Introduction to CI/CD with Jenkins

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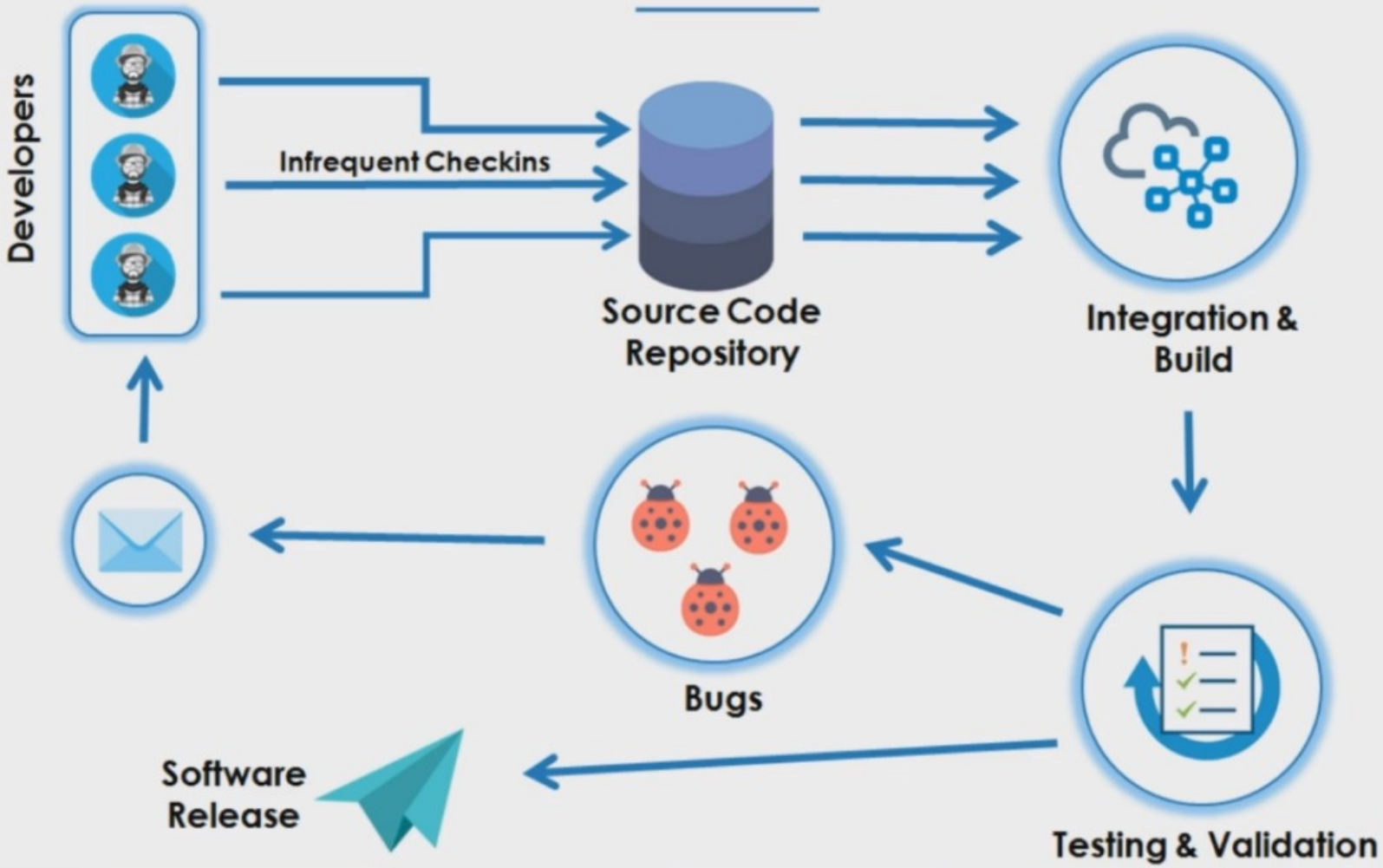
Process Before Continuous Integration



Drawbacks of the Process

No Constant Feedback

Developers have to wait till the application is deployed & the QA team verifies.

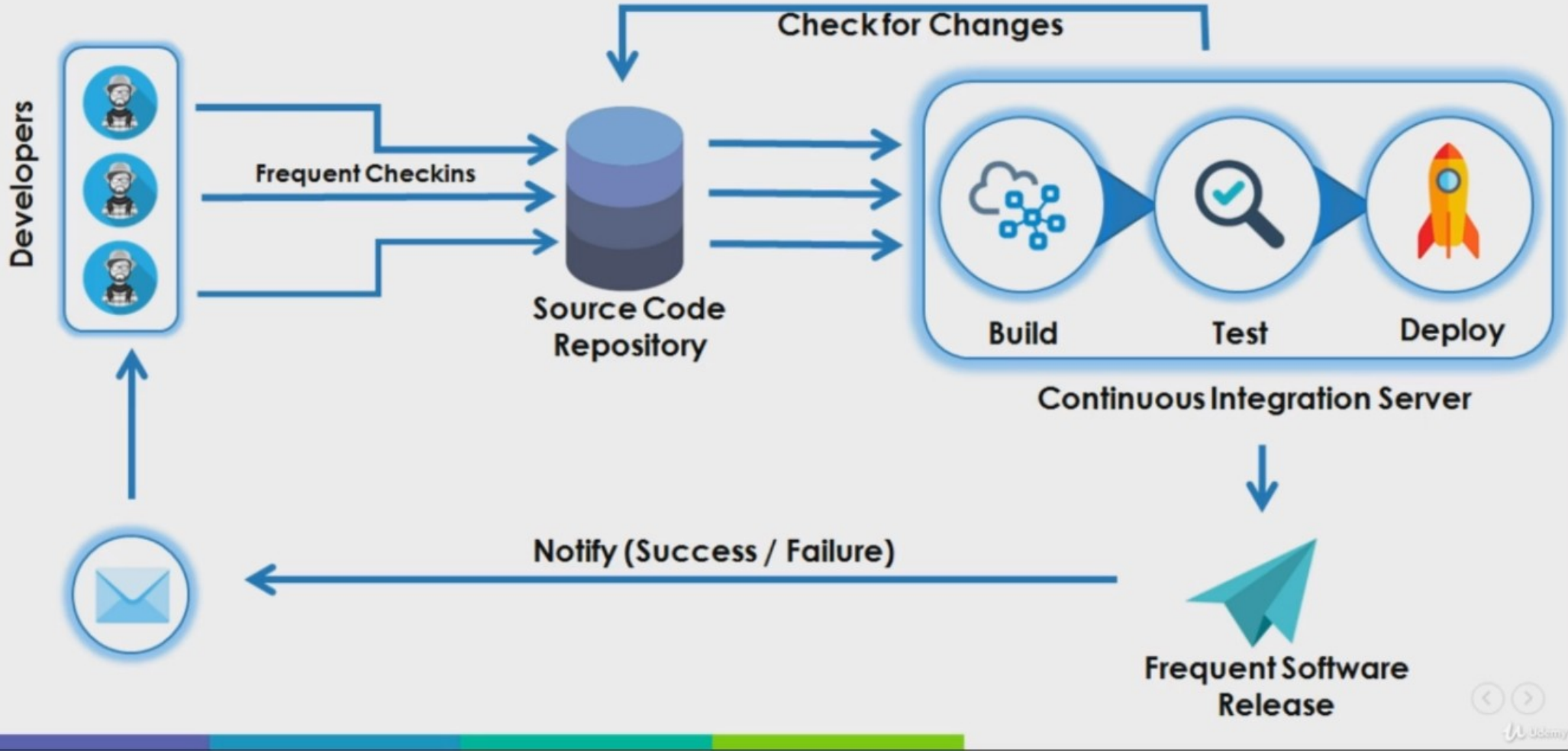
Bug Fixing - Costly

Locating & fixing the bugs by itself becomes a time consuming process.

