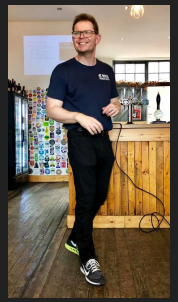
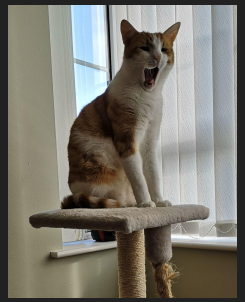
Kotlin Multiplatform Beyond the Basics

KotlinConf 2024

About Your Instructor - Garth

- Kotlin Developer Advocate at JetBrains

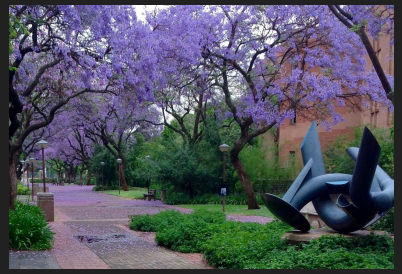
- From Belfast (via Portstewart), Northern Ireland


About Your Instructor - Pamela

- Kotlin Developer Advocate at JetBrains



- From Pretoria, South Africa




About Your Mentor - Kostya

- Software Developer in Kotlin Multiplatform at JetBrains
- Lives in Leiden, Netherlands





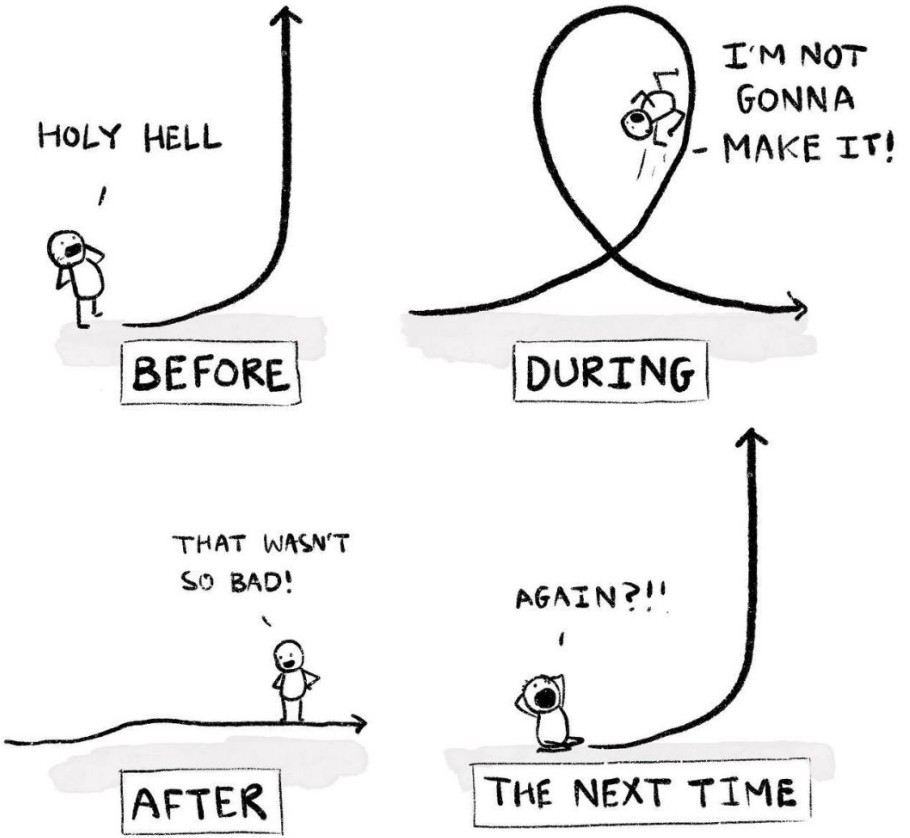

Morning Agenda

- Setup verification
- Welcome and speaker introduction
- What is Kotlin Multiplatform?
- UIs with Compose Multiplatform
- Networking with Ktor, serialization with kotlinx.serialization
- The expect / actual mechanism
- Testing in KMP Applications

Afternoon Agenda

- Caching
- Coroutines and Flows
- Sharing View Models
- Dependency Injection with Koin
- KMP libraries
- Xcode primer
- Sharing Kotlin APIs with Swift codebases
- Distributing shared code with iOS teammates
- Discussion
- Closing

HOW LEARNING CURVES FEEL...



@STEINBERGDRAWSCARTOONS

Break Schedule

- 08:00: Welcome and registration
- 09:00: Workshop starts
- 10:30-11:00 Coffee break
- 12:30-13:30: Lunch
- 15:00-15:30 Coffee break
- 17:00: Workshop ends

What is Kotlin Multiplatform?

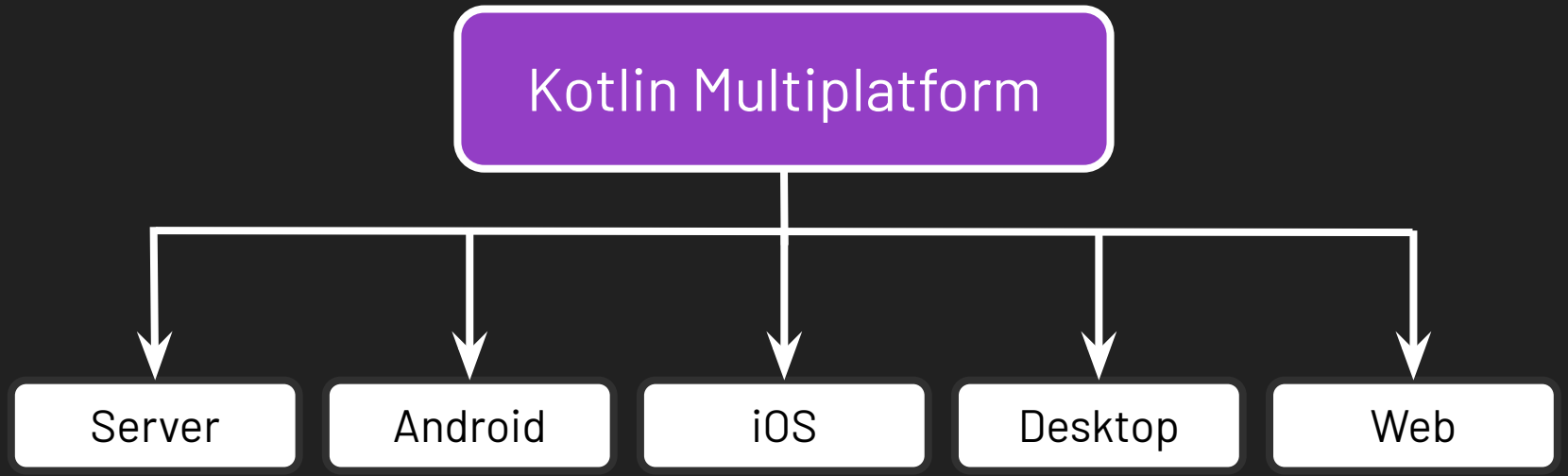
What is Kotlin Multiplatform?

- Technology by JetBrains
- Allows development teams to share common code between platforms
- Doesn't impose restrictions on non-shared code

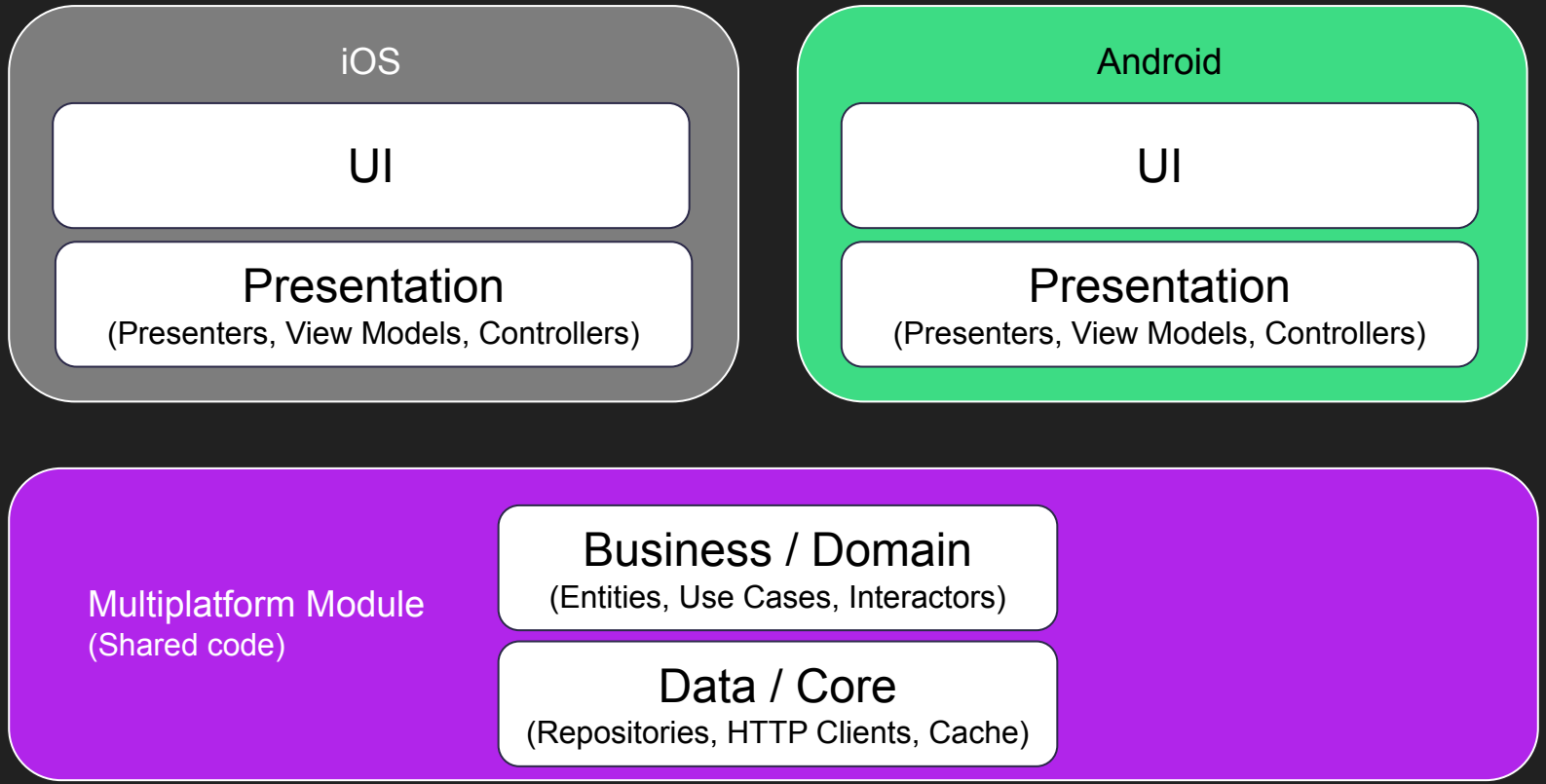
What is Kotlin Multiplatform?

- Technology by JetBrains
- Allows development teams to share **common code** between **platforms**
- Doesn't impose restrictions on non-shared code

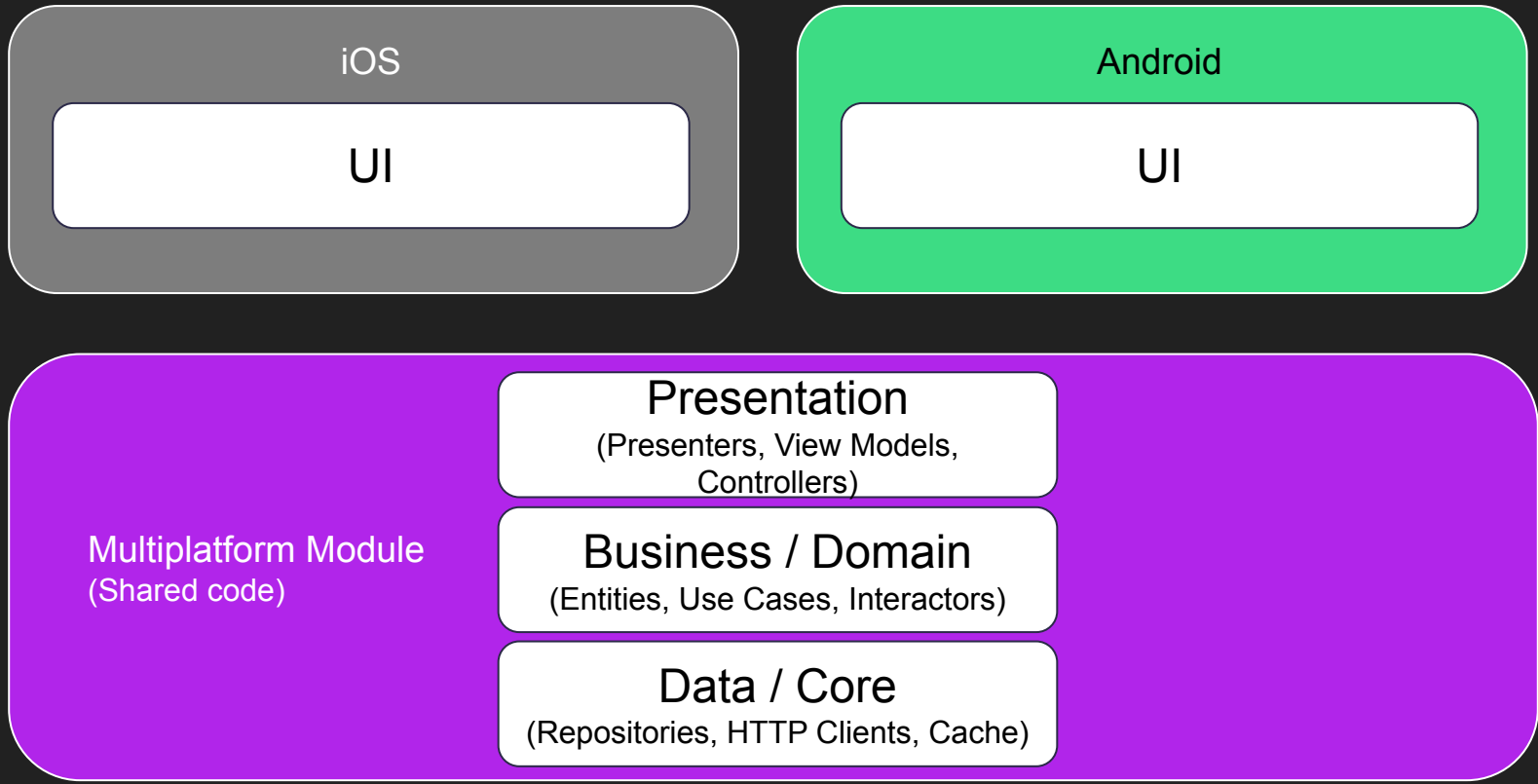
What kind of platforms?



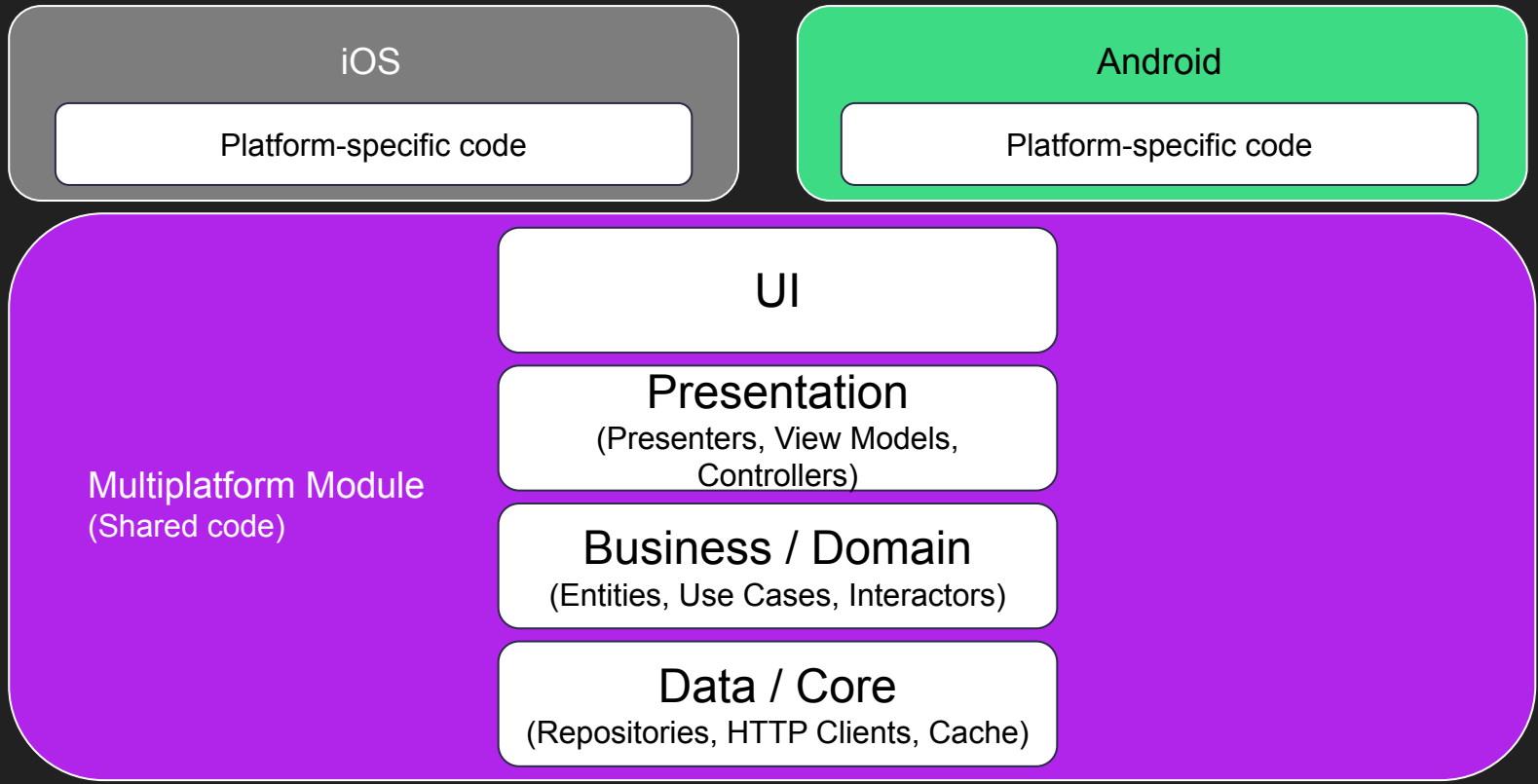
What kind of common code?



What kind of common code?



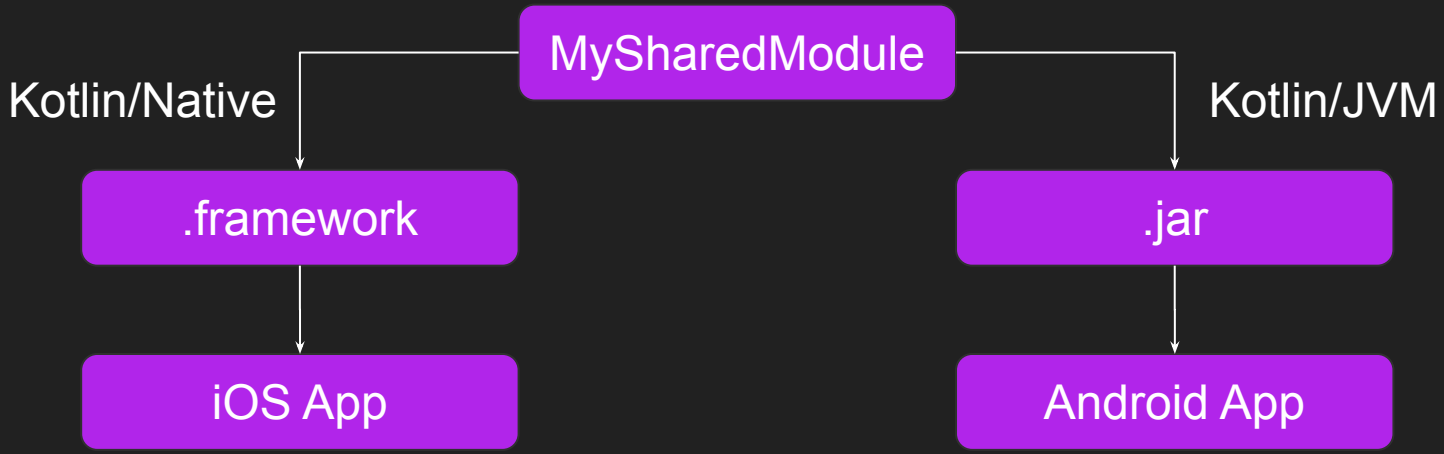
What about ✨*Compose Multiplatform*✨?



Kotlin Multiplatform == Sharing

- With Kotlin Multiplatform you can share what you want, eg:
  - Networking
  - Data storage & validation
  - Business logic etc.
- And write the rest natively - just as before

How does Kotlin Multiplatform work?



