Towards Production Level Cardiac Image Analysis with Grids

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September 1, 2009

Motivation and Objectives

- Lack of sophisticated IT infrastructure and automation in Health Institutions: “Healthgrid Workflows”
- Large Number of patient datasets in clinical trials: Automation using techniques like parameter sweeps
- Fine tune parameters in order to adapt to images variability
- Studying practical grid performance and its suitability

Overview of Current Work

- This work details our data-intensive Cardiac Image Processing Experiments. We use the EGEE Grid Computing Infrastructure and show qualitative and quantitative results using *MOTEUR* and *Taverna2* enactments of our experiment workflows.
- Two experiments for *Myocardial Segmentation* and one for *Cardiac Motion Estimation* were carried out.

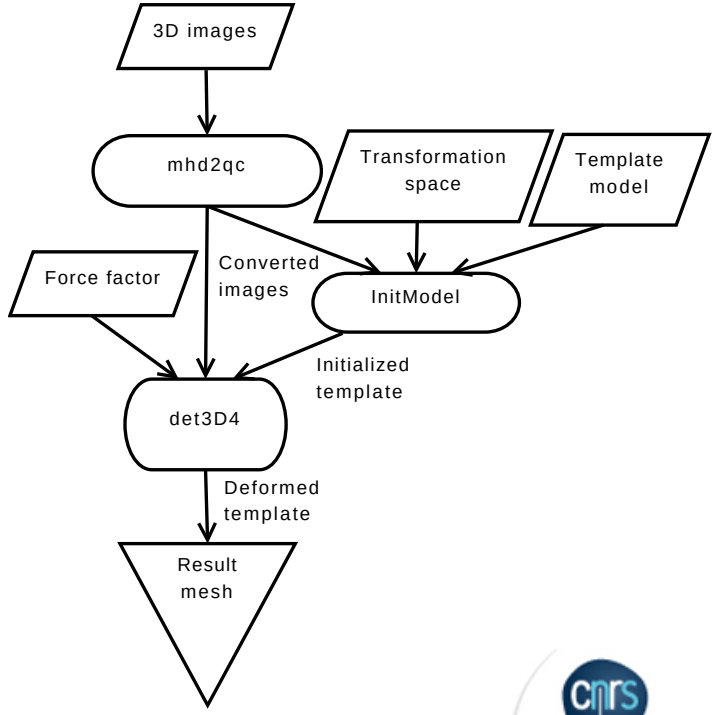
Workflow Managers: MOTEUR and Taverna

- Taverna and MOTEUR (with VBrowser integration) provides complimentary features necessary for our experiments.
- MOTEUR: A Parallel, Grid-enabled Enactment, working within the VBrowser[1] environment, offers advanced Data browsing capabilities.
- Taverna[2]: Rich-client User Interface, extended with gLite plugin interfacing EGEE (to be published in cbms09), Mixed Local-Grid execution modes.

[1] vl-e project, UvA, Amsterdam
[2] *my*Grid, Manchester University

Myocardial Segmentation: Analysis of Heart Shape

- MOTEUR enactment
- *mhd2qc*: 3D image conversion step
- *InitModel*: Initialization using an *a priori* heart model
- *det3D4*: Segmentation step that deforms the model to fit myocardial borders
- *Force factor*: A threshold influencing the deformation process



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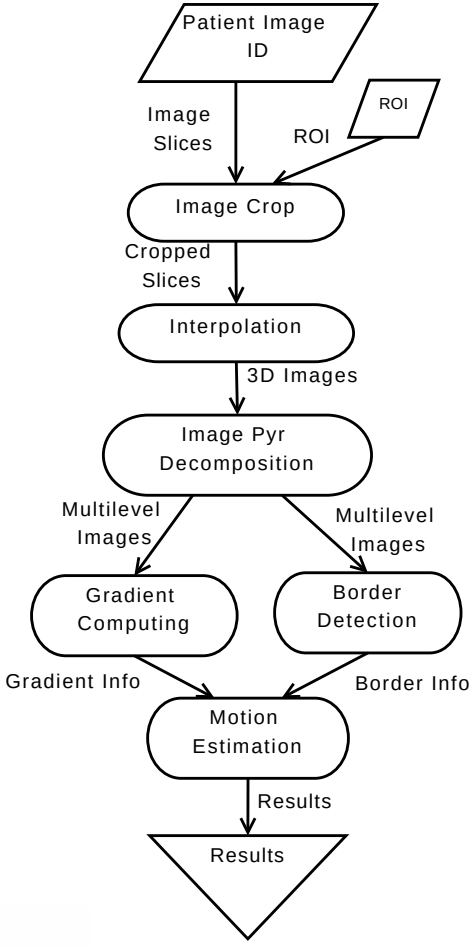
Myocardial Motion Estimation: Analysis of Heart Beat