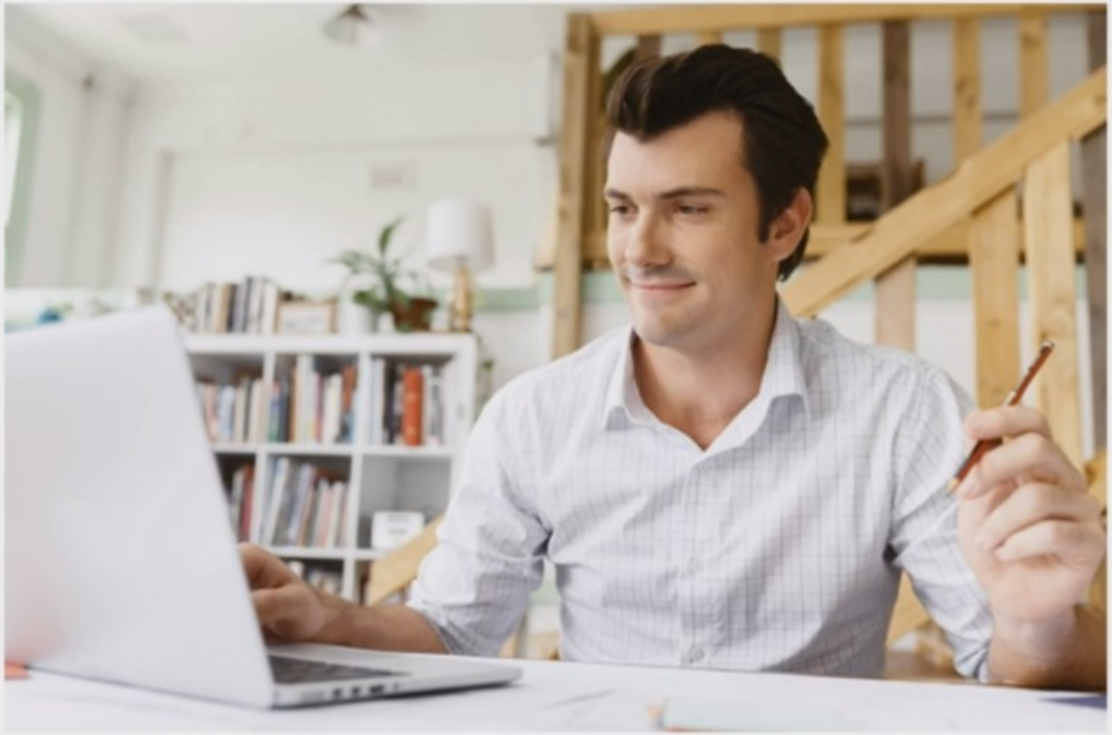
Slow Software Delivery

Software delivery process became slow & inconsistent with a lot of ifs & buts.

Continuous Integration to the Rescue



Benefits of the Process



Constant Feedback

Developers get constant feedback because of the automated build & test process.

Bug Fixing - Effective

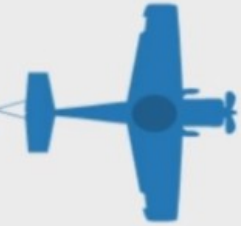
Time taken to identify the cause of the bug is reduced drastically.

Fast Software Delivery

The frequency of the software releases increases.

What is Continuous Integration?

What is Continuous Integration?



Continuous Integration (CI) is a development practice where developers integrate code into a shared repository frequently, preferably several times a day. Each integration can then be verified by an automated build and automated tests.

Key Benefits Include

One of the key benefits of integrating regularly is that you can detect errors quickly and locate them more easily.

Continuous Delivery & Deployment

Continuous Deployment and Continuous Delivery have developed as best-practices for keeping your application deployable at any point

CI CD

What is the difference between Continuous Integration, Continuous Deployment & Continuous Delivery?

1

Continuous Integration (CI)

This is the practice of integrating changes from different developers in the team into a mainline as early as possible, in best cases several times a day. Each integration can then be verified by an automated build and automated tests.

2

Continuous Delivery (CD)

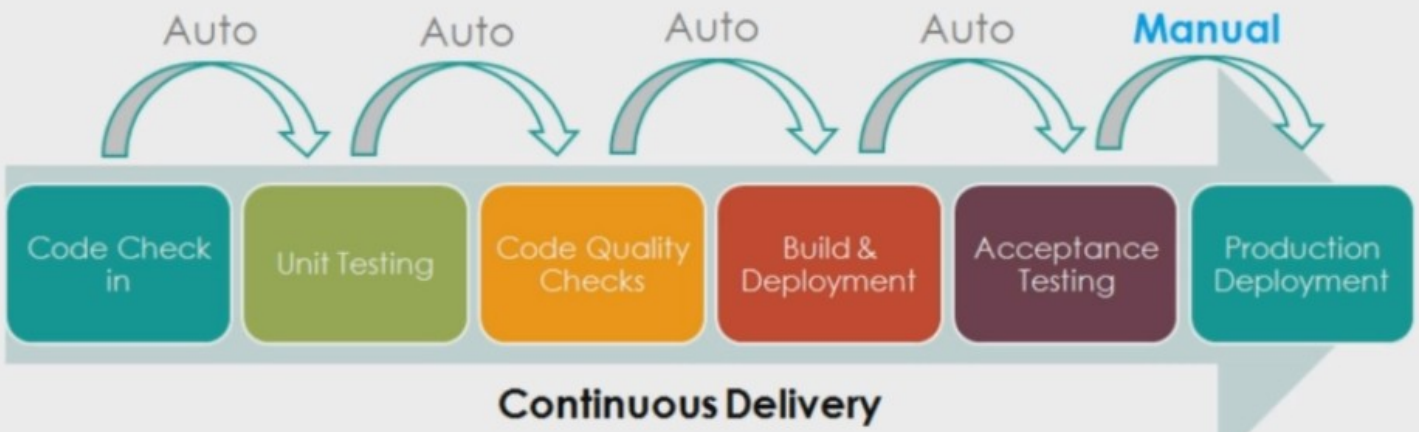
This is the practice of keeping your codebase deployable at any point. Beyond making sure your application passes automated tests it has to have all the configuration necessary to push it into production.

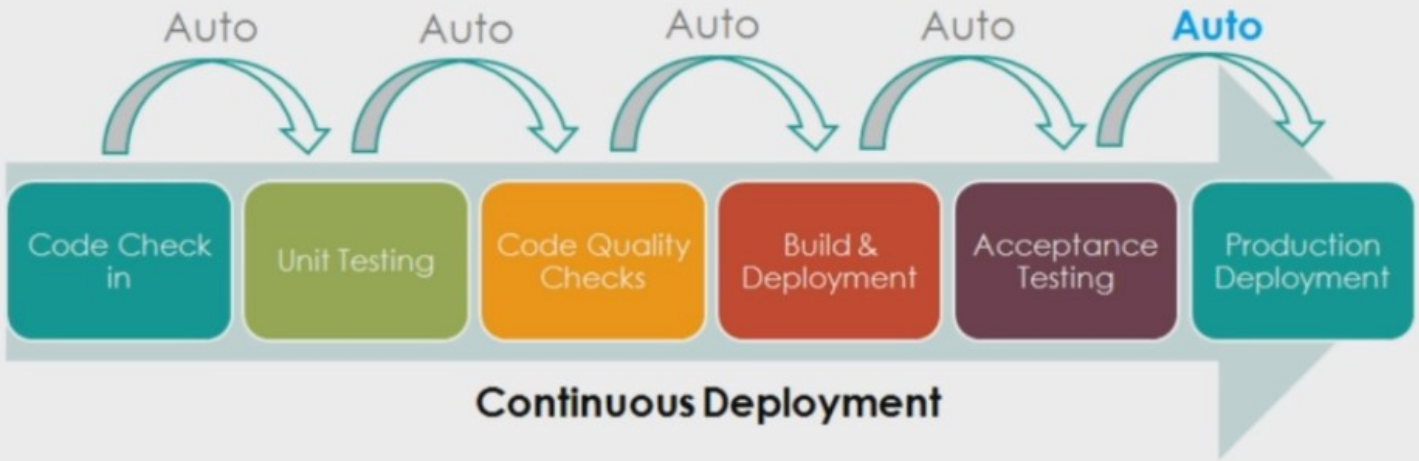
3

Continuous Deployment

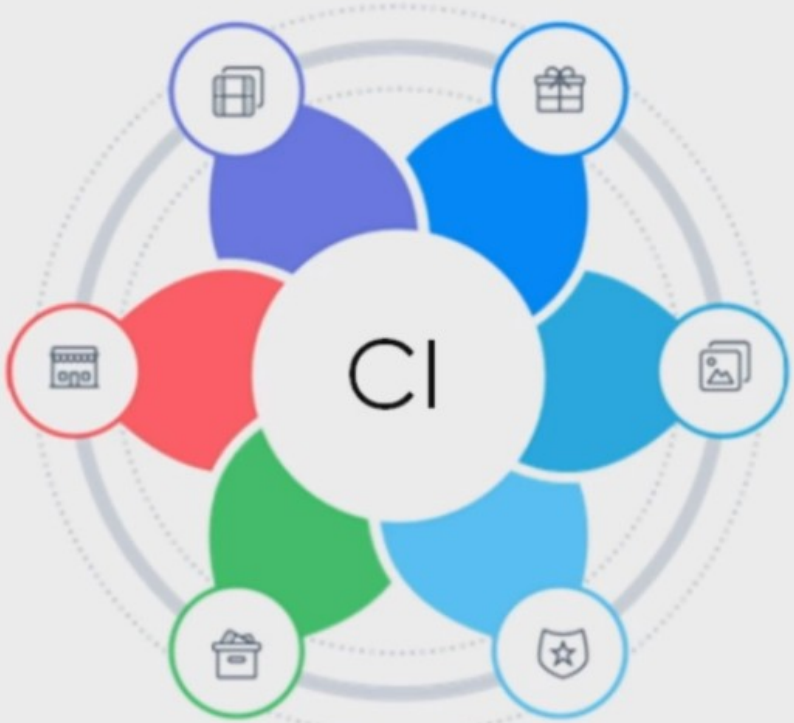
This is closely related to Continuous Integration and refers to keeping your application deployable at any point or even automatically releasing to a test or production environment if the latest version passes all automated tests

