An overview of the EGEE project and middleware

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Information Society

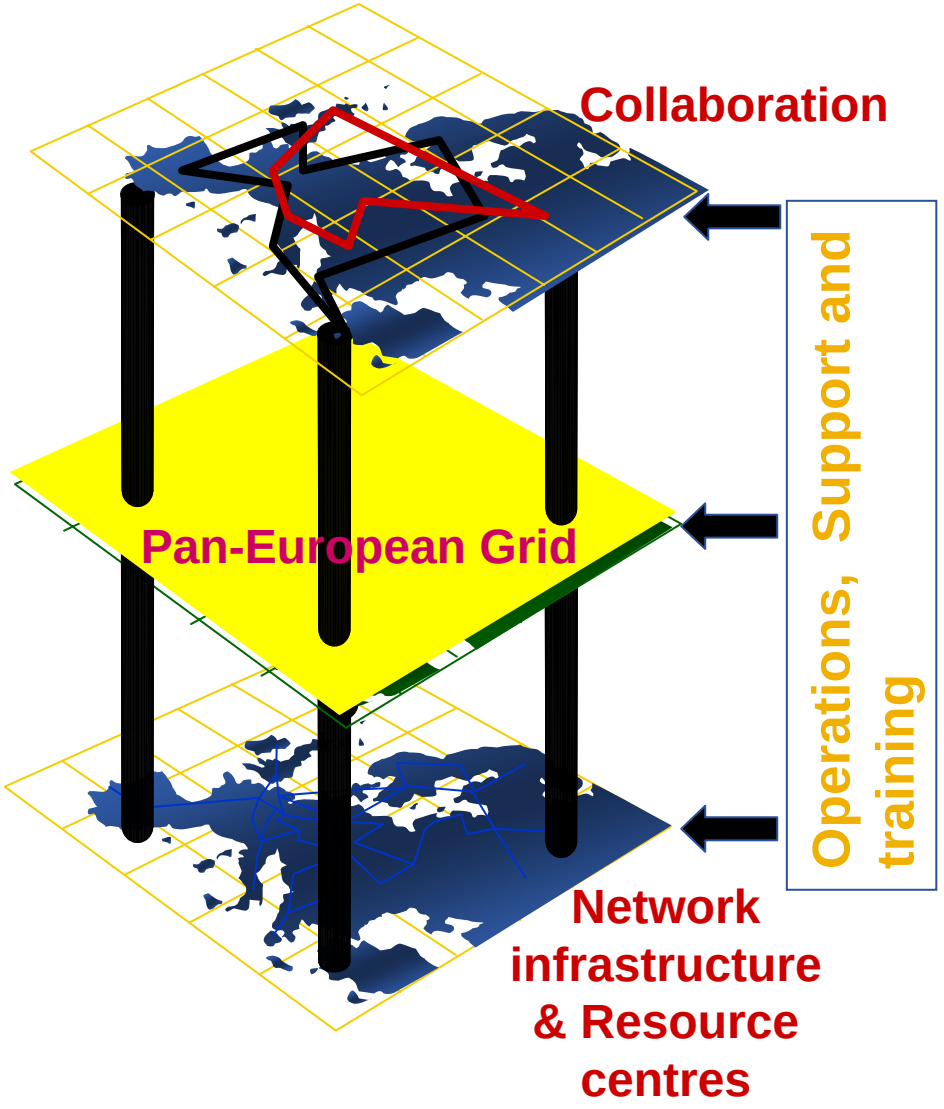
Contents

- What is EGEE?
- Overview of the main grid services

EGEE – international e-infrastructure

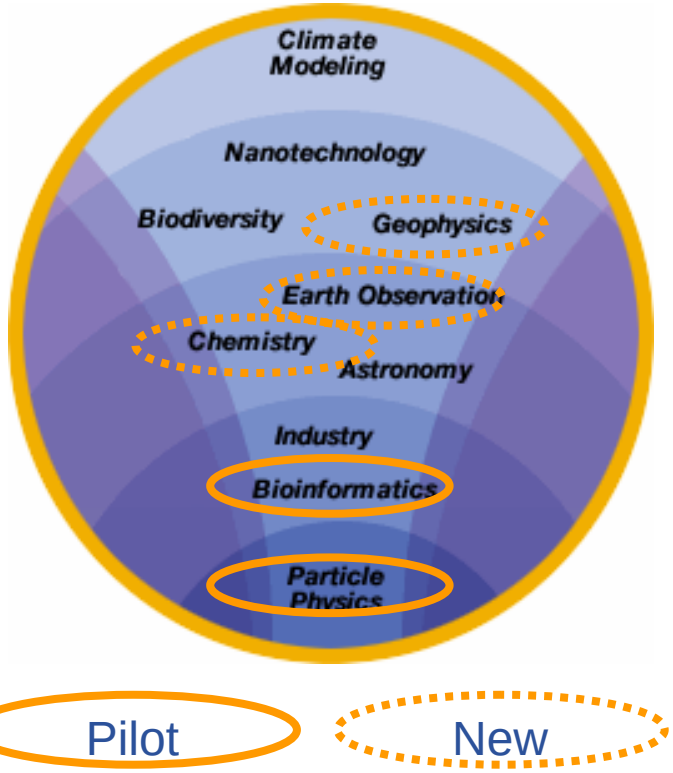
A four year programme:

- **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**

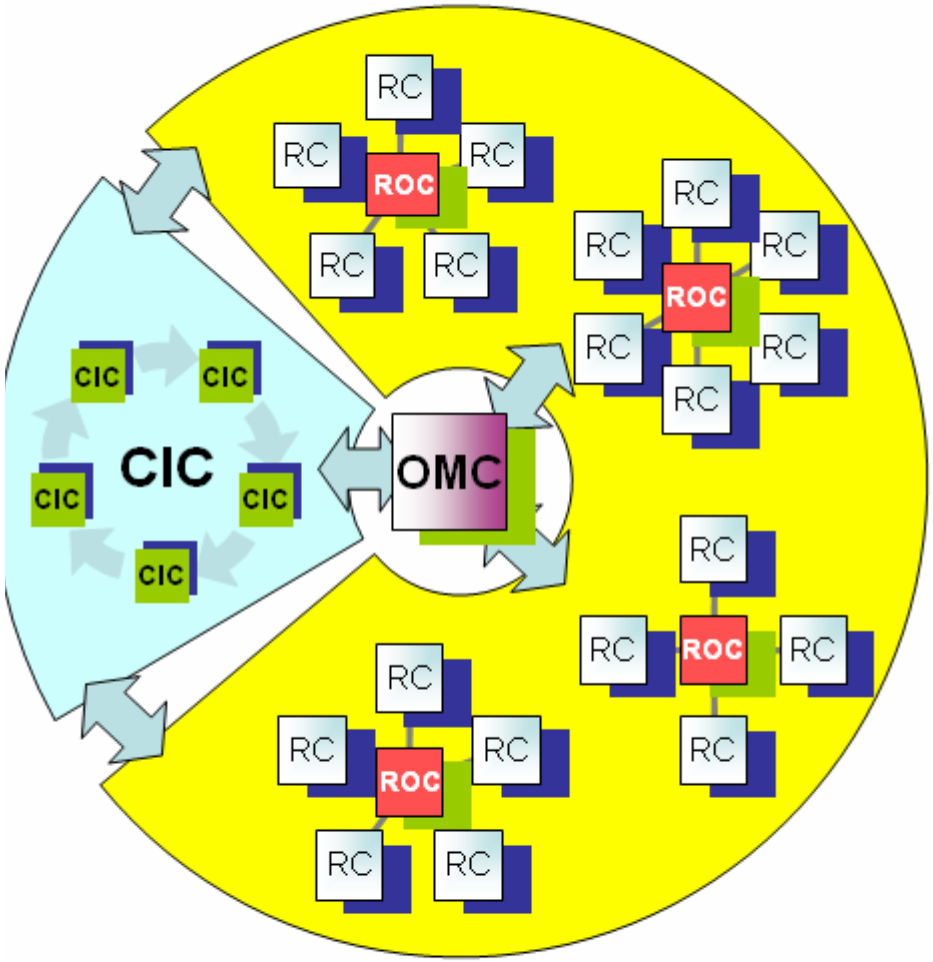


In the first 2 years EGEE

- **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 scientific communities on board**
- **Secured a second phase from April 2006**

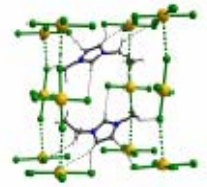


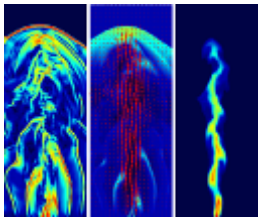
Grid Operations



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**





- **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

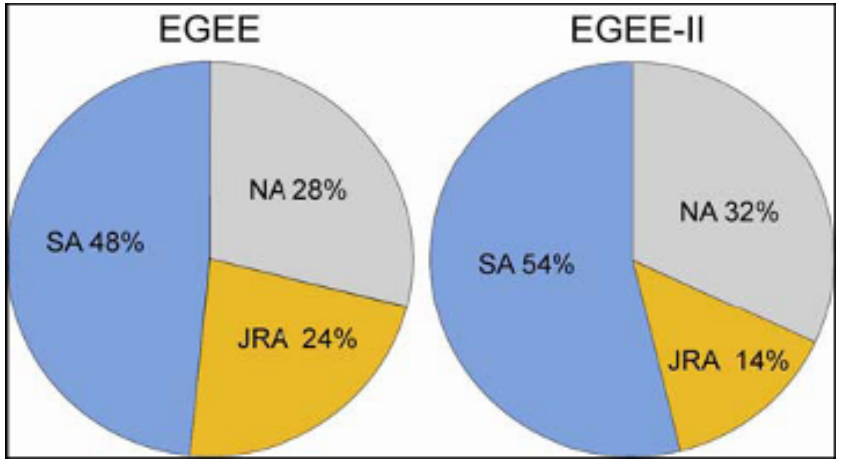
- establishing operations

NA: network activities

- supporting VOs

JRA: “joint research activities”

