Improve your multi-module app build config with convention plugins

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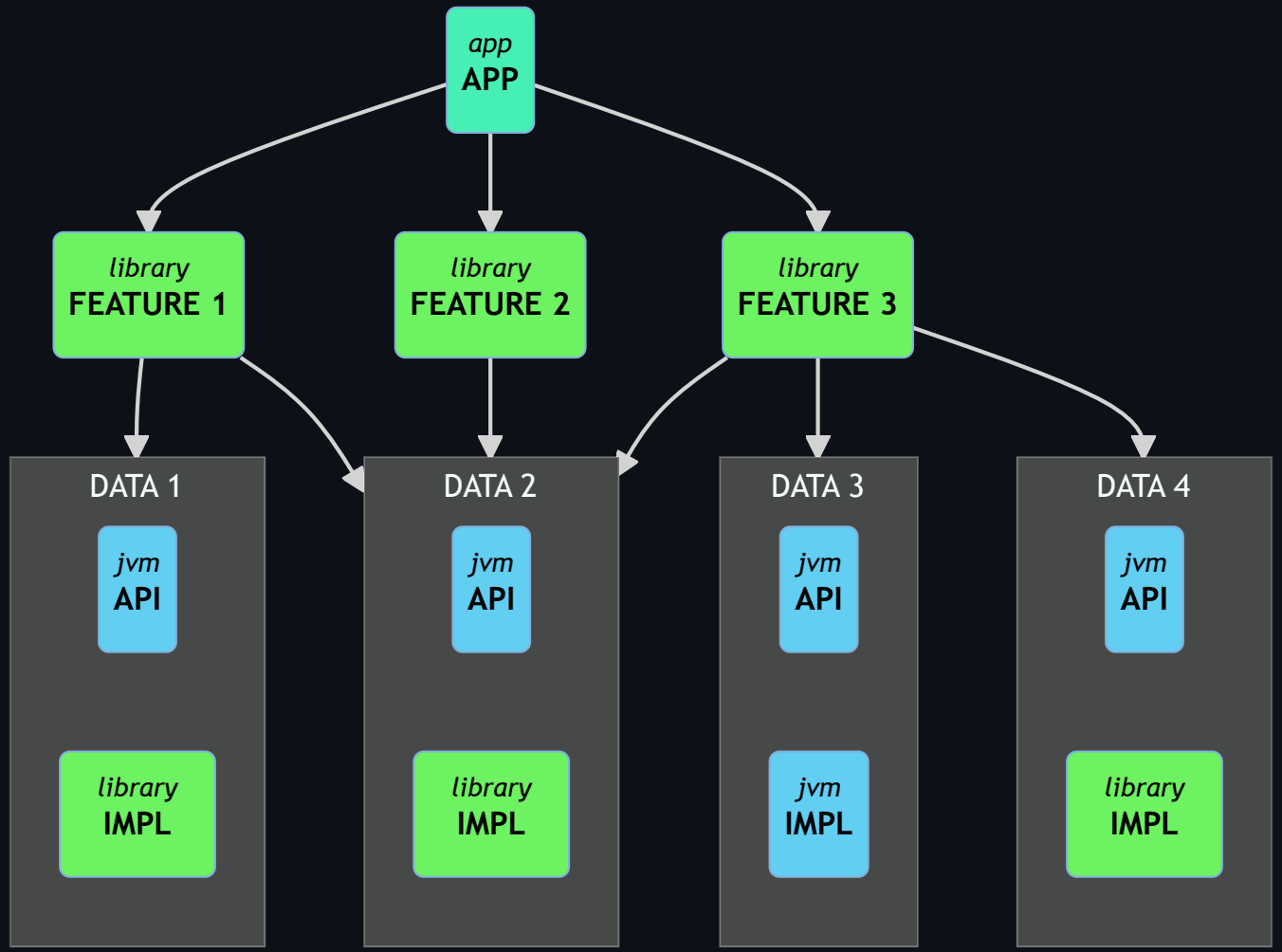
A multi-module architecture

Why should I use a multi-module application ?

- Part of the Google's Guide to app architecture
- Reduces the build time:
  - api/impl modules pattern (compilation avoidance)
  - Only use the necessary plugins in your module (android plugins are expensive)
  - Gradle modules parallel compilation
- Create several apps (demo apps, free vs pro, white-labelling, etc)
- ~~Square/Slack/Twitter is doing it~~

A multi-module architecture



A multi-module architecture

Drawbacks

- Each module has its own gradle configuration file (`build.gradle`)
- `com.android.library` and `com.android.applications` plugins should be configured the same way for each modules
- Feature modules are all configured the same way (with extra dependencies and plugins)
- ⌘+C, ⌘+V 🙈

⏭️ Let's fix this

Simplify our modules build configurations files

Let's take for example an implementation data module (`data:game:impl`).

