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CMSC436: Programming Handheld Systems

Lifecycle-Aware Components

Today's Topics

Lifecycle-Aware Components

ViewModel

Live Data

Android App Behavior

Multiple entry points launched individually

Components started in many different orders

Android kills components on reconfiguration / low memory

Key Architectural Goals

Don't store app data or state in your app components

Don't design your app components so they depend on each other

Lifecycle-Aware Components

Links app components to their lifecycle events

LifeCycle – Represents Android lifecycle

LifecycleOwner – A component with an Android lifecycle

LifecycleObserver – Callbacks for listening to lifecycle changes

Lifecycle

Holds information about the lifecycle state of an Android component

State – Enum representing lifecycle states

Events – Enum representing lifecycle events
(transitions between states)

Lifecycle.State

INITIALIZED - Initialized state for LifecycleOwner

CREATED - Created state for LifecycleOwner

DESTROYED - Destroyed state for
LifecycleOwner

RESUMED - Resumed state for LifecycleOwner

STARTED - Started state for LifecycleOwner

Lifecycle.Event

ON_ANY - Constant matching all events

ON_CREATE - onCreate event of the LifecycleOwner

ON_DESTROY - onDestroy event of the LifecycleOwner

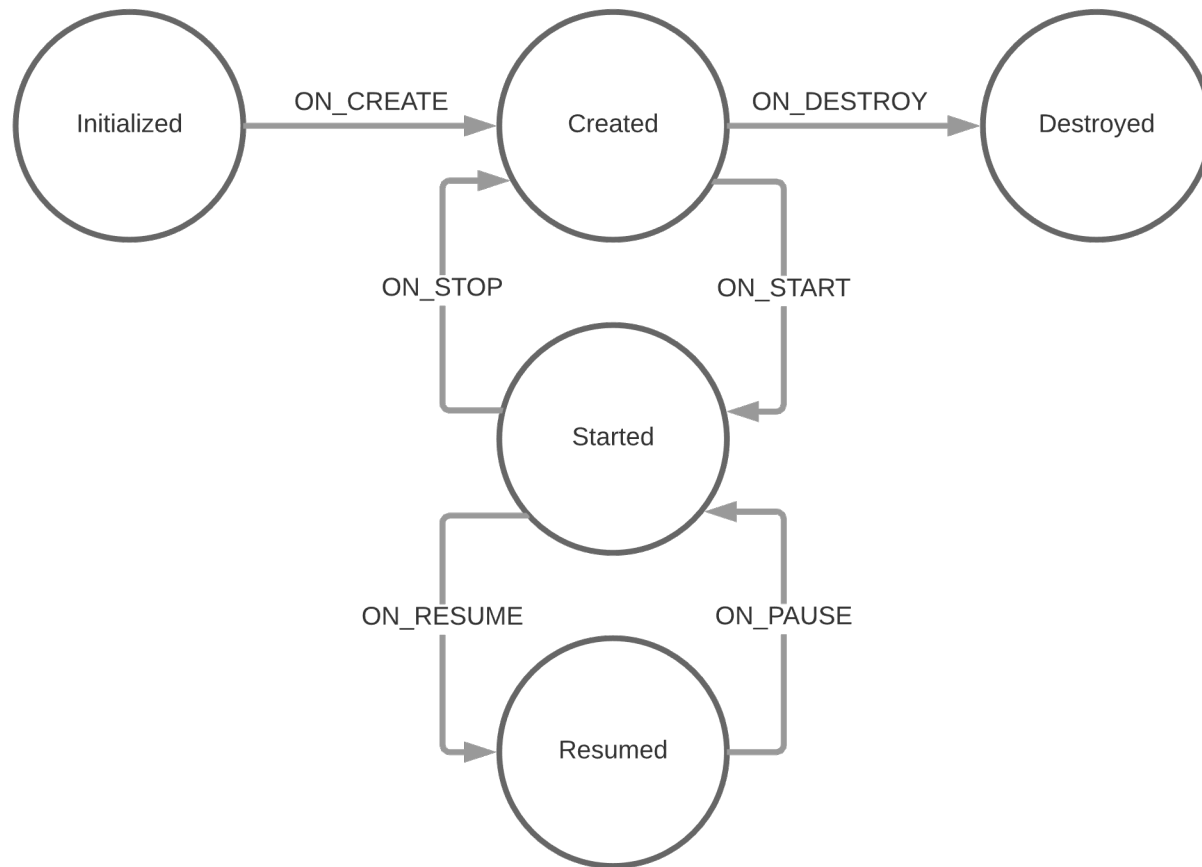
ON_PAUSE - onPause event of the LifecycleOwner