- e.g. hardening middleware

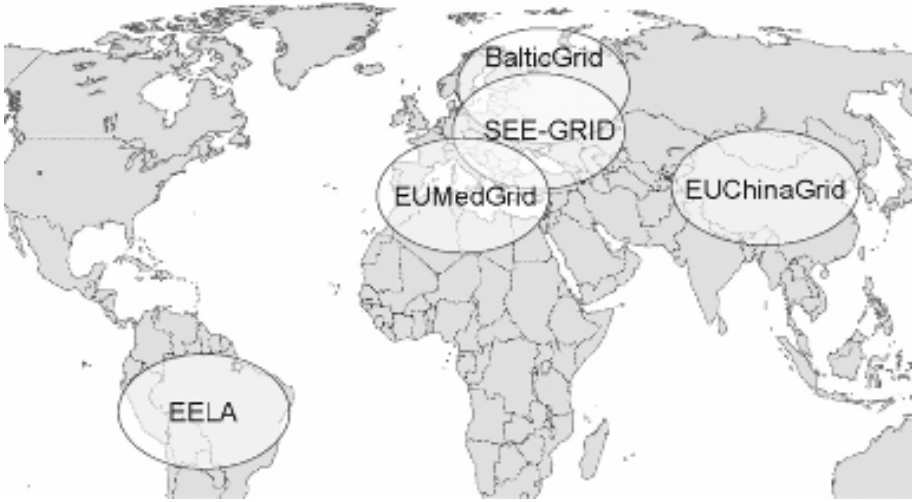


EGEE-II: Expertise & Resources

- More than 90 partners
- 32 countries
- 12 federations

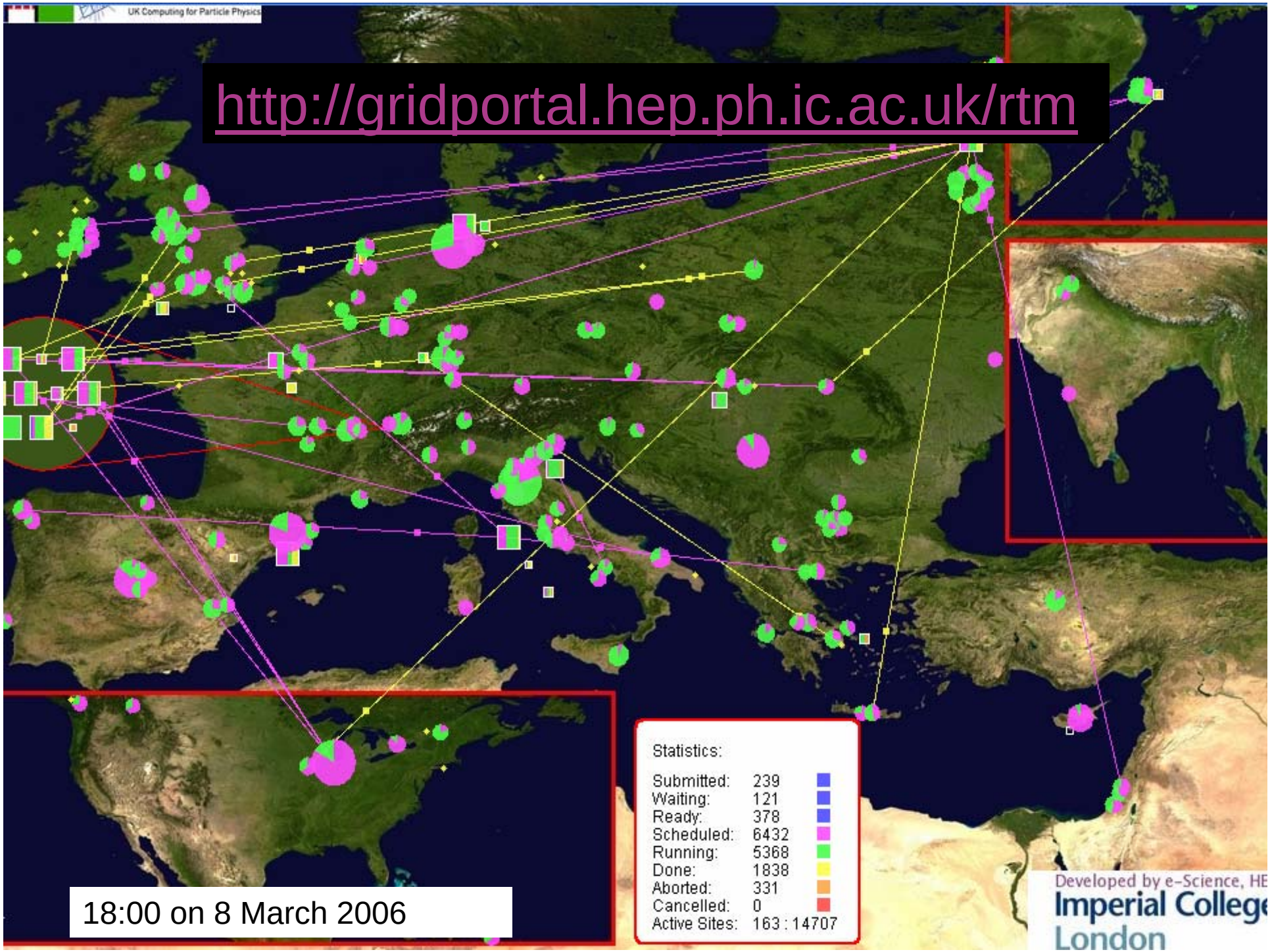
→ Major and national Grid projects in Europe, USA, Asia

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



Related projects: infrastructure, education, application

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
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


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

Grid services

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

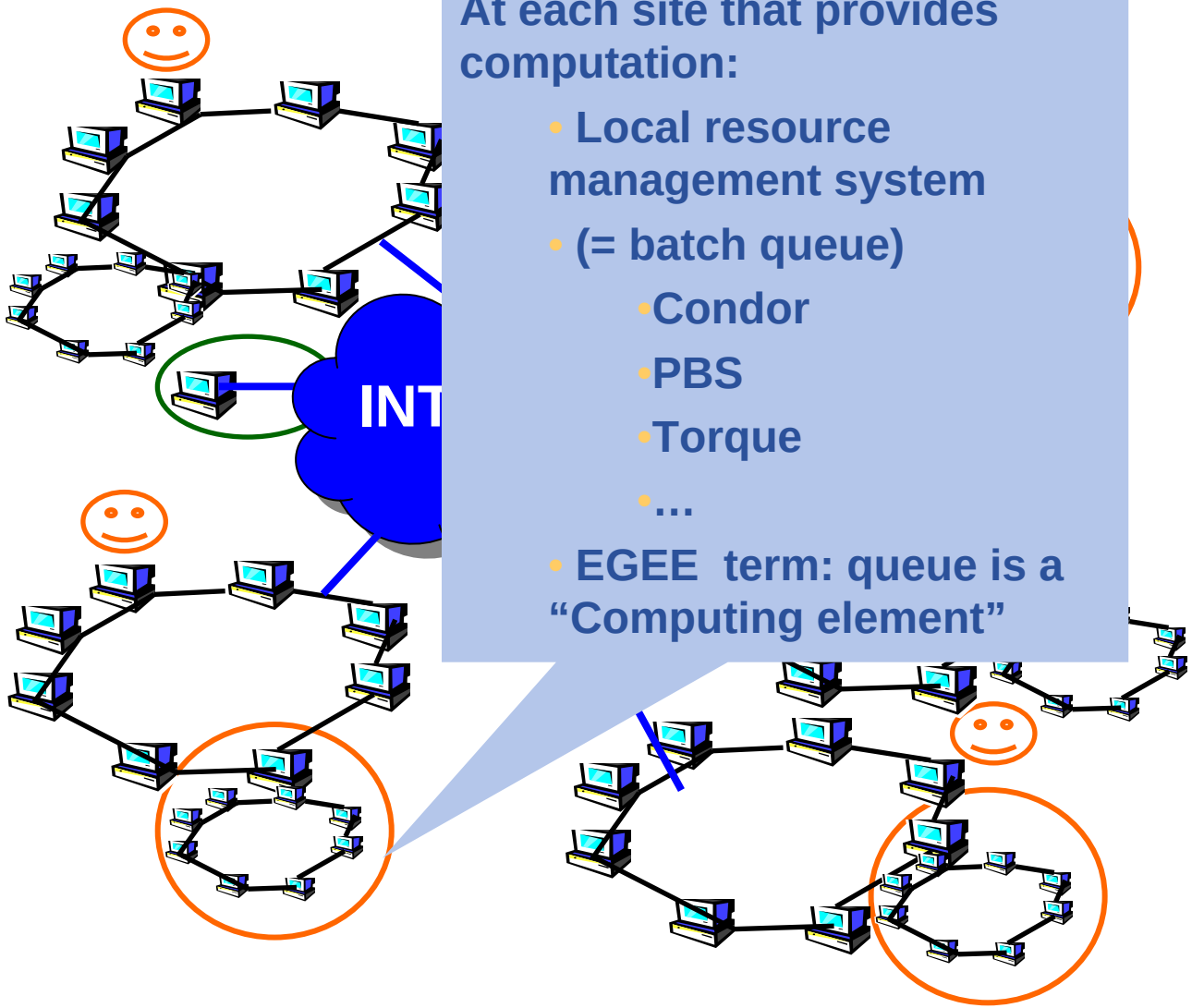
Grid Middleware

- **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)

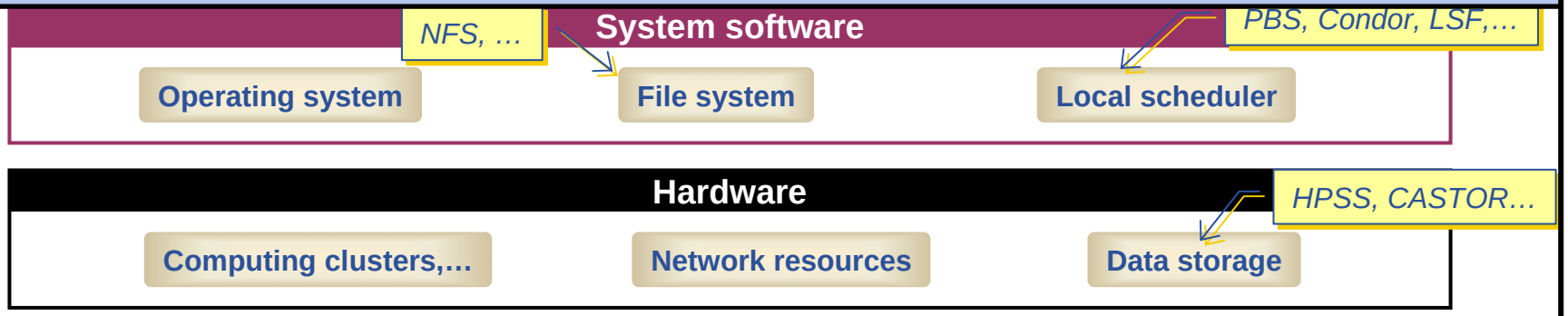
Users in many locations and organisations

