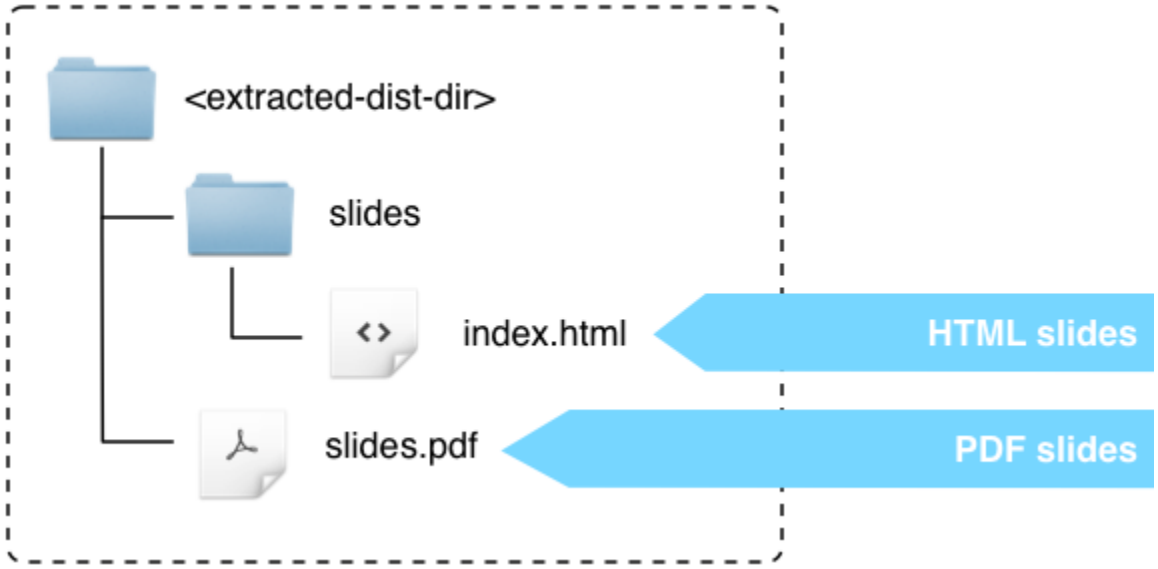
Introduction to Gradle

The fundamentals of building projects with Gradle

Gradle

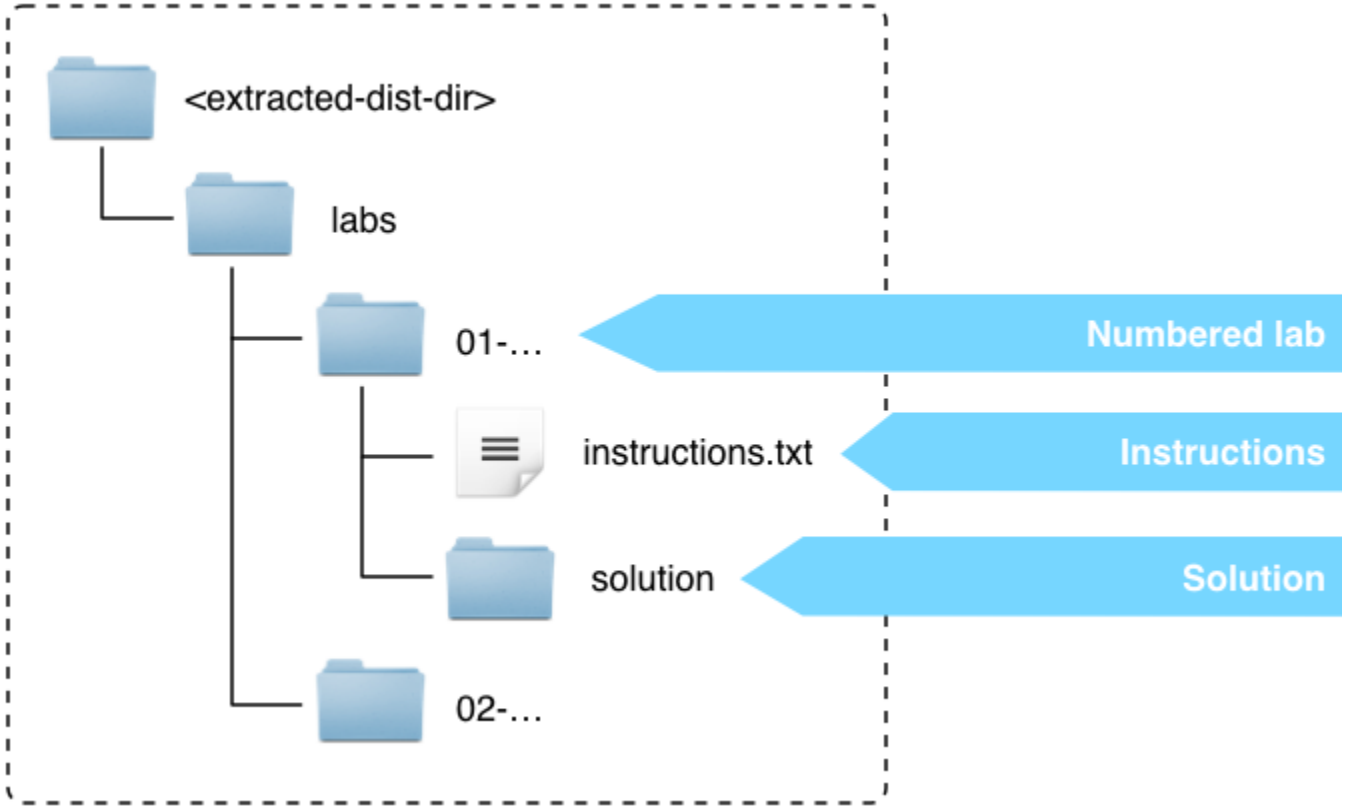
Slides

- Available in different formats
- Same content as today's presentation



Practical labs

- Solutions are available (but don't overuse them)
- Take your time and experiment
- The labs are not a test!



Ask questions

- Please ask questions at any time!
- You control the speed of the presentation
- Q&A session at the end of the workshop

Objectives

- A solid understanding of basic Gradle concepts
- An ability to write and run Gradle tasks
- Knowledge of how to use Java and C++ plugins
- Exposure to more advanced build capabilities

Topics we won't cover

- Android/Scala builds
- Continuous Integration/Delivery
- IDE integration
- Custom tasks
- Plugin development
- Advanced dependency management techniques
- Rule based model configuration

Agenda

- The Gradle Project
- Gradle Basics
- Tasks
- Working with the Filesystem
- Archives
- The Java plugin
- The C++ plugin
- Dependency Management
- Multi-Project Builds

Prerequisites

1. Ability to read/write Java/Groovy code
2. A basic understanding of build automation

Gradle

About the project

Gradle

Gradle is a build and automation tool.

Gradle can automate the building, testing, publishing, deployment and more of software packages or other types of projects such as generated static websites, generated documentation or indeed anything else.

- Cross-platform, JVM based
- Implemented in Java

http://www.gradle.org

Gradle Project

- Open Source, Apache v2 license - Completely free to use
- Source code on Github - github.com/gradle/gradle
