Job Submission

The European DataGrid Project Team

http://www.eu-datagrid.org

Contents

- Job Submission to the EDG Testbed
  - The EDG Workload Management System
  - Job Description Language
  - Job Submission & Monitoring
- A simple program example: the job lifecycle

Job Preparation

- Job decomposition
- Data requirements (input/output data)
- Computational requirements
- Software dependencies

- Which EDG tools are required
- How to use them (command-line vs. API)
- Executable vs. script

The EDG WMS

- User interacts with Grid via a **Workload Management System**
- WMS is currently composed of the following parts:
  - **User Interface** (UI): access point for the user to the GRID (using JDL language)
  - **Resource Broker** (RB): the broker of GRID resources, performing the match-making
  - **Job Submission System** (JSS): A wrapper to Condor-G, interfacing batch systems
  - **Information Index** (II): an LDAP server used by the Broker as a filter to select resources
  - **Logging and Bookkeeping** services (LB): MySQL databases to store Job Info

Job Description Language

- Based upon Condor's *CLASSified ADvertisement language (CLASSAD)*
- <attribute> = <value>;
- JDL defines a set of attributes for the WMS:
  - *Job Attributes:*
    - Executable, Arguments, StdIN/OUT/ERR, InputData, Rank, Requirements, …
  - *Resource Attributes:*
    - MinPhysicalMemory, MinLocalDiskSpace, FreeCPUs, RunningJobs, …

Example JDL File

```
Executable      = "~testperson/test/gridTest";

InputData       = "LF:testbed0-00019";

ReplicaCatalog  = "ldap://sunlab2g.cnaf.infn.it:2010/ \
                   rc=WP2 INFN Test, dc=infn, dc=it";

DataAccessProtocol      = "gridftp";

Rank            = "other.MaxCpuTime";

Requirements    = other.LRMSType=="Condor" && \
                  other.Architecture=="INTEL" && \
                  other.OpSys=="LINUX" && other.FreeCpus >=4;
```

Main WMS Commands

- **dg-job-submit**

  submit a job

- **dg-job-list-match**

  list resources matching a job description

- **dg-job-cancel**

  cancel a given job

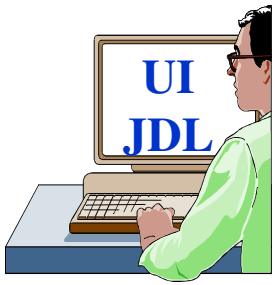
- **dg-job-status**

  display the status of the job (submitted, waiting, ready, scheduled, running, chkpt, done, outputready, aborted, cleared)

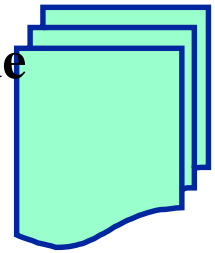
- **dg-job-get-output**

  returns the job-output to the user

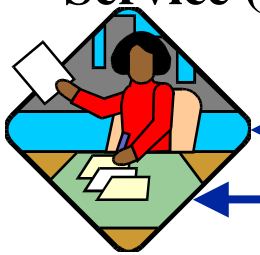
Job Submission Scenario



Replica Catalogue (RC)



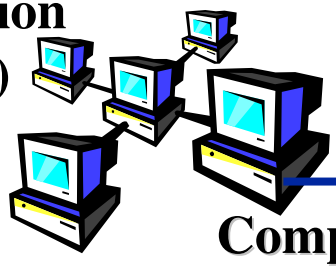
Information Service (IS)



Resource Broker (RB)

Logging & Bookkeeping (LB)

Job Submission Service (JSS)



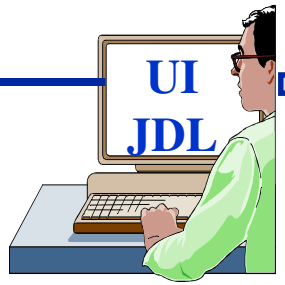
Storage Element (SE)

Compute Element CE)

A Job Submission Example

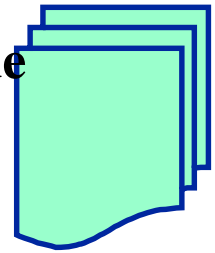
Job Status

submitted



Input Sandbox

Replica Catalogue (RC)



