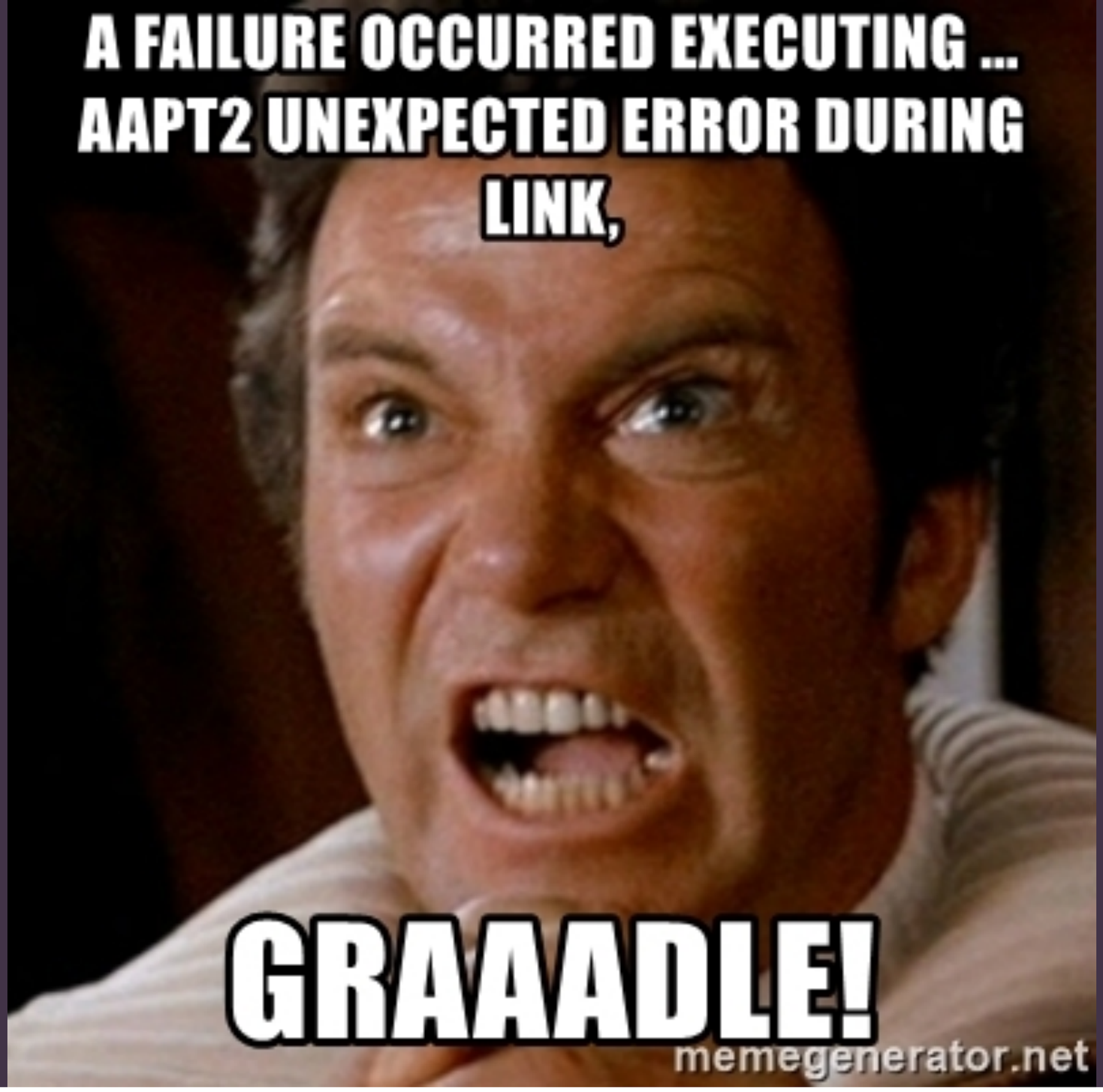

Denver,CO
{360|AnDev}
2021

Gradle Isn't Just a Bad Word

Inspired by my Mobile DevOps experience supporting Android developers
and building gradle plugins



The way Android devs use the word "gradle" it sounds like profanity
only hear it when their build breaks.