- Active user community, centered around discuss.gradle.org
- Frequent releases (minor releases roughly every 4-8 weeks)
- Strong quality commitment
  - Extensive automated testing (including documentation) - builds.gradle.org
  - Backwards compatibility & feature lifecycle policy
  - Thorough design and review process
- Developed by domain experts
  - Gradle, Inc. staff and community contributors

Gradle Documentation

- User Guide
  - Many chapters and lots of samples
  - single page HTML, multi page HTML, PDF
  - Search tip: Full text search on single page HTML
- Build Language Reference (gradle.org/docs/current/dsl/)
  - Best starting point when authoring build scripts
  - Javadoc-like, but higher-level
  - Links into Javadoc and Groovydoc
- Gradle Guides (guides.gradle.org/)
  - Topic focused (e.g., Plugin Development)
  - Novice to Master

Other Gradle Resources

- Gradle Distribution
  - Includes user guide, build language reference, and **many sample builds**
  - `gradle-all` vs. `gradle-bin`
- help.gradle.org
  - Portal to other helpful resources
- discuss.gradle.org
  - Best place to ask questions
- Books, several are free!

Running Gradle

Getting Information

Print basic help information:

```
$ gradle help
```

Print command line options:

```
$ gradle -?
```

Print the available tasks in a project:

```
$ gradle tasks
```

Best Practices for Running Gradle

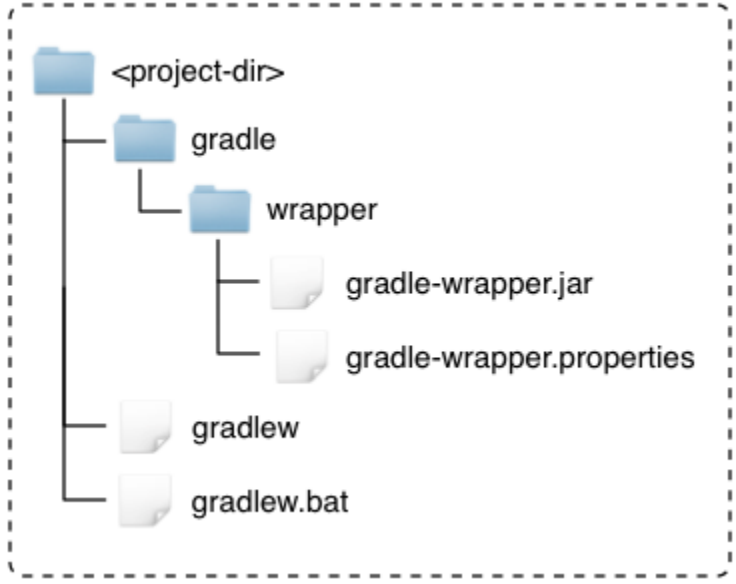
- Always use the wrapper
- Keep up-to-date with new releases
  - Performance bottlenecks are removed
  - New features are added
  - Deprecation warnings prevent surprises
- Use the daemon
  - Gradle 1.x and 2.x have the daemon off by default.
  - Gradle 3.x enables the daemon by default.

