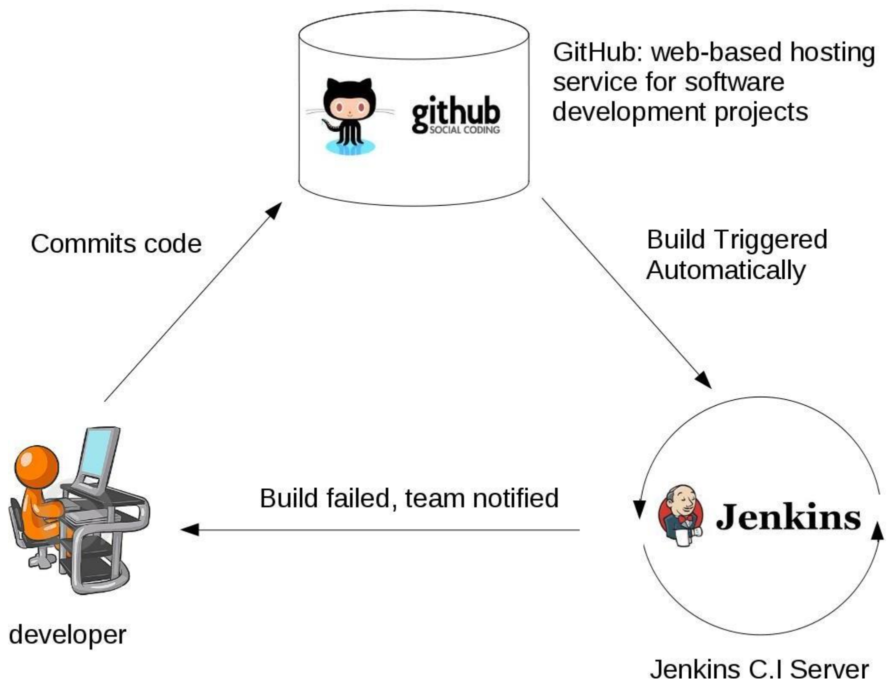
Continuous Integration

- What is Continuous Integration?
- Why do we need it?
- Different phases of adopting Continuous Integration


GitHub: web-based hosting service for software development projects
github SOCIAL CODING
Commits code
Build Triggered Automatically
Build failed, team notified
Jenkins
developer
Jenkins C.I Server

What is Continuous Integration?

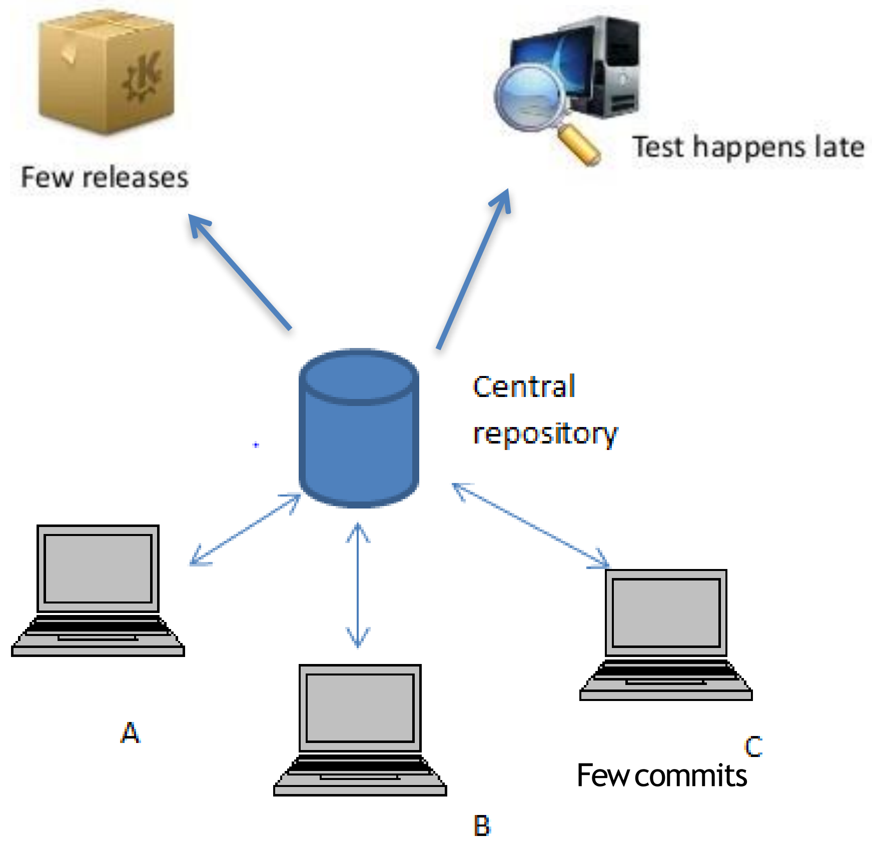
- Developers commit code to a shared repository on a regular basis.
- Version control system is being monitored. When a commit is detected, a build will be triggered automatically.
- If the build is not green, developers will be notified immediately.

Why do we need Continuous Integration?

- Detect problems or bugs, as early as possible, in the development life cycle.
- Since the entire code base is integrated, built and tested constantly , the potential bugs and errors are caught earlier in the life cycle which results in better quality software.

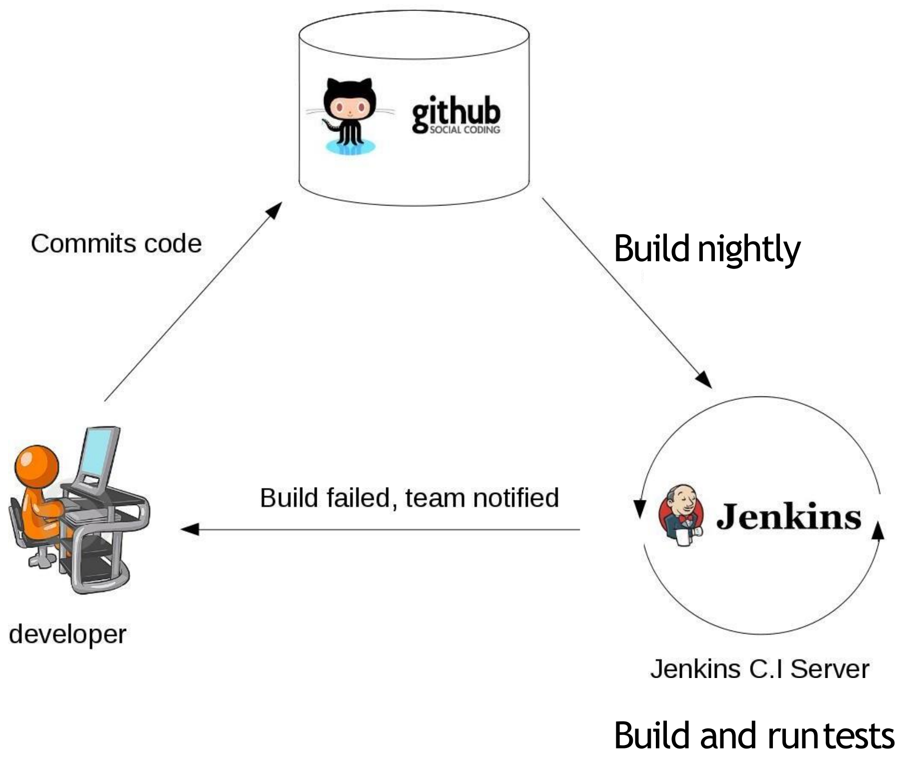
Different stages of adopting Continuous Integration

Jenkins



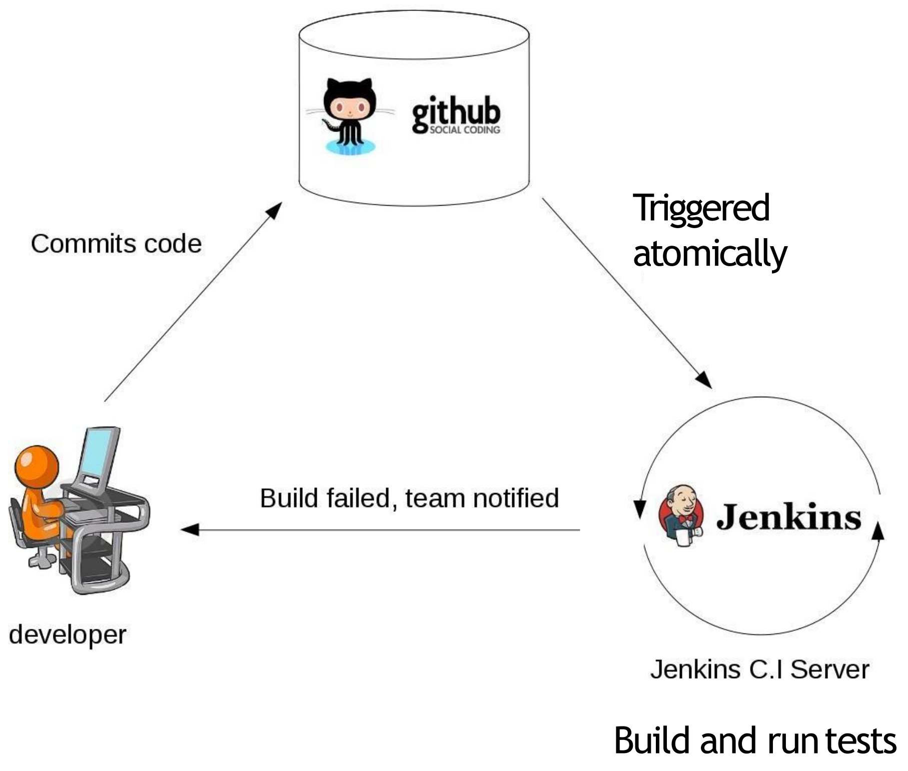
Stage 1:

- No build servers.
- Developers commit on a regular basis.
- Changes are integrated and tested manually.
- Fewer releases.



