



BASICS AND ADVANCES OF THE GRID
RUNNING ON THE GRID USING MIGRATING DESKTOP

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Abstract: This document presents Migrating Desktop (MD) tutorial.





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Introduction

Rapid growth of demands for computational power over the last few years aroused interest in the research in the area of computational Grids. One of the research fields is designing tools and technologies that give easy, secure and consistent access to Grid applications and resources.

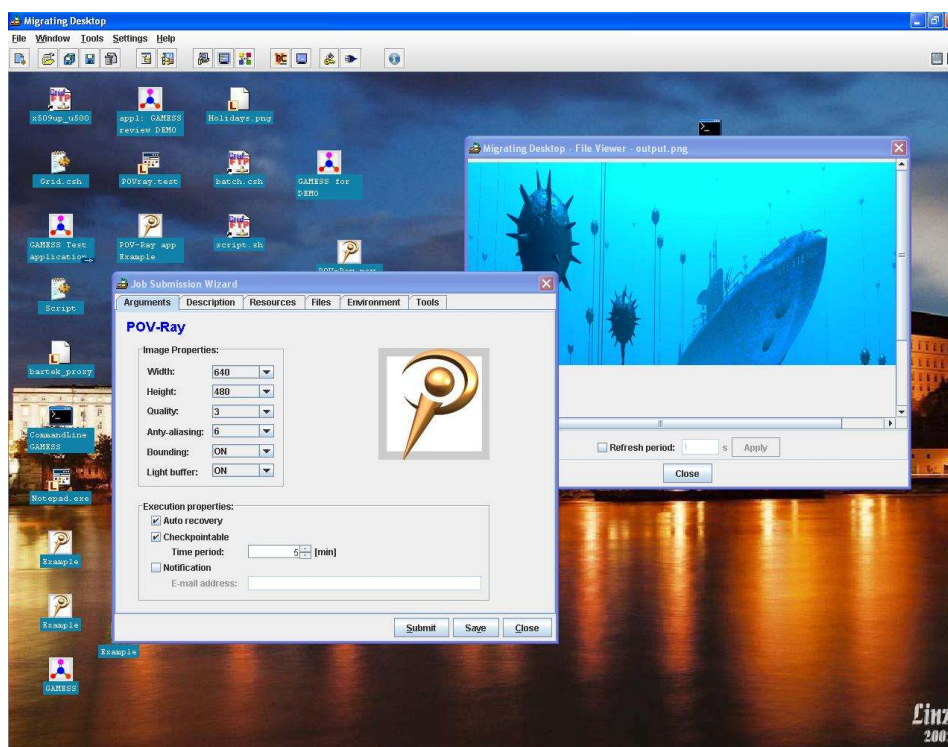


Fig. 1 Migrating Desktop

The most commonly used way of accessing Grid remote resources are *Web based user interfaces to HPC systems*. They offer easy manner of interaction with user that hides from the user heterogeneity and complexity of the Grid systems. Web-browser based interfaces beside services dedicated for Grid systems (like users' profile management, information services, remote job submission, job tracking, file transfer, authentication and authorisation) usually provides also a large set of additional services, such as e-mail, forums, search engines, etc. The most popular representatives of that group are *Grid vortals* - portals that addresses the large user Grid community with its various requirements Its main task is to provide transparent, easy and secure Web access to



computational Grids. However, some limitations of portals technology (not so intuitive usage, problems with extending functionality by third party providers, problems with accessing local resources, etc) caused over the last few years significant growth of another group of products - “grid desktops” - windows like systems, much more friendly for the “ordinary” user than browser style environments, comfortable for the user that is used to play with more and more sophisticated graphical user tools.

The Migrating Desktop is an advanced user-friendly environment that serves as a uniform grid working environment independent of any specific grid infrastructure. Java based GUI is designed especially for mobile users and is independent of any platform (MS Windows, Linux, Solaris). It is a complex environment that integrates many tools and allows working with many grids transparently and simultaneously. The main functionality concerns interactive grid application support, local and grid file management, security assurance, authorisation of access to resources and applications, and single sign-on technology based on X509 certificates.

1. Authentication to the grid

1.1 *Obtaining a grid certificate*

In order to authenticate to the Grid you must be a member of the Virtual Organisation and obtain a valid certificate. Please consult your Virtual Organisation for further details. For EGEE more details can be found at <http://cern.ch/egee-sa1/Users.htm>, for BalticGrid more details can be found at <http://voms.balticgrid.org/>.

1.2 *Authentication to the Migrating Desktop*

To authenticate to the Migrating Desktop you will have to have on a local workstation:

- a valid certificate and private key or
- a valid proxy file
- or access to the MyProxy server that your certificate is stored on.





2 Requirements

2.1 Operating Requirements

The Migrating Desktop requires access to the Roaming Access Server (RAS). RAS is a part of the CrossGrid software publicly available under the CROSSGRID license. For detailed installation and maintenance instructions see the RAS Installation Guide on pages <http://desktop.psnc.pl>.

2.2 Local hardware Requirements

Any computing system ready to launch the java runtime environment.

Optimal requirements:

- Minimum Memory: 256MB RAM
- Processor – any (e.g. Intel P3, 1GHz or equivalent in performance).

2.3 Local software requirements

Currently, there are two ways of launching MD: a web browser and Java Web Start.

- A Java-enabled web browser (for example Netscape Navigator, Internet Explorer etc. with the Java plugin version 1.4.2 or higher). Under a web browser use the proper address of the Migrating Desktop web page. Remember to keep the Java Plugin cache (JAR cache) disabled!
- Java Web Start.



It has been proved that running MD from Java Web Start is much faster than using a Web Browser launcher. A remarkable advantage of JWS is the caching of entire applications on a local workstation.

2.3.1 Network requirements

- For proper working with the grid environment, MD should invoke services from middleware deployed in a testbed. Network bandwidth requirement for MD: min. 256 kb/s
- Open the firewalls for 8443 port.





- If you want to use direct connections to gridftp servers, open the pool of port: 13000-17000, 2811 in both directions between your local workstation and remote SE(s).

2. Setup the Migrating Desktop environment

2.1 Login process

The user should do the following simple steps in order to start his work with the Migrating Desktop application:

Currently, there are two ways of launching MD: a web browser and Java Web Start.

- A Java-enabled web browser (for example Netscape Navigator, Internet Explorer etc. with the Java plugin version 1.4.2 or newer). Under a web browser use the proper address of the Migrating Desktop web page (currently: *http://<RAS-host>/md*).



You have to disable java archive files (JAR) caching in Java Control Panel application!





- Java Web Start ([JWS 1.4.2](#) or newer). Run MD from this location:
http://<RAS-host>/md/JWS/MigratingDesktop.jnlp



If you see this warning message: "Failed to verify certificate" **do not use the CLOSE button** - use the window upper right "x" button !

The User Login Dialog collects data about the localization of user certificates, and location of RAS web services (host and port).

- a) Choose localization of user certificate
- b) Choose localization of user key
- c) Specify password to private key
- d) Select option VOMS proxy
- e) Write name of Virtual Organisation ("*bgtut*")
- f) Choose server settings





- g) Specify host address, for example: balsa.man.poznan.pl
- h) Specify port : default is 8443





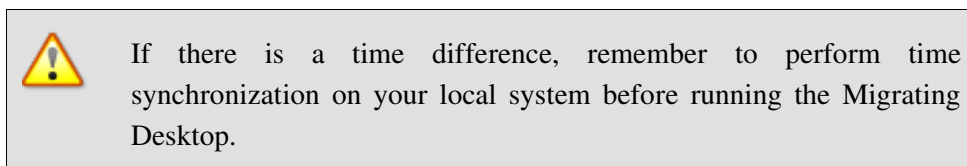
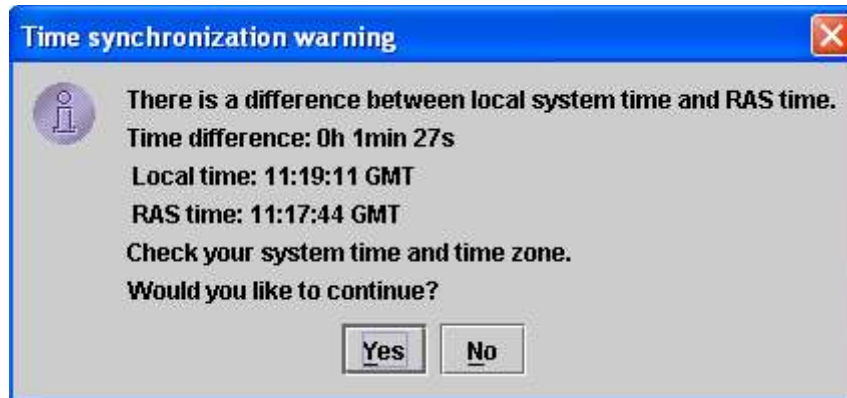
- i) It is possible to save the settings, so next time all these settings will be chosen as default. Remember that saving the password is always insecure, so before saving leave the password field empty.