Gradle Wrapper

Gradle Wrapper

A way to bootstrap Gradle installations.

- **gradle-wrapper.jar:** Micro-library for downloading distribution
- **gradle-wrapper.properties:** Defines distribution download URL and options
- **gradlew:** Gradle executable for *nix systems
- **gradlew.bat:** Gradle executable for Windows systems



Usage example:

```
$ ./gradlew build
```

Wrapper task

- Wrapper task is built-in and generates:
  - wrapper scripts
  - wrapper jar
  - wrapper properties

```
$ gradle wrapper --gradle-version=4.1
```

- The `--distribution-type` flag lets you specify `all` if you want the complete distribution (the default is `bin`). The result is larger, but includes the source and samples.

Lab

01-wrapper

Gradle Build Daemon

Makes builds start faster. Way faster.

For Gradle 1.x/2.x:

- Enable with:
  - `--daemon` command line option
  - `org.gradle.daemon=true` in `gradle.properties`
  - `-Dorg.gradle.daemon=true` in `GRADLE_OPTS`

The daemon is enabled by default in Gradle 3.x.

Use `gradle --status` to see running daemons (3.x+ only).

Force shutdown with `gradle --stop`.

Lab

02-daemon-setup

Gradle Basics

Groovy

- Groovy basics are not covered in this class
- For more information:
  - Groovy Documentation
  - Groovy GDK
  - Groovy In Action (2nd Ed)

Gradle Build Scripts

- Must be valid Groovy syntax
- Can't be executed by plain Groovy runtime
- Are backed by a `org.gradle.api.Project` object

```
// does not compile:
println "Gradle

// compiles, fails when run with Groovy or Gradle:
println zipCode

// compiles, fails when run with plain Groovy:
println name
```

Gradle Build Scripts

- Conventionally build script is located in `build.gradle`
- Many aspects of the build can be controlled from `settings.gradle`
- Most useful capabilities are added via plugins

```
apply plugin: "java"
apply plugin: "idea"
apply plugin: "maven"
```

Lab

03-quickstart

Tasks

Tasks

Tasks are the basic unit of work in Gradle.

- Declared & configured in build scripts (or plugins)
- **Executed by Gradle**

```
task helloWorld {
  doLast {
    println "Hello World!"
  }
}
```

`task` is a keyword in the Gradle DSL.

All tasks implement the `Task` interface.

Task Actions

Tasks have a *list* of actions.

```
task helloWorld {
  doLast {
    println "World!"
  }
  doFirst {
    println "Hello"
  }
}
```

Most tasks have one useful main action.

`doLast()` and `doFirst()` can be used to decorate the action.

Executing Tasks

Execute tasks by specifying them on the command line.

```
$ gradle helloWorld
:helloWorld
Hello world!
```

Abbrev. Task Name Execution

Save your fingers by only typing the bare minimum to identify a task.

```
task myNameIsPrettyLong {
  doLast {
    println "Long name"
  }
}

task someOtherTask {
  doLast {
    println "Other task"
  }
}

//running:
$ gradle mNIPL sOtherT
```

Characters between word boundaries can be dropped.

Lab

04-tasks

Task types

Most of the time, tasks will use an existing task type.

```
task copyFiles(type: Copy) {
  // configure the task
}
```

Task is of type `Copy`. Configure it using its API.

If you don't specify a type, you get a `DefaultTask`.

Task Types and API

```
task helloWorld {
  onlyIf { System.getProperty("be.nice") == "true" }
  doLast { println "Hello" }
}
```

The `onlyIf()` and `doLast()` methods are available for all tasks (i.e. part of the `Task` interface).

```
task copyFiles(type: Copy) {
  from "sourceDir"
  into "targetDir"
}
```

The `from()` and `into()` methods are only available for `Copy` tasks.

The task's API allows the task to be *configured*.

Question

When would you implement a task type over an ad-hoc task?

1. never
2. if I want to reuse an existing task definition
3. if the logic becomes complex
4. if I want to implement ad-hoc logic
5. always

Task Dependencies

- Tasks can depend on each other
- Execution of one task requires prior execution of another task
- Executed tasks form a directed acyclic graph

```
task foo

task bar {
  dependsOn foo
}
```

Build Lifecycle

- Initialization Phase
  - Configure environment (init.gradle, gradle.properties)
  - Find projects and build scripts (settings.gradle)
- Configuration Phase
  - Evaluate all build scripts
  - Build object model (Gradle -> Project -> Task, etc.)
  - Build task execution graph
- Execution Phase
  - Execute (subset of) tasks

A *key* concept to grasp.