What are the benefits of Kotlin Multiplatform?

- **Flexibility** to choose what is shared and what isn’t
- Choose to share in a **new** or **existing** project
- Shared code lowers the **effort and cost** per feature
- Shared code ensures **consistency** amongst platforms
- Access to platform capabilities **without overhead**

Forbes

PHILIPS

vmware®

AUTODESK

chalk

https://www.jetbrains.com/help/kotlin-multiplatform-dev/case-studies.html

Demo: Using Project Wizards

Introducing Compose Multiplatform

The TL;DR on Compose

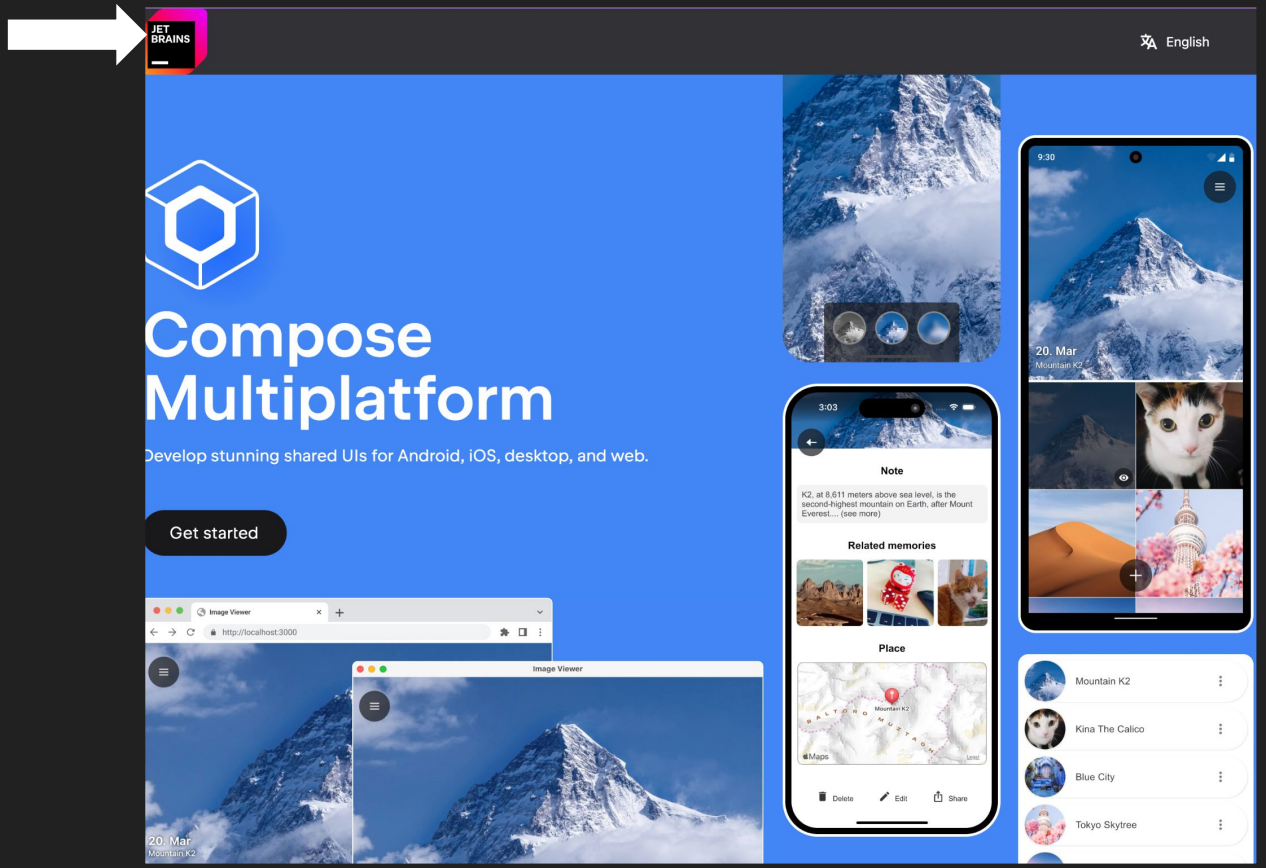
- Compose lets you create awesome UIs
- Compose Multiplatform is produced by **JetBrains**
- Built on Kotlin Multiplatform by **JetBrains**
- Powered by Jetpack Compose from **Google**

Build better apps faster with Jetpack Compose

Jetpack Compose is Android's recommended modern toolkit for building native UI. It simplifies and accelerates UI development on Android. Quickly bring your app to life with less code, powerful tools, and intuitive Kotlin APIs.

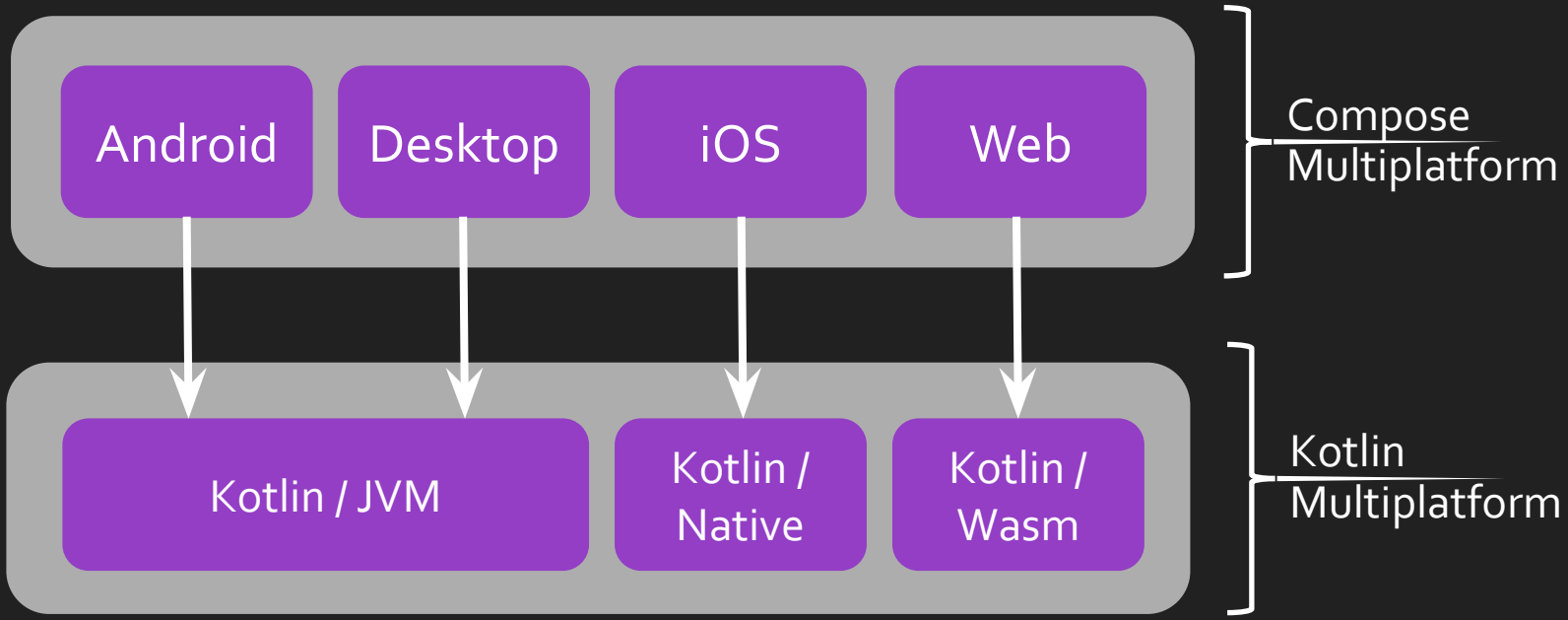
```
@Composable
fun JetpackCompose() {
    Card {
        var expanded by remember { mutableStateOf(false) }
        Column(Modifier.clickable { expanded = !expanded }) {
            Image(painterResource(R.drawable.jetpack_compose))
            AnimatedVisibility(expanded) {
                Text(
                    text = "Jetpack Compose",
                    style = MaterialTheme.typography.bodyLarge,
                )
            }
        }
    }
}
```

https://developer.android.com/jetpack/compose



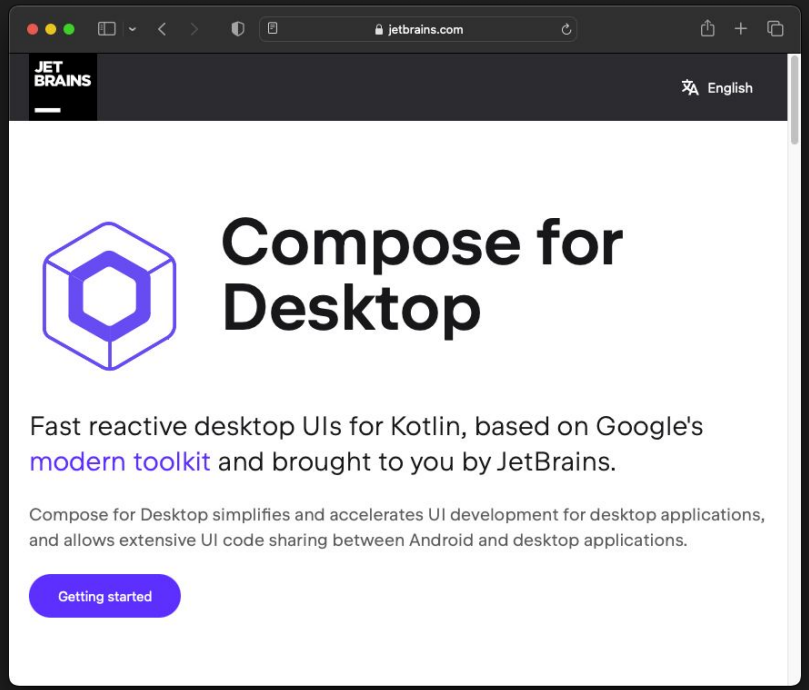
https://jb.gg/compose

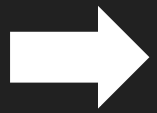
Compose & Kotlin Multiplatform

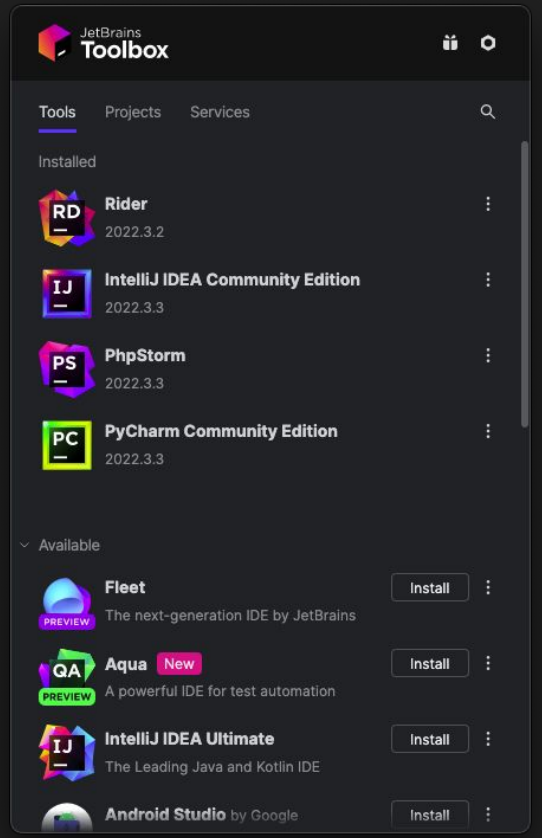


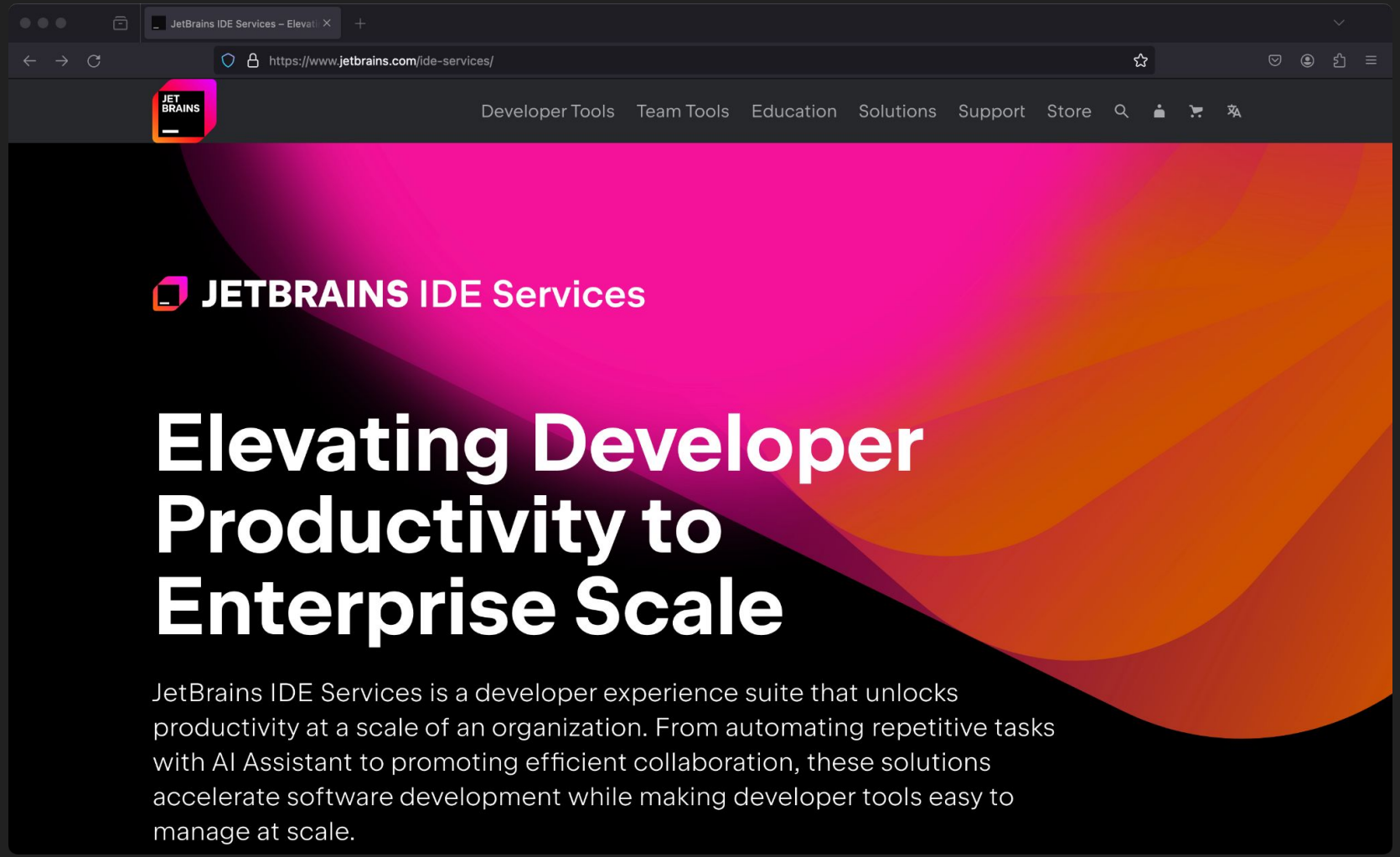
What is WebAssembly / Wasm?

- A binary instruction format for portable virtual machines
- Smaller and faster than JavaScript, but fully interoperable
- Write code in languages like Kotlin / Go / Rust, compile to Wasm
- Already supported in most modern browsers, Node.js
- Includes a Component Model (since January 2024)


jetbrains.com
JET BRAINS
English
Compose for Desktop
Fast reactive desktop UIs for Kotlin, based on Google's modern toolkit and brought to you by JetBrains.
Compose for Desktop simplifies and accelerates UI development for desktop applications, and allows extensive UI code sharing between Android and desktop applications.
Getting started

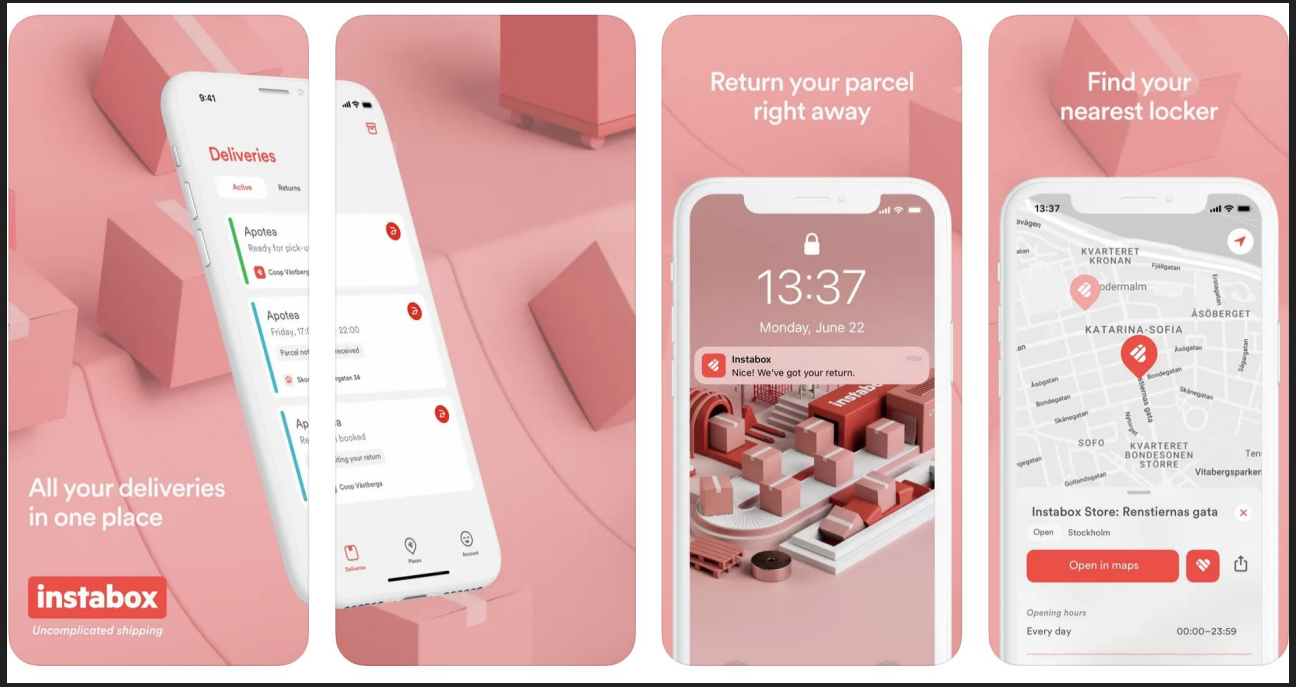



JetBrains Toolbox
Tools
Projects
Services
Installed
Rider
2022.3.2
IntelliJ IDEA Community Edition
2022.3.3
PhpStorm
2022.3.3
PyCharm Community Edition
2022.3.3
Available
Fleet
The next-generation IDE by JetBrains
Install
Aqua
New
A powerful IDE for test automation
Install
IntelliJ IDEA Ultimate
The Leading Java and Kotlin IDE
Install
Android Studio by Google
Install


JetBrains IDE Services – Elevati
https://www.jetbrains.com/ide-services/
JET BRAINS
Developer Tools
Team Tools
Education
Solutions
Support
Store
JETBRAINS IDE Services
Elevating Developer Productivity to Enterprise Scale
JetBrains IDE Services is a developer experience suite that unlocks productivity at a scale of an organization. From automating repetitive tasks with AI Assistant to promoting efficient collaboration, these solutions accelerate software development while making developer tools easy to manage at scale.

