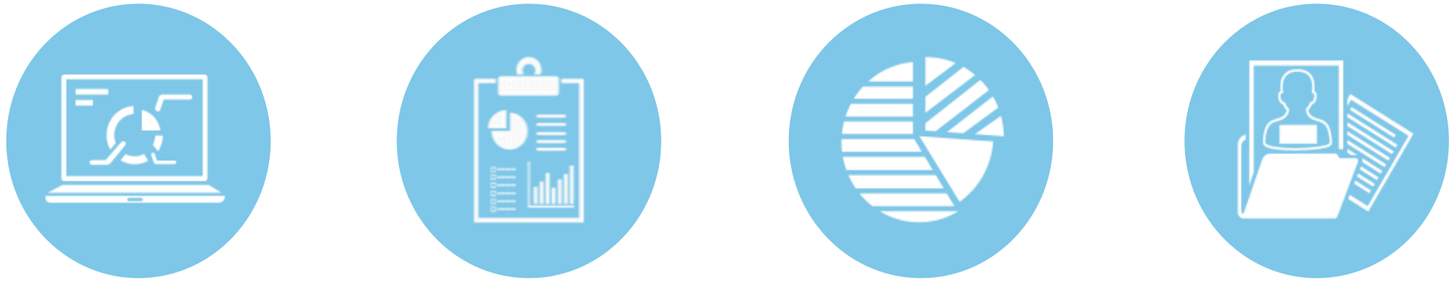
DevOps Certification Training

Lesson 03: Continuous Integration, Continuous Deployment, and Build Tools



Learning Objectives

By the end of this lesson, you will be able to:

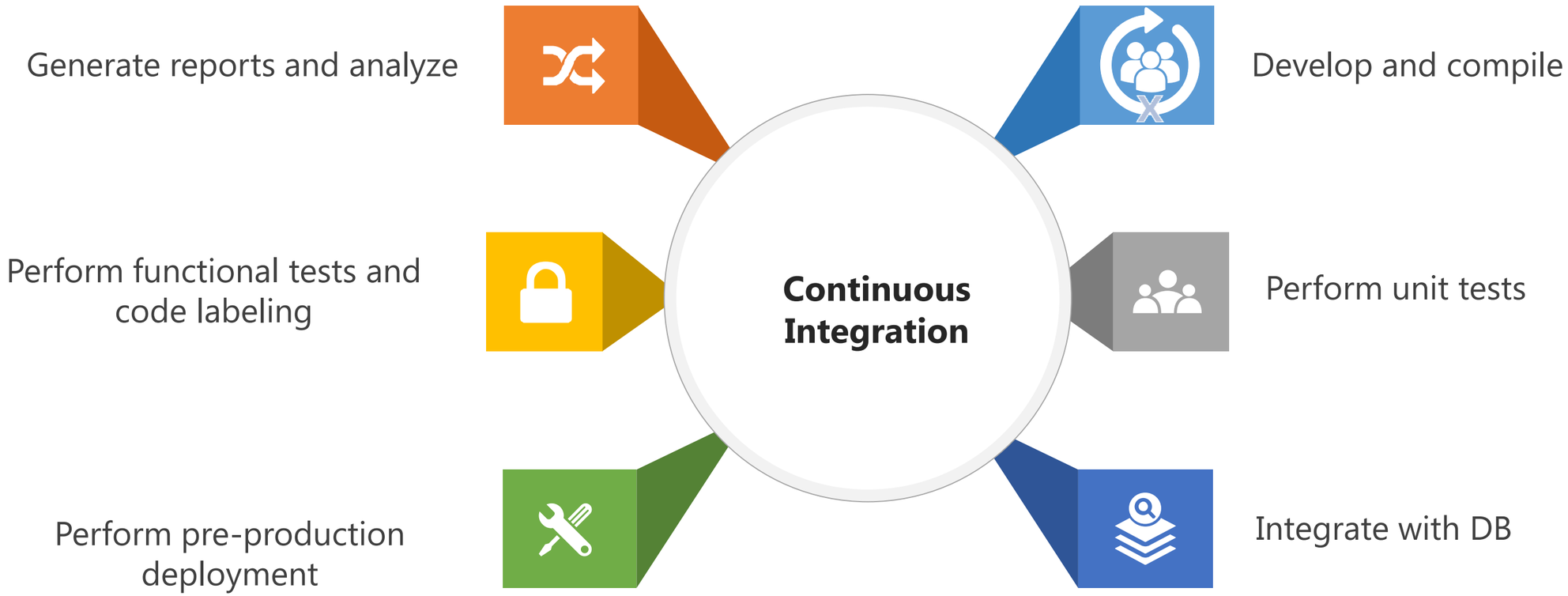
- Describe the importance of continuous integration and continuous deployment
- List the features of Jenkins and demonstrate their uses
- List the features of TeamCity and demonstrate their uses
- Select a suitable build tool for your organization

Continuous Integration, Continuous Deployment, and Build Tools

Overview and Importance of Continuous Integration and Continuous Deployment

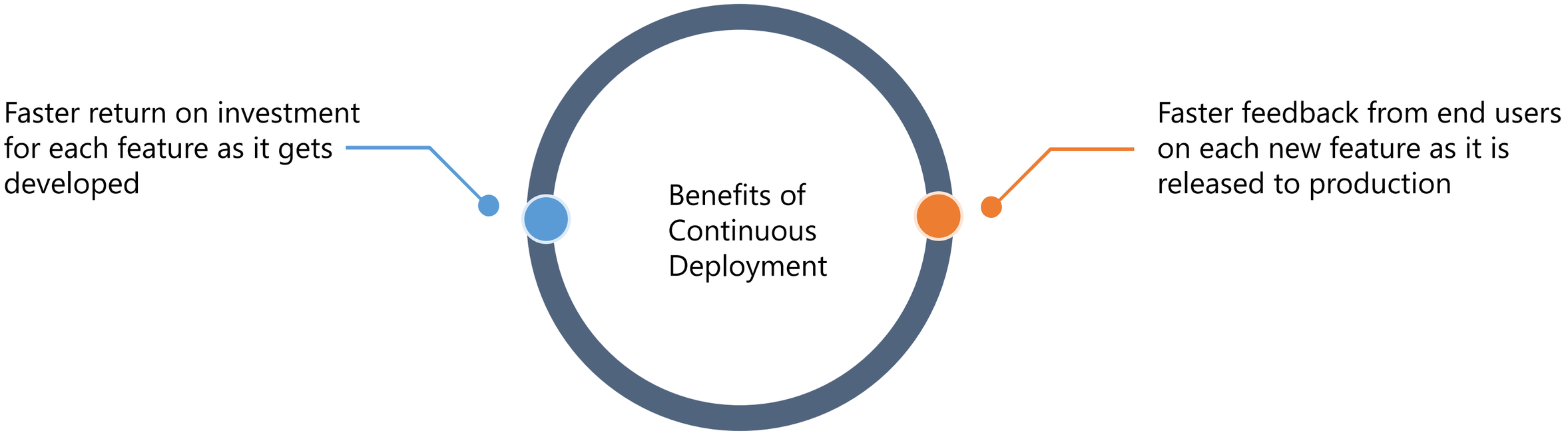
Overview of Continuous Integration

Continuous integration is a development practice of code integration into a shared repository. Each integration is verified by an automated build and automated tests.

