An Introduction to Jenkins

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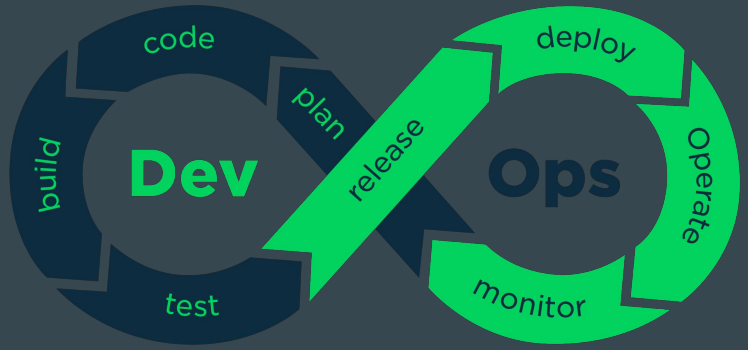
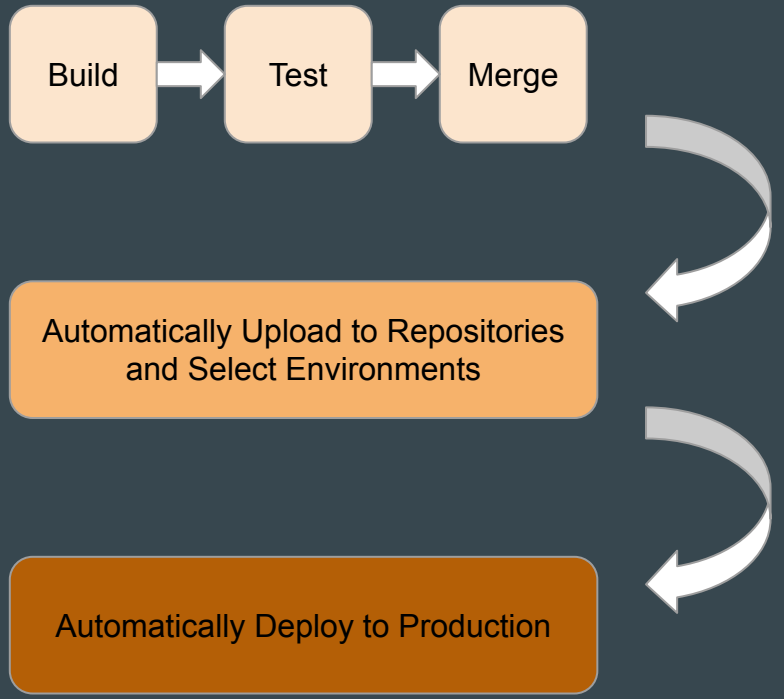
What is CI/CD?

- A method to frequently deliver applications by incorporating ongoing automation and monitoring during the lifecycle of an application
    - Includes stages of development from integration, functionality and performance testing, to delivery and deployment



CI/CD Pipeline

- Continuous Integration
  - Automating and integrating code changes from a team throughout development
- Continuous Delivery
  - Automatically uploading application changes to select environments or repositories
  - Testing of application in staging environment to ensure code integrity and deployability
- Continuous Deployment
  - Automatically release applications to production environments



What is Jenkins?

- Open source framework used to manage all types of automation
    - Software builds, application testing, deployments, etc

- Extensible automation server that can be used as a simple CI server or turned into the continuous delivery hub for any project

Why Use Jenkins? Free / Open Source

- Community
  - Large support and thorough documentation
  - Conferences and events
- Anyone can examine the code
  - Develop new features
  - Find and fix issues
- Plugins
  - Hundreds available to support building, deploying and automating any project
  - Easy to create your own

Why Use Jenkins? Extensibility and Flexibility

- Hundreds of community developed plugins
  - Allows integration with practically every tool in the CI/CD toolchain.
  - Extends features and functionality, providing limitless possibilities