Here's the target `build.gradle.kts` :

```
plugins {
    id("fr.sjcqs.android.lib")
    id("com.squareup.sqldelight")
}

dependencies {
    implementation(platform(libs.firebase.bom))
    implementation(libs.firebase.database)
    implementation(libs.kotlin.coroutines.playServices)

    implementation(libs.sqldelight.coroutines)

    implementation(projects.data.game.public)
}
```

⏭️ Let's start by sharing our dependencies

Sharing dependencies and versions with a Gradle version catalog

⭐ Having a single source of truth for the dependencies and plugins

You can create a version catalog file in `gradle/libs.versions.toml`

```
[versions]
coroutines = "1.6.0"
sqldelight = "1.5.3"
// ...

[libraries]
// ...
firebase-bom = "com.google.firebase:firebase-bom:29.0.4"
firebase-database = { module = "com.google.firebase:firebase-database-ktx" }
// ...
kotlin-coroutines-playServices = { module = "org.jetbrains.kotlinx:kotlinx-coroutines-play-services", version.ref = "coroutines" }
// ...
sqldelight-coroutines = { module = "com.squareup.sqldelight:coroutines-extensions-jvm", version.ref = "sqldelight" }
```

A `libs` property will be accessible from all your modules build configuration.

- `libs.<library>` to get a dependency
- `libs.versions.<version>` to get a version

⏭ Let's create our conventions plugins and included them in our app

Creating the `plugins` project

Alongside our app, let's create our `plugins` project with a `settings.gradle` file

```
dependencyResolutionManagement {
    repositories {
        google()
        gradlePluginPortal()
        mavenCentral()
    }
}
// Sharing the root project version catalog
versionCatalogs {
    create("libs") {
        from(files("../gradle/libs.versions.toml"))
    }
}
```

Creating the `plugins` project

We will to use the unsafe API to access the version catalog from the plugins code.

```
/**
* Usage: libs["<library>']
*/
internal val Project.libs: VersionCatalog
    get() = extensions.getByType<VersionCatalogsExtension>().named("libs")

internal operator fun VersionCatalog.get(name: String): Provider<MinimalExternalModuleDependency> {
    val optionalDependency = findLibrary(name)
    if (optionalDependency.isEmpty) {
        error("$name is not a valid dependency, check your version catalog")
    }
    return optionalDependency.get()
}

internal fun VersionCatalog.requireVersion(alias: String): String {
    val optionalVersion = findVersion(alias)
    if (optionalVersion.isEmpty) {
        error("$alias is not a valid version, check your version catalog")
    }
    return optionalVersion.get().toString()
}
```

Adding the plugins dependencies

In our plugins, `build.gradle.kts`:

Define the plugins that will be used in our app as `compileOnly` dependencies.

```
dependencies {
    compileOnly(libs.kotlin.gradle) // org.jetbrains.kotlin:kotlin-gradle-plugin

    compileOnly(libs.android.gradle) // com.android.tools.build:gradle
    compileOnly(libs.hilt.gradle) // com.google.dagger:hilt-android-gradle-plugin
}
```

Register the conventions plugins

In our plugins, `build.gradle.kts`:

```
plugins {
    id("java-gradle-plugin")
}

dependencies { ... }

// java-gradle-plugin
gradlePlugin {
    plugins {
        register("fr.sjcqs.android.lib") {
            id = "fr.sjcqs.android.lib"
            implementationClass = "fr.sjcqs.AndroidLibPlugin"
        }
    }
}
```

Include the plugins build in our root project

In our root project `settings.gradle.kts`:

```
includeBuild("plugins")
```

Plugins will be compiled and accessible in our app's modules build configuration.

> *Note:* They can also be published and provided throught a Maven repository

⏭️ Now let's write our convention plugin

Writing a convention plugin

Regardless of the language we are using in our `build.gradle(.kts)` files (Kotlin or Groovy), we can write Gradle plugins in Groovy, Java or Kotlin.

The syntax is similar to the one we would use in a `build.gradle` file.

Writing a convention plugin

Creating the convention plugin class

```
package fr.sjcqs

import org.gradle.api.Plugin
import org.gradle.api.Project

class AndroidLibPlugin : Plugin<Project> {
    override fun apply(target: Project) {
        // configuration ...
    }
}
```

Writing a convention plugin

Applying plugins on the target project

```
package fr.sjcqs

import org.gradle.api.Plugin
import org.gradle.api.Project
import org.gradle.kotlin.dsl.apply

class AndroidLibPlugin : Plugin<Project> {
    override fun apply(target: Project) {
        with(target) {
            with(pluginManager) {
                apply("com.android.library")
                apply("kotlin-android")
            }
            // ...
        }
    }
}
```

Writing a convention plugin

Configure the Android extension

```
class AndroidLibPlugin : Plugin<Project> {
    override fun apply(target: Project) {
        with(target) {
            extensions.configure<LibraryExtension> {
                configureAndroidAndKotlin(this)
                // Config is a shared object
                defaultConfig.targetSdk = Config.android.targetSdk
                buildTypes {
                    all { isMinifyEnabled = false }
                }
            }
        }
    }
}
```