Continuous Delivery Vs Deployment





Benefits of Continuous Integration



- Reduces Risk
- Reduces Overhead
- Better Communication
- Earlier Detection
- Faster Iterations
- Helps Collaboration

CI – Principles & Practices

The Principles

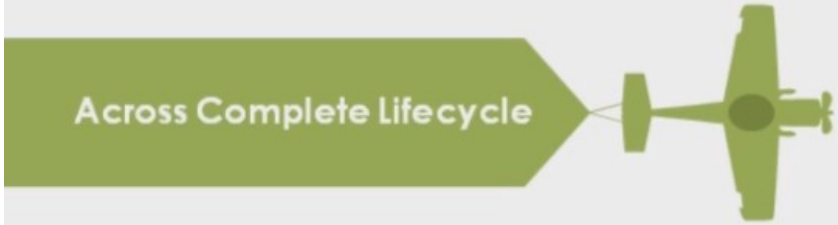
- ❑ Maintain a single source repository
- ❑ Automate the build
- ❑ Make your build self-testing
- ❑ Every commit should build on an integration machine
- ❑ Keep the build fast
- ❑ Test in a clone of the production environment
- ❑ Make it easy for anyone to get the latest executable version
- ❑ Everyone can see what's happening
- ❑ Automate deployment

The Practices

- ❑ Developers check out code into their private workspaces
- ❑ When done, commit the changes to the repository
- ❑ The CI server monitors the repository and checks out changes when they occur
- ❑ The CI server builds the system and runs unit and integration tests
- ❑ The CI server releases deployable artefacts for testing
- ❑ The CI server assigns a build label to the version of the code it just built
- ❑ The CI server informs the team of the successful build
- ❑ If the build or tests fail, the CI server alerts the team
- ❑ The team fixes the issue at the earliest opportunity
- ❑ Continue to continually integrate and test throughout the project

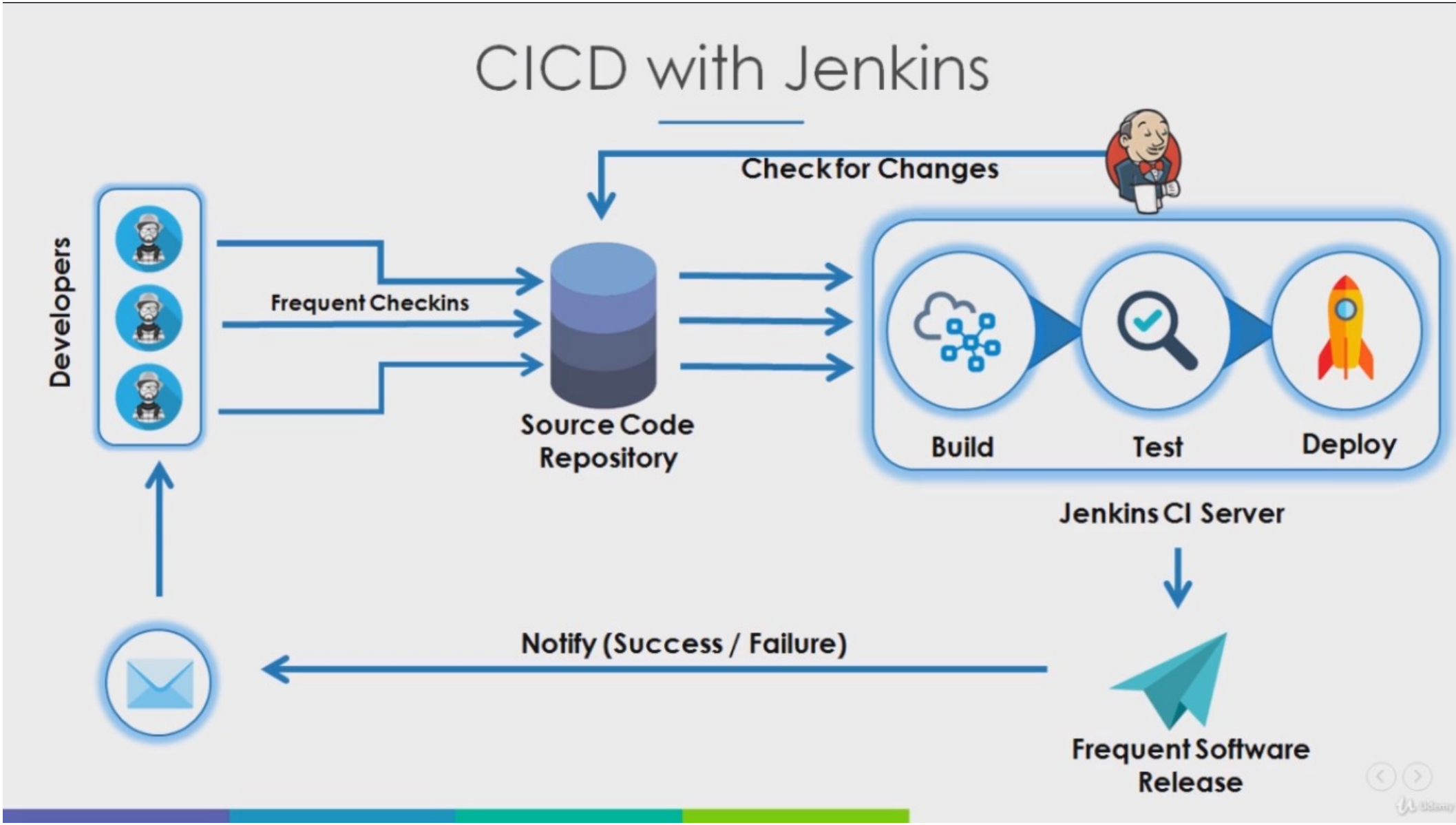
What is Jenkins?

Jenkins is the most popular open source continuous integration & continuous delivery server capable of orchestrating a chain of events / actions that help to achieved CI in an automated fashion.



Jenkins supports the complete development lifecycle of software from building, testing, documenting the software, deploying and other stages of a software development lifecycle.

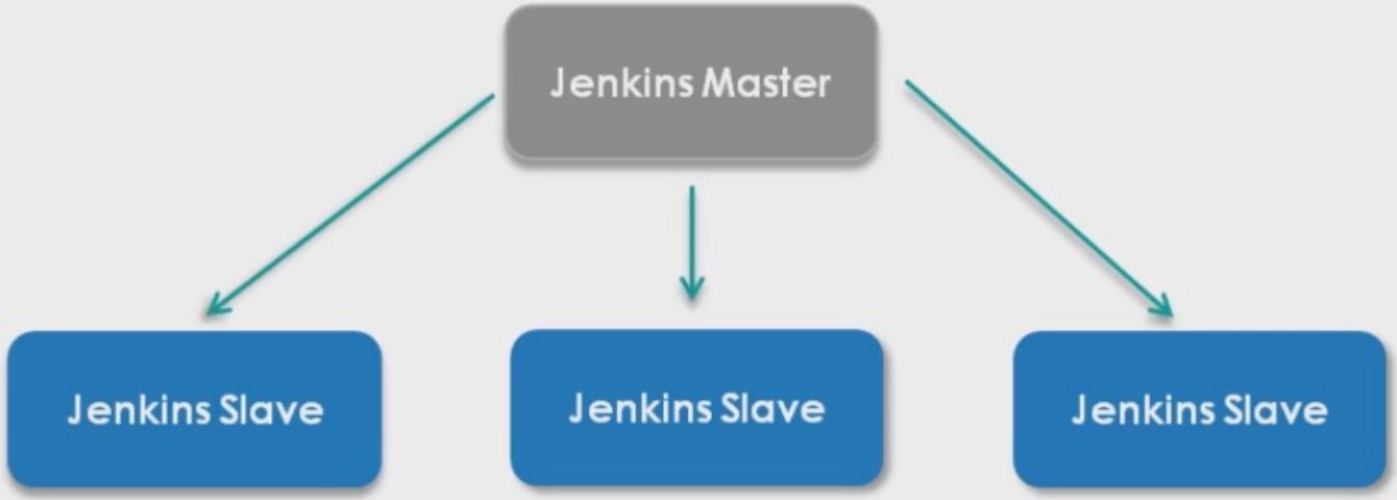
Jenkins Plugins are at the heart of how Jenkins functions in achieving CICD. Jenkins is interconnected with well over 1,000 plugins that allow it to integrate with most of the development, testing and deployment tools.
Refer - https://plugins.jenkins.io/


CICD with Jenkins
Check for Changes
Developers
Frequent Checkins
Source Code
Repository
Build
Test
Deploy
Jenkins CI Server
Notify (Success / Failure)
Frequent Software
Release

Features of Jenkins

Jenkins Distributed Architecture

Scheduling & Dispatching jobs to slaves, Monitor the slaves, Record & present job results, execute some jobs directly



Handles all requests from the Jenkins Master instance. Each slave in an independent entity running on its own OS.