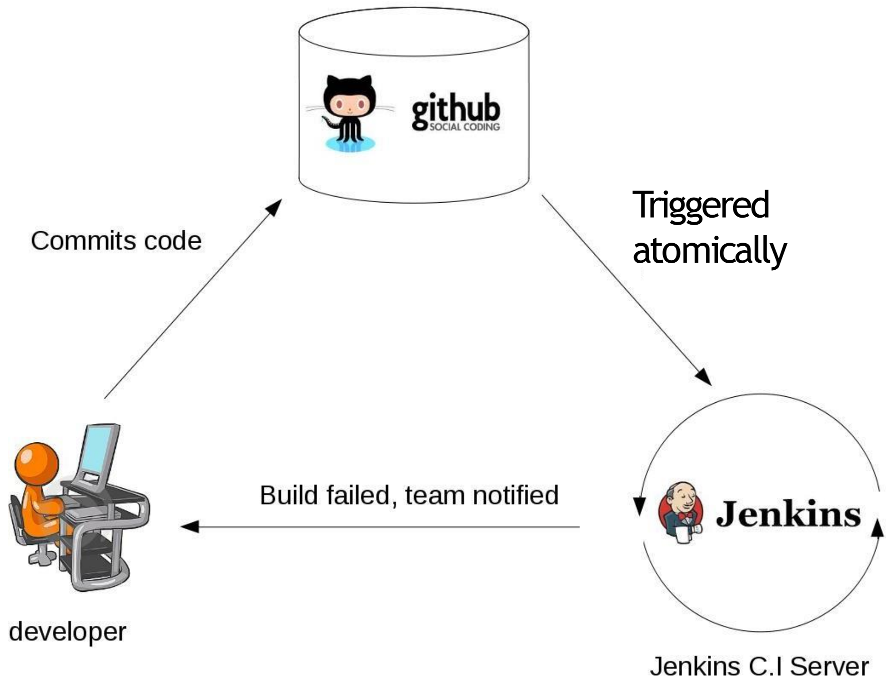
Stage 2:

- Automated builds are scheduled on a regular basis.
- Build script compiles the application and runs a set of automated tests.
- Developers now commit their changes regularly.
- Build servers would alert the team members in case of build failure.



Stage 3:

- Abuild is triggered whenever new code is committedto the central repository.
- Broken builds are usually treated as a high priority issue and are fixedquickly.



Build, run code quality and code coverage metrics along with tests

Stage 4:

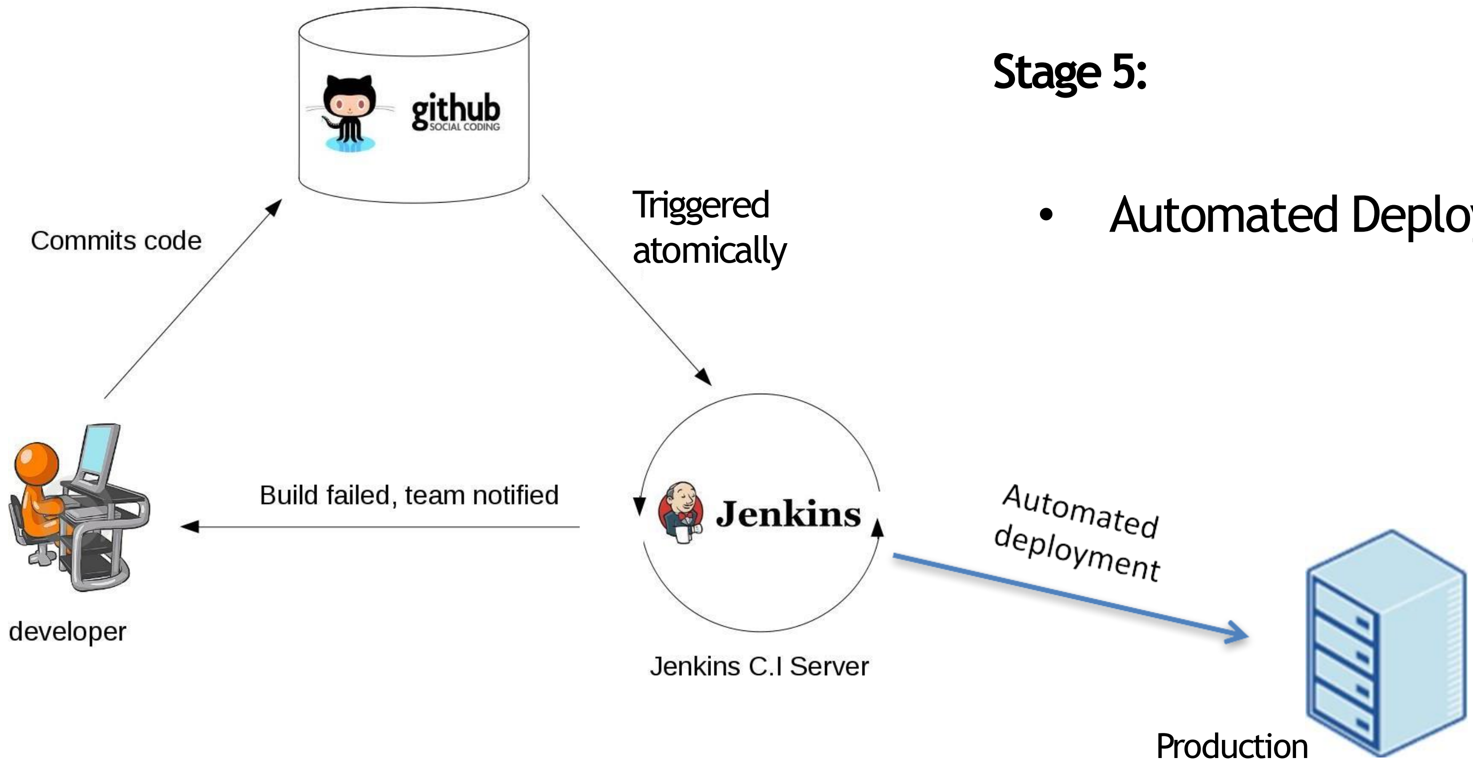
- Automated code quality and code coverage metrics are now run along with unit tests to continuously evaluate the code quality.

Is the code coverage increasing?

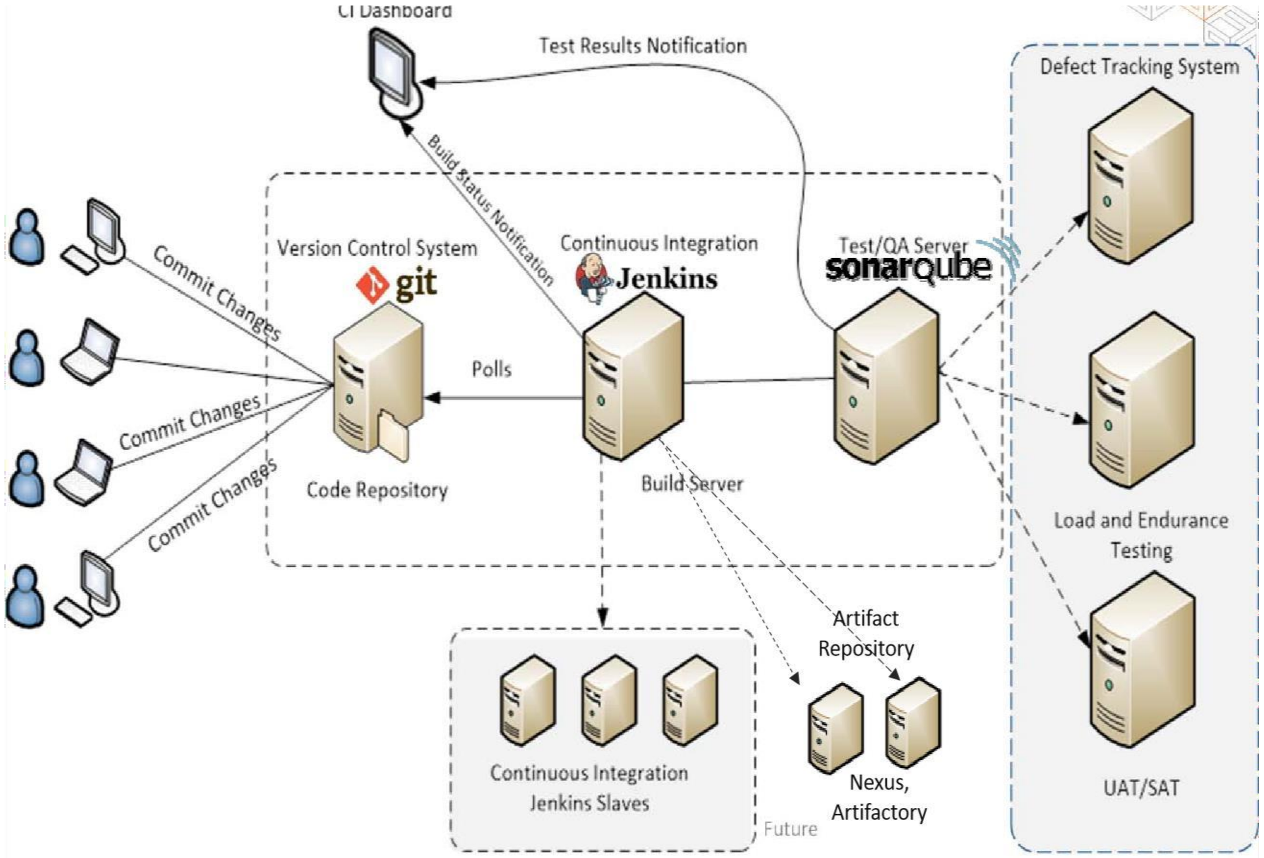
Do we have fewer and fewer build failures?