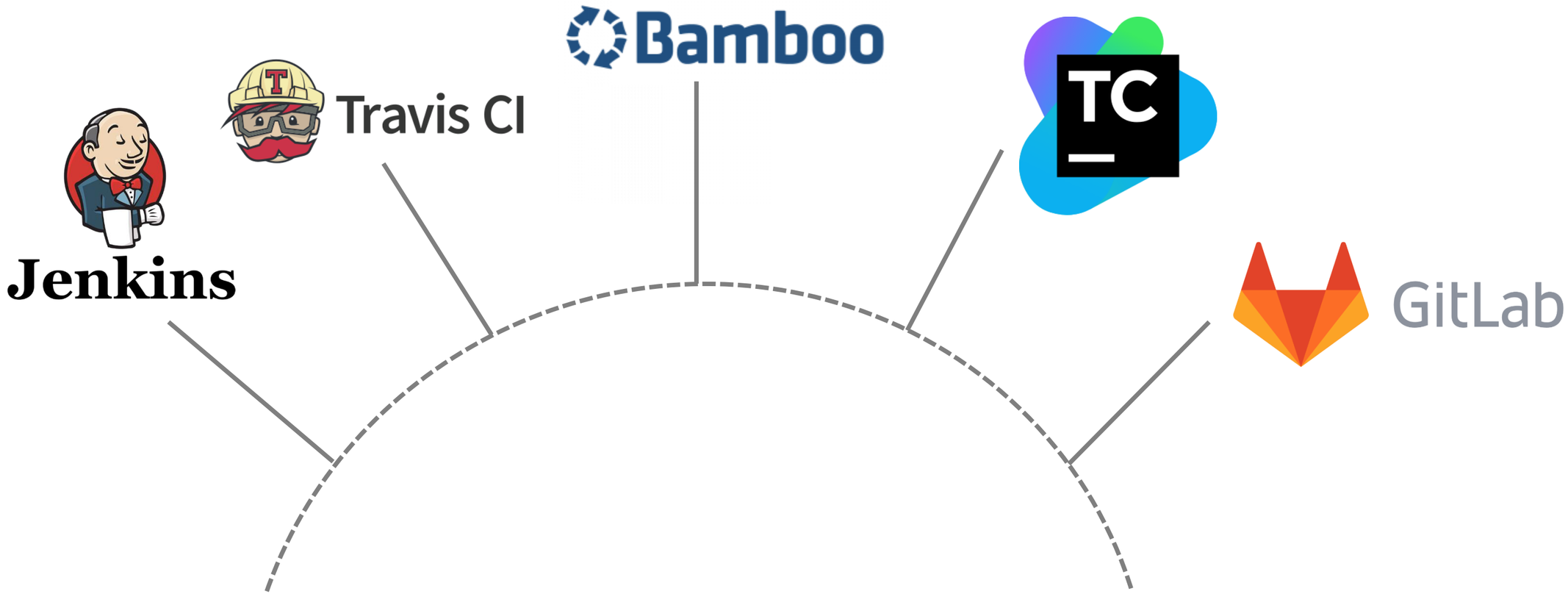


Overview of Continuous Deployment

Continuous Deployment is an extension of continuous integration. It targets to reduce the time between development team writing one new line of code and using it in production.



