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CMSC436: Programming Handheld Systems

The Activity Class

Today’s Topics

The Activity class

The Task Backstack

The Activity lifecycle

Starting an Activity

Handling configuration changes

The Activity Class

Provides a visual interface for user interaction

Conceptually*, each Activity typically supports one focused thing a user can do, such as

- Viewing an email message
- Showing a login screen

* Often implemented with help of a Fragment. For now, we will ignore Fragments

Activities and Application

Applications can comprise several Activities

User interaction can result in navigating across these Activities

Android’s Navigation Support

Tasks

The Task Backstack

Suspending and resuming Activities

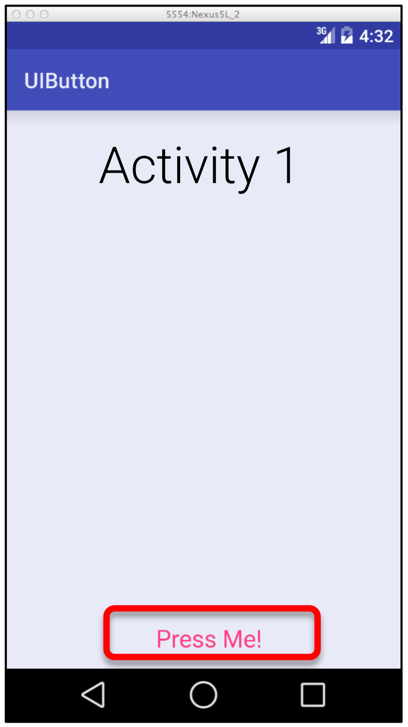
Tasks

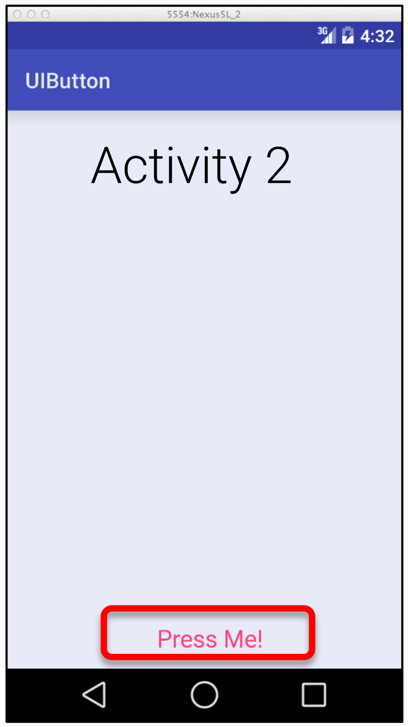
- A set of related Activities
  - Can come from different applications
- Most Tasks start at the home screen

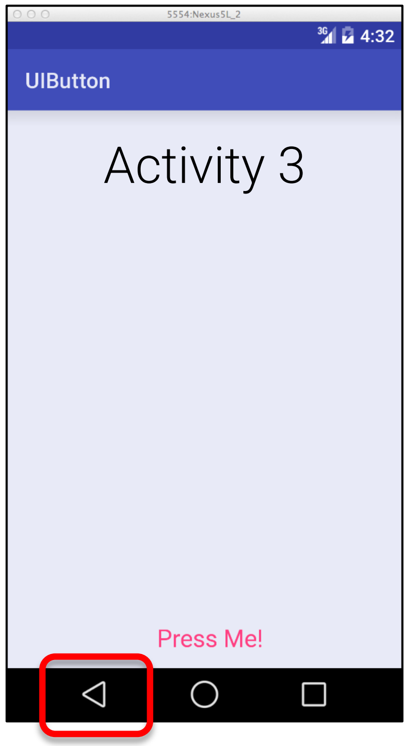
Task Backstack

When an Activity is launched, it goes on top of the backstack

When the Activity is destroyed, it is popped off the backstack







●   ●   ●

Activity 3
Activity 2
Activity 1

Task Backstack

The Activity Lifecycle

Activities are created, suspended, resumed and destroyed as necessary when an application executes