- Distributed
  - Easily distribute work across multiple machines, driving builds, tests and deployments faster

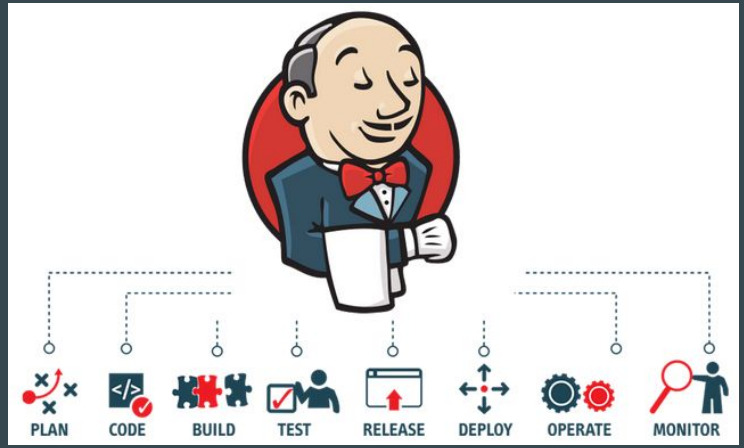
Why Use Jenkins? Ease of Use

- Easy Installation
  - Self-contained and java-based, ready to run out-of-the-box for all major operating systems
- Easy Configuration
  - Set up and configured via its web interface
    - Includes on-the-fly error checks and built-in help
  - Documentation and examples directly included or easily accessible
- User-friendly Interface
  - Intuitive
  - Easy to navigate

What can Jenkins do?

- Maintain, orchestrate, and accelerate the entire software development life cycle
- Integrate with various SCM systems
- Manage and control software delivery processes throughout the entire lifecycle
    - Build, Document, Test, Package, Deploy
- Generate reports
- Push to various artifact or code repositories
- Notify stakeholders of build status

And, with the help of plug ins, so much more!



Demo!

Terminology

- Job/Project
  - A user-configured description of work which Jenkins should perform, such as building a piece of software, etc.
- Pipeline
  - A user-defined model of a continuous delivery pipeline.
- Item
  - An entity in the web UI corresponding to either a Folder, Pipeline, or Job/Project.
- Build
  - The result of a single execution of a Job/Project.

Terminology

- Controller
  - The central, coordinating process which stores configuration, loads plugins, and renders the various user interfaces for Jenkins.
- Agent
  - Typically a machine, or container, which connects to a Jenkins controller and executes tasks when directed by the controller.
- Node
  - A machine which is part of the Jenkins environment and capable of executing Pipelines or Projects. Both the Controller and Agents are considered to be Nodes.

Jenkins User Interface

- New Item
  - Create a new Item, such as a project/job.
- People
  - Configure and view a list of known users
- Build History
  - A list of the builds that have completed
- Manage Jenkins
  - System Configuration
    - Define global settings and paths
    - Configure various tools
    - Add, remove, update, disable or enable plugins
    - Add, remove, control, and monitor nodes and clouds
  - Security
    - Define/Configure who is allowed to access and use the system
    - Define values used for authenticating the services outside of Jenkins with usernames, passwords, private keys and certificates

Jenkins User Interface

- Build Queue
  - A list of what builds are waiting to be run

- Build Executor
  - Shows what builds are running at the present moment

Freestyle Projects/Jobs

- What is a Project/Job?
  - A user-configured description of work which Jenkins should perform.
- Configuration
  - Adding parameters, disabling the job, etc
  - Controlling how Jenkins interacts with any code stored in external SCM
  - Specifying how and when a job is built automatically
  - Controlling the environment in which the job will run
  - Adding various types of steps that will be executed in any build of the job
  - Adding various steps that will execute after a build of the job is complete

Jenkins Pipeline

- What is Pipeline?
  - A user-defined model of a continuous delivery pipeline.
  - “Pipeline-as-code” written in a ‘Jenkinsfile’
- Why Pipeline?
  - Code, Durable, Pausable, Versatile, Extensible
- Concepts and Syntax
  - **Pipeline**: User-defined pipeline as a whole, representing the basis for your entire build process.
  - **Node/Agent**: A machine that is part of the Jenkins environment. Capable of building a Pipeline.
  - **Stage**: Defines a conceptually distinct subset of tasks performed through the entire Pipeline
  - **Step**: A single task, telling Jenkins what to do at a particular point in time / step in the process.

