

✓ Apache Maven - Complete Guide

◆ What is Maven?

Maven is a **build automation tool** used mainly for **Java projects**.

It helps you **compile, test, package**, and **manage dependencies** of a Java project easily.

◆ Why Do We Use Maven?

Purpose	Explanation
Build automation	Compiles code, runs tests, creates JAR/WAR
Dependency management	Automatically downloads required libraries
Project structure	Provides a standard project layout
Consistency	Works the same across all environments
Plugin support	Plugins help add tasks like Docker, Kubernetes, etc.

🧱 Maven Standard Project Structure

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project-name/

|

| — src/

|

| — main/

|

| | — java/ → Source code

|

| | — resources/ → Config files, static data

|

| — test/

|

| — java/ → Unit tests

|

└─ target/ → Output files (JAR, WAR)

└─ pom.xml → Maven project file

What is pom.xml?

POM = Project Object Model

This is the **heart of a Maven project**. It contains:

- Project metadata
 - Dependencies (external libraries)
 - Build plugins
 - Versioning
 - Build lifecycle config
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Sample pom.xml (Simple)

xml

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```
<project xmlns="http://maven.apache.org/POM/4.0.0">
```

```
  <modelVersion>4.0.0</modelVersion>
```

```
  <groupId>com.example</groupId>
```

```
  <artifactId>student-api</artifactId>
```

```
  <version>1.0.0</version>
```

```
  <packaging>jar</packaging>
```

```
  <dependencies>
```

```
    <!-- Spring Boot -->
```

```
    <dependency>
```

```
      <groupId>org.springframework.boot</groupId>
```

```
      <artifactId>spring-boot-starter-web</artifactId>
```

```
</dependency>
</dependencies>

<build>
  <plugins>
    <!-- Maven Compiler Plugin -->
    <plugin>
      <groupId>org.apache.maven.plugins</groupId>
      <artifactId>maven-compiler-plugin</artifactId>
      <version>3.10.1</version>
      <configuration>
        <source>17</source>
        <target>17</target>
      </configuration>
    </plugin>
  </plugins>
</build>

</project>
```

Maven Lifecycle Phases

bash

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mvn clean install

Phase	Description
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clean	Deletes target/ folder (old builds)
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compile	Compiles Java source code
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Phase	Description
test	Runs unit tests
package	Packages compiled code into JAR/WAR
install	Installs package into local repo
deploy	Uploads artifact to remote repo

Maven Dependencies

Want to use a library like MySQL Connector or Lombok?

Add this inside `<dependencies>`:

xml

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```
<dependency>
  <groupId>mysql</groupId>
  <artifactId>mysql-connector-java</artifactId>
  <version>8.0.30</version>
</dependency>
```

Maven will download and use it automatically.

Maven Plugin Example

To build a Spring Boot app:

xml

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```
<plugin>
  <groupId>org.springframework.boot</groupId>
  <artifactId>spring-boot-maven-plugin</artifactId>
</plugin>
```

Real-Life Example

Let's say you're creating a Spring Boot Student API:

- Instead of downloading every JAR manually
- Maven will handle:
 - Adding required libraries (Spring Boot, JPA, MySQL)
 - Building and testing
 - Creating .jar or .war files for deployment

Benefits of Using Maven

Benefit	Why it matters
Saves time	Automates repetitive tasks
Handles dependencies	No need to download JARs
Promotes consistency	Standard directory structure
Works well with Jenkins	Seamless CI/CD integration

Drawbacks of Maven

Limitation	Notes
XML-based config is verbose	Gradle is more concise (Groovy-based)
Can be slow	Especially for large builds
Hard to debug plugins	Plugin issues may be complex

Maven Common Commands

Command	Purpose
mvn clean	Clean project
mvn compile	Compile code

Command	Purpose
<code>mvn test</code>	Run unit tests
<code>mvn package</code>	Create JAR/WAR file
<code>mvn install</code>	Install to local .m2 repo
<code>mvn spring-boot:run</code>	Run Spring Boot app

Interview Questions on Maven

1. What is Maven and why is it used?
2. What is pom.xml?
3. What are the Maven build lifecycle phases?
4. How does Maven manage dependencies?
5. What's the difference between install and package?
6. How is Maven used in CI/CD?