Basic Exercises

Job Submission to Grid Computing Environments

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Grids & e-Science 2009
UIMP - Palacio de la Magdalena
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Just for the first time..
User certificate and VO subscription

1. A certificate issued by a trusted Grid Certification Authority

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1 A certificate issued by a trusted Grid Certification Authority
- Public & private keys copied in your User Interface's account

```
[tut01@i2gui01  ]$ ls -l .globus/
-rw——- 1 tut01 tut 4495 Jun 8 12:44 usercert.pem
-r——— 1 tut01 tut 963 Jun 8 12:44 userkey.pem
```

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```

2. Virtual Organization membership

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- Public & private keys copied in your User Interface's account

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[tut01@i2gui01  ]$ ls -l .globus/
-rw-------- 1 tut01 tut 4495 Jun 8 12:44 usercert.pem
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```

2 Virtual Organization membership

- Managed by **VOMS servers**
  - Each one supports a set of VOs
  - User requests approved by a VO manager

Every time we want to access the Grid..
VOMS Proxy certificate

What is a VOMS Proxy certificate?

- Special kind of certificate that enables you to use Grid facilities during a certain period
- This certificate contains
    - Certificate credentials
    - VOMS extensions of your VO

Why do we need a proxy?

- In the Grid world it is often necessary for a remote service to act on a user's behalf

VOMS Proxy Certificate - Exercises
Create a VOMS proxy

- Log into your account in the User Interface

$ ssh tut01@i2gui01.ifca.es

VOMS Proxy Certificate - Exercises
Create a VOMS proxy

- Log into your account in the User Interface

$ ssh tut01@i2gui01.ifca.es

- Create the proxy certificate with VOMS extensions

[tut01@i2gui01 ∼]$ voms-proxy-init –voms itut

- Passphrase: **temp1234**

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Create a VOMS proxy

- Log into your account in the User Interface

  $ ssh tut01@i2gui01.ifca.es

- Create the proxy certificate with VOMS extensions

  [tut01@i2gui01 ~]$ voms-proxy-init –voms itut

  - Passphrase: **temp1234**

```
Cannot find file or dir: /home/tut01/.glite/vomses
Enter GRID pass phrase:
Your identity: /C=PT/O=LIP/CN=user01
Creating temporary proxy ................. Done
Contacting i2g-voms.lip.pt:20003 [/C=PT/O=LIPCA/O=LIP/OU=Lisboa/CN=i2g-voms.lip.pt] "itut" Done
Creating proxy ................................................ Done
Your proxy is valid until Mon Jun 15 01:48:20 2009
```

VOMS Proxy Certificate - Exercises
Printing proxy certificate info

[tut01@i2gui01 ~]$ voms-proxy-info -all

VOMS Proxy Certificate - Exercises
Printing proxy certificate info

[tut01@i2gui01 ~]$ voms-proxy-info -all

```
subject                              : /C=PT/O=LIP/CN=user01/CN=proxy
issuer                               : /C=PT/O=LIP/CN=user01
identity                             : /C=PT/O=LIP/CN=user01
type                                 : proxy
strength                             : 1024 bits
path                                 : /tmp/x509up_u10402
timeleft                             : 11:59:55
=== VO itut extension information ===
VO                                   : itut
subject                              : /C=PT/O=LIP/CN=user01
issuer                               : /C=PT/O=LIPCA/O=LIP/OU=Lisboa/CN=i2g-voms.lip.pt
attribute                            : /itut/Role=NULL/Capability=NULL
timeleft                             : 11:59:55
uri                                  : i2g-voms.lip.pt:20003
```

VOMS Proxy Certificate - Exercises
VOMS Proxy lifetime limit

Problem

Proxy lifetime limited to 12 hours by default

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Solution 1

Extend it with -valid H:M option:

[tut01@i2gui01 ~]$ voms-proxy-init –voms itut -valid 120:00

VOMS Proxy Certificate - Exercises
VOMS Proxy lifetime limit

Problem

Proxy lifetime limited to 12 hours by default

Solution 1

Extend it with `-valid H:M` option:

[tut01@i2gui01 ~]$ voms-proxy-init –voms itut -valid 120:00

```
Cannot find file or dir: /home/tut01/.glite/vomses
Enter GRID pass phrase:
Your identity: /C=PT/O=LIP/CN=user01
Creating temporary proxy ............................................................ Done
Contacting i2g-voms.lip.pt:20003 [/C=PT/O=LIPCA/O=LIP/OU=Lisboa/CN=i2g-voms.lip.pt] "itut" Done
Warning: i2g-voms.lip.pt:20003: The validity of this VOMS AC in your proxy is shortened to 86400 seconds!
Creating proxy ............................................. Done
```