Some of these actions depend on user behavior

- e.g., User hits back button

Some depend on Android

- e.g., Android can kill Activities when it needs their resources

Activity Lifecycle States

Resumed/Running—Visible, user interacting

Paused—Visible, user not interacting, can be terminated in older versions of Android

Stopped—Not visible, can be terminated

The Activity Lifecycle Methods

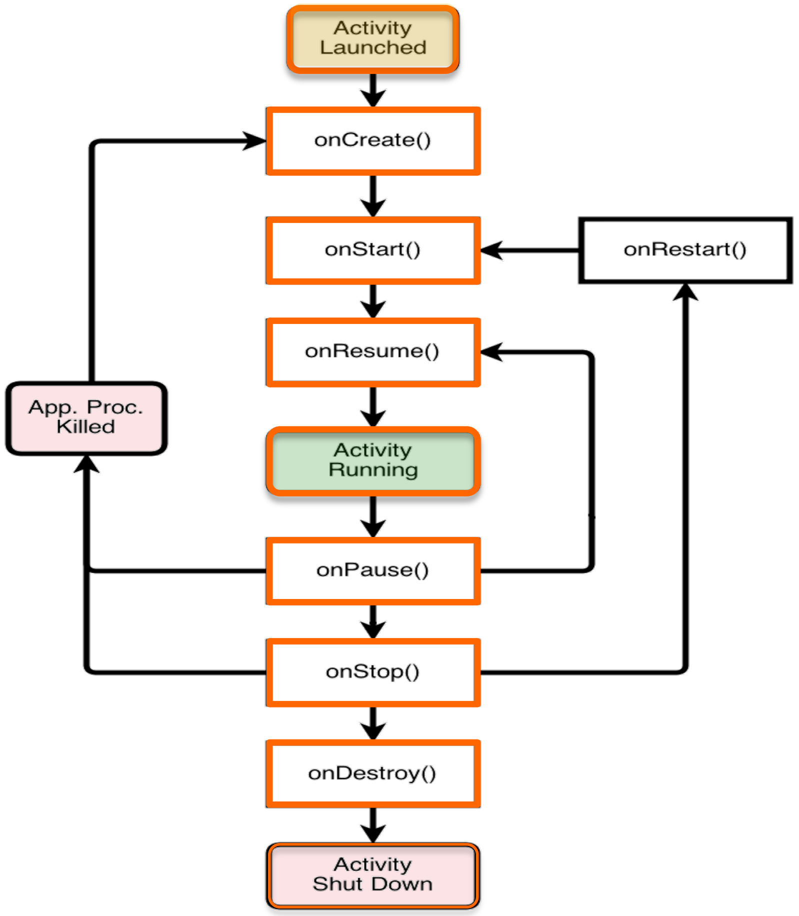
Android announces Activity lifecycle state changes to Activities by calling specific Activity methods