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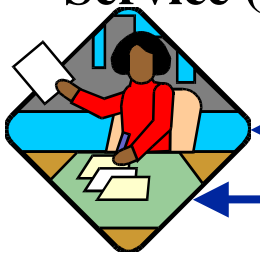
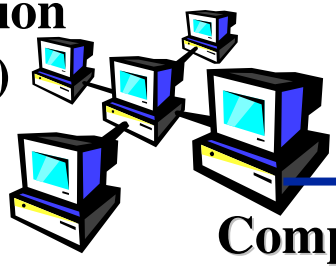


Job Submit Event

Resource Broker (RB)

Logging & Bookkeeping (LB)

Job Submission Service (JSS)



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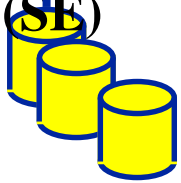
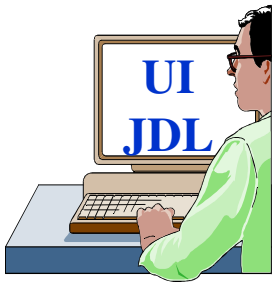


Storage Element (SE)

A Job Submission Example



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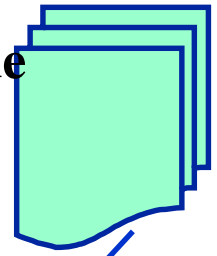

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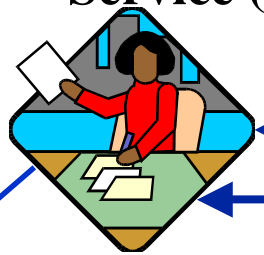

Resource Broker (RB)

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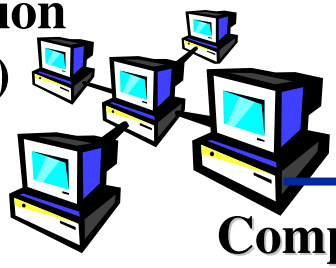
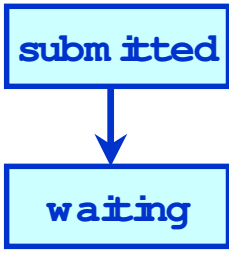


Compute Element (CE)

Storage Element (SE)

Job Status



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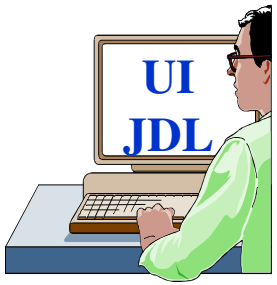

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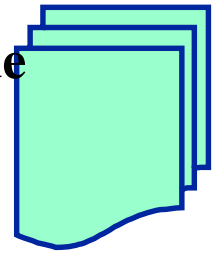

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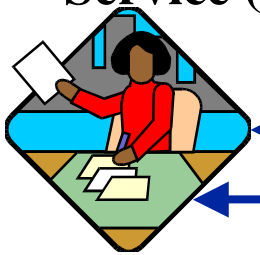

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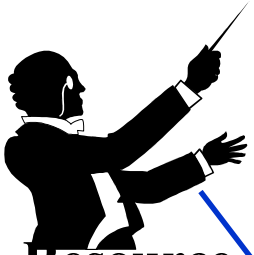

Resource Broker (RB)

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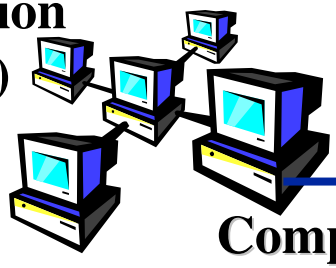

Compute Element (CE)

Storage Element (SE)

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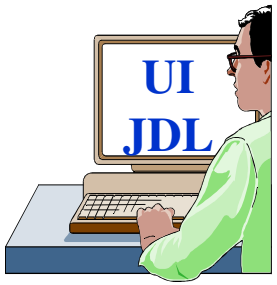

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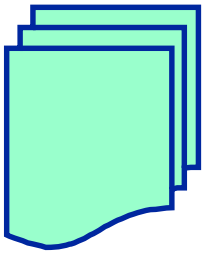