Instabee

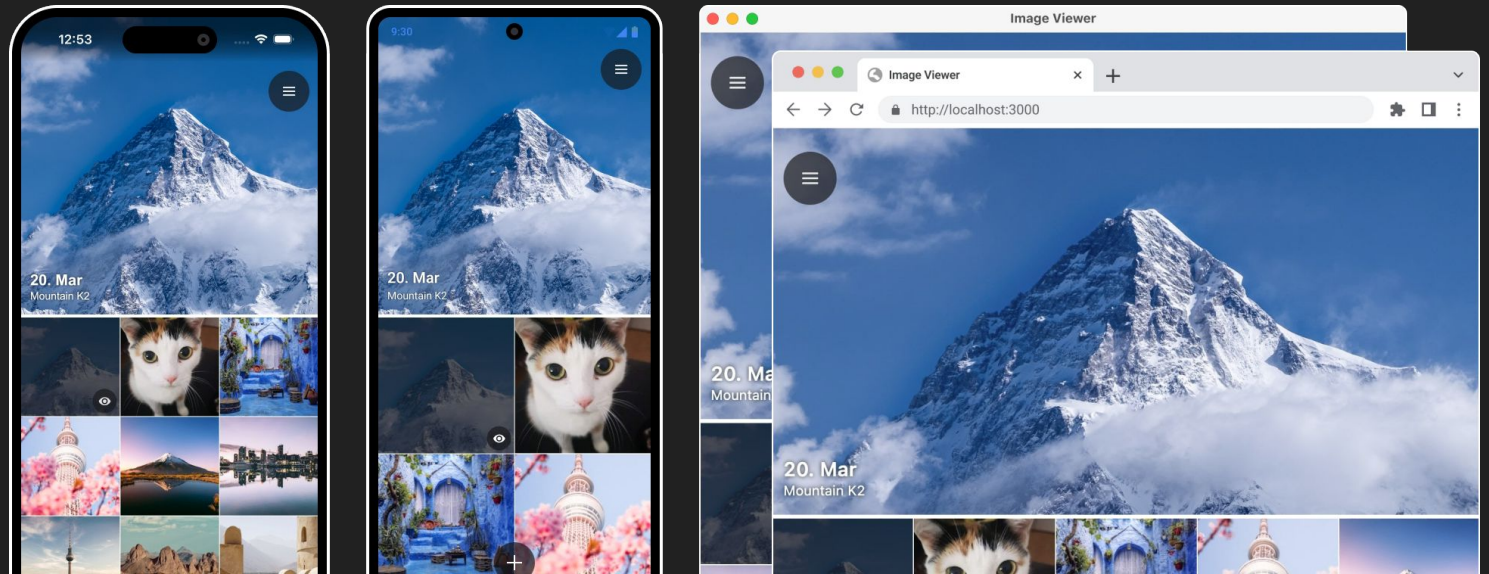
Built on Compose Multiplatform (Android and iOS)



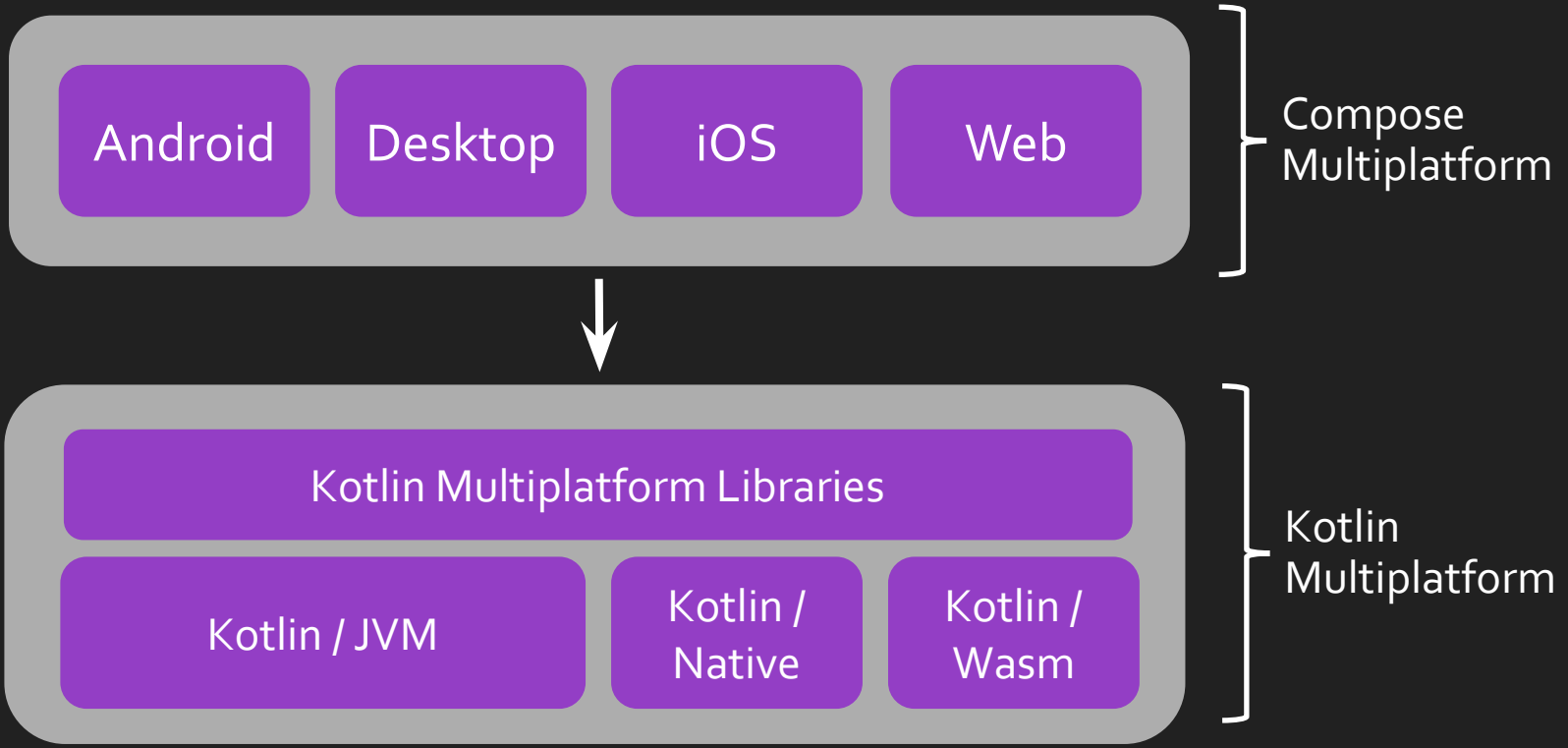
The ImageViewer Sample Application

An example image gallery with camera and map support

Built on Compose Multiplatform (Desktop, Android and iOS)



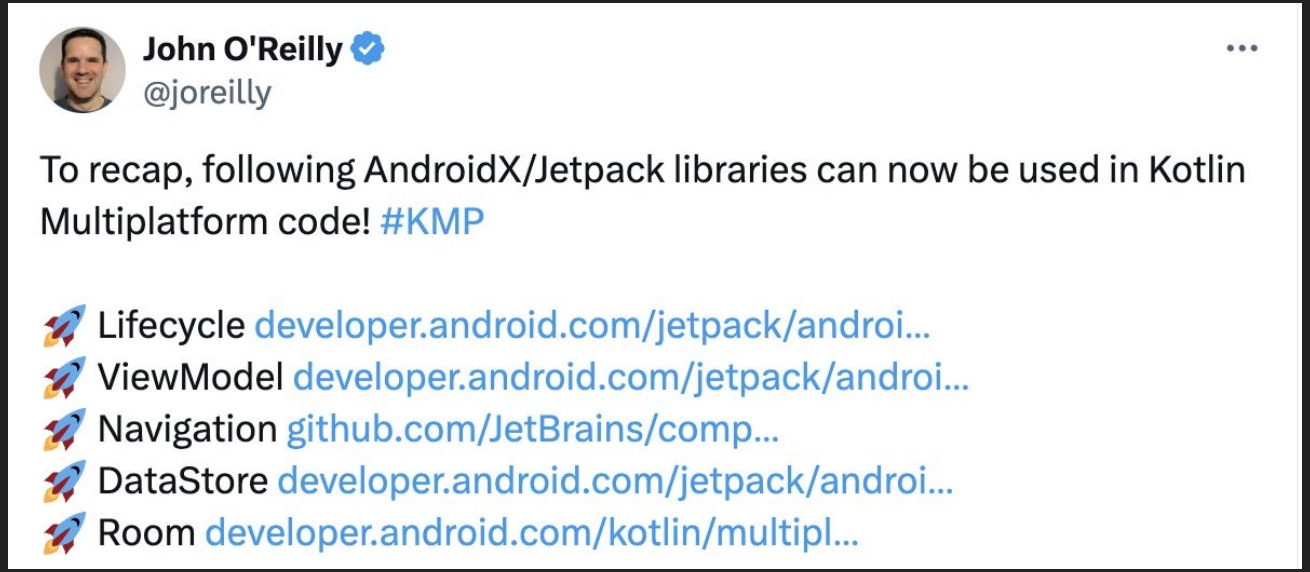
Compose & Kotlin Multiplatform & Libraries



Some Kotlin Multiplatform Libraries

Koin	Dependency Injection framework
Ktorfit	Adds declarative functionality to Ktor, similar to Retrofit
KMP-ObservableViewModel	Allows sharing of ViewModels across Android and iOS
KMP-NativeCoroutines	Allows coroutines to be used / cancelled in Swift code
SQLDelight	Generates type safe Kotlin API’s from SQL
Multiplatform Settings	Simplifies persisting key/value pairs in multiplatform code
Jetpack DataStore	Stores key/value pairs and objects using coroutines and flows
Circuit	Architectural framework for Compose Multiplatform

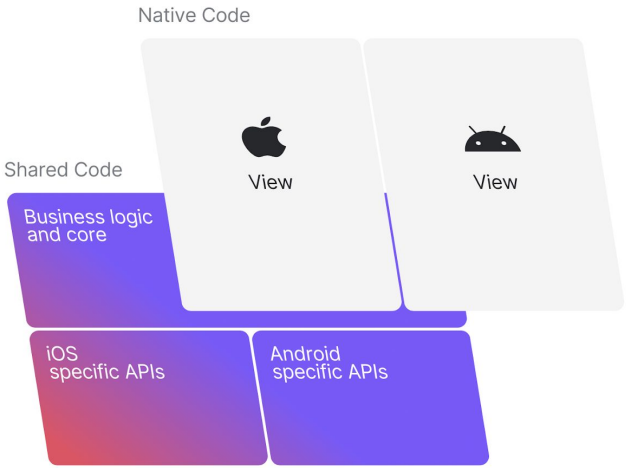
Great News!


John O'Reilly
@joreilly
To recap, following AndroidX/Jetpack libraries can now be used in Kotlin Multiplatform code! #KMP
🚀 Lifecycle developer.android.com/jetpack/androi...
🚀 ViewModel developer.android.com/jetpack/androi...
🚀 Navigation github.com/JetBrains/comp...
🚀 DataStore developer.android.com/jetpack/androi...
🚀 Room developer.android.com/kotlin/multipl...

github.com

README.MD

Awesome KMM



PRs welcome | awesome | stars 1.3k | maven-central v1.8.20

Kotlin Multiplatform Mobile (KMM) is an SDK designed to simplify creating cross-platform mobile applications. With the help of KMM, you can share common code between iOS and Android apps and write platform-specific code only where it's necessary. For example, to implement a native UI or when working with platform-specific APIs.

Resources

1.3k stars
48 watching
60 forks
Report repository

Releases 9

Issue 9 Latest
last month

+ 8 releases

Contributors 23

+ 12 contributors

https://github.com/terrakok/kmp-awesome

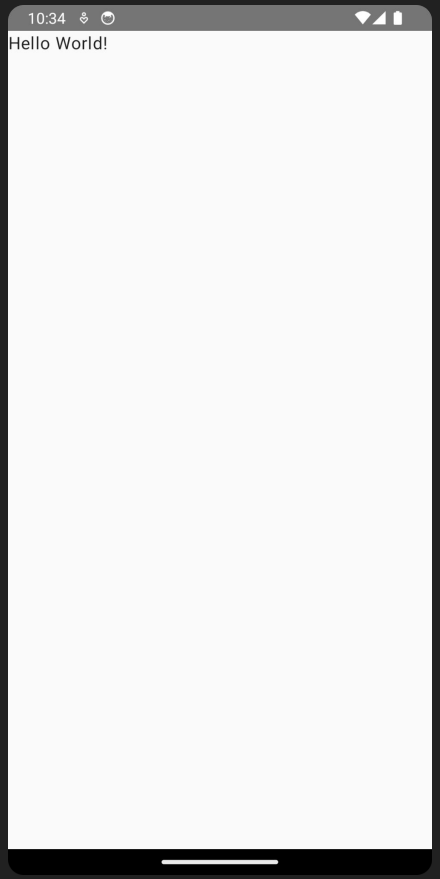
Hello Compose Multiplatform 👋

Concepts

- Composable functions
- Layouts
- Images
- Themes
- Lists
- Buttons

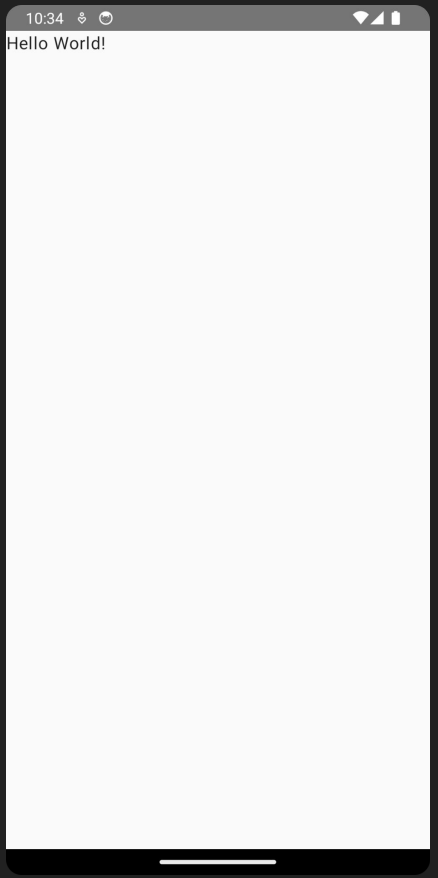
Adding a Text Composable

```
@Composable
fun App() {
    MaterialTheme {
        Text("Hello World!")
    }
}
```



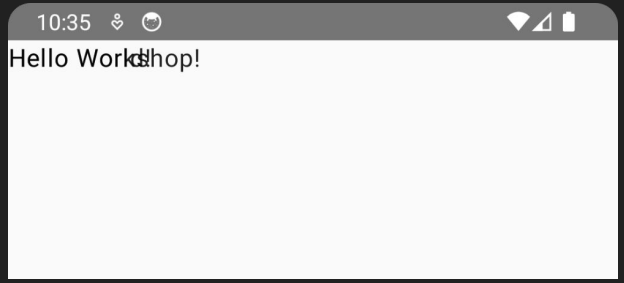
Defining Your Own Composable

```
@Composable
fun App() {
    MaterialTheme {
        Hello()
    }
}

@Composable
fun Hello(){
    Text("Hello World!")
}
```



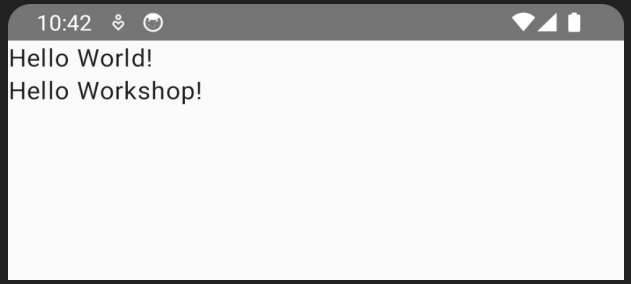
Adding Multiple Texts

```
@Composable
fun Hello(){
    Text("Hello World!")
    Text("Hello Workshop!")
}
```



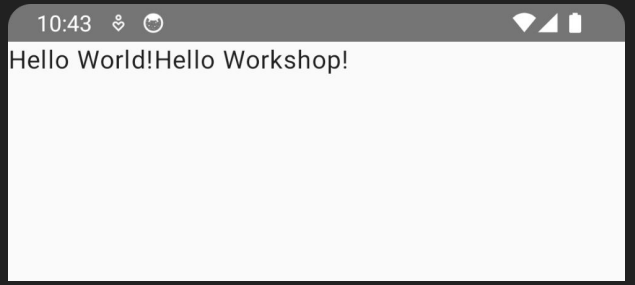
Adding Multiple Texts - Vertical

```
@Composable
fun Hello(){
    Column {
        Text("Hello World!")
        Text("Hello Workshop!")
    }
}
```



Adding Multiple Texts - Horizontal

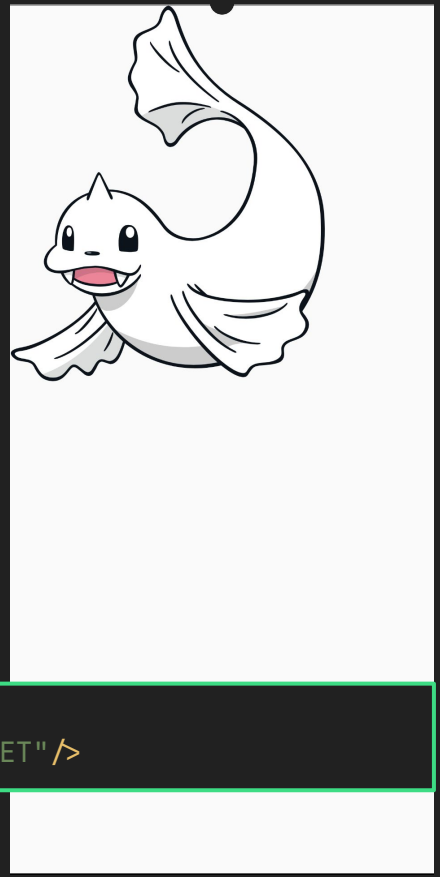
```
@Composable
fun Hello(){
    Row {
        Text("Hello World!")
        Text("Hello Workshop!")
    }
}
```

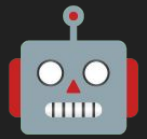


Adding an Image

```
@Composable
fun PokemonImage(url: String, contentDescription: String){
    val painterResource =
        rememberImagePainter(url = url)
    Image(
        painter = painterResource,
        contentDescription = contentDescription,
        contentScale = ContentScale.FillBounds
    )
}
```

```
PokemonImage("https://unpkg.com/pokeapi-sprites@2.0.2/sprites/pokemon/other/dream-world/87.svg", "A white pokemon")
```

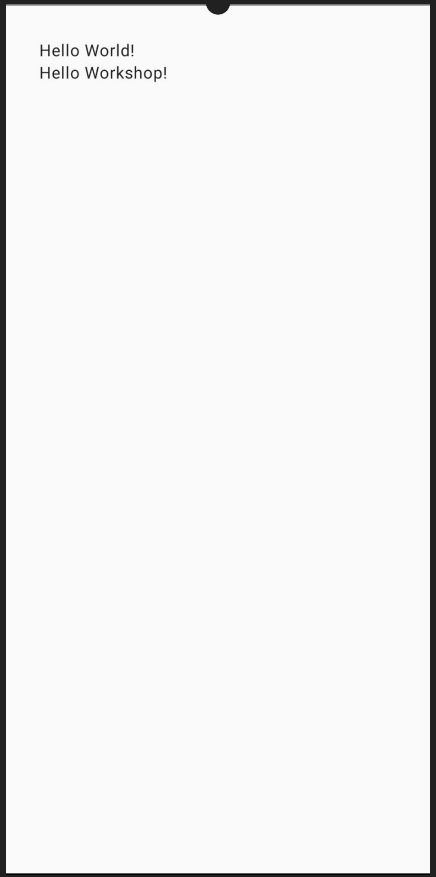




```
<uses-permission
android:name="android.permission.INTERNET"/>
```

Configuring Padding

```
@Composable
fun Hello() {
    Column(modifier = Modifier.padding(32.dp)) {
        Text("Hello World!")
        Text("Hello Workshop!")
    }
}
```

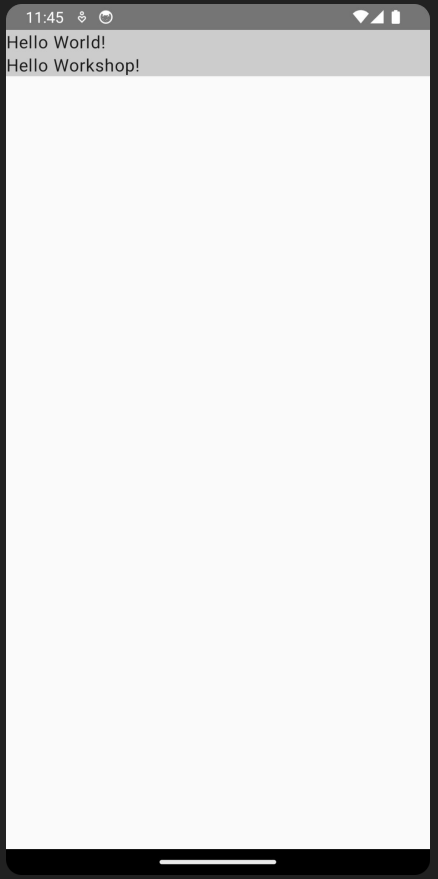


Configuring Sizing - Width

```
@Composable
fun Hello() {
    Column(
        modifier = Modifier.fillMaxWidth()
            .background(Color.LightGray)
    ) {
        Text("Hello World!")
        Text("Hello Workshop!")
    }
}
```