- Known as Activity lifecycle callback methods

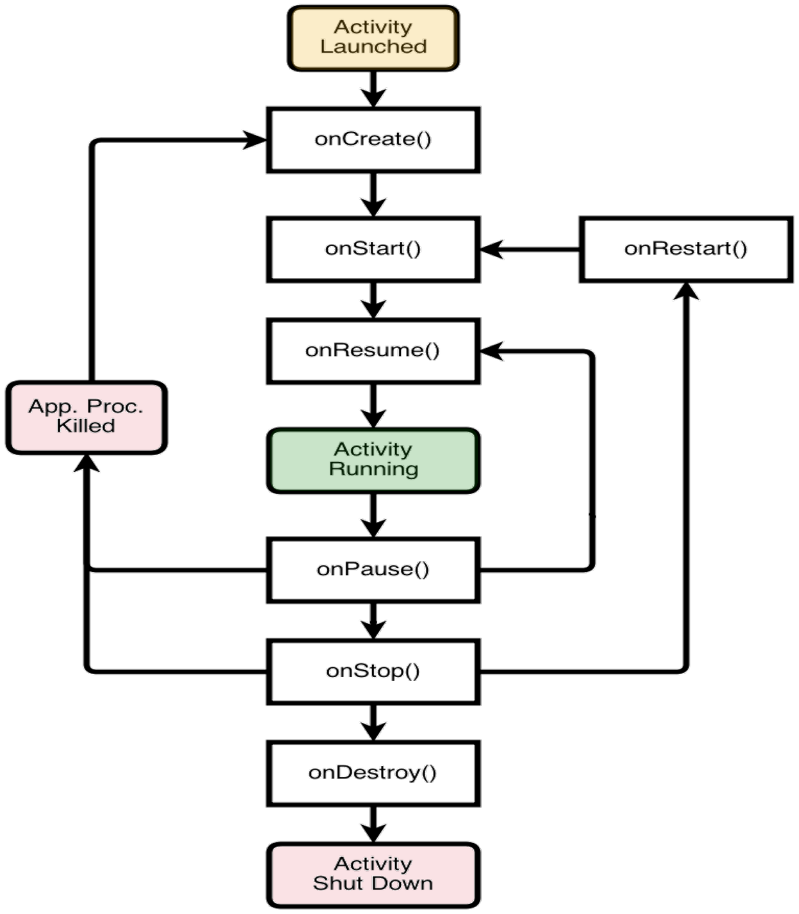
Some Activity Callback Methods

```
protected open fun onCreate(savedInstanceState: Bundle?): Unit
protected open fun onStart(): Unit
protected open fun onResume(): Unit
protected open fun onPause(): Unit
protected open fun onRestart(): Unit
protected open fun onStop(): Unit
protected open fun onDestroy(): Unit
```