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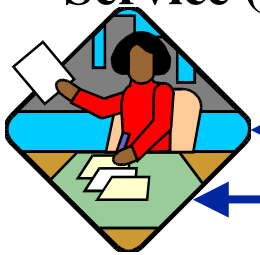
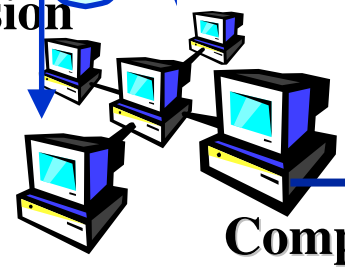


Resource Broker (RB)

Logging & Bookkeeping (LB)

Job Submission Service (JSS)

BrokerInfo



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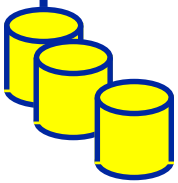

Storage Element (SE)

Job Status

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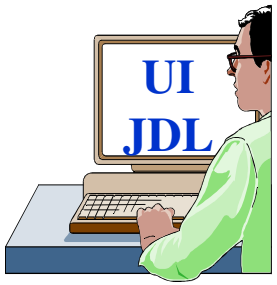

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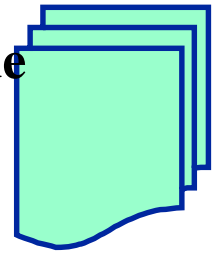

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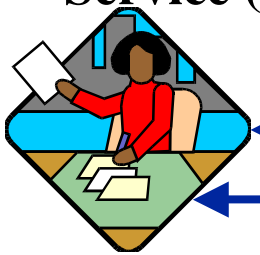
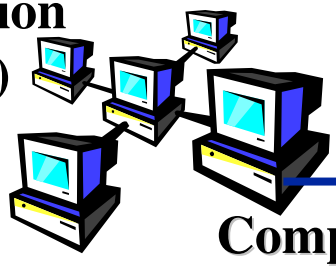


Resource Broker (RB)

Input Sandbox

Logging & Bookkeeping (LB)

Job Submission Service (JSS)



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Job Status

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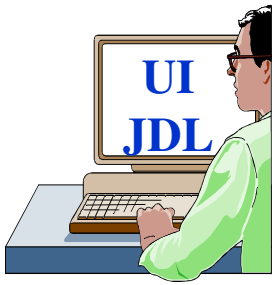

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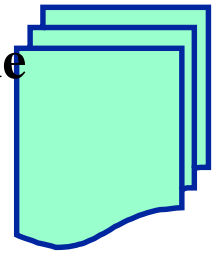

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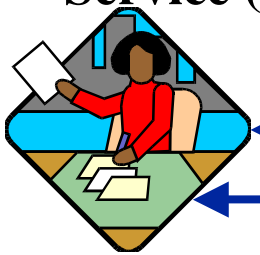

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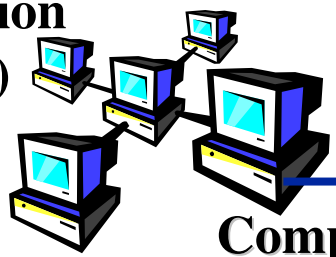

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Job Status

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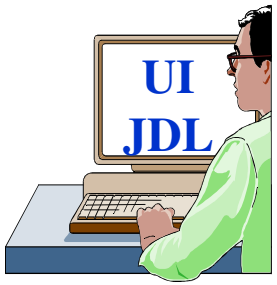
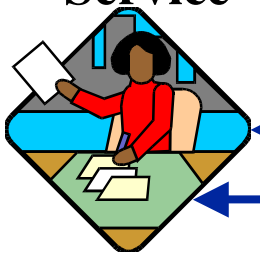