Sample Pipeline

```
pipeline {
    agent any // specifies the agent to run on, which in this case is any agent
    stages {
        stage('Build') { // Defines the Build stage
            steps {
                // perform any steps required for the Build stage
            }
        }
        stage('Test') { // Defines the Test stage
            steps {
                // perform any steps required for the Test stage
            }
        }
        stage('Deploy') { // Defines the Deploy stage
            steps {
                // perform any steps required for the Deploy stage
            }
        }
    }
}
```

Parameters, Global Variables, Workspaces

- Parameters
  - Boolean, String, Choice, Credentials, etc
- Global Variables
  - Environment Variables
  - Parameters
  - Properties of the current build of a Pipeline
  - SCM configuration
- Workspace
  - A disposable directory on the file system of a Node where work can be done by a Pipeline/Job
  - Every Job and Pipeline you define is given a dedicated workspace

Builds

- **Build**: The result of a single execution of a Job/Project.
- Tracking/Monitoring Build State
  - It is useful to be able to go into the system and monitor the current status of a build environment
- Build Artifacts
  - An artifact is an immutable file generated during a build which is archived onto the Controller
- Polling SCM for Build Triggering
  - It is important in CI/CD to communicate with a SCM system, like Github
- Triggering Builds with GitHub Webhooks
  - The goal is to integrate Jenkins with SCM, so that changes in a repository, are automatically pushed back into the Jenkins environment.

Agents and Distributing Builds

- What is an agent?
  - A machine, or container, which connects to a Jenkins controller and executes tasks when directed by the controller.
- Distributing Builds
  - Within a Jenkins environment, we often start out with a single machine/agent, but as load and tasks increase it is helpful to have multiple machines.
- Adding an SSH Build Agent
- Using Docker Image for Agents

Agents and Distributing Builds

- Further Node Configuration
  - As your Jenkins environment grows and the number of potential agents increases, you may want to start targeting builds to toward specific nodes.
  - This can be done with labels
    - User-defined text for grouping Agents, typically by similar functionality or capability.
    - For example: ‘linux’ for Linux-based agents or ‘docker’ for Docker-capable agents.

Testing and Post-Execution Behavior

- Post-Execution Behaviors
  - Define additional steps following the completion of specific stages or the pipeline as a whole.
  - *post* block supports a number of different condition blocks, allowing the execution of steps inside each condition depending on the build status of the Pipeline or stage.
- Testing
  - As part of a multi-stage Pipeline process, we might perform tasks like building, testing, and deploying. If a certain step fails, then you wouldn't want to proceed.
  - Use Pipeline to build applications and stop the deployment process at any time if something goes wrong

Jenkins REST API

- REST API
  - While most interactions with Jenkins are done through the UI or through SCM, there are times when we may want to interact with Jenkins outside of a plugin enabled resource.
- What can you do with it?
  - Create, Copy, and Delete Projects and Pipelines
  - Retrieve all builds of a specified Project or Pipeline
  - Retrieve the Build Queue
  - Fetch or Update a Project or Pipeline description
  - Perform/Trigger a build of a Project or Pipeline
- Triggering a build via the REST API
- Retrieving Various Information

Further Topics and Next Steps

- Using Folders and Views to organize jobs
- Triggering Downstream Builds
- Security
- Doing more with Pipelines
- Automating software and tool installation on agents
- Global Libraries for pipelines
- Finding and using more Plugins
- Exploring the official Jenkins website, and contributing to the code and the community in some form

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