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Create a long-term proxy and store it in a **MyProxy Server**

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Create a long-term proxy and store it in a **MyProxy Server**

[tut01@i2gui01 ~]$ myproxy-init -d -n -c 120

VOMS Proxy Certificate - Exercises
VOMS Proxy lifetime limit

Problem

Proxy lifetime limited to 12 hours by default

Solution 2

Create a long-term proxy and store it in a **MyProxy Server**

[tut01@i2gui01 ~]$ myproxy-init -d -n -c 120

```
Your identity: /C=PT/O=LIP/CN=user01
Enter GRID pass phrase for this identity:
Creating proxy .......................... Done
Proxy Verify OK
Your proxy is valid until: Fri Jun 19 15:51:53 2009

A proxy valid for 120 hours (5.0 days) for user /C=PT/O=LIP/CN=user01 now exists on i2gpx01.ifca.es.
```

VOMS Proxy Certificate - Exercises
VOMS Proxy lifetime limit

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Proxy lifetime limited to 12 hours by default

Solution 2

Create a long-term proxy and store it in a **MyProxy Server**

[tut01@i2gui01 ~]$ myproxy-init -d -n -c 120

Your identity: /C=PT/O=LIP/CN=user01
Enter GRID pass phrase for this identity:
Creating proxy .... Done
Proxy Verify OK
Your proxy is valid until: Fri Jun 19 15:51:53 2009

A proxy valid for 120 hours (5.0 days) for user /C=PT/O=LIP/CN=user01 now exists on i2gpx01.ifca.es.

Long-term proxies need a VOMS proxy certificate (created with `voms-proxy-init`)

Information Service
Concepts

- Sites have to publish the information about their computing resources

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- Sites have to publish the information about their computing resources
- This information follows a LDAP implementation
- 2 main tools allow end users to easily request this info without querying directly the LDAP tree
    - **lcg-infosites**
    - **lcg-info**

Information Service - Exercises
lcg-infosites

- Used to obtain VO-specific information on existing Grid resources

> [tut01@i2gui01 basic-js]$ lcg-infosites –vo itut ce

Information Service - Exercises
lcg-infosites

- Used to obtain VO-specific information on existing Grid resources

[tut01@i2gui01 basic-js]$ lcg-infosites –vo itut ce

#CPU	Free	Total Jobs	Running	Waiting	ComputingElement
24	24	0	0	0	i2ce.polgrid.pl:2119/jobmanager-pbs-itut
1004	57	0	0	0	i2gce01.ifca.es:2119/jobmanager-lcgpbs-infiniband
28	25	0	0	0	i2g-ce01.lip.pt:2119/jobmanager-lcgsge-itutgridsdj
600	600	0	0	0	iwrce2.fzk.de:2119/jobmanager-lcgpbs-i2gpar
1004	57	0	0	0	i2gce01.ifca.es:2119/jobmanager-lcgpbs-infinibandlarge
8	8	0	0	0	ce.i2g.cyf-kr.edu.pl:2119/jobmanager-pbs-itut
1004	57	0	0	0	i2gce01.ifca.es:2119/jobmanager-lcgpbs-itut

Information Service - Exercises
lcg-infosites

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> [tut01@i2gui01 basic-js]$ lcg-infosites –vo itut ce

#CPU	Free	Total Jobs	Running	Waiting	ComputingElement
24	24	0	0	0	i2ce.polgrid.pl:2119/jobmanager-pbs-itut
1004	57	0	0	0	i2gce01.ifca.es:2119/jobmanager-lcgpbs-infiniband
28	25	0	0	0	i2g-ce01.lip.pt:2119/jobmanager-lcgsge-itutgridsdj
600	600	0	0	0	iwrce2.fzk.de:2119/jobmanager-lcgpbs-i2gpar
1004	57	0	0	0	i2gce01.ifca.es:2119/jobmanager-lcgpbs-infinibandlarge
8	8	0	0	0	ce.i2g.cyf-kr.edu.pl:2119/jobmanager-pbs-itut
1004	57	0	0	0	i2gce01.ifca.es:2119/jobmanager-lcgpbs-itut

- 'ce' lists the Computing Elements that support `itut` VO

Information Service - Exercises
lcg-infosites

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> [tut01@i2gui01 basic-js]$ lcg-infosites –vo itut ce