ON_RESUME - onResume event of the LifecycleOwner

ON_START - onStart event of the LifecycleOwner

ON_STOP - onStop event of the LifecycleOwner

Lifecycle State Model



Lifecycle Methods

`void addObserver(LifecycleObserver observer)`

Adds a LifecycleObserver that will be notified when the LifecycleOwner changes state

`void removeObserver(LifecycleObserver observer)`

Removes the given observer from the observers list

`Lifecycle.State getCurrentState()`

Returns the current state of the Lifecycle

LifecycleOwner

Represents a component with an Android lifecycle

An interface that returns a Lifecycle object from the `getLifecycle()` method

LifecycleObserver

Callbacks for listening to lifecycle changes to a LifecycleOwner

Observe events with DefaultLifecycleObserver

DefaultLifecycleObserver Methods

`void onCreate(LifecycleOwner owner)`

Notifies that ON_CREATE event occurred.

`void onStart(LifecycleOwner owner)`

Notifies that ON_START event occurred.

`void onResume(LifecycleOwner owner)`

Notifies that ON_RESUME event occurred.

DefaultLifecycleObserver Methods

`void onDestroy(LifecycleOwner owner)`

Notifies that `ON_DESTROY` event occurred

`void onPause(LifecycleOwner owner)`

Notifies that `ON_PAUSE` event occurred

`void onStop(LifecycleOwner owner)`

Notifies that `ON_STOP` event occurred

LifecycleObserver Methods

ON_CREATE, ON_START, ON_RESUME events are dispatched after the LifecycleOwner's related method returns

ON_PAUSE, ON_STOP, ON_DESTROY events are dispatched before the LifecycleOwner's related method is called

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ViewModel Responsibilities

Responsible for managing data for an Activity or a Fragment (owner)

Handles communication between the Activity or Fragment and the rest of the application

ViewModel Lifecycle

Associated with a scope (e.g., a Fragment or an Activity)

Retained as long as the scope is alive

Will not be destroyed if its owner is destroyed for a configuration change

The new instance of the owner will be reconnected to the existing ViewModel

ViewModel Implementation Rules

Should never access the View hierarchy or hold a reference to the Activity or the Fragment

ViewModel Methods

`void onCleared()`

This method will be called when this ViewModel is no longer used and will be destroyed

ViewModelProvider

`<init> (@NonNull owner: ViewModelStoreOwner)`

Creates a `ViewModelProvider`

`open T get(@NonNull modelClass: Class<T>)`

Returns an existing `ViewModel` or creates a new one in the scope (usually, a fragment or an activity), associated with this `ViewModelProvider`

