CONTINUOUS INTEGRATION IN A CRAY MULTIUSER ENVIRONMENT

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ARGONNE LEADERSHIP COMPUTING
FACILITY SUPERCOMPUTERS

Theta Intel/Cray [Production]
- 4,392 nodes
- 16 GB MCDRAM, 192GB RAM per Node
- Peak flop rate: 9.65 PF
- 10 PB Lustre Filesystem

Mira - IBM BG/Q [Production]
- 49,152 nodes / 786,432 cores, Peak flop rate: 10 PF
- 786 TB RAM

Cooley - Cray/NVIDIA [Production]
- 126 nodes / 1512 Intel Haswell CPU cores
- 126 NVIDIA Tesla K80 GPUs
- 48 TB RAM / 3 TB GPU memory
- Peak flop rate: 223 TF

Storage
- Home: 1.44 PB raw capacity
- Scratch:
  - fs0 - 26.88 PB raw, 19 PB usable; 240 GB/s sustained
  - fs1 - 10 PB raw, 7 PB usable; 90 GB/s sustained
- Tape: 21.25 PB of raw archival storage [17 PB in use]
CONTINUOUS INTEGRATION (CI)

What is it?

- The ability to checkout code from a software repository
- The ability to compile the code
  - On-Demand or on a set schedule
- The ability to test the code to verify it still functions as expected.
- Ideally this provides better code for the project since there’s consistent testing.
CI IN ALCF

- In 2017, users started inquiring about a CI solution
- Since we are an open science user facility, our users are located globally
- ALCF’s Requirements for a CI solution:
  - Security
  - Multiplatform Support
  - Easy of Use
  - Integration with various software repositories
  - Maintainable
  - Cobalt integration
  - Actively maintained
THE SOLUTION

- After considering various options, we deployed an open source Jenkins solution.
- ALCF has extensive knowledge of Jenkins since it is used for their internal software development.
- It is actively developed with a long term support release.
- It provides project-level segregation as per requirement.
- Integrates within the ALCF environment:
  - X86_64 and PPC hardware, as well as any environment with a JRE.
- *ALCF already creates a Linux group per project.
THE SOLUTION (CONT)

- Easy of use
  - Jenkins has a large following with tutorials on-line
- Security
  - 2FA for user logins
  - Logging of user actions to a central logging service
- Project isolation
  - We isolate our projects based on Linux groups
- Integration with software repositories external to ALCF
  - The ALCF does not host software repositories
  - Git, SVN, Mercurial, etc.
THE SOLUTION (CONT)

- Manageable
  - We have deployed this solution with all open source plugins
  - Limited customization needed

- Centralization
  - Jenkins provides a central location for managing various jobs for the project

- The compiling of code or execution is occurring on the login nodes and generic x86_64; therefore, the Jenkins VM is lightweight
HOW JENKINS IS DEPLOYED AT THE ALCF

- How Jenkins is deployed
  - The Jenkins service is deployed in a VM since VM Ware provides the ability to grow the server on-demand
  - VM Ware also provides High Availability
  - Slaves are deployed on bare metal servers
  - The Jenkins data directory is hosted on a NFS appliance which also provides for snapshotting

- Nginx is deployed as the webserver front-end
  - We deployed NGINX as the webserver so we can decouple the webserver if needed
WHY NOT JUST USE CRON?

- Jenkins provides the following:
  - Build steps within a job – you can have dependent steps within a job
  - Build timeouts – you can set a duration for a job to run
  - It captures stdout and stderr and keeps this centrally. Jenkins will also prune the logs as defined by the users
  - It also does not start a new job until the currently executing one is completed
  - It provides a secure location, not on the shared filesystem, to store the project’s credentials to the software repositories.
  - Lastly, Jenkins provides centralization.
JENKINS IN ALCF

![Diagram showing JENKINS IN ALCF network and components](image-url)
KEY JENKINS PLUGINS

- Folders
  - Allows for project separation
  - Credentials are also stored at the folder level
- Job and Node ownership
  - This also aides in the isolation
  - This plugin ties a project’s linux group to a job
- Job restrictions
  - This is how we prevent jobs from running on another project’s slave
- SCM Sync Configuration
  - This enables automatic backups of the Jenkins configurations to a Git repo
KEY JENKINS PLUGINS

- **Matrix authorization**
  - With the use of this and folders, we are able to keep projects isolated
  - This is used in conjunction with the LDAP plugin which feeds it group information

- **SSH Slaves**
  - The ssh slaves ssh from the VM over a private network to the login nodes or generic x86_64 servers when the demand arises for a build. Slaves are only activated when the demand is in the queue

- **LDAP authentication**
  - This plugin allows Jenkins to communicate with our LDAP systems
  - LDAP also provides Jenkins with group membership information
JENKINS FROM AN ADMIN STAND POINT
JENKINS FROM THE PROJECT STANDPOINT
JENKINS FROM THE PROJECT STANDPOINT (CONT)
FUTURE JENKINS WORK

- We are currently seeking more ‘friendly’ projects
- We would like to explore workflows with a project in Jenkins. Jenkins provides the framework for workflows natively
- We would like to automate the project on-boarding process
- Direct integration into the Cobalt scheduler using it’s API
- Documentation for our users and catalysts
QUESTIONS?