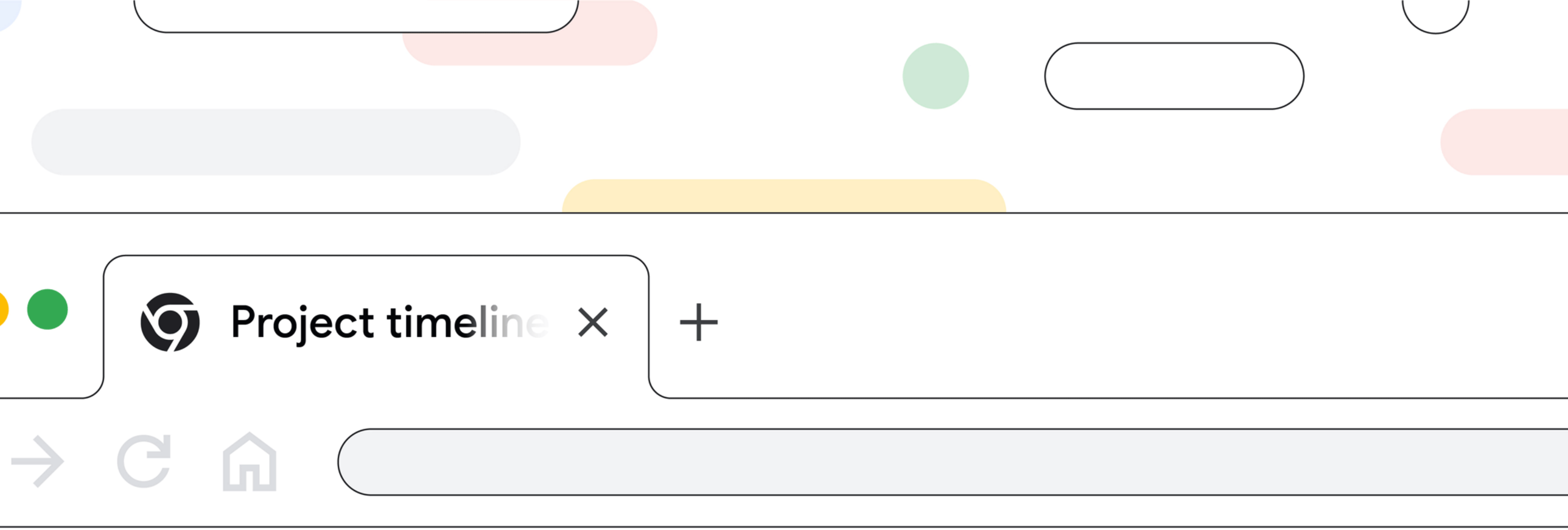
Navigation in a Multiplatform World
Choosing the Right Framework for your App

Droidcon NYC - September '24 🇺🇸

Ash Davies - SumUp

Android & Kotlin GDE Berlin

ashdavies.dev



blog.google/products/chrome/help-me-out-how-to-organize-chrome-tabs

```
val history = ArrayDeque<Screen>()

history.addLast(ForwardScreen)

history.removeLast()
```