Popular Tools in Continuous Integration and Continuous Deployment



Continuous Integration with Jenkins

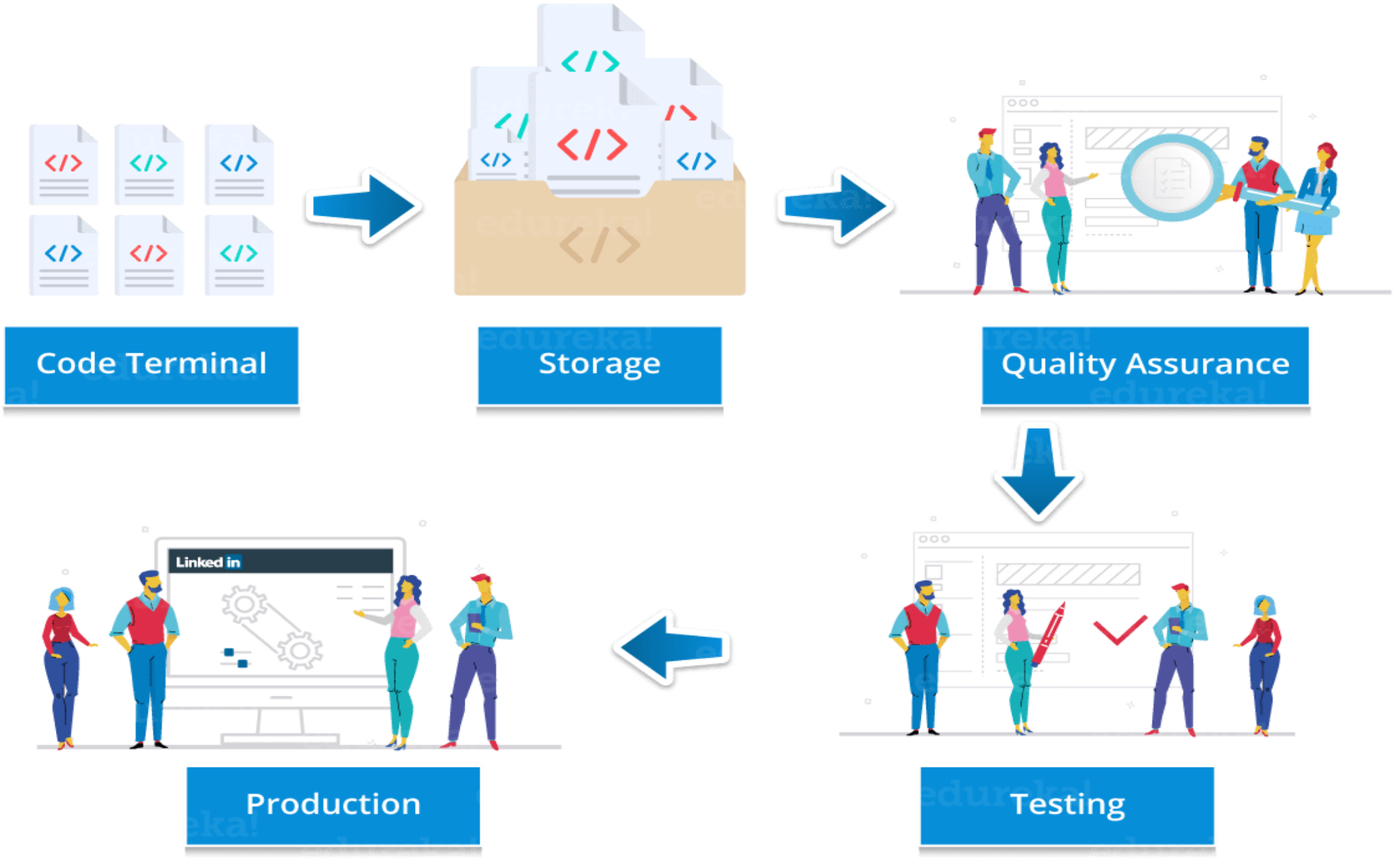
Over 1000 Jenkins plugins

Integration with over 100 DevOps tools

Orchestration of the DevOps toolchain

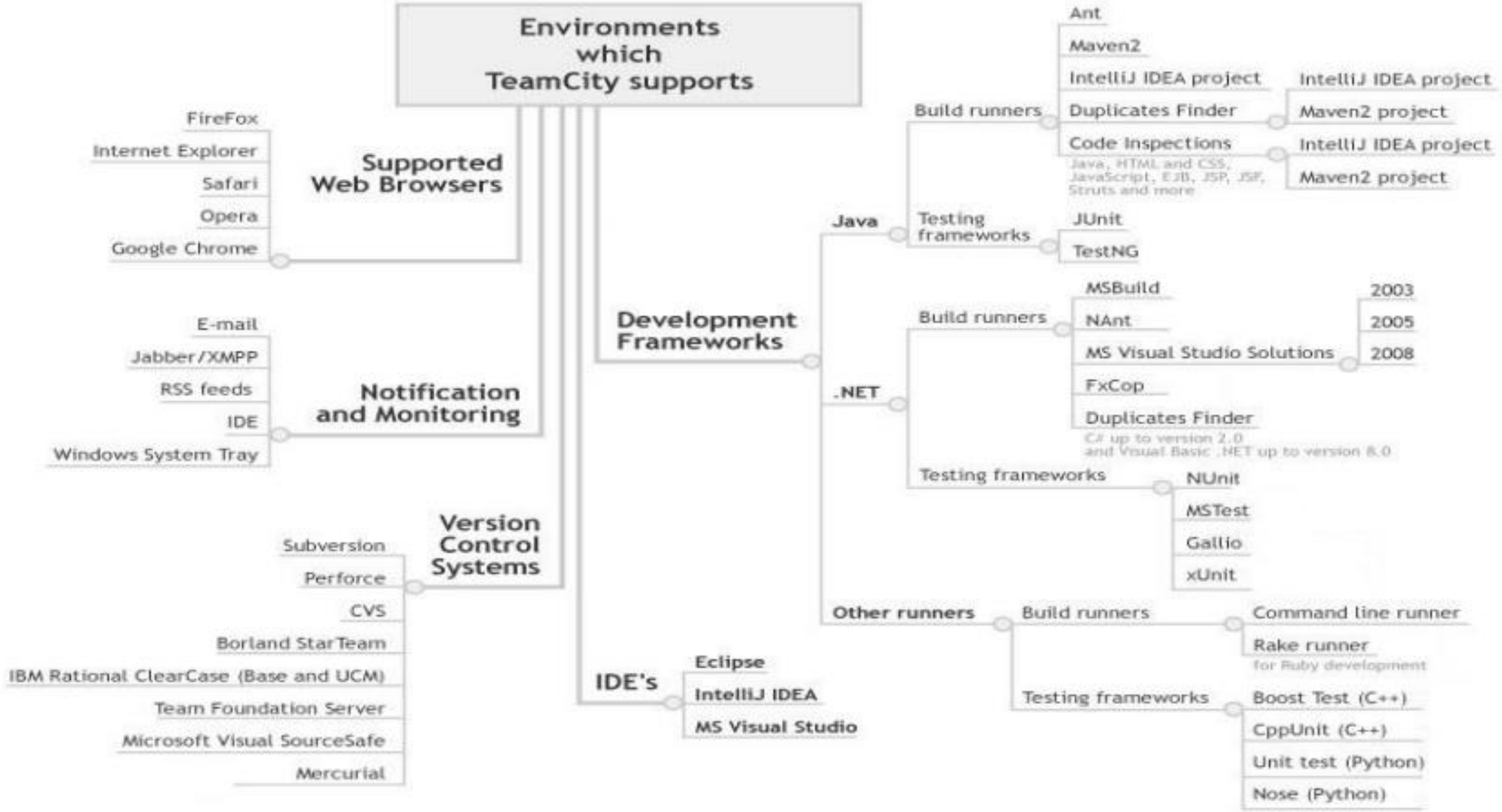
End-to-end CD pipeline management

Continuous Deployment with Jenkins