Question

Task actions are executed

1. in the initialization phase
2. in the configuration phase
3. in the execution phase
4. in the last phase of Gradle's build lifecycle

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05-build-lifecycle

Bonus Question

What will happen here?

```
task bar {
  doLast {
    dependsOn foo
  }
}
```

Will `foo` execute before `bar`?

Working with the Filesystem

Files

- Primary function of most builds
- Standard Java File API
- Gradle adds new types (e.g `FileCollection`, `FileTree`)
- Fundamental to Gradle's input/output model

Gradle provides support for common operations out of the box (e.g. zip, copy, delete).

Project File properties

Important properties:

- `projectDir` (read-only) - the base directory of the project
- `buildDir` - the build output directory of the project
- `rootDir` (read-only) - the base directory of the root project (multi-project)

The `buildDir` is `"$projectDir/build"` by default.

In plugins, don't assume this. Use `"$buildDir"`.

Relative files

Don't do this:

```
new File("src/main/java/Thing.java")
```

You don't know what the working directory of the JVM is.

Use:

```
project.file("src/main/java/Thing.java")
```

`Project.file(Object)` always resolves relative to the `projectDir`.

Many tasks accept `Object` for file types; resolved by `project.file()`.

Copy task

Copies files from one or more locations, to *one* destination.

```
task copyLibs(type: Copy) {
  from "libsDir", "docs/index.html", "/some.txt"
  into "ide"
}
```

Powerful API, including filtering and transforming.

Used very often in "standard builds".

Multiple sources/sub directories

API has a tree like structure.

```
task copyStuff(type: Copy) {
  exclude "**/.svn"  // default
  into "targetDir"
  into("targetSubDir") {
    from "sourceDir"
  }
  into("targetSubDir2") {
    from "sourceDir2", "someFile.txt"
  }
  into("targetSubDir3") {
    from "sourceDir3"
    include "**/*.jpeg"
    exclude "**/obsoleteImages/*"
  }
}
```

Transforming

Files can be mutated during copy.

```
task copyStuff(type: Copy) {
  into "targetDir"
  from("someDir") {
    // Use Ant's HeadFilter
    filter(HeadFilter, lines: 25, skip: 2)
  }
  from("otherDir") {
    // Line by line transform
    filter { line -> line.substring(5) }
  }
  from("anotherDir") {
    // Groovy's SimpleTemplateEngine
    // "$foo" -> "bar", "$red" -> "blue"
    expand(foo: "bar", red: "blue")
  }
}
```

Renaming

Files can be renamed and/or moved.

```
task copyStuff(type: Copy) {
  into "targetDir"
  from("someDir") {
    rename "(.*)_OEM_BLUE_(.*)", '$1$2'
  }
  from("otherDir") {
    eachFile { FileCopyDetails copyDetails ->
      if (copyDetails.name.length() > 10) {
        copyDetails.path = "longFileNames/$copyDetails.name"
      }
    }
  }
}
```

`eachFile` can also exclude files, deal with duplicates, etc.

Lab

06-copy

Permissions

Permissions at the destination can be specified.

```
task copyStuff(type: Copy) {
  into("targetDir")
  into("bin") {
    from "src/bin"
    fileMode = 0755
    dirMode = 0755
  }
}
```

Particularly useful when creating archives (covered soon).

Sync Task

Same as `Copy`, except that destination will *only* contain copied files (and nothing else).

```
task ide(type: Sync) {
  from sharedNetworkLibsDir
  into "ide"
}
```

Full copy (not incremental like rsync).

Question

A Copy task can

1. filter files
2. set permissions for files and directories
3. delete files
4. copy directories recursively
5. rename files

Archives

Archive Handling

Task type for each archive type (`Zip`, `Jar`, `War`, `Tar`).

- Similar to copy
  - Archiving: Copying to a directory
  - Unarchiving: Copying from a directory
- Supports transforming/renaming etc.