It's Complicated

Mail

Inbox 24

Outbox

Favorites

Trash

Personal folders

Family

Wedding

B■■

Adaptable Creatures: Coyotes in North America

Personalized · 2 hours ago

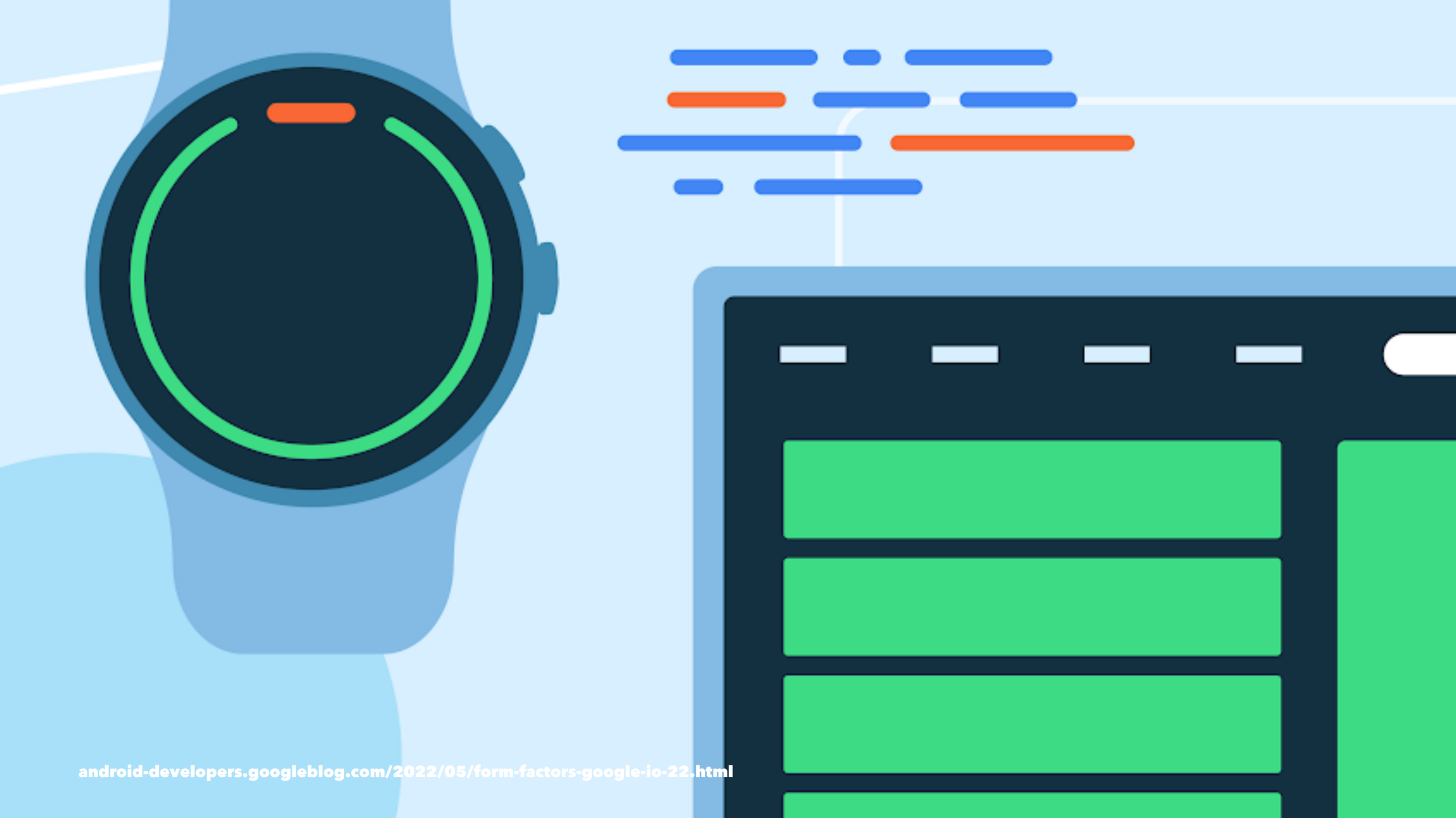
Tomorrow Today

Genetic code for California's iconic trees uncovered

News Global For You Trending

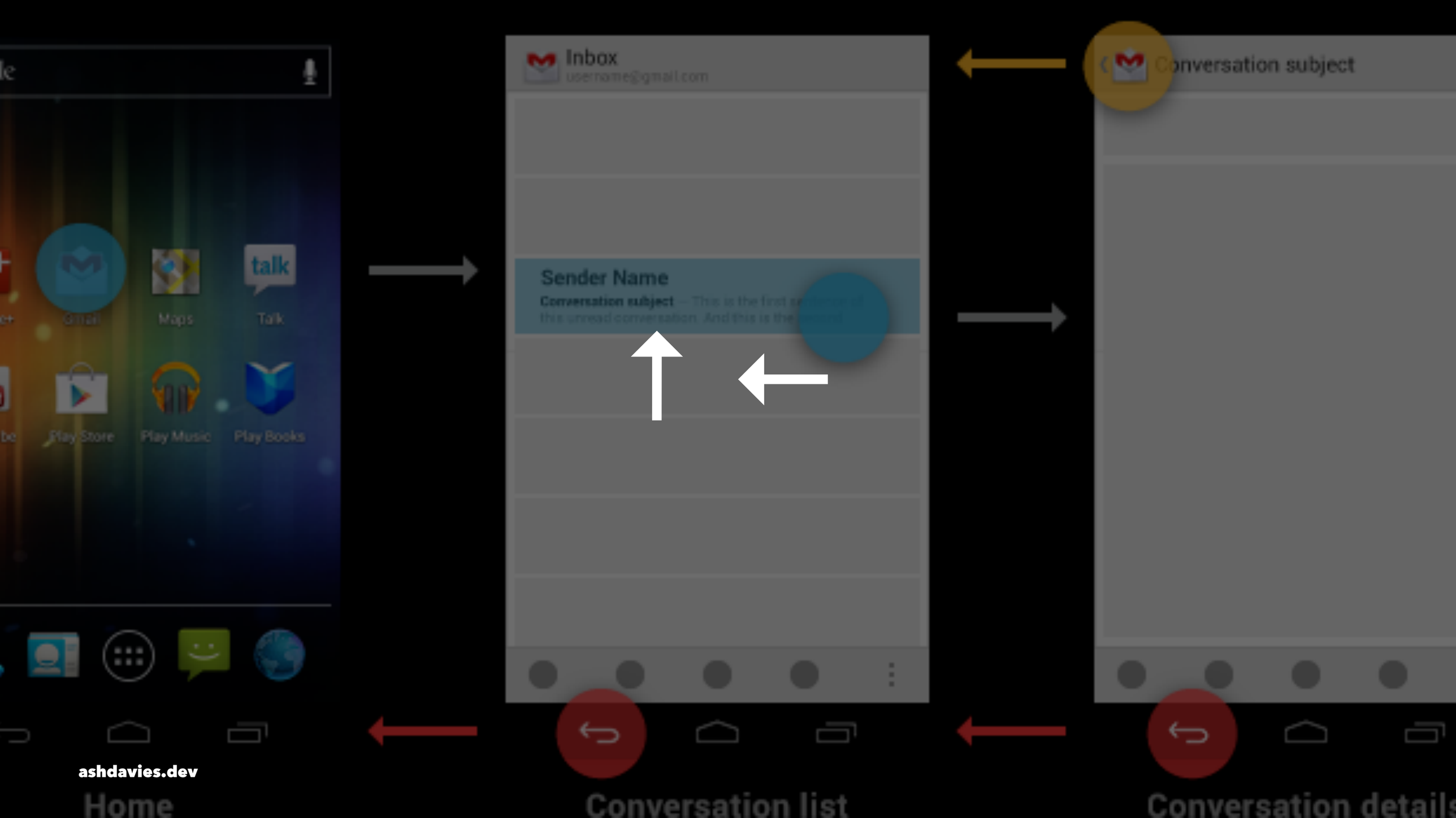
m3.material.io/components/navigation-bar/overview

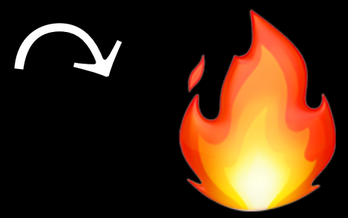
satukyrolainen.com/affordances

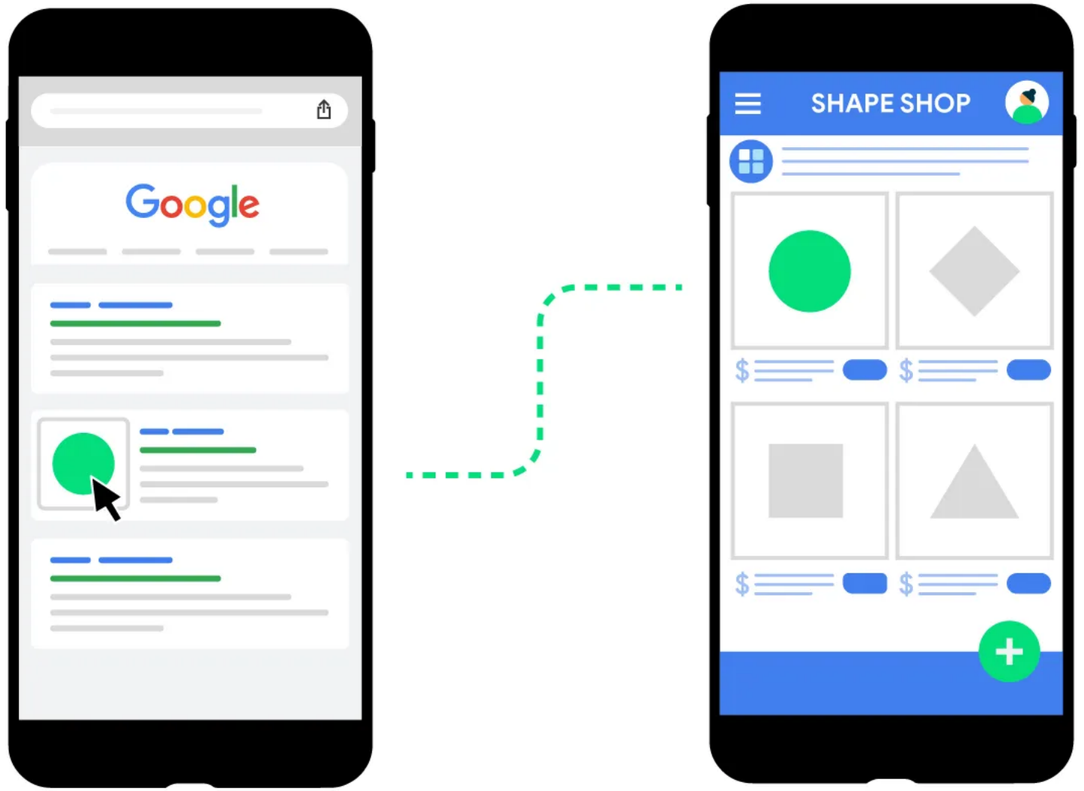


android-developers.googleblog.com/2022/05/form-factors-google-io-22.html

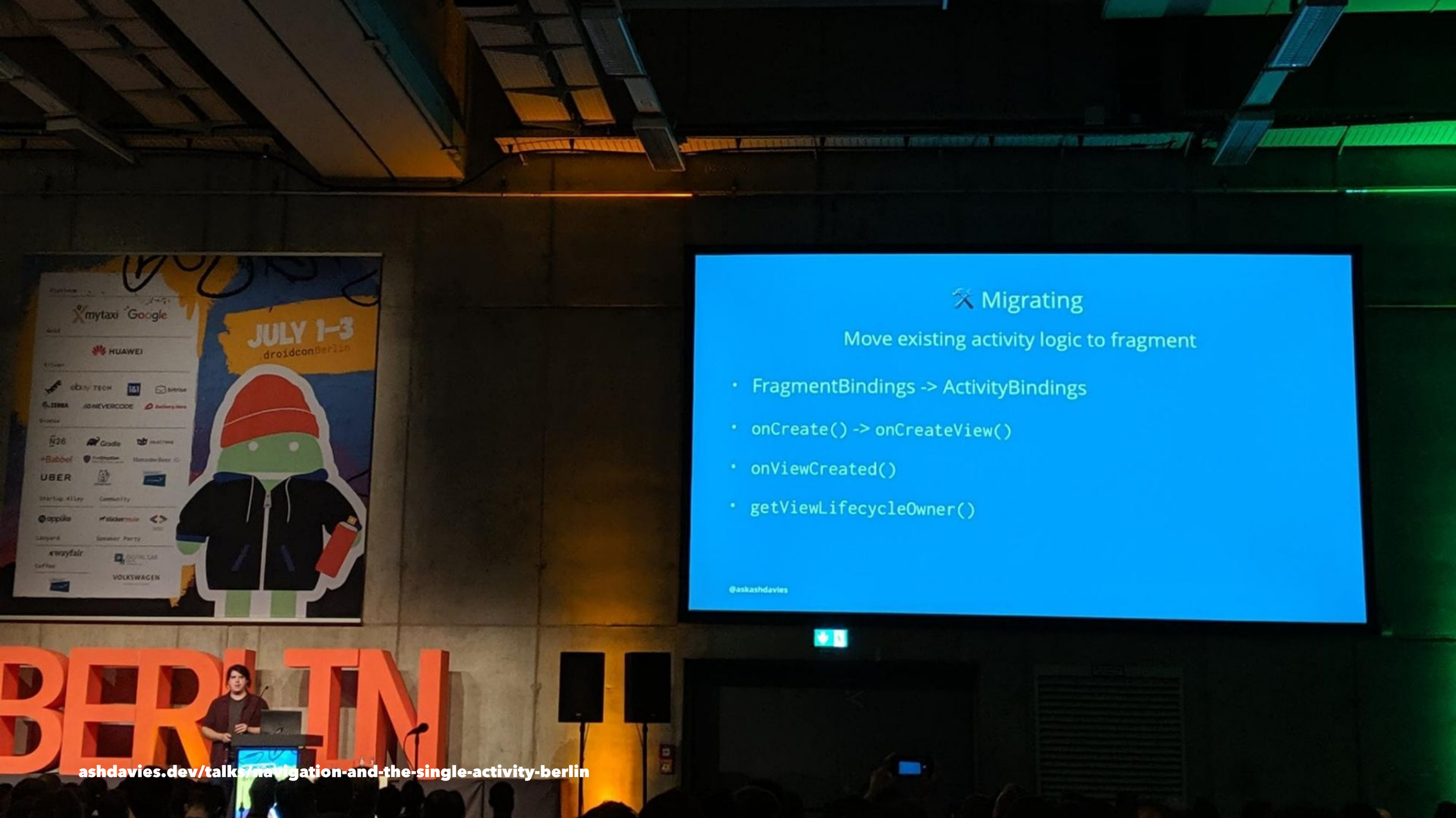
learn.microsoft.com/en-us/windows/apps/design/basics/navigation-history-and-backwards-navigation