Jenkins Pipeline

Jenkins Pipeline (or simply "Pipeline") is a suite of plugins which supports implementing and integrating continuous delivery pipelines into Jenkins.

A continuous delivery pipeline is an automated expression of your process for getting software from version control right through to your users and customers.

Developer & Build Admin Roles

Developer Roles

- Coding
- Unit Testing
- Code Review
- Push code to Repository

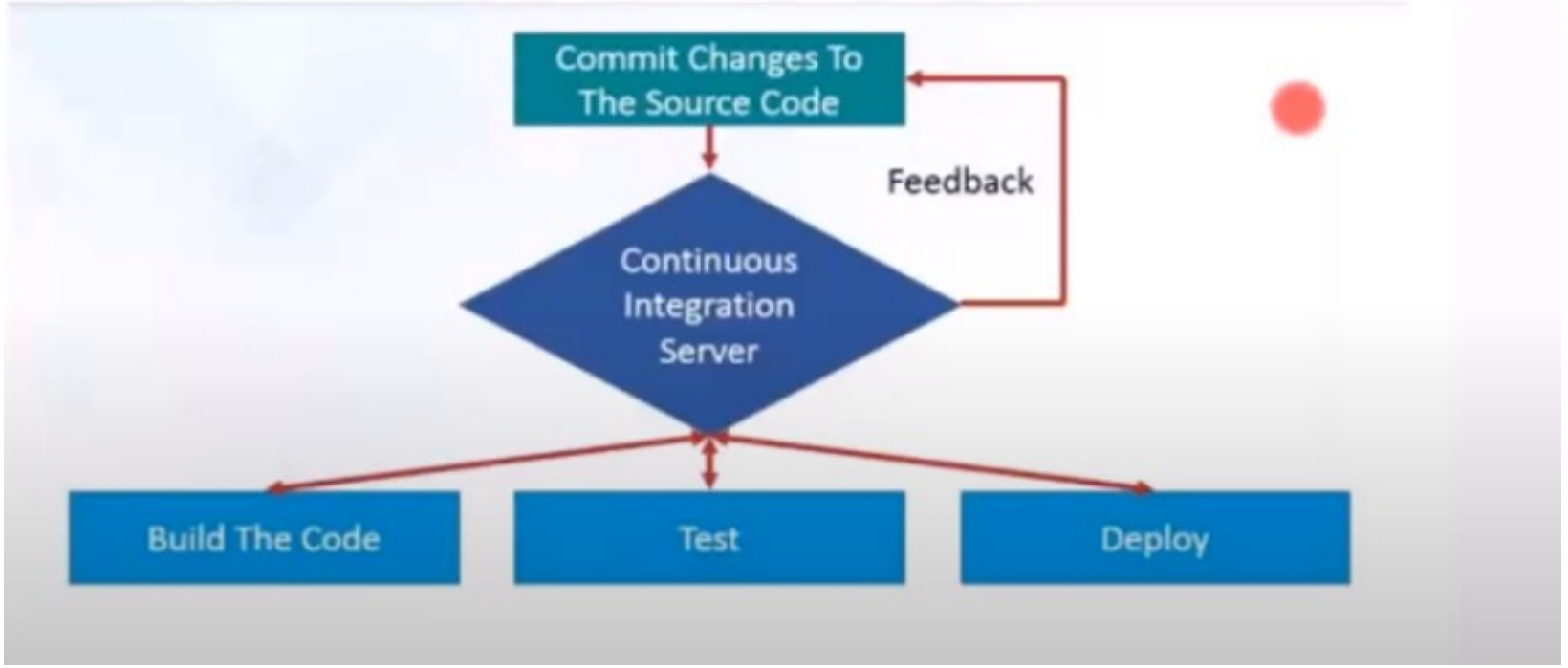
Build Admin Roles

- Pull Latest Code from Repo
- Compile Source Code
- Execute Unit Test Suites
- Package source code as jar/war/ear
- Deploy to Server

Dis Advantages of Manual Build Process

- Dedicated Administrators are required to do project builds
- Developers needs to send build requests to admin to do the deployment when new committed to repo.
- Admin needs to spend some to pull the code, to compile and to package and to deploy.
- It is time consuming process.

CI Work Flow

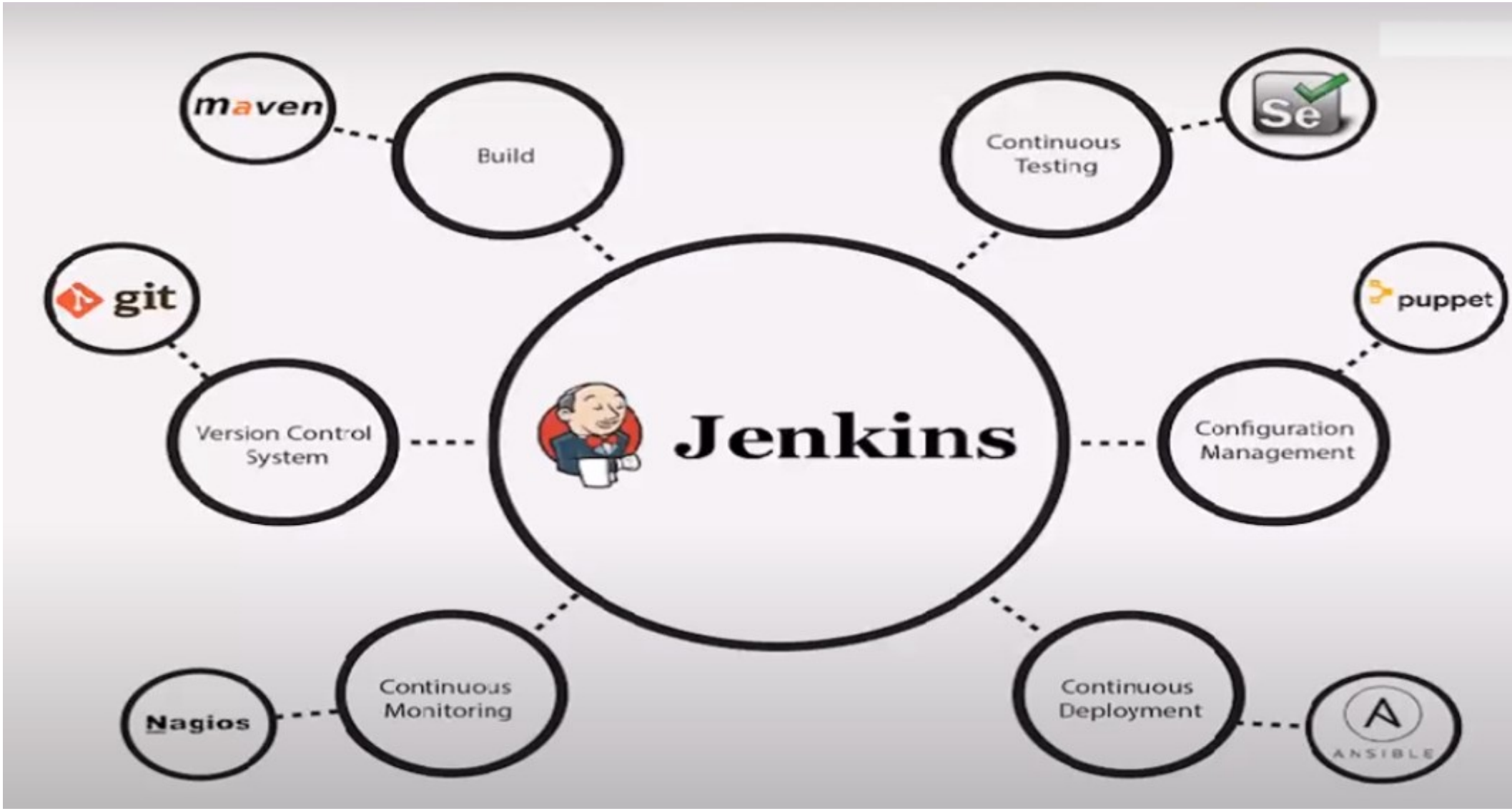

Commit Changes To The Source Code
Feedback
Continuous Integration Server
Build The Code
Test
Deploy

CI Benefits

- Immediate bug detection
- No integration step in the lifecycle
- A deployable system at any given point
- Record of evolution of the project

CI Tools

- Code Repositories
  - SVN, Mercurial, Git
- Continuous Build Systems
  - Jenkins, Bamboo, Cruise Control
- Test Frameworks
  - JUnit, Cucumber, CppUnit


maven
Build
Continuous Testing
Se
git
puppet
Version Control System
Jenkins
Configuration Management
Nagios
Continuous Monitoring
Continuous Deployment
ANSIBLE