Goals 🎯

→ reduce fear of Gradle

→ help you understand Stack Overflow snippets

→ new tools to help debug builds

to help you understand what's going under the covers of Android Studio,
use gradle directly on the command line in a Terminal window

github.com/phatblat/CompositeProject

I've worked up a companion project for this talk

My bot will paste that URL into Slack

Agenda 🗓️

- → 🏛️ Project Structure
- → ⌨️ Invoking Gradle from the CLI
- → ✅ Creating Tasks
- → 🔌 Plugins
- → 👨‍👧‍👧 Dependencies
- → 🧱 Composite Projects

Composite projects are a neat trick for debugging and/or modifying a dependency while testing it inside your app!

Files

Gradle Project Structure

→ Wrapper
→ Ignore
→ File Layout
→ Project Hierarchy

First, the rapper

no, not that kind of rapper

Wrapper

```
└── gradle
    └── wrapper
        ├── gradle-wrapper.jar
        └── gradle-wrapper.properties
├── gradlew
└── gradlew.bat
```

no need to install gradle

wrapper pins version of gradle

in your project

check these files into git

Ignore

→ .gradle/
→ build/

No preceding slash will ignore all build dirs

Gradle Files

→ build.gradle

→ settings.gradle

→ gradle.properties

Groovy plus a custom DSL can put any valid groovy or java in a .gradle file, provided the DSL syntax allows

Kotlin Script

→ build.gradle.kts

→ settings.gradle.kts

Don't use it; don't feel bad if you aren't

Kotlin script hasn't been very well supported by Android Studio

Most sample Gradle build scripts will be in Groovy

build.gradle

→ gradle DSL

→ plugin "extension" DSLs

settings.gradle

→ rootProject.name

→ multi-project configuration (`include`)

→ composite configuration (`includeBuild`)

Only place root project name can be tailored. Defaults to folder name

gradle.properties

→ Comment lines with `#`

→ Leading/trailing whitespace ignored `key = value`

→ Values read as `String`

→ Properties inherited by subprojects

→ AGP 4.2+ ignores these files in subprojects [1]

[1] See the AGP 4.2 release notes

Java properties syntax

Need special handling for Integers

Properties defined in the root project are visible in subprojects, but can be overridden

Causes confusion where to put values

local.properties

→ `sdk.dir`

→ `ndk.dir`

Only used by AGP for a few dir values

Project Hierarchy

```
Root project 'CompositeProject'
+--- Project ':app'
\--- Project ':module'
```

View using the "projects" task.

Each line lists a gradle project within a multi-project setup.

Every Android project is a multi-project where the root is just for configuration.
Gradle uses semicolon as Hierarchy notation
a single semicolon references the "root" project in a multi-project

Invoking Gradle from the CLI

Invoking the Wrapper

```
→ ./gradlew taskName
→ gradlew.bat taskName
→ gw taskName
```

Always run from root of the repo.

./ is needed on unix since the current dir is not on the PATH

Wrapper Function (Bash & Z Shell)

```
function gw {
    if [ -e ./gradlew ]; then
        ./gradlew $argv
        return
    fi

    echo "There is no Gradle wrapper in the current dir."
    gradle $argv
}
```

~/.bashrc or ~/.zshrc

Put this in your .bashrc or .zshrc

Wrapper Function (Fish Shell)

```
function gw
    if test -e ./gradlew
        ./gradlew $argv
        return
    end

    echo "There is no Gradle wrapper in the current dir."
    gradle $argv
end
```

~/.config/fish/functions/gw.fish

Input

→ build.gradle
→ gradle.properties
→ ~/.gradle/gradle.properties
→ -Pproperty=value

Output

→ console
→ log levels
→ stacktrace
→ build scans

Options to control output

--console

```
→ plain
```

Log Levels

→ error: -q, --quiet
→ warn: -w, --warn
→ lifecycle (default)
→ -i, --info
→ -d, --debug

debug can include sensitive info

Stack Trace

→ -s, --stacktrace

→ -S, --full-stacktrace

Print out the full (very verbose) stacktrace for all exceptions.