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28	25	0	0	0	i2g-ce01.lip.pt:2119/jobmanager-lcgsge-itutgridsdj
600	600	0	0	0	iwrce2.fzk.de:2119/jobmanager-lcgpbs-i2gpar
1004	57	0	0	0	i2gce01.ifca.es:2119/jobmanager-lcgpbs-infinibandlarge
8	8	0	0	0	ce.i2g.cyf-kr.edu.pl:2119/jobmanager-pbs-itut
1004	57	0	0	0	i2gce01.ifca.es:2119/jobmanager-lcgpbs-itut

- 'ce' lists the Computing Elements that support `itut` VO
- Other options: **se, closeSE, lfc, wms, fts, sitenames, ..**

Information Service - Exercises
lcg-info

- List either CEs or SEs satisfying a given set of conditions on their attributes

lcg-info [–list-ce — –list-se — –list-service — –list-site] [–query <query>] [–attrs <attrs>]

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lcg-info [–list-ce — –list-se — –list-service — –list-site] [–query <query>] [–attrs <attrs>]

- List of supported attributes

[tut01@i2gui01 basic-js]\$ lcg-info –list-attrs

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lcg-info [–list-ce — –list-se — –list-service — –list-site] [–query <query>] [–attrs <attrs>]

- List of supported attributes

[tut01@i2gui01 basic-js]$ lcg-info –list-attrs

Attribute name	Glue object class	Glue attribute name
EstRespTime	GlueCE	GlueCEStateEstimatedResponseTime
WorstRespTime	GlueCE	GlueCEStateWorstResponseTime
TotalJobs	GlueCE	GlueCEStateTotalJobs
TotalCPUs	GlueCE	GlueCEInfoTotalCPUs
[...]		

Information Service - Exercises
lcg-info - Simple Query

- List all the CEs that support `itut` VO

  [tut01@i2gui01 basic-js]$ lcg-info –list-ce –vo itut

Information Service - Exercises
lcg-info - Simple Query

- List all the CEs that support `itut` VO

  [tut01@i2gui01 basic-js]$ lcg-info –list-ce –vo itut

- CE: ce.i2g.cesga.es:2119/jobmanager-lcgsge-GRID_itut
- CE: ce.i2g.cyf-kr.edu.pl:2119/jobmanager-pbs-itut
- CE: i2ce.polgrid.pl:2119/jobmanager-pbs-itut
- CE: i2g-ce01.lip.pt:2119/jobmanager-lcgsge-itutgridsdj

[..]

Information Service - Exercises
lcg-info - Simple Query with constraints

- List all the CEs that support `itut VO` with 30-or-less running jobs

> [tut01@i2gui01 basic-js]$ lcg-info –list-ce –vo itut
>   –query 'VORunningJobs<=30'

Information Service - Exercises
lcg-info - Simple Query with constraints

- List all the CEs that support `itut` VO with 30-or-less running jobs

> [tut01@i2gui01 basic-js]$ lcg-info –list-ce –vo itut
> –query 'VORunningJobs<=30'

- More comma-separated constraints can be added

> [tut01@i2gui01 basic-js]$ lcg-info –list-ce –vo itut
> –query 'VORunningJobs<=30,OS=Scientific'

Information Service - Exercises
lcg-info - Simple Query with constraints and attribute listing

- List all the CEs that support `itut` VO with 30-or-less running jobs and therefore list useful information attributes

```
[tut01@i2gui01 basic-js]$ lcg-info –list-ce –vo itut
                –query 'VORunningJobs<=30'
–attr 'CloseSE,FreeCPUs,TotalJobs,WaitingJobs,RunningJobs'
```

Information Service - Exercises
lcg-info - Simple Query with constraints and attribute listing

- List all the CEs that support `itut VO` with 30-or-less running jobs and therefore list useful information attributes

```
[tut01@i2gui01 basic-js]$ lcg-info –list-ce –vo itut
            –query 'VORunningJobs<=30'
–attr 'CloseSE,FreeCPUs,TotalJobs,WaitingJobs,RunningJobs'
```

```
- CE:          i2g-ce01.lip.pt:2119/jobmanager-lcgsge-itutgridsdj
- CloseSE      se05.lip.pt
               i2g-se01.lip.pt
- FreeCPUs     28
- TotalJobs    0
- WaitingJobs  0
- RunningJobs  0
- CE:          i2gce01.ifca.es:2119/jobmanager-lcgpbs-infiniband
- CloseSE      i2gse01.ifca.es
               griddpm01.ifca.es
- FreeCPUs     52
- TotalJobs    0
- WaitingJobs  0
- RunningJobs  0
[..]
```