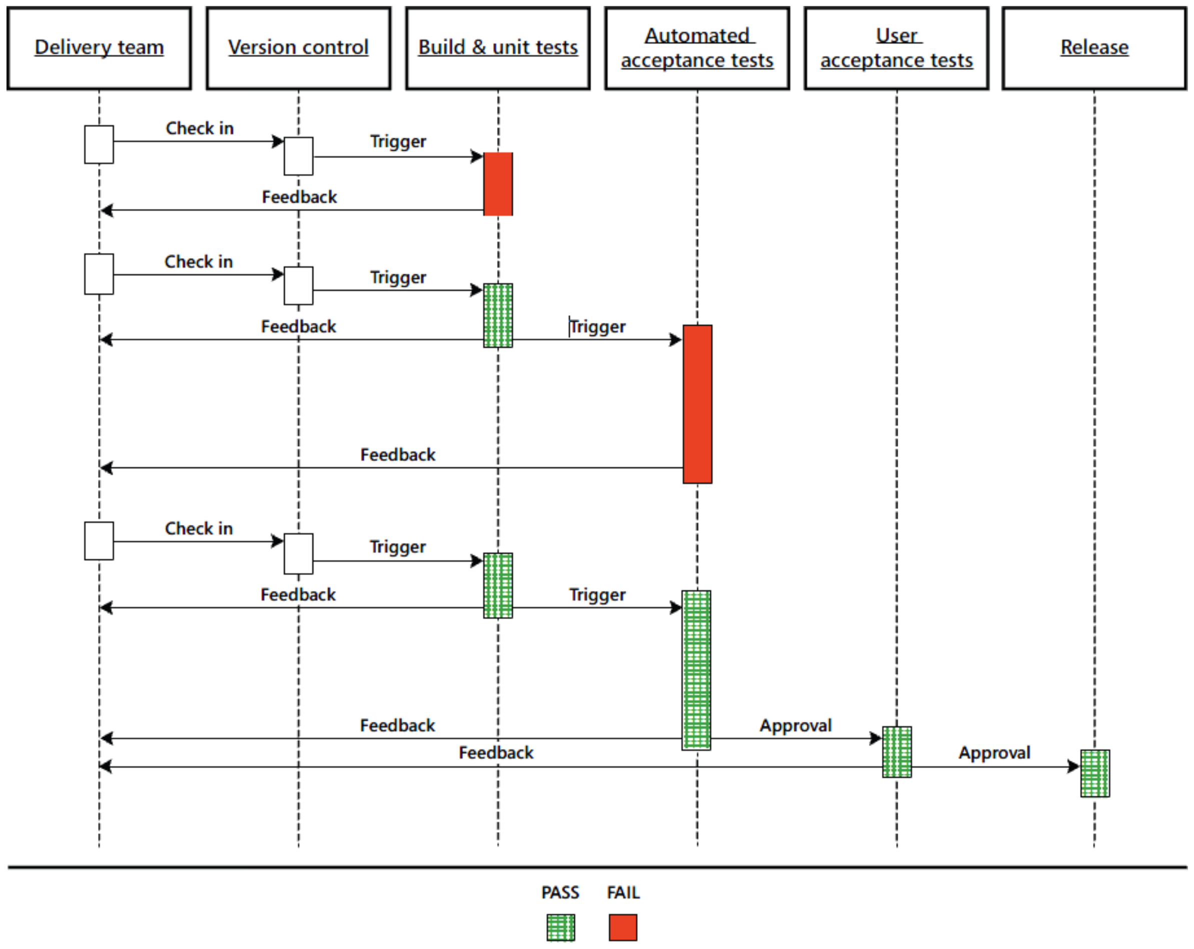
Stage 5:

- Automated Deployment



CI/CD Environment




Delivery team
Version control
Build & unit tests
Automated acceptance tests
User acceptance tests
Release
Check in
Trigger
Feedback
Check in
Trigger
Feedback
Trigger
Feedback
Check in
Trigger
Feedback
Trigger
Feedback
Approval
Feedback
Approval
PASS
FAIL

Continuous Integration
Continuous Delivery
Continuous Deployment

- **Continuous Integration**

  The practice of merging development work with the main branch constantly.

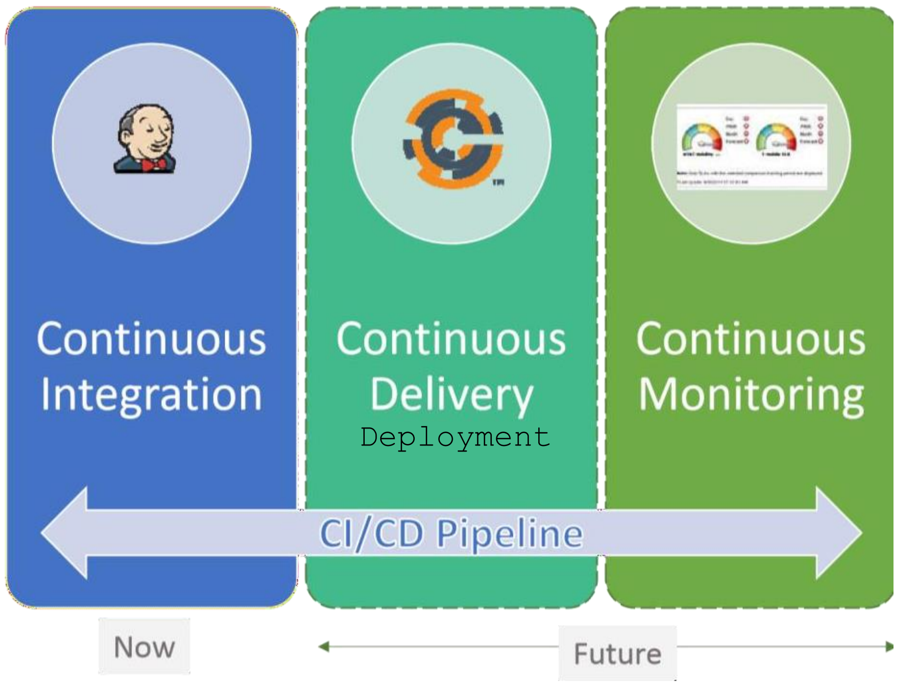
- **Continuous Delivery**

  Continual delivery of code to an environment once the code is ready to ship. This could be staging or production. The idea is the product is delivered to a user base, which can be QAs or customers for review and inspection.

- **Continuous Deployment**

  The deployment or release of code to production as soon as it is ready.

DevOps


Continuous Integration
Continuous Delivery
Deployment
Continuous Monitoring
CI/CD Pipeline
Now
Future

How to implement Continuous Integration?

circleci

Non-hosted solutions

Hosted solutions

Continuous Integration is also amindset

- Fixing broken builds should be treated as a high priority issue for all team members.

- The deployment process should be automated, with no manual steps involved.

- All team members should focus on contributing to high-quality tests because the confidentiality of the CI process highly depends on the quality of the tests.

What is Jenkins

- Jenkins is a continuous integration and build server.
- It is used to manually, periodically, or automatically build software development projects.
- It is an open source Continuous Integration tool written in Java.
- Jenkins is used by teams of all different sizes, for projects with various languages.