Replica Catalogue

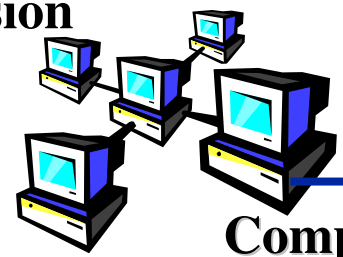


Information Service

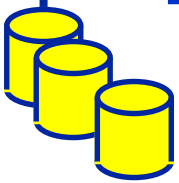
Resource Broker

Logging & Bookkeeping

Job Submission Service

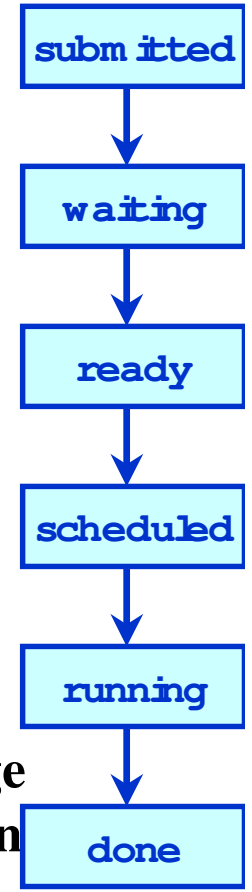


Compute Element



Storage Element

Job Status



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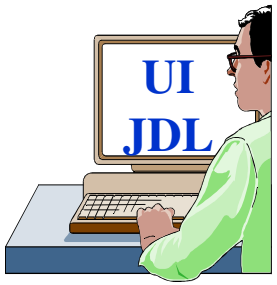

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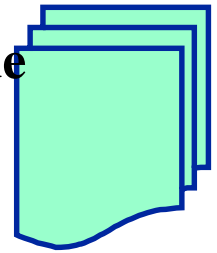
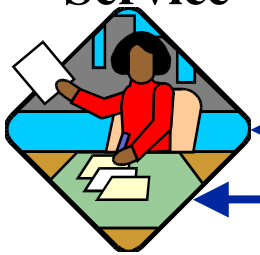


Information Service



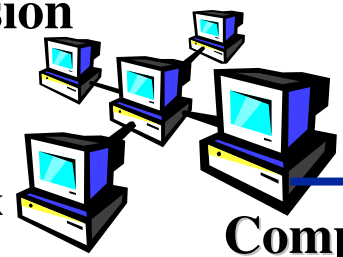
Resource Broker

Logging & Bookkeeping

Job Submission Service

Storage Element

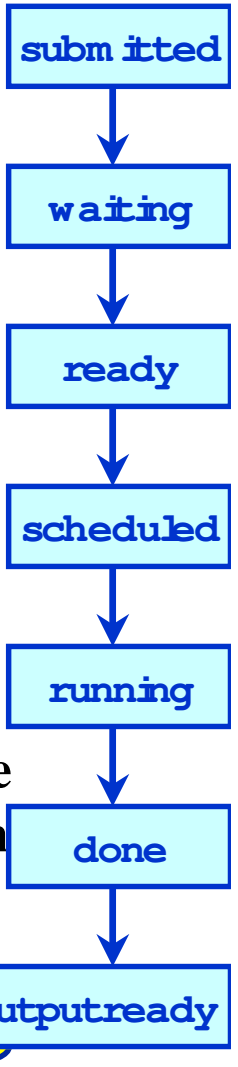
Output Sandbox



Compute Element

Job Status

Job Status



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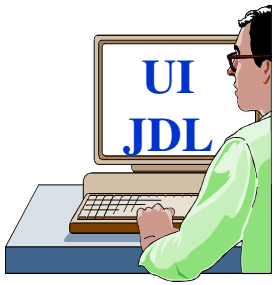

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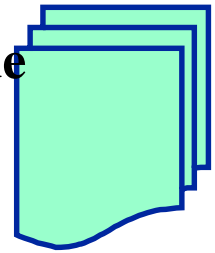

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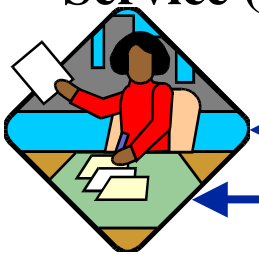
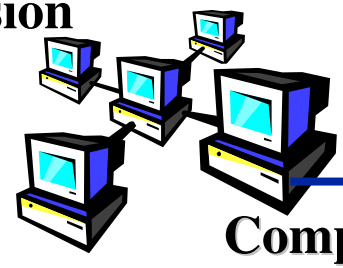


Output Sandbox

Resource Broker (RB)

Logging & Bookkeeping (LB)

