Running Workflow Systems
at OLCF with Slate

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Agenda

• HPC Workflow Requirements
• Kubernetes for HPC Workflows
• Kubernetes at OLCF
• Demo
• Recap
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
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
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
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!