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

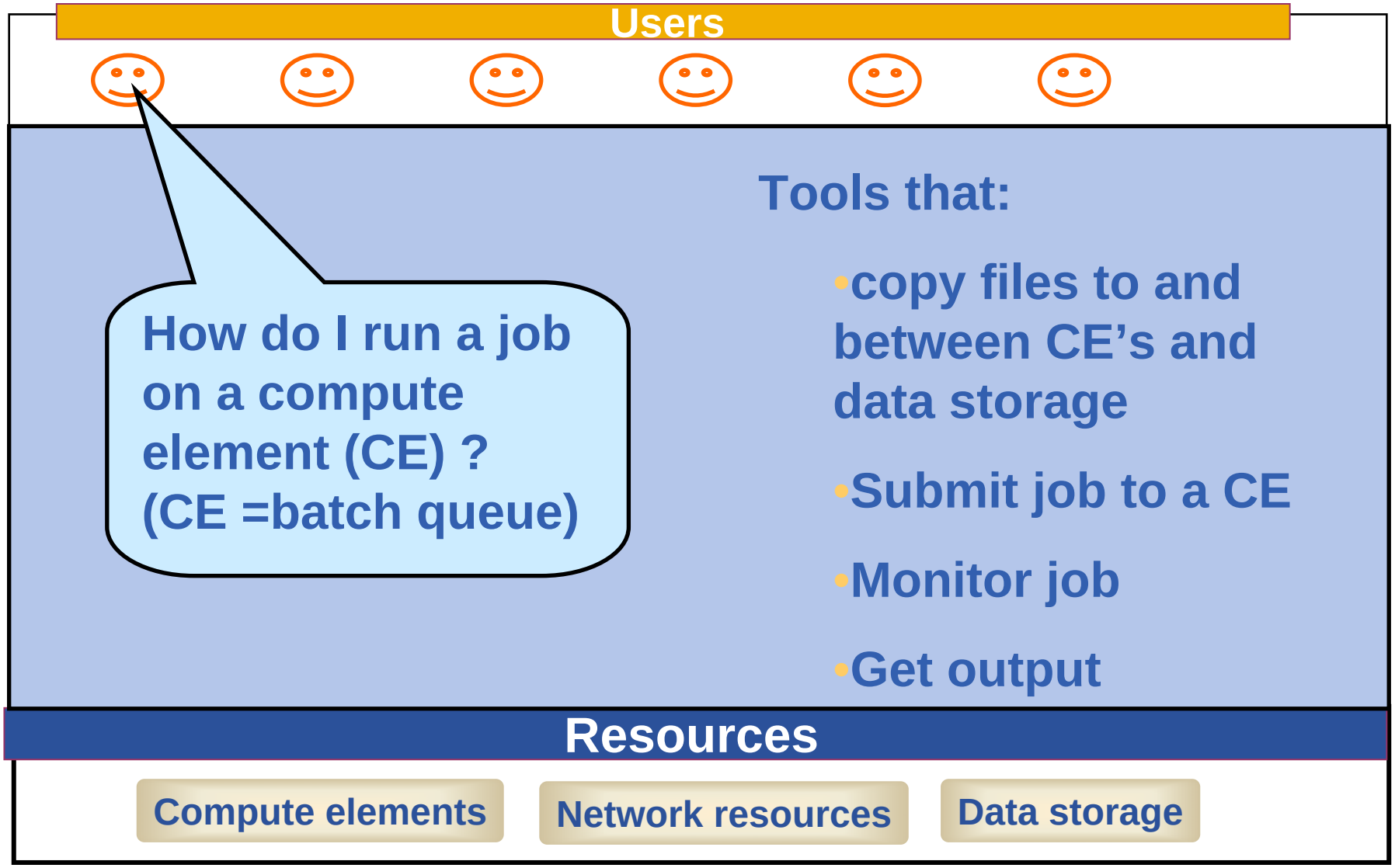
GRID SERVICES

Build on Grid Security Infrastructure

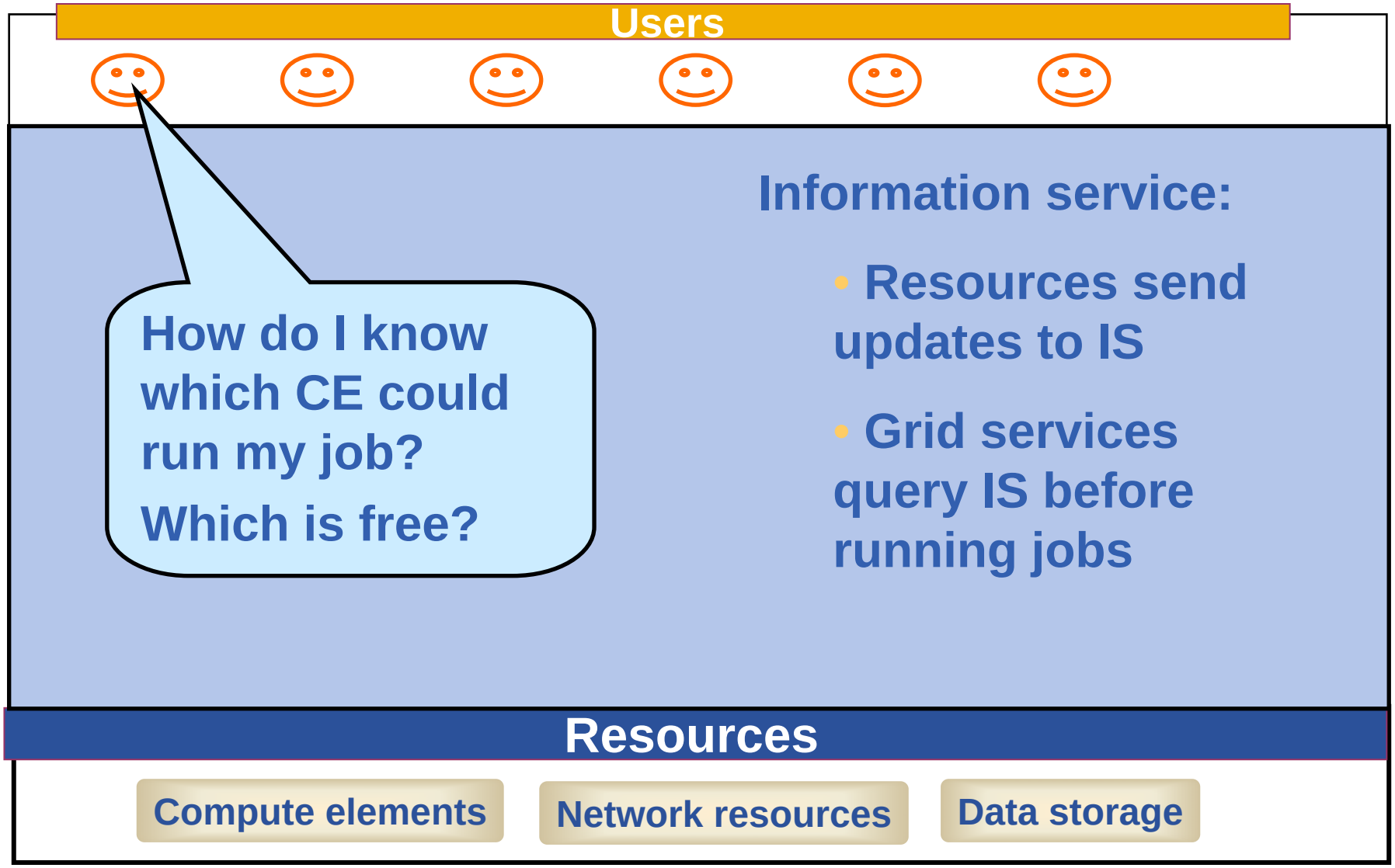
“Gate keeping”:
map user’s credential to local user id / account