Build --scan

`--scan`

Creates a sharable web report

Tasks

Listing Tasks

→ gw tasks

→ gw tasks --all

```
Zzz tasks
---------
clonePlugin - Clones the ShellExec plugin project into a sibling directory.
cloneRetrofit - Clones the Retrofit project into a sibling directory.
fortune - An example script task.
hello - An example task class.
```

without --all only dasks which have a "group" are shown

the group name is "zzz"

Creating Tasks

```
tasks.register('hello') {
    doLast {
        println 'hello world'
    }
}
```

Goes in build.gradle

doLast is the task action

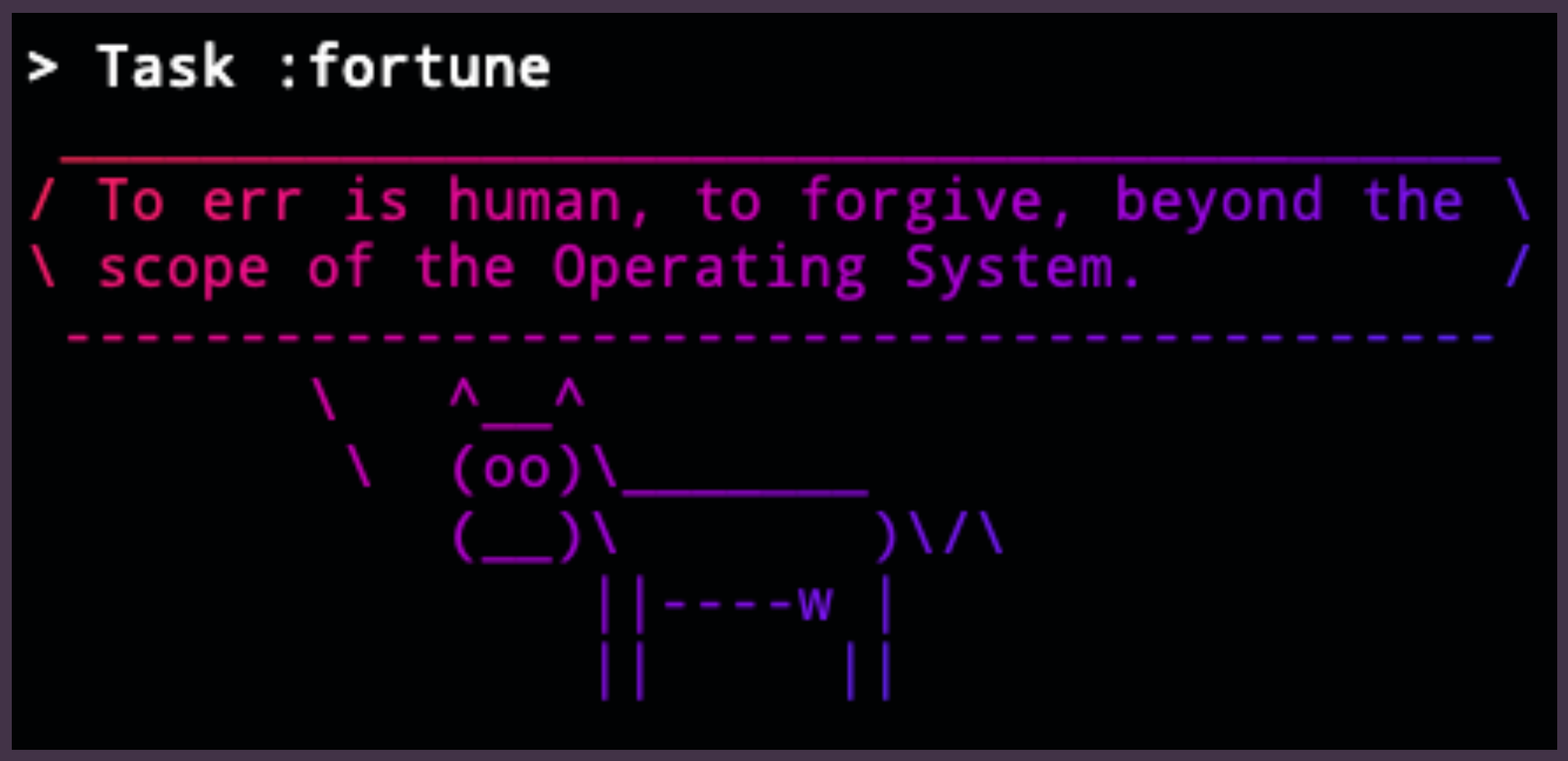
Example Tasks

→ buildTypes
→ productFlavors
→ flavorDimensions
→ buildVariants
→ variantFilter

companion project includes some simple gradle tasks along with some more advanced ones

ShellExec

```
tasks.register('fortune', ShellExec) {
    command "fortune | cowsay | lolcat --force"
}
```



Gradle plugin to replace Exec

Supports any Bash syntax in the command string

dependsOn

→ Chains tasks

🙅‍♀️ `assembleDebug.dependOn(fortune)`

```
tasks.whenTaskAdded { task ->
    if (task.name == 'assembleDebug') {
        task.dependsOn(fortune)
    }
}
```

Task graph is a DAG. After tree/graph is built, then task order is determined

Not intuitive

Dry Run

→ -m, --dry-run

```
↪ gw --dry-run assembleDebug
:fortune SKIPPED
:app:preBuild SKIPPED
...
:app:packageFullDebug SKIPPED
:app:assembleFullDebug SKIPPED
:app:assembleDebug SKIPPED
..
:module:compileDebugSources SKIPPED
:module:assembleDebug SKIPPED
```

Plugins

Script Plugins

```
apply from: "android-info.gradle"
```

→ File path

→ ~~URL~~

Simple way to split up your build.gradle

Remote scripts can be applied with an HTTP URL, but that's a terrible idea