JDL
Job Description Language

- JDL $\implies$ language to describe job's requirements

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JDL example - basic.jdl

```
Type = "Job";
JobType = "Normal";
RetryCount = "2"; Executable = /bin/sh";
Arguments = "basic.sh";
StdOutput = "basic.out";
StdError = "basic.err";
InputSandbox = "basic.sh";
OutputSandbox = {"myscript.err","myscript.out" };
```

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JDL example - basic.jdl

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Arguments = "basic.sh";
StdOutput = "basic.out";
StdError = "basic.err";
InputSandbox = "basic.sh";
OutputSandbox = {"myscript.err","myscript.out" };
```

where

InputSandbox	: files to be copied to the execution node
OutputSandbox	: files to be copied back after job execution

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Resource allocation

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  - Proxy renewal (if you've used a MyProxy server)

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  - Final site selection (that matches your requirements)
  - Storage of sandboxes
  - Transitions within the status of jobs (scheduled, running, done, aborted..)
  - Proxy renewal (if you've used a MyProxy server)
- Currently there are 2 main implementations:
  - Crossbroker (i2g-job-* commands)
  - gLite Workload Management System (glite-wms-job-* commands)

Job submission - Exercises
Check matching resources

- Go to $\sim$/*basic-js/* and take a look to *basic.jdl* and *basic.sh*

[tut01@i2gui01 basic-js]$ i2g-job-list-match basic.jdl

Job submission - Exercises
Check matching resources

- Go to ∼/*basic-js/* and take a look to *basic.jdl* and *basic.sh*

[tut01@i2gui01 basic-js]$ i2g-job-list-match basic.jdl

```
Selected Virtual Organisation name (from proxy certificate extension): itut
Connecting to host i2grb01.ifca.es, port 7772
******************************************************************************
                        COMPUTING ELEMENT IDs LIST
The following CE(s) matching your job requirements have been found:
                                    *CEId*
iwrce2.fzk.de:2119/jobmanager-lcgpbs-i2gpar/itut
i2gce01.ifca.es:2119/jobmanager-lcgpbs-itut/itut
i2gce01.ifca.es:2119/jobmanager-lcgpbs-infinibandlarge/itut
i2gce01.ifca.es:2119/jobmanager-lcgpbs-infiniband/itut
i2g-ce01.lip.pt:2119/jobmanager-lcgsge-itutgridsdj/itut
i2ce.polgrid.pl:2119/jobmanager-pbs-itut/itut
ce.i2g.cyf-kr.edu.pl:2119/jobmanager-pbs-itut/itut
ce.i2g.cesga.es:2119/jobmanager-lcgsge-GRID_itut/itut
******************************************************************************
```

Job submission - Exercises
Submitting the job

[tut01@i2gui01 basic-js]$ i2g-job-submit basic.jdl

Job submission - Exercises
Submitting the job

[tut01@i2gui01 basic-js]$ i2g-job-submit basic.jdl

Selected Virtual Organisation name (from proxy certificate extension): itut
Connecting to host i2grb01.ifca.es, port 7772
Logging to host i2grb01.ifca.es, port 9002
****
JOB SUBMIT OUTCOME
The job has been successfully submitted to the Network Server.
Use i2g-job-status command to check job current status. Your job identifier is:

- https://i2grb01.ifca.es:9000/s8_rgISqhoQ9JA0kkW3C0w

****

Job submission - Exercises
Submitting the job

[tut01@i2gui01 basic-js]$ i2g-job-submit basic.jdl

Selected Virtual Organisation name (from proxy certificate extension): itut
Connecting to host i2grb01.ifca.es, port 7772
Logging to host i2grb01.ifca.es, port 9002
****
                                    JOB SUBMIT OUTCOME
The job has been successfully submitted to the Network Server.
Use i2g-job-status command to check job current status. Your job identifier is:
- https://i2grb01.ifca.es:9000/s8_rgISqhoQ9JA0kkW3C0w

****

- –o option deviates the jobid to a file:

[tut01@i2gui01 basic-js]$ i2g-job-submit -o jobids basic.jdl

- This is useful when submitting a bunch of jobs

Job submission - Exercises
Checking the status of the job

[tut01@i2gui01 basic-js]$ i2g-job-status <job_id>

Job submission - Exercises
Checking the status of the job

[tut01@i2gui01 basic-js]$ i2g-job-status <job_id>

```
**************************************************************
                    BOOKKEEPING INFORMATION:
Status info for the Job : https://i2grb01.ifca.es:9000/s8_rgISqhoQ9JA0kkW3C0w
Current Status: Scheduled
Status Reason: Job successfully submitted to Globus
Destination: i2gce01.ifca.es:2119/jobmanager-lcgpbs-itut
reached on: Sun Jun 14 18:01:01 2009