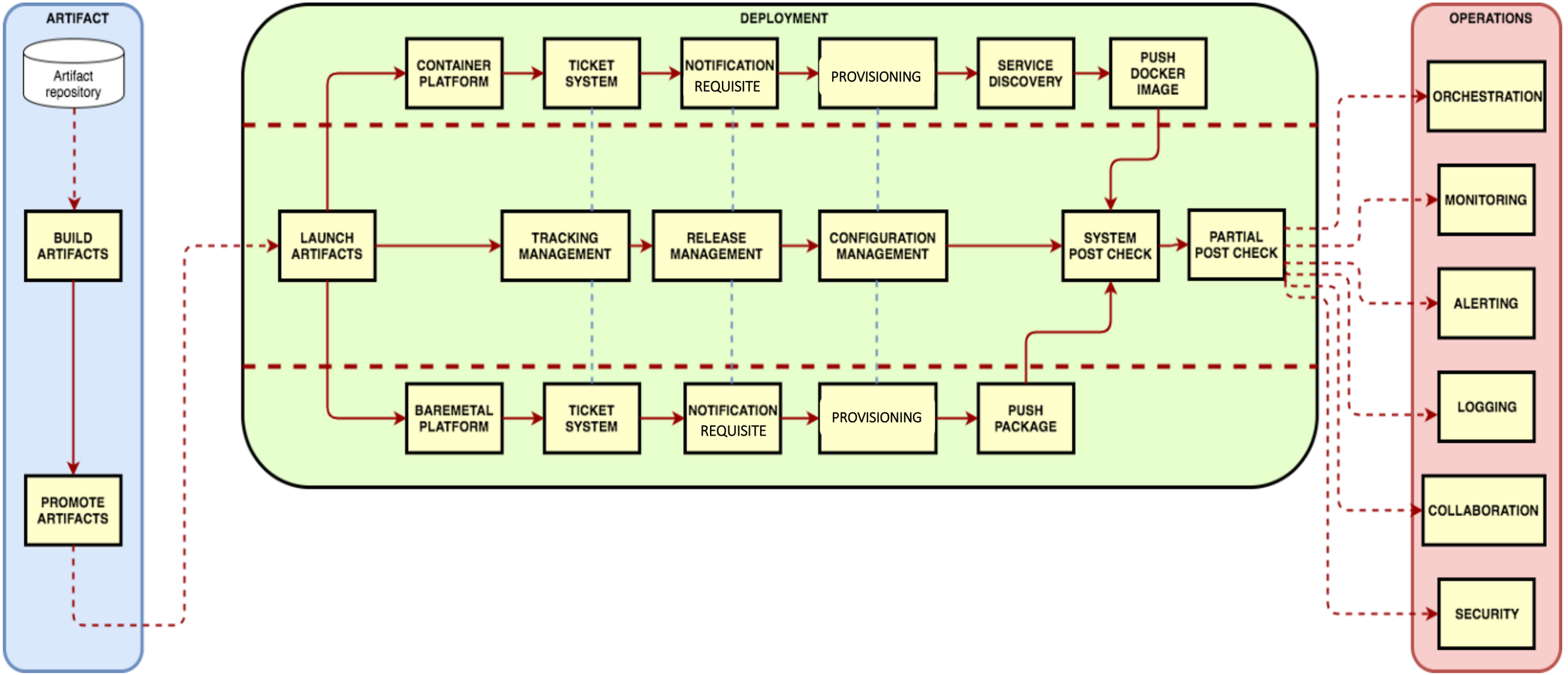


A case study by LinkedIn

Continuous Integration with TeamCity



Continuous Deployment with TeamCity

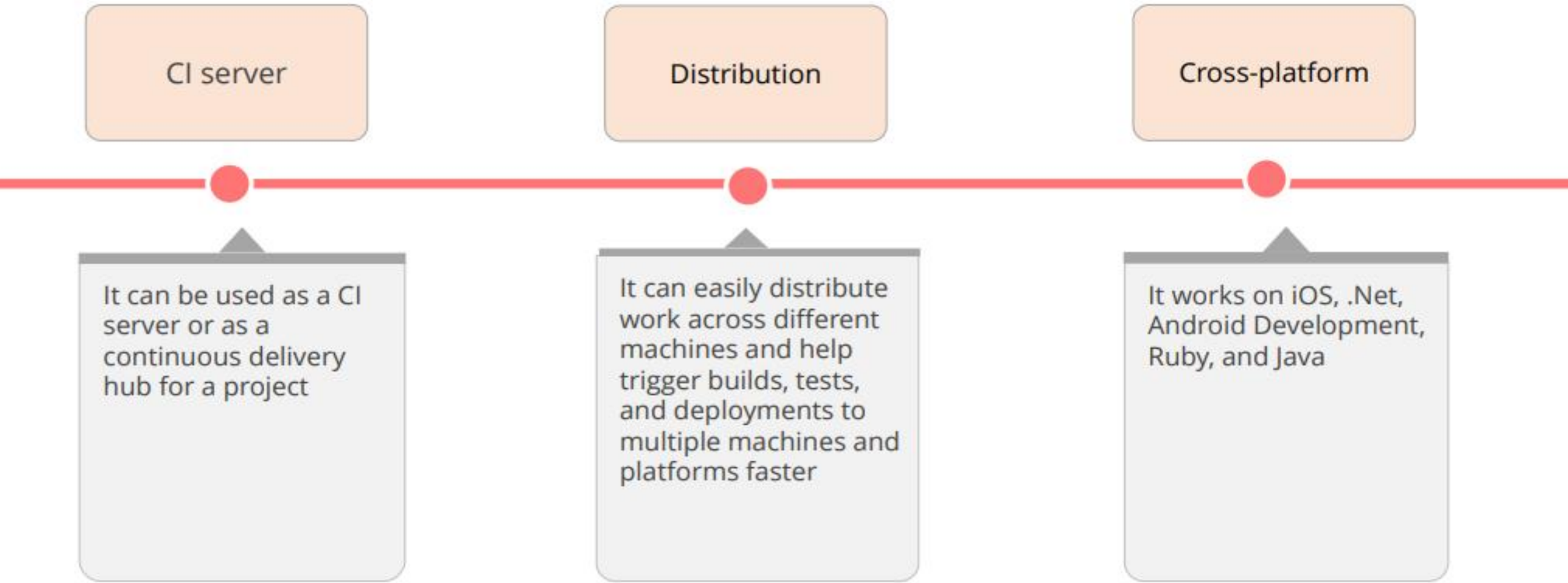


Continuous Integration, Continuous Deployment, and Build Tools

Overview and Features of Jenkins

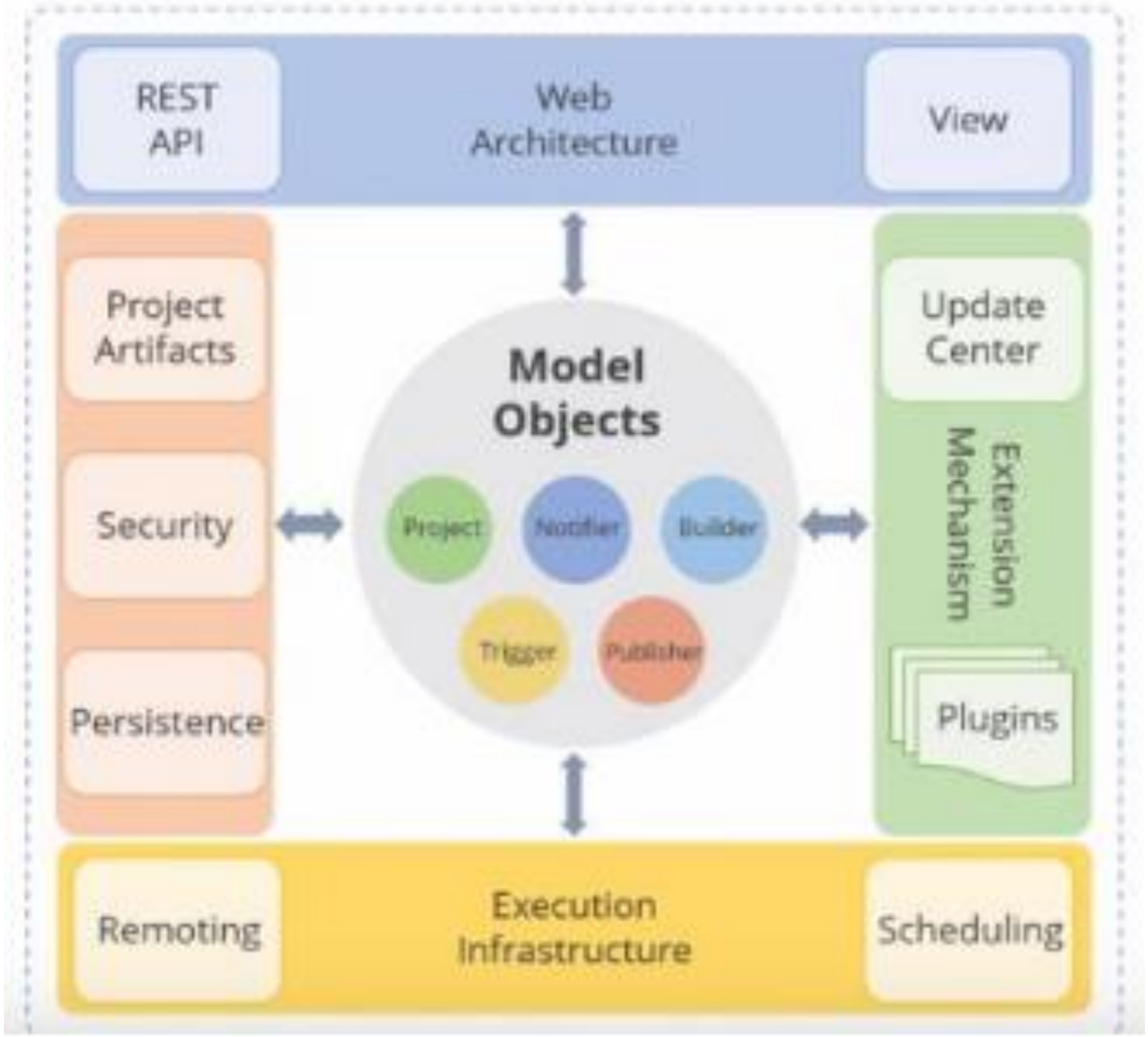
Jenkins as a Continuous Integration Tool