Gmail
Maps
Talk
Play Store
Play Music
Play Books
Inbox
username@gmail.com
Sender Name
Conversation subject
Conversation subject
ashdavies.dev
Home
Conversation list
Conversation details





medium.com/androiddevelopers/the-deep-links-crash-course-part2-deep-links-from-zero-to-hero-37f94cc8fb88

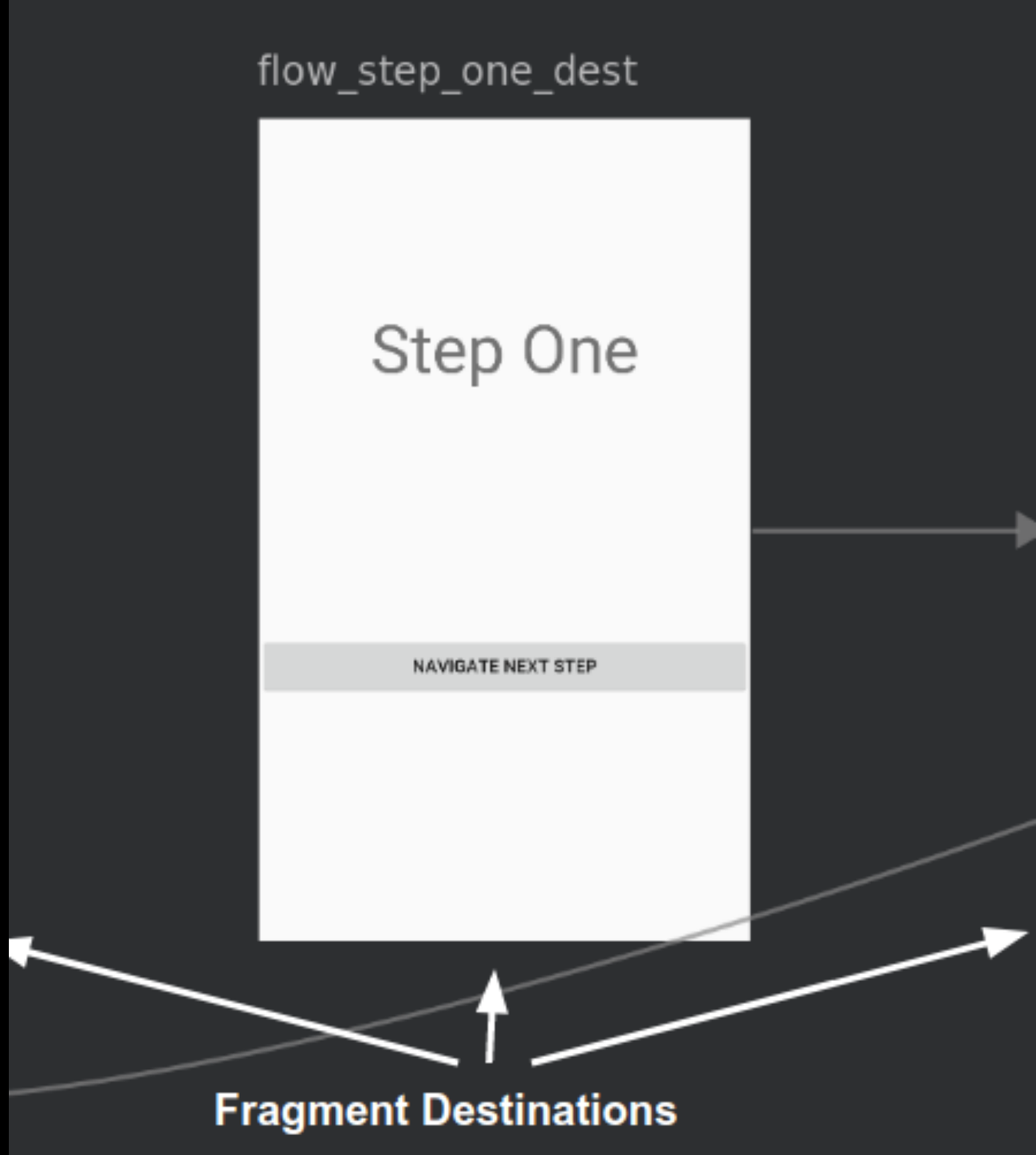

JULY 1–3
droidconBerlin
mytaxi
Google
HUAWEI
UBER
wayfair
VOLKSWAGEN
Migrating
Move existing activity logic to fragment
FragmentBindings -> ActivityBindings
onCreate() -> onCreateView()
onViewCreated()
getViewLifecycleOwner()
@askashdavies
BERLIN
ashdavies.dev/talks/navigation-and-the-single-activity-berlin

"Once we have gotten in to this entry-point to your UI, we really don't care how you organise the flow inside."

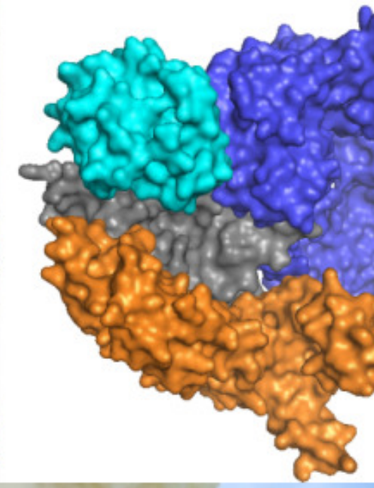
– Dianne Hackborn, Android Framework team, 2016