- Taverna Enactment
- Quantitative motion estimation of heart beat
- Image Processing Filters
- Compute Intensive and Parallelism

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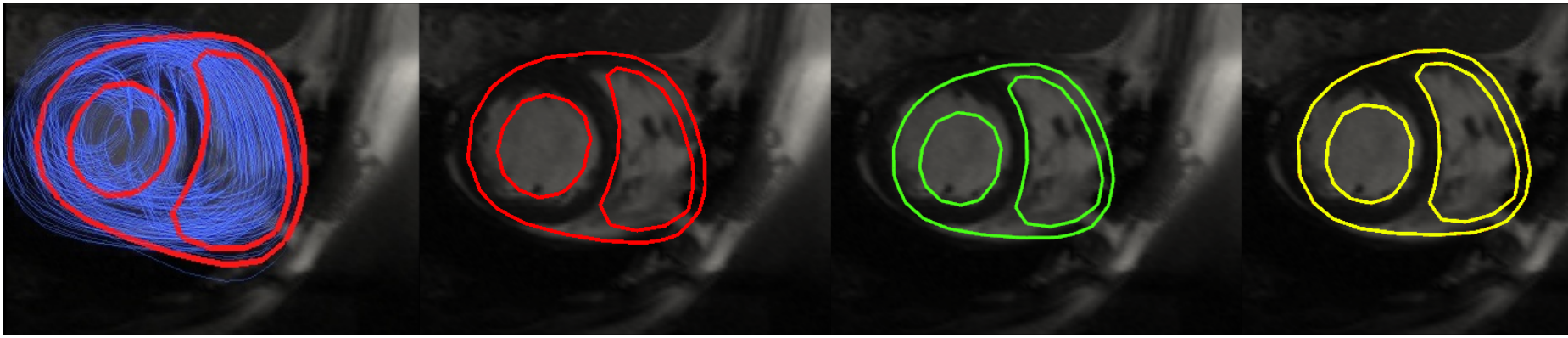
Segmentation Automation Infrastructure

- MOTEUR enactment in the VBrowser[3] environment.
- EGEE File Catalogue and single Storage Element for Grid Data Management.
- Local Simulation on intel xeon 5410, 2.33 GHz quad-core (3 dedicated and 1 server hosting core)
- 10 MRI examination sets scanned using a Seimens MR scanner.
- Production at the cardiology hospital, Lyon, France.

[3] Virtual Resource Browser from the Informatics Center, University of Amsterdam