Archive Tasks

```
task zipLibs(type: Zip) {
  into("ide") {
    from("libsDir", "docs/index.html")
  }
  from "src/license.txt"
}
```

Zip content:

- license.txt
- ide/someJarFromLibsDir.jar
- ide/index.html

Archive Names

Base plugin adds conventional naming defaults.

```
apply plugin: "base"
version = "1.0"
task zipLibs(type: Zip) {
  baseName = "services"
  appendix = "api"
  // …
}
```

- baseName -> project.name
- appendix -> empty string
- version -> project.version
- classifier -> empty string
- extension -> type extension

Pattern: *«baseName»-«appendix»-«version»-«classifier».«extension»*

Default destinations

- Default destination dir for `Zip`/`Tar` (by `base` plugin)
  - `"build/distributions"`
- Default destination dir for `Jar`/`War` (by `java-base` plugin)
  - `"build/libs"`

Destination directory is customizable:

```
apply plugin: "base"

task myZip(type: Zip) {
  destinationDir = file("$buildDir/specialZips")
}
```

Unarchiving

Use `zipTree()` and `tarTree()` to specify archive *content*.

```
task unpackArchives(type: Copy) {
  from zipTree("zip1.zip"), zipTree("jar1.jar")
  from(tarTree("tar1.tar")) {
    exclude "**/*.properties"
  }
  from "zip2.zip"
  into "unpackDir"
}
```

Merging

`zipTree()` and `tarTree()` can be used to merge archives.

```
task mergedZip(type: Zip) {
  from zipTree("someZip.zip")
  from zipTree("otherZip.zip")
}
```

Typical use case: fat jars.

Java Plugin

Java Plugin

The basis of Java development with Gradle.

- Introduces concept of source sets
- “main” and “test” source set conventions
- Compilation pre-configured
- Dependency management
- JUnit & TestNG testing
- Produces single JAR
- Javadoc generation
- Standard lifecycle/interface

Source Sets

A logical compilation/processing unit of sources.

- Java source files
- Non compiled source files (e.g. properties files)
- Classpath (compile & runtime)
- Output class files
- Compilation tasks

```
sourceSets {
  main {
    java {
      srcDir "src/main/java" // default
    }
    resources {
      srcDir "src/main/resources" // default
    }
  }
}
```

Lifecycle Tasks

The `java` plugin provides a set of “lifecycle” tasks for common tasks.

- `clean` - delete all build output
- `classes` - compile code, process resources
- `test` - run tests
- `assemble` - make all archives (e.g. zips, jars, wars etc.)
- `check` - run all quality checks (e.g. tests + static code analysis)
- `build` - combination of `assemble` & `check`

Testing

Built-in support for JUnit and TestNG.

- Pre-configured "test" task
- Automatic test detection
- Forked JVM execution
- Parallel execution
- Configurable console output
- Human-readable HTML reports
- Machine-readable reports for further processing (e.g. XML)

Lab

07-java-plugin

Native language support

History

- Early version of 'cpp' plugin was developed in 2011
- Significant new development since 2013
  - C/C++/Assembler/Objective-C/Objective-C++
  - Windows Resources
  - Binary variants (build types, platforms, flavors)
  - Tool Chains (Visual C++, Clang, Gcc)
  - Visual Studio integration
  - CUnit support
  - Google Test support
  - Parallel compilation
  - Precompiled header support

Native Support is *incubating*

- Incubating means it's still under active development
  - We use incubating to gather real world feedback on new features
  - Syntax details may change between minor releases
  - Check release notes to understand potential impacts!
- Planned features
  - Variant-aware dependency resolution
  - Improved usability
  - More Tool Chains
  - Performance improvements

Native Binary Plugins

- Usual mechanism is to apply one or more language plugins, providing:
  - Core model elements and containers
  - Specific language support
  - Standard Tool Chain support

```
apply plugin: 'cpp'
apply plugin: 'c'
apply plugin: 'assembler'
apply plugin: 'windows-resources'
```

Each language plugin is composed of separate plugins that add language support, model support, tool chains, etc.

Model Driven Configuration

'Standard' Gradle (1.0):

- Plugins provide tasks and conventions
- Most build customisation is by configuring **tasks**

Model Driven Approach:

- Plugins provide model elements, rules and conventions (encoded as rules)
- Most build customisation is by configuring **model**
- Model + rules + conventions => tasks

Task Graph is still used at execution time

Native Model Elements

- Component: Abstract software component (NativeExecutableSpec, NativeLibrarySpec)
- Source Set: Language-specific grouping of sources (C Sources, C++ Sources)
- Variant Dimension: Different ways a component can be built (Linkage, Build Type, Platform)
- Native Binary (variants): Actual compiled binary (Debug static library for win32)
- Tool Chain: Set of tools that can build a Native Binary (Visual C++, Gcc, Clang)

All of these are configured via the model containers.

Defining an Executable

`NativeExecutableSpec` is one type of native *component*

- Every executable has a unique name within the project.
- Define an executable by adding an element to the `components` container with type `NativeExecutableSpec`.
- Without a component defined, Gradle will not build anything

```
model {
  components {
    myApplication(NativeExecutableSpec)
  }
}
```

Given an `NativeExecutableSpec` component, Gradle can build one or more `NativeExecutableBinarySpec` variants

Defining a Library

`NativeLibrarySpec` is a type of native *component*

- Each library has a unique name within the project
- Define a library by adding an element to the `components` container with type `NativeLibrarySpec`.
- Each library binary has a compile-time, link-time and (optional) runtime representation.

```
model {
  components {
    myLibrary(NativeLibrarySpec)
  }
}
```

Tasks Generated for each binary

- Compile sources
- Link executable
- Build executable ('lifecycle' task - does not have any actions)
- Install executable

```
:compileDebugMainExecutableMainCpp
:linkDebugMainExecutable
:debugMainExecutable
:installDebugMainExecutable
```

All tasks are incremental (skipped if inputs and outputs are up-to-date)

Source Set Conventions

By default, for a language `Y`, there is a `LanguageSourceSet` named **`sources.Y`** in each native component

```
model {
  components {
    hello(NativeExecutableSpec) {
      sources {
        cpp
        c
        asm
      }
    }
  }
}
```

These are implicitly configured for you when the language plugin is applied.