Remember to save your settings! This will speed-up the startup process next time you are running the Migrating Desktop.

A message about the time difference may appear if time on the local machine is not proper (not synchronized with the NIST server). Such difference can cause some problems during the Migrating Desktop runtime.





Now the desktop is starting. The splash screen of the Migrating Desktop will appear. It has a status bar containing some messages which will inform the user about the progress of the application initialization.





If the user worked with the Migrating Desktop before, his/her personal settings of the graphic user interface will be restored. In the other case a default user profile will be created by the application and the main empty Desktop will appear.

2.2 Configuration of user personal profile

In order to configure your personal profile please follow the steps listed below:

- a) Open “New Grid Window” from toolbar





- b) From pop-up menu (right-click in the Desktop area) choose “Properties”
- c) In tab description give a new name for a desktop (example “tutorial window”)
- d) Go to background tab, and select one of predefined wallpapers



- e) Close the properties dialog. Save your profile by clicking on “Store User Profile” icon from toolbar



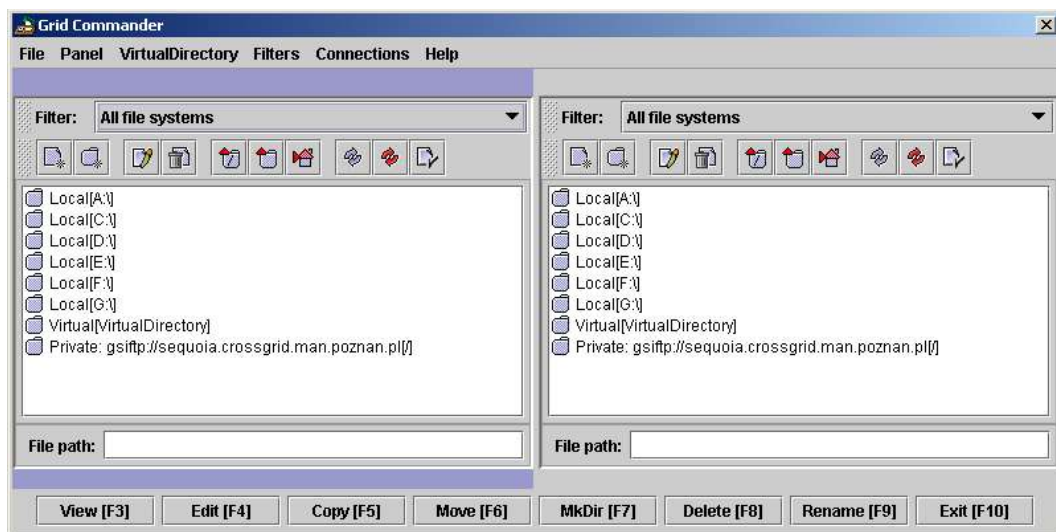
Remember that you can always save your profile. Saving preferences makes it easier to use the Migrating Desktop.

3. Simple data management

3.1 Grid Commander

The main file Management tool in the Migrating Desktop is called Grid Commander. The Grid Commander is a two-panel application similar to the Commander family tools. A single panel can represent a local directory, GridFTP or ftp directory, or other protocol to the native storage. Each protocol is defined as a plug-in that makes file management in MD easy to extend to other protocols.

- a) Open Grid Commander from toolbar or from menu.



3.2 Using GridFTP

In order to use GridFTP, follow the instructions below:

- a) open Grid Commander
- b) choose “Connections”, “GridFTP manager” from menu





- c) choose "Connections", "GridFTP manager" from menu
- d) choose "New"





Connection Parameters

Connection name: kriit.eenet.ee

Host: kriit.eenet.ee

Port: 2811

Path: /tmp/

Keep alive period [min]: 1

Transfer type: BINARY

Connection mode:
 passive
 active

Connection type:
 direct (requires open ports)
 tunneled (slow)

Data channel authentication: NONE

Data channel protection: CLEAR

OK Cancel

- e) fill “connection name”, “host”, “path”
- f) if there are firewall set passive and tunneled
- g) after adding new site press “Connect” and then “Save”



Remember to save your settings. This will save your time next time you are connecting to the GridFTP server.

- h) In Grid Commander go to root, select new created GridFTP connection
- i) Press home button
- j) Create new directory, called test, create a file





- k) Select local file on the other panel. Copy this file to GridFTP server

4. Running jobs on the grid

4.1 Job submission

Grid applications available for users are grouped in a user-friendly way in a Job Wizard in MD. An application can be selected from a tree control (with default settings) or loaded from the previously recorded template (non-default settings)

- a) Open “Application Wizard” from toolbar



- b) Choose “PS” (it will run /bin/ps command)

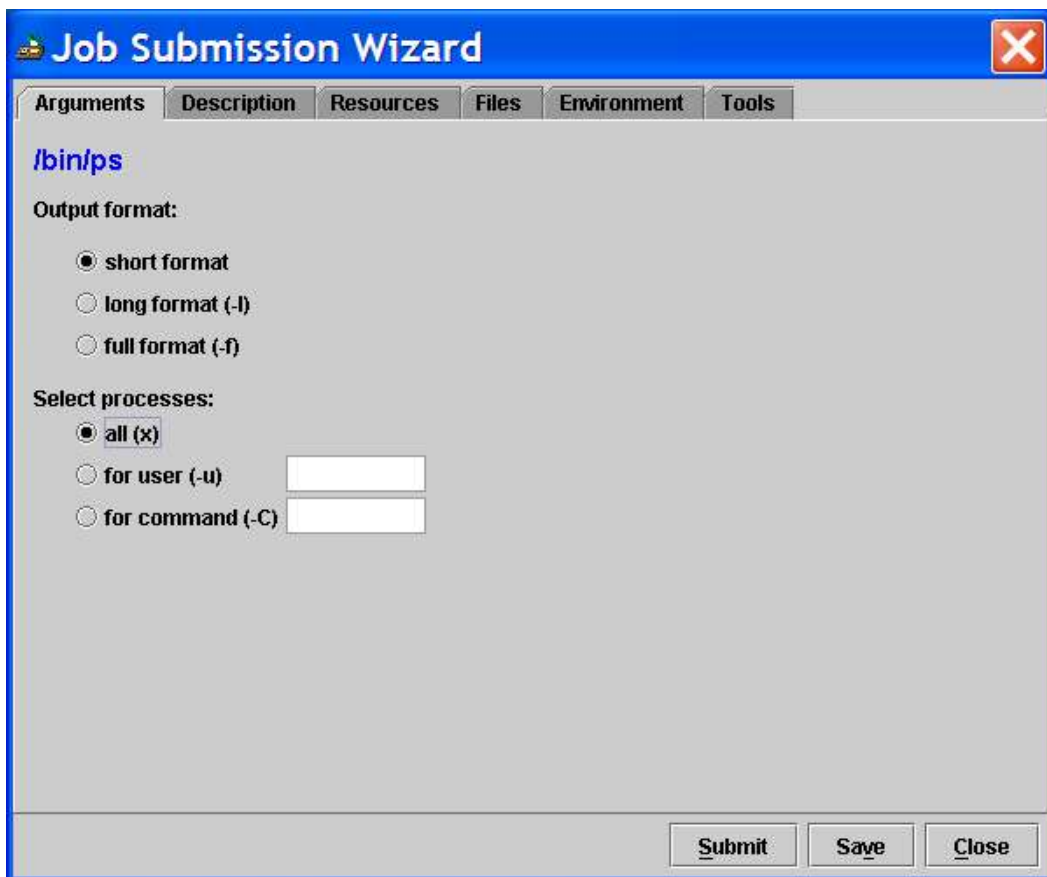




- c) Press Ok. Job Submission Wizard will appear.

This Job Submission Wizard simplifies the process of specifying parameters and limits, suggesting user defaults or recently used parameters. The Wizard is responsible for proper preparation of the user's job and consists of several panels. One panel is an application-specific plug-in, and the rest can be used to set job information, resource requirements, files and environment variables. The application plug-in asks the user for application parameters and these parameters are then passed to the command line.