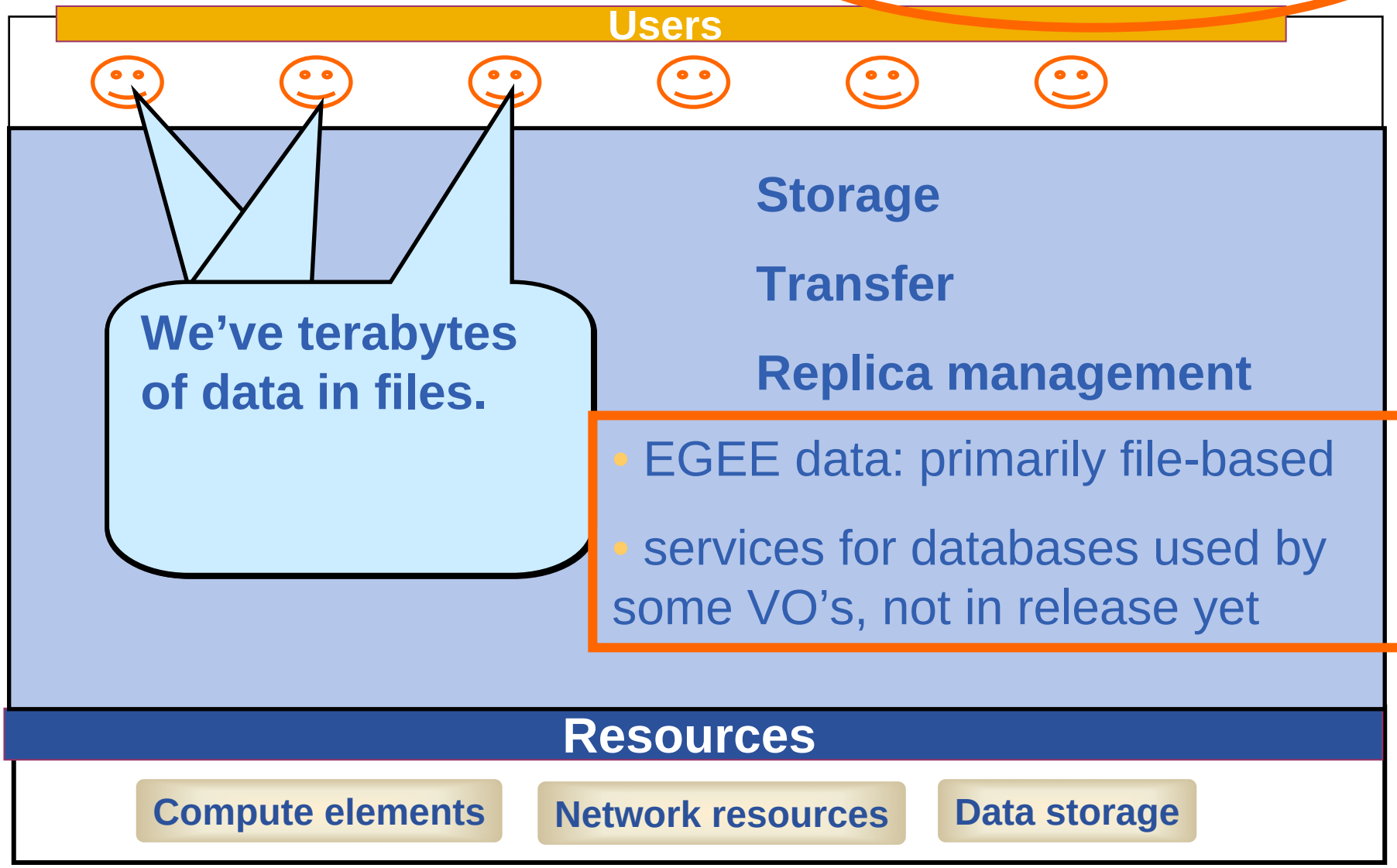
Basic job submission



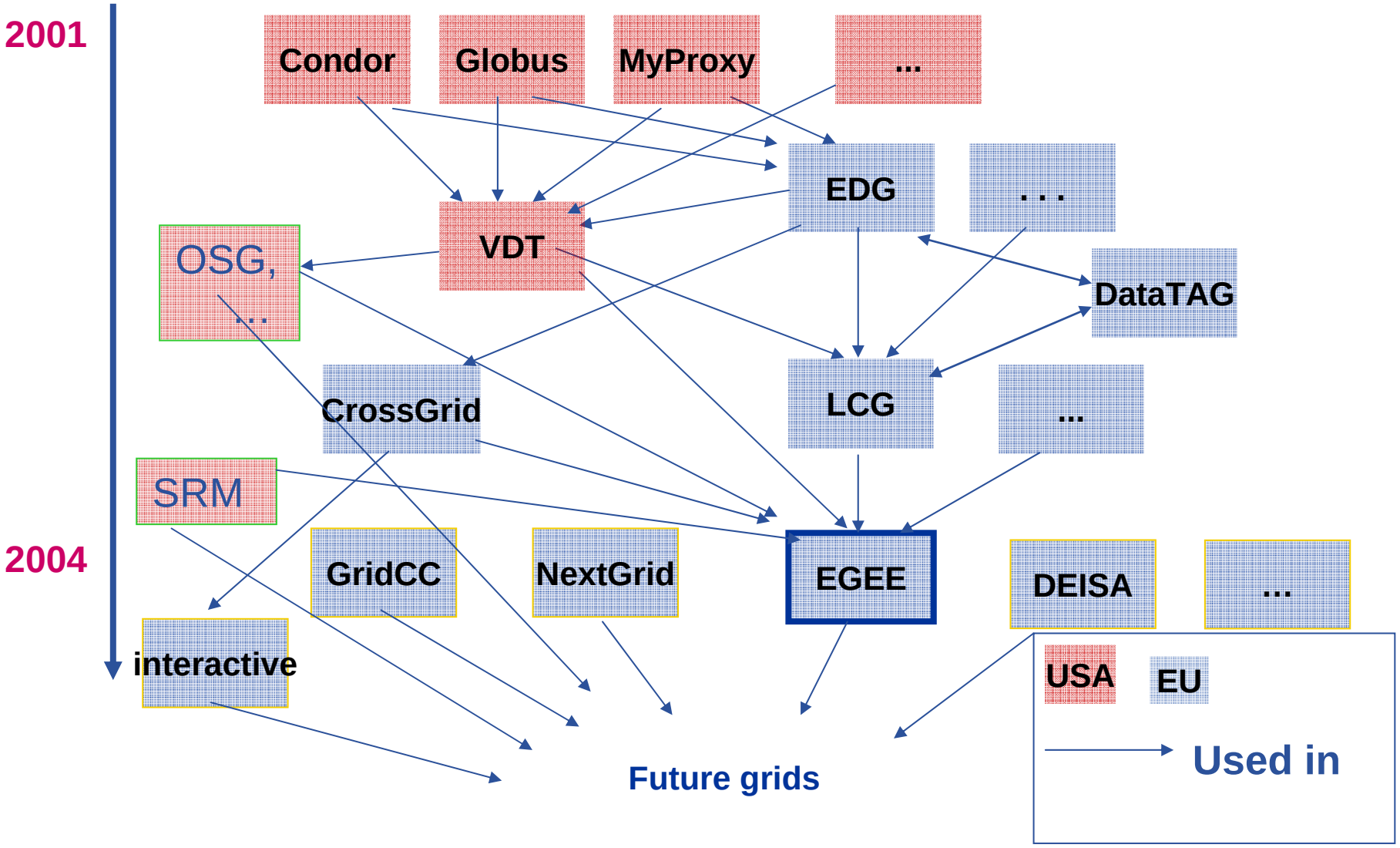
Information service (IS)



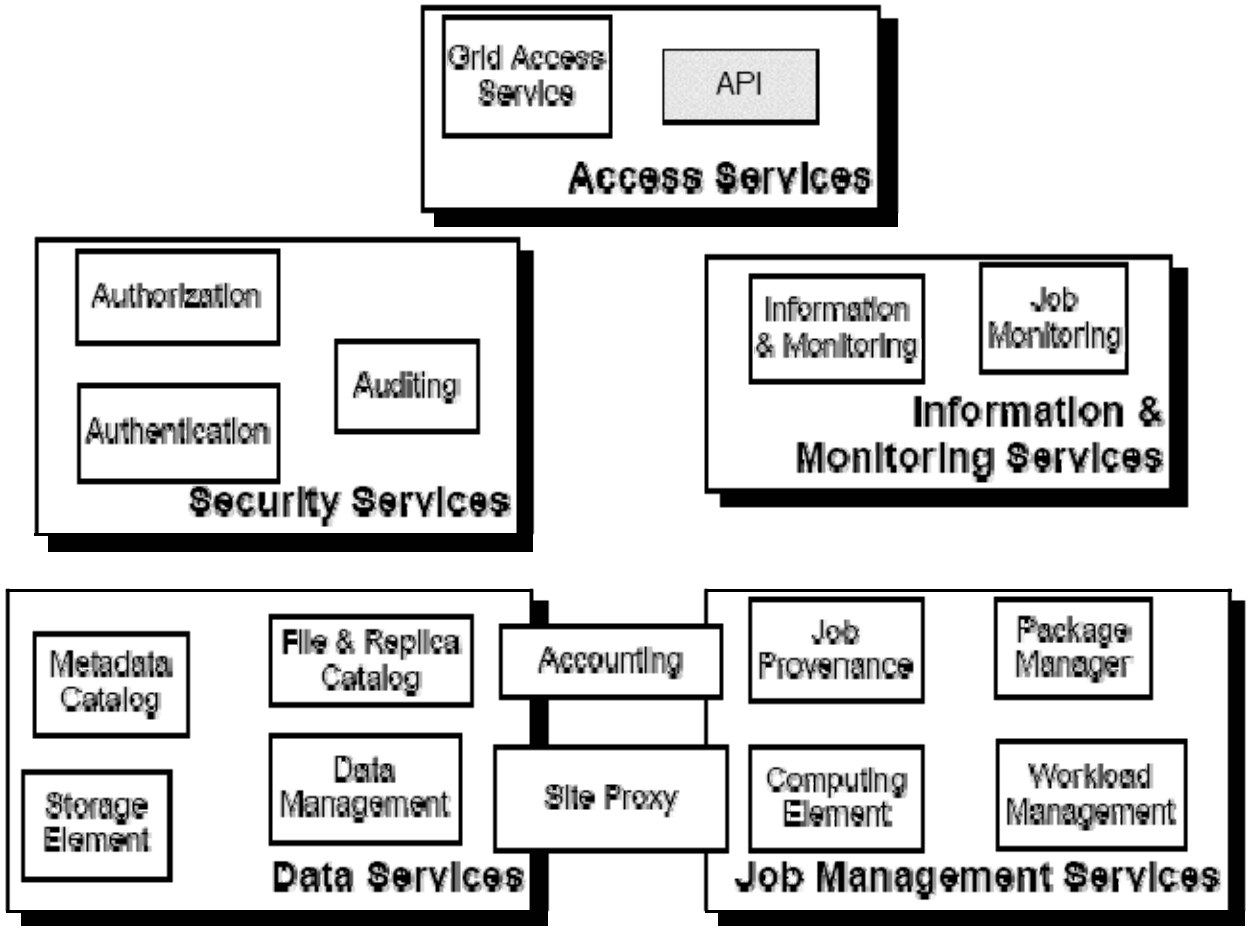
File management



Parts of the Grid "ecosystem"



Overview of gLite Middleware



Security, Authentication and Authorisation

How does EGEE...

- **How does EGEE build dynamic distributed systems?**
  - For many international collaborations (“virtual organisations”)
  - With n,000 processors in hundreds of independent sites (“administrative domains”)
  - With no prior direct relationship between users and resource providers
  - In a world where public networks are abused by hackers, etc.

