CorralWMS: Integrated Resource Provisioning Across the National Cyberinfrastructure in Support of Scientific Workloads

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Problem Statement

- Throughput applications, such as workflow, master-worker, and parameter sweep, contain many serial tasks with short runtimes
- Scheduling throughput applications on the Grid is difficult because Grids have large per-job overheads that significantly reduce performance
- Throughput applications need some way to reduce these overheads to achieve desired performance and reduce time-to-solution

Approach: Resource Provisioning

- Usually resources are allocated for each job individually. With provisioning resources are allocated for a group of jobs.
- Provisioning reduces overheads by amortizing resource allocation costs and by giving the application control over scheduling.

Glideins

- A way to provision Grid resources using ordinary Grid jobs
- Grid jobs are used to start Condor worker daemons on a Grid site
- Condor worker daemons contact user-controlled Condor manager to be matched with application jobs
- After initial provisioning user controls scheduling of application jobs

Glidein Performance

- Experiments demonstrate the effectiveness of glideins using two workflow applications: Montage (astronomy) and Epigenome (genomics)
- Experiments compared the runtime of workflows using Globus/Grid vs Corral/Glideins. These are compared to the runtime using HEFT (Heterogeneous-Earliest-Finish-Time) schedule assuming no scheduling overhead as a lower bound.

Running Epigenomics on USC’s HPCC cluster results in performance close to ideal for up to 512 processors. In comparison Globus cannot use more than 30 processors because of HPCC’s PBS policies.

Corral

- A web service for provisioning resources using Glideins
- Features: pre-staging of Condor binaries, fixed-size provisioning requests, parallel requests, automatic request resubmission, GSI authentication
- Interfaces: REST, Java API, command-line tool
- 1 GRAM job => N glideins

CorralWMS

- Two successful, glidein provisioning projects leveraging each other
- Provisioning of resources across national cyber infrastructure (TeraGrid, OSG) as well as campus and eventually cloud resources
- Combines dynamic provisioning of glideinWMS with explicit provisioning of Corral
- Adds features for monitoring system status and resource usage, provides statistics for application developers

glideinWMS

- A workload management system using Glideins
- Features: dynamic provisioning based on current workload, scalable architecture
- Built on top of Condor; users submit jobs to a Condor queue and the glideins form a virtual private Condor pool

Built-in monitoring tools show the status of the glideins requested by all VO Frontends supported by the UCSD Glidein Factory

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