Writing a convention plugin

Configure the Android extension

```
internal fun Project.configureAndroidAndKotlin(extension: CommonExtension<*, *, *, *>) {
    with(extension) {
        compileSdk = Config.android.compileSdkVersion
        defaultConfig {
            minSdk = Config.android.minSdk
            testInstrumentationRunner = "androidx.test.runner.AndroidJUnitRunner"
        }
        buildTypes {
            getByName("debug") {
                isMinifyEnabled = false
                matchingFallbacks.add("release")
            }

            getByName("release") {
                isMinifyEnabled = true
                proguardFiles(getDefaultProguardFile("proguard-android-optimize.txt"),"proguard-rules.pro")
            }
        }
        compileOptions {
            sourceCompatibility = Config.jvm.javaVersion
            targetCompatibility = Config.jvm.javaVersion

            isCoreLibraryDesugaringEnabled = true
        }
        kotlinOptions {
            jvmTarget = Config.jvm.kotlinJvm
            freeCompilerArgs = freeCompilerArgs + Config.jvm.freeCompilerArgs
        }
        packagingOptions.resources.excludes += "/META-INF/{AL2.0,LGPL2.1}"
    }

    dependencies.apply {
        add("coreLibraryDesugaring", libs["desugarJdk"])
    }
}


private fun CommonExtension<*, *, *, *>.kotlinOptions(block: KotlinJvmOptions.() -> Unit) {
    (this as ExtensionAware).extensions.configure("kotlinOptions", block)
}
```

Writing a convention plugin

Adding the dependencies

```
class AndroidLibPlugin : Plugin<Project> {
    override fun apply(target: Project) {
        // ...
        // We don't have access to extensions like `implementation` and `compileOnly`
        dependencies {
            add("implementation", project(":tools:annotations"))

            add("compileOnly", libs["javaxInject"])

            add("implementation", libs["kotlin.stdlib"])
        }
    }
}
``

---
## Usage
```kotlin
plugins {
    id("fr.sjcqs.android.lib")  // 🔙
    id("com.squareup.sqldelight")
}

dependencies {
    implementation(platform(libs.firebase.bom))
    implementation(libs.firebase.database)
    implementation(libs.kotlin.coroutines.playServices)

    implementation(libs.sqldelight.coroutines)

    implementation(projects.data.game.public)
}
```
```

Reusing a convention plugin

We can reuse our convention plugin in another one.

```
package fr.sjcqs

import extensions.get
import extensions.libs
import org.gradle.api.Plugin
import org.gradle.api.Project

class AndroidFeaturePlugin : Plugin<Project> {
    override fun apply(target: Project) {
        with(target) {
            pluginManager.apply {
                apply(AndroidLibPlugin::class.java)
            }
        }
        // ...
    }
}
```

Gotchas & further thoughts

Gradle scripts

It's possible to write gradle script in `src/main/java/<plugin-id>.build.gradle.kts`, Gradle will generate a plugin whose id is `<plugin-id>`

Don't do this (#39 on android/nowinandroid)

	scripts plugins	code plugins
Configuring Projects	12.724s	0.765s
Total Build Time	25.373s	11.205s

Gotchas & further thoughts

Dependencies (~interface segregation principle)

Limit the number of dependencies (and plugins) declared in your conventions plugins.

Gotchas & further thoughts

Further thoughts

1. You could publish those plugins to an internal maven repository, it should also improve configuration and build time. (using binary vs compilation)

   But it comes at a few costs:

   - Setup your CI to publish those plugins
   - Version the plugins
   - Switching between the internal repository and the included build when working on the build config

2. Conventions plugins can be used in any Gradle multi-module projects (not just Android apps)

Gotchas & further thoughts

Notes

You don't have to follow this talk to the letter

- Speak with your team:
- How many modules do you have ?
- Is build configuration a pain point ?
- Would you be able to maintain those plugins ? (and teach how ?)
- *I'm not perfect nor an expert on the subject. There might be things that could be done in a better way.*

⏭️ Finally some references and peoples to follow

References

Those references should not be blindly followed. Some of them are from people working in large companies with multiples people working on a single app and even people dedicated to build configuration.

Be pragmatic, keep the scale of your app and your team in mind, take only what you need.

~~Don't be a fanboy~~ 🤩

References

1. Herding elephants 🐘
   Some feedbacks and best practices on the Android's build configuration by Tony Robalik who is working on build and tooling at Square
   🔗 https://developer.squareup.com/blog/herding-elephants/
2. Slack gradle plugins 👀
   Slack started open sourcing part of their build tools on Github.
   🔗 https://github.com/slackhq/slack-gradle-plugin
3. Improve Build Times in Less Time by Zac Sweers, Slack 🎬
   A talk from Android Makers 2022 with some best practices to improve build time.
4. Now in Android project 📱
   🔗 https://github.com/android/nowinandroid

Any Questions ❓

Feedbacks 👂

🐦 @sjcqs (*feel free to reach out*)