Mobile Computing
Managing State on Android

Slides: tmb.gr/mc-mst

Source on GDocs

Overview

These slides show how to manage state on Android.

How application UI state can be saved in Compose.

How to use a ViewModel to move data/logic away.

Prerequisites

Have some basic knowledge of writing Kotlin code.

Finish the lesson on composing UIs for Android.

Bring your Android device or use the emulator.

Compose is Kotlin

.kt|.html

Compose uses nested function calls and Kotlin idioms.

```
fun Row(
    modifier: Modifier = Modifier, …,
    content: @Composable RowScope.() -> Unit)
```

```
Row(…, { … }) // content param is a lambda
Row(…) { … } // trailing lambda, outside ()
Row() { … } // default params can be omitted
Row { … } // empty constructor, OK to omit ()
```

Conditional UI

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Use conditionals (*if*, etc.), to show/hide UI elements.

```
if (newToThis) { Onboarding() } else { App() }
```

A multi-page UI could work like this, using *when*.

```
when (page) {
    1 -> ScreenA(…) // calls page++
    2 -> ScreenB(…) // calls page++ or page--
    else ScreenC(…) }
```

Button onClick event .html

Button provides a *onClick* event, to plug in a lambda.

```
@Composable
fun MyCounter() {
  var n = remember { mutableStateOf(0) } //*
  Button(onClick = { n.value++ }) {
    Text("${n.value}")
  } }
```

*Value stays around, like a *static* local variable in C.

Mutable state .html

Compose updates the UI, if underlying data changes, *mutableStateOf()* provides plumbing needed for this.

```
val state = x // does not notify on changes
val state = mutableStateOf(x) // not stored
```

Functions can be (re)evaluated any time, in any order, *remember()* preserves the state across recomposition.

```
val state = remember { mutableStateOf(x) }
```

Saveable state .html

The *remember()* function works as long as the Activity.

```
val s = remember { mutableStateOf(x) }
```

On rotate*, the Acitivty restarts and the state is lost.

Use *rememberSaveable()* instead, to persist state.

```
var s = rememberSaveable { mutableStateOf(x) }
```

*Or when using dark mode or restarting the process.

Hoisting state

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Hoisting is about where in the UI tree to place state.

Move state up to a common ancestor of who needs it, pass callbacks/lambdas down, to bubble events up.

```
Post(likeCount: Int, onLike: () -> Unit) {
  Text(text = "$likeCount")
  Button(onClick = onLike) { Text("+1") } }

var likes …; Post(likes, onLike = { likes++ })
```

Hands-on, 10': State in Compose

Fix state and logic, *commit* and *push* changes.

- Update your private repository (see these slides).
- Open the *MyStatefulApp* in your repository */02*, it implements a multi-page UI as sketched (p. 14)
- Use lambdas to update *page*, *onNext*/*onBack*.
- Make sure that *MultiPage* remembers its state.
- Try changing the screen orientation of the device.

UI update loop

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Events notify the code that e.g. a click has *happened*.

Handling events leads to the UI state being *updated*.

Which leads to the updated UI state being *displayed*.

Upon seeing the updated UI state, the user reacts.*

*Events can be triggered by the system, as well.

Lazy list components .kt|.html

A *LazyColumn* or *LazyRow* allows 1000+ items, by creating visible items lazyly, when scrolling the list.

```
import androidx.compose.foundation.lazy.items

LazyColumn(modifier = …) { // or LazyRow
  items(items = names) { name ->
    Greeting(name = name)
  }
}
```

Mutable observable lists .kt|.html

toMutableStateList() makes mutable lists observable*.

```
val list = listOf(…).toMutableStateList()
```

This works with *remember()*, but it's not …*Saveable()*.

Also, large data objects should not be stored in the UI.

*By the Compose framework, to update the UI.

ViewModel overview .html

A *ViewModel* exposes application state to the UI, it encapsulates business logic, caches and persists state.

This relieves the UI from having to re-fetch data when navigating between activities, or rotating the screen.

It stays around as long as its *ViewModelStoreOwner*, e.g. an activity, a UI fragment or a navigation graph.

