

GridAE: A Grid-based Framework for Artificial Evolution Applications

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The candidate solutions found in AE are used to generate “offsprings” based on their fitness values; fitter candidates generating more offsprings into the next generation. This makes the entire computational requirements tend to be proportional to that of evaluating a single individual. Hence, the fitness evaluations of candidate solutions need to be spread over a large number of processors to make the whole process viable.

The development of GridAE (supported under the SEE-GRID2 project) aims to create a Grid-based framework for AE applications by porting the idea and experience of our earlier study, Parallelized Evolution System (developed as a part of our Swarm-bots project to be run on clusters), onto the Grid.

This framework should create a transparent interface for the AE user (similar to BEAGLE or GALib), which would manage the execution of the evolution on the Grid, to be achieved both as a command line interface and a GUI through a portlet on the TR-Grid P-GRADE portal.

3. Impact

The GridAE framework employs the master-worker paradigm with the modules below:

Interface to Framework (IF) interacts with the user. Currently, the command-line version is in use, and its portlet version (to be included in the TR-Grid portal) is under development.

Job Manager (JM) is the application initiator running on a gLite UI host. It starts up master and worker jobs, monitors them to achieve fault tolerance, and controls the iteration of the evolution process.

Instant Messaging (IM) service layer has been developed on top of gLite SE through `lcg_utils` calls to LCG File Catalogue. It provides messaging, using temporary files, among the master and workers running within an AE application.

Each of the worker modules calculates a series of fitness values belonging to a group of individuals using the user-defined fitness function.

Master module finds the best solutions, out of the ones provided by the workers, using the user supplied parameters for selection, crossover and mutation.

URL for further information:

Application Home: “<http://gridae.ceng.metu.edu.tr/>” (under development)

4. Conclusions / Future plans

We are now testing and debugging the framework on the multi-Grid-sites using sample applications on robotics. We have achieved the messaging requirements among the master and workers by adding the IM layer on the SE services. The main difficulty was due to some malfunctioning sites, which has been attacked by adding monitoring function to our job manager module to achieve fault-tolerance. Currently, its command-line interface is in use, and also a portlet is under development to provide a GUI.

Provide a set of generic keywords that define your contribution (e.g. Data Management, Workflows, High Energy Physics)

Artificial Evolution, Messaging, Robotics, Application Framework, Master-Slave,

1. Short overview

Artificial Evolution (AE) is an approach, inspired from the famous theory of evolutions of Darwin, which can generate solutions for complex optimization problems. The approach relies on computing the “fitness” (quality) of a population of candidate solutions, and employed in many areas such as engineering, computer

graphics, medical imaging. However, one limiting factor is the high cost of “fitness computation” of solution candidates, requiring it to run on federation of computational resources.

If demonstration is requested please explain what visual or interactive aspects of the contribution necessitate a demonstration rather than a presentation or poster?

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