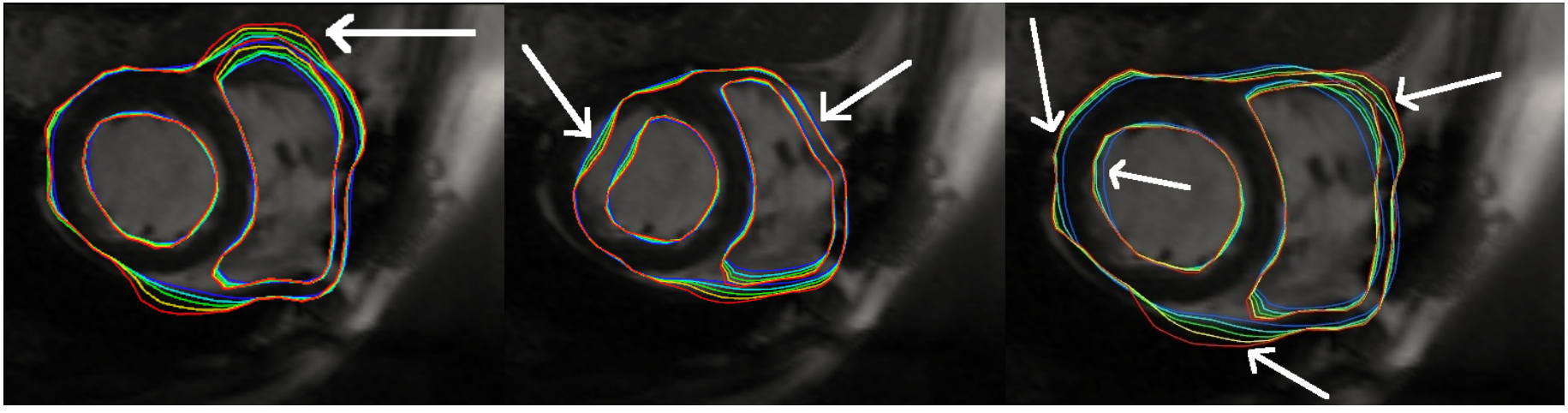
Segmentation Experiment #1

- Obtained results for different values of Rotational and Transformational parameters.
- A sweep on 75 different parameter combinations was done.



Segmentation Experiment #2

- Results for different values of *Force Factor* Parameters
- Force factor: 0.1=blue 0.2=cyan, 0.3=green 0.4=yellow 0.5=red

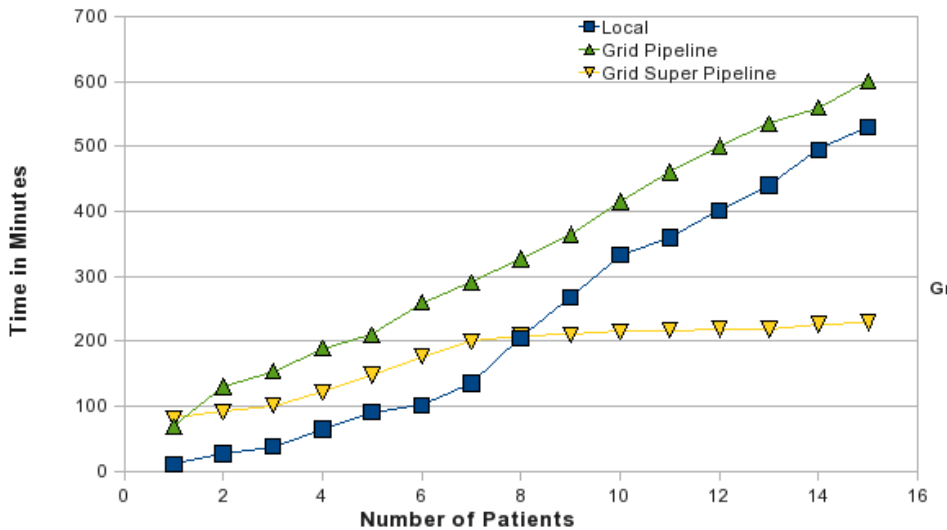


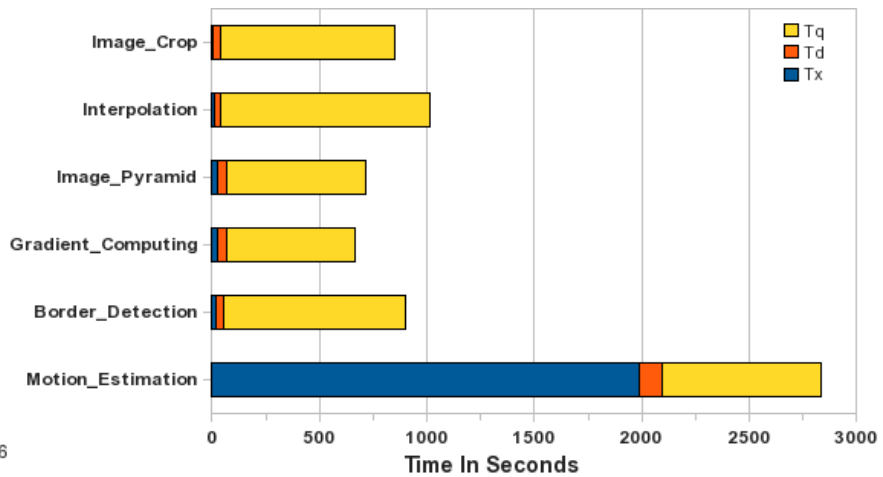
Motion Estimation Infrastructure

- Enactment using Taverna gLite plugin
- Job resubmission policy
- Round Robin Workload manager selection policy
- Data transfer request resubmission in case of failures
- Different enactment modes: local, pure grid, mixed-mode