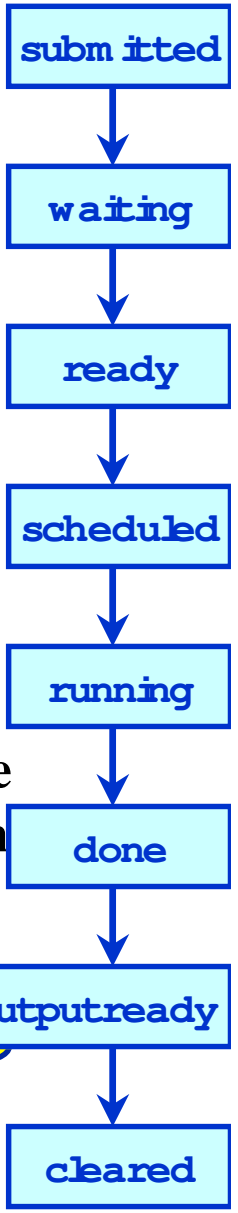
Job Submission Service (JS)



Compute Element (CE)

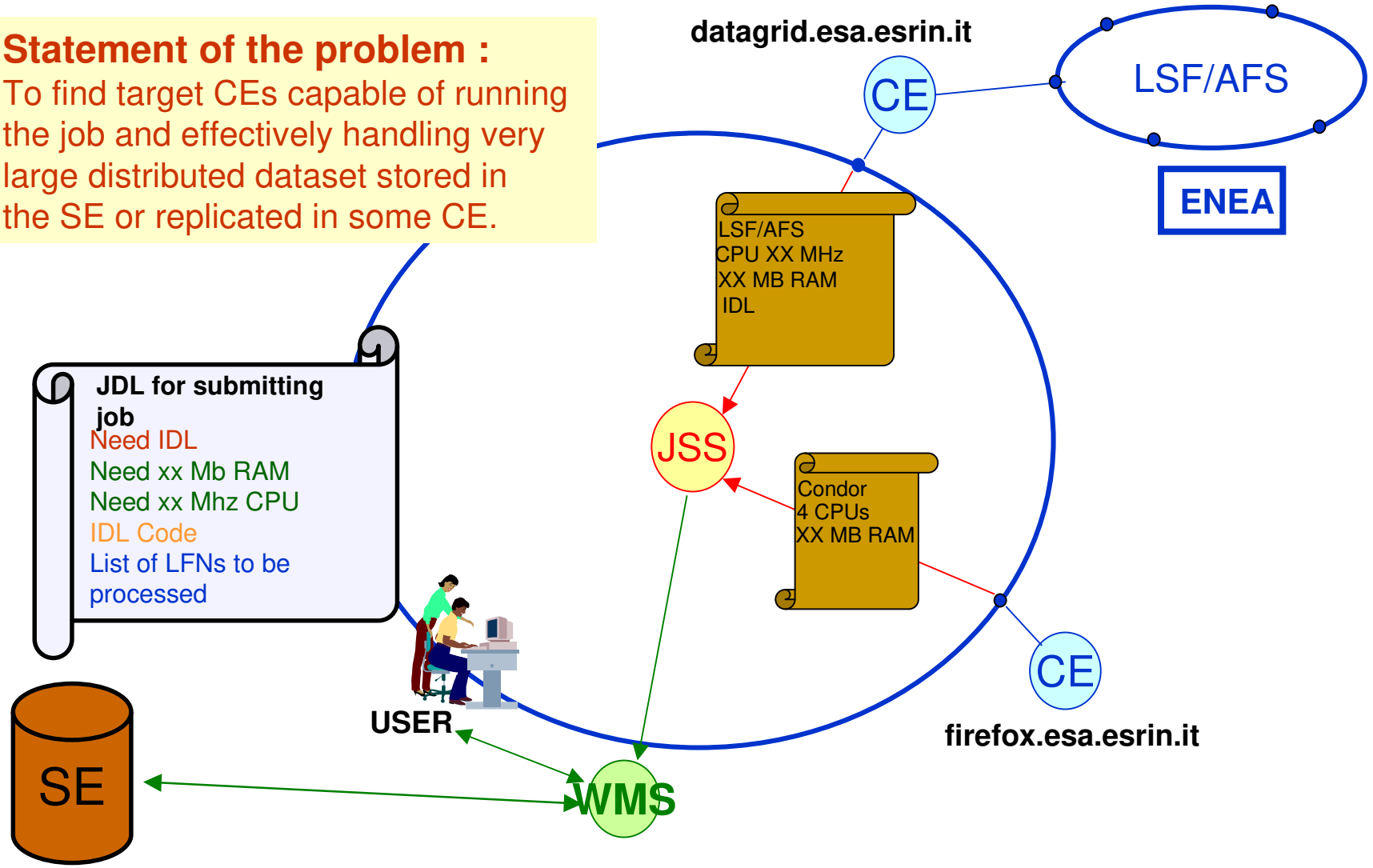
Storage Element (SE)