Jetpack Navigation

Fragments


flow_step_one_dest
Step One
NAVIGATE NEXT STEP
Fragment Destinations

2019



en.wikipedia.org/wiki/2019

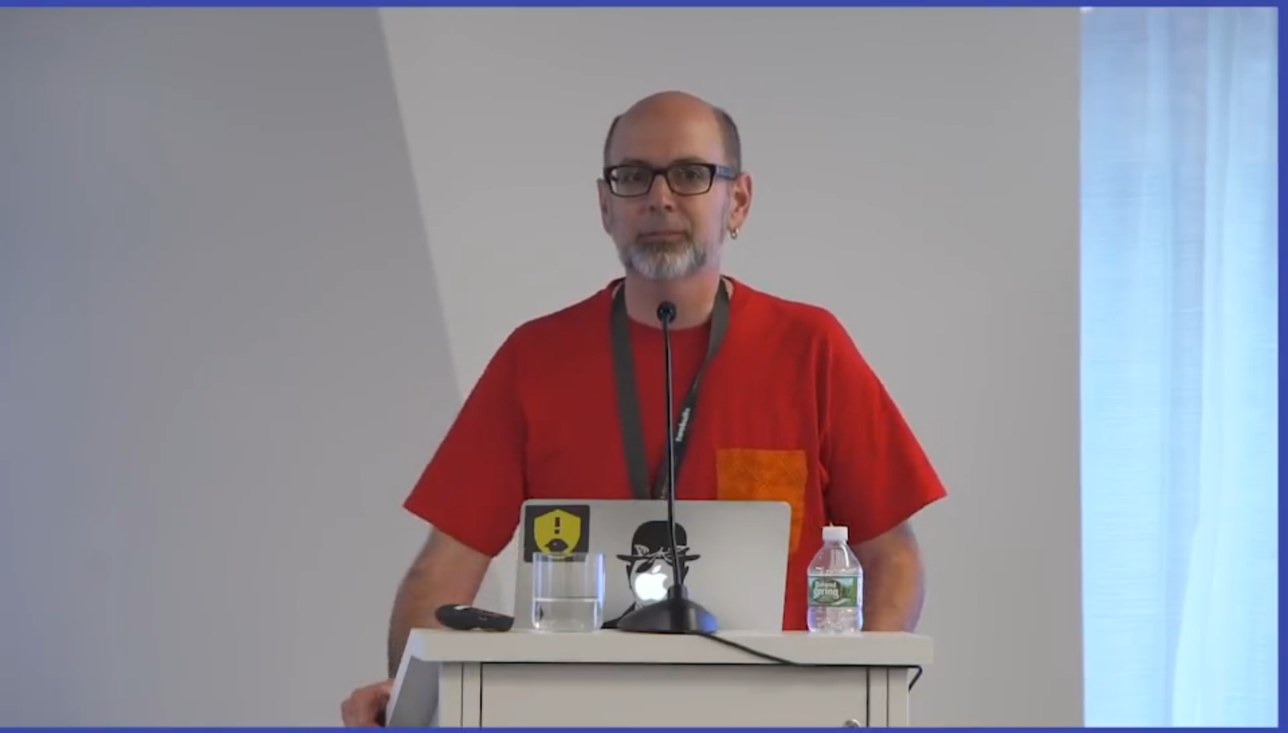
2014: mortar & flow

github.com/square/mortar

developer.squareup.com/blog/simpler-android-apps-with-flow-and-mortar

droidconNYC

September 25-26 2017



reacting to code sprawl

Reactive Workflows

Ray Ryan

square/workflow

square.github.io/workflow

Why should I use this?

You work at Square ¯_(ツ)_/¯

2016: uber/ribs

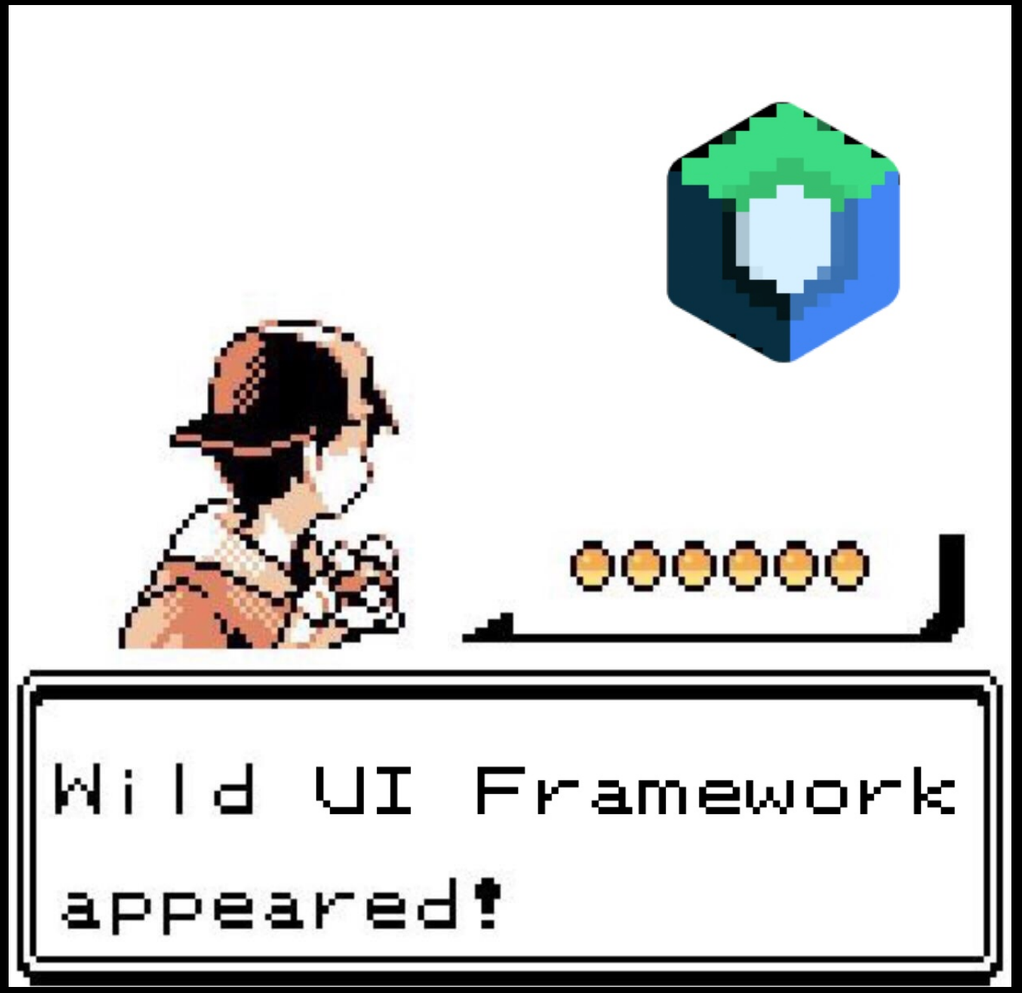
github.com/uber/RIBs

uber.com/en-GB/blog/new-rider-app-architecture

Moving On...

Compose UI

github.com/androidx/androidx/tree/androidx-main/compose/ui



Compose UI

- Declarative UI Framework
- Open Source Kotlin
- Accelerate UI development
- Intuitive Idiomatic API

Obligatory Notice ⚠️

Compose != Compose UI

Compose is, at its core, a general-purpose tool for managing a tree of nodes of any type … a "tree of nodes" describes just about anything, and as a result Compose can target just about anything.

– Jake Wharton

jakewharton.com/a-jetpack-compose-by-any-other-name

droidconnewyork

#dcnyc24

Deep Dive into the Compose Compiler

Mohit Sarveiya

Google Developers Expert
Kotlin & Android

SEPTEMBER 19th - 20th, 2024

Jetpack Navigation Compose
v2.4.0 (2021)

- Build a navigation graph with a `@Composable` Kotlin DSL
- Compose `viewModel()` scoped to navigation destination
- Desintation level scope for `rememberSaveable()`
- Automatic back handling support

Jetpack Navigation Compose < v2.8.0

```
private const val HOME_ROUTE = "home"

NavHost(
    navController = navController,
    startDestination = HOME_ROUTE,
) {
    composable(route = HOME_ROUTE) {
        HomeScreen(
            onBackClick = navController::popBackStack,
            /* ... */
        )
    }
}
```

Jetpack Navigation Compose < v2.8.0

```
private const val DETAIL_ID_KEY = "detailId"
private const val DETAIL_ROUTE = "detail"

NavHost(
    navController = navController,
    startDestination = DETAIL_ROUTE,
) {
    composable(
        route = DETAIL_ROUTE,
        arguments = listOf(
            navArgument(DETAIL_ID_KEY) {
                type = NavType.StringType
                defaultValue = null
                nullable = true
            }
        )
    ) {
        DetailScreen(/* ... */)
    }
}
```

Jetpack Navigation Compose < v2.8.0

```
private const val DETAIL_ID_KEY = "detailId"

fun NavController.navigateToDetail(detailId: String) {
  navigate("detail?$DETAIL_ID_KEY=$detailId")
}

savedStateHandle.getStateFlow(DETAIL_ID_KEY, null)
```

