Numerical Simulations and Databases in Astronomy, and their integration in Grid: FRANEC and BaSTI as a practical example

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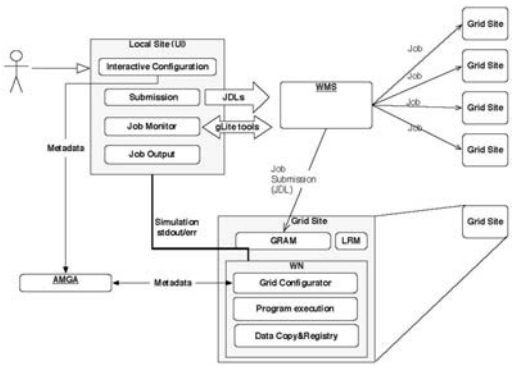
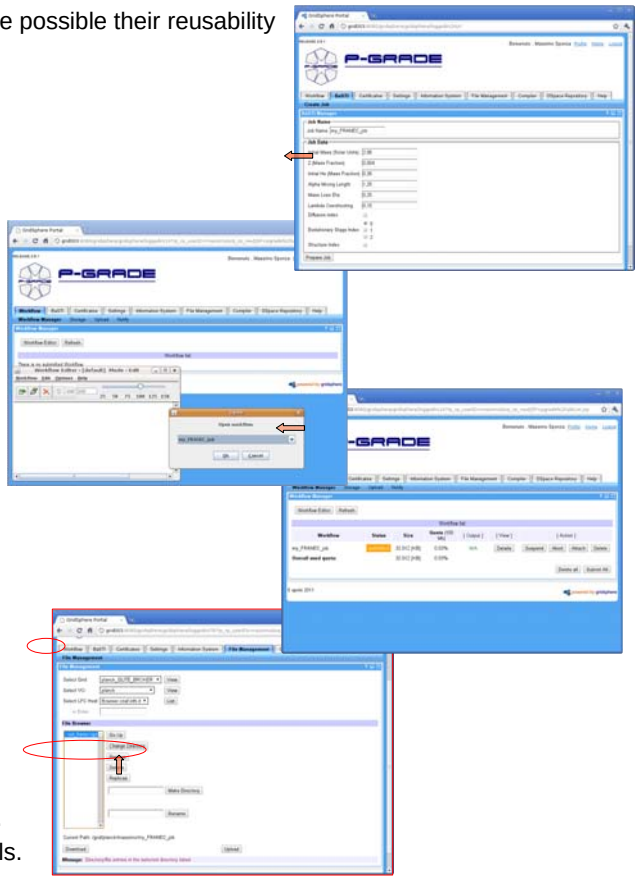


Some key concepts

- Stellar evolutionary computations are extremely important to face a wealth of astrophysical problems; such problems are extremely demanding in terms of computing power and data storage.
- BaSTI (The Bag of Stellar Tracks and Isochrones) is a theoretical astrophysical catalogue that collects fundamental data sets involving stars formation and evolution.
- BaSTI is also a usecase for the Virtual Observatory, and a testbed for the definition of standards to access numerical simulations.
- To create and populate BaSTI, a large number of stellar evolutionary computations are necessary.
- We proved that the "gridification" of stellar evolution code is extremely convenient in terms of data processing speed and data sharing.

Work already done to gridify FRANEC, the code used to feed BaSTI

- Creation of specific services in gLite Environment, used to submit both SMRs (Synthetic Model Runs) and FIRs (Full Isochrone Runs).
  - Desktop environment (aimed at hiding the complexity in configuring and submitting FRANEC tasks)
  - Computational Services (aimed at managing the configuration and execution of FRANEC tasks)
  - Data Oriented Services (aimed at managing simulated data)
- Services for gLite are designed and implemented in a modular way to make possible their reusability



Activity currently in progress

- Integration in P-GRADE: A specialized dedicated portal has been built on top of P-GRADE.
- The specialized portal is implemented in a modular way so that its components may be reused more times.
  - Added a page allowing users to insert values for all those parameters necessary to run the job.
  - Automatic check of inserted data to verify their formal correctness.
  - New P-GRADE component (Java script) producing a P-GRADE compatible workflow starting from data provided by users. This workflow is handled as any other workflow of P-GRADE.
- Improvements of FRANEC: the values of some fundamental parameters requested to run pipelines are automatically generated and fed to FRANEC through input files.
- Modification of some components of P-GRADE to automate the porting of jobs in Grid. In this way users need to concentrate only on scientific aspects (parameters) required by pipeline runs.
- The construction of appropriate P-GRADE compatible workflows remains in charge of the application.
- Workflows are submitted through the standard tools provided by P-GRADE.

Next Steps

- Interfacing the BaSTI DB and the Grid and integrating BaSTI in P-GRADE.
  - Users may easily discover already existing stellar evolutionary models.
  - Users will access the data using Virtual Observatory standards.
  - Not already existing evolutionary models can be generated through new simulation runs. New generated models are stored in a hidden instance of BaSTI to be validated, normalized and, if appropriate, brought in the official database instance.
- Repeated runs with fixed values for a set of K parameters and values ranging in predefined intervals for the remaining set of N-K parameters (e.g. run of X jobs with different values of the mass).
- Use of robot certificates to ease users in approaching and using the portal and the underlying Grid infrastructure.