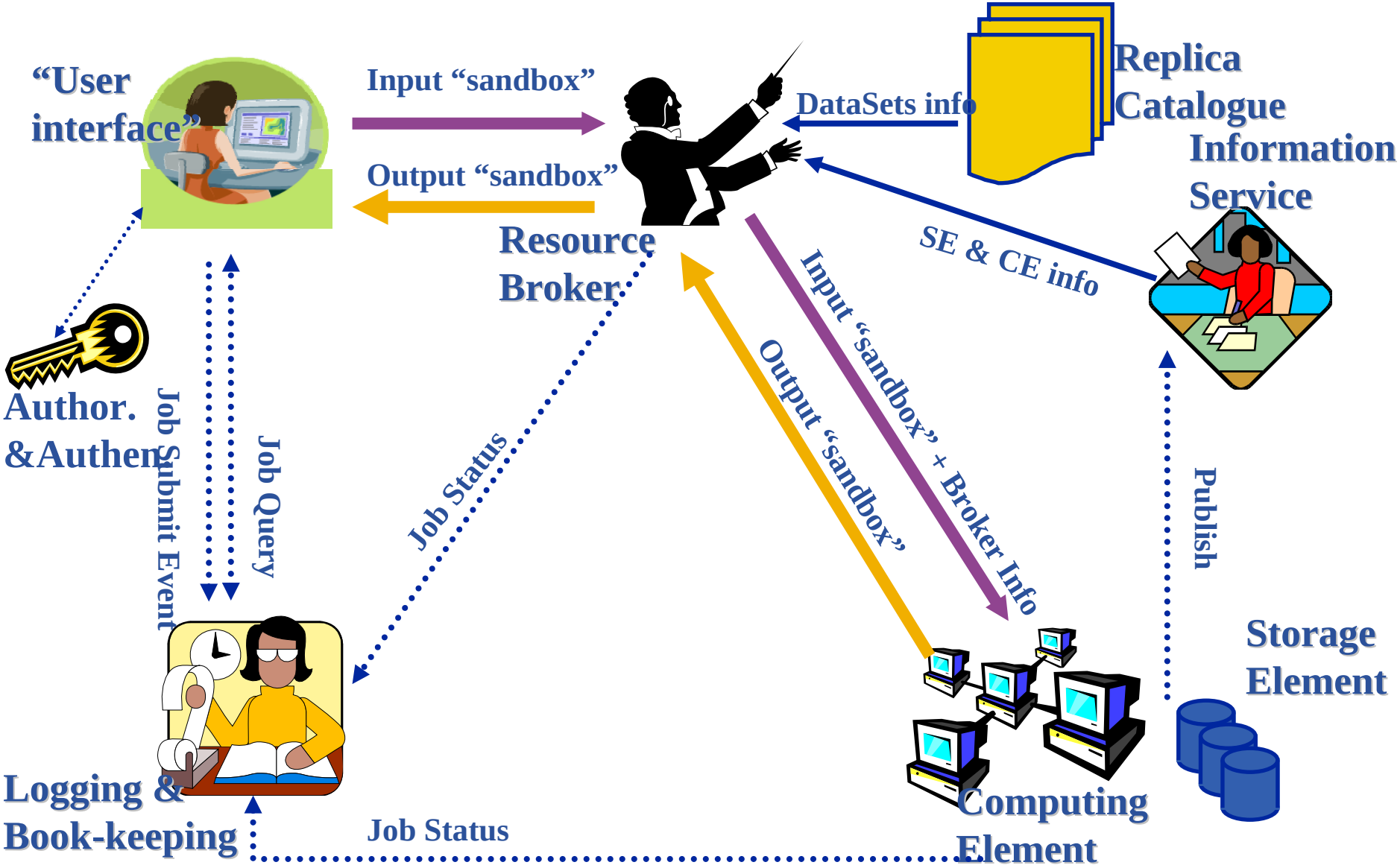
1. **Authentication - communication of identity**

   Basis for
   - Message integrity - so tampering is recognised
   - Message confidentiality, if needed - so sender and receiver only can understand the message
   - Non-repudiation: knowing who did what when – can’t deny it
2. **Authorisation - once identity is known, what can a user do?**
3. **Delegation- A allows service B to act on behalf of A**

- **Based on “X.509 certificates” – next talk!!**

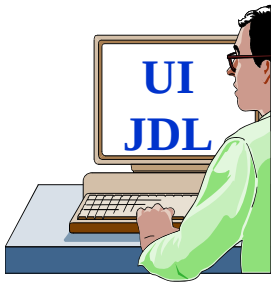
Workload Management

Current production middleware



User Interface node

- **The user's interface to the Grid**
- **Command-line interface to**
  - Create/Manage proxy certificates
  - Job operations
    - To submit a job
    - Monitor its status
    - Retrieve output
  - Data operations
    - Upload file to SE
    - Create replica
    - Discover replicas
  - Other grid services
- **Also C++ and Java APIs**



- **To run a job user creates a JDL (Job Description Language) file**

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:/grid/myVO/testbed0-00019”;
DataAccessProtocol = “gridftp”;
Requirements = other.Architecture==“INTEL” && \
               other.OpSys==“LINUX” && other.FreeCpus >=4;
Rank = “other.GlueHostBenchmarkSF00”;
```

Building on basic tools and Information Service

- **Submit job to grid via the "resource broker",**
- **edg_job_submit *my.jdl***

Returns a "job-id" used to monitor job, retrieve output

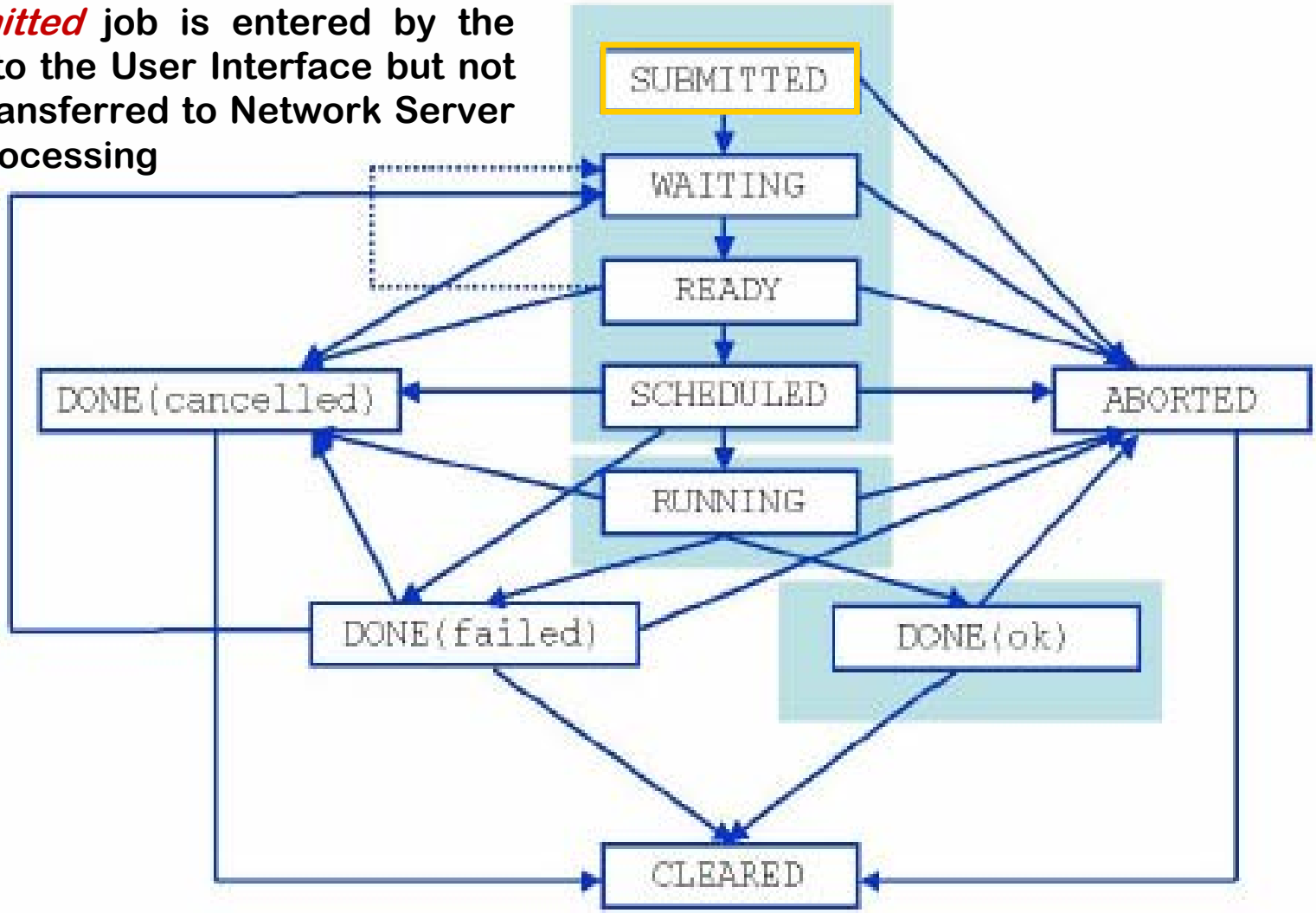
Example JDL file