Binary Plugins

→ Buildscript Block

→ Plugins Block

→ Maven Coordinates vs Plugin ID

Plugins extend the Gradle DSL (android) block, add tasks

Buildscript Block

```
buildscript {
    repositories {
        google()
        mavenCentral()
        jcenter()
    }
    dependencies {
        classpath 'at.phatbl:shellexec:+'
    }
}

apply plugin: "at.phatbl.shellexec"
```

only in root project

dependencies (plugins)

always use "classpath"

Plugins Block

```
plugins {
  id "at.phatbl.shellexec" version "1.5.2"
}
```

→ version only needed in root project

→ auto-applies plugin to the current project

→ opt out with: `apply false`

Android Studio 4.2 uses plugins block in subprojects/ modules

Maven Coordinates

→ group ID
→ artifact ID
→ version
→ classifier (optional)
→ extension (optional)

```
configurationName 'group:name:version:classifier@extension'
configurationName group: group, name: name, version: version, classifier: classifier, ext: extension
```

components separated by colon

except extension is prefixed with @

double quotes required if using a variable

Maven Group ID

→ typically reverse-domain syntax of author

→ phatbl.at <-> at.phatbl

→ org.jetbrains.kotlin

→ com.android.tools.build

authors with lots of published libraries may use many groups

Maven Artifact ID

→ library name

→ typically words separated by dash

→ e.g. `protobuf-gradle-plugin`

Version

→ Semantic verion number

→ Rolling `-SNAPSHOTS`

→ Optional pre-release qualifier (e.g. 1.0-alpha-3)

Specifying versions

→ Support for version ranges [2]

→ Dynamic versions (+)

[2] Maven Dependency Version Requirement Spec

Version ranges probably only useful for libraries.