OR

```
modifier = Modifier.width(130.dp)
```

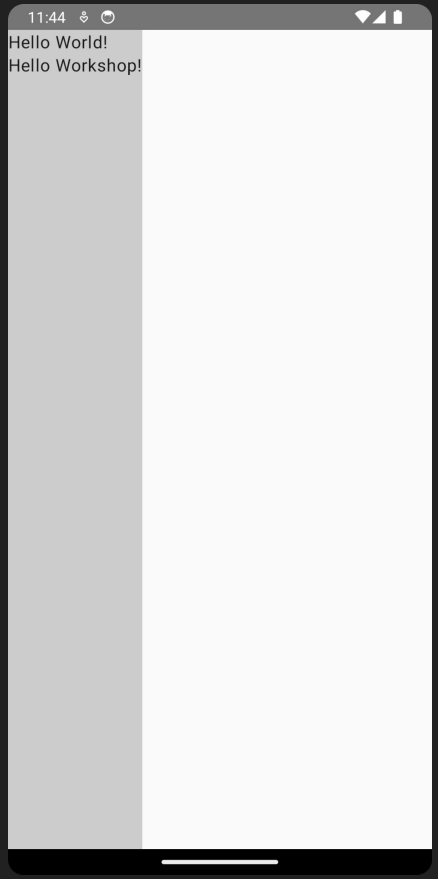


Configuring Sizing - Height

```
@Composable
fun Hello() {
    Column(
        modifier = Modifier.fillMaxHeight()
            .background(Color.LightGray)
    ) {
        Text("Hello World!")
        Text("Hello Workshop!")
    }
}
```

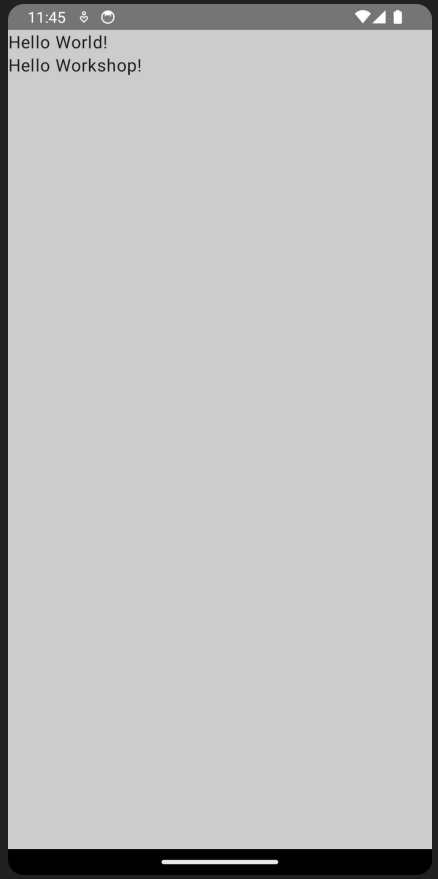
OR

```
modifier = Modifier.height(128.dp)
```



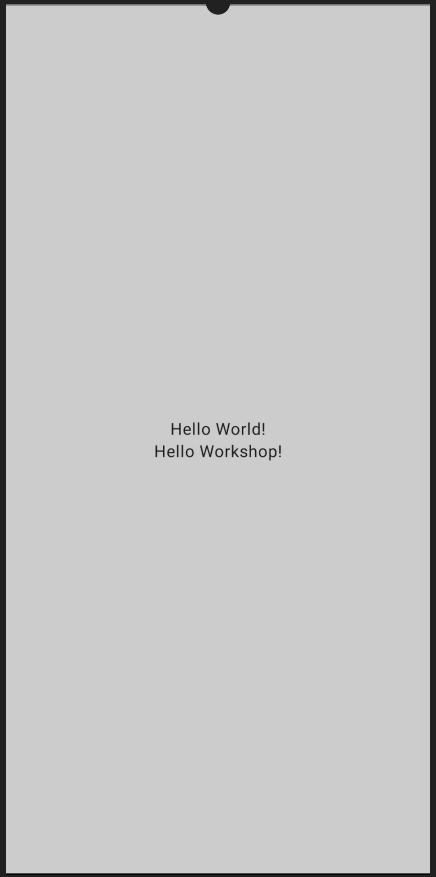
Configuring Sizing - Size

```
@Composable
fun Hello() {
    Column(
        modifier = Modifier.fillMaxSize()
            .background(Color.LightGray)
    ) {
        Text("Hello World!")
        Text("Hello Workshop!")
    }
}
```



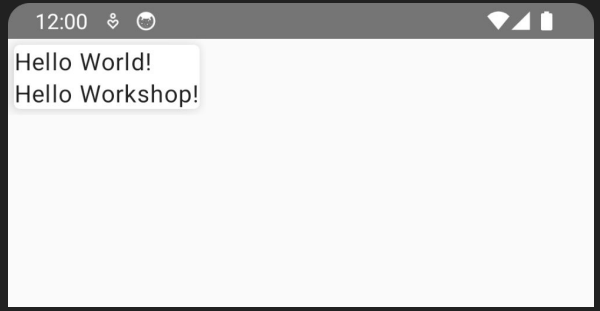
Centering

```
@Composable
fun Hello() {
    Column(
        horizontalAlignment = Alignment.CenterHorizontally,
        verticalArrangement = Arrangement.Center,
        modifier = Modifier
            .fillMaxSize()
            .background(Color.LightGray)
    ) {
        Text("Hello World!")
        Text("Hello Workshop!")
    }
}
```



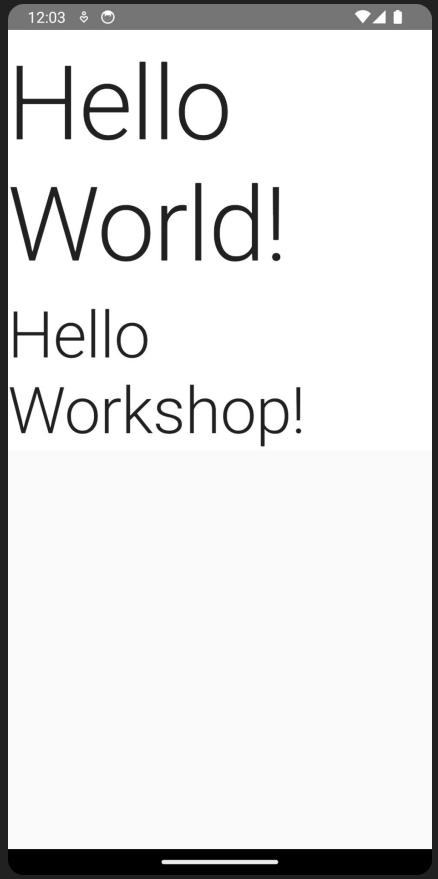
Creating a Card

```
@Composable
fun Hello() {
    Card(
        modifier = Modifier.padding(4.dp),
        elevation = 10.dp,
        shape = MaterialTheme.shapes.small
    ) {
        Column {
            Text("Hello World!")
            Text("Hello Workshop!")
        }
    }
}
```



Formatting Text

```
@Composable
fun Hello() {
    Column {
        Text(
            "Hello World!",
            style = MaterialTheme.typography.h1
        )
        Text(
            "Hello Workshop!",
            style = MaterialTheme.typography.h2
        )
    }
}
```

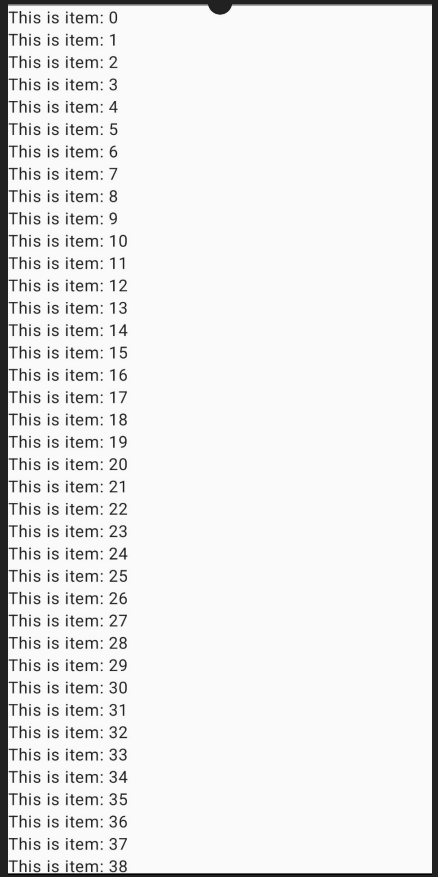


Formatting Text

Scale Category	Typeface	Weight	Size	Case	Letter spacing
H1	Roboto	Light	96	Sentence	-1.5
H2	Roboto	Light	60	Sentence	-0.5
H3	Roboto	Regular	48	Sentence	0
H4	Roboto	Regular	34	Sentence	0.25
H5	Roboto	Regular	24	Sentence	0
H6	Roboto	Medium	20	Sentence	0.15
Subtitle 1	Roboto	Regular	16	Sentence	0.15
Subtitle 2	Roboto	Medium	14	Sentence	0.1
Body 1	Roboto	Regular	16	Sentence	0.5
Body 2	Roboto	Regular	14	Sentence	0.25
BUTTON	Roboto	Medium	14	All caps	1.25
Caption	Roboto	Regular	12	Sentence	0.4
OVERLINE	Roboto	Regular	10	All caps	1.5

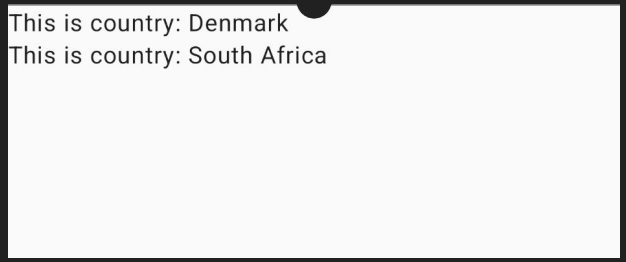
Lists - Number of Items

```
@Composable
fun HelloList() {
    LazyColumn {
        items(count = 100) {
            Text("This is item: $it")
        }
    }
}
```



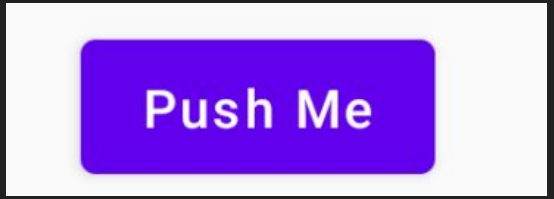
Lists - Collection

```
@Composable
fun HelloList() {
    val countries = listOf<String>(
        "Denmark",
        "South Africa"
    )
    LazyColumn {
        items(countries) {
            Text("This is country: $it")
        }
    }
}
```



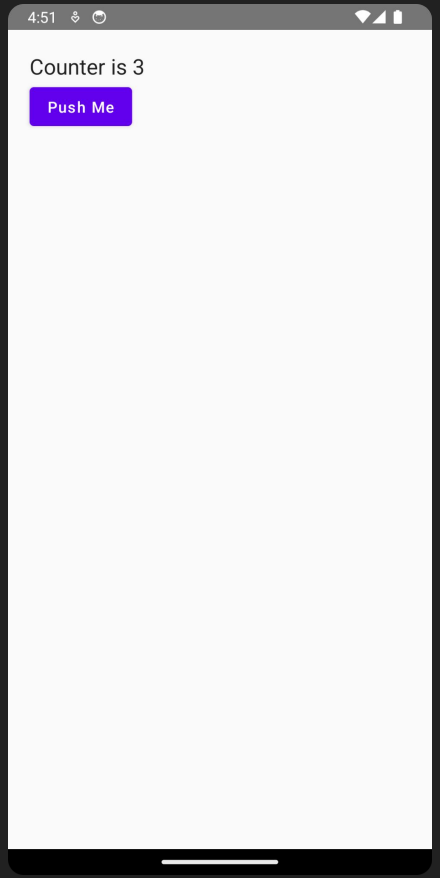
Buttons

```
@Composable
fun HelloButton() {
    Button(onClick = { doSomething() }) {
        Text("Push Me")
    }
}
```



Practical 1: Creating a Compose Multiplatform Card [20 mins]

```
@Composable
fun CounterExample() {
    var counter by remember { mutableStateOf(0) }

    Column(modifier = Modifier.padding(20.dp)) {
        Text(
            style = TextStyle(fontSize = 20.sp),
            text = "Counter is $counter"
        )
        Button(onClick = { counter++ }) {
            Text("Push Me")
        }
    }
}
```



`mutableStateOf` creates an observable.

```
var counter by remember { mutableStateOf(0) }
```

`remember` stores values across recompositions.

```
var counter by remember { mutableStateOf(0) }
```

Compose Multiplatform navigation is currently experimental and has its limitations* so we'll be looking at a stable alternative.

https://www.jetbrains.com/help/kotlin-multiplatform-dev/compose-navigation-routing.html*

Voyager - Multiplatform Navigation Library for Compose

- **Linear navigation**
- **Back navigation**
- BottomSheet navigation
- Tab navigation
- Multi-module navigation
- Nested navigation

Linear Navigation - Screens

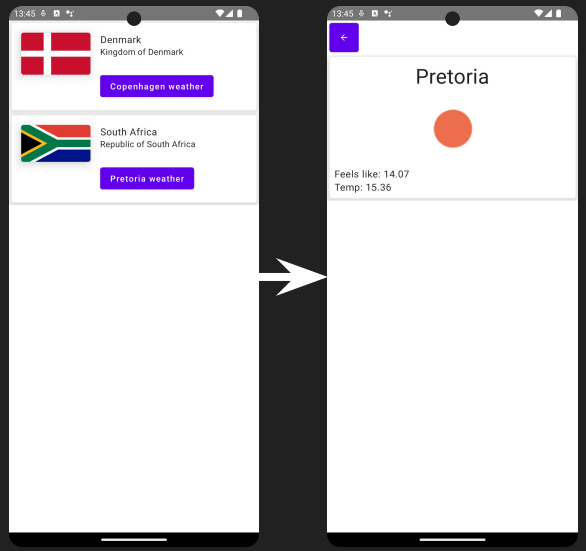
```
class HomeScreen : Screen {
    @Composable
    override fun Content() {
        // Contents of Screen
    }
}
```

Linear Navigation - Setup

```
@Composable
fun App() {
    MaterialTheme {
        Navigator(HomeScreen())
    }
}
```

Linear Navigation - Navigation

```
val navigator = LocalNavigator.currentOrThrow
navigator.push(OtherScreen())
```



Back Navigation - Poppable / Popping

Function	Description
navigator.canPop	If it’s not the “root” or “home” screen
navigator.pop()	Move back to the previous screen
CurrentScreen()	Display the current screen contents

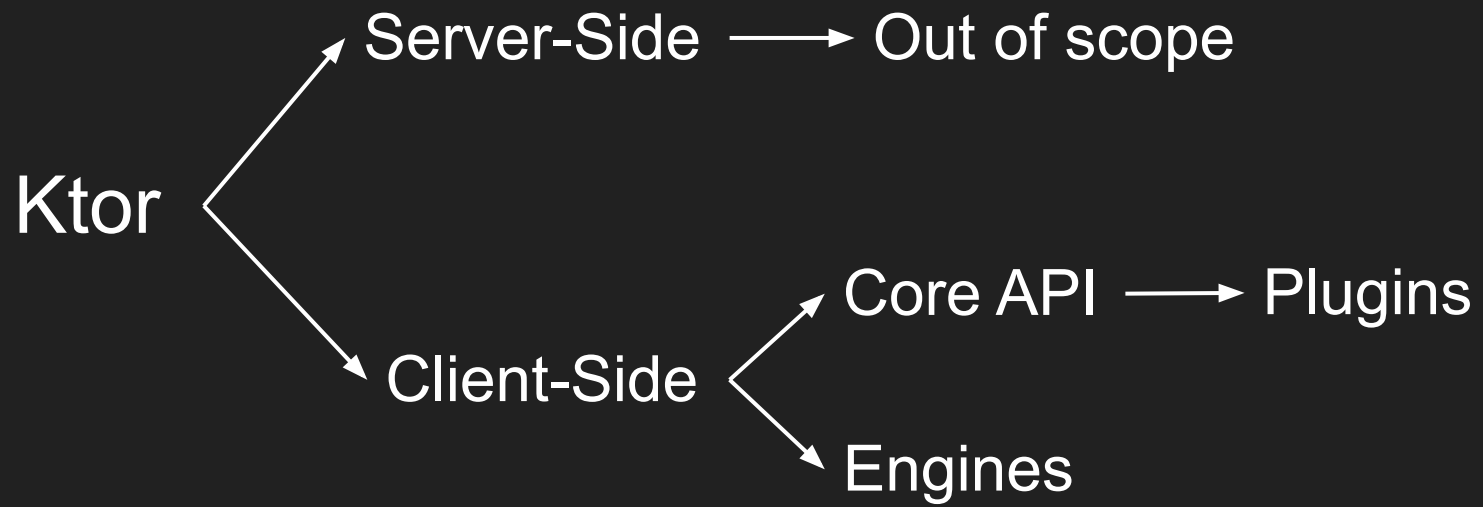
Summary

- We are coding with **Composable Functions / Composables.**
- **Modifiers** allow you to decorate or augment a Composable.
- `remember` stores values across recomposition.
- `mutableStateOf` creates a Compose observable.
- **Voyager** is an alternative navigation library for Compose Multiplatform.

Ktor Client & Kotlinx.serialization

Introducing Ktor

- Ktor is a framework for managing services
- You can both create and consume services
- You create consumers via the Ktor Client
- Ktor Client has platform-specific Engines
- Both client and server depend on Plugins


Ktor
Server-Side
Out of scope
Client-Side
Core API
Plugins
Engines

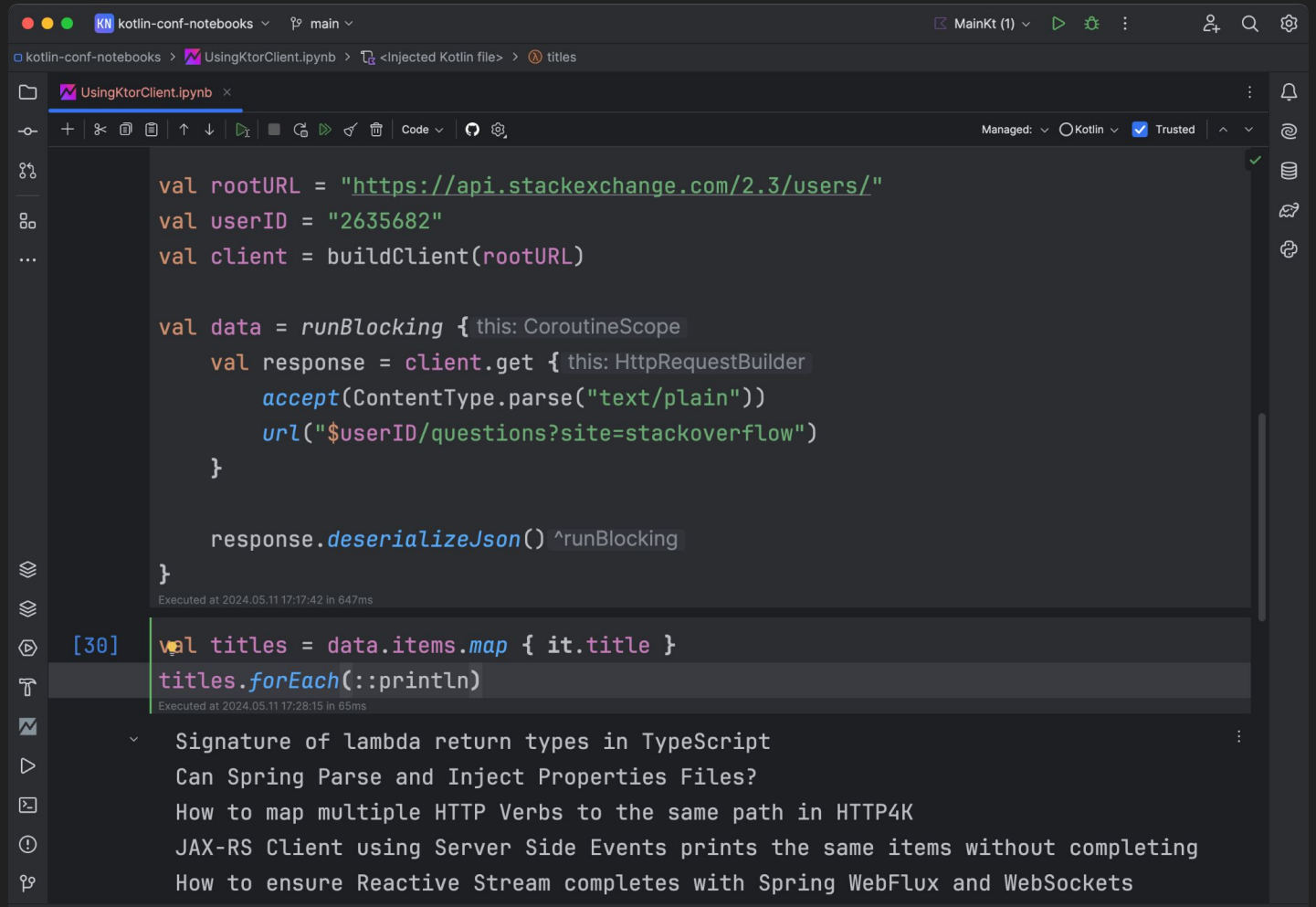
Configuring Ktor Client

To configure Ktor Client we declare dependencies:

- On the core and logging, in the common source set
- On an engine, in each platform source set

NB Kotlin Notebook users have a shortcut

- ‘`%use ktor-client`’ provides immediate access to the Ktor Client
- Notebooks are a great way to prototype your networking code


kotlin-conf-notebooks
main
MainKt (1)
kotlin-conf-notebooks > UsingKtorClient.ipynb > <Injected Kotlin file> > titles
UsingKtorClient.ipynb
Code
Managed:
Kotlin
Trusted
val rootURL = "https://api.stackexchange.com/2.3/users/"
val userID = "2635682"
val client = buildClient(rootURL)
val data = runBlocking { this: CoroutineScope
val response = client.get { this: HttpRequestBuilder
accept(ContentType.parse("text/plain"))
url("$userID/questions?site=stackoverflow")
}
response.deserializeJson() ^runBlocking
}
Executed at 2024.05.11 17:17:42 in 647ms
[30]
val titles = data.items.map { it.title }
titles.forEach(::println)
Executed at 2024.05.11 17:28:15 in 65ms
Signature of lambda return types in TypeScript
Can Spring Parse and Inject Properties Files?
How to map multiple HTTP Verbs to the same path in HTTP4K
JAX-RS Client using Server Side Events prints the same items without completing
How to ensure Reactive Stream completes with Spring WebFlux and WebSockets
40:26
LF
UTF-8
4 spaces
main

Configuring Ktor Client - Common Source Set

```
commonMain.dependencies {
    implementation(compose.runtime)
    implementation(compose.foundation)
    implementation(compose.material)
    implementation(compose.ui)

    implementation("io.ktor:ktor-client-core:2.3.7")
    implementation("io.ktor:ktor-client-logging:2.3.7")
}
```

Configuring Ktor Client - Desktop Source Set

```
desktopMain.dependencies {
    implementation(compose.desktop.currentOs)

    implementation("io.ktor:ktor-client-cio:2.3.7")
}
```

Configuring Ktor Client - iOS Source Set

```
iosMain.dependencies {
    implementation("io.ktor:ktor-client-darwin:2.3.7")
}
```

Configuring Ktor Client - Android Source Set

```
androidMain.dependencies {
    implementation(libs.compose.ui.tooling.preview)
    implementation(libs.androidx.activity.compose)

    implementation("io.ktor:ktor-client-android:2.3.7")
}
```

Using the Ktor Client - Part 1

To use the Ktor Client in our code we:

1. Create an instance of the `HttpClient` type
2. Add required plugins via the `install` method
3. Further configure the plugins as required

The Ktor philosophy is ‘no magic annotations’

- Plugins on the classpath do not register themselves
- You must explicitly configure them by calling `install`
- This may differ from other frameworks you have used

Using the Ktor Client - Part 1

```
class ItemRepository {

    private val client = HttpClient {
        install(ContentNegotiation) {
            json(Json {
                prettyPrint = true
                ignoreUnknownKeys = true
            })
        }
    }

    suspend fun allItems(): List<Item> { ... }
    suspend fun singleItem(id: Long): Item? { ... }
}
```

This plugin manages serialization, based on the HTTP Accept header. We configure it to format our JSON for viewing.

Using the Ktor Client - Part 2

For each call to the server we:

- Invoke `request` to acquire a `Response`
- Check the HTTP status code is 2xx
- Extract the body from the response

Using the Ktor Client - Part 2

```
suspend fun allItems(): List<Item> {
    val response = client.request("$ENDPOINT_URL/items")

    if (!response.status.isSuccess()) {
        //Return an empty list if the
        // response code is not 2xx
        return listOf()
    }
    return response.body()
}
```

Using the Ktor Client - Part 2

```
suspend fun singleItem(id: Long): Item? {
    val response = client.request("$ENDPOINT_URL/items/$id")

    if (!response.status.isSuccess()) {
        //Return null if the response
        // code is not 2xx
        return null
    }
    return response.body()
}
```

Introducing Serialization

The previous example will not work (yet!)

Because we have not considered serialization

Ktor does not convert objects to and from JSON

We need to add another library to accomplish this

Introducing Kotlinx.serialization

Platform specific serialization libraries exist

But we want to be multiplatform wherever possible

Hence we should use the kotlinx.serialization library:

https://github.com/Kotlin/kotlinx.serialization

Configuring Kotlinx.serialization

Kotlinx.serialization does not make use of reflection

Code to marshall objects is generated at build time

Hence we need to add two items into Gradle:

- The dependency on the library itself
- A compiler plugin to generate the code

Configuring Kotlinx.serialization - Common Source Set

```
commonMain.dependencies {
    …
    implementation("io.ktor:ktor-client-serialization-kotlinx-json:2.3.7")
  }
}
```

Using Kotlinx.serialization

Ktor will use the kotlinx.serialization library for you

You simply need to annotate your types with `@Serializable`

The qualified name is `kotlinx.serialization.Serializable`

Configuring Kotlinx.serialization - Compiler Plugin

```
plugins {
    ...

    kotlin("plugin.serialization") version "1.9.22"
}
```

Using Kotlinx.serialization

It is possible to customize the serialization process in many ways

See the guide in the library documentation for details:

https://github.com/Kotlin/kotlinx.serialization/blob/master/docs/serialization-guide.md

Practical 2: Connecting to a Web Service [20 mins]

Understanding Expect / Actual

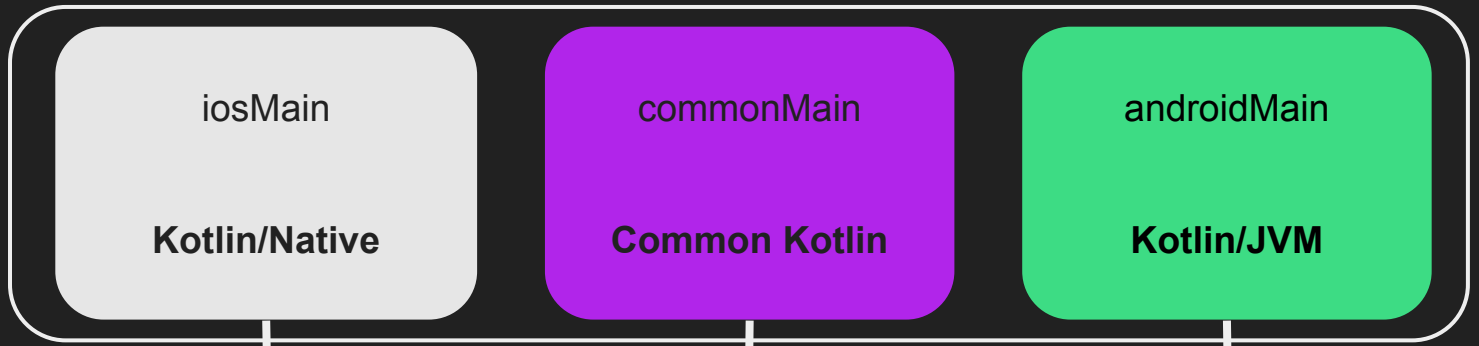
Demo: Wizard `expect`/`actual` Usage

What We Saw

- The Compose Multiplatform template uses `expect/actual` for `getPlatform()`
- The `expect` definition is in `commonMain` - we define what we're expecting
- The actual implementation is in `androidMain/desktopMain/iosMain` - we actually implement what we promised

It’s important to have `actual` fun(s) 😄

Expect/actual functions




```
expect fun randomUUID(): String
```

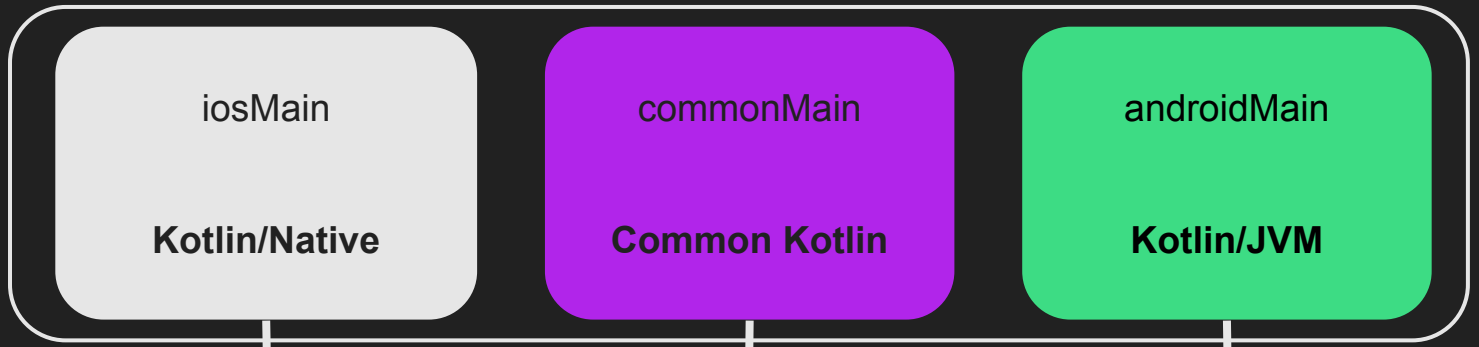
```
import platform.Foundation.NSUUID
actual fun randomUUID(): String =
NSUUID().UUIDString()
```

```
import java.util.*
actual fun randomUUID() =
UUID.randomUUID().toString()
```

Use `expect/actual` functions for **simple** cases

Use `interfaces` for more **complex** cases

interfaces



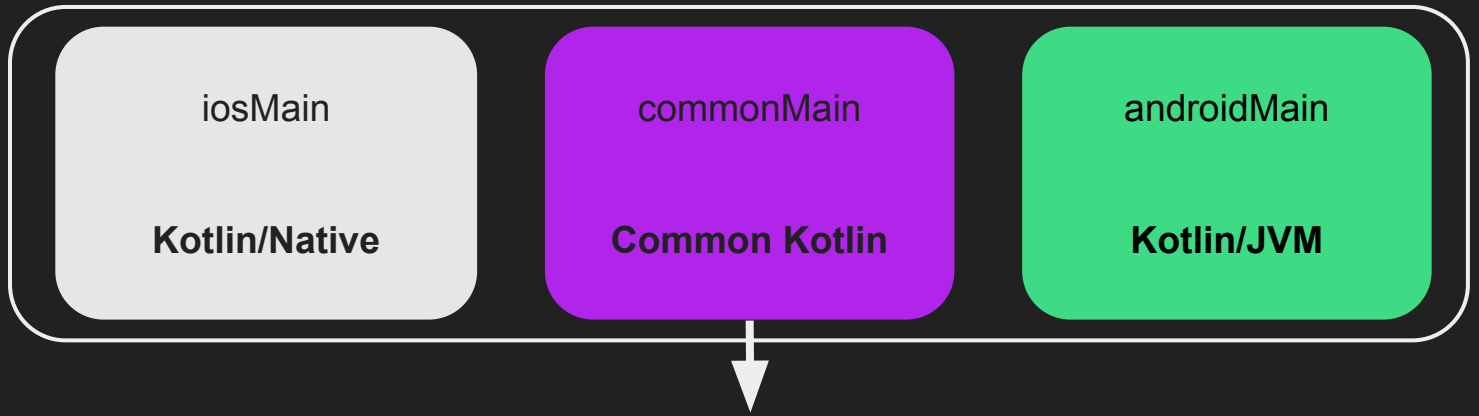

```
interface Platform {
    val name: String
}
```

```
class iOSPlatform: Platform
```

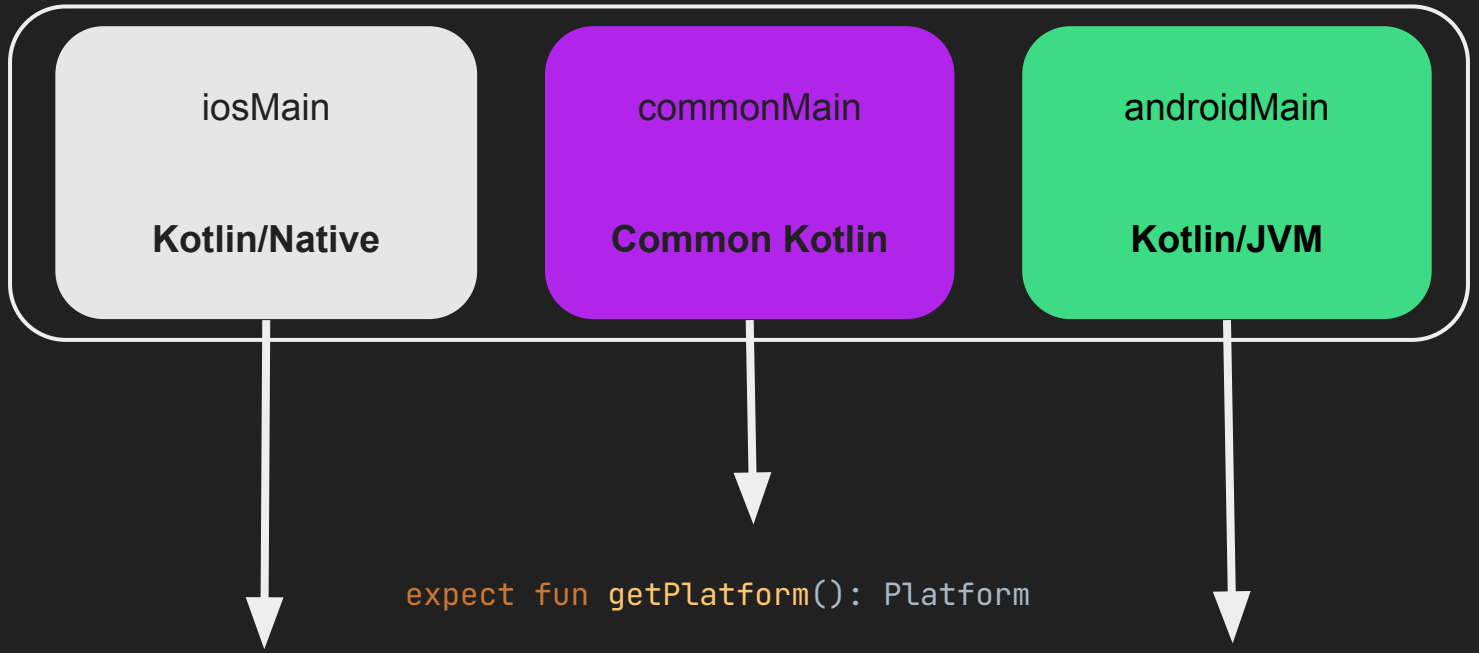
```
class AndroidPlatform: Platform
```

But how do we actually provide the implementation?

Factory Functions




```
interface Platform {
    val name: String
}

expect fun getPlatform(): Platform
```

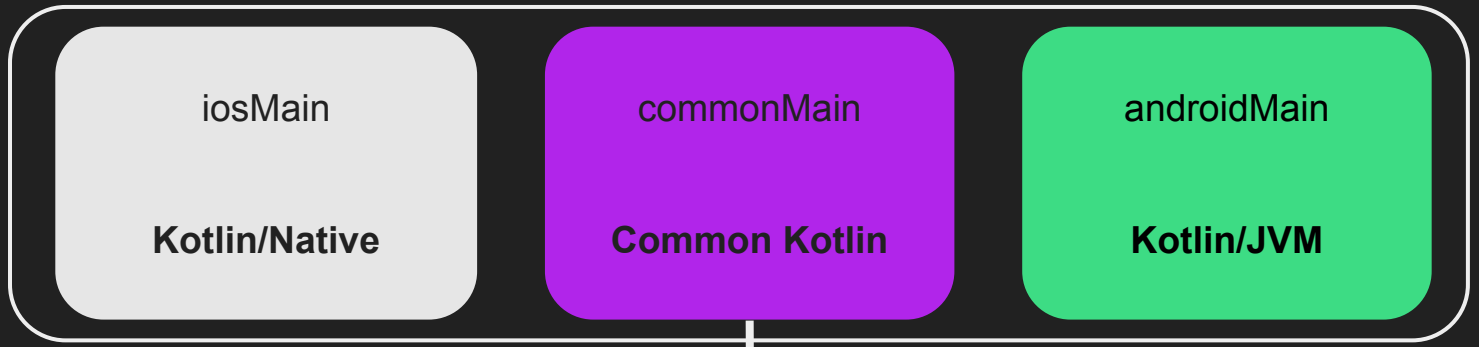



```
expect fun getPlatform(): Platform
```

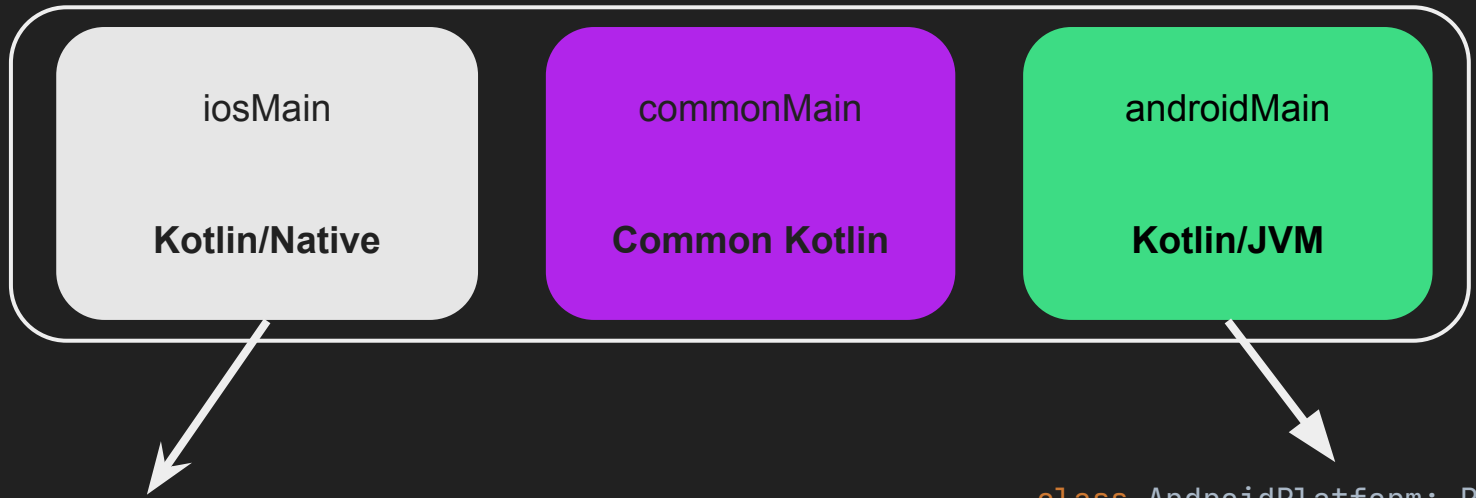
```
class iOSPlatform: Platform
…

actual fun getPlatform() = iOSPlatform()
```

```
class AndroidPlatform: Platform
…

actual fun getPlatform() = AndroidPlatform()
```

Early Entry Points




```
interface Platform {
    val name: String
}

fun app(p: Platform) {
    // app logic
}
```

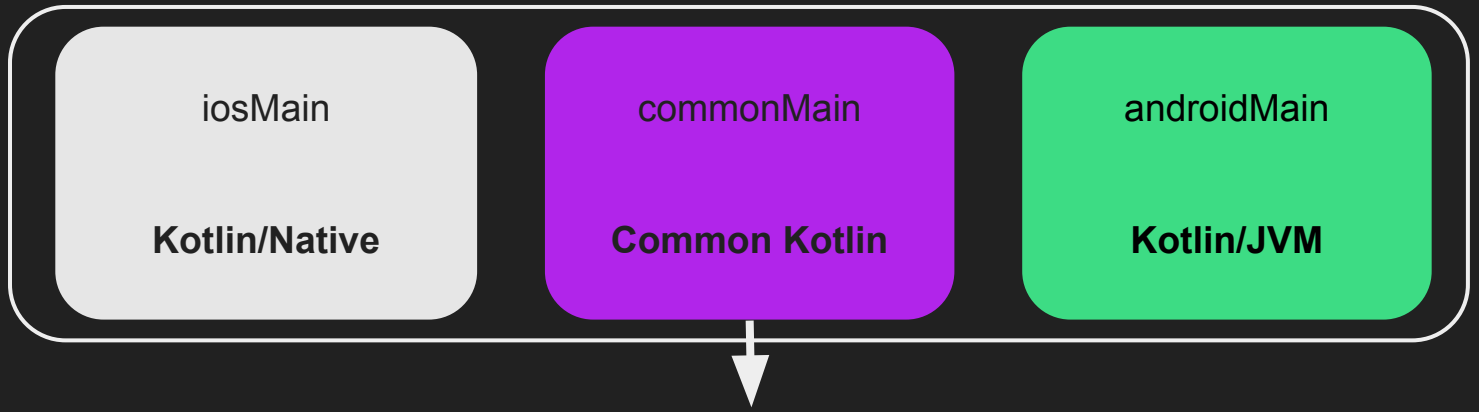



```
class iOSPlatform: Platform
…

@main
struct iOSApp : App {
   init() {
       app(IOSPlatform())
   }
}
```