```
Executable = "gridTest";
StdError = "stderr.log";
StdOutput = "stdout.log";
InputSandbox = {"/home/joda/test/gridTest"};
OutputSandbox = {"stderr.log", "stdout.log"};
InputData = "lfn:testbed0-00017";
DataAccessProtocol = "gridftp";
Requirements = other.Architecture=="INTEL" && \
               other.OpSys=="LINUX" && other.FreeCpus >=4;
Rank = "other.GlueHostBenchmarkSF00";
```

Uses BDII Information System

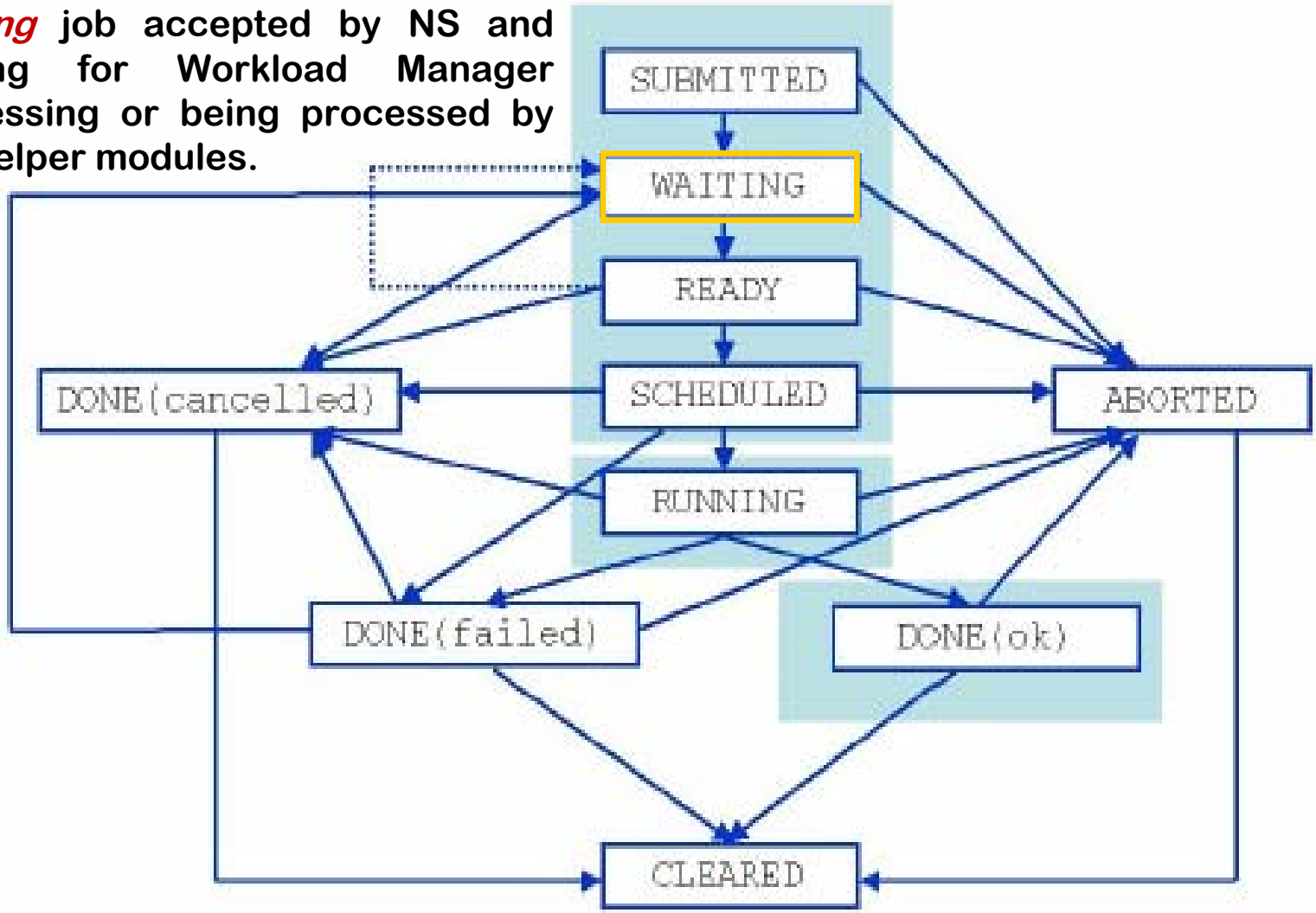
Jobs State Machine (1/9)

Submitted **job is entered by the user to the User Interface but not yet transferred to Network Server for processing**



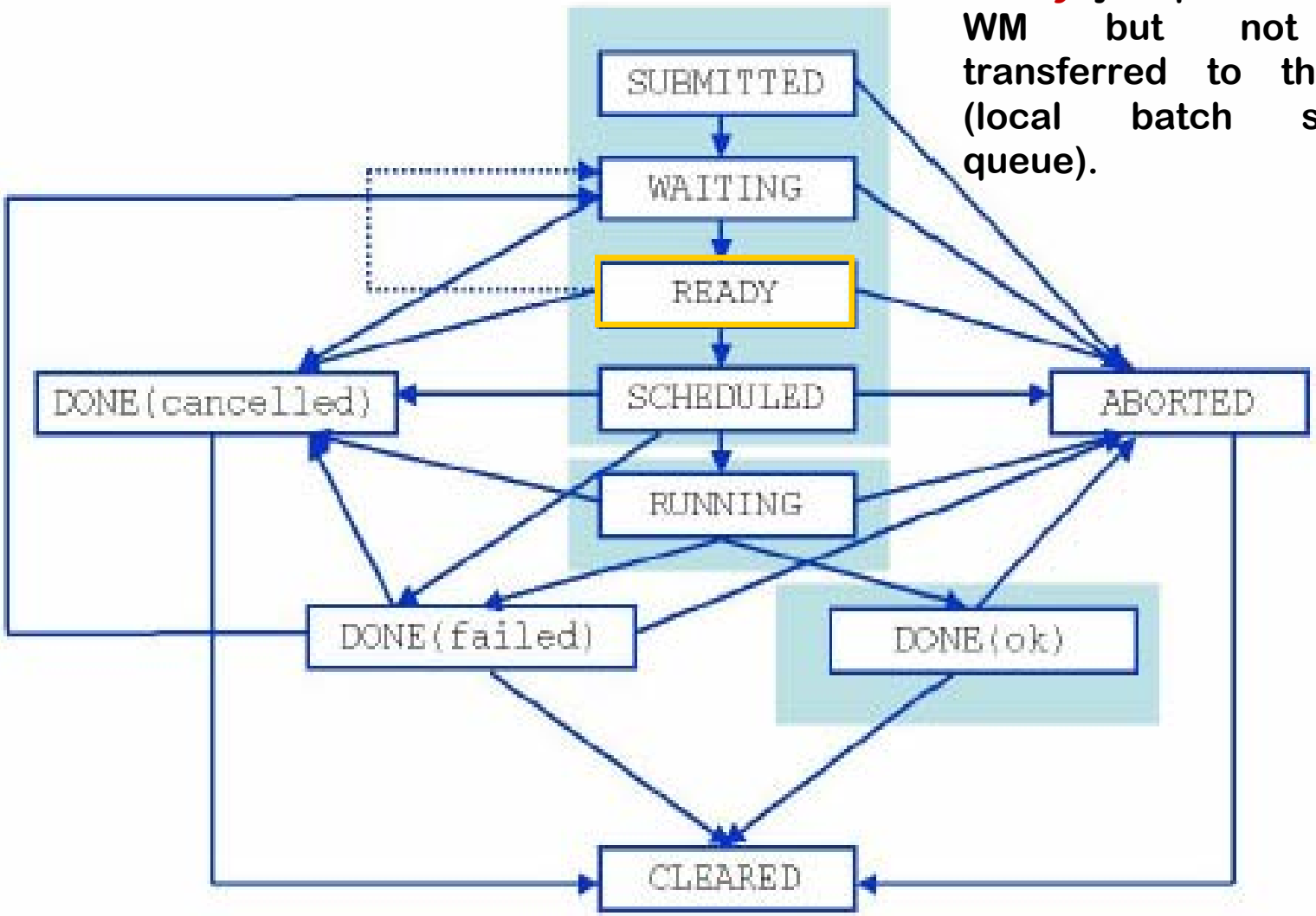
Jobs State Machine (2/9)

Waiting **job accepted by NS and waiting for Workload Manager processing or being processed by WMHelper modules.**

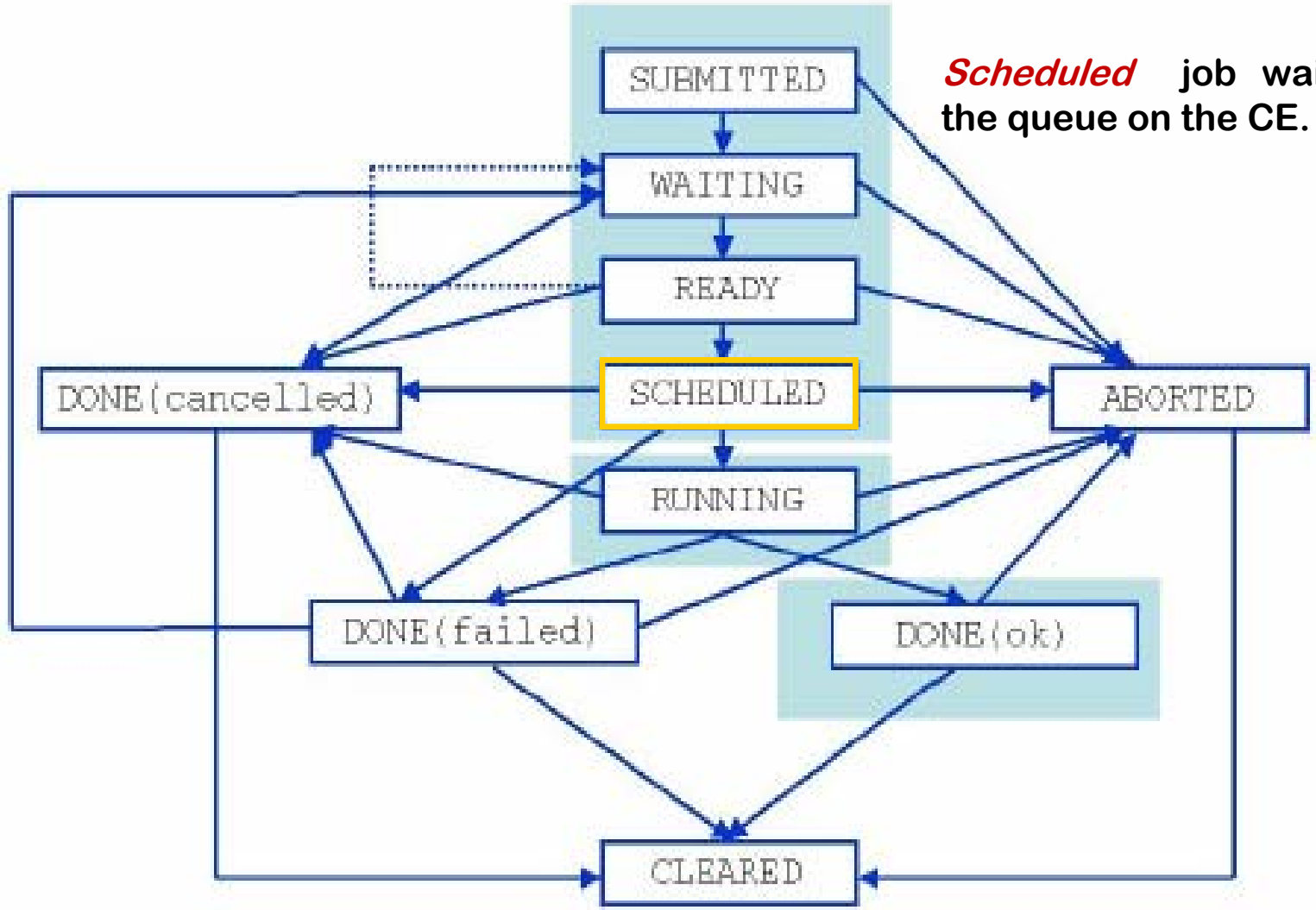


Jobs State Machine (3/9)

Ready **job processed by WM but not yet transferred to the CE (local batch system queue).**

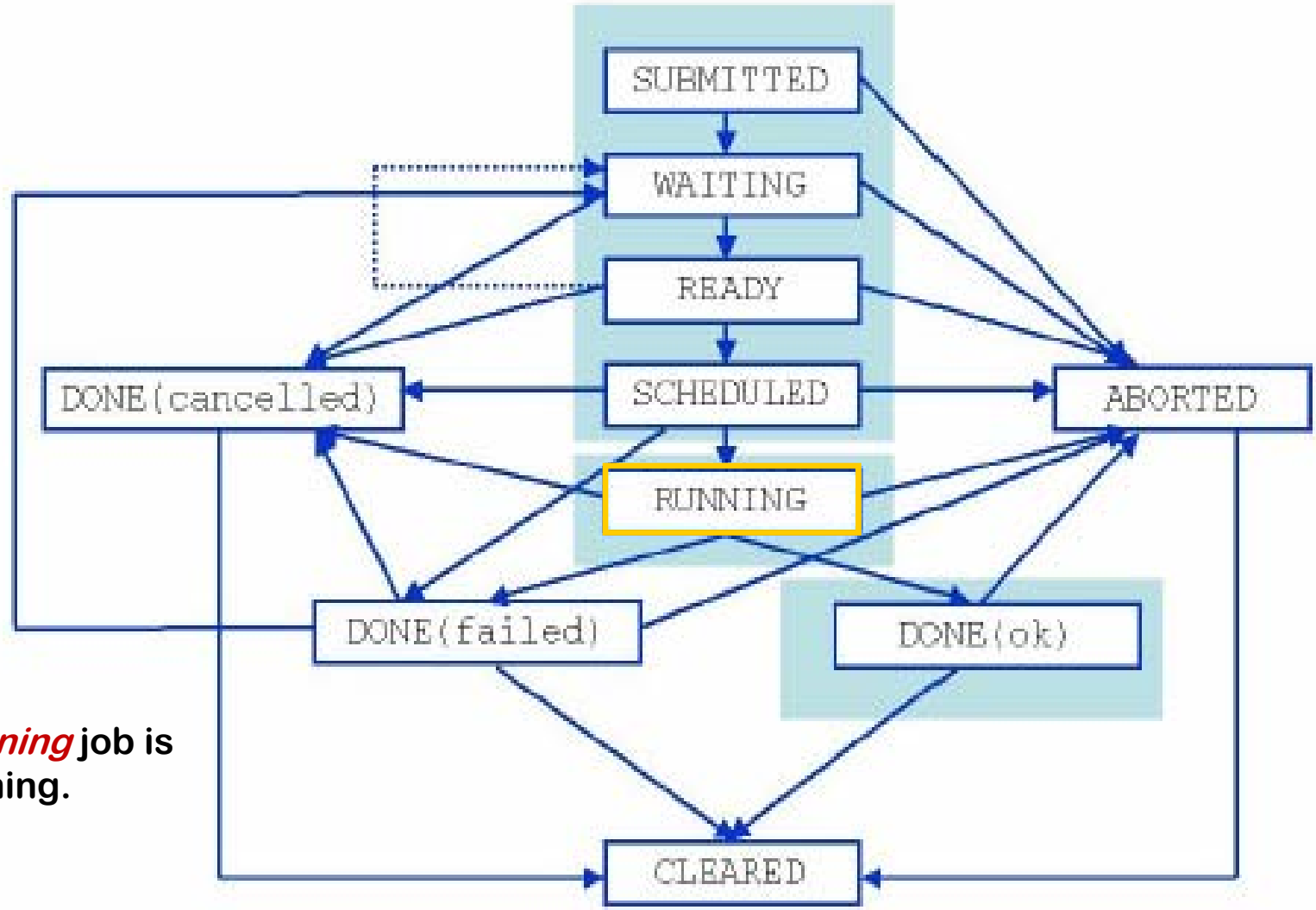


Jobs State Machine (4/9)



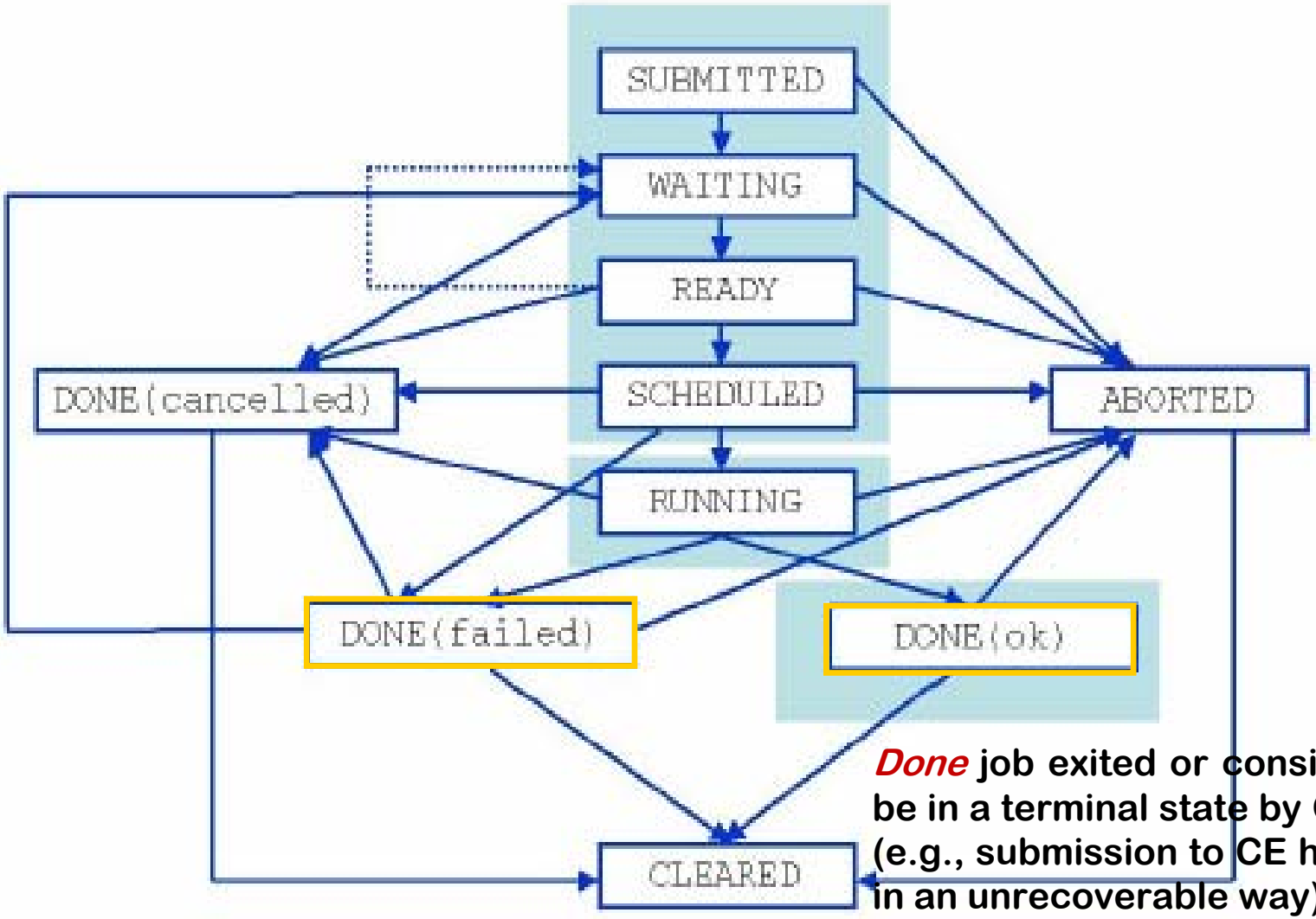
Scheduled **job waiting in the queue on the CE.**

Jobs State Machine (5/9)



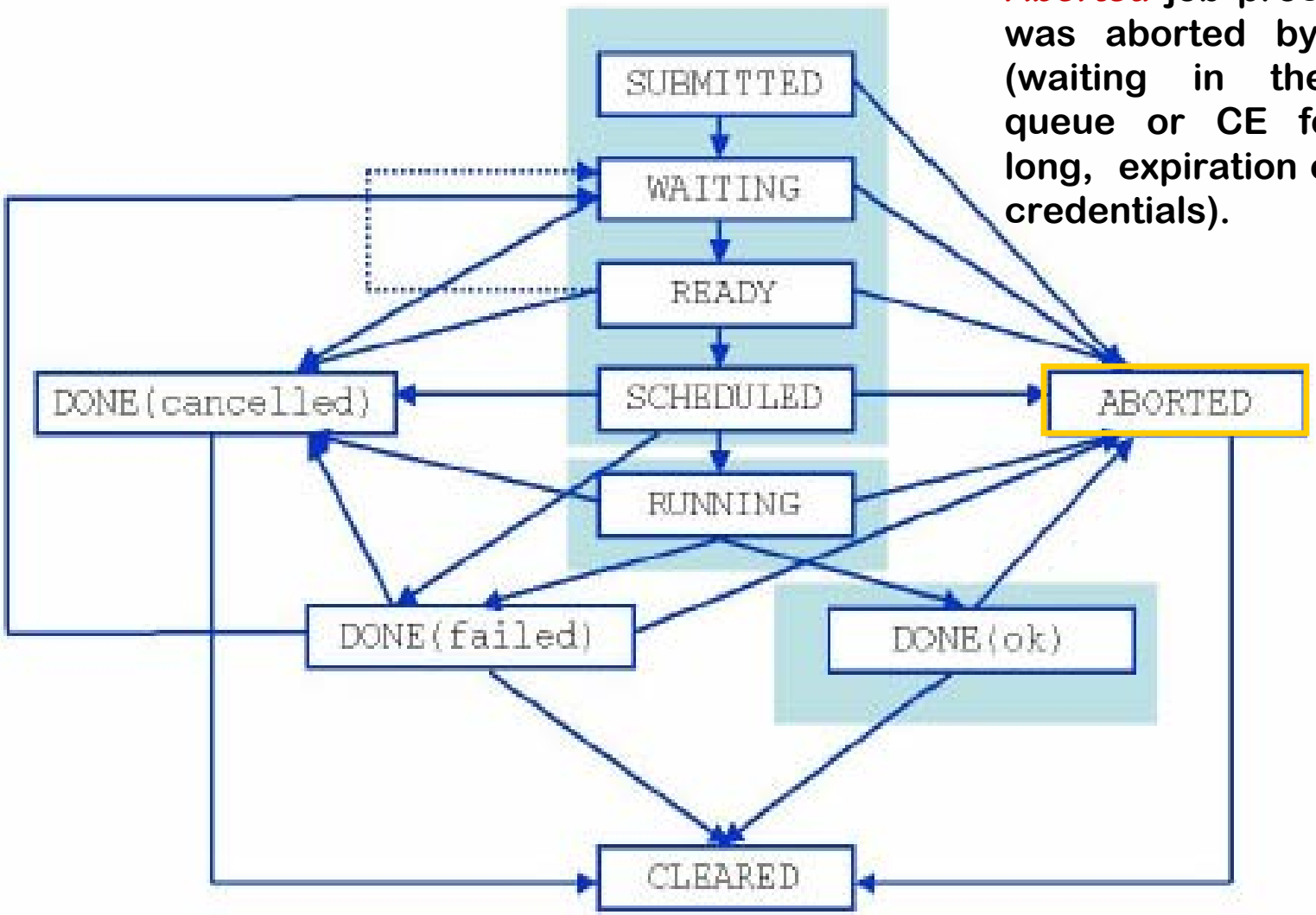
Running **job is running.**

Jobs State Machine (6/9)