Why Jenkins is popular

- Easy to use
- Great extensibility
  - Support different version control systems
  - Code quality metrics
  - Build notifiers
  - UI customization

Plugins by topic

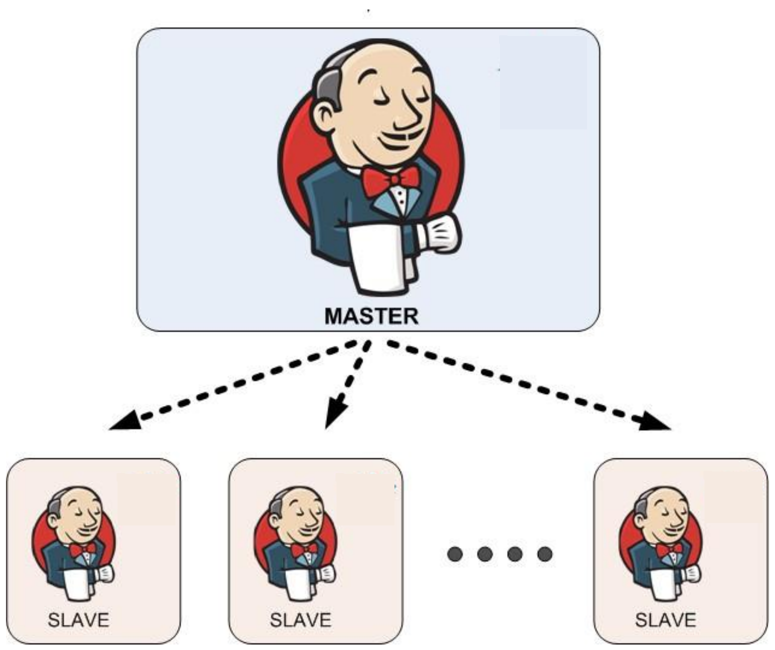
Source code management

Jenkins has native support for Subversion and CVS as well as the following plugins:

- AccuRev Plugin — This plugin allows you to use AccuRev as a SCM.
- Anchore Container Image Scanner Plugin — Allows users to add a build step to run the Anchore container image scanner.
- archive-files-scm-plugin — ArchiveFilesSCM - This plugin for Jenkins checkouts archive files and extracts to Jenkins job workspace
- AWS CodePipeline Plugin — AWS CodePipeline is a continuous delivery service for fast and reliable application updates.
- Bazaar Plugin — This plugin integrates Bazaar version control system to Jenkins. The plugin requires the Bazaar binary (bzr) to be installed on the target machine.
- Bitbucket Branch Source Plugin — Multibranch projects and Team/Project folders from Bitbucket Cloud and Server. Please note that this plugin requires a server running BitBucket 4.0 or later; Stash 3.x and earlier are not supported.
- BitKeeper Plugin — Add BitKeeper support to Jenkins
- BlameSubversion — This plug-in provides utilities for getting svn info from upstream job to downstream job
- ClearCase Plugin — Integrates Jenkins with ClearCase.
- ClearCase UCM Baseline Plugin — Allows using ClearCase UCM baselines as the input of builds: When using this SCM, users will be asked at build-time to select the baseline on which the job has to work.
- ClearCase UCM Plugin — A Praqmatic integration to ClearCase UCM, simplifying continuous integration with Jenkins.
- Clone Workspace SCM Plugin — This plugin makes it possible to archive the workspace from builds of one project and reuse them as the SCM source for another project.
- CMVC Plugin — This plugin integrates CMVC to Hudson.
- Compuware Source Code Download for Endevor, PDS, and ISPW Plugin — The Compuware Source Code Download for Endevor, PDS, and ISPW plugin allows Jenkins users to download Endevor, PDS, or ISPW members from the mainframe to the PC.
- Config Rotator Plugin
- CVS Plugin — This bundled plugin integrates Jenkins with CVS version control system.
- Darcs Plugin — This plugin integrates Darcs version control system to Jenkins. The plugin requires the Darcs binary (darcs) to be installed on the target machine.
- Dimensions Plugin — This plugin integrates the Serena Dimensions CM SCM with Jenkins.
- File System SCM — Use File System as SCM.

- Jenkins' Master and Slave Architecture
- Some Important Jenkins' Terminologies

Jenkins' Master and Slave Architecture



Master:
- Schedule build jobs.
- Dispatch builds to the slaves for the actual job execution.
- Monitor the slaves and record the build results.
- Can also execute build jobs directly.

Slave:
- Execute build jobs dispatched by the master.

Jenkins UI Overview

Install GIT and GitHub plugin

Jenkins

Install and Configure Maven

What does Maven do?

- Maven describes how the software is built.
- Maven describes the project’sdependencies.

Java Build Tools

Maven™

gradle

<APACHE ANT>

Configure Jenkins for a Maven -based project

Create a Maven -based Jenkins project

Run Maven-based Jenkins project

Maven pom.xml file

- Describe the software project being built, including
  - The dependencies on other external modules.
  - The directory structures.
  - The required plugins.
  - The predefined targets for performing certain tasks such as compilation and packaging.

Different Phases in Maven Build Lifecycle

validate	Validate the project is correct and all necessary information is available.
compile	Compile the source code of the project.
test	Test the compiled source code using a suitable unit testing framework.
package	Take the compiled code and package it in its distributable format.
verify	Run any checks on results of integration tests to ensure quality criteria are met.
install	Install the package into the local repository, for use as a dependency in other projects locally.
deploy	Copy the final package to the remote repository for sharing with other developers and projects.

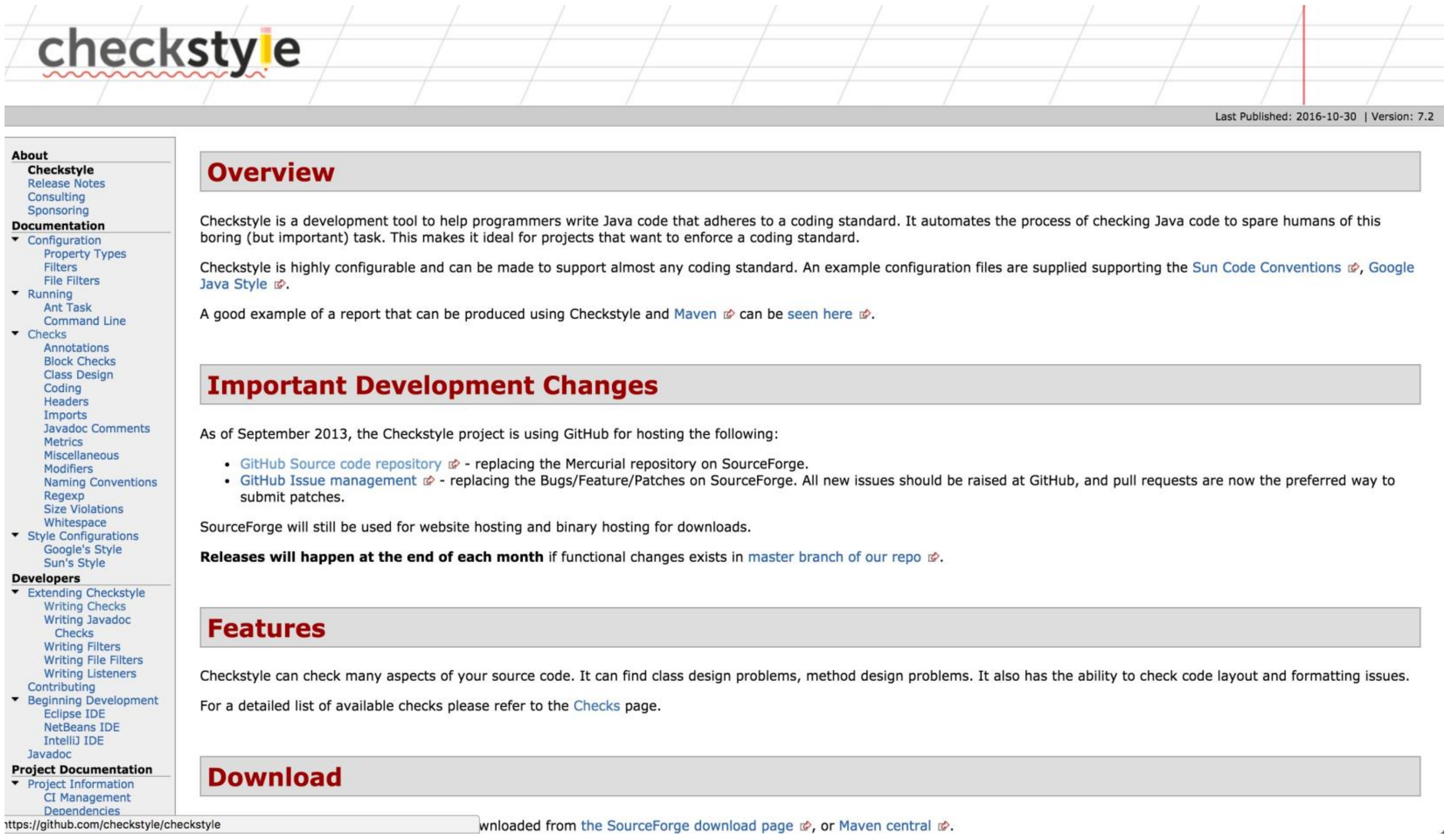
Maven Build Phases

- These lifecycle phases are executed sequentially to complete the default lifecycle.

- We want to specify the maven package command, this command would execute each default life cycle phase in order including validate, compile, test before executing package.

