Gradle
Build automation

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What is Gradle

- Gradle is flexible general purpose build tool
- It combines Ant with Dependency management and Maven conventions
- It provides Groovy based DSL interface for writing build scripts
- Conventions with great flexibility
- Combination of declarative and imperative build tool

Tools put together

- Flexibility
- Full control
- Chaining of targets

- Dependency management

maven

- Convention over configuration
- Multimodule projects
- Extensibility via plugins

- Groovy DSL on top of Ant

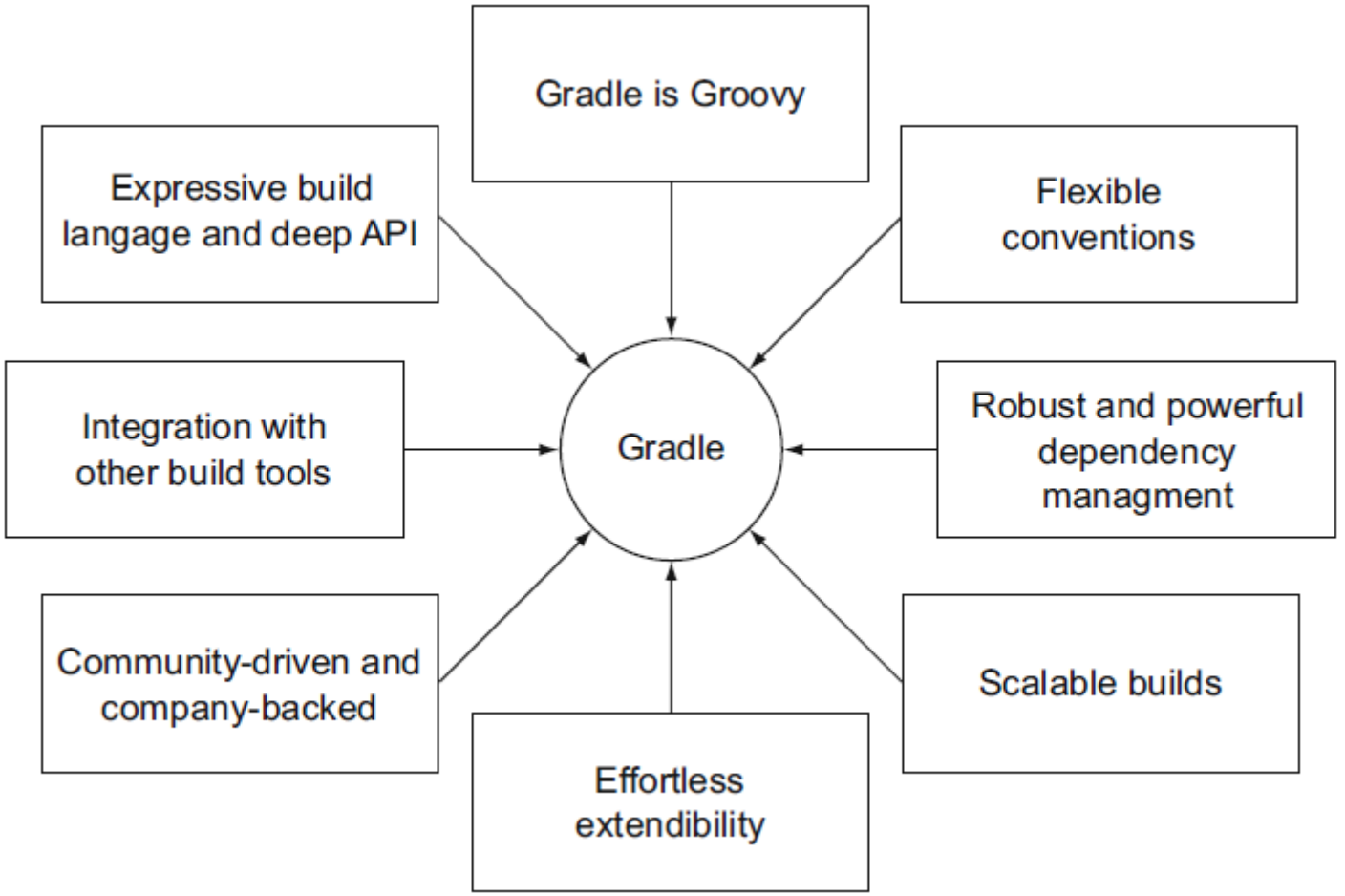
Kotlin

- Kotlin DSL

Gradle offers

- Build automation, checking, testing, publishing
- Dependency management based on Apache Ivy
- Support of multi-project builds
- Incremental builds
- Pluggable architecture
- IDE support and integration
- You can build Java, Android, C++ and more

Gradle is ...