What is Jenkins

- Jenkins is the leading open source continuous integration tool.
- Jenkins was originally developed as the Hudson project. Hudson's creation started in summer of 2004 at Sun Microsystems.
- In November 2010, an issue arose in the Hudson community with respect to the infrastructure used. Negotiations were held between the principal project contributors and Oracle; a key sticking point was the control of the name "Hudson" itself, which Oracle claimed, and on January 11, 2011, a proposal was made to change the project name from "Hudson" to "Jenkins"

Installing and Configuring Jenkins

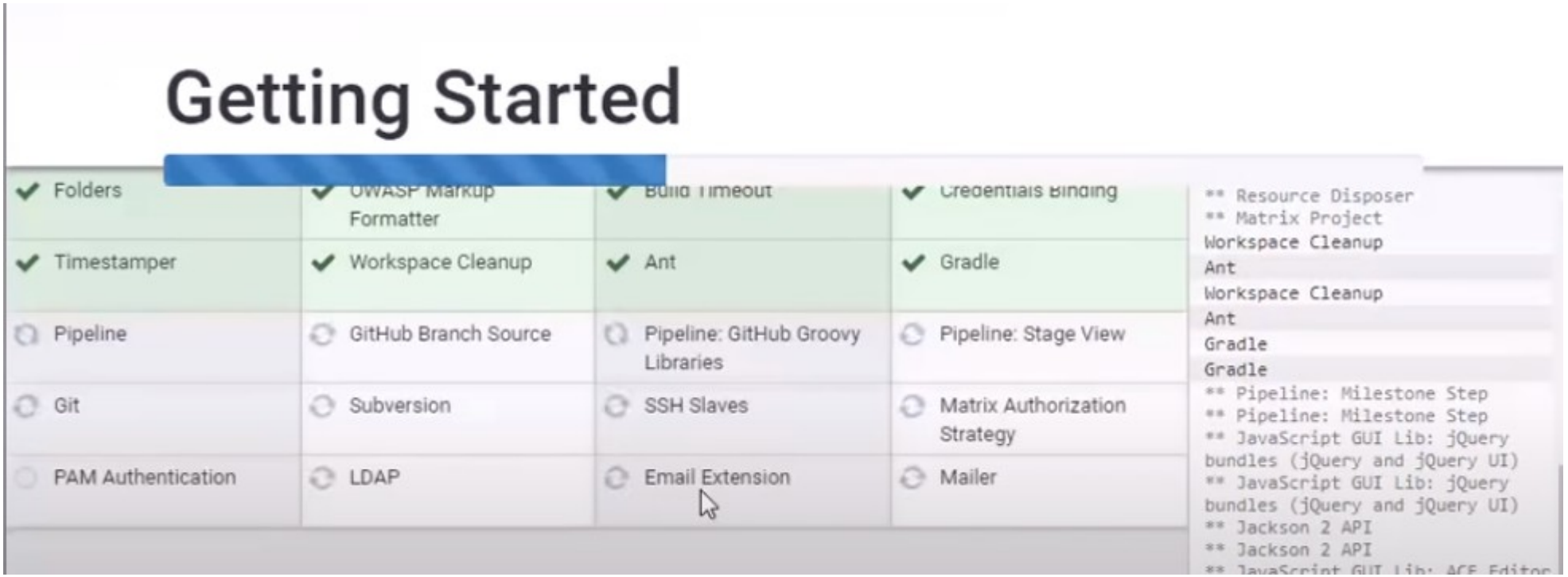
- Download Jenkins: Open the official website of Jenkins :

  https://jenkins.io/index.html

- After downloading, from the command prompt, browse to the directory where the jenkins.war file is present. Run the following command:

  java -jar jenkins.war

- Extraction of the war file is done by an embedded webserver called winstone.
- Jenkins by default runs on port 8080, but we can run it on different port by issuing following command: java -jar jenkins.war --httpPort=8181


Getting Started
Folders
OWASP Markup Formatter
Build Timeout
Credentials Binding
Timestamper
Workspace Cleanup
Ant
Gradle
Pipeline
GitHub Branch Source
Pipeline: GitHub Groovy Libraries
Pipeline: Stage View
Git
Subversion
SSH Slaves
Matrix Authorization Strategy
PAM Authentication
LDAP
Email Extension
Mailer
** Resource Disposer
** Matrix Project
Workspace Cleanup
Ant
Workspace Cleanup
Ant
Gradle
Gradle
** Pipeline: Milestone Step
** Pipeline: Milestone Step
** JavaScript GUI Lib: jQuery bundles (jQuery and jQuery UI)
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** Jackson 2 API
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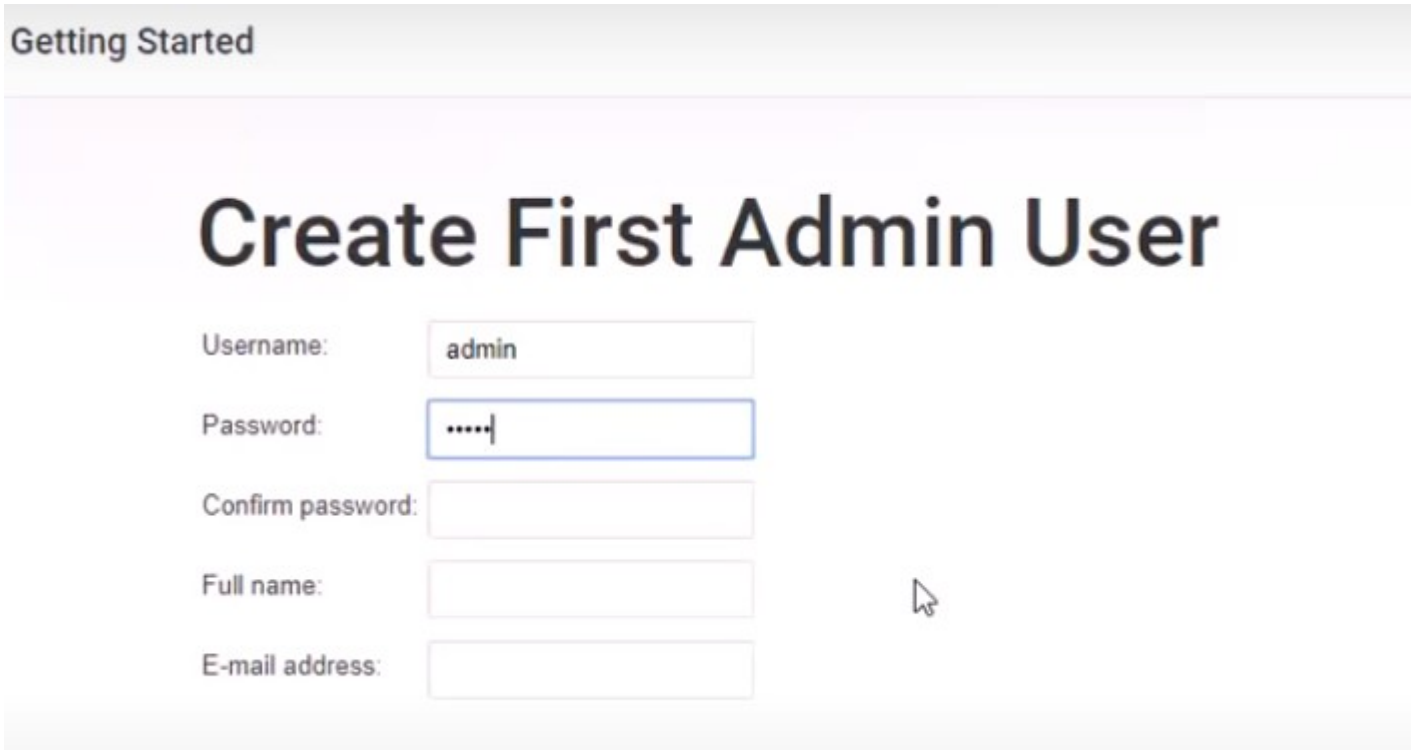

Getting Started
Create First Admin User
Username:
admin
Password:
Confirm password:
Full name:
E-mail address:

Enter an item name

springmvc2

» *Required field*

Freestyle project

This is the central feature of Jenkins. Jenkins will build your project, combining any SCM with any build system, and this can be even used for something other than software build.

Pipeline

Orchestrates long-running activities that can span multiple build agents. Suitable for building pipelines (formerly known as workflows) and/or organizing complex activities that do not easily fit in free-style job type.

Multi-configuration project

Suitable for projects that need a large number of different configurations, such as testing on multiple environments, platform-specific builds, etc.