Jetpack Navigation Compose v2.8.0 (04.09.2024)

```
@Serializable
data class DetailRoute(val id: String)

NavHost(
    navController = navController,
    startDestination = "detail",
) {
    composable<DetailRoute> {
        DetailScreen(/* ... */)
    }
}

val route = savedStateHandle.toRoute<DetailRoute>()
```

medium.com/androiddevelopers/type-safe-navigation-for-compose-105325a97657

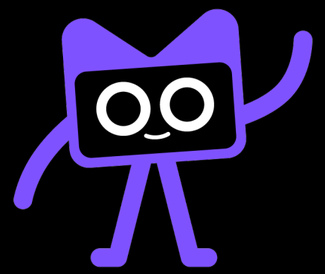
Navigation in a Multiplatform World
Choosing the Right Framework for your App

~~**Android Navigation für N00bs**~~

~~by Ash Ketchum those Burgers~~

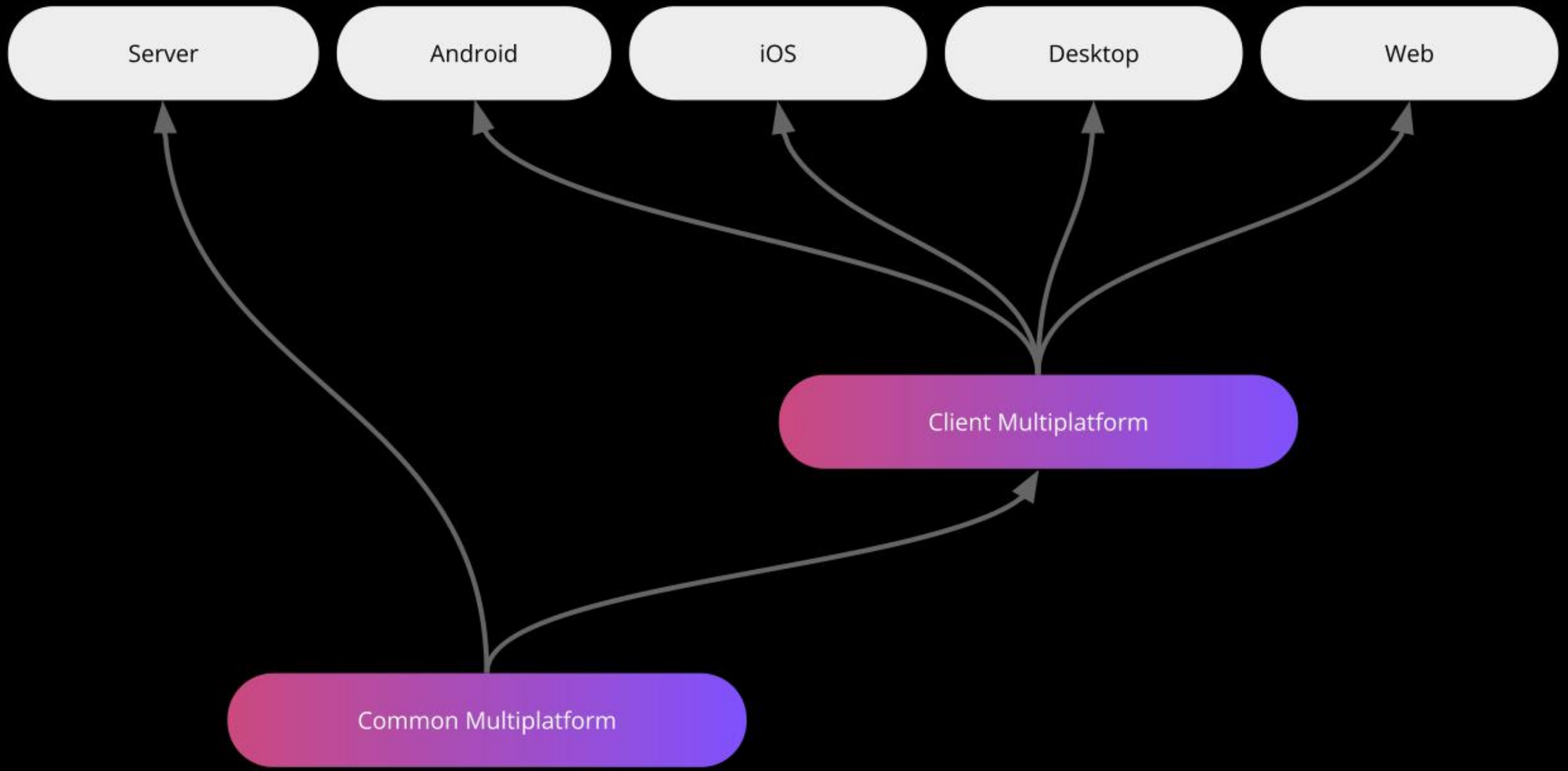
Kotlin Multiplatform

Stable (1.9.20)

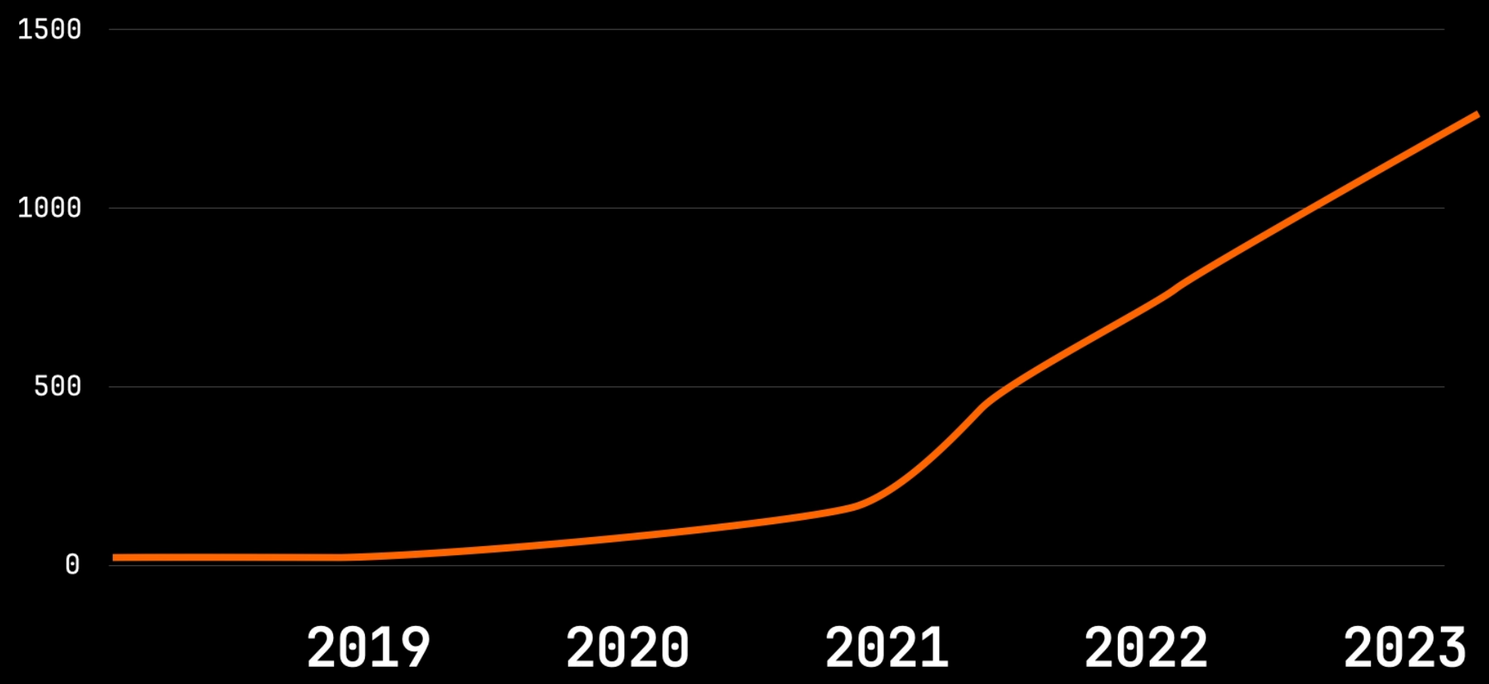


The Before-Times

The Before Times


Server
Android
iOS
Desktop
Web
Client Multiplatform
Common Multiplatform

Multiplatform Libraries by Year



blog.jetbrains.com/kotlin/2023/04/kotlinconf-2023-opening-keynote/

Maven Group ID	Latest Update	Stable Release	Alpha Release
annotation	04.09.2024	1.8.2	1.9.0-alpha03
collection	04.09.2024	1.4.3	1.5.0-alpha01
datastore	01.05.2024	1.1.1	-
lifecycle	04.09.2024	2.8.5	2.9.0-alpha02
paging	07.08.2024	3.3.2	-
room	21.08.2024	2.6.1	2.7.0-alpha07
sqlite	21.08.2024	2.4.0	2.5.0-alpha07

developer.android.com/kotlin/multiplatform | As of 15.09.2024

```
kotlin {
  sourceSets.commonMain.dependencies {
    implementation("androidx.lifecycle:lifecycle-viewmodel-ktx:2.8.5")
  }
}

// Backed by ViewModelImpl
public expect abstract class ViewModel
```

cs.android.com/androidx/platform/frameworks/support/+/androidx-main:lifecycle/lifecycle-viewmodel/src/commonMain/kotlin/androidx/lifecycle/ViewModel.kt