Dynamic Versions

→ `+` - any version

→ `1.+` - any v1 minor version

→ `1.2.+` - any v1.2 patch version

→ Version cached for 24h

→ Force check with `--refresh-dependencies`

Gradle feature, not maven

Gradle has dependency locking, but I haven't used it

Dynamic Version Caveats

→ Discouraged by Google

→ Build non-determinism if dependency updates are being released

→ Slower dependency resolution

→ Every repo is checked for dependency versions

Every repo in list is searched, even after match is found

Google moved plugin from jcenter to their own repo builds failed if jcenter listed before google

Plugin ID

→ Used when applying plugins

→ Used in newer Gradle `plugins` block

Maven Coordinates vs Plugin ID

→ `at.phatbl:shellexec:1.0.0`

→ `at.phatbl.shellexec`

→ View on plugins.gradle.org for most plugins

AGP published to google's maven repo

Dependencies

Configuration

→ compile (don't use)

→ implementation (use this)

```
implementation ...
testImplementation ...
```

configuration is a group of dependencies

compile removed in Gradle 7

Configuration

→ api - for modules & libraries

→ when types defined in a dependency are exposed by your public API

→ see app -> module.GitHub -> retrofit in example project

List Plugins

```
↪ gw buildEnvironment

classpath
+--- com.android.application:com.android.application.gradle.plugin:4.2.2
|    \--- com.android.tools.build:gradle:4.2.2
|    ...
\--- at.phatbl.shellexec:at.phatbl.shellexec.gradle.plugin:1.5.2
     \--- gradle.plugin.at.phatbl:shellexec:1.5.2
          +--- org.jetbrains.kotlin:kotlin-stdlib:1.3.61 -> 1.5.21 (*)
          +--- org.jetbrains.kotlin:kotlin-stdlib-jdk8:1.3.61 -> 1.4.31 (*)
          \--- org.jetbrains.kotlin:kotlin-reflect:1.3.61 -> 1.5.21 (*)
```

Gradle Dependencies Task

```
↪ gw :app:dependencies --configuration implementation

implementation - Implementation only dependencies for 'main' sources. (n)
+--- project module (n)
+--- org.jetbrains.kotlin:kotlin-stdlib:1.5.21 (n)
+--- androidx.core:core-ktx:1.6.0 (n)
+--- androidx.appcompat:appcompat:1.3.0 (n)
+--- com.google.android.material:material:1.4.0 (n)
\--- androidx.constraintlayout:constraintlayout:2.0.4 (n)
```

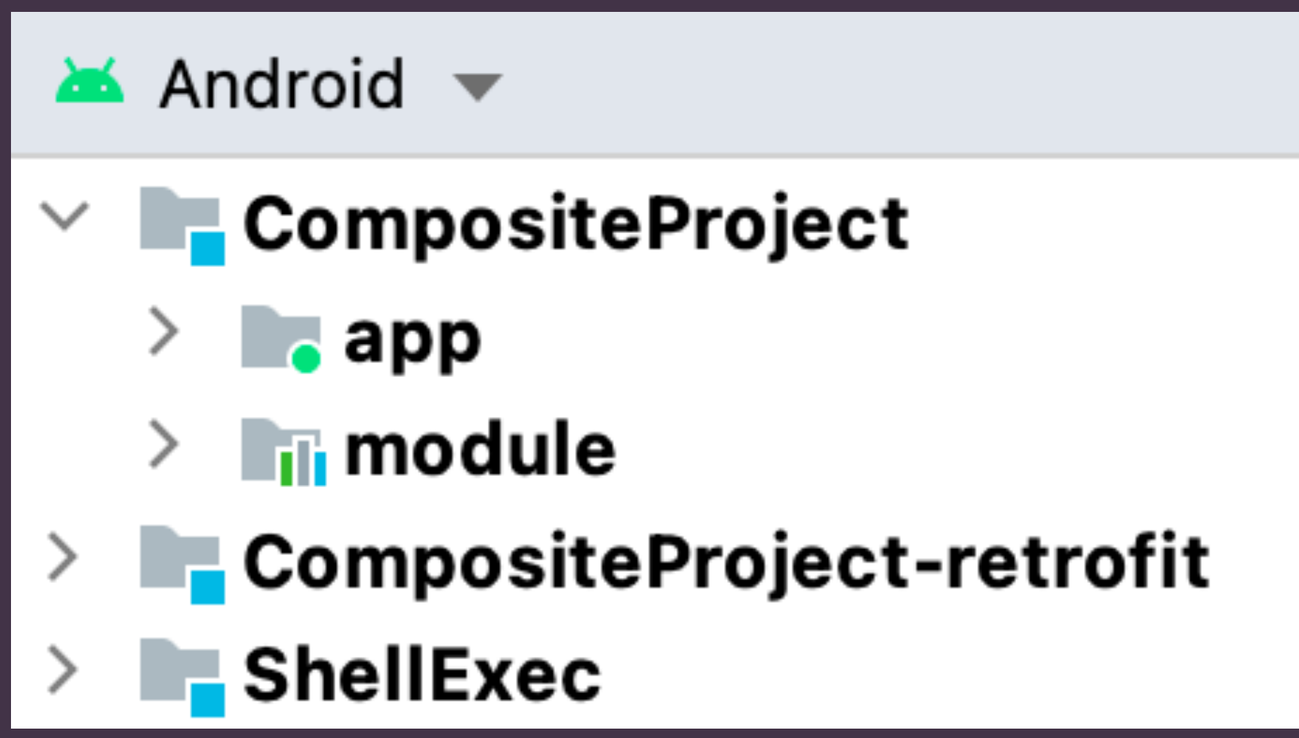
Android Dependencies Task

```
↪ gw androidDependencies

releaseUnitTestRuntimeClasspath - Dependencies for runtime/packaging
+--- :module (variant: release)
+--- junit:junit:4.13.2@jar
+--- com.squareup.retrofit2:converter-gson:2.9.0@jar
+--- com.squareup.retrofit2:adapter-java8:2.9.0@jar
+--- com.squareup.retrofit2:retrofit:2.9.0@jar
+--- androidx.core:core-ktx:1.6.0@aar
+--- com.google.code.gson:gson:2.8.5@jar
\--- com.squareup.okio:okio:1.17.2@jar
```