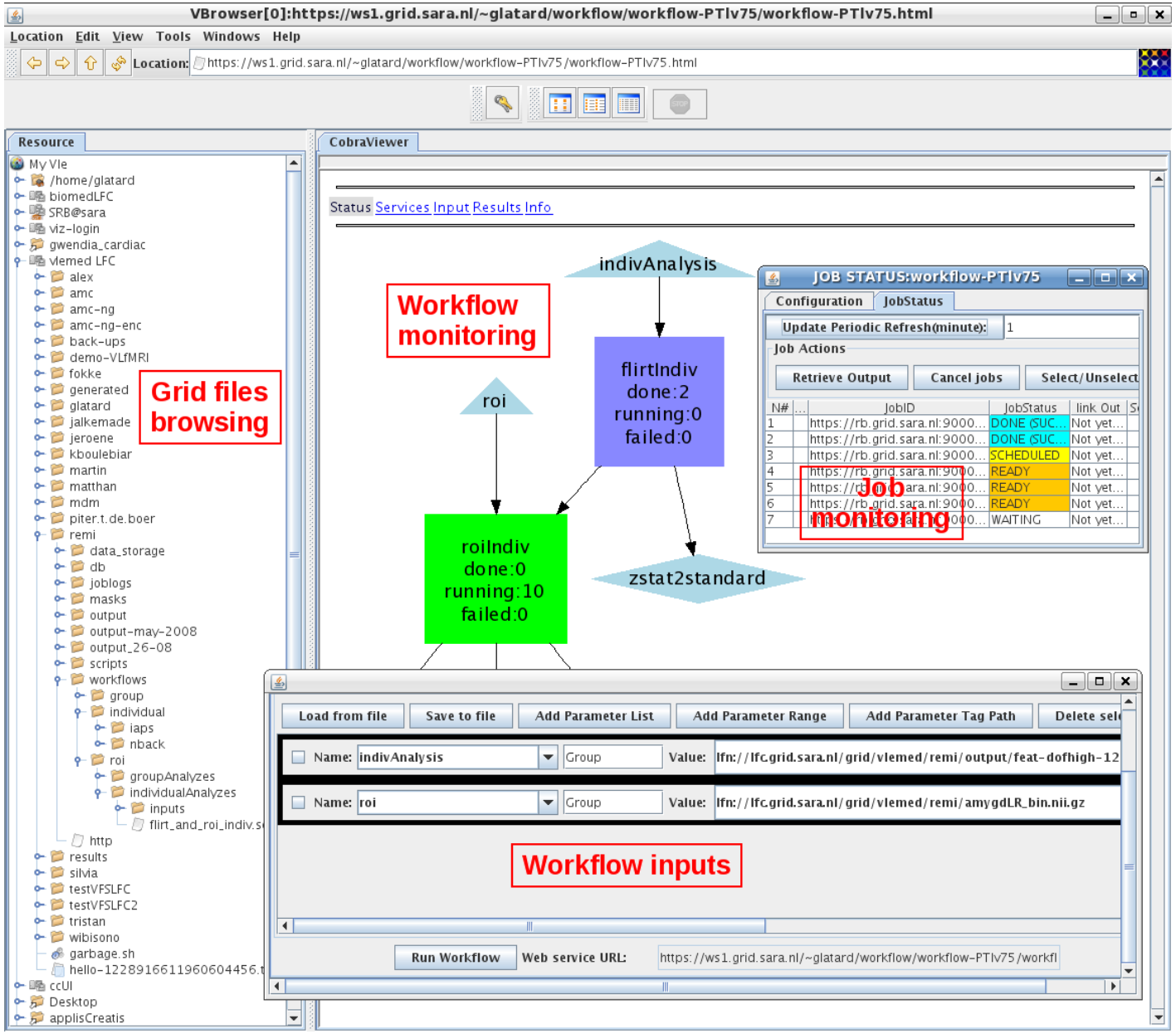
Results

- Tq=Queuing Overhead
- Tx=Execution time
- Td=Data Transfer times

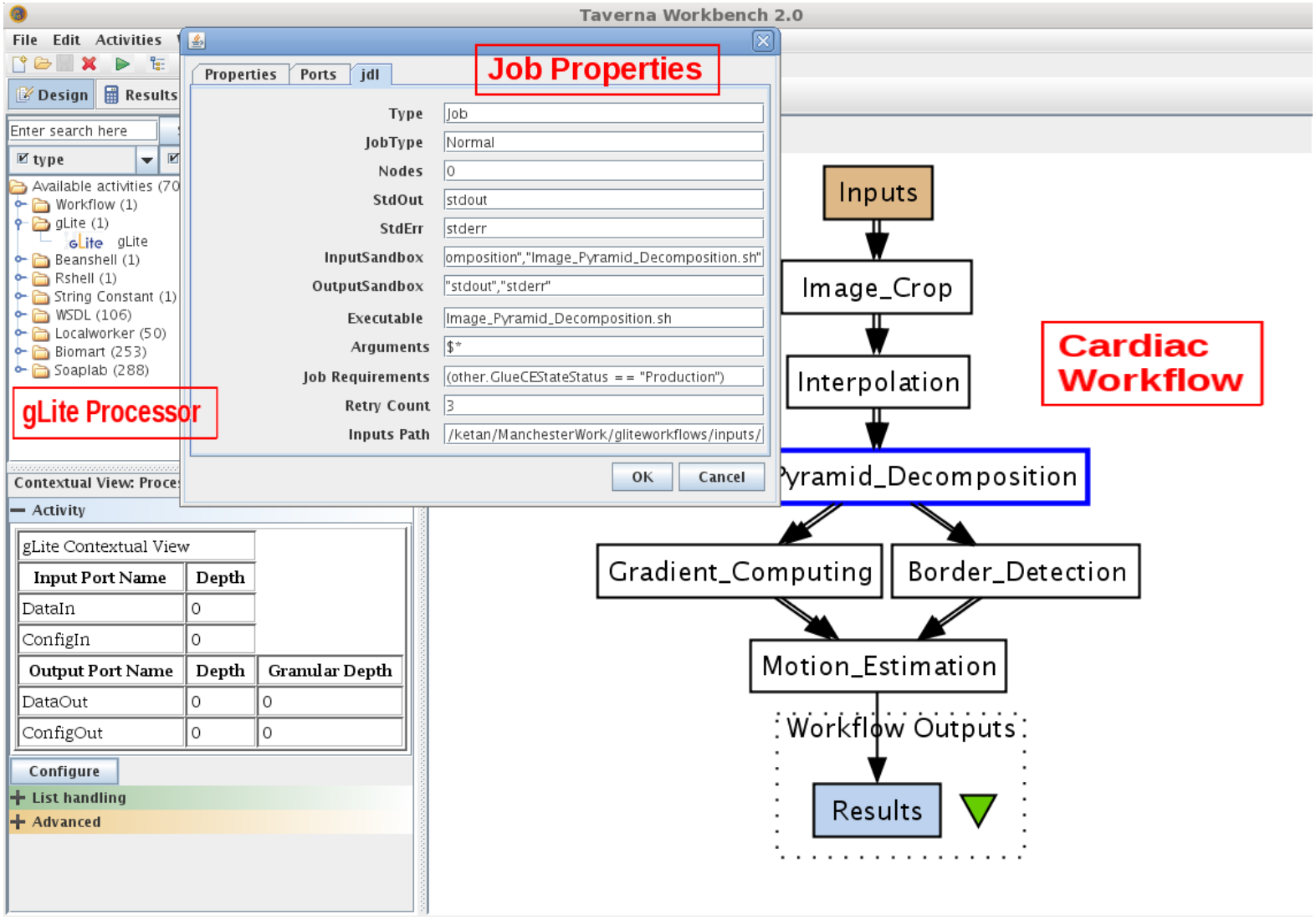




Screenshot: MOTEUR and Vbrowser



Screenshot: Taverna and gLite Plugin



Taverna Courtesy: The mygird team, Informatics Department, Manchester University.

Conclusions

- An attempt to leverage the power of healthgrids with high level workflow enactment tools
- Parameter sweep paradigm well-suitable for Grids
- Different performance results for the same workflow under different conditions

Thanks!! Questions??

Acknowledgment: This work is supported by the French ANR GWENDIA under contract number ANR-06-MDCA-009. The Région Rhônes-Alpes is gratefully acknowledged for its support through the project Simed of the cluster ISLE. We are grateful to MD-PhD P. Croisille for providing the MR examinations exploited in this study.