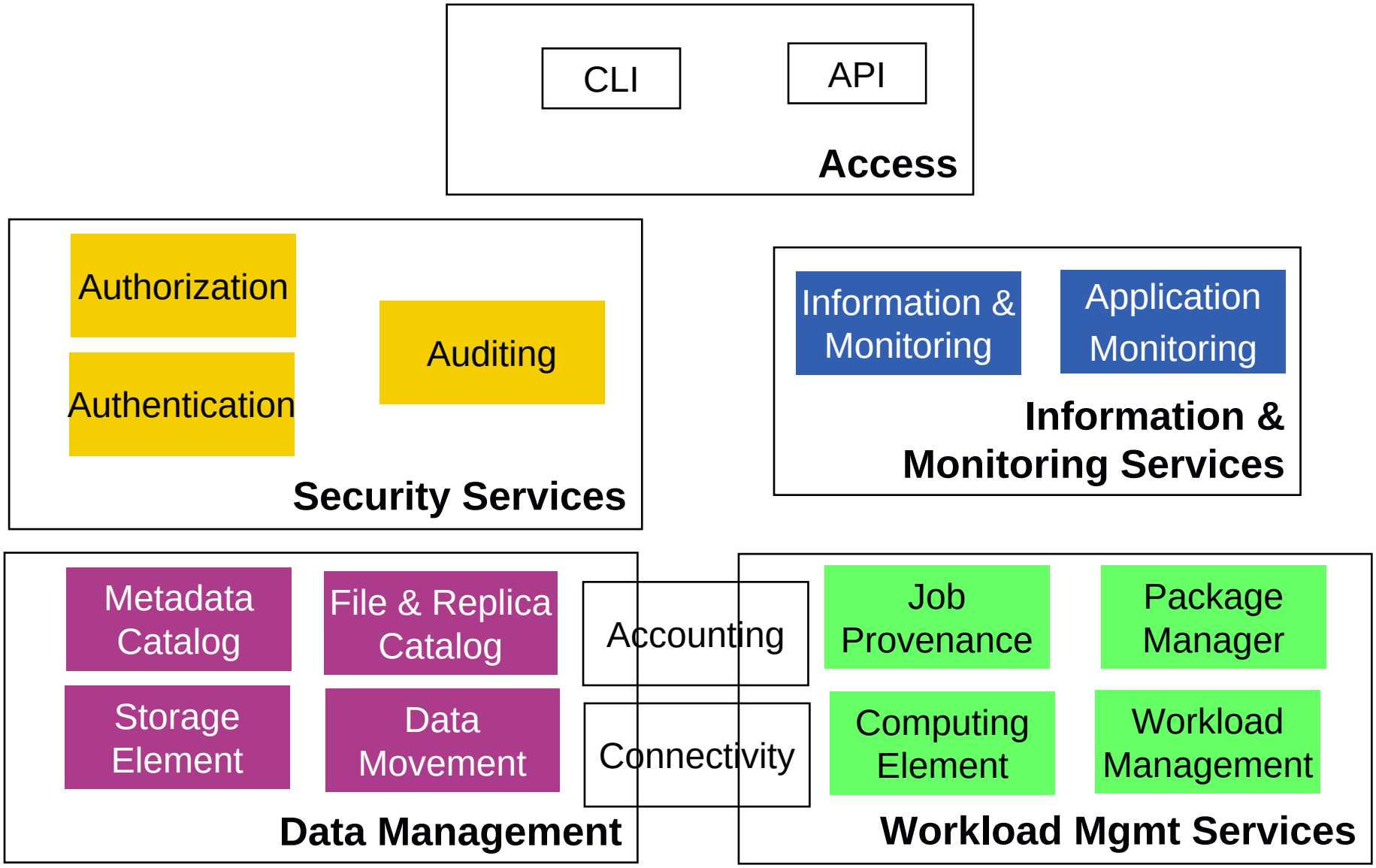
"gLite 3.0" the current middleware

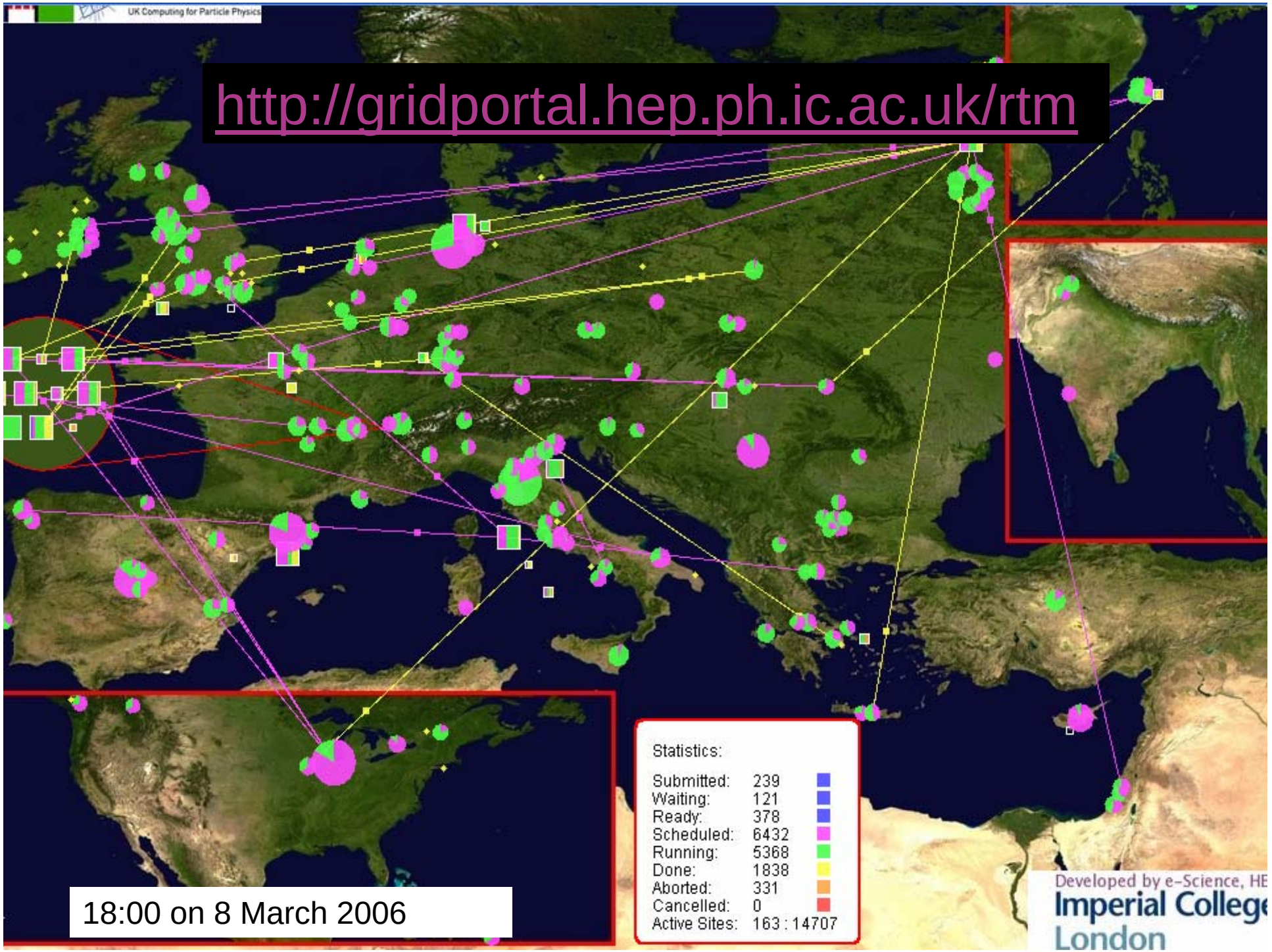
- **Runs on various Linux releases**
  - "Scientific Linux" most common
  - Ports to other Operating Systems in progress
- **Being deployed on EGEE production Grid now**
- **History**
  - During last 2 years, some new services were created in releases of new middleware, up to gLite 1.5, has been in pre-production 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

After 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*

gLite Grid Middleware Services




UK Computing for Particle Physics
http://gridportal.hep.ph.ic.ac.uk/rtm
Statistics:
Submitted: 239
Waiting: 121
Ready: 378
Scheduled: 6432
Running: 5368
Done: 1838
Aborted: 331
Cancelled: 0
Active Sites: 163 : 14707
18:00 on 8 March 2006
Developed by e-Science, HE
Imperial College
London

t-Infrastructure

- **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

The GILDA t-Infrastructure (https://gilda.ct.infn.it)

- 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

Summary

- 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

Further information

- **EGEE Conference: 25-29 September 2006**
  http://www.eu-egee.org/news/registration-open-for-egee2010-September-2006-geneva/
- **EGEE digital library: http://egee.lib.ed.ac.uk/**
  - Needs certificate (GILDA or national CA in browser)
- **EGEE www.eu-egee.org**
- **EGEE: 1st 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/**