- d) Leave default or change parameters for this test application

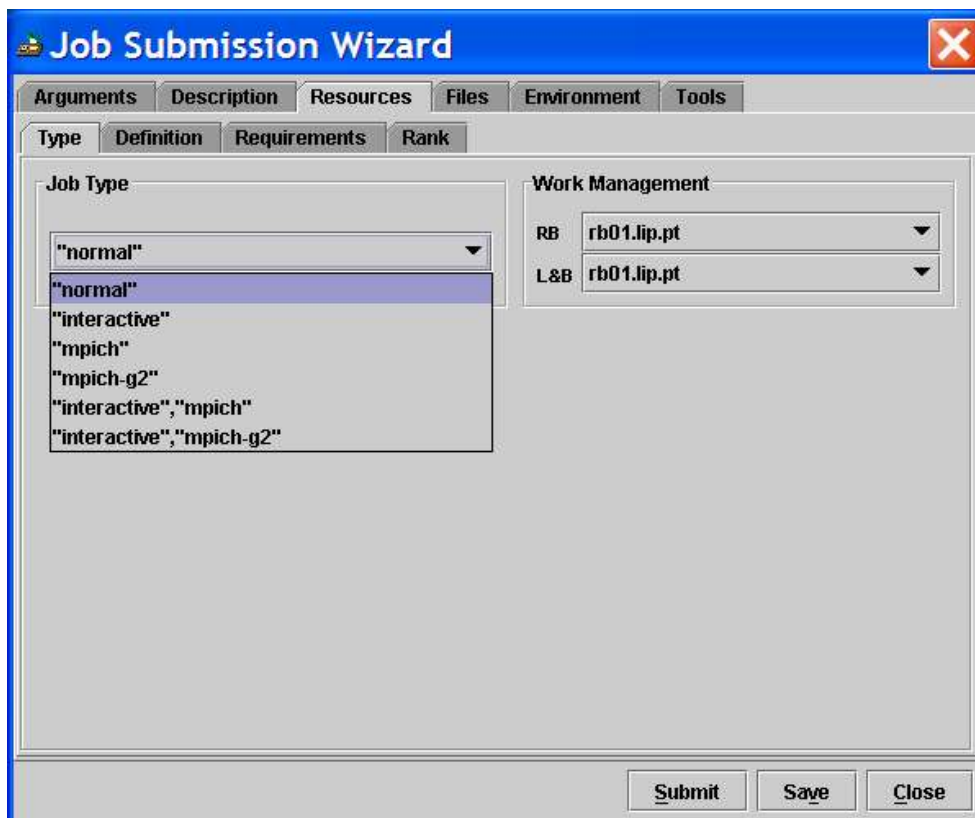


There is a common set of job requirements that can be specified in the same way for a different kind of applications. There are several tabs in the JobSubmission Dialog for specifying different types of parameters.





- e) Choose tab “Resource”, “Type”
- f) Choose type of job – in this use case select “normal”
- g) Choose Resource Broker server and Logging and Bookkeeping server (for example: grid3.mif.vu.lt)



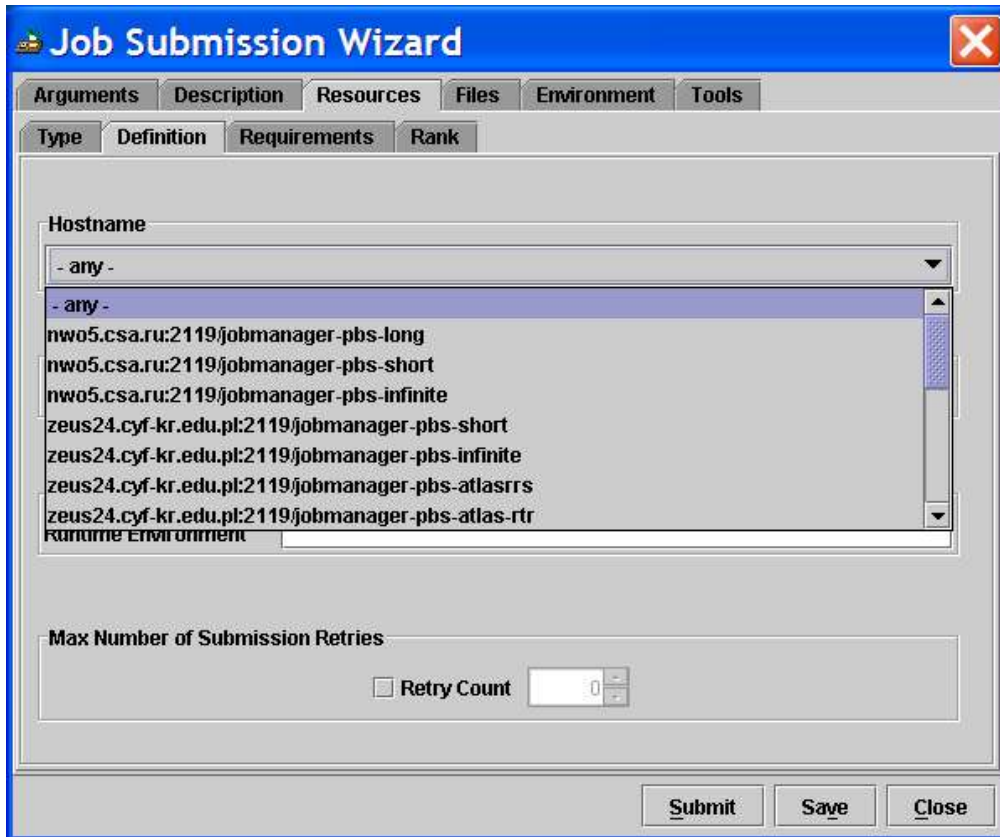
Remember to set Work Management parameters (RB and L&B) as it is the user who defines these parameters. These are required for the job submission.

- h) Change tab to “Definition”



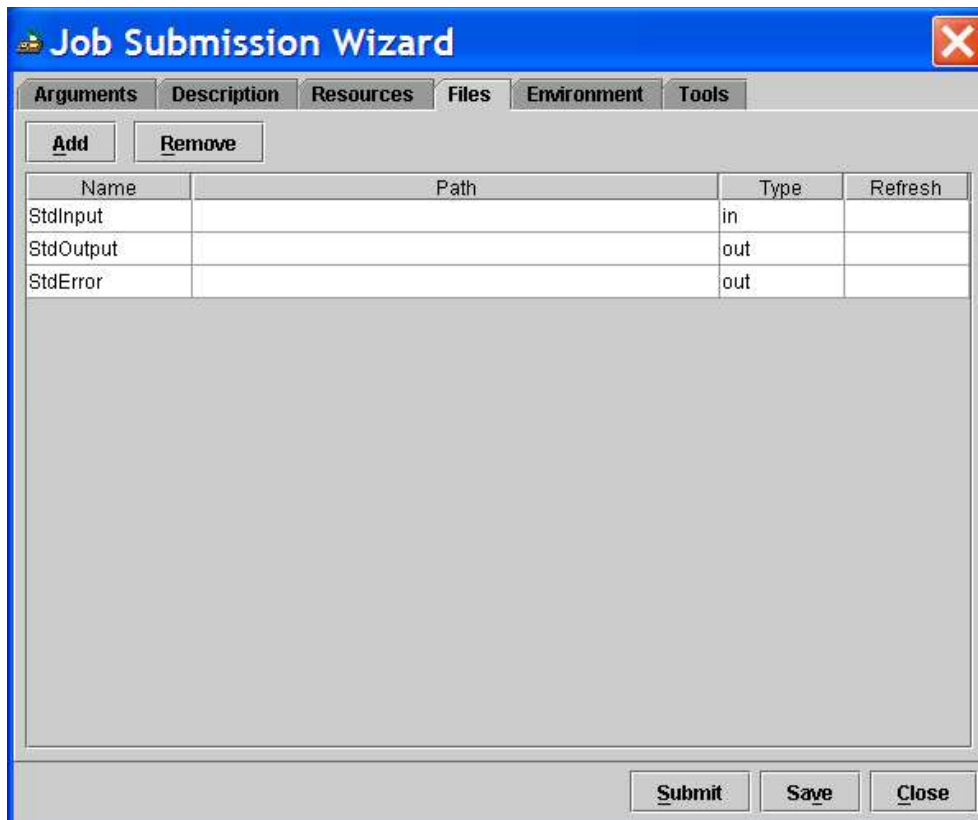


- i) Select hostname you want your job to run on (CE) or leave “any” if this decision should be taken by the Resource Broker.