Configuring Additional Source Sets

- Additional source sets can be added to a component in the same way as new components can be added to the model

```
model {
  components {
    hello(NativeExecutableSpec) {
      sources {
        additionalCpp(CppSourceSet)
        extraC(CSourceSet)
        x86Assembler(AssemblerSourceSet)
      }
    }
  }
}
```

Conventional Source Locations

- For a LanguageSourceSet `X.sources.Y`, the default sources are 'src/X/Y'
- For a HeaderExportingSourceSet `X.sources.Y`, the default headers are 'src/X/headers'

Default source code locations for LanguageSourceSet `hello.sources.cpp`:

```
src/
  hello/
    cpp/
      source3.cpp
      source4.cpp
    headers/
      header1.h
      header2.h
```

Lab

08-executable

Dependency Management

Dependency Management

Gradle supports managed and unmanaged dependencies.

- “Managed” dependencies have identity and possibly metadata.
- “Unmanaged” dependencies are just anonymous files.

Managed dependencies are superior as their use can be automated and reported on.

Unmanaged Dependencies

```
dependencies {
  compile fileTree(dir: "lib", include: "*.jar")
}
```

Can be useful during migration.

Managed Dependencies

```
dependencies {
  compile "org.springframework:spring-core:4.0.5.RELEASE"
  compile group: "org.springframework", name: "spring-web",
          version: "4.0.5.RELEASE"
}
```

Group/Module/Version

Configurations

Dependencies are assigned to *configurations*.

```
configurations {
  // default with "java" plugin
  compile
  runtime
  testCompile
  testRuntime
}

dependencies {
  compile "org.springframework:spring-core:4.0.5.RELEASE"
}
```

See `Configuration` in DSL reference.

Transitive Dependencies

Gradle (by default) fetches dependencies of your dependencies. This can introduce version conflicts.

Only one version of a given dependency can be part of a configuration.

Options:

- Use default strategy (highest version number)
- Disable transitive dependency management
- Excludes
- Force a version
- Fail on version conflict
- Dependency resolution rules

Disable Transitives

Per dependency…

```
dependencies {
  compile("org.foo:bar:1.0") {
    transitive = false
  }
}
```

Configuration-wide…

```
configurations {
  compile.transitive = false
}
```

Excludes

Per dependency…

```
dependencies {
  compile "org.foo:bar:1.0", {
    exclude module: "spring-core"
  }
}
```

Configuration-wide…

```
configurations {
  compile {
    exclude module: "spring-core"
  }
}
```

Version Forcing

Per dependency…

```
dependencies {
  compile("org.springframework:spring-core:4.0.5.RELEASE") {
    force = true
  }
}
```

Configuration-wide…

```
configurations {
  compile {
    resolutionStrategy.force "org.springframework:spring-core:4.0.5.RELEASE"
  }
}
```

Fail on Conflict

Automatic conflict resolution can be disabled.

```
configurations {
  compile {
    resolutionStrategy.failOnVersionConflict()
  }
}
```

If disabled, conflicts have to be resolved manually (using force, exclude etc.)

Cross Configuration Rules

Configuration-specific rules can be applied to all configurations.

```
configurations {
  all {
    resolutionStrategy.failOnVersionConflict()
  }
}
```

`all` is a special keyword, meaning all things in the configuration container.

Dependency Cache

Default location: `~/.gradle/caches/...`

- Multi-process safe
- Source location aware
- Optimized for reading (finding deps is fast)
- Checksum based storage
- Avoids unnecessary downloading
  - Finds local candidates
  - Uses checksums/etags

An opaque cache, not a repository.

Changing Dependencies

Changing dependencies are mutable.

Version numbers ending in `-SNAPSHOT` are changing by default.

```
dependencies {
  compile "org.company:some-lib:1.0-SNAPSHOT"
  compile("org:somename:1.0") {
    changing = true
  }
}
```

Default TTL is 24 hours.

Dynamic Dependencies

Dynamic dependencies do not refer to concrete versions.

Can use Ivy symbolic versions.

```
dependencies {
  compile "org.company:some-lib:2.+"
  compile "org:somename:latest.release"
}
```

Default TTL is 24 hours.

