



Enabling Grids for E-scienceE



# Medical Imaging From Basic Gridification to Advanced End-User Services

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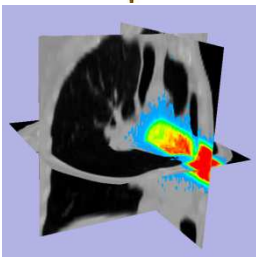
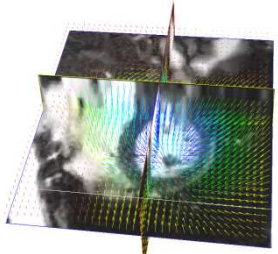
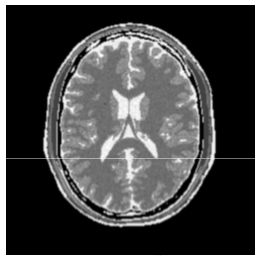
EGEE'08

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- **Few words about CREATIS lab**

- 80 permanent staff + 70 PhD students
- Medical imaging : from acquisition to image processing up to clinical research



- **Our grid expertise built on applications**

- From *DataGrid* to *EGEE3*, + French projects
- Our goal: Making grid useful for medical imaging and used by end users
- A real grid team : 2 full staff, and 4 connected staff
- Experience return given as a multi layer view of gridification

**Basic**

- **Successful execution**

**Inter  
mediate**

- **Application parallelization**

**Advanced**

- **Parallel job submission, monitoring and retrieval**
- **Middleware compatibility**
- **Integration into service platforms**

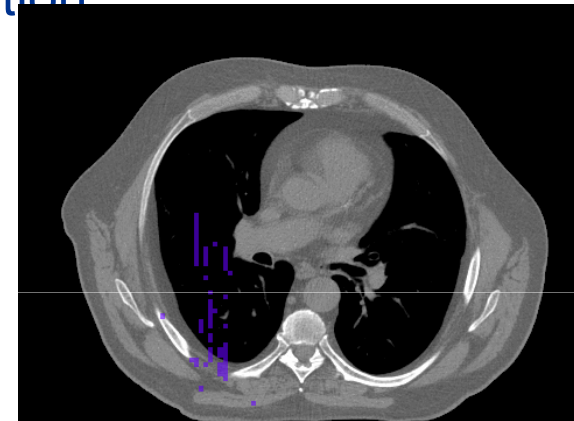
**End user**

- **High level interface**

- **Aim: successful application execution on the grid WN**

- **Methods**

- Distant grid node environment customization
  - Limited access rights
  - Download input files, create folders, define environment variables...
- Application customization
  - Shared libraries non existing on the node
    - *Copy needed libraries with executable*
    - *Re-build dependencies and link statically*



ThIS Application

- **Results**

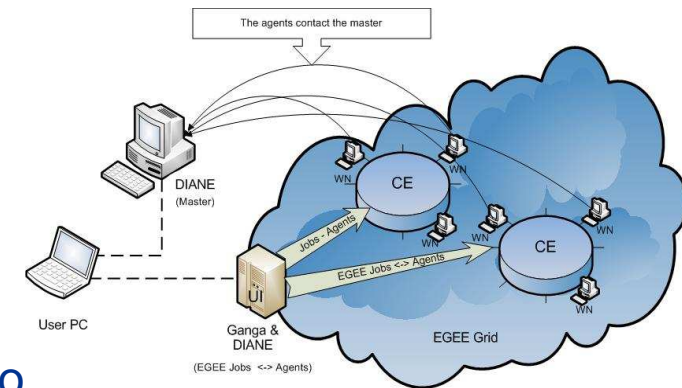
- Obtained with the application 'ThIS' (Therapeutic Irradiation Simulator)
- Static building and linking to the Geant4 and CLHEP libraries
- Successful execution: 5% -> 80%

- **Aim: parallelize the application**
- **Methods and examples**
  - MPI (Message Passing Interface)
    - Transparent to the end user
    - The application can be executed on the personal computer, parallel machines, clusters, etc.
    - Needs to be taken into account at the application development phase
    - Example: Simri (MRI Simulator)
  - Split the simulation into independent jobs (Monte Carlo simulations)
    - Can be done with generic tools
    - Is flexible
    - Depends on the application
- **Results**
  - ‘ThIS’ -> Monte Carlo simulator -> ~50M particles split in 100 jobs
  - Global speed up difficult to estimate
    - Problem: failures among the 100 jobs of a same simulation

- **Aim: submission and parallelization automation**

- **Methods**

- Grid middleware integrates basic tools
  - Submission, result retrieval...
  - Example: the gLite WMS
- More advanced tools exist
  - Java Job Submission (JJS)
    - *Optimized submission, but no splitting management*
  - Ganga [Moscicki2004] and Diane [Maier2007]
    - *Splitting oriented*
- Wrappers for integration into a service platfo....
  - GEMSS project [Gemss2005] mentions application descriptors



