Running Workflow Systems at OLCF with Slate

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Agenda

- HPC Workflow Requirements

- Kubernetes for HPC Workflows

- Kubernetes at OLCF

- Demo

- Recap

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HPC Workflow Requirements

- Need ways for users to manage their own workflow systems/databases/web portals
  - Diverse ecosystem of tools is difficult for operations group to support

- Why not just use SSH keys for remote access?
  - Our moderate security controls require remote actions to be authenticated with RSA two-factor credentials
  - Instead allow running workflow systems inside of our security boundary

- Upon surveying existing workflow systems we came up with the following requirements:
  - Run a persistent service that can stay running across system reboots
  - Talk to batch submission system for current queue information and job submission
  - Interact with files on GPFS/Lustre/NFS

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Kubernetes for HPC Workflows

- For Users
  - Access to HPC resources from service containers
  - Similar user experience when compared to batch scheduling paradigm
  - Growing industry standard for designing portable services that can be run anywhere

- Operations
  - Kubernetes allows users to **declare their intent** and operations to **implement and realize that intent**
    - We make use of this in order to enforce operational policy such as running containers as a particular UID/GID and enforcing authentication on exposed services
  - Kubernetes provides a single scheduling interface for both users and operations to run their workloads on a resource

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Kubernetes at OLCF

- Production cluster running Red Hat OpenShift
  - Use resource quota and limit systems in Kubernetes, projects get Kubernetes namespaces to run their services

- Containers run as project-level automation user
  - Batch job submission from inside container
  - HPC parallel filesystem can be mounted inside container

- Can expose HTTP services externally with NCCS 2-factor authentication accessible to project members

- Can expose TCP/UDP services on higher level ports for access to services from compute nodes inside of OLCF

- Container build service available as part of OpenShift platform

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Demo

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Recap

Lessons Learned

- Diverse ecosystem of workflow tools

- Workflows present a number of production problems that have to be solved in new and unique ways

- Slate allows users to run their workflow tool at OLCF with access to OLCF resources

Looking Forward

- Kubernetes is becoming the standard for container orchestration

- Ongoing Slate pilot has been well received by both staff and users

- Get in touch with us!