Jenkins is a Java-based, open source automation tool. It functions as a server and is a software development and cross-platform tool used for continuous integration and continuous deployment.

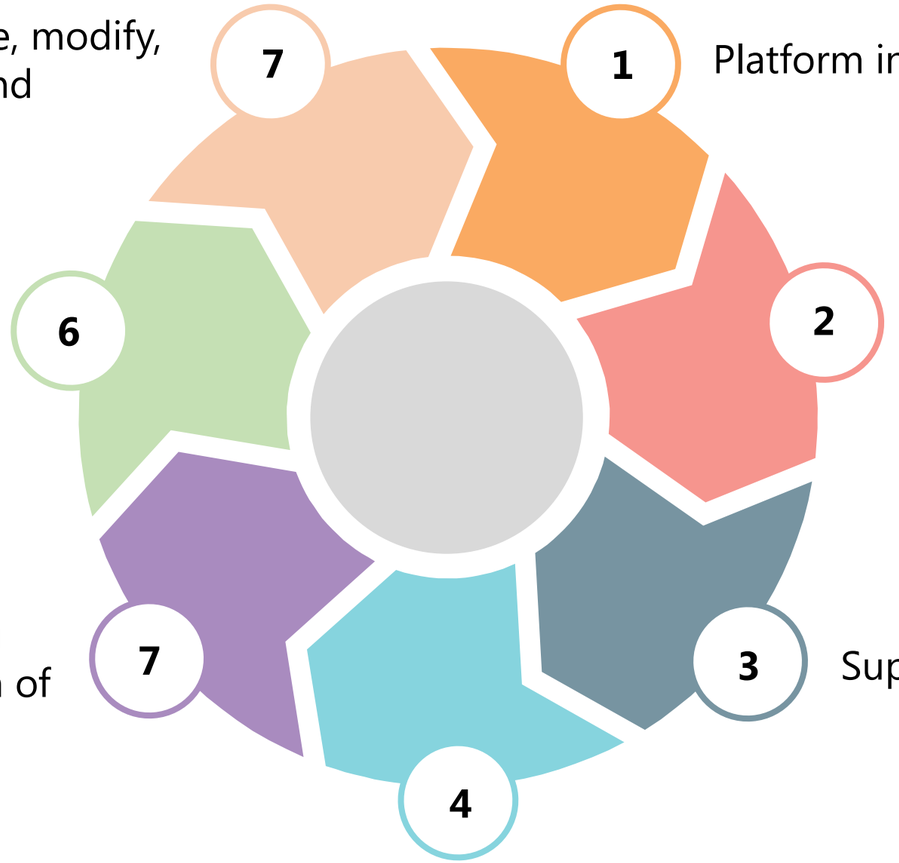


Architecture of Jenkins

- Jenkins has classes like project and build.
- It uses Jelly as the view technology.
- It uses file system to store its data. Directories are created inside $JENKINS_HOME.
- It supports plugins, which can plug into those extension points and extend the capabilities of Jenkins.



Popular Features of Jenkins



1. Platform independent
2. Rich plugin ecosystem
3. Support from large communities
4. Scaling of large error-ridden integrations
5. Automation integration enabling immediate detection and resolution of issues
6. Open source and user-friendly
7. Easy to configure, modify, and extend

Build Status and Job Health

Status of the build	Description
	Failed
	Unstable
	Success
	Pending
	Disabled
	Aborted

Figure a: Build status

Job health	Description
	No recent builds failed
	20-40% of recent builds failed
	40-60% of recent builds failed
	60-80% of recent builds failed
	All recent builds failed
	Unknown status

Figure b: Weather reports

Assisted Practice

Duration: 30 mins

Set up Jenkins

Problem Statement: You are given a project to install and configure Jenkins on your Ubuntu operating system.

Access: Click on the **Labs** tab on the left side panel of the LMS. Copy or note the username and password that is generated. Click on the **Launch Lab** button. On the page that appears, enter the username and password in the respective fields, and click **Login**.

Assisted Practice: Guidelines to Install and Configure Jenkins

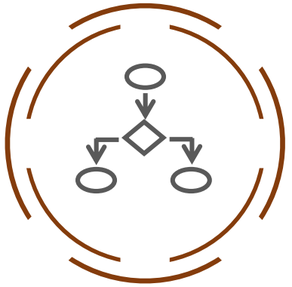
1. Login to your Ubuntu lab provided with the course.
2. Open the terminal and execute the command available in the lab document 3.1 to add the key to the system.
3. Edit the sources.list file, add the command to the file, and save it.
4. Update the apt-get package.
5. Install JDK 8+ version.
6. Install Jenkins via apt-get package.
7. Navigate to x.x.x.x:8080 in the browser of your virtual Machine.
8. Get the password and enter it in the Jenkins window.
9. Create a new role/job in Jenkins.
10. Explore the free style project section and build section.

Continuous Integration, Continuous Deployment, and Build Tools

Overview and the Features of TeamCity

TeamCity as a Continuous Integration Tool

TeamCity is a Java-based, management and continuous integration server. It is a licensed commercial software used for continuous integration and continuous deployment.



