Heterogeneous Computational Grid Emulation for a Mesh-Partitioner

MCS Candidate Basile Clout, Supervisor Dr. Eric Aubanel

Grid computing allows distributing processing across a parallel infrastructure by networking many heterogeneous resources to model a virtual supercomputer. This model better uses the unused resources (CPU cycles, disk storage) of the available computing power to solve computationally intensive programs such as grand challenge problems (e.g. earthquake simulation, climate modeling). Implementation of many large-scale applications based on mesh models (such as finite element based problems) require appropriate mesh partitioning that considers both processor and network heterogeneity of the Grid. Experimental evaluation of the performances of a mesh partitioner on a real system requires heterogeneity-controlled cluster configurations.

The Grid Computing Research Group at UNB has created such a partitioner called PaGrid. Our objective is to create a configurable platform associated to PaGrid that allows for controlled experiments for testing applications on a large set of heterogeneous configurations. The problem domain includes mesh-based applications as well as weighted graphs problems in general. We use Wrekavoc, software developed at the French national research Institution INRIA (*http://wrekavoc.gforge.inria.fr*), to emulate a heterogeneous cluster.

To simulate heterogeneity, we degrade a homogeneous cluster by managing the nodes' CPU power and inter-node network bandwidth and latency. First prototypes were run on linux systems and use ad hoc tools like “tc” and “cpufreq”. The next step is to integrate this capability in the heterogeneous mesh partitioner PaGrid and to develop a test bed to validate its execution time model and compare its performance, that is the experimental execution time corresponding to the partition, with other publicly available partitioners.