Folder

Creates a container that stores nested items in it. Useful for grouping things together. Unlike view, which is just a filter, a folder creates a

Jenkins Job to Deploy Spring App in Tomcat Server

- Download and Install Tomcat Server
- Change Tomcat Server Port Number (If Required) in server.xml file
- Configure User with manager-script role in tomcat-user.xml file
- Start Tomcat server and Open Tomcat Server Admin Console
- Install Deploy Container Plugin in Jenkins
- Re-Start Jenkins Server to Reflect Container Plugin
- Create Jenkins Job to Deploy Application into Tomcat Server

Jenkins Pipeline

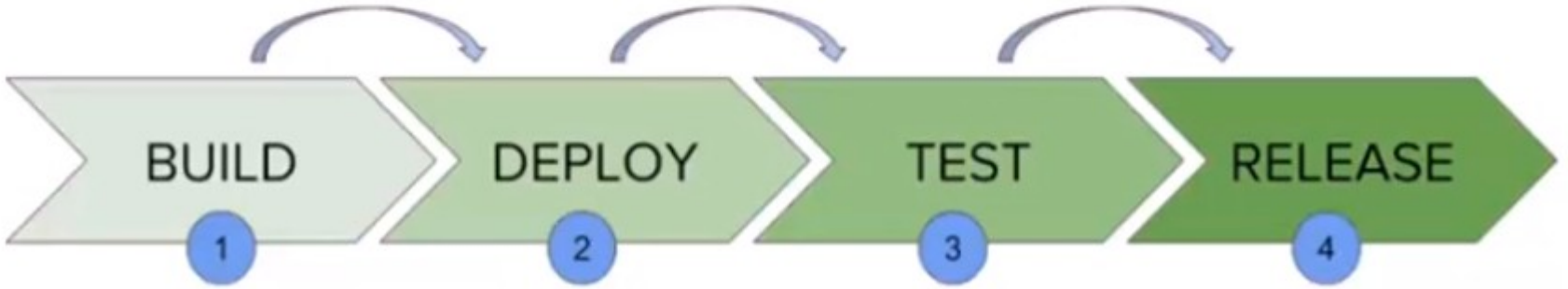
- In Jenkins, a pipeline is a group of events or jobs which are interlinked with one another in a sequence.
- In simple words, Jenkins Pipeline is a combination of plugins that support the integration and implementation of continuous delivery pipelines using Jenkins

Types of Pipelines

- Build Plugin Pipeline
- Declarative Pipeline
- Scripted Pipeline

What is Continuous Delivery Pipelines? How it Works?

In a Jenkins pipeline, every job or event has some sort of dependency on at least one or more events.

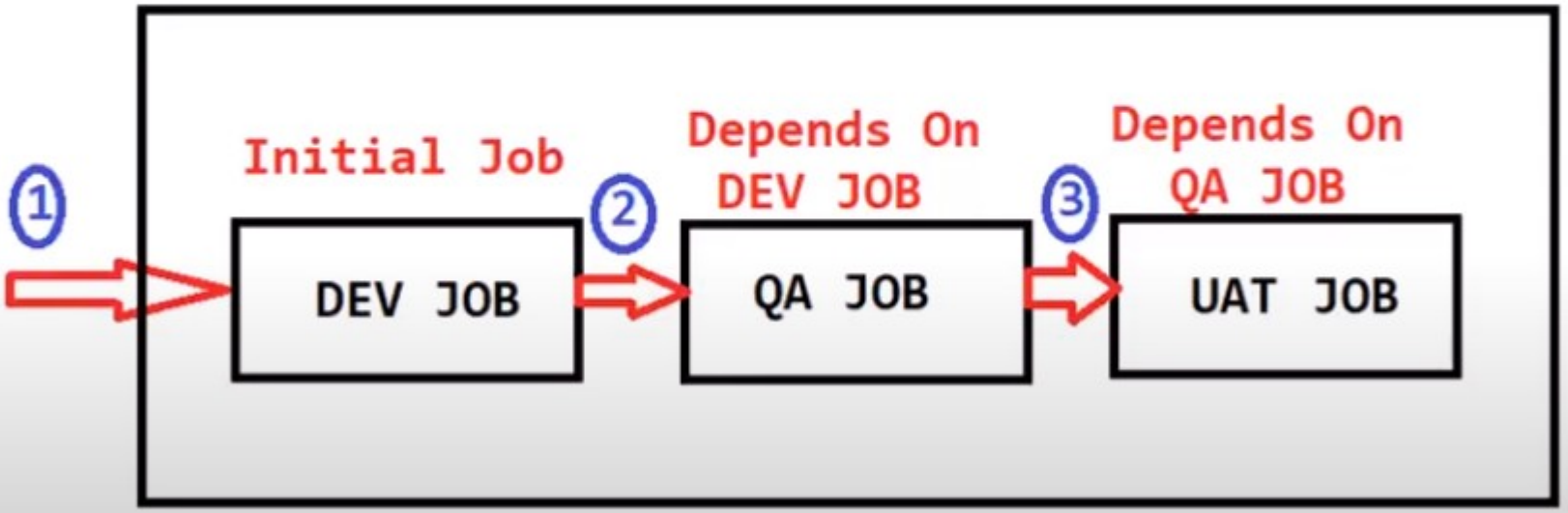


Install Build Pipeline Plugin in Jenkins

- With the build pipeline plugin, you can create a pipeline view of incoming and outgoing jobs, and create triggers which require manual intervention.
- Here is how you can install the build pipeline plugin in your Jenkins:

Step 1) The settings for the plugin can be found under **Manage Jenkins > Manage Plugins.**

Pipeline Creation Overview



Jenkins Pipeline

What is Pipeline?

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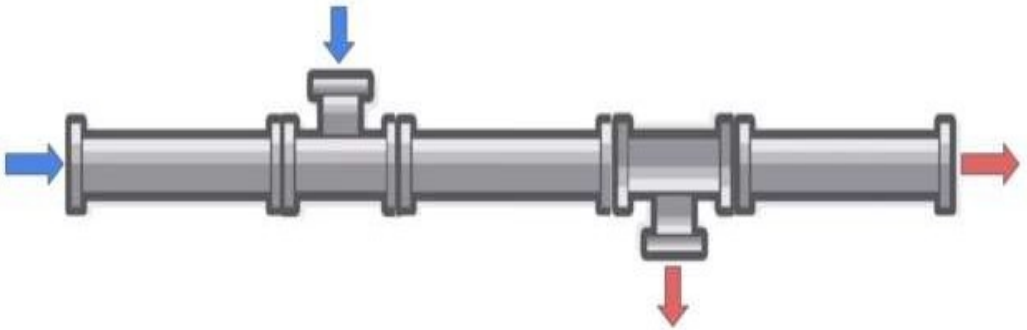
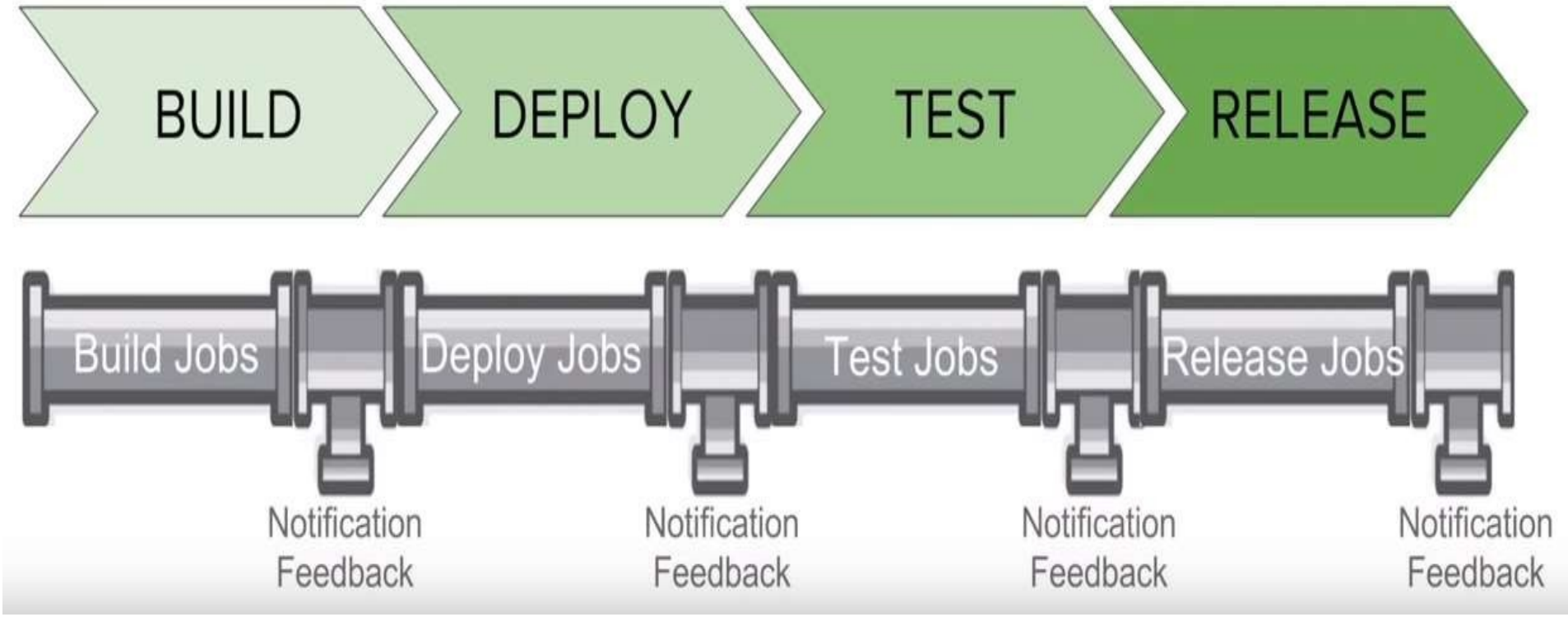
Pipe