Gated commits

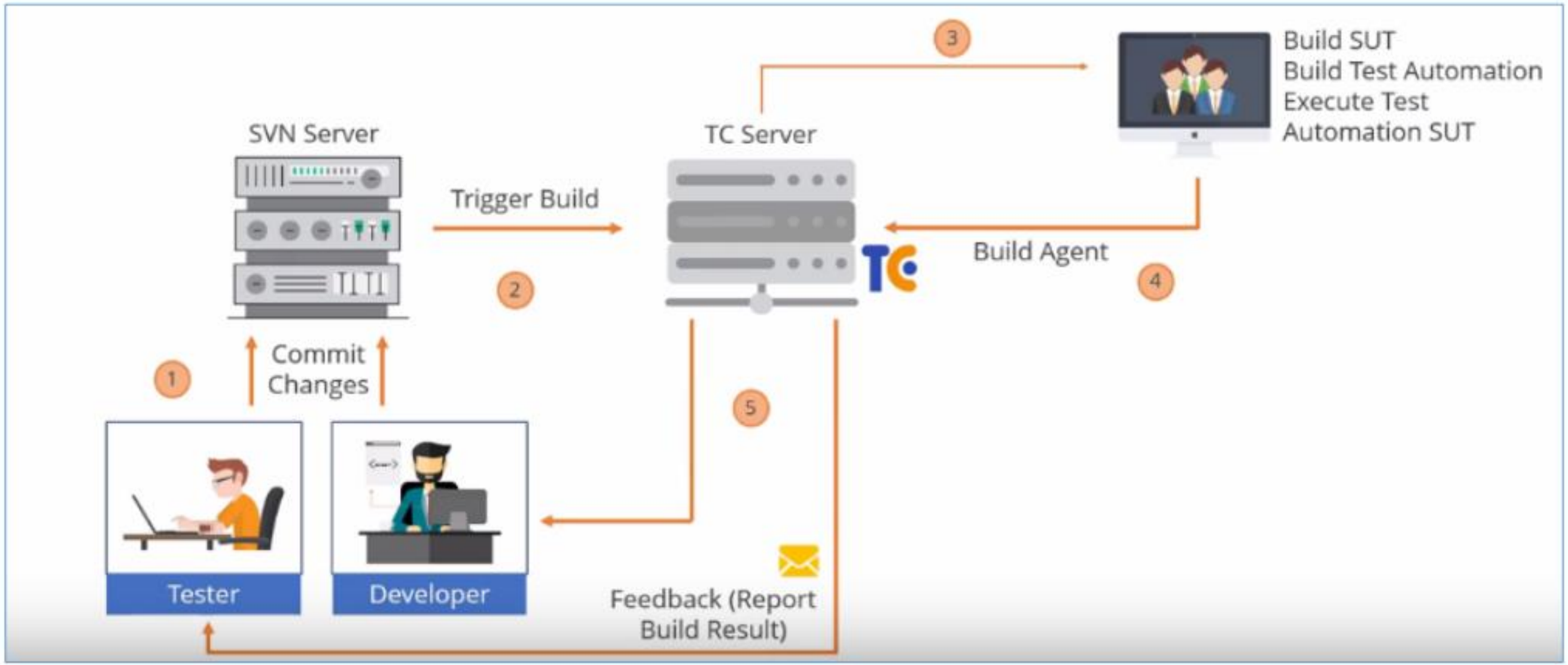
Build grid

Integrated code

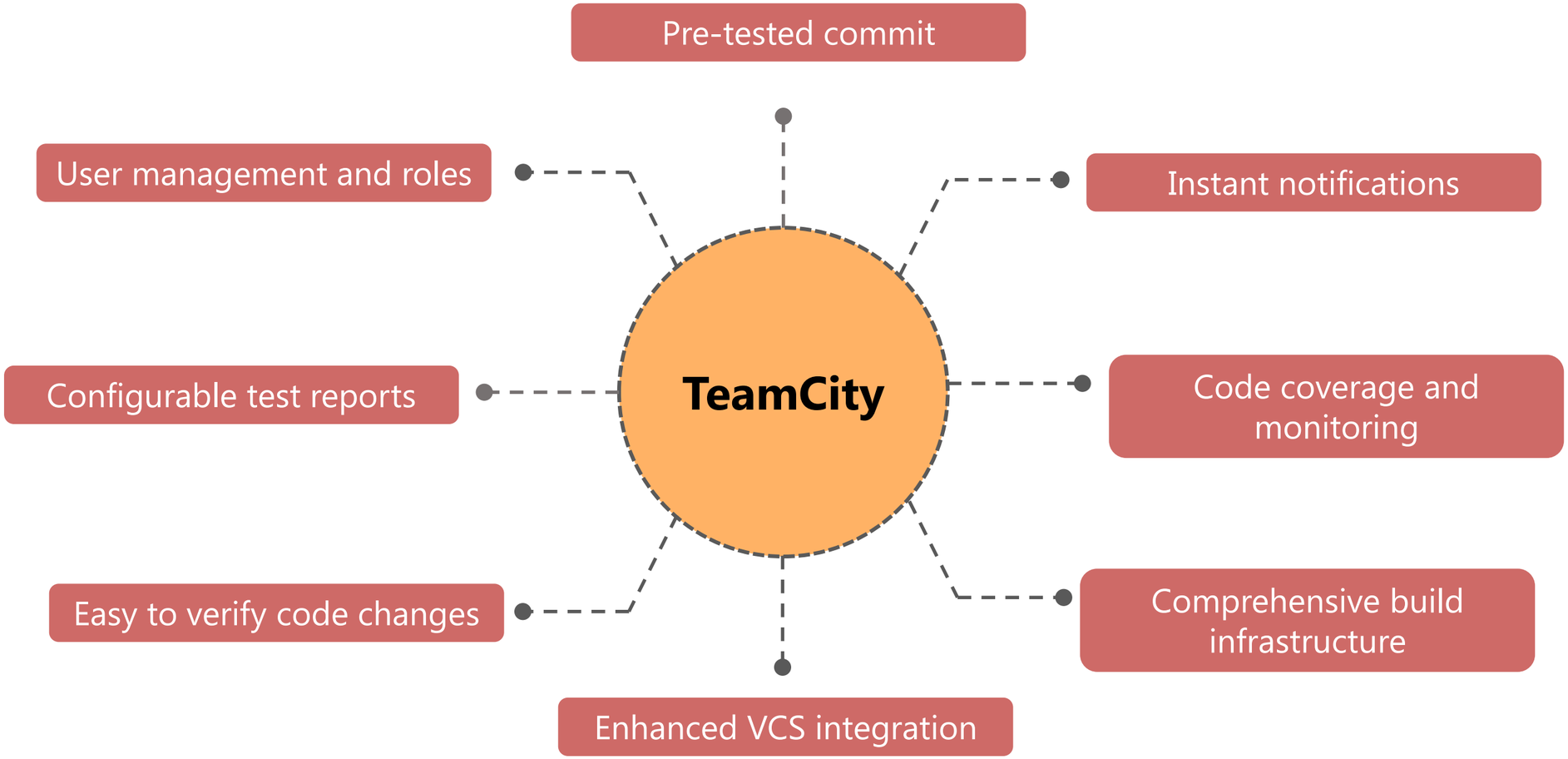
Integration with IDEs

Cross-platform support

TeamCity Workflow



Popular Features of TeamCity



Assisted Practice

Duration: 30 mins

Set up TeamCity

Problem Statement: You are given a project to install and configure TeamCity on your Ubuntu operating system.

Access: Click on the **Labs** tab on the left side panel of the LMS. Copy or note the username and password that is generated. Click on the **Launch Lab** button. On the page that appears, enter the username and password in the respective fields, and click **Login**.

Assisted Practice: Guidelines to Install and Configure TeamCity

1. Login to your Ubuntu lab provided with the course.
2. Download TeamCity from the official site.
3. Unzip the folder and install TeamCity.
4. Provide the read, write, and execute mode access to TeamCity .
5. Run TeamCity at x.x.x.x:8111 where x.x.x.x is your IP address.
6. Create an account in TeamCity and add the basic details to complete the set up process.
7. Explore options such as **Projects**, **Changes**, **Agents**, and **Build Queue**.