Controlling Updates & TTL

```
configurations.all {
  resolutionStrategy.cacheChangingModulesFor 4, "hours"
  resolutionStrategy.cacheDynamicVersionsFor 10, "minutes"
}
```

- `--offline` - don't look for updates, regardless of TTL
- `--refresh-dependencies` - look for updates, regardless of TTL

Dependency Reports

View the dependency graph.

```
$ gradle dependencies [--configuration «name»]
```

View a dependency in the graph.

```
$ gradle dependencyInsight --dependency «name» [--configuration «name»]
```

Built in tasks.

Repositories

- Any Maven/Ivy repository can be used
- Very flexible layouts are possible for Ivy repositories

```
repositories {
  jcenter()
  mavenCentral()

  maven {
    name "codehaus"
    url "http://repository.codehaus.org"
  }

  ivy {
    url "http://repo.mycompany.com"
    layout "gradle" // default
  }

  flatDir(dirs: ["dir1", "dir2"])
}
```

Question

Dependency management in Gradle can be configured to do the following

1. avoid pulling in transitive dependencies
2. look up dependencies in the local Maven repository
3. download zip files
4. retrieve dependencies from an Ivy repository
5. use files from the local file system as dependencies

Lab

09-dependencies

Uploading

- Upload your artifacts to any Maven/Ivy repository
- ivy.xml/pom.xml is generated
- Repository metadata (e.g. maven-metadata.xml) is generated

Uploading to Maven Repositories

```
apply plugin: "maven"

uploadArchives {
  repositories {
    mavenDeployer {
      repository(url: "http://my.org/m2repo/")
    }
  }
}
```

- Provided by the maven plugin
- You can use all wagon protocols for uploading
- For Artifactory, JFrog provides an `artifactory-publish` plugin

Gradle Build Scans

Creating build scans

- Creating a build scan is free.
- Build scans are a permanent, centralized and shareable record of a build.
- Build scans offer insight into how you are building your software.
- **All build scans created during this course will be uploaded to a Gradle, Inc server**. A self-hosted version is available.
- See Gradle Build Scans for more information.

We encourage you to generate a build scan if you have a problem with a lab, so we can help you solve your problem. Just run your build with `--scan`.

Lab

10-create-build-scan

Multi-Project Builds

Multi-Project Builds

- Flexible directory layout
- Configuration injection
- Project dependencies & partial builds
- Separate configuration/execution hierarchy

Configuration Injection

- **ultimateApp**
  - api
  - services
    - webservice
  - shared

```
subprojects {
  apply plugin: "java"
  dependencies {
    testCompile "junit:junit:4.7"
  }
  test {
    jvmArgs "-Xmx512M"
  }
}
```

Filtered Injection

- **ultimateApp**
  - api
  - services
    - webservice
  - shared

```
configure(nonWebProjects()) {
  jar.manifest.attributes Implementor: "Gradle Inc."
}

def nonWebProjects() {
  subprojects.findAll { !it.name.startsWith("web") }
}
```

Project Dependencies

- ultimateApp
  - **api**
  - services
    - webservice
  - shared

```
dependencies {
  compile "commons-lang:commons-lang:2.4"
  compile project(":shared")
}
```

Partial Builds

- ultimateApp
  - **api**
  - services
    - webservice
  - shared

```
$ gradle build
$ gradle buildDependents
$ gradle buildNeeded
```

Name Matching Execution

- **ultimateApp**
  - api
  - services
    - webservice
  - shared

```
$ gradle build
$ gradle classes
$ gradle war
```

Task/Project Paths

- For projects and tasks there is a fully qualified path notation:
  - : (root project)
  - :clean (the clean task of the root project)
  - :api (the api project)
  - :services:webservice (the webservice project)
  - :services:webservice:clean (the clean task of webservice)

```
$ gradle :api:classes
```

Defining a Multi-Project Build

- settings.gradle (location defines the root)
- root project is implicitly included

```
//declare projects:
include "api", "shared", "services:webservice"

//Everything is configurable:

//default: root dir name
rootProject.name = "main"

//default: "api" dir
project(":api").projectDir = file("/myLocation")

//default: "build.gradle"
project(":shared").buildFileName = "shared.gradle"
```

Question

In a multi-project build, one can

1. define project dependencies
2. inject configuration from the root project to only Java-based subprojects
3. not nest subprojects deeper than one level
4. run a single task from one of the subprojects
5. not change the name of a subprojects

Feature Tour

A selection of useful features not covered so far.

Init Plugin

Create build from template, convert Maven build.

```
$ gradle init --type java-library

$ gradle init --type pom
```

Continue after Failure

```
$ gradle build --continue
```

Especially useful for CI builds.

Parallel Builds

Run independent tasks from different projects in parallel.

```
$ gradle build --parallel
```

Incubating feature; some restrictions apply.