Gradle is Groovy
Expressive build langage and deep API
Flexible conventions
Integration with other build tools
Gradle
Robust and powerful dependency managment
Community-driven and company-backed
Effortless extendibility
Scalable builds

Gradle Install or Wrapp

- Gradle requires JDK
- Groovy distribution is shipped with Gradle
- You can manually download and install Gradle
  - https://gradle.org/gradle-download
  - Unpack distribution and set `GRADLE_HOME`
  - Set JVM options to run gradle, `GRADLE_OPTS` or `JAVA_OPTS`
  - Use `gradle` command to build your project
- Or you can use Gradle Wrapper
  - Automatically downloads Gradle distribution
  - You should check it into version control
  - Use `gradlew` instead `gradle` command
  - Available on Windows and Linux

gradle/gradlew command

- Build is started with `gradle/gradlew` command
- Command accepts different options. Use `gradle -h` to list command options
- You typically provide task name and configuration properties. Gradle looks for `build.gradle` in current folder
- If there is a default task defined in build script, you just execute `gradle/gradlew` command with no additional parameters

Gradle daemon

- Background process
  - Speeds up the build
- Ideal when you build frequently
- Can be enabled via CLI, or for environment
  - `gradle -daemon`
  - `GRADLE_OPTS: -Dorg.gradle.daemon=true`
  - `org.gradle.daemon=true in the GRADLE_USER_HOME/gradle.properties`
  - In Gradle v3 the daemon is enabled by default
    - Use `-no-daemon` option to disable daemon for build

Gradle build

- Scripts - build source code is organized in one or more gradle scripts. Default script name is `build.gradle`
- Projects - at least one or more projects. The name of the projects is the build script's parent directory
- Tasks - build is collection of tasks with dependencies. You can use build-in tasks, or define your tasks. You ca exclude task from execution during build process
- Properties - comprises a build environment
- Plugins - gradle features extension. Bring new tasks and configuration into your project build. There are a lot of official, or unofficial Gradle plugins you can use in your projects

Gradle build lifecycle

- Gradle creates instance(s) of defined Project(s)

- Project objects are configured
- Project scripts are executed, without task execution
- Statements you have written outside of the task in the configuration block would be executed

- Gradle determines the subset of the tasks, created and configured during the configuration phase
- Gradle executes all tasks in defined order given in the command line

Gradle build Script

- Build script is code in Gradle
  - Set of actions that execute in some predefined order and perform certain operations
  - Represented by `org.gradle.api.Script`
- You can implement any build functionality directly in build script using Groovy
- For cleaner code organization, you can split your code into multiple source files and apply them, where you need
- Check the available plugins before, you implement required functionality

Gradle Project

- Root entity (`org.gradle.api.Project`)
- Contains one or more Tasks
- Execution of the build represents the execution of the Project object, which internally calls different tasks to perform the operations
- Build can contain more than one Project. Then we call it multiproject build

Gradle Task

- Atomic unit of execution (`org.gradle.api.Task`)
- Collection of actions and properties. It can depend on some other tasks
- Can accept input and return output
- Task defines two types of closures: `doFirst` and `doLast`. You can use these to add specific code before, or after task execution
- Gradle provides conditional Task execution

Gradle and Ant Tasks

- There are many exiting useful Ant tasks you can easily reuse in the Gradle build script

```
task hello {
  doLast {
     String greeting = 'hello from Ant'
     ant.echo(message: greeting)
  }
}
```

Incremental Builds

- Incremental build speeds up build execution
- Only not up to date task are executed
- Gradle implements mechanism to execute build task, only if task input, or output has changed

Environment Variables

- Use `GRADLE_OPTS` or `JAVA_OPTS` to specify command-line arguments to use to start the JVM. You can use these variables to set for example the JVM memory of Java process which executes the build
- You can use environment properties like this
  - `ORG_GRADLE_PROJECT_propertyName=Value`
- System properties can be defined using -D command line option. It has the same effect as -D option for java command
- It is useful to store some variables in VCS. For such scenario, use Gradle property file

Gradle Properties

- Properties are defined in gradle.properties file and are injected into project
- Properties file can be placed
  - In project directory
  - In gradle user home directory
    - `$USER_HOME/.gradle` by default
    - Can be changed by `GRADLE_USER_HOME` env variable
  - The properties file in the user's home directory has precedence over property files in the project directories
- Project properties can be defined using -P command line option
  - it has precedence over property files

Repositories

- External Project dependencies are usually stored in repositories
- Gradle supports several repository types
  - Maven
  - Apache Ivy
  - Flat directories
- You must define one or more repositories where Gradle will look for dependencies
  - Use `repositories {…}` closure

Repositories Definition Example [1]

```
repositories {
  mavenCentral()
  jcenter()
  mavenLocal()
}
```

- Maven Central repo: http://search.maven.org/
- Jcenter repo: https://jcenter.bintray.com/
- Maven Local cache: `<USER_HOME>/.m2/repository`