Job Status



The Scheduling Problem

Statement of the problem :
To find target CEs capable of running the job and effectively handling very large distributed dataset stored in the SE or replicated in some CE.



WMS Match Making

- Direct Job Submission:
  - Job is scheduled on given CE
- Job Submission without Data Requirements:
  - Requirements check
  - Rank computation
- Job Submission with Data Requirements:
  - Requirements check
  - Rank computation

- Input/Output Data Locations
- Supported Data Transfer Protocols

Example of Job Submission Sequence

- User logs in on the UI
- User issues a *grid-proxy-init* and enters his certificate's password, getting a valid Globus proxy
- User sets up his JDL file, filling in the various Condor ClassAds attributes
- Example of Hello World JDL file :

```
Executable = "/bin/echo";

Arguments = "Hello World !";

StdOutput = "Messagge.txt";

StdError = "stderr.log";

OutputSandbox = "Message.txt";
```

- User issues : *dg-job-submit HelloWorld.jdl*
  and gets back from the system a unique Job Identifier (JobId)

Job Submission Example

[reale@testbed006]$ ***dg-job-submit HelloWorld.jdl***

Connecting to host testbed011.cern.ch, port 7771

Logging to host testbed011.cern.ch, port 15830 - JOB SUBMIT OUTCOME :

The job has been successfully submitted to the Resource Broker.
Use dg-job-status command to check job current status.

Your job identifier (dg_jobId) is:
https://testbed011.cern.ch:7846/137.138.181.253/233028455264 71?testbed011.cern.ch:7771

Job Id

Example of Job Submission Sequence Cont'd

- User issues a *dg-job-status JobId*
  to get logging information about the current status of his Job
- When the "Done" status is reached, the user can issue a
  dg-job-get-output JobId
- The system returns him the name of the temporary directory where he can find the output of his job, on the UI machine.

Job Submission Example Cont'd

[reale@testbed006]$ ***dg-job-status*** \
https://testbed011.cern.ch:7846/137.138.181.253/23302845526471?testbed011.cern.ch:7771

Retrieving Information from server. Please wait: this operation could take some seconds.

********** BOOKKEEPING INFORMATION:

Printing status info for the Job :
https://testbed011.cern.ch:7846/137.138.181.253/23302845526471?testbed011.cern.ch:7771

dg_JobId = https://testbed011.cern.ch:7846/137.138.181.253/23302845526471?testbed011.cern.ch:7771

Status = Done

Last Update Time (UTC) = Mon Apr 29 23:31:16 2002

Job Destination = tbn01.nikhef.nl:2119/jobmanager-pbs-q_72h256mb

Status Reason = terminated

Job Owner = /C=IT/O=INFN/OU=Personal Certificate/L=CNAF/
CN=Mario Reale/Email=Mario.Reale@cnaf.infn.it

Status Enter Time (UTC) = Mon Apr 29 23:31:16 2002

Job Submission Example Cont'd

[reale@testbed006] ***dg-job-get-output*** \
https://testbed011.cern.ch:7846/137.138.181.253/23302845526471?testbed011.cern.ch:7771

****

JOB GET OUTPUT OUTCOME

Output sandbox files for the job:
https://testbed011.cern.ch:7846/137.138.181.253/23302845526471?testbed011.cern.ch:7771

have been successfully retrieved and stored in the directory:

/tmp/23302845526471

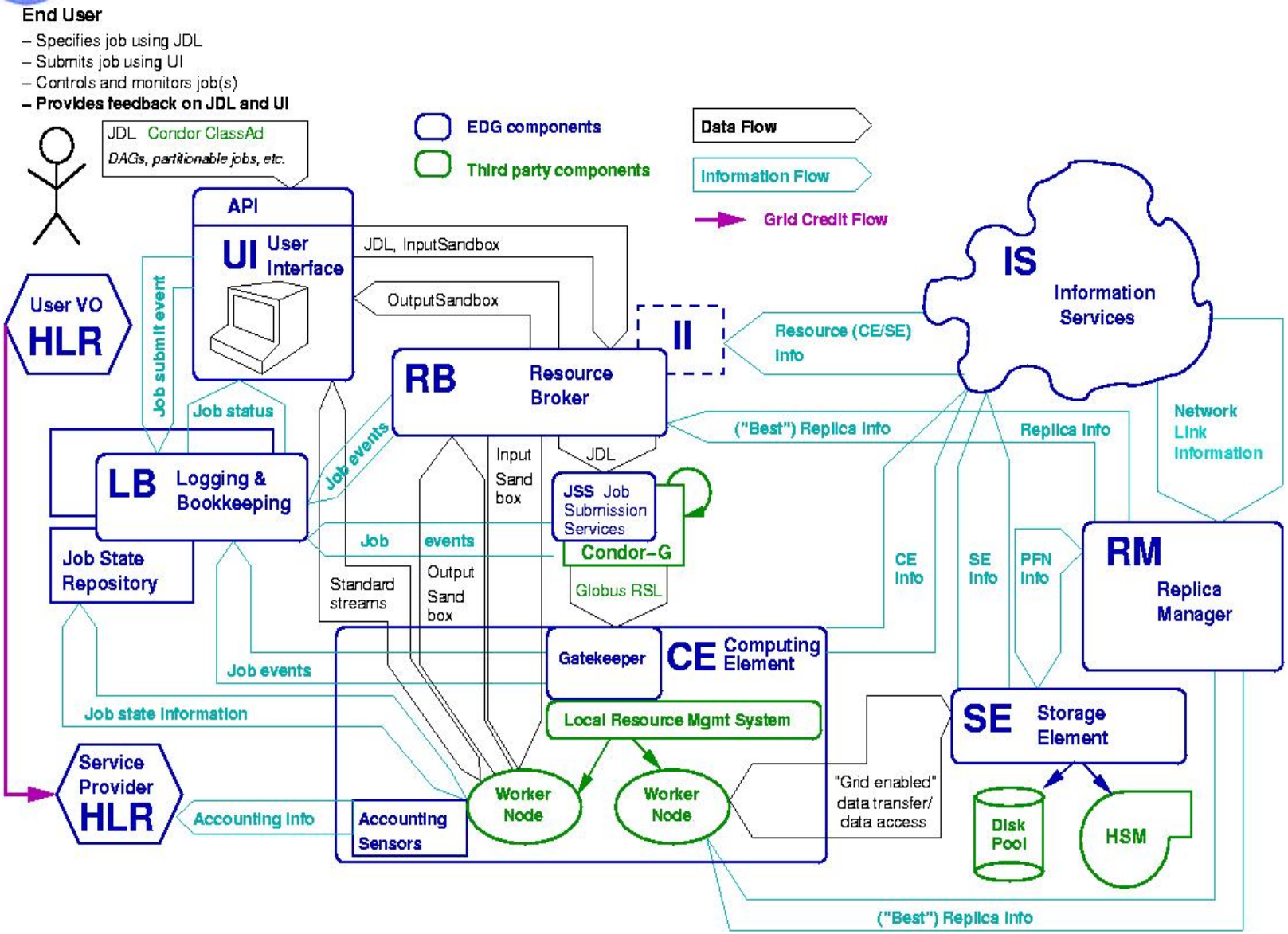
****

[reale@testbed006] ***cd /tmp/23302845526471***

reale@testbed006 /tmp/23302845526471] ***less Message.txt***

Hello World !

Detailed Interplay of EDG Components



Summary

- Job Preparation
- Job Description Language
- WMS Commands
- Jobs Scheduling on EDG Testbed

Further Information

- The EDG User's Guide

  http://marianne.in2p3.fr/datagrid/documentation/

- WMS and JDL

http://server11.infn.it/workload-grid/documents.html