Pipeline


BUILD
DEPLOY
TEST
RELEASE
Build Jobs
Deploy Jobs
Test Jobs
Release Jobs
Notification Feedback
Notification Feedback
Notification Feedback
Notification Feedback

How to setup BUILD PIPELINE in Jenkins

Step1: Chain required jobs in sequence Add upstream/downstream jobs Step2: Install *Build Pipeline Plugin*

Step3: Add

Build Pipeline View Configure the view Step

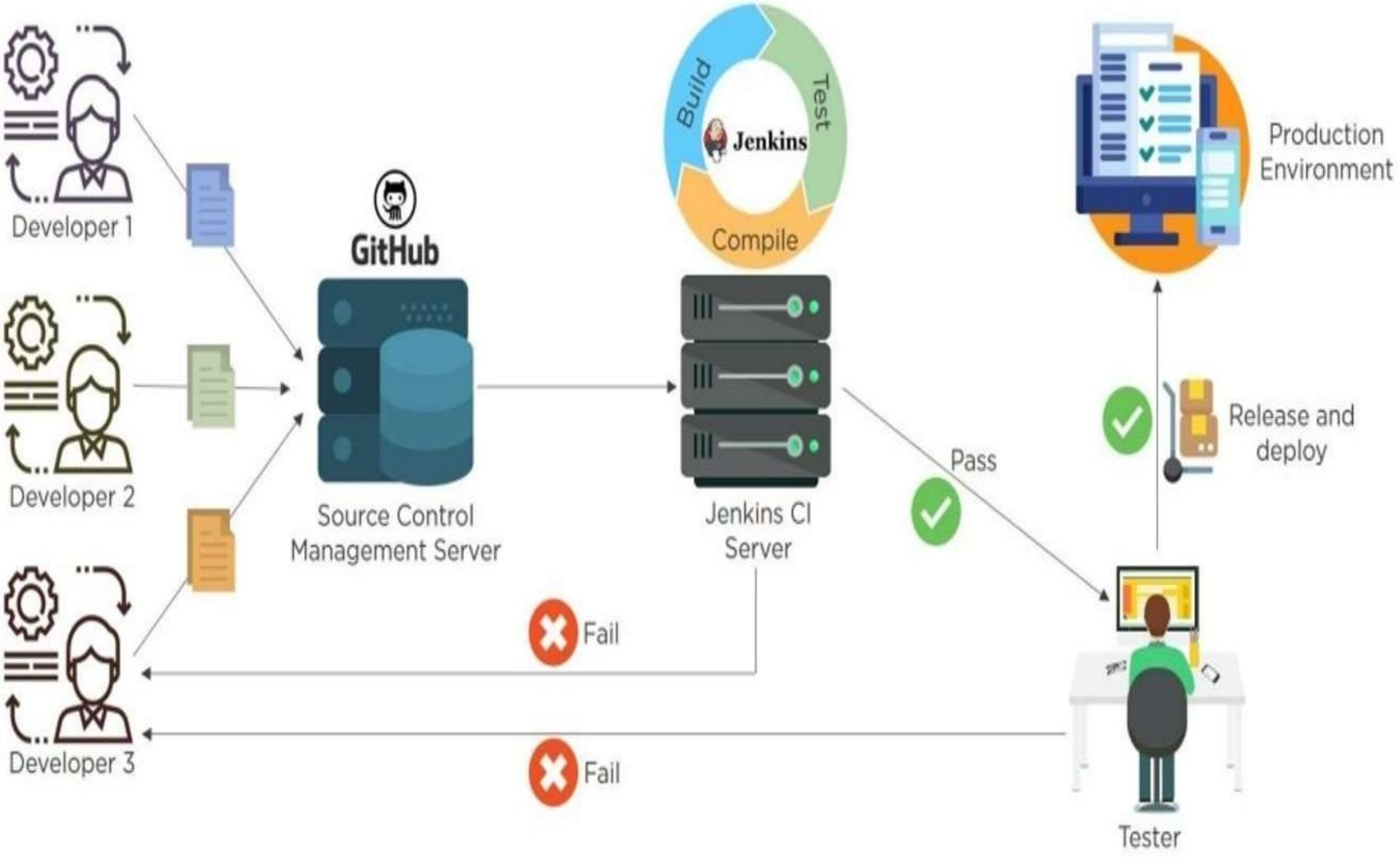
Step4: Run and Validate

How to Build Pipelines with Groovy Script

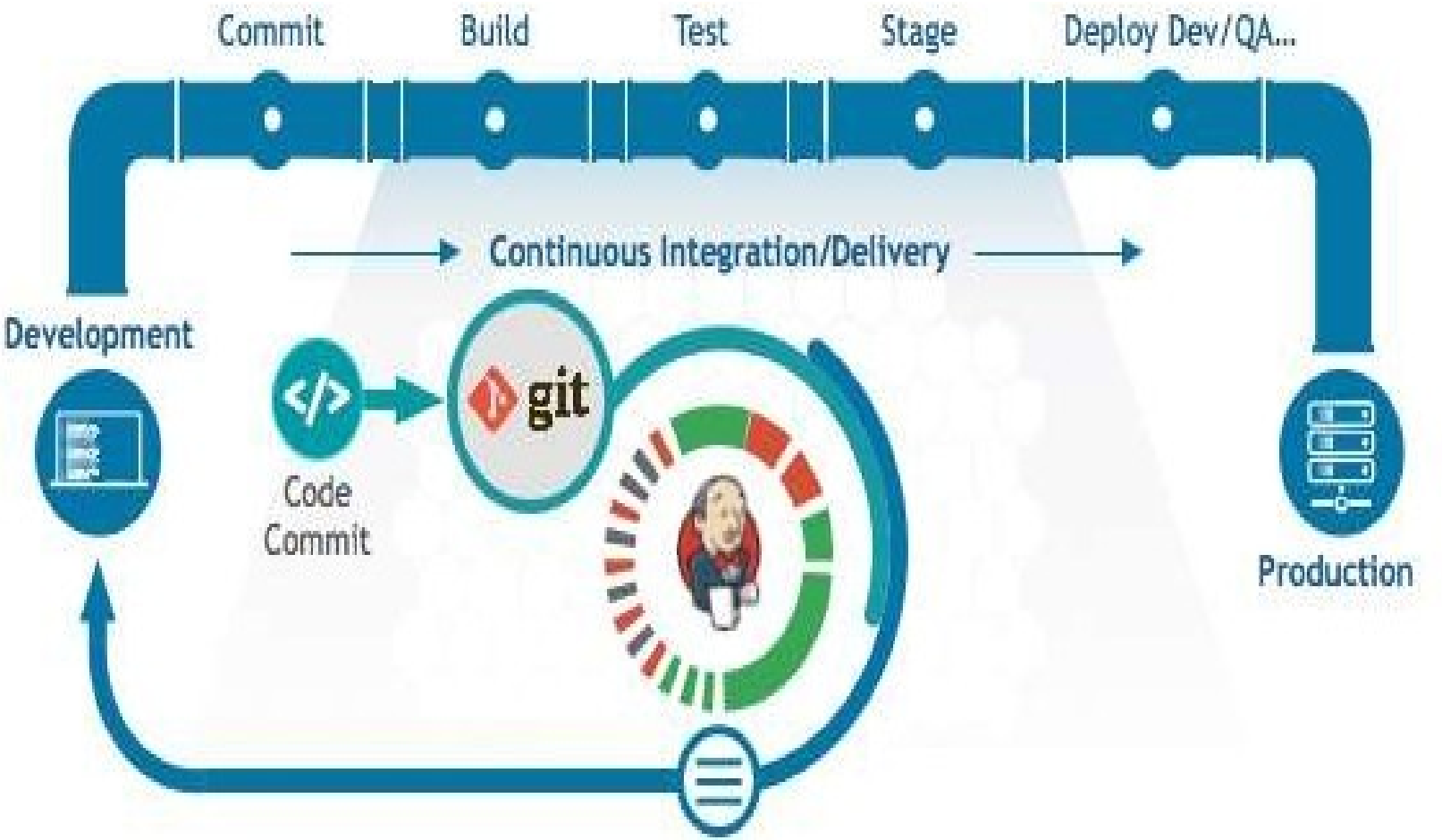
Agenda

- CI & CD
- What is Jenkins Pipeline?
- How many ways we can create Pipeline?
- Create Jenkins Pipeline using Groovy Script / Jenkins File

