High-performance Solutions Based on Desktop-grids and Combined Infrastructures

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Abstract: The desktop grids (volunteer grids) can collect huge amount of cheap computational resources harnessing idle cycles of personal computers. Desktop grids can be used together with traditional sources of computing power such as service grids, supercomputers and clouds. In this paper we outline some of relevant approaches.

Keywords: desktop grids, volunteer computing, BOINC, combined distributed infrastructures.

Desktop grids (DGs) is a relatively new technology for assembling resources of PCs from over the world for solving hard computational problems. Volunteers donate the idle resources of their personal computers (“clients”) by connecting them to a project server that manages the computational process.

The primer tool for desktop grid computing is BOINC (Berkeley Open Infrastructure for Network Computing) [1]. BOINC is a software system that makes it easy for scientists to create and operate public-resource computing projects. It supports diverse applications, including those with large storage or communication requirements. PC owners can participate in multiple BOINC projects, and can specify how their resources are allocated among these projects.

Potentially DGs can collect a huge computational power however its efficient utilization faces lots of significant challenges, e.g. heterogeneity and unreliability of computational resources, limited network bandwidth, limited

connectivity among nodes. Overcoming these issues have led to a noticeable progress in DG technologies resulted in several new technologies, namely:

- virtualization to cope with binary incompatibility of client PCs;
- building combined distributed infrastructures based on DGs, service grids and clouds.

Virtualization copes with binary compatibility, licensing and safety issues of desktop grid applications. The primer tool for desktop grid computing BOINC supports "VM apps" - applications that run in VirtualBox virtual machines. This provides several benefits:

- You don't need to build application versions for different platforms. You can develop your app in your environment of choice (say, Debian Linux), and then bundle the resulting executable with a virtual machine image containing an appropriate runtime environment. The application can then be run on all platforms (Windows, Mac OS X, all versions of Linux) with no additional work on your part.
- Virtual machines provide the strongest available security sandbox: a VM app cannot access or modify the host system. This makes it feasible to deploy untrusted applications.
- VM apps don't need to have their own checkpoint/restart mechanism – BOINC provides one.

We should also notice that volunteer computing is not a replacement for traditional approaches such supercomputers, service grids or clouds. It is just another approach to increasing computational resources. In the past a lot of efforts have been made to combine difference sources of computing power. The 3G-Bridge [2] combines the advantages of the service and desktop grids concepts. A building block of this infrastructure is bridging between the different grid types. 3G-Bridge provides the special BOINC client application so it can represent itself as a very powerful machine towards the BOINC server. It can start a wrapper

application specified in a configuration file that can be used to handle the workunit in basically any way based on its description file produced by the modified BOINC client.

The CluboRUN tool [3] is the technology for integrating idle computing cluster resources into volunteer computing projects. The main principles of this technology are the following: only standard cluster user credentials and only idle computing cluster resources (i.e. the resources that are not employed by other cluster users) are used. The CluBORun tool was successfully applied to boost the performance of volunteer computing projects SAT@home and OPTIMA@home.

References

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