P-GRADE Portal: Towards a User-friendly Grid Environment

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Technology concerns of Grid systems

• Fast evolution of Grid systems and middleware:
  – GT1, GT2, OGSA, OGSI, GT3, WSRF, GT4, …

• Different Grid systems are using different technologies
  – EGEE (LCG-2, g-Lite), NorduGrid, UK NGS, Grid2003, etc.
  – Different technologies means:
    • Different usage scenarios
    • Different commands

• It’s too difficult for a normal user!
The problem of current portals

- They tightly connected and tailored to only one particular Grid (e.g., NGS portal, NorduGrid portal)
- If the user wants to move to another Grid
  - She has to obtain certificate for the new Grid
  - She has to get an account for its portal
  - She has to learn the new environment
  - She has to copy the files into the new system
- Even in this case the application will use only one of those Grids!
Grid systems for HPC – User concerns

• How to cope with the variety of Grid systems?
• How to develop/create new Grid applications?
• How to execute Grid applications?
• How to observe the application execution in the Grid?
• How to tackle performance issues?
• How to connect legacy applications into Grid systems?
• How to execute Grid applications over several Grids in a transparent way?

Workflow-oriented grid portals are the answer!
Properties of the P-GRADE Portal

• General purpose, graphical, workflow-oriented Grid portal. Supports the development and execution of workflow-based Grid applications.
• Grid services supported by the portal:
  – MyProxy – proxy credential management
  – GridFTP – file transfer
  – GT2/GT3 GRAM – job execution
  – Mercury – job monitoring
  – PROVE – workflow & job execution visualization
  – BDII and MDS-2 – obtain information about resources
  – LCG-2 broker – resource selection
  – GEMLCA – invoke legacy codes
• Support for multi-grid workflows
• GridSphere based
  – Easy to expand with new portlets, easy to customize for end-users
• One common interface for all the different Grid infrastructures
**Migration scenarios with vs. without P-Grade Portal**

- Migration from LCG-2 → G.Lite
  - **Without P-GRADE Portal: user works 😞**
    - Users should learn the new technology
    - Users should modify the Grid enabled applications
  - **With P-GRADE Portal: Portal developer works 😊**
    - Users can use the same, already known user interface
    - Users can use the same, already used applications
    - P-GRADE Portal developers should work to solve the migration problems (with customized back-end interfaces)
      (It’s coming soon in our new version!)
The typical P-GRADE Portal scenario

Part 1 - development phase
The typical P-GRADE Portal scenario

Part 2 - execution phase

- Certificate servers
  - Download Proxy Certificates
  - Transfer Files, Submit Jobs
  - Visualize Jobs and Workflow Progress
  - Monitor Jobs
- Portal server
  - Download Results
- Grid services
  - Download Results
Developing workflows with the P-GRADE Portal

Main steps

1. Define the Grid environment
2. Define the workflow

But first, let’s see what a P-GRADE Portal workflow is!
What is a P-GRADE Portal workflow?

- A directed acyclic graph
  - Nodes represent jobs (executable batch programs)
    - Sequential, parallel, legacy codes
  - Ports represent input/output files the jobs expect/produce
  - Arcs represent file transfer between the jobs
- Semantics of the workflow:
  A job can be executed if all of its input files are available
- Information handling:
  - Local input files: on the portal server
  - Remote input files: at Grid storage service providers
Two levels of parallelism by a workflow

- The P-GRADE Portal workflow concept enables the efficient parallelization of complex problems.

- Semantics of the workflow enables two levels of parallelism:
  - Parallel execution inside a workflow node
  - Parallel execution among workflow nodes
Multi-Grid P-GRADE Portal

Different jobs can be executed in different grids

Note: Different Grids need different certificates!

EGEE Grid

UK NGS
Forecasting dangerous weather situations (storms, fog, etc.), crucial task in the protection of life and property

Processed information: surface level measurements, high-altitude measurements, radar, satellite, lightning, results of previous computed models

Requirements:
• Execution time < 10 min
• High resolution (1km)
The typical P-GRADE Portal scenario

Development phase – step 1:

- Certificate servers
- Portal server
- Grid services

DOWNLOAD PROXY CERTIFICATES
Certificate Manager

certificates portlet

- To access Globus Grid services the portal server application needs proxy certificates
- “Certificates” portlet:
  - to upload long-term certificates to MyProxy servers
  - to download short-term proxy certificates into the portal server application
Certificate Manager

associating the proxy with a grid

This operation displays the details of the certificate and the list of available Grids.
Multiple proxies can be downloaded in the portal server application at the same time!
The typical P-GRADE Portal scenario

Development phase – step 2:

Certificate servers

DEFINE THE GRID ENVIRONMENT

Portal server

Grid services
Resource Manager
(settings portlet)

- To define which grid resources my workflows will use
- Two levels:
  1. Define grids $\rightarrow$ administrator
     1. Name (e.g. SEE-GRID)
     2. Information system (e.g. bdii.phy.bg.ac.yu:2170)
  2. Define Globus GRAM sites for each grid:
     1. Automatically from information system
     2. Manually by the administrator
     3. Manually by the user
List of available grids

