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Implementation of a small-scale desktop grid computing infrastructure in a commercial domain

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Distributed computing in the context of desktop grid computing, has been successfully utilized for a number of years in academia for a range of citizen science projects spread across a variety of different scientific domains. The Berkeley Open Infrastructure for Network Computing (BOINC) software is used as the framework of choice for these projects. BOINC is an L-GPL licensed software that has been specifically designed for distributed computing. To-date however, there has not been a single successful application of this distributed computing software within the commercial domain.

In this work we describe the successfully design and deployment of a small-scale desktop grid computing infrastructure within a commercial domain with the goal of building an infrastructure that would act as a test project to prove the viability of the potential construction of a much larger, production, desktop grid computing environment within the commercial domain.

In the commercial domain the specification, purchasing and setup of a new HPC system can take a significant amount of time, this acts as a limit to the number of computations that can be run at any one time and forces the reduction of the resolution of those computations through the contention of the limited resources. Desktop grid computing offers a low cost, quick to set up, alternative to obtaining a new HPC system. Desktop grid computing utilizes existing desktop computers when they are not being actively used, computers that have not been specifically obtained for the purpose of providing dedicated computational resources, but are nevertheless capable.

The test desktop grid computing infrastructure that was built in this work was built to prove that additional computational resources could be provided to augment an already overloaded in-house HPC system, providing an additional resource that could be used for computing and analysis. The desktop grid would enable the utilization of pre-existing in-house desktop computing resources more efficiently and would encompass minimal outlay for new infrastructure.

In this work we set up a small-scale test computing grid and implemented two different applications across the infrastructure. In the first application, a large number of simulations were run to perform a parameter sweep with a range of different parameters, this enabled the response of the application to be plotted over the parameter ranges, and provided the optimum solution to the problem studied. These simulations were of sufficient length such that they would complete within an overnight time window and would provide results in a timely fashion for the start of the next business day. In the second application, the test desktop grid was used to demonstrate that the overflow of CAD analysis computational jobs could be run in a timely fashion on the infrastructure.

In addition, we examined the additional energy that would be consumed and the heat that would be produced by the running the computational work on the desktop computing resources in a typical office environment. This was in order to quantify both the change in temperature produced and the additional cost of the energy consumed. The results from this analysis show that the raise in temperature produced was minimal and the additional cost of the energy consumed was also minimal.

In this work we proved that a test desktop grid computing infrastructure in a commercial domain could produce useful, timely results on a representation scale that with further scaling would produce commercially useful results that would represent a significantly saving of money compared to the cost of the equivalent computational time utilizing either HPC or cloud computing resources. We have shown that such a setup can have a significant business-relevant impact at a very low cost for the additional infrastructure obtained and for the energy consumed.

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