- j) Set input/output files by specifying files from GridFTP



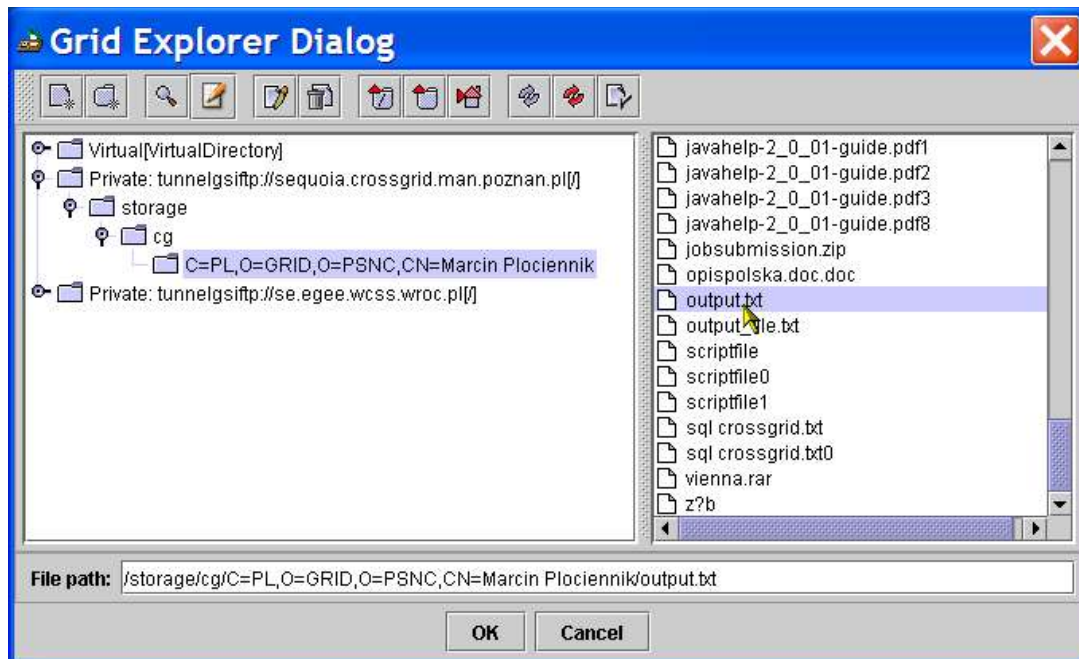


k) Choose output file



l) Choose file from GridFTP explorer





- m) Follow step j), k) and l) for error file
- n) Submit the job by pressing “Submit” button
- o) Wait for job submission confirmation. It can take a few seconds and this time depends on Resource Broker response.

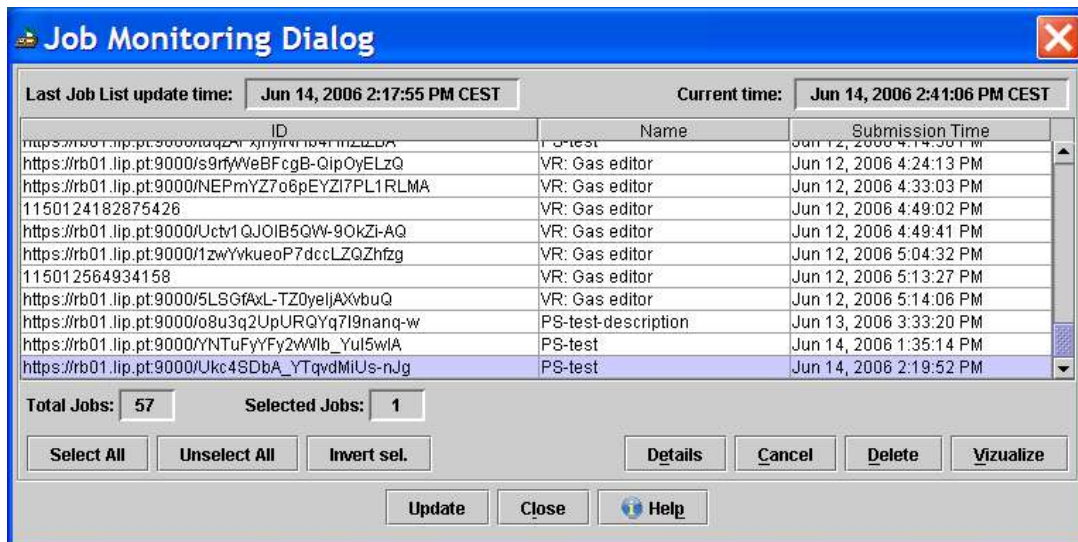




4.2 Job monitoring

In order to check the job status you have to choose the Job Monitoring dialog from the menu or toolbar. The Job Monitoring dialog is a tool for tracing the status, viewing details, logs and parameters of the previously submitted jobs. This dialog contains all the information about the submitted job (its full description and status embedded in the jobs table)

- Open Monitoring Dialog from toolbar
- Select your job (one or more) (recognized by id or by more user-friendly field “Name”)



- Press “Details” button for checking status of the job and other detailed information like submission parameters, files, variables





Job Status Details

Job Status Table

Last Job Status refresh time: Jun 14, 2006 2:41:48 PM CEST Current time: Jun 14, 2006 2:42:13 PM CEST

ID	Name	Status	Submitted At
https://rb01.lip.pt:9000/Ukc4SDbA_YTqvdMiUs-nJg	PS-test	Done	Jun 14, 2006 2:19:52 PM

Total displayed jobs: 1 Refresh Cancel Delete Vizualize

Selected Job Details

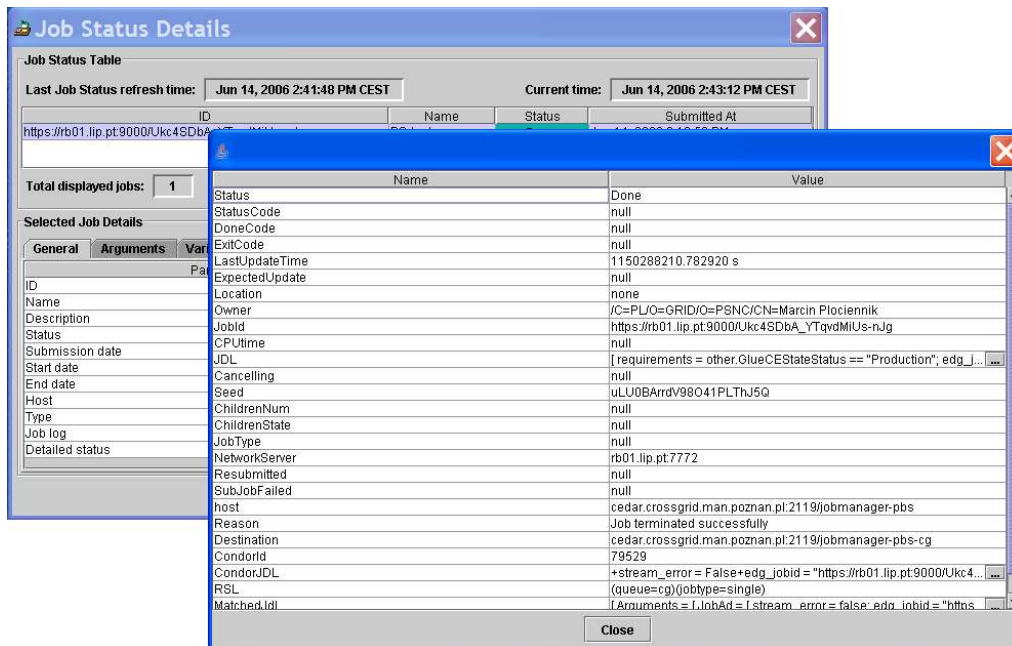
General Arguments Variables Resources Files

Parameter	Value
ID	https://rb01.lip.pt:9000/Ukc4SDbA_YTqvdMiUs-nJg
Name	PS-test
Description	
Status	Done
Submission date	
Start date	
End date	
Host	cedar.crossgrid.man.poznan.pl:2119/jobmanager-pbs
Type	"normal"
Job log	View...
Detailed status	View...

Close Help

- d) There is also a possibility to check extended details of running jobs basing on information that comes from Logging and Bookkeeping. Press detailed status “View...”





- e) In order to check logs of the running job basing on information that comes from Logging and Bookkeeping. Press job log “View...”.

4.3 Obtaining job output

When the job has been terminated successfully and the job status in the monitoring Dialog is “done”, the user can check the output of the job. It can be visualized if there is an adequate visualization plug-in. There are ready to use predefined plug-ins for the visualization of text file, jpg file, and svg format.