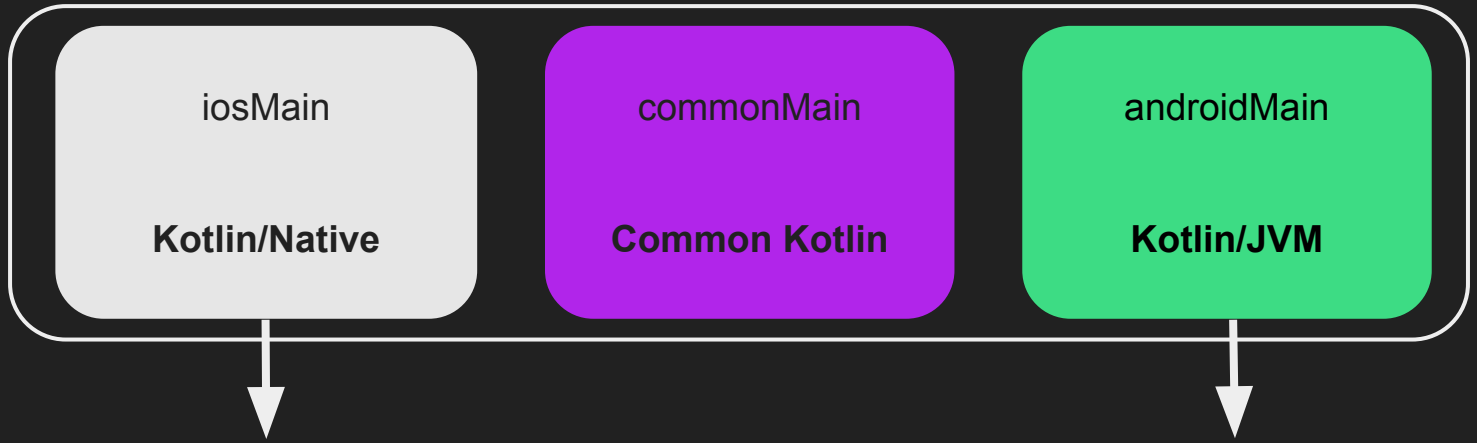
```
class AndroidPlatform: Platform
…

class MyApp : Application() {
   override fun onCreate() {
       super.onCreate()
       app(AndroidPlatform())
   }
}
```

Use **Dependency Injection** frameworks to provide interface implementations

Dependency Injection with Koin




```
interface Platform {
    val name: String
}

expect val platformModule: Module
```




```
class iOSPlatform: Platform
…

actual val platformModule: Module  = module {
   single<Platform> {
     IOSPlatform()
   }
}
```

```
class AndroidPlatform: Platform
…

actual val platformModule: Module = module {
   single<Platform> {
       AndroidPlatform()
   }
}
```

Find out more about
Dependency Injection
later

Practical 3: Getting the Device Country Code [20 mins]

- Your `expect`/`actuals` must be in the same package
- Your Android `actual` goes in `androidMain`
- Your Desktop `actual` goes in `desktopMain`
- Your iOS `actual` goes in `iosMain`
- Use the gutter icons to navigate between the `expect`/`actuals`

Testing in Kotlin Multiplatform

Testing in Kotlin Multiplatform

Testing is a massive topic in it’s own right

Here we are only concerned with unit and integration testing

- System and non-functional testing are out of scope
- By definition they test the application from the outside

Testing in Kotlin Multiplatform

In a KMP application we need to distinguish between:

- Writing tests for platform specific code
- Writing / running tests for common code

Tests for Platform Specific Code

These will use a platform specific testing tool

They may need framework specific extensions

- Such as the Ktor extensions to JUnit

We can include them in a multiplatform project

- But only within a platform-specific source set

Tests for Common Code

These are our main focus in this topic

The code being tested will execute on any platform

Hence we can use any supported testing framework

Tests for Common Code

We don’t want to tightly couple our code to one testing framework

Hypothetically say we wrote all our tests for common code in JUnit

…then we could only run our unit tests on the JVM

Writing Tests for Common Code

Tests for common code use the kotlin.test API

This provides platform agnostic annotations and assertions

The tests you create can be run:

- With JUnit4, JUnit5 and TestNG on the JVM
- With a bespoke native test runner on iOS

kotlin.test

The `kotlin.test` library provides annotations to mark test functions and a set of utility functions for performing assertions in tests, independently of the test framework being used.

The test framework is abstracted through the Asserter class. A basic `Asserter` implementation is provided out of the box. Note that the class is not intended to be used directly from tests, use instead the top-level assertion functions which delegate to the `Asserter`.

The library consists of the modules:

- `kotlin-test-common` – assertions for use in common code;
- `kotlin-test-annotations-common` – test annotations for use in common code;
- `kotlin-test` – a JVM implementation of assertions from `kotlin-test-common`;
- `kotlin-test-junit` – provides an implementation of Asserter on top of JUnit and maps the test annotations from `kotlin-test-annotations-common` to JUnit test annotations;
- `kotlin-test-junit5` – provides an implementation of Asserter on top of JUnit 5 and maps the test annotations from `kotlin-test-annotations-common` to JUnit 5 test annotations;
- `kotlin-test-testng` – provides an implementation of Asserter on top of TestNG and maps the test annotations from `kotlin-test-annotations-common` to TestNG test annotations;
- `kotlin-test-js` – a JS implementation of common test assertions and annotations with the out-of-the-box support for Jasmine, Mocha, and Jest testing frameworks, and an experimental way to plug in a custom unit testing framework.

Demo of Testing Common Code

```
fun grep(
    lines: List<String>,
    pattern: String,
    action: (String) → Unit
) {
    val regex = pattern.toRegex()
    lines.filter(regex::containsMatchIn)
        .forEach(action)
}
```

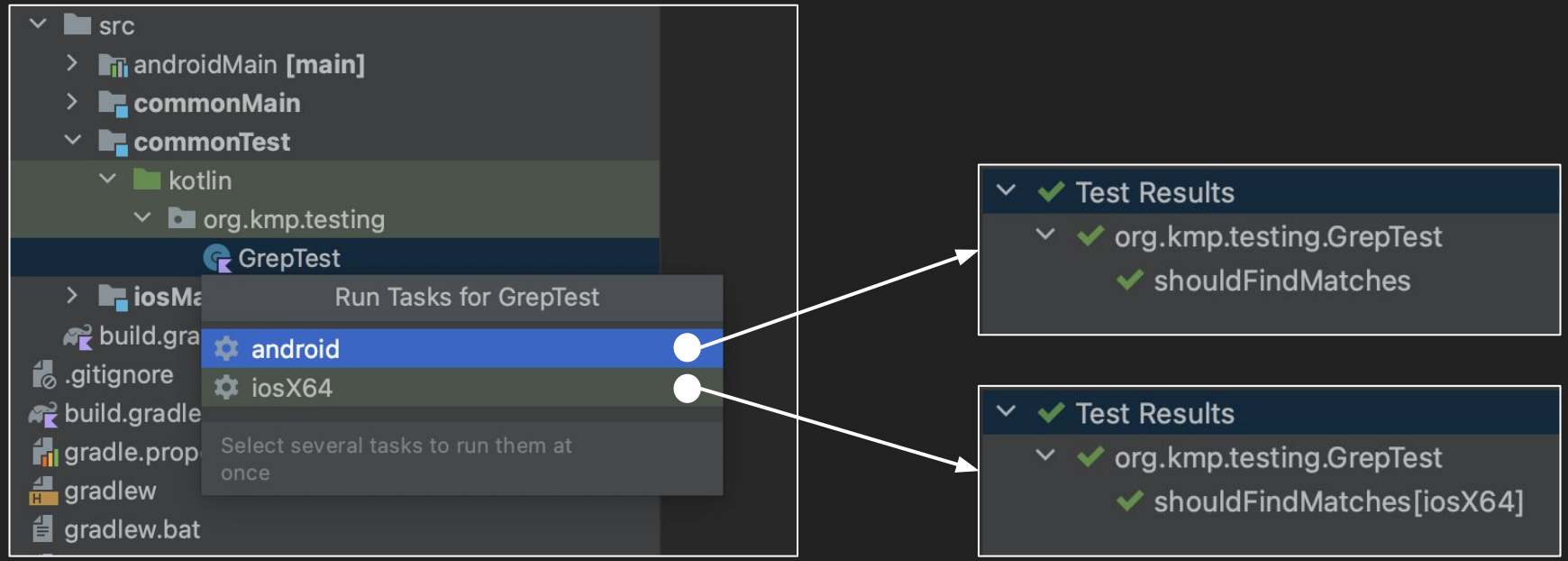
Demo of Testing Common Code

```
import kotlin.test.Test
import kotlin.test.assertContains
import kotlin.test.assertEquals

class GrepTest {
    companion object {
        val sampleData = listOf(
            "123 abc",
            "abc 123",
            "123 ABC",
            "ABC 123"
        )
    }
```

Demo of Testing Common Code

```
    @Test
    fun shouldFindMatches() {
        val results = mutableListOf<String>()
        grep(sampleData, "[a-z]+") {
            results.add(it)
        }


        assertEquals(2, results.size)
        for (result in results) {
            assertContains(result, "abc")
        }
    }
}
```

Demo of Testing Common Code



Writing Tests for Common Code

Tests in common code cannot use platform specific types

- Using JUnit types will give compiler errors
- The kotlin.test API is all that you have
- It’s not just a good idea - it’s the (compiler) law 😉

The assertions are specified in the `Asserter` interface

- Within the API these are mapped to the tool in use

The Asserter Interface

```
interface Asserter {
    fun fail(message: String?): Nothing
    fun fail(message: String?, cause: Throwable?): Nothing
    fun assertTrue(lazyMessage: () → String?, actual: Boolean)
    fun assertTrue(message: String?, actual: Boolean)
    fun assertEquals(message: String?, expected: Any?, actual: Any?)
    fun assertNotEquals(message: String?, illegal: Any?, actual: Any?)
    fun assertSame(message: String?, expected: Any?, actual: Any?)
    fun assertNotSame(message: String?, illegal: Any?, actual: Any?)
    fun assertNull(message: String?, actual: Any?)
    fun assertNotNull(message: String?, actual: Any?)
}
```

Testing and Expected / Actual Declarations

Common code can require platform specific inputs

- You could be testing business rules in common code
- …but where data comes from a sensor on the device

Your tests can use expected and actual declarations to work

- The test methods will still be implemented in common code
- …but the methods to build the data will be platform specific

```
expect fun buildSampleData(): List<String>

class GrepTest {
    companion object {
        val sampleData = buildSampleData()
    }

    @Test
    fun shouldFindMatches() {
        val results = mutableListOf<String>()
        grep(sampleData, "[a-z]{3}[0-9]{3}") {
            println("Matched '$it'")
            results.add(it)
        }

        assertEquals(2, results.size)
    }
}
```

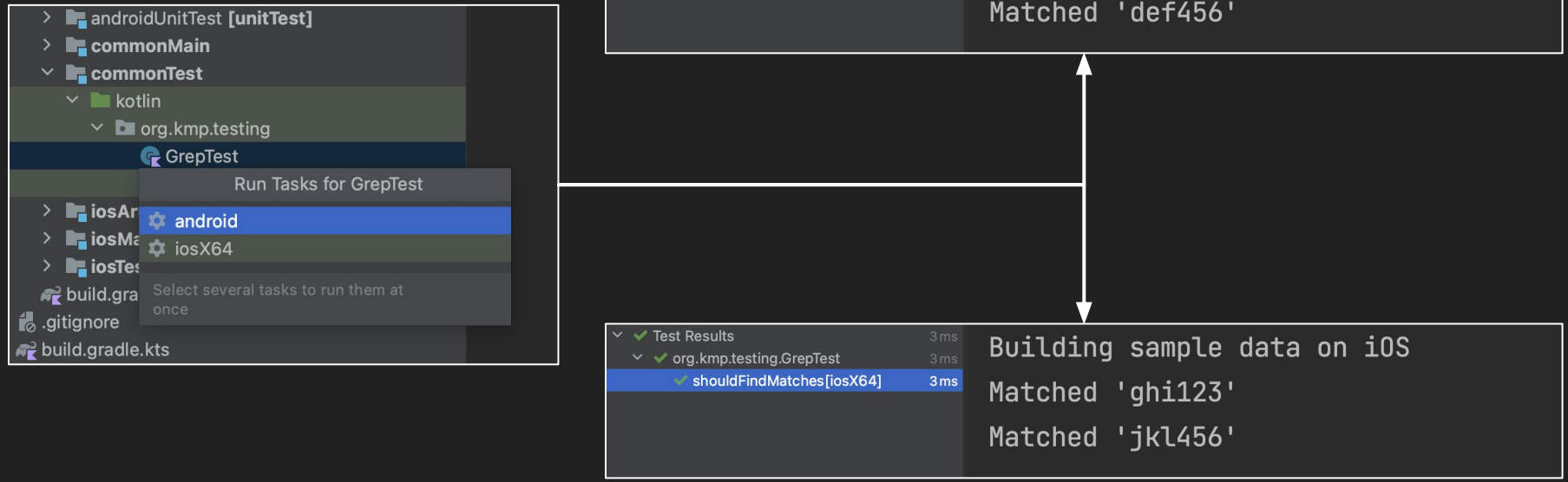
In **commonTest**

In **androidUnitTest**

```
actual fun buildSampleData(): List<String> {
    println("Building sample data on Android/JVM")

    return listOf(
        "abc123",
        "123abc",
        "def456",
        "456def"
    )
}
```

In **iosTest**

```
actual fun buildSampleData(): List<String> {
    println("Building sample data on iOS")

    return listOf(
        "ghi123",
        "123ghi",
        "jkl456",
        "456jkl"
    )
}
```


androidUnitTest [unitTest]
commonMain
commonTest
kotlin
org.kmp.testing
GrepTest
Run Tasks for GrepTest
android
iosX64
Select several tasks to run them at once
build.gradle.kts
Test Results 39 ms
org.kmp.testing.GrepTest 39 ms
shouldFindMatches 39 ms
Building sample data on Android/JVM
Matched 'abc123'
Matched 'def456'
Test Results 3 ms
org.kmp.testing.GrepTest 3 ms
shouldFindMatches[iosX64] 3 ms
Building sample data on iOS
Matched 'ghi123'
Matched 'jkl456'

Additional Options for Testing Common Code

The KMP Ecosystem is continually expanding

Existing libraries, like Kotest, now support KMP

With Kotest you can:

- Write tests in multiple styles (Cucumber, Jasmine, ScalaTest etc…)
- Execute the same test many times, but with different data sets
- Add delays, retries and timeouts for non-deterministic tests
- Perform Property Based Testing using generated values

Kotest is a flexible and elegant multi-platform test framework for Kotlin with extensive assertions and integrated property testing

Get Started

Star 4,053

KOTLINLANG KOTEST | RELEASE V5.7.2 | LATEST SNAPSHOT V5.6.0.1131-SNAPSHOT | LICENSE APACHE2.0 | STACKOVERFLOW KOTEST

Test Framework

The Kotest test framework enables test to be laid out in a fluid way and execute them on JVM, Javascript, or native platforms.

With built in coroutine support at every level, the ability to use functions as test lifecycle callbacks, extensive extension points, advanced conditional evaluation, powerful data driven testing, and more.

Assertions Library

The Kotest assertions library is a Kotlin-first multi-platform assertions library with over 300 rich assertions.

It comes equipped with collection inspectors, non-determistic test helpers, soft assertions, modules for arrow, json, kotlinx-datetime and much more.

Read more

Property Testing

The Kotest property testing module is an advanced multi-platform property test library with over 50 built in generators.

It supports failure shrinking, the ability to easily create and compose new generators; both exhaustive and arbitrary checks, repeatable random seeds, coverage metrics, and more.

Lunch

Post-Lunch Review

What Have We Achieved So Far?

- Described Kotlin Multiplatform and Compose Multiplatform as technologies in general
- Learnt how to create a project from scratch using the Kotlin Multiplatform wizard
- Created the user interface for the project using Compose Multiplatform
- Replaced the dummy data with real network calls
- Added platform code that can be called from common code
- Learnt about testing Kotlin Multiplatform applications

Caching

KStore

- Stores objects in files
- Needs platform-specific path
- Uses coroutines, kotlinx-serialization, okio
- Read-write locks
- In-memory caching

https://github.com/xxfast/KStore

Dependencies

```
kotlin {
    sourceSets {
        commonMain.dependencies {
            implementation("io.github.xxfast:kstore:0.6.0")
            implementation("io.github.xxfast:kstore-file:0.6.0")
        }
    }
}
```

File Paths

- Android: `"${context.filesDir.path}/country_cache.json"`
- iOS: `"${NSHomeDirectory()}/country_cache.json"`
- Desktop:

```
val appDir = AppDirsFactory
    .getInstance()
    .getUserDataDir("weatherapp", "1.0.0", "workshop")
"$appDir/country_cache.json"
```

Create Cache

```
import io.github.xxfast.kstore.KStore
import io.github.xxfast.kstore.file.storeOf
…
private val cache: KStore<List<Country>> = storeOf(filePath =
pathToCountryCache())
…
expect fun pathToCountryCache(): String
```

Caching Behavior

1. Get everything in the cache

2. If cache contents is null:
    a. Get the data from the webservice (API)
    b. Fill the cache with the new data

3. Return the data

Caching Behaviour

```
suspend fun getAllCountries(): List<Country> {
    return cache.get()
        ?: api.getAllCountries().also {
            cache.set(it)
        }
}
```

Coroutines and Flows

Why Do We Need Coroutines?

- Concurrency design pattern that you can use to **simplify** code that executes **asynchronously**
- Help to manage **long-running tasks** that might otherwise **block the calling thread**
- For apps the calling thread is the **main thread**. Blocking the main thread can cause your app to become **unresponsive** (ANR)

Suspending Functions

- Function that can **suspend** its computation at some point and **resume** later on, without blocking the thread / freeing the thread to do other work
- Marked with **suspend** keyword in function signature
- Can only be called from **coroutine builders** or **other suspend functions**

Consuming Suspending Functions

```
var weather: Weather? by remember { mutableStateOf(null) }

LaunchedEffect(Unit) {
    weather = WeatherApi().getWeather(lat, long)
}
```

LaunchedEffect: run suspend functions in the scope of a composable

What is a Flow?

- Type that can **emit multiple values** sequentially, as opposed to suspend functions that return only a **single value**
- Example: changes in prices to the stock market
- Created using a **flow builder** `flow { … }`
- You can `emit(...)` values inside a flow builder
- You can call **suspending functions** inside a flow builder

StateFlow

- Optimally emit state updates and emit values to multiple consumers
- `StateFlow` is a state-holder observable flow that emits the current and new state updates to its collectors
- The current state value can also be read through its **`value`** property
- To update state and send it to the flow, assign a new `value` to the value property of the `MutableStateFlow` class.

Creating a Flow

```
flow {
    // Call suspending functions and use their values
    WeatherApi().getWeather(0.0,0.0)

    // Emit a value
    emit(...)

    // Wait an approximate time
    delay(1.seconds)
}
```

Consuming a StateFlow in Compose Multiplatform

Remember across recomposition.
May not be necessary if the flow is saved in another way (like VM).

Collects values of Flow and transforms into Compose State

```
val myValue = remember { someFlow }.collectAsState()

Text(text = "My value: ${myValue.value}")
```

kotlinx-datetime

- `Instant` is a moment in time, independent of timezone
- `LocalDateTime` is a moment in time, related to timezone
- `Clock.System.now()` queries the OS for current time `Instant`
- Convert an `Instant` to your `LocalDateTime` with `time.toLocalDateTime(TimeZone.currentSystemDefault())`
- Query a `LocalDateTime` with `hour`, `minute`, `second` etc.

Practical 4: Consuming Flows

Sharing View Models

ViewModel

- Integral part of the MVVM (Model-View-ViewModel) pattern
- Exposes state to the UI, encapsulates business logic
- On Android, `ViewModel` survives configuration changes

Fixes a code smell 

Code Smell 🚫

```
class TimeApi {
    private val clockTime = flow {
        while(true) {
            emit(formatTime(Clock.System.now()))
            delay(1.seconds)
        }
    }

    val actualTime = clockTime.stateIn(GlobalScope, SharingStarted.Eagerly, "N/A")
    …
}
```

Delicate coroutines API.

