**Accessing OLCF Resources Using Pegasus WMS**

**Problem definition - Motivation**

Accessing OLCF resources with Pegasus WMS has been difficult for DOE scientists in the past, because of either the need to install and configure Pegasus' software stack (Pegasus and High Throughput Condor) for different types of head nodes or handle issues arising from 2-factor authentication when they wanted to orchestrate remote submissions. Previous solutions included approaches like the rvGAHP, but when a new machine arrives (e.g. Summit), all the steps of setting up the workflow/submit environment have to be done once again. Creating a workflow submission environment shouldn't discourage users from using a workflow management system. It should be an easy and well defined process that motivates them to take advantage of all the benefits a workflow management system has to offer, such as portability, automated data management, better application tracking, or making complex workflows easier to capture. We work present two new approaches to support local submissions and remote submissions of Pegasus workflows, on OLCF's computing resources.

**Pegasus Workflow Management System**

- Pegasus (https://pegasus.isi.edu) is a system for mapping and executing abstract application workflows over a range of execution environments
- The same abstract workflow can, at different times, be mapped to different execution environments such as OLCF (Titan, Rhea, Summit), XSEDE, OSG, commercial and academic clouds, campus grids, and clusters
- Pegasus can easily scale both the size of the workflow, and the resources that the workflow is distributed over, ranging from just a few computational tasks up to 1 million
- Stores static and runtime metadata associated with workflow, files and tasks.
- Pegasus-MPI-Cluster enables fine-grained task graphs to be executed efficiently on HPC resources

**Remote Submissions of Pegasus Workflows at OLCF**

Submit workflows using PanDA

- PanDA, by leveraging local automation features and exposing a modern REST API, can enable Pegasus' remote submisions.
- In order to support execution of Pegasus workflows via PanDA we had to extend Condor's GAHP module.
- The extended module allows HTCondor to interface with the PanDA Server, submit and track jobs to the exposed resources.
- Harvester is a new-generation edge service for PanDA which resides on a front node of an HPC resource and interacts between the PanDA Server, where the payloads are stored, and the compute nodes.

**Local Submissions of Pegasus Workflows at OLCF**

Workflows submit host as a service

- In order to support local submissions and make the creation of the environment simpler we are leveraging the container orchestration support on OLCF, based on OpenShift, using Docker containers.
- The CCS Marblte cluster provides access to the Lustre FS, the NFS Home, Titan, Rhea and Summit via cross submisions.
- We have prepared recipes that are ready to submit on Titan and Rhea, and in the future Summit as well (https://github.com/pegasus-is/pegasus-olcf-kubernetes).
- Users can authenticate themselves on the marble cluster, build and spawn new pods, preconfigured as workflow submit nodes. After connecting to a Pegasus submit pod, the experience of submitting jobs is similar to that of a dedicated login node of each system.

**Panorama 360**

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