Multiplatform Architecture

Decompose & Essenty

arkivanov.github.io/Decompose

```
import com.arkivanov.decompose.ComponentContext

class DefaultRootComponent(
    componentContext: ComponentContext,
) : RootComponent, ComponentContext by componentContext {

    init {
        lifecycle... // Access the Lifecycle
        stateKeeper... // Access the StateKeeper
        instanceKeeper... // Access the InstanceKeeper
        backHandler... // Access the BackHandler
    }
}
```

```
class RootComponent(context: ComponentContext) : Root, ComponentContext {
  private val navigation = StackNavigation<Config>()
  override val childStack = childStack(/* ... */)

  fun createChild(config: Config, context: ComponentContext): Child = when (config) {
    is Config.List -> Child.List(ItemListComponent(context) {
      navigation.push(Config.Details(itemId = it)) }
    )

    is Config.Details -> /* ... */
  }
}

private sealed class Config : Parcelable {
  @Parcelize object List : Config()
  @Parcelize data class Details(val itemId: Long) : Config()
}
```

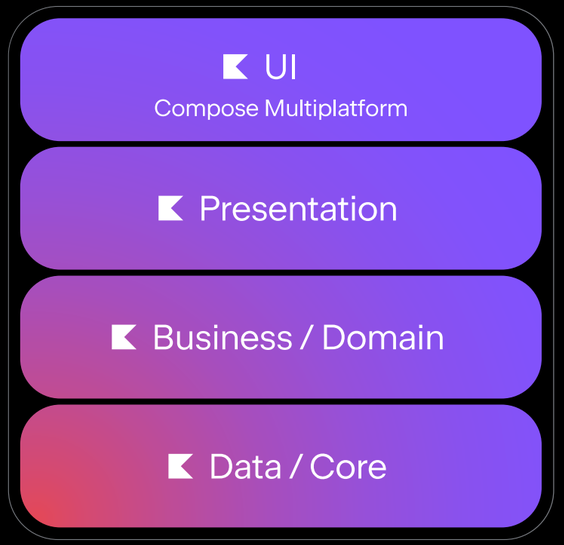
Decompose

- com.arkivanov.decompose:extensions-compose
- com.arkivanov.decompose:extensions-android
- com.arkivanov.essenty:state-keeper

Enter Compose Multiplatform 

Compose Multiplatform

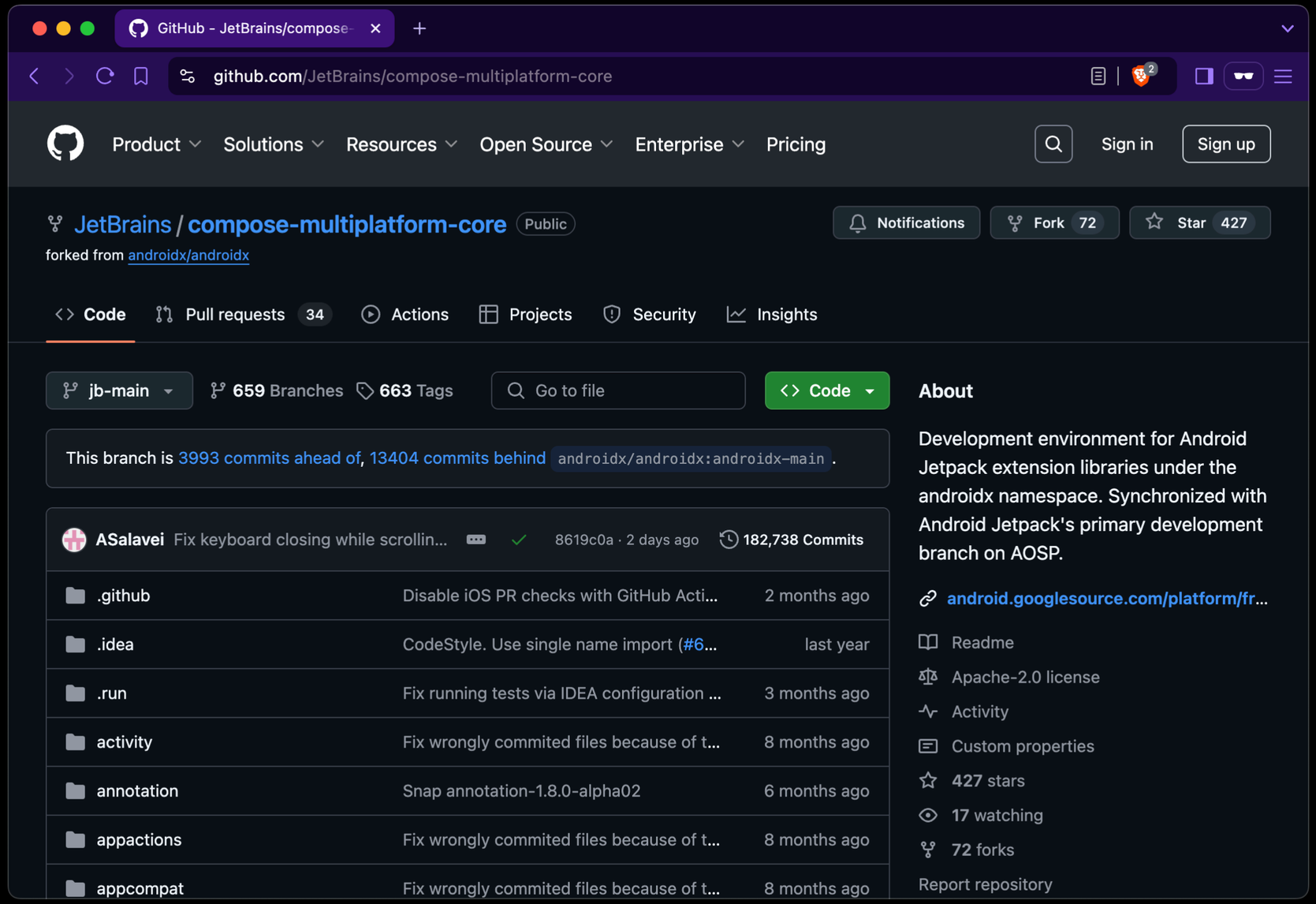
v1.0 | 2021



Platform	Stability level
Android	Stable
iOS	Stable
Desktop (JVM)	Stable
Server-side (JVM)	Stable
Web based on Kotlin/Wasm	Alpha
Web based on Kotlin/JS	Stable
watchOS	Best effort
tvOS	Best effort