- Lifetime is responsibility of programmer
- Easy to create memory leaks

Importing the Dependencies

```
commonMain.dependencies {
    …
    implementation("cafe.adriel.voyager:voyager-navigator:1.0.0")
    implementation("cafe.adriel.voyager:voyager-screenmodel:1.0.0")
}
```

The ViewModel

```
class HomeScreenModel : ScreenModel {

    val actualTime = TimeApi().clockTime.stateIn(screenModelScope, SharingStarted.Eagerly, "N/A")

}
```

Creating the ViewModel

```
class HomeScreen : Screen {
    @Composable
    override fun Content() {
        val screenModel = rememberScreenModel { HomeScreenModel() }

        Surface {
            …

            val time = screenModel.actualTime.collectAsState()

            Column {
                Text(
                    modifier = Modifier.align(Alignment.CenterHorizontally).padding(8.dp),
                    text = "Local time: ${time.value}",
                    style = MaterialTheme.typography.h4
                )

            }
    }
}
```

Using the ViewModel

```
class HomeScreen : Screen {
    @Composable
    override fun Content() {
        val screenModel = rememberScreenModel { Hom

        Surface {
            …

            val time = screenModel.actualTime.collectAsState()

            Column {
                Text(
                    modifier = Modifier.align(Alignment.CenterHorizontally).padding(8.dp),
                    text = "Local time: ${time.value}",
                    style = MaterialTheme.typography.h4
                )
            …
            }
        }
    }
}
```

Flow is saved by VM, no need to remember it.

Dependency Injection with Koin

Why Dependency Injection?

Decouple the interface from the implementation

Easily substitute one implementation for another

- Such as when you want to use a fake / mock / crash test dummy
- Or support multiple implementations from different vendors

Simplify the platform specific parts of your design

- Let the DI container manage the expected / actual declarations

How to apply Dependency Injection:

For each dependency we create an appropriate interface

These interfaces are then used in constructors

- In this case the constructors of the two View Models
- Technically this is ‘constructor injection’ - other options exist

Implementations of the interfaces are injected from outside

The View Models don’t know which versions they are using

Summary of steps:

1. Include the DI library in the `build.gradle.kts` file
2. Extract interfaces from the components to be injected
3. Add constructors (with parameters) to your View Models
4. Declare ‘wiring instructions’ using the Koin DSL
5. Initialise the DI library on application startup

Import the dependencies

```
androidMain.dependencies {
    …
    implementation("io.insert-koin:koin-android:3.2.0")
}
commonMain.dependencies {
    …
    implementation("cafe.adriel.voyager:voyager-koin:1.0.0")
    implementation("io.insert-koin:koin-core:3.2.0")
}
```

Implement `interfaces`

```
interface CountryApi {
    suspend fun getAllCountries(): List<Country>
}

class CountryApiImpl : CountryApi{
    …
}

// And so on
```

Create constructors for View Models

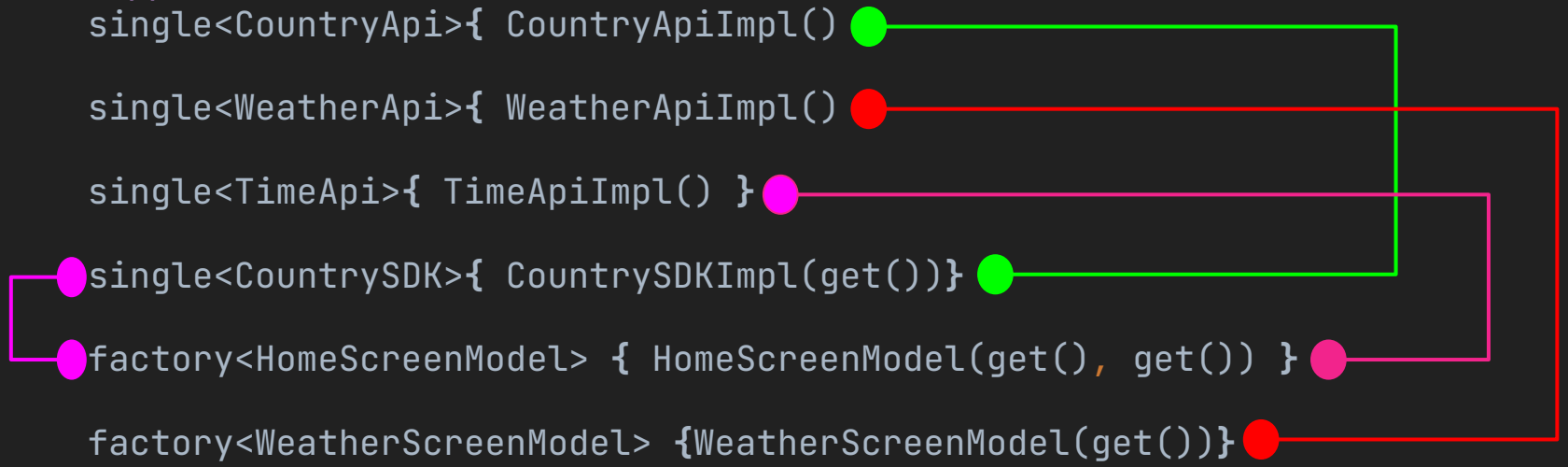
```
class HomeScreenModel(
    private val sdk: CountrySDK,
    private val timeApi: TimeApi
) : ScreenModel {

    val actualTime = timeApi.clockTime.stateIn(
        screenModelScope,
        SharingStarted.Eagerly,
        "N/A"
    )

    suspend fun getSortedCountries(): List<Country> {
        return sdk.getAllCountries().sortedBy { it.name.common }
    }
}
```

Create constructors for View Models

```
class WeatherScreenModel(
    private val weatherApi: WeatherApi
) : ScreenModel {

    suspend fun getWeather(lat: Double, long: Double) =
        weatherApi.getWeather(lat, long)

}
```

Create module

```
val appModule = module {
    single<CountryApi>{ CountryApiImpl()

    single<WeatherApi>{ WeatherApiImpl()

    single<TimeApi>{ TimeApiImpl() }

    single<CountrySDK>{ CountrySDKImpl(get())}

    factory<HomeScreenModel> { HomeScreenModel(get(), get()) }

    factory<WeatherScreenModel> {WeatherScreenModel(get())}
}
```



Call `startKoin` for Android

```
class WeatherApplication : Application() {

    override fun onCreate() {
        super.onCreate()

        startKoin() {
            modules(appModule)
        }
    }
}
```

Call `startKoin` for iOS

```
fun initKoin(){
    startKoin {
        modules(appModule)
    }
}
```

Call helper function from iOS app `init`

```
@main
struct iOSApp: App {

    init() {
        MainViewControllerKt.doInitKoin()
    }

    var body: some Scene {
        WindowGroup {
            ContentView()
        }
    }
}
```

Recap of steps:

1. Include the DI library in the `build.gradle.kts` file
2. Extract interfaces from the components to be injected
3. Add constructors (with parameters) to your View Models
4. Declare ‘wiring instructions’ using the Koin DSL
5. Initialise the DI library on application startup

Libraries

Build with Compose Multiplatform

If you are building with Jetpack Compose for Android:

- Consider Compose Multiplatform instead
- So your code is available for **many** platforms

Compose Multiplatform libs are fully compatible with Jetpack Compose

- Developers using Jetpack Compose, and hence targeting only Android, can still depend on your Compose Multiplatform library

Resources

- Multiplatform library template
- Very out-of-date instructions to building with GitHub Actions, publishing to Maven Central (to be updated after KotlinConf)
- Much better third-party instructions by Kwabena Bio Berko 🙏 OR
- A more succinct alternative by Vivien Mahé 🙏

Design For Use From Common Code

Design your APIs to be called from common code

- Users should not need platform-specific code to invoke your functions

Place APIs in the broadest possible source set

In order of preference:

- The commonMain source set
- Intermediate source sets
- Platform-specific source sets

Ensure Consistent Behaviour Across All Platforms

Try to ensure consistency across platforms

- The same inputs are considered valid
- The same kinds of actions are performed
- Results and errors are returned the same way

This means you only have to document common code

- Workarounds are not needed from API users on ‘cursed’ platforms.

Test On All Platforms

Write tests in common code as far as possible

Run tests regularly on all supported platforms

Consider Non-Kotlin Users

Design declarations to be easy to use from Swift (for example).

Xcode Primer

What we will see

Understanding how embedAndSign… is integrated into Xcode project building.

Adding dependencies (SPM / CocoaPods) to native parts of the application.

Debugging the application.

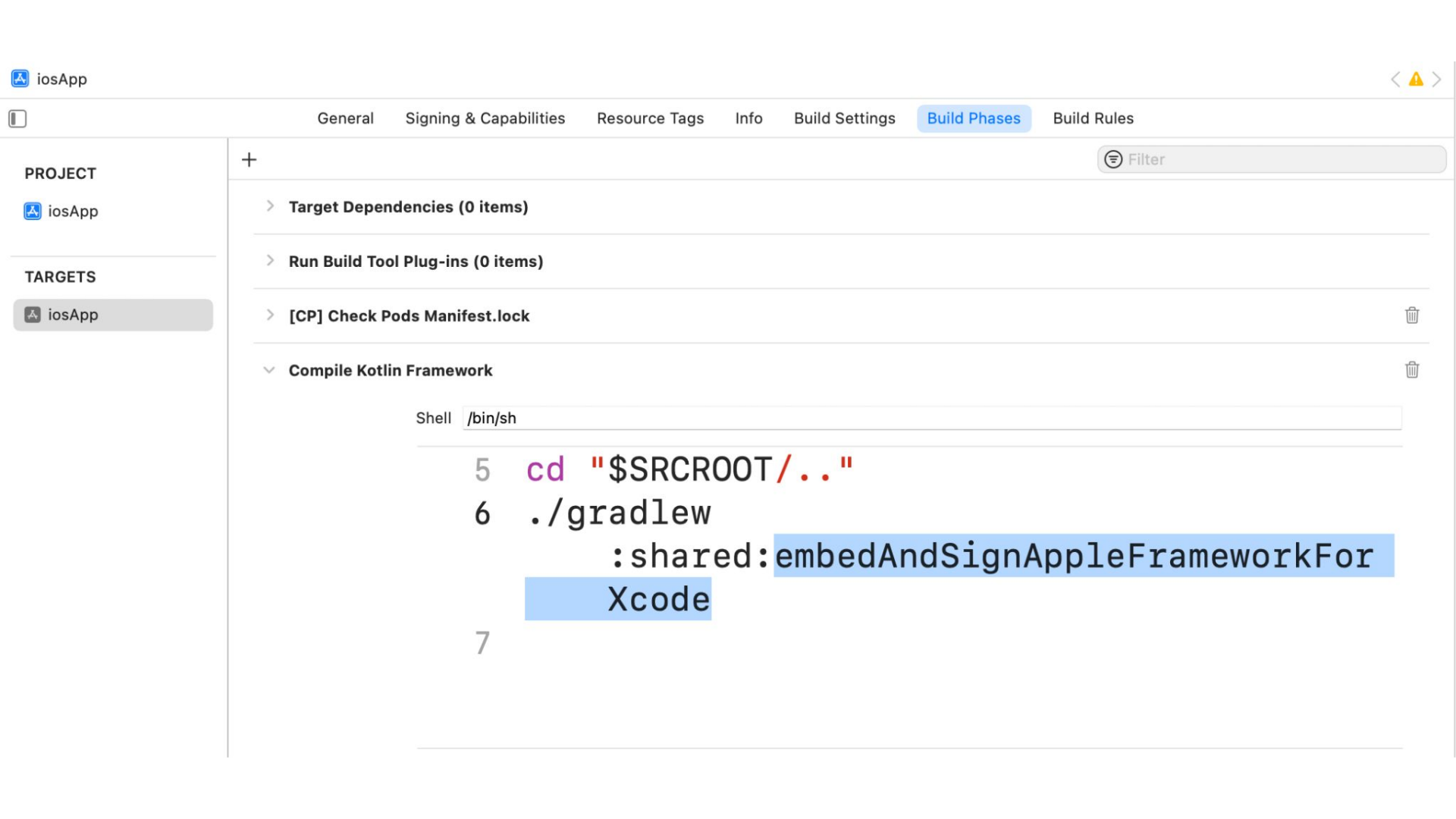
How Updating Shared Code Locally Works

We need to build the framework each time the app is built.

To build the framework:

```
./gradlew embedAndSignAppleFrameworkForXcode
```

We can add it to a Build Phase (the wizard does this for us).


iosApp
General
Signing & Capabilities
Resource Tags
Info
Build Settings
Build Phases
Build Rules
PROJECT
iosApp
TARGETS
iosApp
Filter
Target Dependencies (0 items)
Run Build Tool Plug-ins (0 items)
[CP] Check Pods Manifest.lock
Compile Kotlin Framework
Shell
/bin/sh
5 cd "$SRCROOT/.."
6 ./gradlew
:shared:embedAndSignAppleFrameworkFor
Xcode
7

Adding Dependencies

CocoaPods and SPM (Swift Package Manager) are dependency managers for iOS projects.

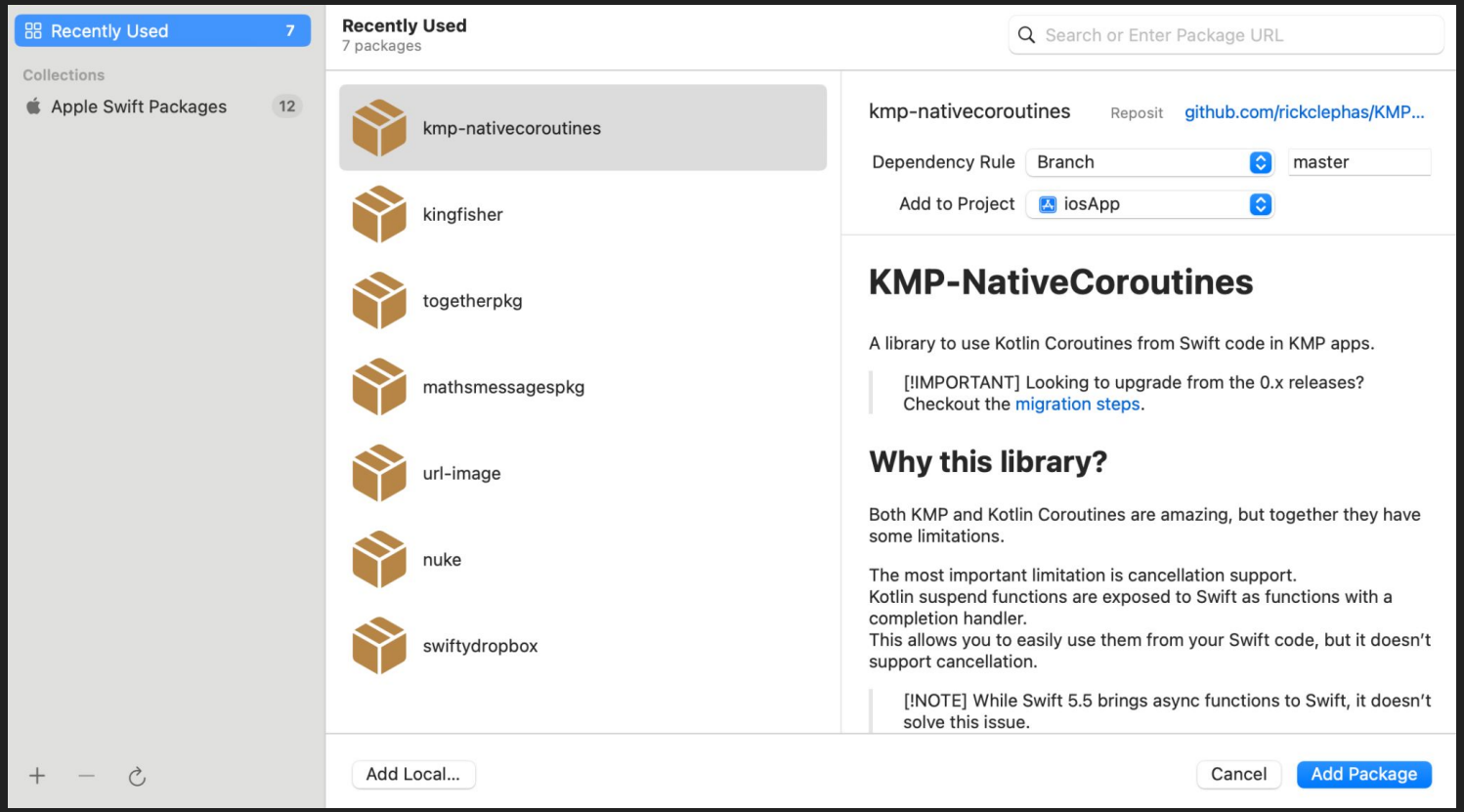
CocoaPods is very established, but can have increasing build times for large projects and lead to a maintenance burden of manual updates.

SPM is the more modern option from Apple with Xcode integration, faster build times, and automatic updates.

Adding Dependencies (SPM)

1. Open ‘File’ -> ‘Add Package Dependencies’.
2. Specify Package URL (.git) and Dependency Rule.
3. Click ‘Add Package’.
4. Remember to import in the source file.
5. Run the app.

Adding Dependencies (SPM)



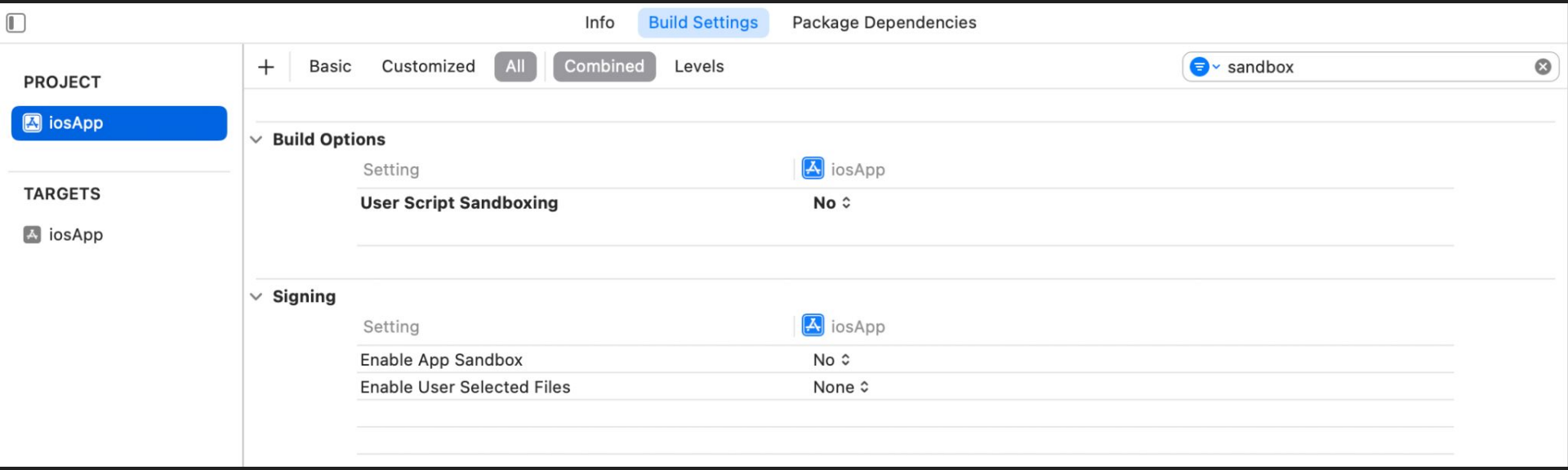
Adding Dependencies (CocoaPods)

1. cd iosApp
2. pod init - Creates the Podfile.
3. Update Podfile with dependencies.
4. pod install - Installs the CocoaPods.
5. open iosApp.xcworkspace - (Not the one in iosApp.xcproject) or reconfigure Android Studio.
6. Make two tiny fixes (issues with wizard).
7. Remember to import in the source file.
8. Run the app.