Repositories Definition Example [2]

```
repositories {
  maven {
    url "http://private.repository/path"
    credentials {
      username 'user'
      password 'psswd'
   }
  }
  maven {
    url "http://repo.springsource.org/release"
  }
}
```

Repositories Definition Example [3]

```
repositories {
  flatDir {
    dirs '/localfile/dir1',
         '/localfile/dir2'
  }
}
```

Dependency Configurations

- Gradle groups dependencies to different configurations
- If you build Java project, the java plugin brings some configurations `(compile, runtine, testCompile, testRuntime, ...)`
- You can define your own dependency configuration
- You define dependencies in `dependencies` closure

```
dependencies { ...}
```

Dependency Artifact

- Typical Maven repository artifact consists of
  - JAR file group (or namespace)
  - JAR filename
  - JAR file version
  - classifier (in case JAR has classifier-like-specific JDK version)
- Example for log4j artifact
  - `group: 'log4j'`
  - `name: 'log4j'`
  - `version: '1.2.16'`

Dependency Resolution [1]

- Project's dependencies can be complex
- There are usually transitive dependencies
  - You specify only first level dependency
  - Gradle handles complex dependencies for you
  - You can exclude dependency from transitive tree
- Gradle handles also version conflicts using several strategies
  - Last version strategy
  - Fail on conflict
  - Force specific version

Dependency Resolution [2]

- Gradle supports dynamic dependency
- When you want to use always latest version

```
group:'some-group',name:'some-name',version:'latest.integration'
group:'some-group',name:'some-name',version:'1.+'
```

Dependency Artifact Examples

```
dependencies {
 compile group:'log4j', name:'log4j', version: '1.2.16'
}
dependencies {
  compile 'log4j:log4j:1.2.16'
  compile files('lib/vehicles/car-2.0.jar')
}
```

Project Dependencies

- Project dependencies ate typical for multi-project builds

```
dependencies {
    compile project(':data:access')
}
```

Build Script Dependencies

- Sometimes you need to add a dependency to the Gradle build script itself as you like to use 3rd party libraries in the build script code
- You need to define repositories and dependencies

```
buildscript {
  repositories {...}
  dependencies { ...}
}
```

Dependency Cache

- The dependency cache of Gradle tries to minimize the number of remote requests and downloads
- Gradle maintains
  - cache for dependency metadata
  - cache for downloaded artifacts
- Both the metadata cache and artifact cache are stored in the directory defined by the `GRADLE_USER_HOME`
  - by default, the `.gradle/caches` directory in the user home directory
- You can use command line options to
  - skip any network requests: `--offline`
  - refresh the metadata caches: `--refresh-dependencies`

Publishing Artifacts

- A Gradle project can contain artifacts you want to publish
- You can define one or more artifacts in one project
- You can publish to defined supported repositories
  - Maven
  - Ivy
  - Local directory
- Publishing to other repositories can be supported by plugins (Artifactory, Bintray)

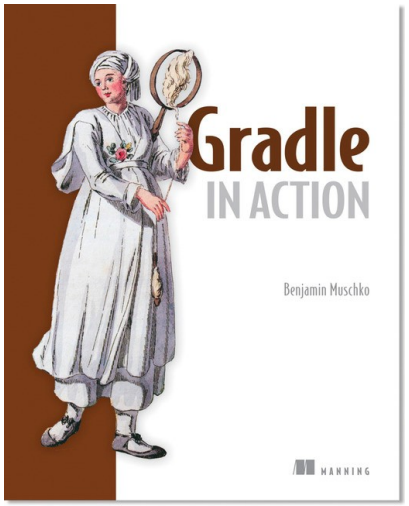
Android Plugin

- Android releases its own Gradle plugin to support Android builds
- Specific Android plugin version requires concrete Gradle version
- Android studio uses Gradle as build tool
- Gradle build file can be manipulated by Android studio

References

- Gradle official web pages: https://gradle.org
- https://docs.gradle.org/current/dsl/index.html
- https://plugins.gradle.org/
- http://gradle.org/maven_vs_gradle/
- http://gradle.org/case-study-continuous-delivery-netflix/
- http://gradle.org/case-study-gradle-continuous-delivery-linkedin/
- http://gradle.org/open-source-build-system-evaluation-in-the-age-of-continuous-delivery-part-1/