- a) If the status of the job has been marked as done, select “files” tab in job monitoring details dialog





The screenshot shows a window titled "Job Status Details" with a blue header. It contains a "Job Status Table" with columns for Name, ID, Status, and Submitted At. Below the table are buttons for "Refresh", "Cancel", "Delete", and "Vizualize". A "Total displayed jobs:" label shows the number "3". Below this is a "Selected Job Details" section with tabs for "General", "Arguments", "Variables", "Resources", and "Files". The "Files" tab is active, showing a table with columns for Name, Type, and Refresh period. A "View" button is visible above the table.

Name	ID	Status	Submitted At
PS	https://rb1.cyf-kr.edu.pl:9000/ytti...	Scheduled	2007-05-02 16:58:55
PS	https://rb1.cyf-kr.edu.pl:9000/Ya...	Scheduled	2007-05-02 16:59:35
PS	https://rb1.cyf-kr.edu.pl:9000/og...	Done	2007-05-02 16:59:35

Name	Type	Refresh period
StdOutput	out	0

- b) Select one of the output files (example StdOutput)
- c) Press "View"
- d) File viewer will appear with content of the output file





Migrating Desktop - File Viewer - out.txt

UID	PID	PPID	C	STIME	TTY	STAT	TIME	CMD
bgtut033	327	4947	1	18:01	?	S	0:00	-sh
bgtut033	545	327	0	18:01	?	S	0:00	/bin/sh /var/spool/pbs/mom_pr
bgtut033	546	545	0	18:01	?	S	0:00	bash /home/bgtut033/globus/
bgtut033	619	546	0	18:01	?	S	0:00	bash /home/bgtut033/globus/
bgtut033	620	619	0	18:01	?	S	0:00	/bin/sh ./md-job-starter.sh -
bgtut033	623	619	0	18:01	?	RN	0:00	/usr/bin/python /opt/lcg/bin/
bgtut033	624	619	0	18:01	?	S	0:00	perl -e ? while (1) {?
bgtut033	648	620	0	18:01	?	S	0:00	/bin/sh ./md-job-starter.sh -
bgtut033	649	648	0	18:01	?	R	0:00	/bin/ps -fx

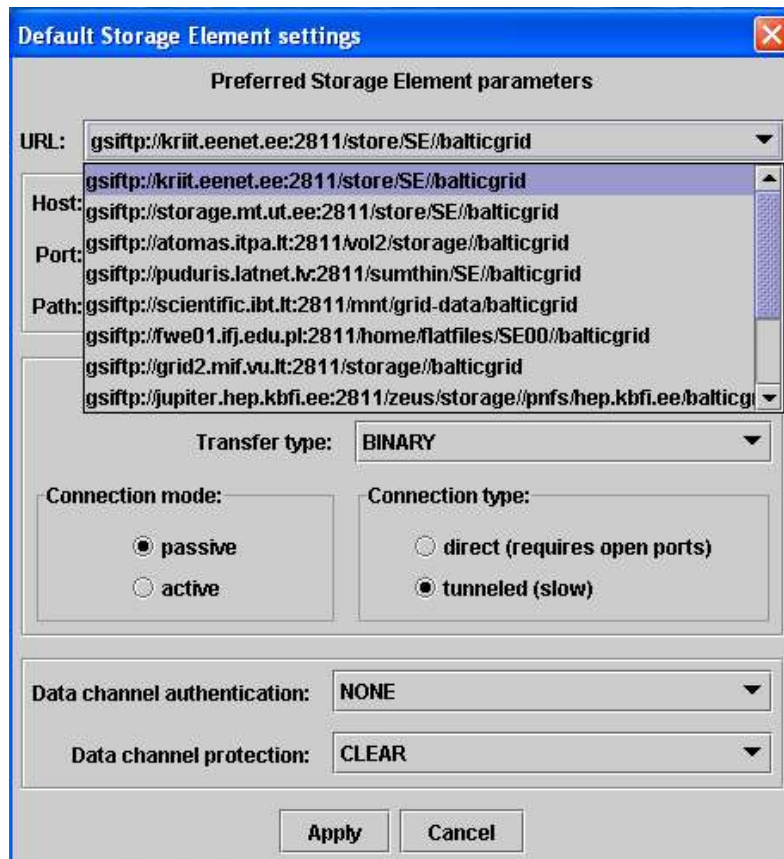
Refresh period: 1 s

5. Data management (advanced)

5.1 Using Virtual Directory

It is a logical, user-friendly representation of grid data similar to LFC. Each user has his/her own home directory. User does not have to care about the localization of files.





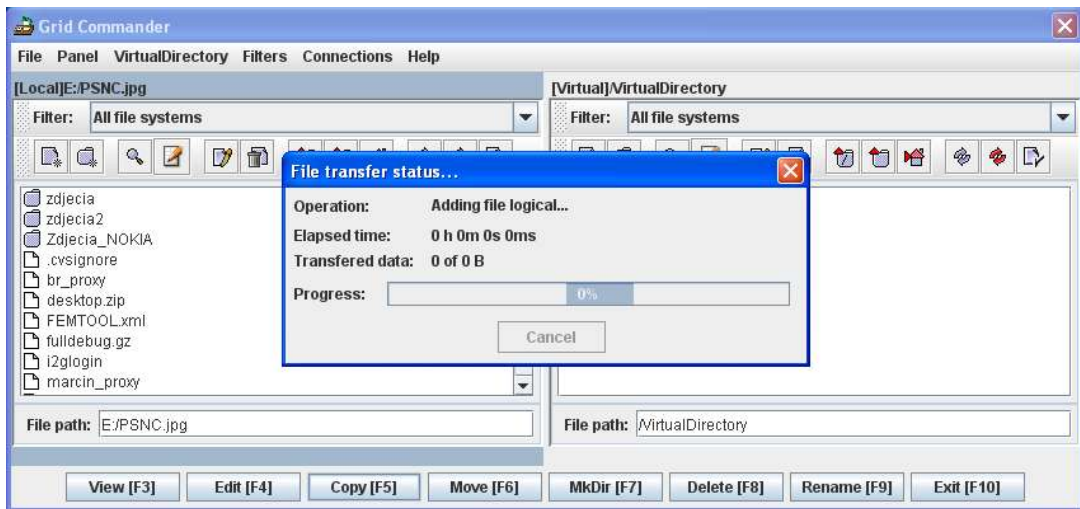
In order to use the Virtual Directory, follow the instructions below:

- a) Open preferred Storage Element, Menu->Default SE settings
- b) Select SE, if there are firewalls, select Connection mode passive, connection type tunneled

5.2 Copying a file into "grid"

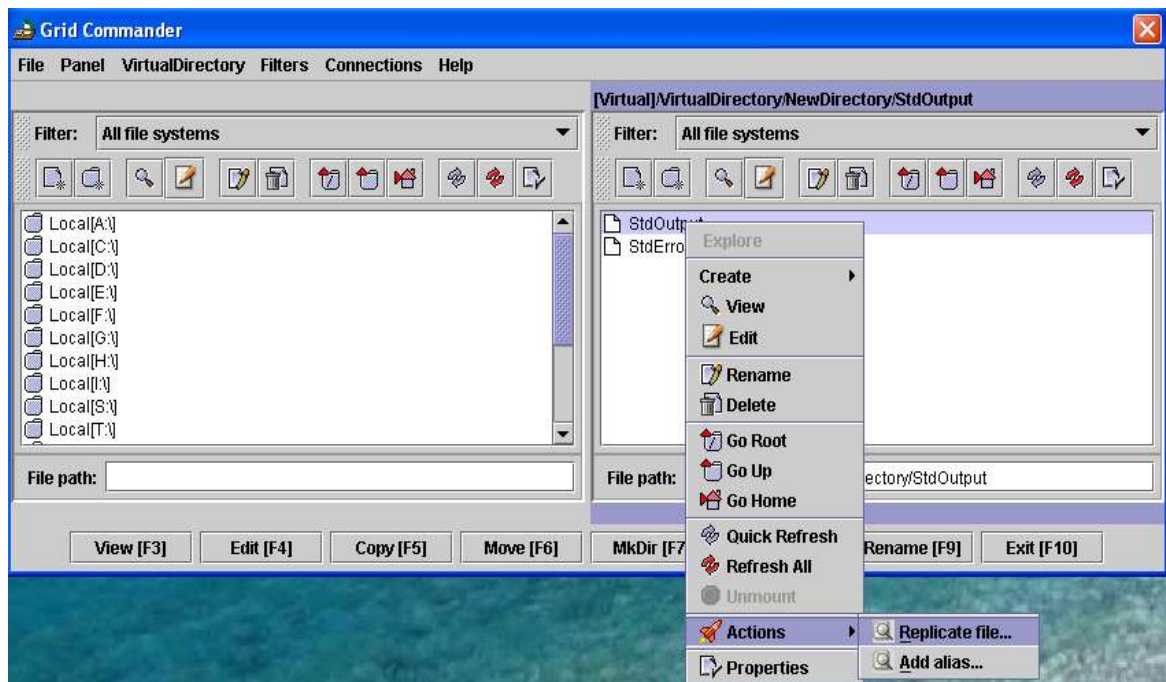
- a) Open Grid Commander, enter VirtualDirectory filesystem (one node available from root)
- b) Create new directory, called test, create a file
- c) Select local file on the other panel. Copy this file to Virtual Directory.