ViewModel implementation .kt|.html

To implement a *ViewModel* create a new subclass of it.

```
class MyViewModel : ViewModel() {
    val people = listOf(Person("A"), …) // data
    fun remove(person: Person) { … } // logic
}
```

Usually the data itself is kept in a custom data class.

```
data class Person(val name: String)
```

ViewModel instance .kts|.kt|.html

The *viewModel()* call returns an existing instance of your *ViewModel* or creates a new one in that scope.

```
fun MyUI(myVM: MyViewModel = viewModel()) { …
```

If you add this to *app/build.gradle.kts* dependencies.

```
implementation("androidx.lifecycle:lifecycle-viewmodel-compose:{latest_version}")
```

ViewModel lifecycle

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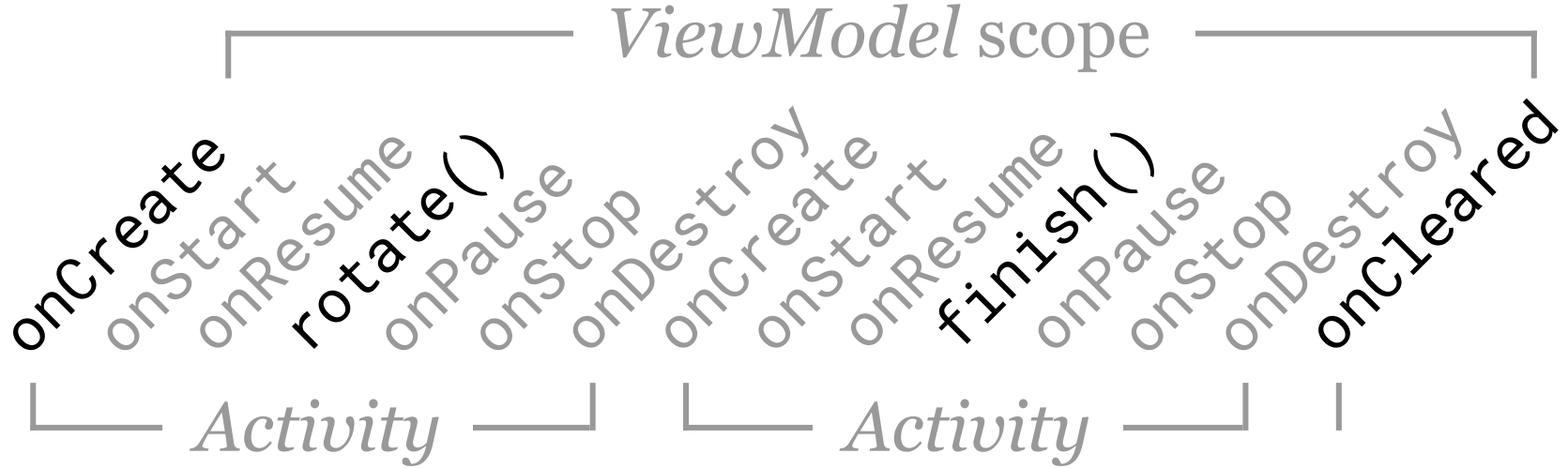
A *ViewModel* stays in memory until *finish()* is called, or in general, until its *ViewModelStoreOwner* ends.



ViewModel caveats .html

The *ViewModel* is not a part of the UI composition.

Do not hold state created in composables, like a value to be remembered, as this could cause memory leaks.

Also, no references to lifecycle-related classes, such as the app *Context* or *Resources*, for the same reason.

ViewModel best practice .html

Use *ViewModels* as a screen level state holder, not for reusable UI parts, because instances are not reusable.

Keep the names of the methods a *ViewModel* exposes and those of the UI state fields as generic as possible.

Do not pass a *ViewModel* to other classes, functions or UI components to prevent access by lower-level code.

Hands-on, 10': ViewModel

Extend the code, *commit* and *push* changes.

- Open the *MyViewModelApp* in your repository */02* which implements a *ViewModel* as sketched before.
- Add a property surname to the *Person* data class.
- Make sure, the property is available in *Greeting*.
- If *show more* was clicked, display the full name.
- Add a *remove()* function to the *ViewModel* class.

Summary

These are the basics of managing state on Android.

Remembering saveable UI state in the composition.

Moving state up (hoisting) and forwarding events.

Using a ViewModel to separate data/logic from UI.

Next: Storing Data on Android.

~~Challenge: Live data~~

Work through the Jetpack Compose TODO codelab.

- Start from this BasicTODOCodelab app project.
- Add the *project files* to your private repository.
- Make sure *not* to add the 3rd-party *repository*.
- Git *commit* and *push* your code to your repo.

Done? There are more codelabs, e.g. on TODO.

Feedback or questions?

Write me on Teams or email

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Thanks for your time.