Continuous Integration, Continuous Deployment, and Build Tools

Build Tools and Their Uses

Build Tools

Build tools are programs that automate the creation of executable applications from the source code. Automation tools allow the build process to be more consistent.

1

Make

Software

3

5

2

#!/bin/bash

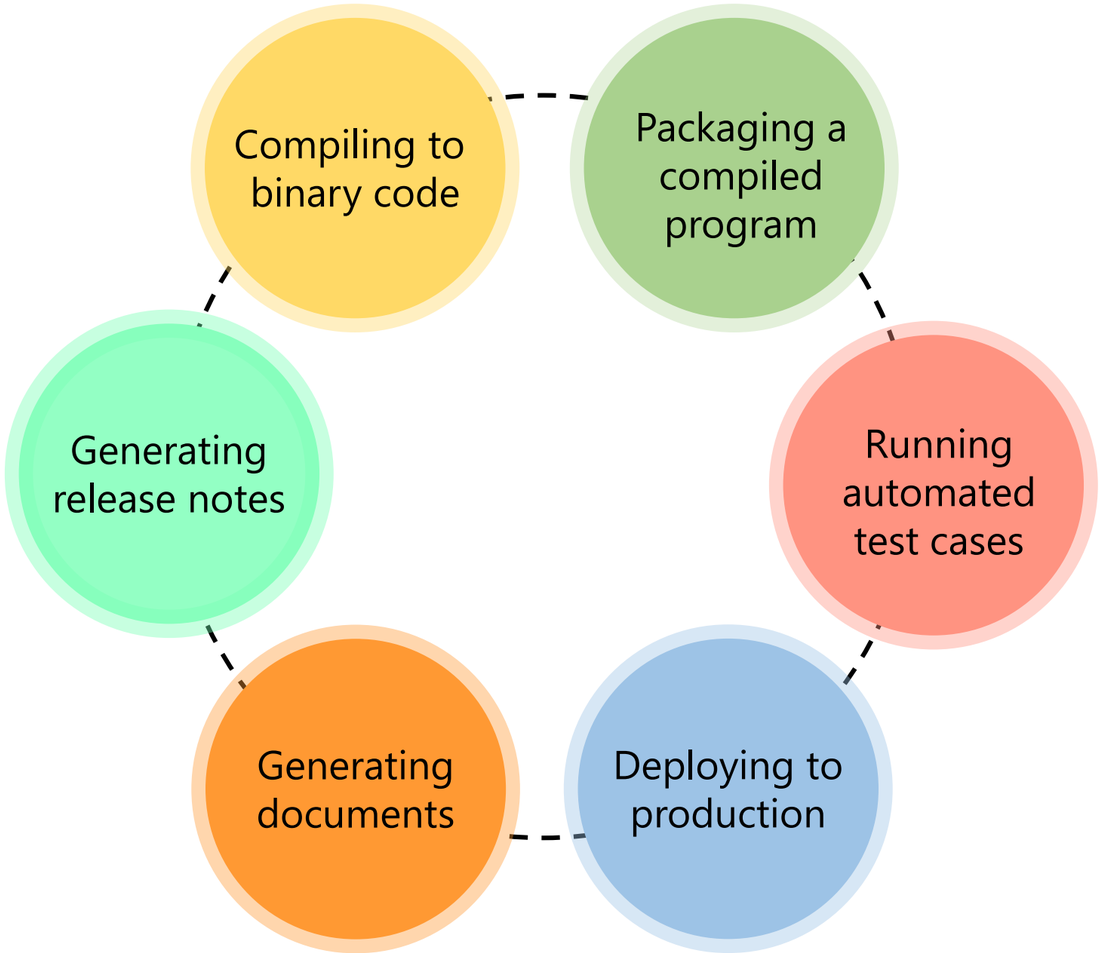
4

Apache Maven

http://maven.apache.org/

6

Popular Features of Build Tools



Overview of Apache Ant

Apache Ant is a Java library and a command-line tool. It aims to drive processes described in build files as targets and extension points dependent on each other.

Features of

- Supplies a number of built-in tasks allowing to compile, test, and run
- Flexible and does not impose coding conventions
- Pilot any type of process
- Build solution combining build tool and dependency with Apache Ivy
- Users can develop custom “Antlibs” using Java
- Solves Make’s portability problems

Limitations of Apache Ant

Ant build files are complex and verbose as they are hierarchical and partly ordered

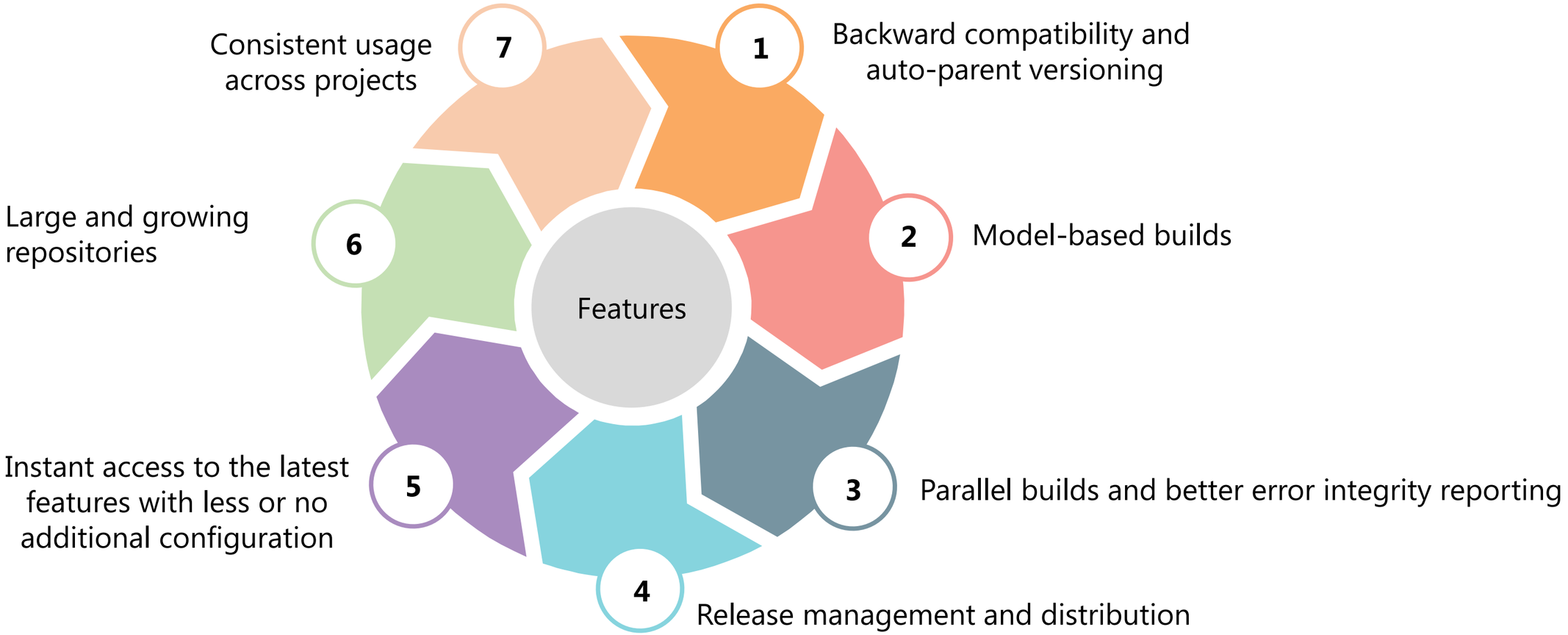
Undefined properties are not raised as errors but left as unexpanded reference