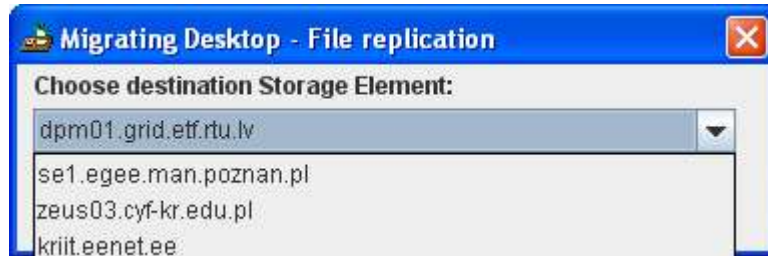
5.3 File replication

- Choose a file in the Virtual Directory you want to replicate.
- Right mouse-click invokes pop-up menu.

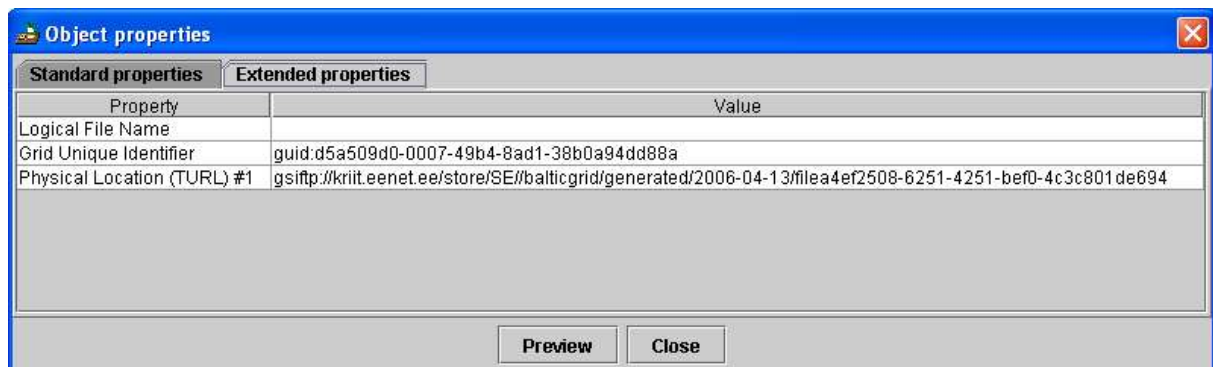




- c) Choose “Actions” and then “Replicate file”.
- d) Select destination Storage Element



- e) Information about the new replica can be observed in Extended File Properties.
- f) Choose from pop-up menu Properties, Extended File Properties tab.
- g) If the file is being replicated, all physical locations are being shown.



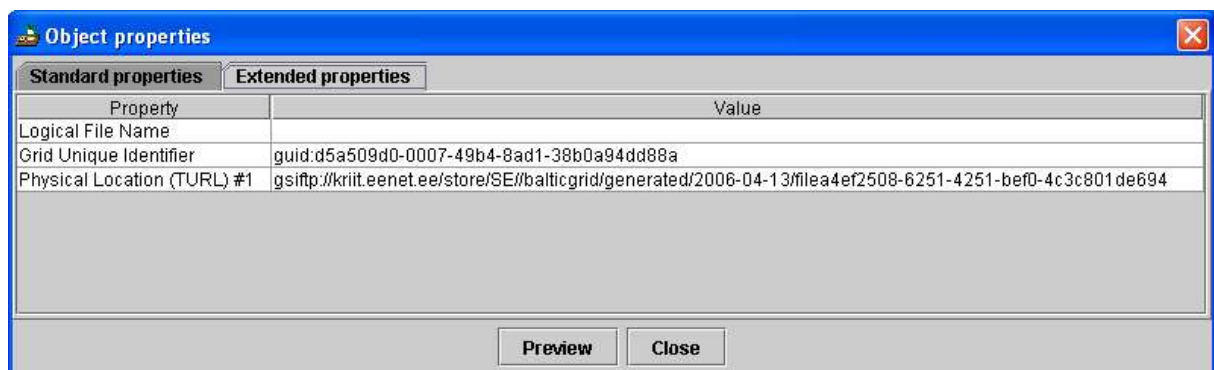
5.4 Adding alias

- h) Choose a file in the Virtual Directory you want to replicate.
- i) Right mouse-click invokes pop-up menu.
- j) Choose “Actions” and then “Add alias”.
- k) Specify an alias for the file





- l) Information about the new replica can be observed in Extended File Properties.
- m) Choose from pop-up menu Properties, Extended File Properties tab.



6. Interactive jobs

6.1 Interactive grid console

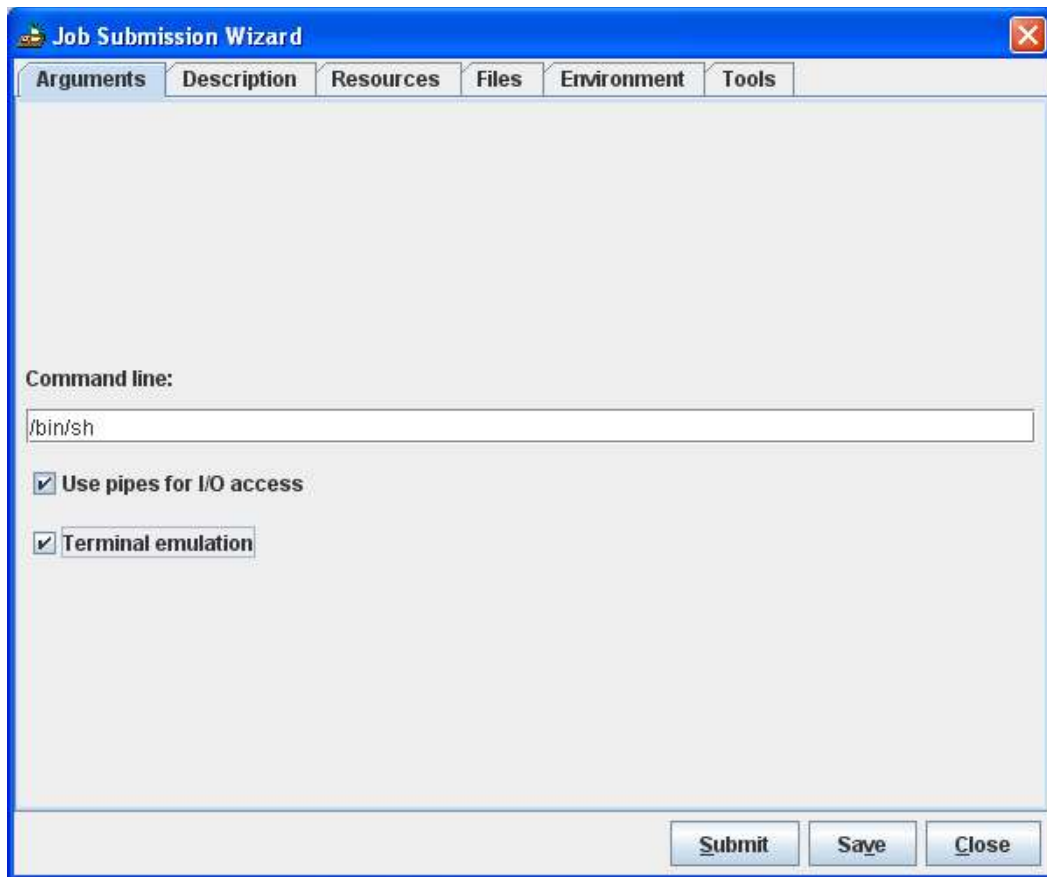
- a) Open “Application Wizard” from toolbar