Advanced This Job Submission Architecture

- **Results**

- 'This' executed on the grid with a new master-agent approach with Ganga & Diane
- Global result at 100%



Architecture	Computation Time
PC Intel Duo Core 2.4 GHz	8h30
Classical submission (gLite) approach	up to 24h
Advanced submission approach	1h45

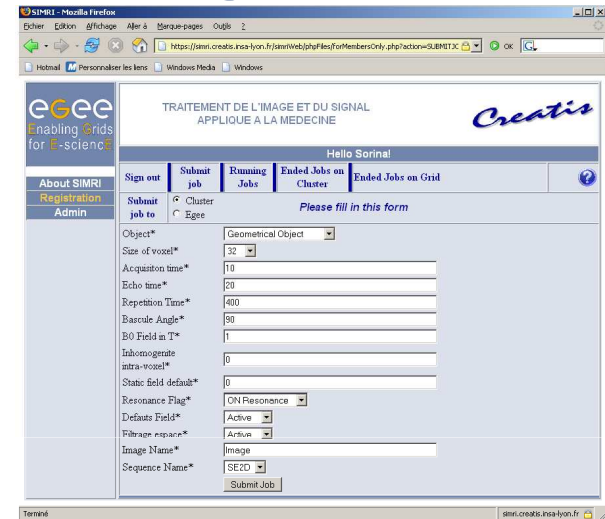
Submission Approach	Failed Jobs		Successful Jobs	Final Result	Remarks
	12% (aborted)	10% (execution errors)			
Classical submission (gLite) approach	12%	10%	78%	78%	
Advanced submission approach	15%		85%	100%	Final result reached while 20% of the jobs still 'Scheduled'

- See poster 15

- Aim: a high level interface for users with no grid knowledge

- **Methods: web portals**

- Home made solutions: the *Simri* simulator portal [Bellet2006]
  - A 3 layer architecture portal (Java, PHP)
- Generic portals: Genius, GridSphere , pGrade
- Challenge: a more generic tool based on web services
  - A portal easily re-configurable for similar applications
  - HOPE platform as a good candidate

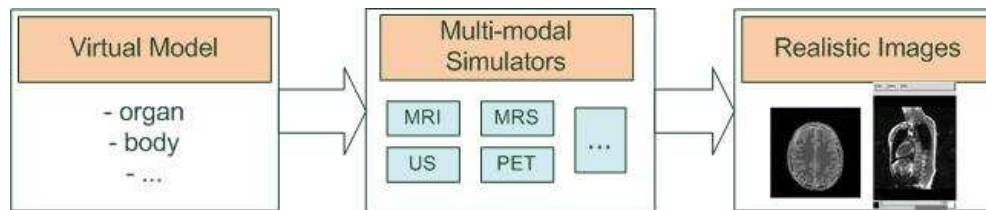


- **Integration of This (fGATE) within a HOPE platform**
  - Collaboration with LPC group
  - Integration Medical Data Management (MDM) service
  - Oriented Researchers as well as Clinical routine
- **Testing of application oriented services**
  - Workflow taverna & moteur - Collaboration I3S Lab
    - *Cardiac application (CAVIAR) linked to French ANR gwendia*
  - AMGA and MDM – This application on HOPE platform
- **Generic web portal for Medical image processing**
  - A key point to make end users come to the grid
- **Toward a Virtual Radiological Platform**
  - FP7 NoE “VPH”



- **Aim of the VRP**

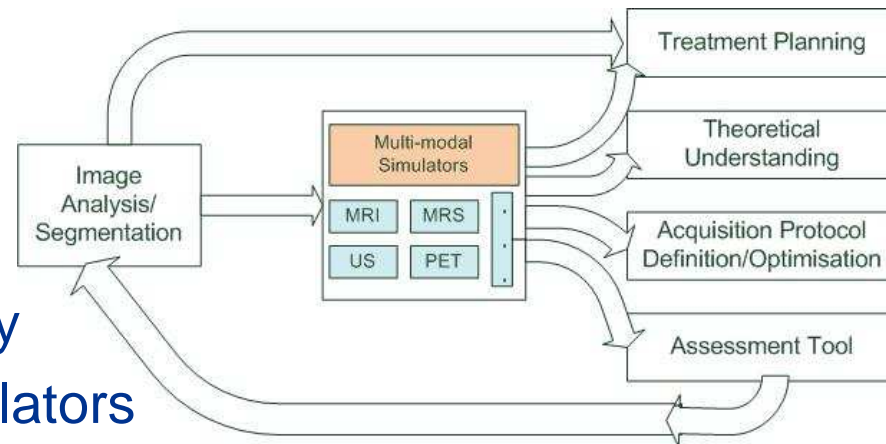
- To provide realistic multi-modal medical images with ‘ground-truth’ knowledge



- **VRP Usage**

- **VRP Requirements**

- Simulators interoperability
- Easy plug-in of new simulators
- Making simulators runnable at a large scale
  - Grid is good for VRP ☺





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**Thank You  
for Your Attention!**  
*Questions?*