Compose Multiplatform	Jetpack Compose
1.6.11	1.6.7
1.6.10	1.6.7
1.6.2	1.6.4

…



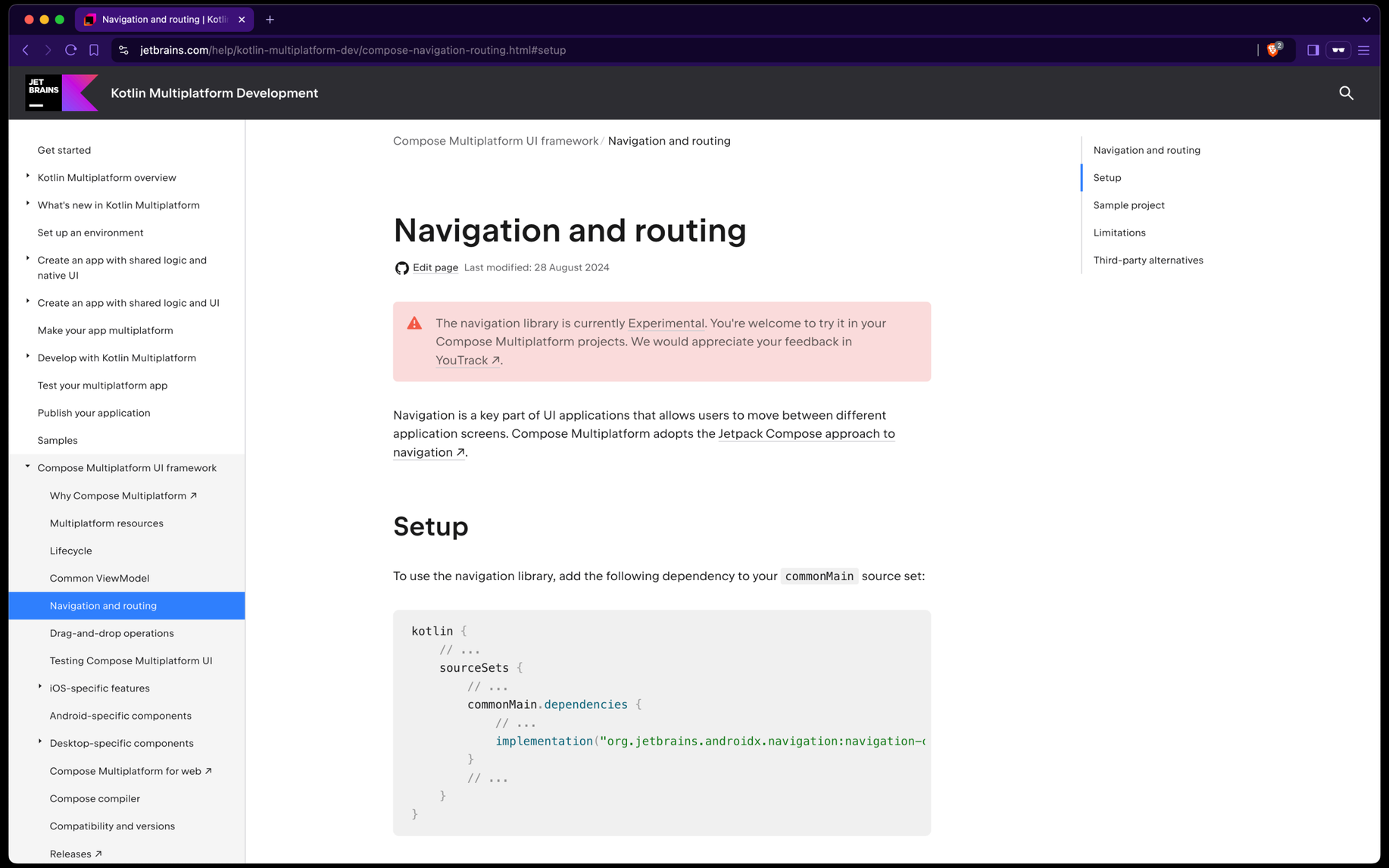
github.com/JetBrains/compose-multiplatform-core

```
kotlin {
    sourceSets.commonMain.dependencies {
        implementation("org.jetbrains.androidx.navigation:navigation-compose:2.8.0-alpha10")
    }
}

@Serializable
data object HomeRoute

NavHost(navController, HomeRoute) {
    composable<HomeRoute> {
        HomeScreen()
    }
}

val route = savedStateHandle.toRoute<HomeRoute>()
```



jetbrains.com/help/kotlin-multiplatform-dev/compose-navigation-routing.html

Compose Multiplatform Migration

- Change artifact coordinates
- Do nothing
- Profit

The early bird gets the worm … but the second mouse gets the cheese

Reactive Architecture

- Push (not pull)
- Unidirectional Data Flow
- Declarative
- Idempotent

Architecture

Callbacks

```
downloadManager.downloadFile("https://.../") { result ->
  fileManager.saveFile("storage/file", result) { success ->
    if (success) println("Downloaded file successfully")
  }
}
```

Architecture

Observables

```
downloadManager.downloadFile("https://.../")
  .flatMap { result -> fileManager.saveFile("storage/file", result) }
  .observe { success -> if (success) println("Downloaded file successfully") }
```

Architecture

Coroutines

```
val file = downloadFile("https://.../")
val success = fileManager.saveFile("storage/file", file)
if (success) println("Downloaded file successfully")
```

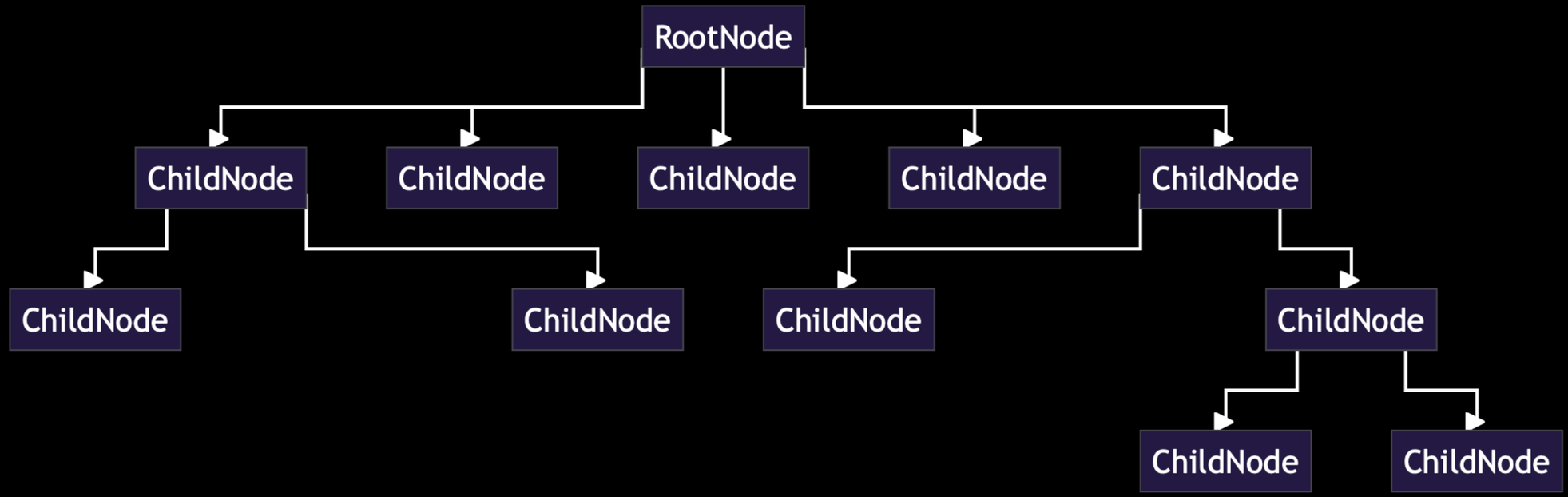
Architecture

Coroutines (Again)

```
downloadManager.downloadFile("https://.../")
  .flatMapLatest { state ->
    when (state) {
      is State.Loaded -> stateFileManager.saveFile("storage/file", state.value)
      else -> state
    }
  }
  .collect { state ->
    when (state) {
      is State.Loading -> /* ... */
      is State.Saved -> println("Downloaded file successfully")
    }
  }
```

Architecture

Compose



Architecture

Compose

```
val downloadState = downloadManager
    .downloadFile("https://.../")
    .collectAsState(State.Loading)

val fileState = when(downloadState) {
  is State.Loaded -> stateFileManager.saveFile("storage/file", state.value)
  else -> state
}

when (fileState) {
  is State.Loading -> /* ... */
  is State.Saved -> LaunchedEffect(fileState) {
    println("Downloaded file successfully")
  }
}
```