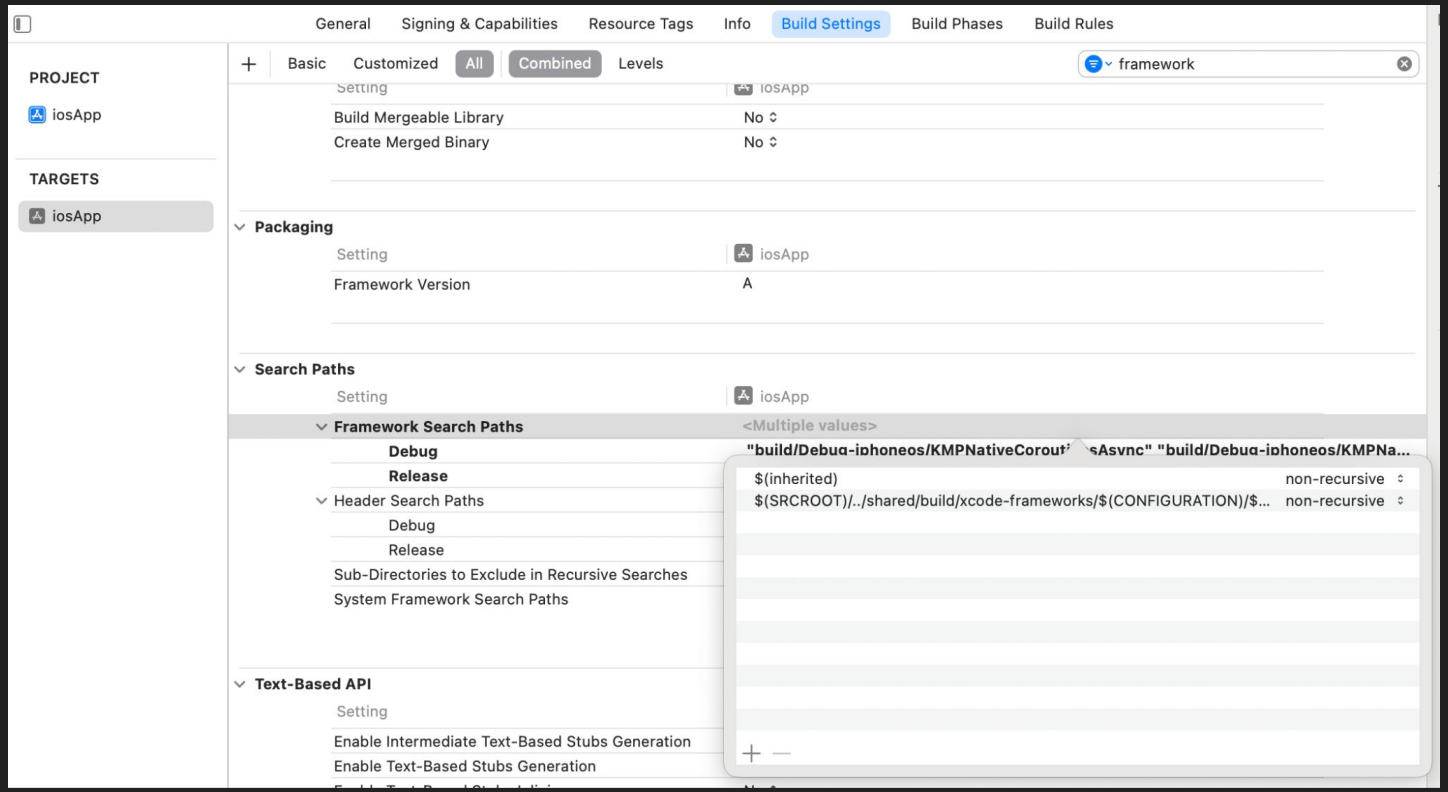
Example Podfile

```
# Uncomment the next line to define a global platform for your project
# platform :ios, '9.0'

target 'iosApp' do
  # Comment the next line if you don't want to use dynamic frameworks
  use_frameworks!

  # Pods for iosApp
    pod 'Kingfisher', '~> 7.0'
    pod 'KMPNativeCoroutinesAsync', '1.0.0-ALPHA-25'

end
```

Tiny Fixes - #1 Disable User Script Sandboxing



Tiny Fixes - #2 Add $(inherited) to Framework Search Paths



Debugging

Enabling/disabling of breakpoints

Running in debug mode

Continue/step over/step in/step out

Sharing Kotlin APIs with Swift codebases

Concepts

- Swift “interop” and the Objective-C bridge
- Kotlin/Swift Interopedia
- 3 key things from the Interopedia
  - Classes, functions/constructors, properties
  - Top-level functions and properties
  - KMP-NativeCoroutines for suspending functions

Kotlin/Swift interop

=

Calling Kotlin declarations from Swift

What exactly is the problem?

- Decision made in ~2018 to be interoperable with Objective-C, not Swift
- Why?
  - Can be used in all iOS projects
  - Swift still on the road to maturity/adoption at that stage

This means:
Kotlin is **not directly** interoperable with Swift
but **indirectly** via an Objective-C bridge.

What this means for Swift developers

Some Kotlin features:

- Work exactly as expected
- Work with a small workaround
- Work better with a community solution
- Don’t work optimally right now
- Don’t work

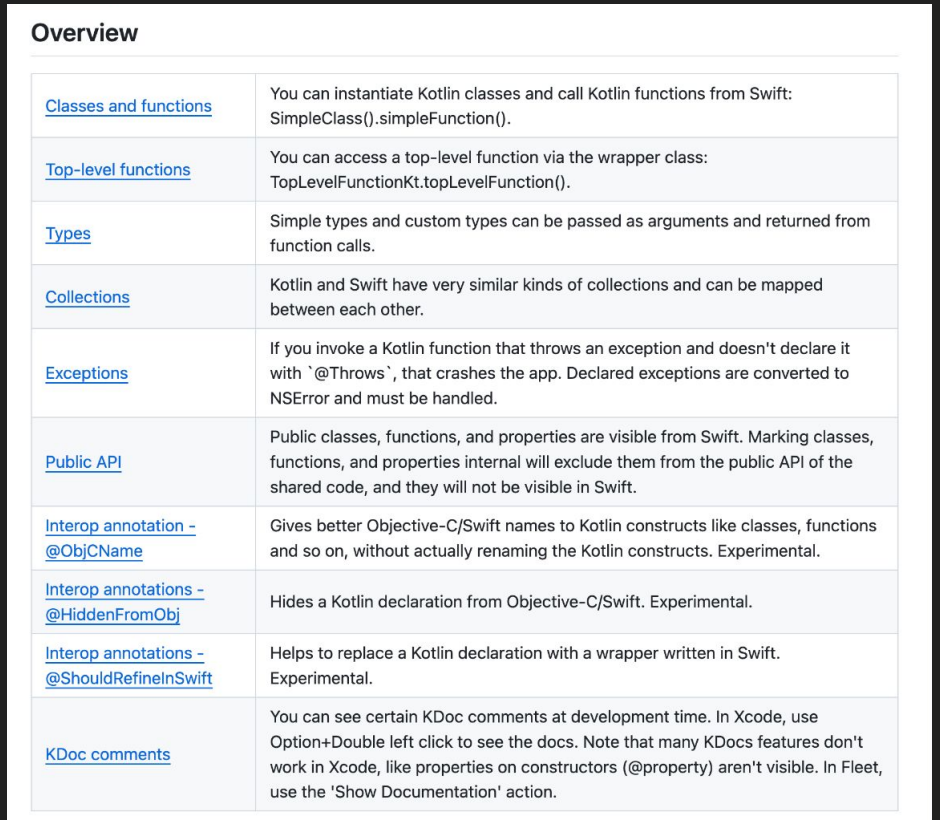
The good news:
What works far outweighs
what doesn’t work.


Functions with a vararg parameter
Top-level properties (Read-only or Mutable)
Inline functions
Enum classes
Generic interfaces
Classes and functions
Exceptions
Top-level functions
Member properties
(Readonly or Mutable)
Functions with default arguments
Annotations
Function overloads
Functions expecting lambda with receiver
Basic types
Collections with custom types
Generic classes
Higher-order functions
(lambda as Parameter
or Return)
Functions with receive
Suspend functions
Collections with basic ty
Optional basic types
Flows
Mutable / immutable collections
Fun interfaces
Extension properties for companion object of
platform class
Unit and Nothing
Generic functions
Sealed classes
Objects
Bounded generics
Inline classes
Inner classes
Abstract classes
Open classes
Covariant generics
Companion objects
Extension function over platform class
Interfaces
Sealed interfaces
Extension function over usual class
Extension properties over platform class
Reified functions
Contravariant generics
Functions with value class parameter
Star projections
Extension properties for companion object of
usual class
Data classes
Extension properties over usual class

forked from hhru/kotlin-swift-interopedia

Kotlin/Swift Interopedia [kotl.in/interopedia]

- Interoperability encyclopedia
- Explains how Kotlin features currently work from Swift
- Lots of code samples
- Gives workarounds, community solutions
- Includes playground app with runnable samples



Overview

Classes and functions	You can instantiate Kotlin classes and call Kotlin functions from Swift: SimpleClass().simpleFunction().
Top-level functions	You can access a top-level function via the wrapper class: TopLevelFunctionKt.topLevelFunction().
Types	Simple types and custom types can be passed as arguments and returned from function calls.
Collections	Kotlin and Swift have very similar kinds of collections and can be mapped between each other.
Exceptions	If you invoke a Kotlin function that throws an exception and doesn't declare it with `@Throws`, that crashes the app. Declared exceptions are converted to NSError and must be handled.
Public API	Public classes, functions, and properties are visible from Swift. Marking classes, functions, and properties internal will exclude them from the public API of the shared code, and they will not be visible in Swift.
Interop annotation - @ObjCName	Gives better Objective-C/Swift names to Kotlin constructs like classes, functions and so on, without actually renaming the Kotlin constructs. Experimental.
Interop annotations - @HiddenFromObj	Hides a Kotlin declaration from Objective-C/Swift. Experimental.
Interop annotations - @ShouldRefineInSwift	Helps to replace a Kotlin declaration with a wrapper written in Swift. Experimental.
KDoc comments	You can see certain KDoc comments at development time. In Xcode, use Option+Double left click to see the docs. Note that many KDocs features don't work in Xcode, like properties on constructors (@property) aren't visible. In Fleet, use the 'Show Documentation' action.

Small excerpt from Interopedia
Classes, Functions/Constructors, Properties

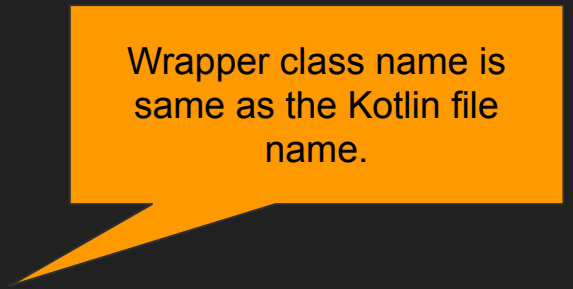
From Swift:

```
Office().printDocument()
Office().stapler
```

Small excerpt from Interopedia

Top-level Functions, Properties

From Swift:




```
let functionResult = DocumentsKt.printDocument()
let propResult = SuppliesKt.stapler
```

Small excerpt from Interopedia
Suspending Functions

Because of Objective-C bridge, represented as function with callbacks but async/await also possible.

Cancellation support not provided out-of-the-box.

We need the help of a community library! KMP-NativeCoroutines by Rick Clephas.

Small excerpt from Interopedia
Suspending Functions with KMP-NativeCoroutines

Follow setup instructions: https://github.com/rickclephas/KMP-NativeCoroutines#installation

- Gradle build files:
  - Add plugins
  - Add @ObjCName opt-in
- Xcode:
  - Add SPM dependencies

Small excerpt from Interopedia
Suspending Functions with KMP-Native Coroutines

In Kotlin (add the annotation):

```
@NativeCoroutines
suspend fun getThing(succeed: Boolean): Thing {
    delay(100.milliseconds)
    if (succeed) {
        return Thing(0)
    } else {
        error("oh no!")
    }
}
```

Small excerpt from Interopedia
Suspending Functions with KMP-Native Coroutines

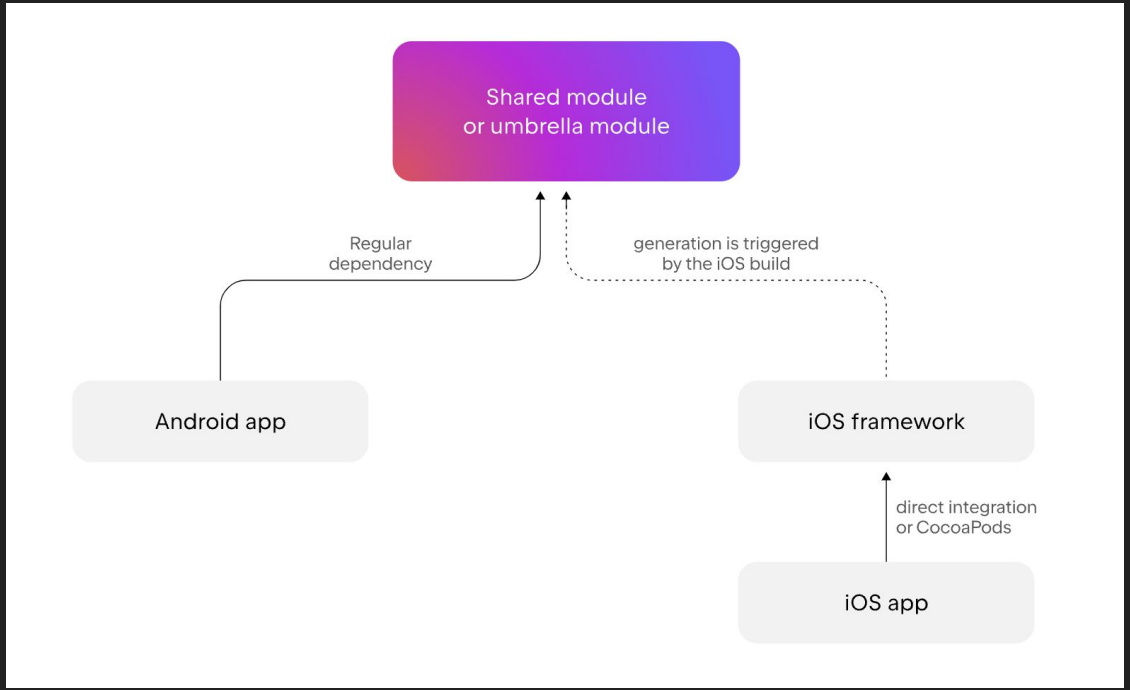
In Swift (add wrapper function call):

```
Task {
    do {
        let result = try await asyncFunction(for: ThingRepository().getThing(succeed: true))
        print("Got result: \(result)")
    } catch {
        print("Failed with error: \(error)")
    }
}
```

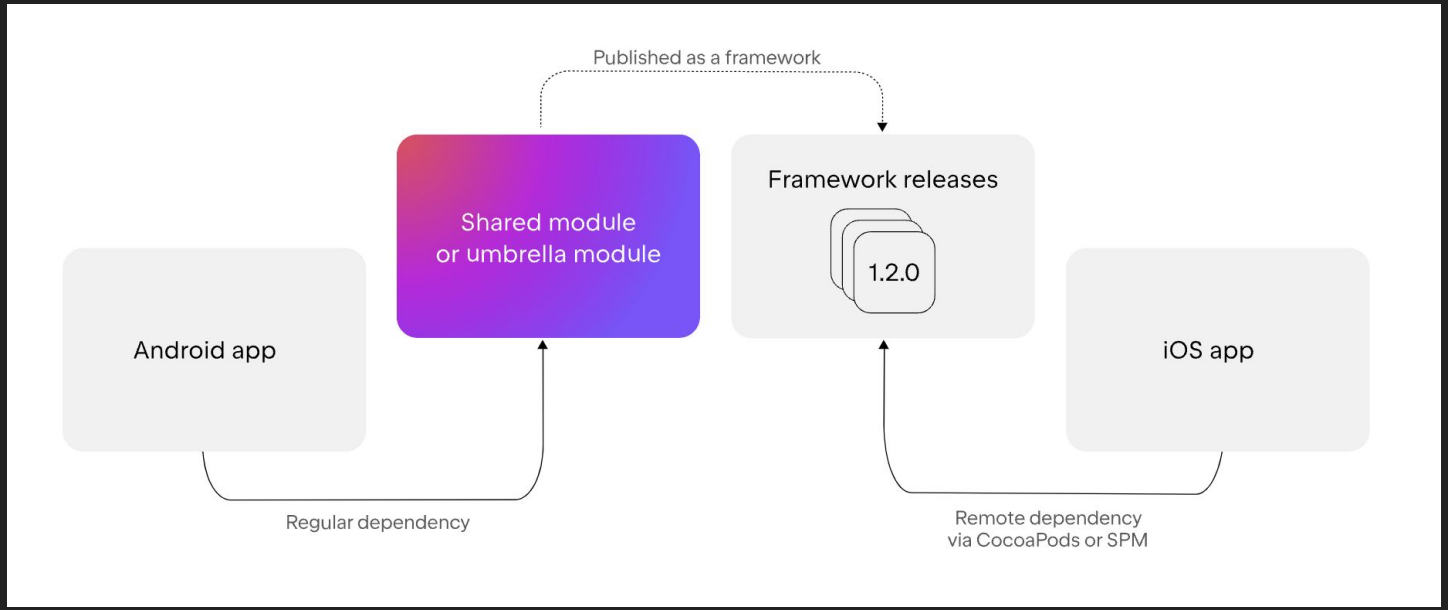
Practical 5: Using Kotlin from SwiftUI

Distributing Shared Code with iOS teammates

Code Workflow - Local(Source) Distribution



Code Workflow - Remote(Artifact) Distribution



Code Workflow - Mixed Distribution

Combination of local (for development and debugging) and remote (for use).

In the long term this a good solution as it allows for gradual increase in participation.

Scenario also supported by KMMBridge with environment variable, or you can roll your own.

Sharing Your Code with SPM

1. Set up your Gradle build file to create an XCFramework
2. Create the framework with a Gradle command
3. Zip the framework file, calculate checksum
4. Create a Package.swift file containing the location of your framework file and the checksum
5. Validate the manifest
6. Deploy:
    a. Package.swift in your repo
    b. XCFramework on your secure file server (eg. Github releases)
7. Point your Xcode to your repo, download and enjoy!

https://kotlinlang.org/docs/native-spm.html#create-the-xcframework-and-the-swift-package-manifest

Resources

- Choosing a configuration for your Kotlin Multiplatform project
  Article on choosing modules, repositories, workflow configurations with pros and cons of each.

- Swift package export setup
  How to do SPM dependencies without KMMBridge

- Exporting multiple modules as an XCFramework (about umbrella frameworks)
  How to create an umbrella framework from multiple modules

- KMMBridge intro
  Starting point to using KMMBridge

Discussion Time

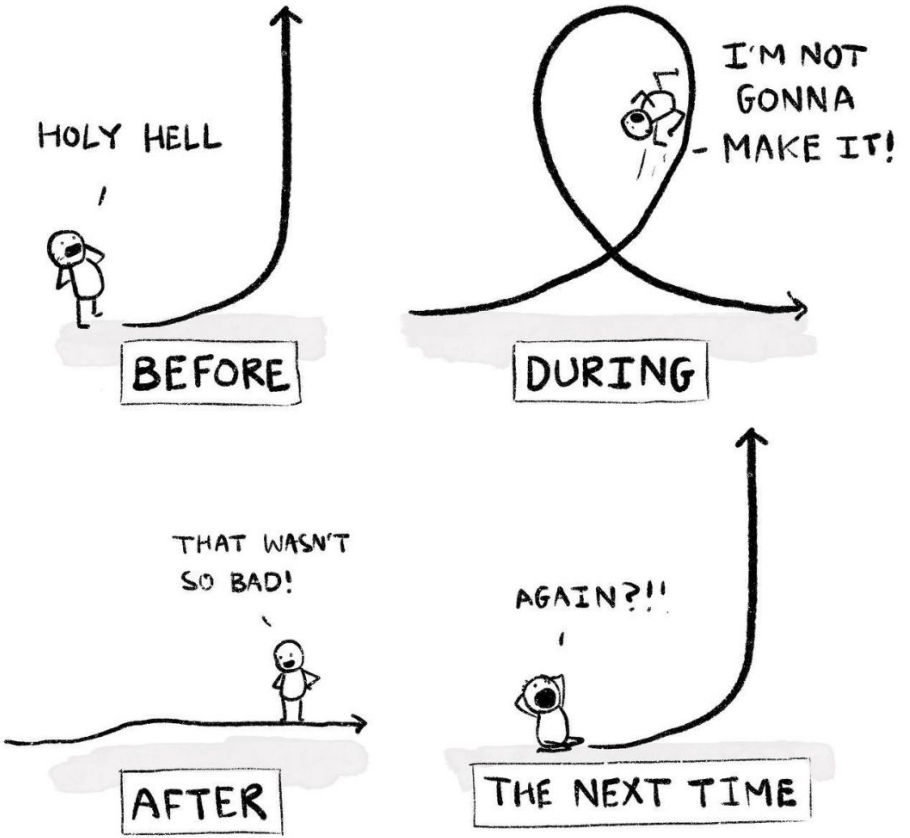
What is your impressions 👁️ of the technology now that you've given it a try?

What are your next steps  ?

How would you convince your team 🤝 to also try it?

Closing

HOW LEARNING CURVES FEEL...



@STEINBERGDRAWSCARTOONS

Group picture 

(Let me know if you don’t want to be photographed)

Come and see our talks!

Kotlin Multiplatform Alchemy:
Making Gold out of Your Swift Interop - Pamela Hill

Thu, 23rd May at 16:15 pm
Auditorium 11

Managing Complexity with Ktor - Garth Gilmour

Fri, 24 May at 15:15 pm
Auditorium 15

Thank you 

Stay in touch:

𝕏 - @pamelaahill | @GarthGilmour

📧 - pamela.hill@jetbrains.com | garth.gilmour@jetbrains.com

👩‍💻 - pamelaahill.com