Books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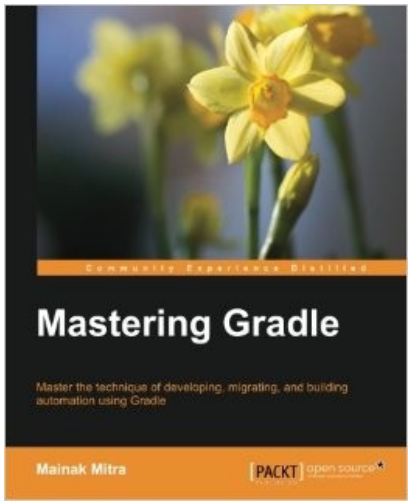
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Mastering Gradle
Master the technique of developing, migrating, and building automation using Gradle
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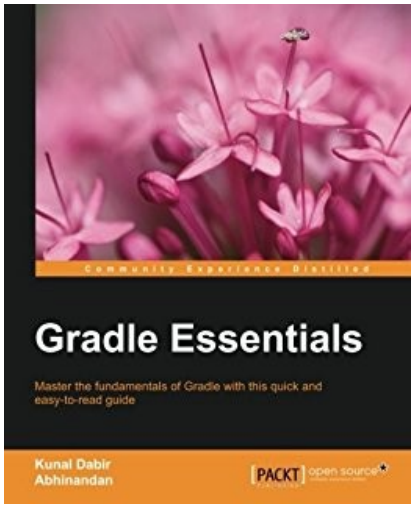
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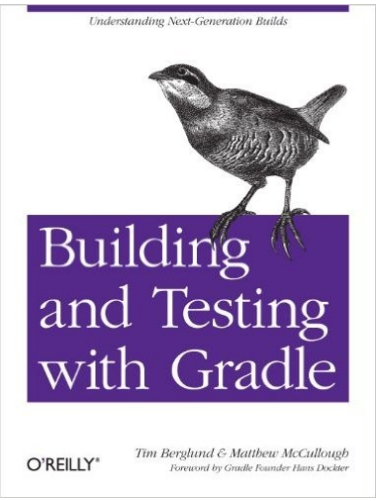
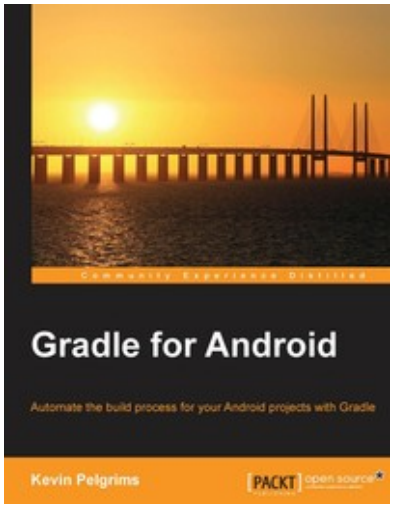

Understanding Next-Generation Builds
Building and Testing with Gradle
O'REILLY
Tim Berglund & Matthew McCullough
Foreword by Gradle Founder Hans Dockter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Gradle for Android
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Kevin Pelgrims
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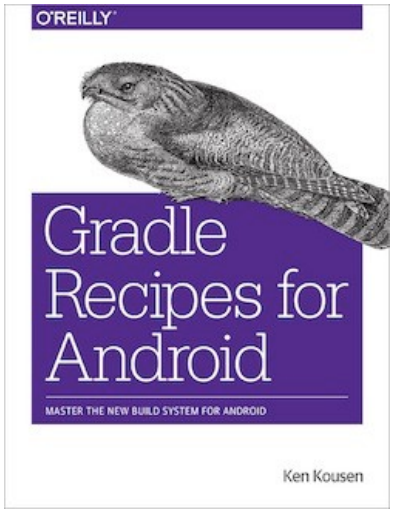
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MASTER THE NEW BUILD SYSTEM FOR ANDROID
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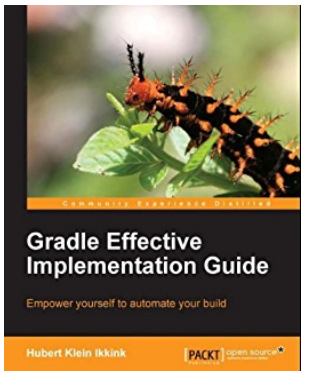
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Empower yourself to automate your build
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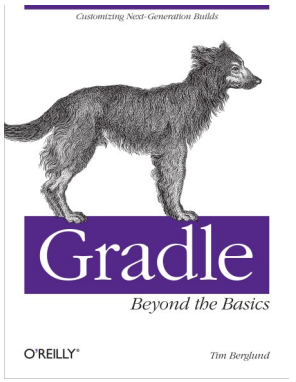
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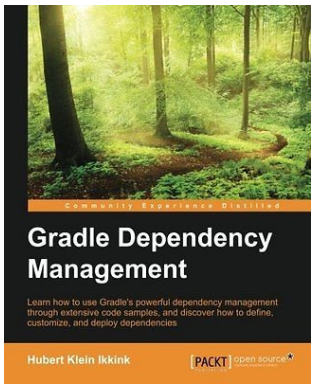
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Learn how to use Gradle's powerful dependency management through extensive code samples, and discover how to define, customize, and deploy dependencies
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