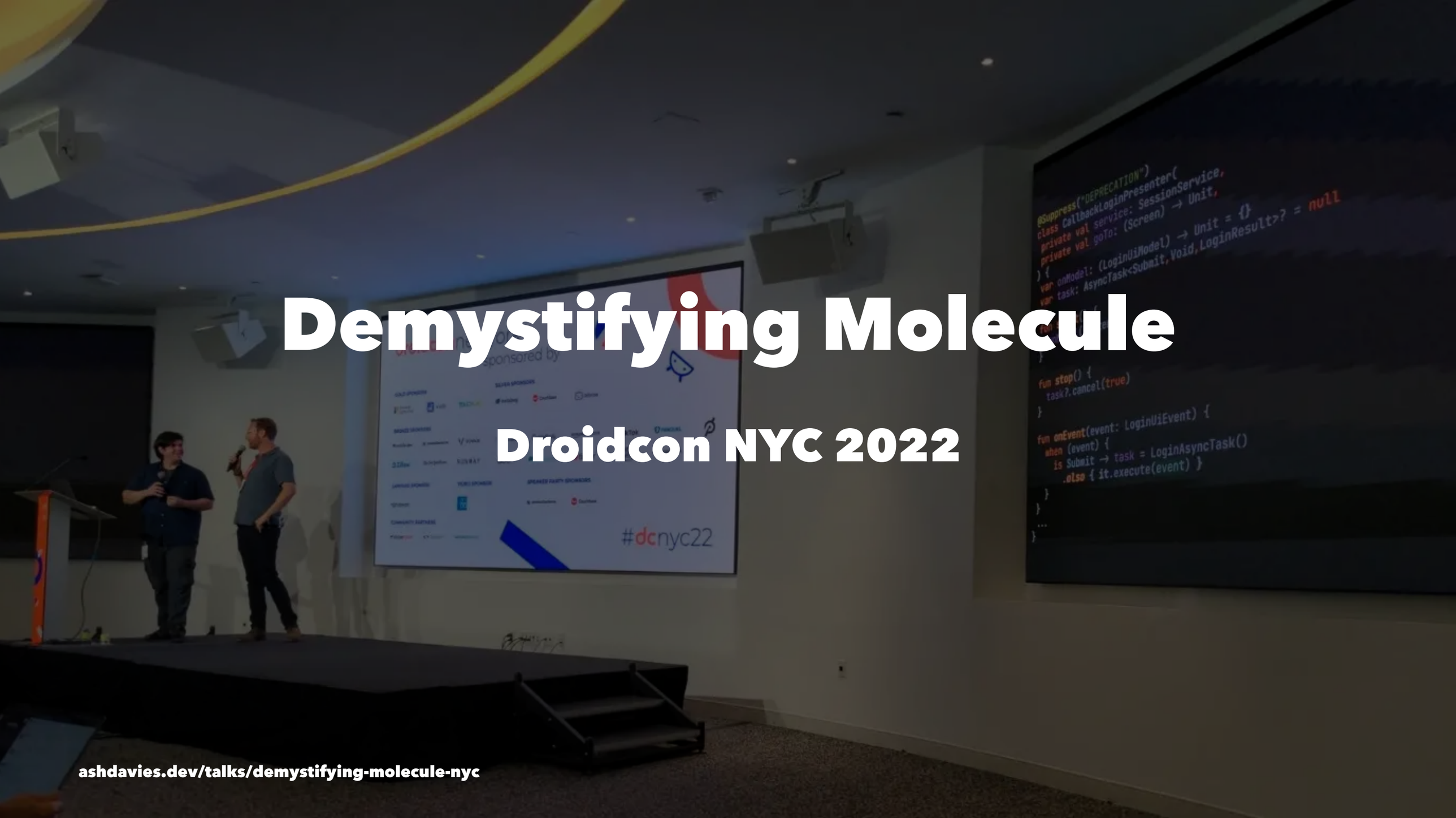
cashapp/molecule

Molecule

```
fun CoroutineScope.launchCounter(): StateFlow<Int> {
  return launchMolecule(mode = ContextClock) {
    var count by remember { mutableStateOf(0) }

    LaunchedEffect(Unit) {
      while (true) {
        delay(1_000)
        count++
      }
    }

    count
  }
}
```



Demystifying Molecule

Droidcon NYC 2022

ashdavies.dev/talks/demystifying-molecule-nyc

Role of Architecture

Pre-Compose Era

slackhq/circuit

github.com/slackhq/circuit

Circuit

- Supports most supported KMP platforms
- Compose first architecture
- Presenter & UI separation
- Unidirectional Data Flow

Circuit

State

```
@Parcelize
data object HomeScreen : Screen {
  data class State(
    val title: String,
  ): CircuitUiState
}
```

Circuit

Presenter

```
class HomePresenter : Presenter<HomeScreen.State> {
  @Composable
  override fun present(): HomeScreen.State {
    return HomeScreen.State("Hello World")
  }
}
```

Circuit

UI

```
@Composable
fun HomeScreen(
  state: HomeScreen.State,
  modifier: Modifier = Modifier,
) {
  Text(
    text = state.title,
    modifier = modifier,
  )
}
```

Circuit

```
val circuit = Circuit.Builder()
  .addPresenter<HomeScreen, HomeScreen.State>(HomePresenter())
  .addUi<LauncherScreen, LauncherScreen.State> { _, _ -> HomeScreen(state, modifier) }
  .build()

CircuitCompositionLocals(circuit) {
    val backStack = rememberSaveableBackStack(HomeScreen)

    NavigableCircuitContent(
        navigator = rememberCircuitNavigator(backStack),
        backStack = backStack,
    )
}
```

Circuit

Navigation

```
@Parcelize
data object HomeScreen : Screen {
  data class State(
    val title: String,
    val eventSink: (Event) -> Unit
  ): CircuitUiState

  sealed interface Event {
    data class DetailClicked(
      val id: String,
    ): Event
}
```

Circuit

Navigation

```
class HomePresenter(private val navigator: Navigator) : Presenter<HomeScreen.State> {

@Composable
  override fun present(): HomeScreen.State {
    return HomeScreen.State("Hello World") { event ->
      when (event) {
        is HomeScreen.Event.DetailClicked -> navigator.goTo(DetailScreen(event.id))
      }
    }
  }
}
```

youtube.com/watch?v=ZIr_uuN8FEw

CircuitX

- com.slack.circuit:circuitx-android
- com.slack.circuit:circuitx-effects
- com.slack.circuit:circuitx-gesture-navigation
- com.slack.circuit:circuitx-overlays


rememberRetained()
chrisbanes.me/posts/retaining-beyond-viewmodels

Circuit

Examples

- **Chris Banes: Tivi**
  github.com/chrisbanes/tivi
- **Zac Sweers: CatchUp**
  github.com/ZacSweers/CatchUp
- **Zac Sweers: FieldSpottr**
  github.com/zacsweers/fieldspottr
- **Ash Davies: Playground**
  github.com/ashdavies/playground.ashdavies.dev

Full Disclosure

Bias

adrielcafe/voyager

voyager.adriel.cafe

Voyager 🚀

```
class PostListScreen : Screen {

    @Composable
    override fun Content() {
        // ...
    }

    @Composable
    private fun PostCard(post: Post) {
        val navigator = LocalNavigator.currentOrThrow

        Card(
            modifier = Modifier.clickable {
                navigator.push(PostDetailsScreen(post.id))
            }
        ) {
            // ...
        }
    }
}
```

Voyager 🚀

```
interface ParcelableScreen : Screen, Parcelable

// Compile
@Parcelize
data class Post(/*...*/) : Parcelable

@Parcelize
data class ValidScreen(
    val post: Post
) : ParcelableScreen {
    // ...
}

// Not compile
data class Post(/*...*/)

@Parcelize
data class ValidScreen(
    val post: Post
) : ParcelableScreen {
    // ...
}
```

ashdavies.dev

appyx

bumble-tech.github.io/appyx

PreCompose

github.com/Tlaster/PreCompose

Comparison

	androidx	circuit	decompose	voyager	workflow
Multiplatform	✅	✅	✅	✅	✅
Compose 1st	❌	✅	❌	✅	❌
Documented*	❌	✅	✅	✅	❌
Ease-of-Use**	❌	✅	/	✅	❌
Opinionated***	❌	✅	❌	❌	✅

* Documentation exists, but is outdated or hard to find
** Subjective, how quick to get started
*** Additional API surface

Y Tho?

Good Code == Removable Code

Code your own obscolescance

Thank You!

Ash Davies - SumUp

Android / Kotlin GDE Berlin

ashdavies.dev

Don't Forget to Vote! 🇺🇸 🫏