Older tasks use default value, which are not consistent, and changing defaults would break existing Ant scripts

Ant has limited fault handling rules and lazy property evaluation is not supported

Overview of Maven

Apache Maven is a software project management and comprehension tool. Based on Project Object Model (POM), Maven can manage a project's build reporting and documentation from a central piece of information.



Drawbacks of Maven

Unreliable with Eclipse

Unable to depend on the outcome status

Slow and a partial black box

Verbose and complex

Maven over Ant

Better collaboration and debugging

More powerful builds

More componentized builds and reduced duplication

Better dependency management

More consistent project structure

Project Object Model (POM)

Project Object Model is an XML representation of a Maven project, which provides general configurations such as project's name, its owner, and its dependencies on other projects.

- The POM needs to define the Group ID, Artifact ID, and Version
- The packaging should also be declared – the default is jar

```
<project xmlns="http://maven.apache.org/POM/4.0.0"
   xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
   xsi:schemaLocation="http://maven.apache.org/POM/4.0.0
                       http://maven.apache.org/xsd/maven-4.0.0.xsd">

   <modelVersion>4.0.0</modelVersion>
   <groupId>eu.totaleclipse</groupId>
   <artifactId>calculator</artifactId>
   <version>1.0</version>
   <packaging>jar</packaging>
</project>
```

Overview of Grunt

Grunt is a JavaScript-based task runner, which is used to automate repetitive tasks in a workflow. It can be used as a command-line tool for JavaScript objects.

- Eases workflow such as writing a set up file
- Helps in automation of repetitive task with less effort
- Minifies the files such as .html, .CSS
- Includes built-in tasks to extend functionality of plugins
- Speeds the development flow and enhances performance
- Supports small infrastructure which is a best fit for new codebase
- Aims at reducing the chances of errors during repetitive tasks
- Currently, it has over 4000 plugins and can be used in larger production sites

Overview of Gulp

Gulp is an open-source JavaScript toolkit used as a streaming build system in front-end web development. It automates time-consuming and repetitive tasks involved in development.

Features

- Code minification and concatenation
- Usage of pure JavaScript code
- Converts LESS or SASS to CSS compilation
- Manages file manipulation in the memory

Advantages

- Easy to code
- Easy to test the web apps
- Plugins are simple to use

Disadvantages

- More number of dependencies
- Multiple tasks cannot be performed
- Configuration is tedious

Assisted Practice

Duration: 50 mins

Continuous Integration with Jenkins and Maven

Problem Statement: You are given a project to configure Jenkins, poll Git commits and build the project code using Maven on your Ubuntu operating system.

Access: Click on the **Labs** tab on the left side panel of the LMS. Copy or note the username and password that is generated. Click on the **Launch Lab** button. On the page that appears, enter the username and password in the respective fields, and click **Login**.

Assisted Practice: Guidelines to Configure Jenkins and Maven

1. Login to your Ubuntu lab provided with the course.
2. Login to Jenkins and create the first Jenkins job.
3. Install and configure Maven.
4. Configure Jenkins with Java, Git, and Maven.
5. Create a Jenkins job for your maven build project and run the project.
6. Poll Git for commits and automatically trigger the build.
7. Build the trigger using Push mechanism instead of Pull.
8. Repeat steps 6 and 7 multiple times to observe the results at **console output** section.

Key Takeaways

You are now able to:

- Describe the importance of continuous integration and continuous deployment
- List the features of Jenkins and demonstrate their uses
- List the features of TeamCity and demonstrate their uses
- Select a suitable build tool for your organization

Knowledge Check

Knowledge Check

1

What advantage does Maven have over Ant?

a. There isn't one

b. Ant only compiles code

c. Maven is easier to configure

d. It resolves dependencies

Knowledge Check

1

What advantage does Maven have over Ant?

a. There isn't one

b. Ant only compiles code

c. Maven is easier to configure

d. It resolves dependencies

The correct answer is **d. It resolves dependencies**

It resolves dependencies on external jar files.

Knowledge Check

2

What advantage does continuous integration provide?

a. It simplifies the build process

b. It stops developers checking in bad code

c. Build errors are quickly detected and reported

d. There are no real advantages

Knowledge Check

2

What advantage does continuous integration provide?

a. It simplifies the build process

b. It stops developers checking in bad code

c. Build errors are quickly detected and reported

d. There are no real advantages

The correct answer is **c. Build errors are quickly detected and reported**

Continuous integration can also perform testing and can generate documentation.

Knowledge Check

3

What does POM stand for?

a. Project Object Model

b. Project Oriented Model

c. Project Operational Model

d. Purpose Only Manufacturing

Knowledge Check

3

What does POM stand for?

a. Project Object Model

b. Project Oriented Model

c. Project Operational Model

d. Purpose Only Manufacturing

The correct answer is **a. Project Object Model**

Knowledge Check

4

What is continuous deployment?

a. A deployment server

b. Deployment tool

c. Open source deployment server for containers

d. Minimizing the time elapsed between writing new code and using new code in production

Knowledge Check

4

What is continuous deployment?

a. A deployment server

b. Deployment tool

c. Open source deployment server for containers

d. Minimizing the time elapsed between writing new code and using new code in production

The correct answer is **d. Minimizing the time elapsed between writing new code and using new code in production**

Continuous deployment refers to automated, faster, and quicker deployments of code into production.

Knowledge Check

5

Which of the following is NOT a continuous deployment tool?

a. Microsoft Visual Studio

b. GitHub

c. ElectricFlow

d. Bamboo

Knowledge Check

5

Which of the following is NOT a continuous deployment tool?

a. Microsoft Visual Studio

b. GitHub

c. ElectricFlow

d. Bamboo

The correct answer is **b. GitHub**

GitHub is not a continuous deployment tool as it is a source code repository.

Lesson-End Project

Continuous Integration with Jenkins, Git, and Maven

Duration: 60 mins

Problem Statement:

Create a FreeStyle project in Jenkins and complete the following:

- Install “Email Extension plugin” in Jenkins.
- Configure Gmail in Jenkins.
- Receive an email when build fails and succeeds.

Access: Click on the **Labs** tab on the left side panel of the LMS. Copy or note the username and password that is generated. Click on the **Launch Lab** button. On the page that appears, enter the username and password in the respective fields, and click **Login**.

Thank You