Composite Project

gw --include-build ../retrofit ...



Gradle has a CLI option to configure a composite project build

includeBuild

```
File retrofitProject = file("../retrofit")

includeBuild(retrofitProject) {
    dependencySubstitution {
        substitute module('com.squareup.retrofit2:retrofit') with project(':retrofit')
    }
}
```

Java file reference to root of build to include

dependencySubstitution

Tells gradle to substitute the dependency with the given project

Sample Project

```
↪ gw clonePlugin cloneRetrofit

> Task :clonePlugin
Cloning into '../ShellExec'...

> Task :cloneRetrofit
Cloning into '../retrofit'...
```

Sample Project

```
↪ gw projects
Including .../ShellExec project in composite build.
Including .../retrofit project in composite build.

> Configure project :ShellExec
...

> Configure project :retrofit:retrofit
...
```

Caveats

→ AGP version

→ Android build variants

→ Gradle plugin using same library

AGP Version

```
> Failed to apply plugin 'com.android.internal.application'.
   > Using multiple versions of the Android Gradle plugin in the same build is not allowed.
     - Project `.../CompositeProject/app` is using version `4.2.2`
     - Project `.../retrofit/retrofit/android-test` is using version `4.2.1`
```

Gradle Properties to the Rescue! 💪

gw -P**agp_version**=4.2.1 projects

```
> Configure project :retrofit:retrofit
```

Once you verify that this works on the CLI, update the property and sync Android Studio

Variants

Comment out:

→ flavorDimensions

→ productFlavors

If you have problems couldn't reproduce

Gradle plugin using same library

→ `includeBuild file("../retrofit")`

```
> Could not resolve com.squareup.retrofit2:retrofit:2.7.1.
    Required by:
        project :retrofit > com.vanniktech:gradle-maven-publish-plugin:0.14.0
        project :retrofit > com.vanniktech:gradle-maven-publish-plugin:0.14.0 > com.squareup.retrofit2:converter-moshi:2.7.1
```

→ Removed the gradle-maven-publish-plugin from retrofit

Problem

If I've been successful, then we have a problem.

You've just lost a bad word from your vocabulary.

Profanity 🤬

→ frak
→ p'tak
→ frell
→ cruk
→ shazbot
→ kriff
→ gorram

https://gizmodo.com/10-scifi-curse-words-for-all-occasions-1792827239


Denver,CO
{360|AnDev}
2021