- We only need to call the last build phase to be executed.

Jenkins code quality metrics report


checkstyle

Last Published: 2016-10-30 | Version: 7.2

About
- Checkstyle
- Release Notes
- Consulting
- Sponsoring

Documentation
- Configuration
  - Property Types
  - Filters
  - File Filters
- Running
  - Ant Task
  - Command Line
- Checks
  - Annotations
  - Block Checks
  - Class Design
  - Coding
  - Headers
  - Imports
  - Javadoc Comments
  - Metrics
  - Miscellaneous
  - Modifiers
  - Naming Conventions
  - Regexp
  - Size Violations
  - Whitespace
- Style Configurations
  - Google's Style
  - Sun's Style

Developers
- Extending Checkstyle
  - Writing Checks
  - Writing Javadoc Checks
  - Writing Filters
  - Writing File Filters
  - Writing Listeners
- Contributing
- Beginning Development
  - Eclipse IDE
  - NetBeans IDE
  - IntelliJ IDE
- Javadoc

Project Documentation
- Project Information
  - CI Management
  - Dependencies

Overview

Checkstyle is a development tool to help programmers write Java code that adheres to a coding standard. It automates the process of checking Java code to spare humans of this boring (but important) task. This makes it ideal for projects that want to enforce a coding standard.

Checkstyle is highly configurable and can be made to support almost any coding standard. An example configuration files are supplied supporting the Sun Code Conventions, Google Java Style.

A good example of a report that can be produced using Checkstyle and Maven can be seen here.

Important Development Changes

As of September 2013, the Checkstyle project is using GitHub for hosting the following:

- GitHub Source code repository - replacing the Mercurial repository on SourceForge.
- GitHub Issue management - replacing the Bugs/Feature/Patches on SourceForge. All new issues should be raised at GitHub, and pull requests are now the preferred way to submit patches.

SourceForge will still be used for website hosting and binary hosting for downloads.

Releases will happen at the end of each month if functional changes exists in master branch of our repo.

Features

Checkstyle can check many aspects of your source code. It can find class design problems, method design problems. It also has the ability to check code layout and formatting issues.

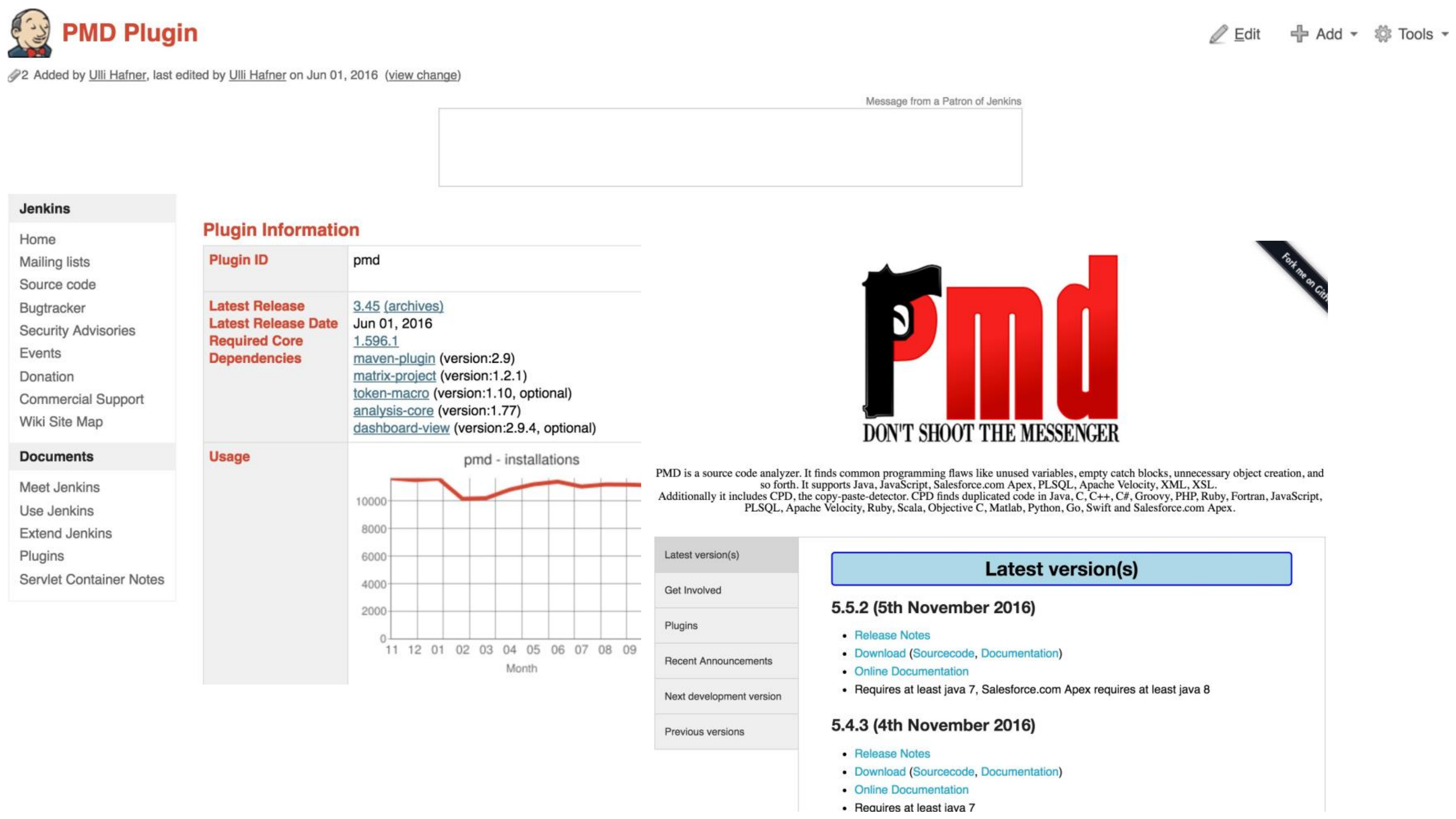
For a detailed list of available checks please refer to the Checks page.

Download

https://github.com/checkstyle/checkstyle wnloaded from the SourceForge download page, or Maven central.

Checkstyle is a code static analysis tool to help programmers to write Java code that adheres to a coding standard such as

- Avoiding multiple blank lines;
- Removing unused variables;
- Enforcing correct indentations;
- …



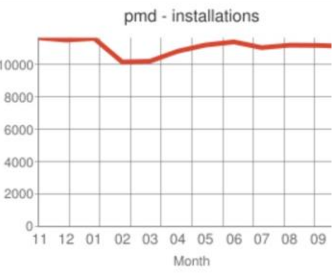
PMD Plugin

Edit Add Tools

2 Added by Ulli Hafner, last edited by Ulli Hafner on Jun 01, 2016 (view change)

Message from a Patron of Jenkins

Plugin Information

Plugin ID	pmd
Latest Release	3.45 (archives)
Latest Release Date	Jun 01, 2016
Required Core	1.596.1
Dependencies	maven-plugin (version:2.9) matrix-project (version:1.2.1) token-macro (version:1.10, optional) analysis-core (version:1.77) dashboard-view (version:2.9.4, optional)
Usage	

PMD is a source code analyzer. It finds common programming flaws like unused variables, empty catch blocks, unnecessary object creation, and so forth. It supports Java, JavaScript, Salesforce.com Apex, PLSQL, Apache Velocity, XML, XSL.
Additionally it includes CPD, the copy-paste-detector. CPD finds duplicated code in Java, C, C++, C#, Groovy, PHP, Ruby, Fortran, JavaScript, PLSQL, Apache Velocity, Ruby, Scala, Objective C, Matlab, Python, Go, Swift and Salesforce.com Apex.

Latest version(s)

5.5.2 (5th November 2016)

- Release Notes
- Download (Sourcecode, Documentation)
- Online Documentation
- Requires at least java 7, Salesforce.com Apex requires at least java 8

5.4.3 (4th November 2016)

- Release Notes
- Download (Sourcecode, Documentation)
- Online Documentation
- Requires at least java 7

FindBugs Plugin

Edit Add Tools

12 Added by Ulli Hafner, last edited by Ulli Hafner on Jun 01, 2016 (view change)

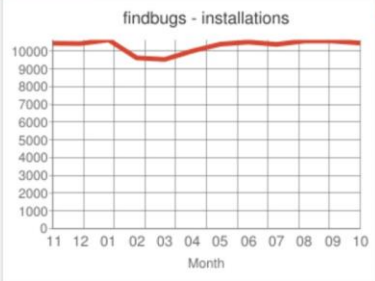
Jenkins

- Home
- Mailing lists
- Source code
- Bugtracker
- Security Advisories
- Events
- Donation
- Commercial Support
- Wiki Site Map

Documents

- Meet Jenkins
- Use Jenkins
- Extend Jenkins
- Plugins
- Servlet Container Notes

Plugin Information

Plugin ID	findbugs	**Changes**	In Latest Release Since Latest Release
Latest Release **Latest Release Date** **Required Core** **Dependencies**	4.65 (archives) Jun 01, 2016 1.596.1 matrix-project (version:1.2.1) analysis-core (version:1.77) maven-plugin (version:2.9) dashboard-view (version:2.9.4, optional) token-macro (version:1.10, optional)	**Source Code** **Issue Tracking** **Pull Requests** **Maintainer(s)**	GitHub Open Issues Pull Requests Ulli Hafner (id: drulli)
Usage		**Installations**	2015-Nov 10439 2015-Dec 10423 2016-Jan 10629 2016-Feb 9619 2016-Mar 9531 2016-Apr 10005 2016-May 10391 2016-Jun 10507 2016-Jul 10376 2016-Aug 10565 2016-Sep 10564 2016-Oct 10452

build passing

This plugin generates the trend report for FindBugs, an open source program which uses static analysis to look for bugs in Java code.