Done **job exited or considered to be in a terminal state by CondorC (e.g., submission to CE has failed in an unrecoverable way).**

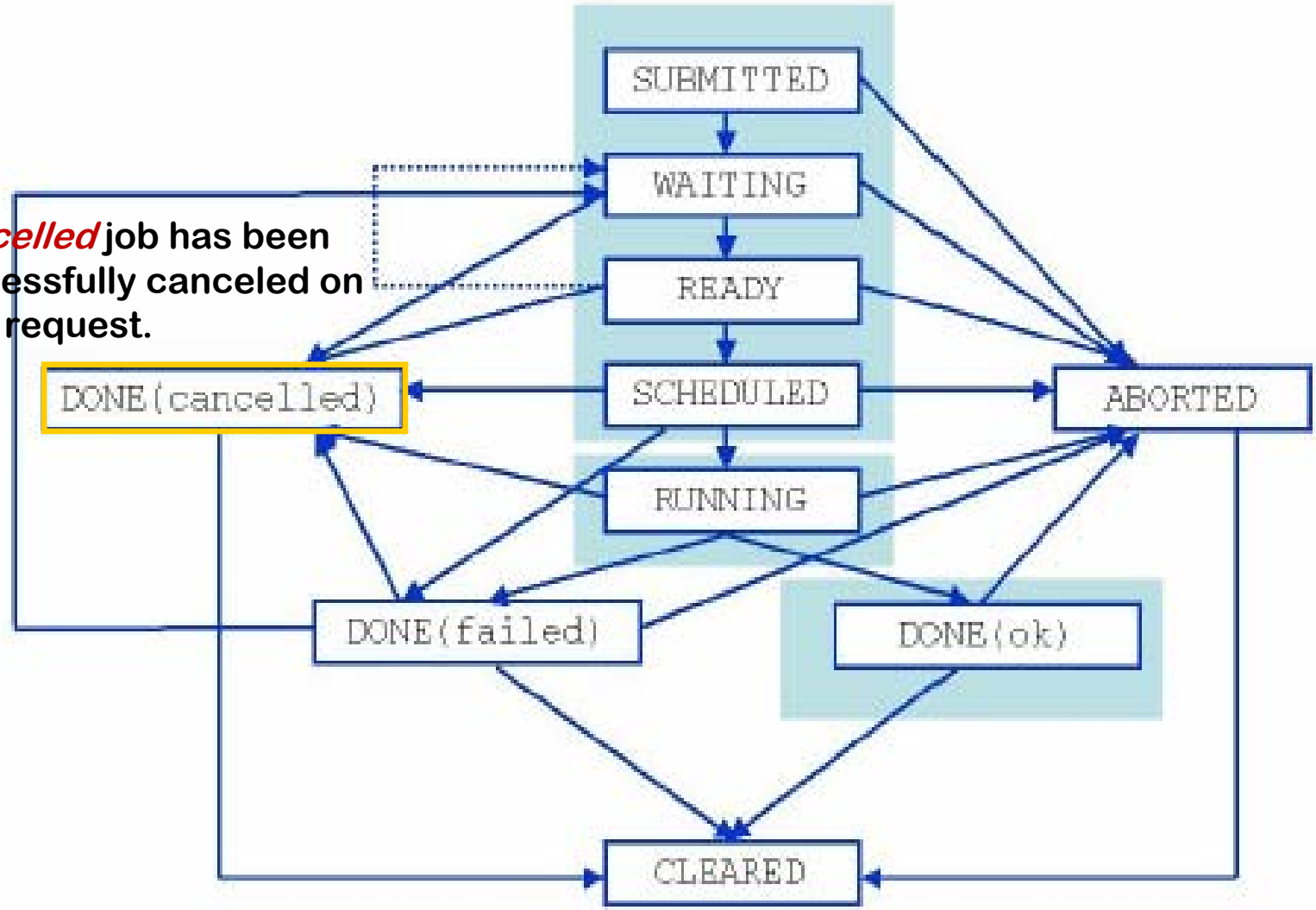
Jobs State Machine (7/9)



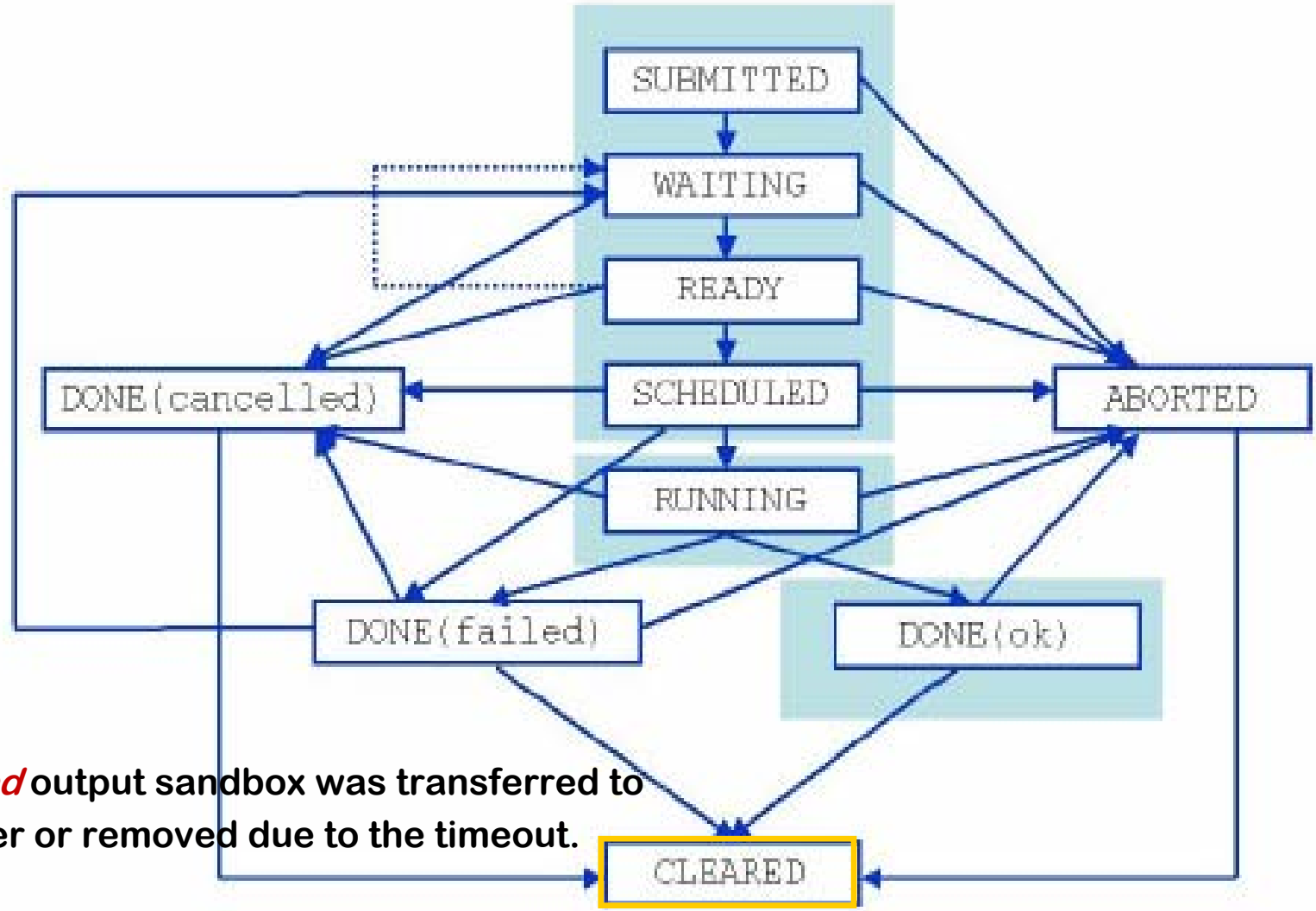
Aborted **job processing was aborted by WMS (waiting in the WM queue or CE for too long, expiration of user credentials).**

Jobs State Machine (8/9)

Cancelled **job has been successfully canceled on user request.**



Jobs State Machine (9/9)



Cleared **output sandbox was transferred to the user or removed due to the timeout.**

Possible job states

Flag	Meaning
SUBMITTED	**submission logged in the LB**
WAIT	**job match making for resources**
READY	**job being sent to executing CE**
SCHEDULED	**job scheduled in the CE queue manager**
RUNNING	**job executing on a WN of the selected CE queue**
DONE	**job terminated without grid errors**
CLEARED	**job output retrieved**
ABORT	**job aborted by middleware, check** *reason*

Summary

- **From the rich grid ecosystem emerged the EGEE production middleware**
  - **Built on tools for**
    - Authorisation and authentication
    - Job submission (direct to a Computing Element)
    - File transfer
  - …**with higher level services**