Continuous Build

When the build completes, instead of exiting, watch the inputs of executed tasks and re-run the build when an input changes.

```
$ gradle build --continuous
```

Incubating feature.

Limitations:

- Changes to build scripts will not trigger a build.

Standard Gradle Plugins

Gradle ships with many useful plugins.

Some examples:

- `java` - compile, test, package, upload Java projects
- `checkstyle` - static analysis for Java code
- `maven` - uploading artifacts to Apache Maven repositories
- `scala` - compile, test, package, upload Scala projects
- `idea` and `eclipse` - generates metadata so IDEs understand the project
- `application` - support packaging your Java code as a runnable application
- `c` / `cpp` - support building native binaries using gcc, clang or visual-cpp

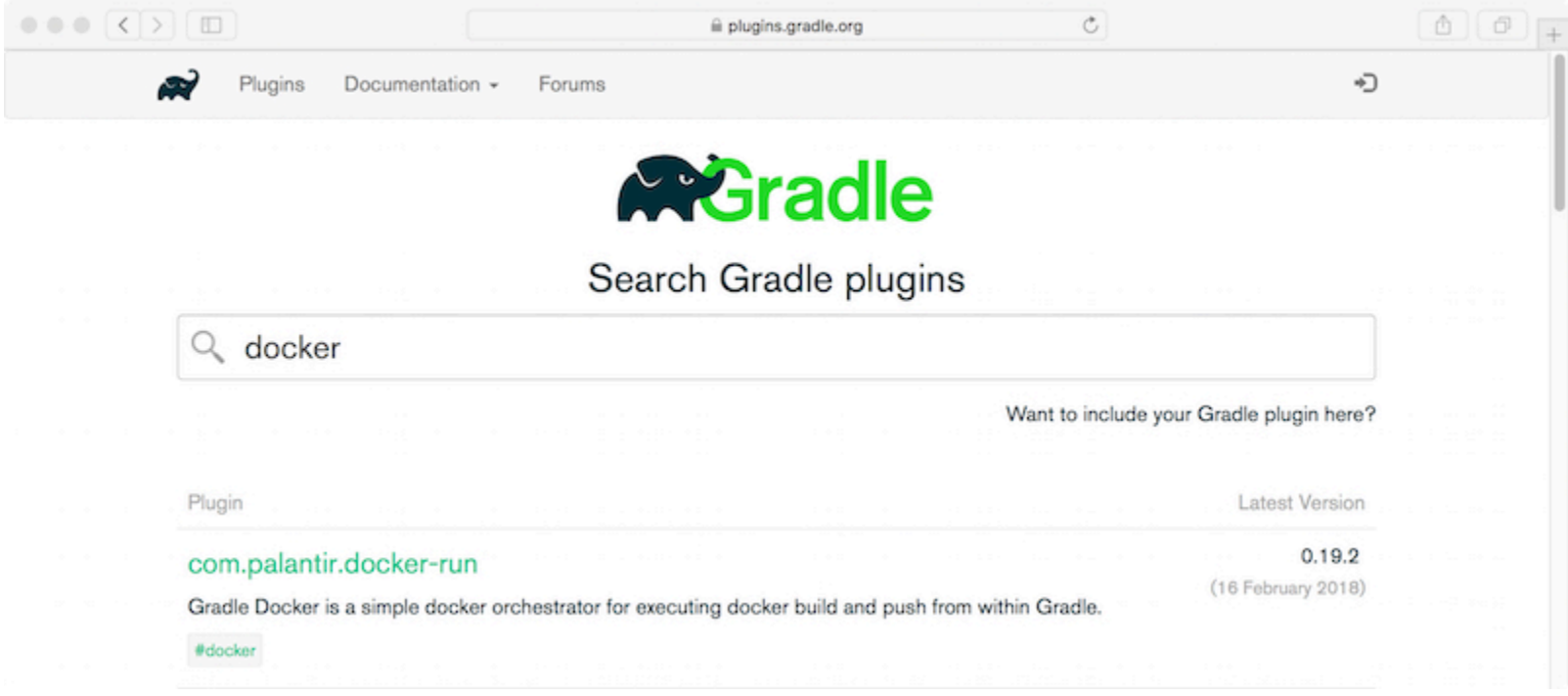
Many more, listed in the Gradle User Guide.

Notable community plugins

- Android: Development of mobile applications for Android
- Gretty: Running web applications on Servlet containers
- Docker: Managing Docker images, containers and work flows
- SSH: Remote command execution and file transfer via SSH
- Git: Executing Git operations, GitHub Pages publishing, Inferring versioning

Gradle's plugin portal

- Internet accessible plugin portal at https://plugins.gradle.org/
- Search and discover community plugins
- Publishing of plugin with dedicated plugin publishing plugin
- Plugin JARs and their metadata are hosted by Gradle Inc.



Thank You!

- Thank you for attending!
- Questions?
- Feedback?
- Gradle Home
- Get more help!

Gradle