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LiveData

Data holder observable within a given lifecycle

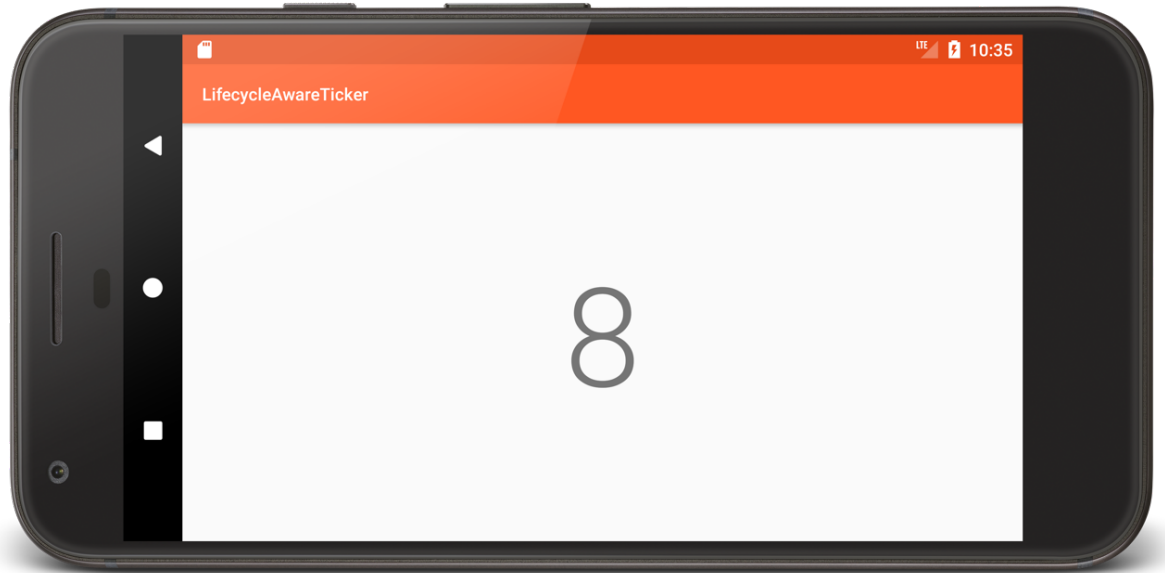
Observer paired with a LifecycleOwner

Observer notified when data changes, only if the LifecycleOwner is in active state

LifecycleOwner is considered active, if its state is STARTED or RESUMED

Designed to hold individual data fields of ViewModel

Can also be used to share data between components



LifecycleAware
Ticker

TickerDisplayActivity.kt

```
override fun onCreate(savedInstanceState: Bundle?) {  
    ..  
    mCounterView = findViewById(R.id.counter)  
    // Get reference to TickerViewModel  
    mTickerViewModel =  
        ViewModelProvider(this).get(TickerViewModel::class.java)  
    // Display initial Ticker value  
    mCounterView.text = mTickerViewModel.counter.value.toString()  
    // Observe changes to Ticker  
    beginObservingTicker()  
    // Tie TickerViewModel to Activity lifecycle  
    mTickerViewModel.bindToActivityLifecycle(this)  
}
```

TickerDisplayActivity.kt

```
private fun beginObservingTicker() {  
    // Create Observer  
    val tickerObserver =  
        Observer<Int> {mCounterView.text = it.toString()}  
    // Register observer  
    mTickerViewModel.counter.observe(this, tickerObserver)  
}
```

TickerViewModel.kt

```
private val mCounter = MutableLiveData<Int>()
...
internal val counter: LiveData<Int>
    get() = mCounter

private val updater: Runnable = object : Runnable {
    override fun run() {
        mCounter.value = mCounter.value!! + 1
        mHandler.postDelayed(this, ONE_SECOND.toLong())
    }
}
init {
    // Set initial value
    mCounter.value = 0
    mHandler = mHandler = Handler(Looper.getMainLooper())
}
```

TickerViewModel.kt

```
internal fun bindToActivityLifecycle(
    tickerDisplayActivity: TickerDisplayActivity) {
    tickerDisplayActivity.lifecycle.addObserver(this)
}

override fun onResume(owner: LifecycleOwner) {
    // Update the elapsed time every second.
    mHandler.postDelayed(updater, 1000L)
}

override fun onPause(owner: LifecycleOwner) {
    // Cancel work on Handler
    mHandler.removeCallbacks(updater)
}
```

Best Practices

Keep your UI controllers (activities and fragments) as lean as possible. They should not try to acquire their own data; instead, use a ViewModel to do that, and observe the LiveData to reflect the changes back to the views

Try to write data-driven UIs where your UI controller's responsibility is to update the views as data changes, or notify user actions back to theViewModel

Put your data logic in your ViewModel class. ViewModel should serve as the connector between your UI controller and the rest of your application

Never reference a View or Activity context in your ViewModel. If the ViewModel outlives the activity (in case of configuration changes), your activity will be leaked and not properly garbage-collected

Next Time

Firestore

Example Applications

LifecycleAwareTicker