Jenkins’ support for other build systems (Ant, Gradle and shell scripts)

Apache Ant

- Widely-used and very well-known build scripting language for Java.
- Flexible, extensible, relatively low-level scripting language.
- An Ant build script is made up of a number of targets, each target performs a particular job in the build process.

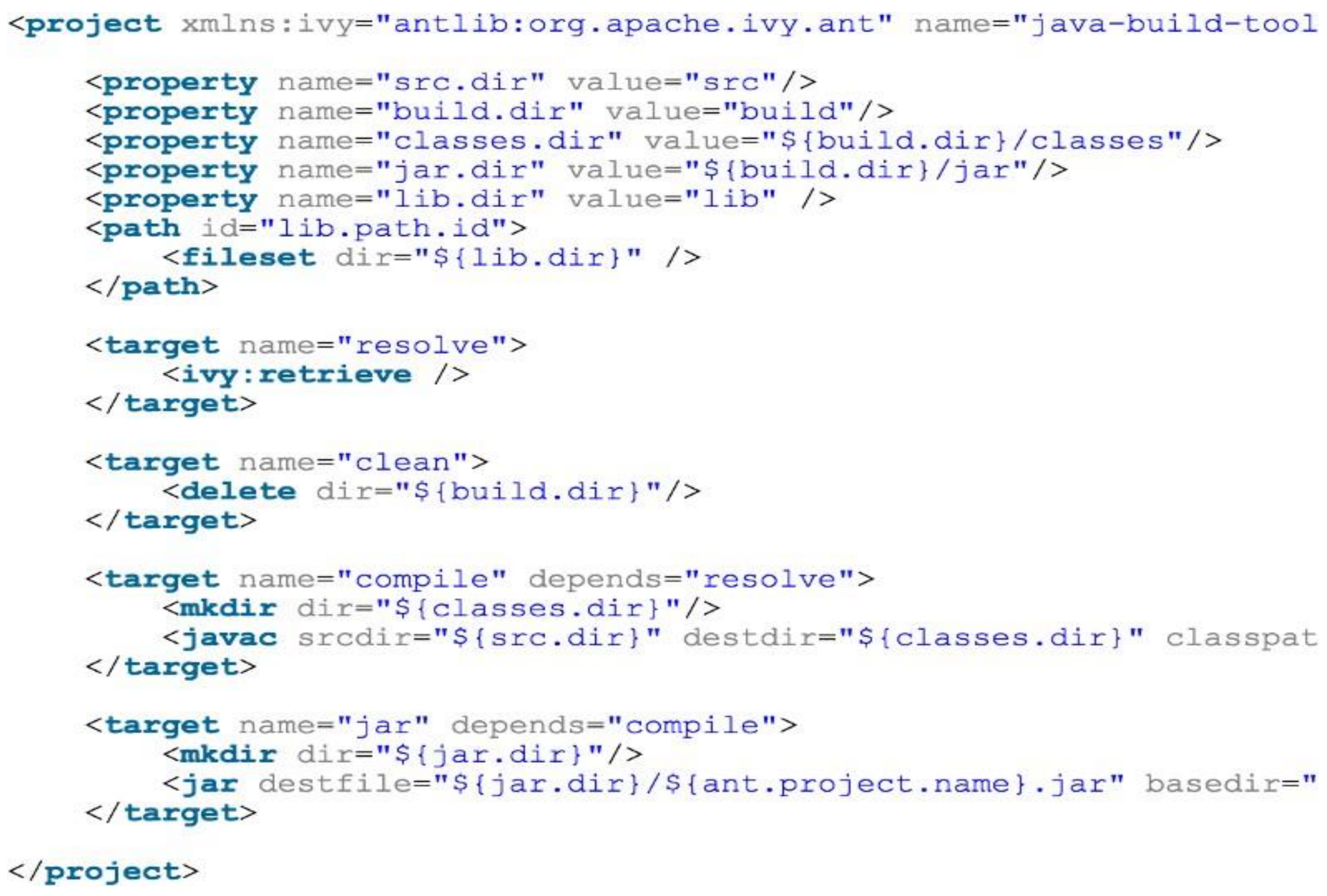
<APACHE ANT>

Gradle

- Gradle is a relatively new open source build tool for the Java Virtual Machine.
- Build scripts for Gradle are written in a Domain Specific Language based on Groovy.
- The concise nature of Groovy scripting lets you write very expressive build scripts with very little code.

Build Scripts

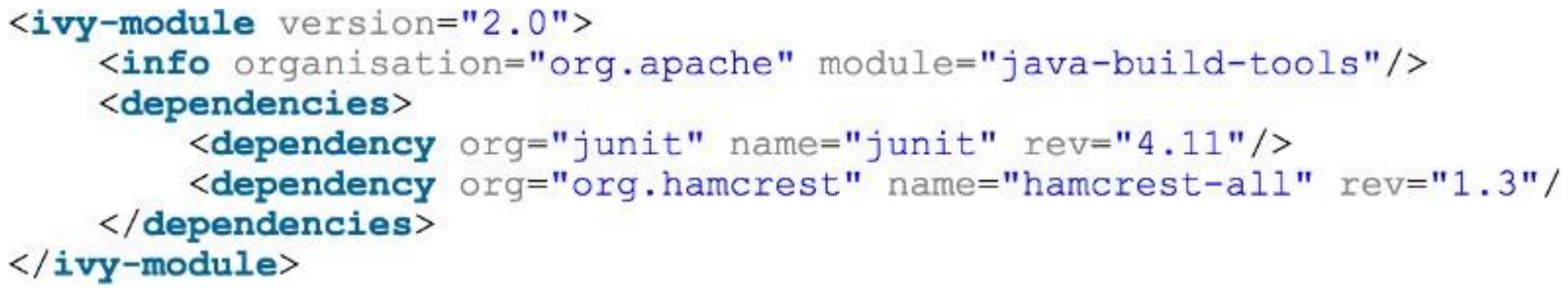
Maven Build Script



```
<project xmlns:ivy="antlib:org.apache.ivy.ant" name="java-build-tool

    <property name="src.dir" value="src"/>
    <property name="build.dir" value="build"/>
    <property name="classes.dir" value="${build.dir}/classes"/>
    <property name="jar.dir" value="${build.dir}/jar"/>
    <property name="lib.dir" value="lib" />
    <path id="lib.path.id">
        <fileset dir="${lib.dir}" />
    </path>

    <target name="resolve">
        <ivy:retrieve />
    </target>

    <target name="clean">
        <delete dir="${build.dir}"/>
    </target>

    <target name="compile" depends="resolve">
        <mkdir dir="${classes.dir}"/>
        <javac srcdir="${src.dir}" destdir="${classes.dir}" classpat
    </target>

    <target name="jar" depends="compile">
        <mkdir dir="${jar.dir}"/>
        <jar destfile="${jar.dir}/${ant.project.name}.jar" basedir="
    </target>

</project>
```

\

Ant Build Script Sample



```
<ivy-module version="2.0">
    <info organisation="org.apache" module="java-build-tools"/>
    <dependencies>
        <dependency org="junit" name="junit" rev="4.11"/>
        <dependency org="org.hamcrest" name="hamcrest-all" rev="1.3"/
    </dependencies>
</ivy-module>
```