To define Globus GRAM sites for such a grid
Each GRAM site is identified by a

- host name
- port number
  (or use default)
- local jobmanager
The typical P-GRADE Portal scenario

Development phase – step 3:

- Certificate servers
- Portal server
- Grid services

OPEN & EDIT or DEVELOP or IMPORT WORKFLOW

SAVE WORKFLOW

OPEN EDITOR
Workflow development
opening the workflow editor

The editor is a Java Webstart application

the download and installation is only one click!
The aim is to define a DAG of computational jobs:

1. **Drag & drop components**: jobs and ports
2. **Define their properties**
3. **Connect ports by channels**
   (no cycles, no loops, no conditions)
Define the job:
- Executable file
- Executable type
- Number of required processors
- Command line params
- The resource to be used for the execution:
  - Grid
  - Grid site

Which site to use?
Which Grid site to use?

The information system portlet helps characterize resources!

I still don’t know which resource to use!
Automatic resource selection
Since P-GRADE Portal v2.2

• Very useful feature
• Broker has always the latest information about resources
• Can handle all the resource selection issues
• Main steps
  1. Describe the requirements of the job
  2. Select a LCG-2 middleware based Grid for it
  3. The workflow manager will use the broker of that Grid during the execution to find the best resource for your job
Select an LCG-2 based Grid!

Don’t select any resource!

Define job requirements with the “Job Description Language”!

Two options:
  • Automatically generated JDL
  • Manually configured JDL
Workflow Editor

defining the ports

Type:
input: the job requires
output: the job produces

File type:
local: from/to my desktop
remote: from/to a GridFTP site

File:
location or URL of the file

Storage type:
Permanent: final result of the WF
Volatile: just inter-job data transfer
Local vs. remote files

Portal server

Only the permanent files!

Grid services

GRAM service

GridFTP service

Local vs. remote files

Local files

Remote files

Portal server

Local input files & executables

Remote input files

Remote output files

Local output files

Only the permanent files!
Workflow has been defined!
Let’s execute it!
Executing workflows with the P-GRADE Portal

Main steps

1. Download Certificate
2. Submit workflow
3. Observe workflow progress
4. If some error occurs correct the graph
5. Download result
Workflow Management
(workflow portlet)

- The portlet presents the status, size and output of the available workflow in the “Workflow” list
- It has a Quota manager to control the users’ storage space on the server
- The portlet also contains the “Abort”, “Attach”, “Details”, “Delete” and “Delete all” buttons to handle execution of workflows
- The “Attach” button opens the workflow in the Workflow Editor
- The “Details” button gives an overview about the selected workflow
Workflow Execution
(observation by the workflowportlet)

- The portal displays the list of jobs and their status
- The current status of the jobs are represented by colors
- It also provides access to their output and error streams

White/Red/Green color means the job is initial/running/finished state
When the jobs are finished the results could be downloaded in zip format.

The “Output” button displays the output of each job.

White/Red/Green color means the job is initialised/running/finished.
I still don’t know what’s happening inside my workflow!
• Main Monitoring levels
  – First (basic) level: Color coded information about the running workflow (Attach button)
Workflow Monitoring in P-GRADE Portal environment

2nd level:
- Job status
- Communication between jobs
- Good for workflow optimization

3rd level:
- Visualize MPI communication within jobs
- Good for mpi optimization
Rescuing a failed workflow 1.
(from P-PGRADE Portal v2.2)

A job failed during workflow execution.

Read the error log to know why.
Rescuing a failed workflow 2.

(from P-GRADE Portal v2.2)

Don’t touch the finished jobs!

Modify the failed job or download a new proxy for it.

The execution can continue where it stopped!
Downloading the results...
References

• Official portal of
  – SEE-GRID infrastructure
  – HUNGRID infrastructure

• P-GRADE portal is available as service for:
  – VOCE
  – UK National Grid Service
  – Croatian Grid
  – EGrid (Italy)
How to access P-GRADE portal?

• If you are interested in using P-GRADE Portal:
  – Take a look at www.lpds.sztaki.hu/pgportal
  – **If you are a user**
    • Ask an account for one of available portal services:
      – SEEGRID portal – SZTAKI
      – HUNGrid portal – SZTAKI
      – NGS portal – University of Westminster
      (Obtain a grid certificate if you don’t have yet)
  – **If you are Grid application developer**
    • Contact SZTAKI to initiate collaboration
  – **If you are Grid administrator**
    • Ask SZTAKI to install the P-GRADE Portal for you!
      – SZTAKI is able to give support
      – SZTAKI is able to give trainings and knowledge transfer
Final conclusions

• P-GRADE portal provides:
  – User friendly interface to vide range of Grid infrastructures
  – Easy-to-use workflow concept for solving complex problems
  – Fast development of Grid applications
  – Integrating various components into large Grid applications:
    • Sequential codes
    • MPI codes
    • Legacy codes
  – Application monitoring, performance visualization, guarantee correctness
  – Interoperability between many different Grid systems
  – Simultaneous execution of application components in different Grids
  – Easy to port applications among Grids (Switching between Grid technologies will be transparent to the end-user)

Key motto of the P-GRADE Portal is

Learn once, use everywhere.
Develop once, execute anywhere!
Thank you.