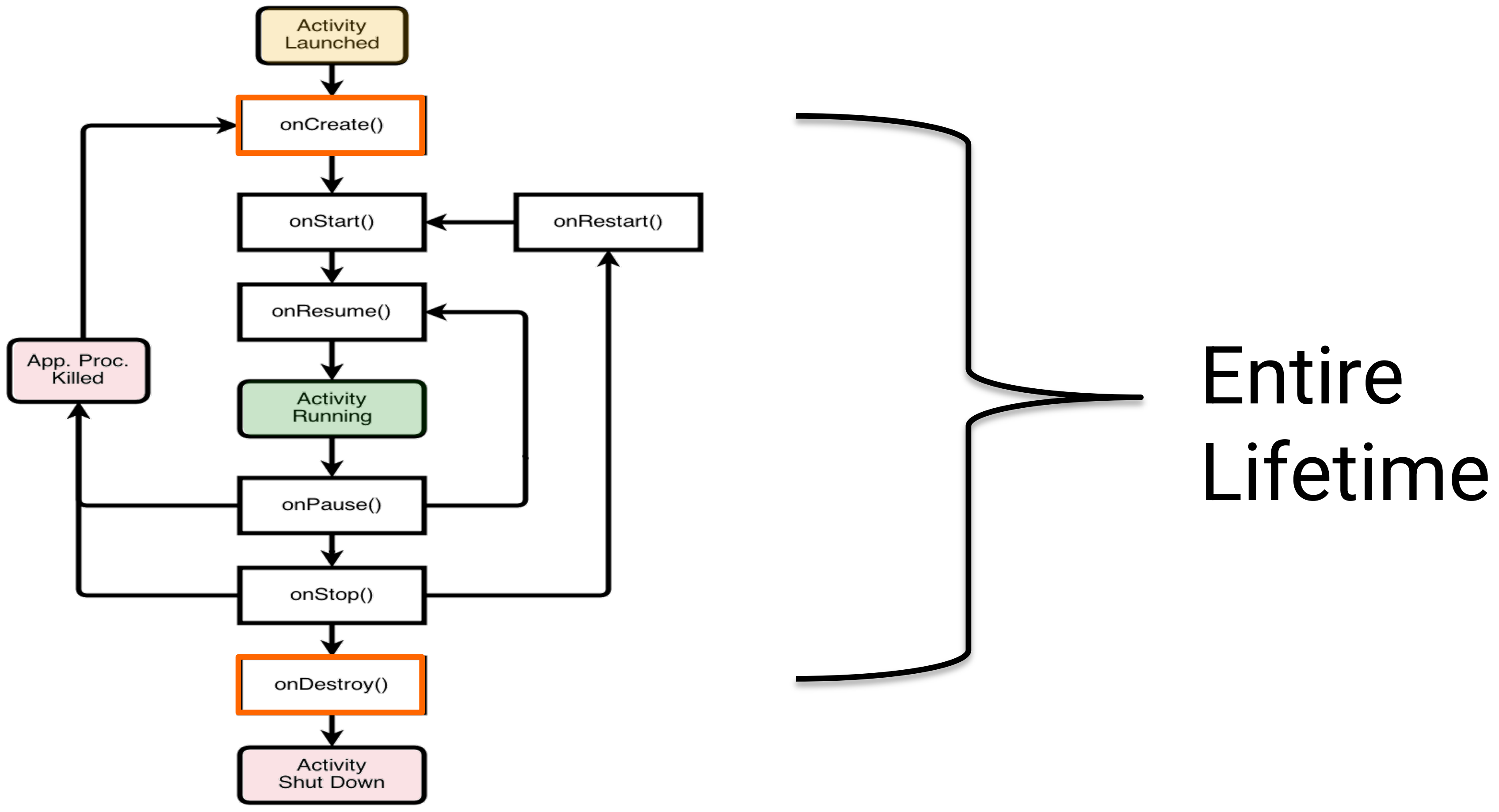
The Activity Lifecycle



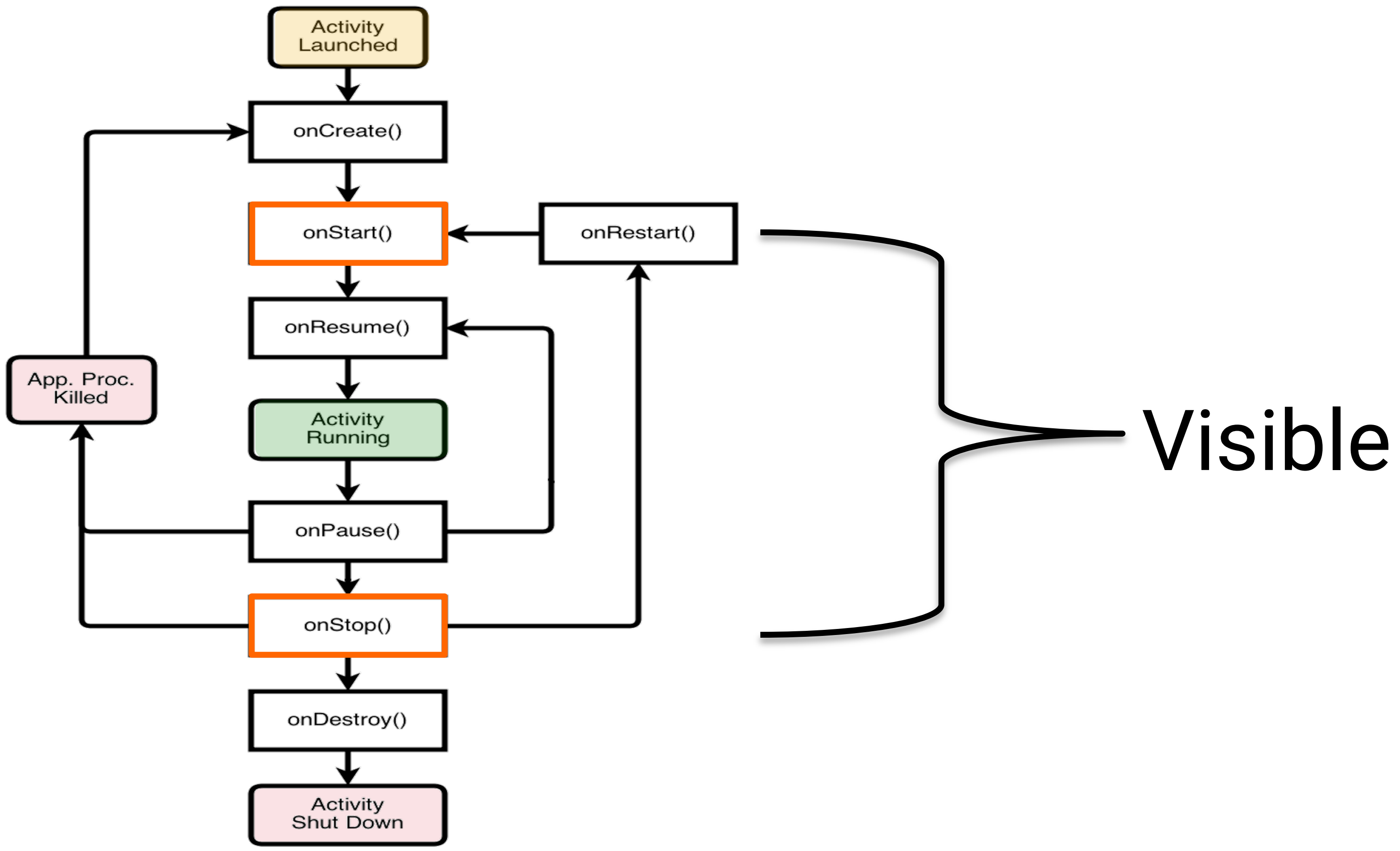
The Activity Lifecycle