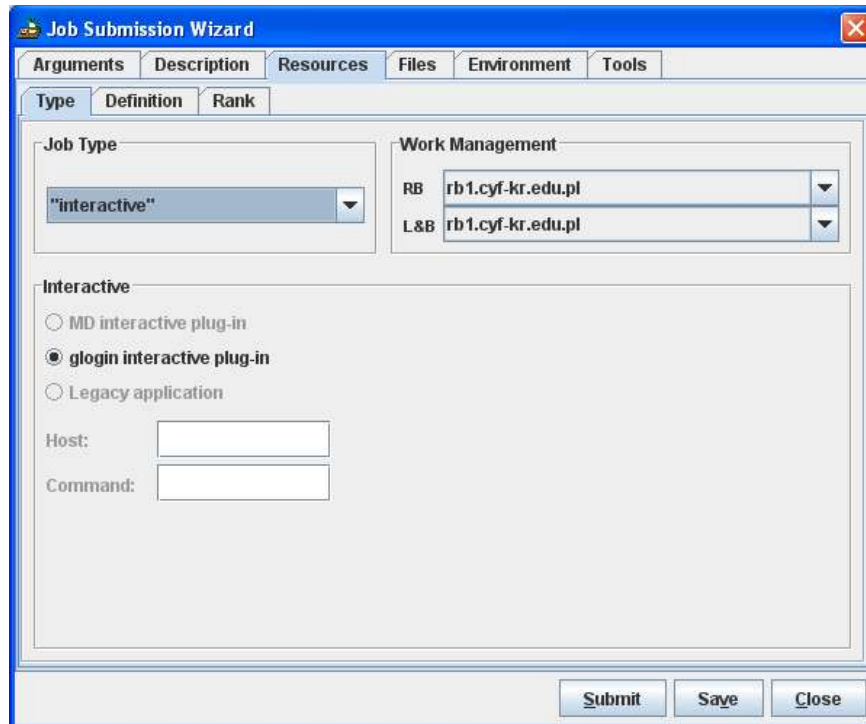
- b) Choose "Glogin" (it will run interactive /bin/sh command)
- c) Press Ok.
- d) Job Submission Wizard will appear.





- e) Write “/bin/sh” in a text field to run shell on remote machine
- f) Select “Use pipes for I/O access”
- g) Select “Terminal emulation”
- h) Choose tab “Resource”, “Type”
- i) Choose type of job – in this use case select “interactive”





- j) Choose Resource Broker server and Logging and Bookkeeping server (for example: grid3.mif.vu.lt)
- k) Change tab to “Definition”
- l) Select hostname you want your job to run on (CE) or leave “any” if this decision should be taken by the Resource Broker.
- m) Submit the job by pressing “Submit” button
- n) Wait for job submission confirmation. It can take a few seconds and this time depends on Resource Broker response.



- o) Open Monitoring Dialog from toolbar





- p) Select your job
- q) Press “Details” button for checking status of the job

- e) Wait until job has status “Running”
- f) Press “Visualize” button

Name	ID	Status	Submitted At
Glogin	https://rb1.cyf-kr.edu.pl:9000/nJ...	Running	2007-05-02 17:33:52
Glogin	https://rb1.cyf-kr.edu.pl:9000/yi7i...	Ready	2007-05-02 17:36:44
Glogin	https://rb1.cyf-kr.edu.pl:9000/G4...	Ready	2007-05-02 17:36:44

Parameter	Value
ID	https://rb1.cyf-kr.edu.pl:9000/nJwdVY_eZu-E5cc8uU0dgw
Name	Glogin
Description	
Status	Running
Submission date	
Start date	
End date	
Host	ce01_grid.efr.tu.lv:2119/jobmanager-pbs
Type	"interactive"
Job log	View...
Detailed status	View...

- g) Simple console will appear
- h) Type any linux command you would like (e.g. “ls -la”), press enter
- i) Command output will be shown in console





```
Migrating Desktop - Application viewer
Glogin console
ls -la
total 68
drwxr-xr-x  2 bgtut033 bgtut  4096 May 2 18:34 .
drwxrwxrwx  6 root    root   4096 May 2 18:34 ..
-rw-r--r--  1 bgtut033 bgtut   803 May 2 18:34 .BrokerInfo
-rwx-----  1 bgtut033 bgtut   240 May 2 18:34 cg-copy-file
-rwx-----  1 bgtut033 bgtut    0 May 2 18:34 cg-job-starter-infiles-list
-rwx-----  1 bgtut033 bgtut    0 May 2 18:34 cg-job-starter-outfiles-list
-rwx-----  1 bgtut033 bgtut    0 May 2 18:34 cg-job-starter-rfiles-list
-rwx-----  1 bgtut033 bgtut   168 May 2 18:34 cg-update-file
-rwx-----  1 bgtut033 bgtut    64 May 2 18:34 command
-rwxrwxrwx  1 bgtut033 bgtut  35576 May 2 18:34 i2glogin
-rw-r--r--  1 bgtut033 bgtut    0 May 2 18:34 .maradona.https_3a_2f_2frb1.cyf-kr.edu.pl_3a9000_2fnJwdVY_5feZu-E5cc8uU0dgv.output
-rwxr-xr-x  1 bgtut033 bgtut   5246 May 2 18:34 md-job-starter.sh
-rw-r--r--  1 bgtut033 bgtut    0 May 2 18:34 StdError
-rw-r--r--  1 bgtut033 bgtut    0 May 2 18:34 StdInput
-rw-r--r--  1 bgtut033 bgtut    0 May 2 18:34 StdOutput

shell>ps aux
Close
```

6.2 Interactive gridGO game





Go game

Go is a strategic [board game](#) for two players. Go originated in ancient [China](#), possibly centuries before it was first mentioned in writing 548 BC. It is now popular throughout the world, especially in [East Asia](#).

Go rules

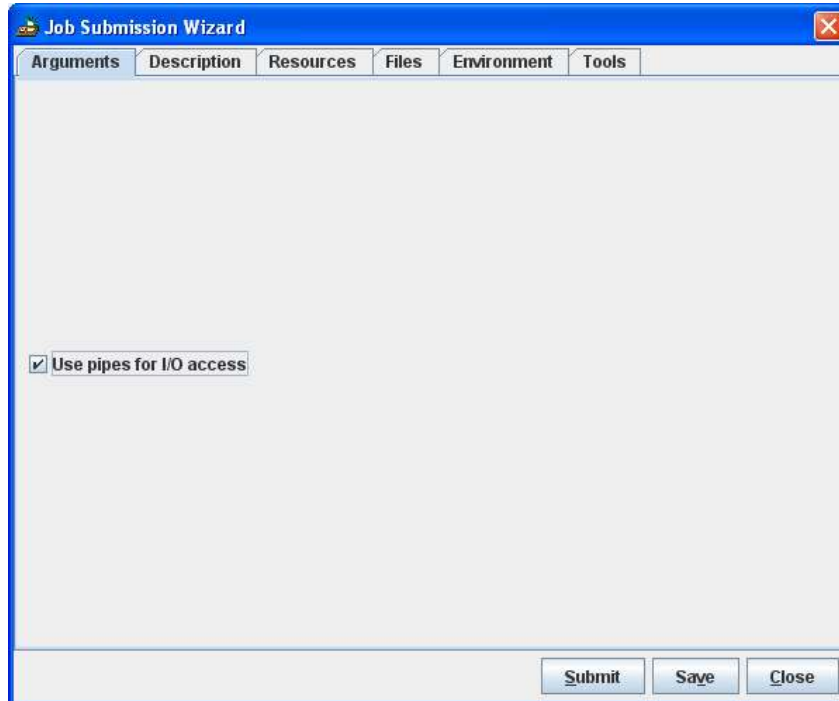
Go is played by two players alternately placing black and white stones on the vacant intersections of a 19x19 [rectilinear](#) grid. A stone or a group of stones is captured and removed if it is tightly surrounded by stones of the opposing color. The objective is to control a larger territory than the opponent's by placing one's stones so they cannot be captured. The game ends and the score is counted when both players consecutively pass on a turn, indicating that neither side can increase its territory or reduce its opponent's; the game can also end by resignation. (from [http://en.wikipedia.org/wiki/Go_\(board_game\)](http://en.wikipedia.org/wiki/Go_(board_game)))