Install and configure Tomcat as a staging environment

Jenkins

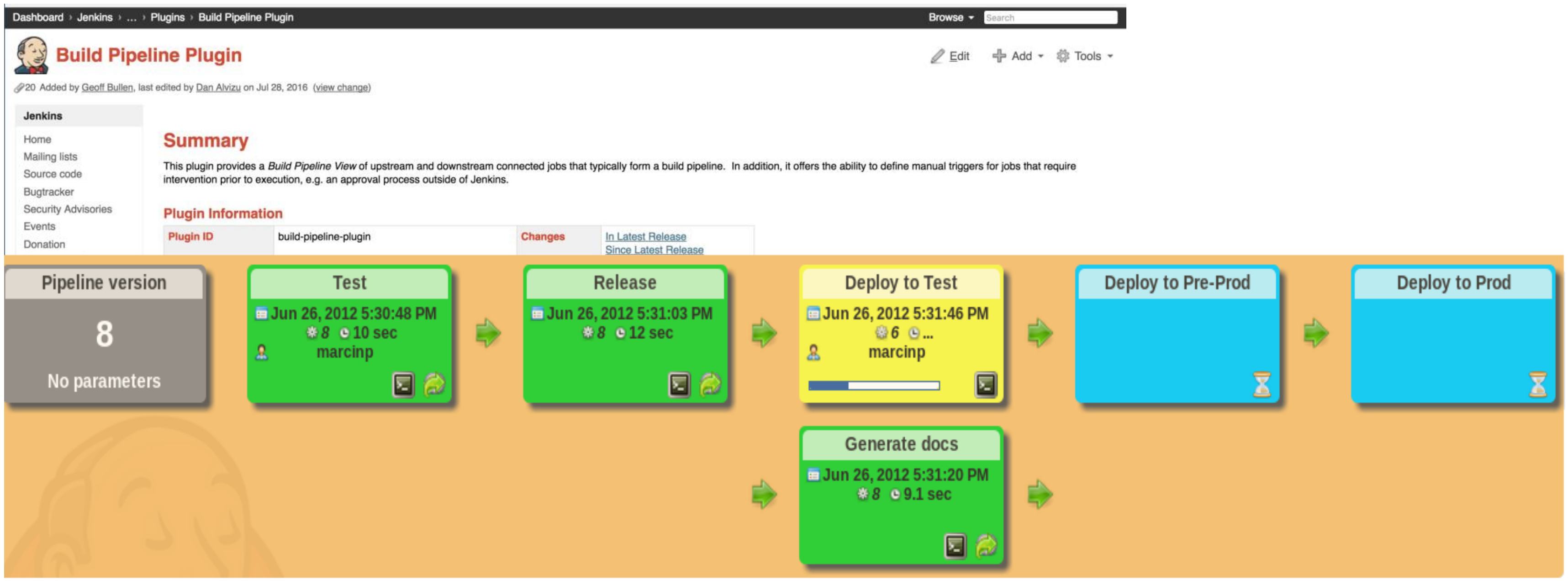
Tomcat

Tomcat is an open-source web server and provides a "pure Java” HTTP web server environment in which Java code can run.

- Install *copy artifact* and *deploy to container* plugins
- Deploy our application to staging environment

Jenkins Build Pipeline

Build Pipeline Plugin



Dashboard › Jenkins › ... › Plugins › Build Pipeline Plugin Browse Search

Build Pipeline Plugin Edit Add Tools

20 Added by Geoff Bullen, last edited by Dan Alvizu on Jul 28, 2016 (view change)

Jenkins

- Home
- Mailing lists
- Source code
- Bugtracker
- Security Advisories
- Events
- Donation

Summary

This plugin provides a *Build Pipeline View* of upstream and downstream connected jobs that typically form a build pipeline. In addition, it offers the ability to define manual triggers for jobs that require intervention prior to execution, e.g. an approval process outside of Jenkins.

Plugin Information

Plugin ID	build-pipeline-plugin	Changes	In Latest Release Since Latest Release

Parallel Jenkins Build

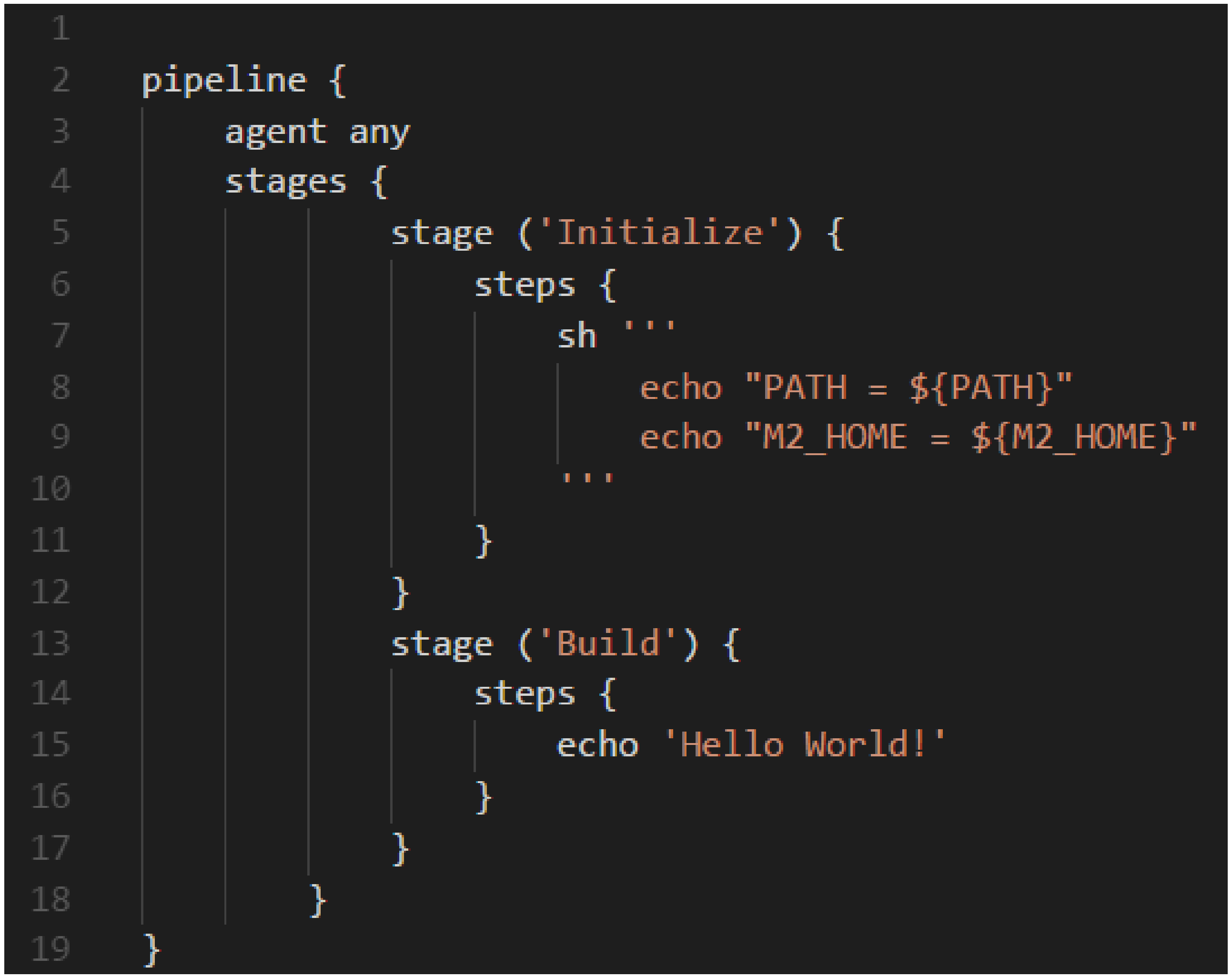
Continuous Delivery

Deploy our app toproduction

Jenkins

Benefits of a code-based pipeline

- Version control
- Best Practices
- Less error-prone execution of jobs
- Logic-based execution of steps



```

pipeline {
    agent any
    stages {
            stage ('Initialize') {
                steps {
                    sh '''
                        echo "PATH = ${PATH}"
                        echo "M2_HOME = ${M2_HOME}"
                    '''
                }
            }
            stage ('Build') {
                steps {
                    echo 'Hello World!'
                }
            }
        }
}
```

Additional automation

- Setup Git repository polling
- Deployment to our tomcat servers
- We will setup tasks to run in parallel

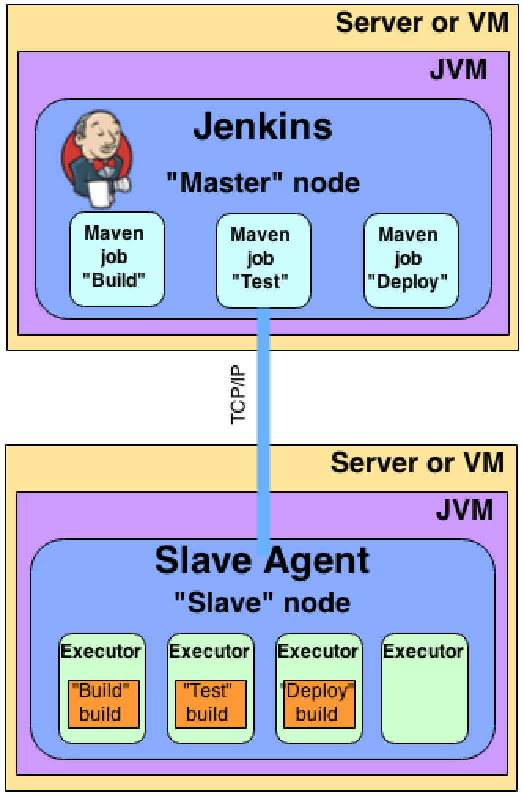
Steps

- **Step 1: Configure securit groups for Tomcat servers and create key pairs.**
- **Step 2:** Provision instances to staging and production environments.
- **Step 3:** Install and run Tomcat on created instances.
- **Step 4:** Fully automate our existing Jenkins pipeline.