**************************************************************
```

Job submission - Exercises
Checking the status of the job

[tut01@i2gui01 basic-js]$ i2g-job-status <job_id>

```
*************************************************************
                    BOOKKEEPING INFORMATION:
Status info for the Job : https://i2grb01.ifca.es:9000/s8_rgISqhoQ9JA0kkW3C0w
Current Status: Scheduled
Status Reason: Job successfully submitted to Globus
Destination: i2gce01.ifca.es:2119/jobmanager-lcgpbs-itut
reached on: Sun Jun 14 18:01:01 2009

*************************************************************
```

- Job finishes as soon as Status parameter changes to Done
- If we've deviated the jobid to a file, we need -i option:

[tut01@i2gui01 basic-js]$ i2g-job-status -i <jobids_filename>

Job submission - Exercises
Retrieving the output

[tut01@i2gui01 basic-js]$ mkdir outputs

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Retrieving the output

[tut01@i2gui01 basic-js]$ mkdir outputs

[tut01@i2gui01 basic-js]$ i2g-job-get-output –dir <output_dir>
<job_id>

Job submission - Exercises
Retrieving the output

[tut01@i2gui01 basic-js]$ mkdir outputs

[tut01@i2gui01 basic-js]$ i2g-job-get-output –dir <output_dir> <job_id>

```
********************************************************************************
                            JOB GET OUTPUT OUTCOME

Output sandbox files for the job:
- https://i2grb01.ifca.es:9000//s8_rgISqhoQ9JA0kkW3C0w
have been successfully retrieved and stored in the directory:
/home/tut01/basic-js/outputs/tut01_s8_rgISqhoQ9JA0kkW3C0w
********************************************************************************
```

Job submission - Exercises
Retrieving the output

[tut01@i2gui01 basic-js]$ mkdir outputs

[tut01@i2gui01 basic-js]$ i2g-job-get-output –dir <output_dir>
<job_id>

```
*******************************************************************************
                            JOB GET OUTPUT OUTCOME

Output sandbox files for the job:
- https://i2grb01.ifca.es:9000//s8_rgISqhoQ9JA0kkW3C0w
have been successfully retrieved and stored in the directory:
/home/tut01/basic-js/outputs/tut01_s8_rgISqhoQ9JA0kkW3C0w
*******************************************************************************
```

- Same as posted before for the `-i` option
- You can see the output sandbox in:

[tut01@i2gui01 basic-js]$ ls -l outputs/

Job submission - Exercises
Other i2g commands

There are several other commands like:

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[tut01@i2gui01 basic-js]\$ i2g-job-get-logging-info <job_id>

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Other i2g commands

There are several other commands like:

[tut01@i2gui01 basic-js]$ i2g-job-get-logging-info <job_id>

- Show the logging info of a submitted job
- Interesting for debugging cases

Job submission - Exercises
Other i2g commands

There are several other commands like:

```
[tut01@i2gui01 basic-js]$ i2g-job-get-logging-info <job_id>
```

- Show the logging info of a submitted job
- Interesting for debugging cases

```
[tut01@i2gui01 basic-js]$ i2g-job-cancel <job_id>
```

Job submission - Exercises
Other i2g commands

There are several other commands like:

[tut01@i2gui01 basic-js]$ i2g-job-get-logging-info <job_id>

- Show the logging info of a submitted job
- Interesting for debugging cases

[tut01@i2gui01 basic-js]$ i2g-job-cancel <job_id>

- Cancel and erases a submitted job
- No more info about the job after executing this command

Brief approach on gLite WMS commands

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- glite WMS uses the same concepts as Crossbroker does

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- glite WMS uses the same concepts as Crossbroker does
- The main difference is that glite WMS requires a delegated proxy before issuing any other command:

  glite-wms-job-delegate-proxy -d <delegation_id>

Brief approach on gLite WMS commands

- glite WMS uses the same concepts as Crossbroker does
- The main difference is that glite WMS requires a delegated proxy before issuing any other command:

  glite-wms-job-delegate-proxy -d <delegation_id>

- Equivalences

i2g-job-list-match	glite-wms-job-list-match
i2g-job-submit	glite-wms-job-submit
i2g-job-status	glite-wms-job-status
i2g-job-get-output	glite-wms-job-output
i2g-job-get-logging-info	glite-wms-job-info
i2g-job-cancel	glite-wms-job-cancel