    - Job submission to "a grid" (via resource broker)
    - Data management
    - Information Systems
  - ..**and upon these can be built toolkits and services for new application communities**
    - Workflow
    - Portals: e.g. P-GRADE Portal – www.lpds.sztaki.hu/pgportal
- **Authorisation and authentication underpin the middleware**
  - resource-sharing across organisations, without centralised control

Further information

- EGEE www.eu-egee.org
- EGEE: 1st user Forum
  http://egee-intranet.web.cern.ch/egee-intranet/User-Forum

- LCG http://lcg.web.cern.ch/LCG/
- LCG User Guide
  https://edms.cern.ch/file/454439//LCG-2-UserGuide.pdf

- User Scenario
  https://edms.cern.ch/file/498081//UserScenario2.pdf

- JDL Attributes
  http://server11.infn.it/workload-grid/docs/DataGrid-01-TEN-0142-0_2.pdf
  https://edms.cern.ch/document/590869/1

- Global Grid Forum http://www.gridforum.org/
- Globus Alliance http://www.globus.org/
- VDT http://www.cs.wisc.edu/vdt/

- EGEE digital library: http://egee.lib.ed.ac.uk/

Contacts

- **EGEE Website**
  http://www.eu-egee.org
- **How to join**
  http://public.eu-egee.org/join/
- **How to try grid running gLite**
  https://gilda.ct.infn.it
- **EGEE Project Office**
  project-eu-egee-po@cern.ch