Introduction to Distributed Jenkins Builds

Install Jenkins Master in theCloud

Jenkins Slave Agent



Install Jenkins slaves in the cloud and form a Jenkins cluster

Concurrent Builds on Jenkins Cluster

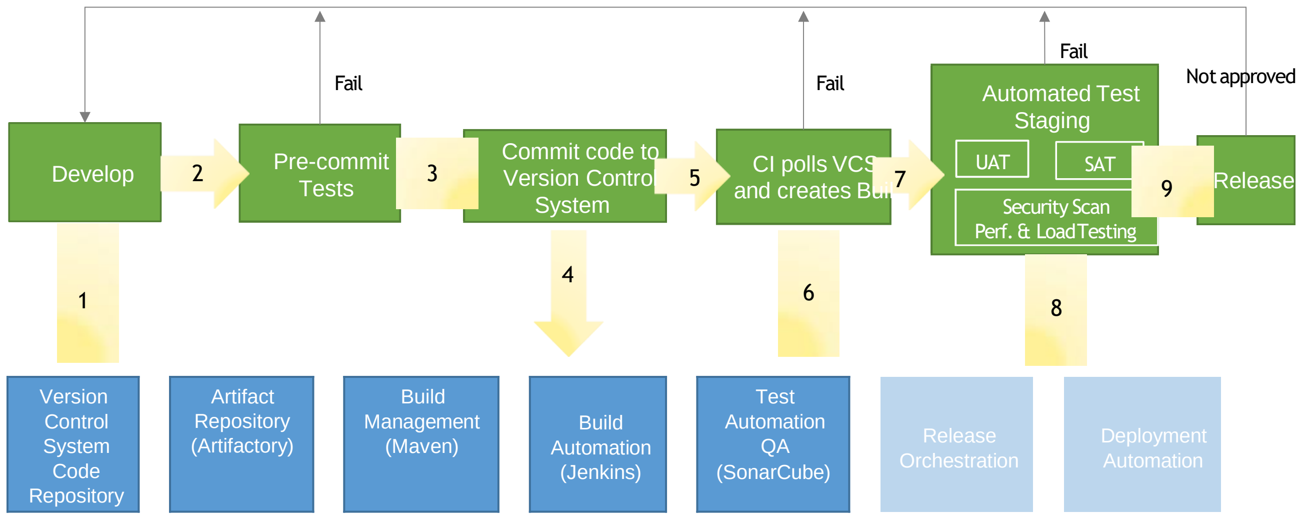
Label Jenkins Nodes

Build Orchestration: Jenkins

- Continuous integration system
- Enable automated build and test process
- Can monitoring executions of externally-run jobs, such as cron jobs and procmail jobs…
- Dependency tracking, allowing file finger printing and tracking for example which build is using which version of jars…
- Generates list of changes made to build from Subversion
- Distributed build/test

- Jenkins is a build orchestration, CI software
  - building/testing software projects continuously
  - monitoring executions of externally-run jobs
- FishEye allows you to extract information from your source code repository and display it in sophisticated reports.
- Crucible allows you to request, perform and manage code reviews.
- Subversion centralized version control system
- Sonar is a quality management platform for analyzing and measuring source code quality.

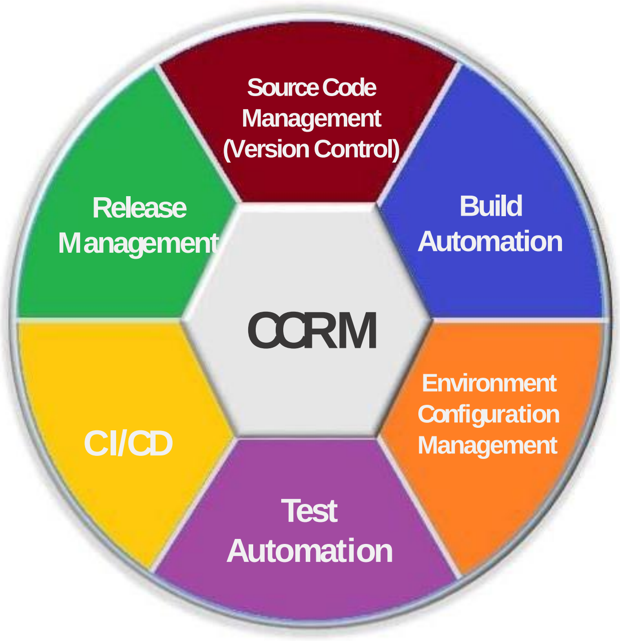
CI/CD Pipeline: Functional Architecture



Develop
2
Pre-commit Tests
3
Commit code to Version Control System
5
CI polls VCS and creates Build
7
Automated Test Staging
UAT
SAT
Security Scan
Perf. & Load Testing
9
Release
Fail
Fail
Fail
Not approved
1
4
6
8
Version Control System Code Repository
Artifact Repository (Artifactory)
Build Management (Maven)
Build Automation (Jenkins)
Test Automation QA (SonarCube)
Release Orchestration
Deployment Automation

An Automated, Integrated and End to Ent CCRM

Git, GitLab, GitHub Enteprise, SVN...


Source Code Management (Version Control)
Build Automation
Environment Configuration Management
Test Automation
CI/CD
Release Management
CCRM

Maven, Ant, Gradle

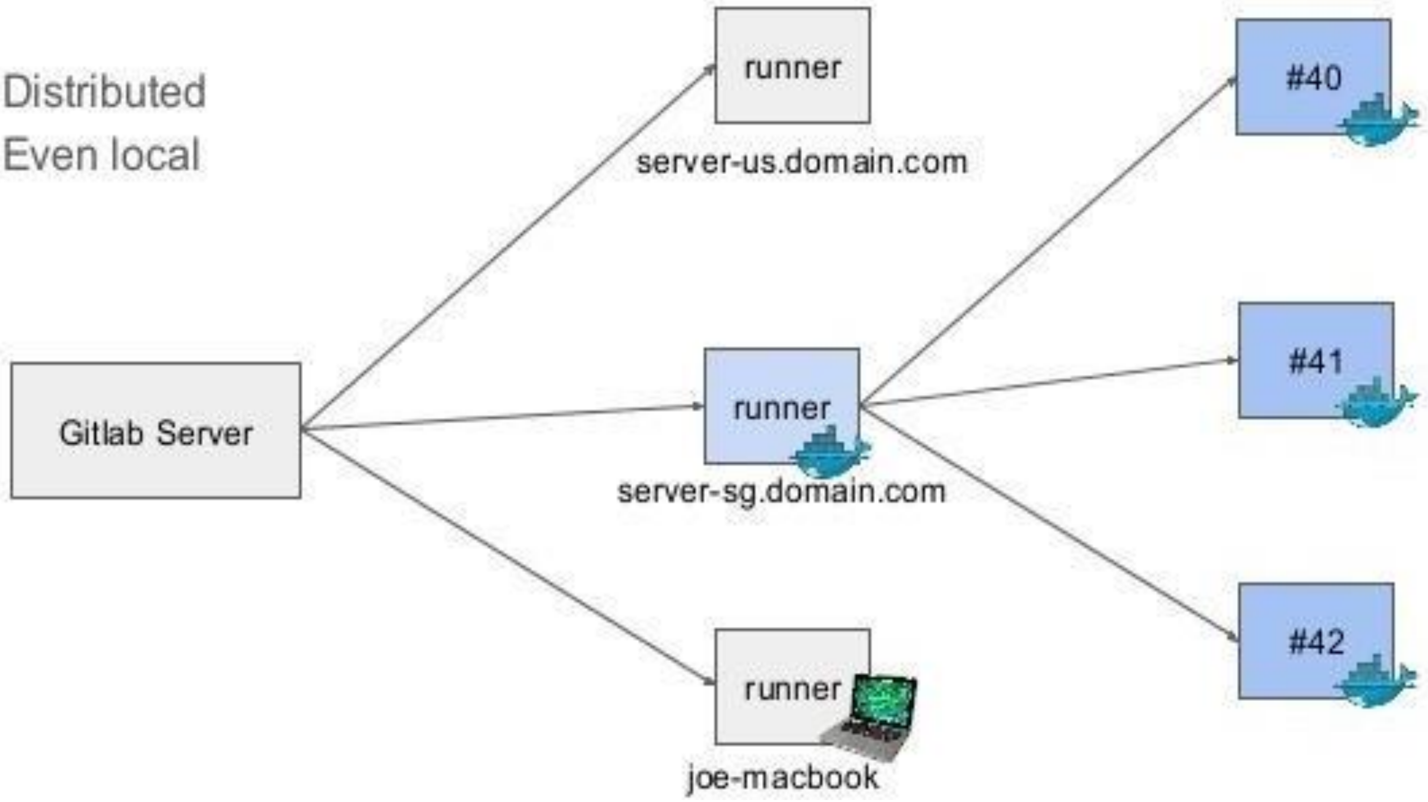
Nexsus, Artifactory

Jenkins...

Junit, Test NG, Cucumber, Selenium, JMeter, SoapUI, LoadRunner...

Runners

- Distributed
- Even local


Gitlab Server
runner
server-us.domain.com
runner
server-sg.domain.com
runner
joe-macbook
#40
#41
#42