a) Open “Application Wizard” from toolbar



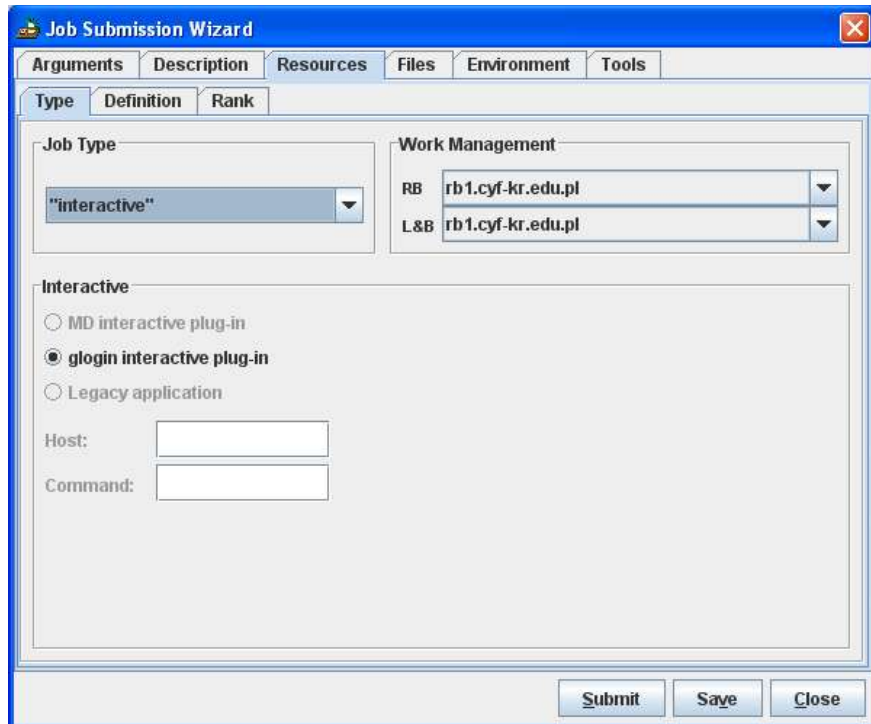


- b) Choose “GridGO” (it will run interactive game)
- c) Press Ok.
- d) Job Submission Wizard will appear.



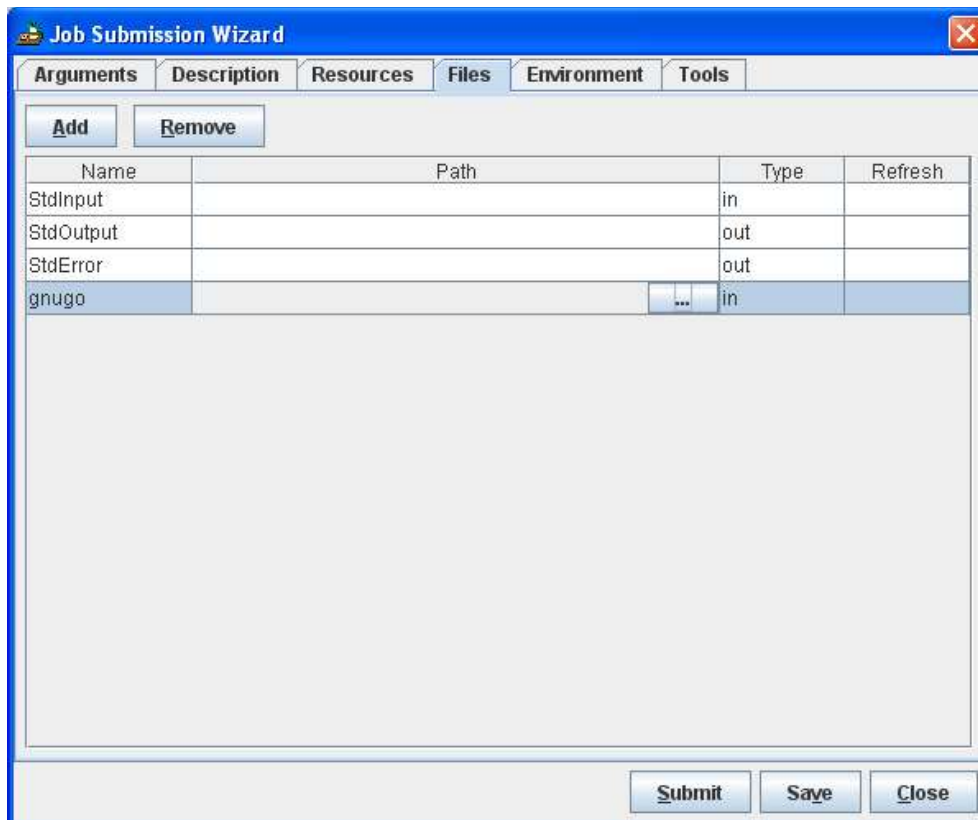
- e) Select “Use pipes for I/O access”
- f) Choose tab “Resource”, “Type”
- g) Choose type of job – in this use case select “interactive”



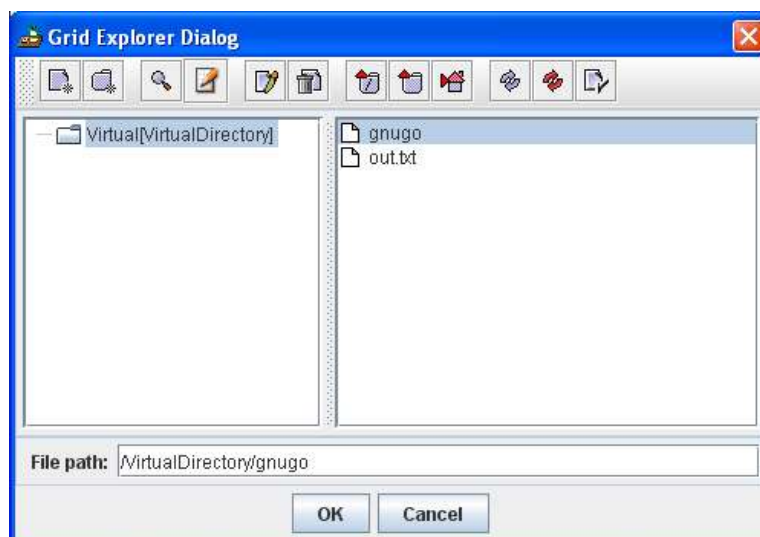


- h) Choose tab "Files"
- i) Press "Add" button
- j) Specify file name: "gnugo"
- k) Specify file type: "in"



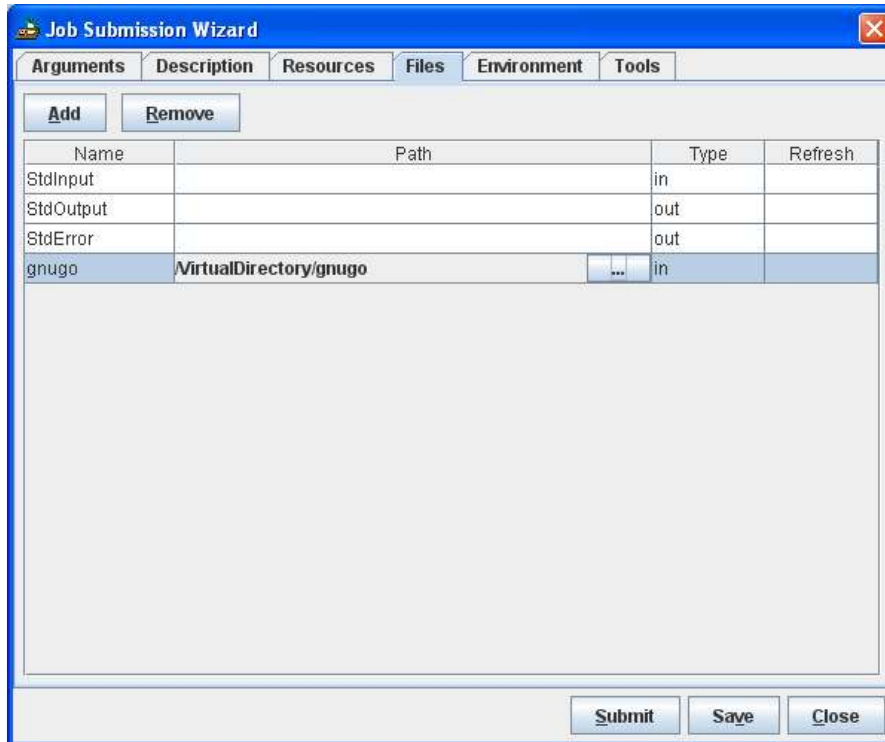


- l) Press "Path" to choose a file
- m) GridExplorer will appear





- n) Choose “gnugo” file (file “gnugo” has to be downloaded earlier and copied “into grid”)



- o) Submit the job by pressing “Submit” button
p) Wait for job submission confirmation.
q) Open Monitoring Dialog from toolbar
r) Select your job
s) Press “Details” button for checking status of the job
t) Wait until job has status “Running”
u) Press “Visualize” button
v) Simple game board will appear
j) Press mouse left button to put your pawn on the board
k) Wait for the answer of the “grid” player