CI & CD


Developer 1
Developer 2
Developer 3
GitHub
Source Control
Management Server
Build
Test
Compile
Jenkins
Jenkins CI
Server
Pass
Fail
Fail
Production
Environment
Release and
deploy
Tester

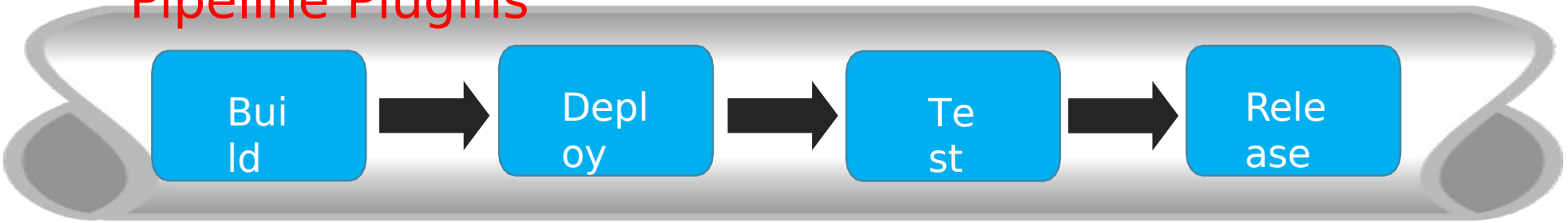
Jenkins Pipeline



How many Ways we can create Pipeline

- We can Create Jenkins Pipeline in 2 Ways
- 1) Using **Build And Delivery Pipeline Plugins**
- **2) Using Groovy Script on the Fly(Here we use Jenkins file)**
  - Scripted
  - Declarative

Build And Delivery Pipeline Plugins



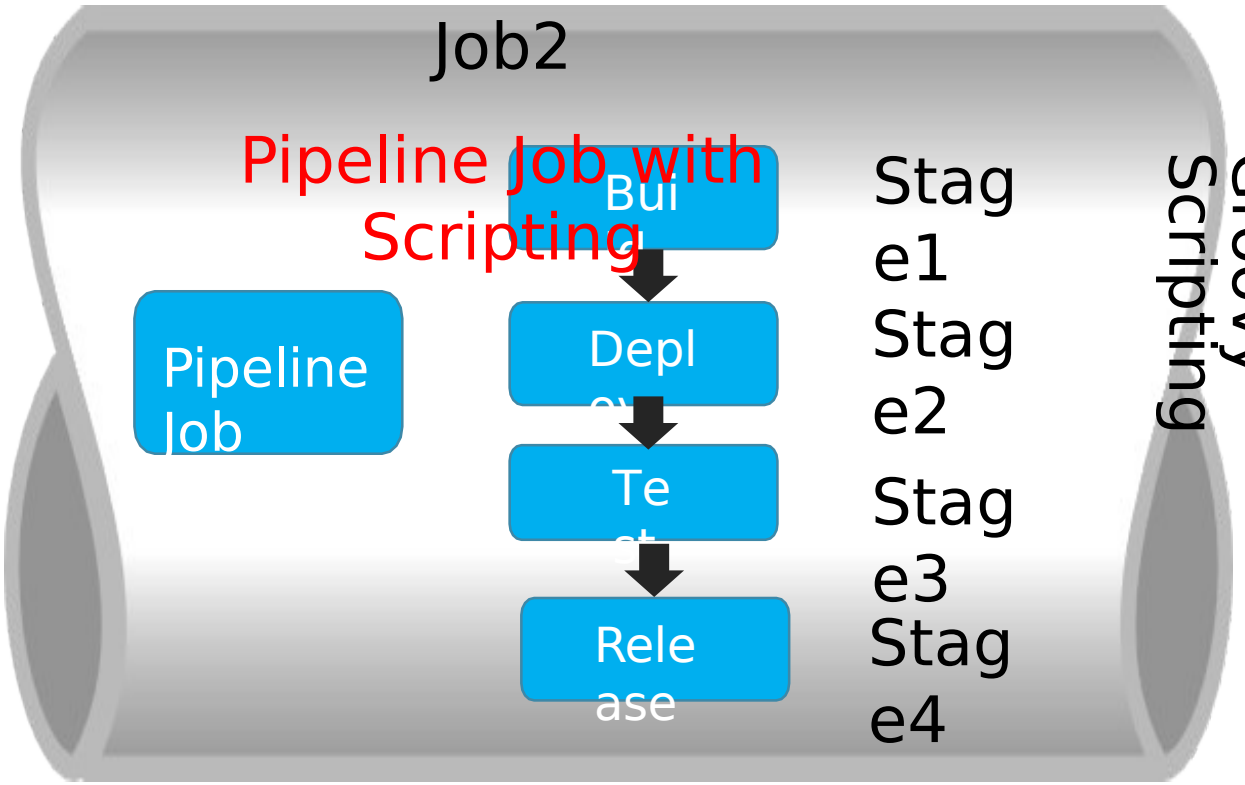
Job1

Job 3

Job 4

Job2

Pipeline Job with Scripting



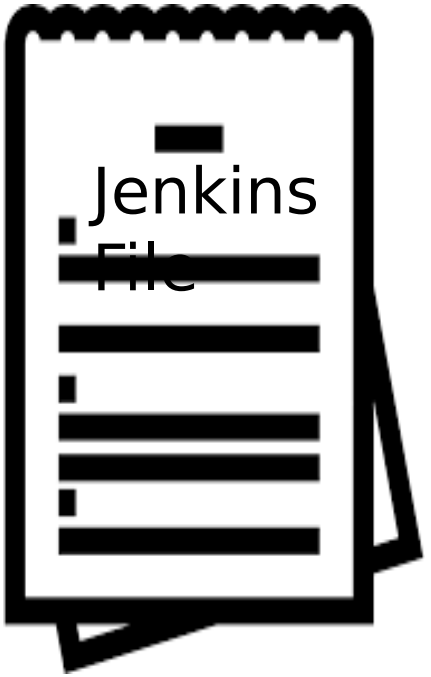
Stage1

Stage2

Stage3

Stage4

Groovy Scripting



Types of Pipeline

- Scripted Pipeline
- Declarative Pipeline

Pipeline concepts

- Pipeline
- A Pipeline is a user-defined model of a CD pipeline. A Pipeline's code defines your entire build process, which typically includes stages for building an application, testing it and then delivering it.
- Also, ***a pipeline block is a key part of Declarative Pipeline syntax***.
- Node
- A node is a machine which is part of the Jenkins environment and is capable of executing a Pipeline.
- Also, ***a node block is a key part of Scripted Pipeline syntax.***
- Stage
- A stage block defines a conceptually distinct subset of tasks performed through the entire Pipeline (e.g. "Build", "Test" and "Deploy" stages), which is used by many plugins to visualize or present Jenkins Pipeline status/progress.
- Step
- A single task. Fundamentally, a step tells Jenkins what to do at a particular point in time (or "step" in the process). For example, to execute the shell command make use the sh step: sh 'make'. When a plugin
  extends the Pipeline DSL, that typically means the plugin has implemented a new step.

Scripted Pipeline

Jenkinsfile (Scripted Pipeline)

```
node { 1
    stage('Build') { 2
        // 3
    }
    stage('Test') { 4
        // 5
    }
    stage('Deploy') { 6
        // 7
    }
}
```

1. Execute this Pipeline or any of its stages, on any available agent.
2. Defines the "Build" stage. `stage` blocks are optional in Scripted Pipeline syntax. However, implementing `stage` blocks in a Scripted Pipeline provides clearer visualization of each `stage's subset of tasks/steps in the Jenkins UI.
3. Perform some steps related to the "Build" stage.
4. Defines the "Test" stage.
5. Perform some steps related to the "Test" stage.
6. Defines the "Deploy" stage.
7. Perform some steps related to the "Deploy" stage.

Pipeline syntax

Declarative pipeline

```
Pipeline {
        agent any
        stages {
                stage("build"){
                        steps {
                        }
                }
        }
}
```

Top-level

Where to build

Where work happens

What to do

Jenkins file

- Jenkinsfile is a text file that contains the definition of a Jenkins Pipeline and is checked into source control.
- https://jenkins.io/doc/book/pipeline/jenkinsfile/

Declarative Pipeline

Jenkinsfile (Declarative Pipeline)

```
pipeline {
    agent any (1)
    stages {
        stage('Build') { (2)
            steps {
                // (3)
            }
        }
        stage('Test') { (4)
            steps {
                // (5)
            }
        }
        stage('Deploy') { (6)
            steps {
                // (7)
            }
        }
    }
}
```

1. Execute this Pipeline or any of its stages, on any available agent.
2. Defines the "Build" stage.
3. Perform some steps related to the "Build" stage.
4. Defines the "Test" stage.
5. Perform some steps related to the "Test" stage.
6. Defines the "Deploy" stage.
7. Perform some steps related to the "Deploy" stage.