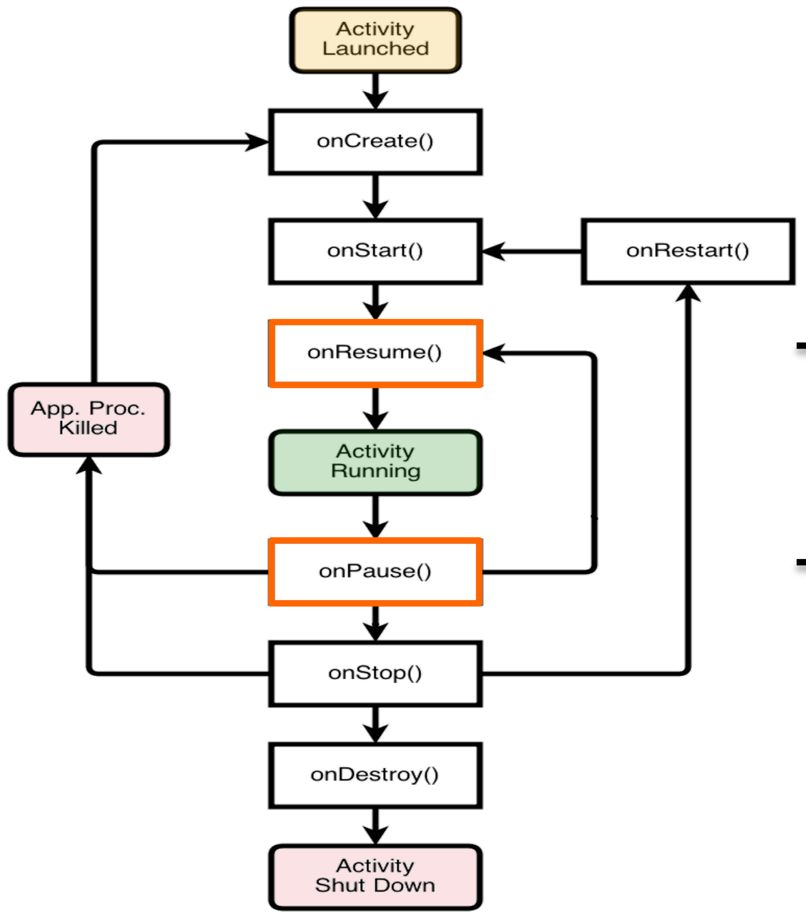
The Activity Lifecycle

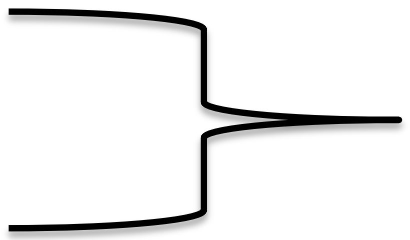


The Activity Lifecycle



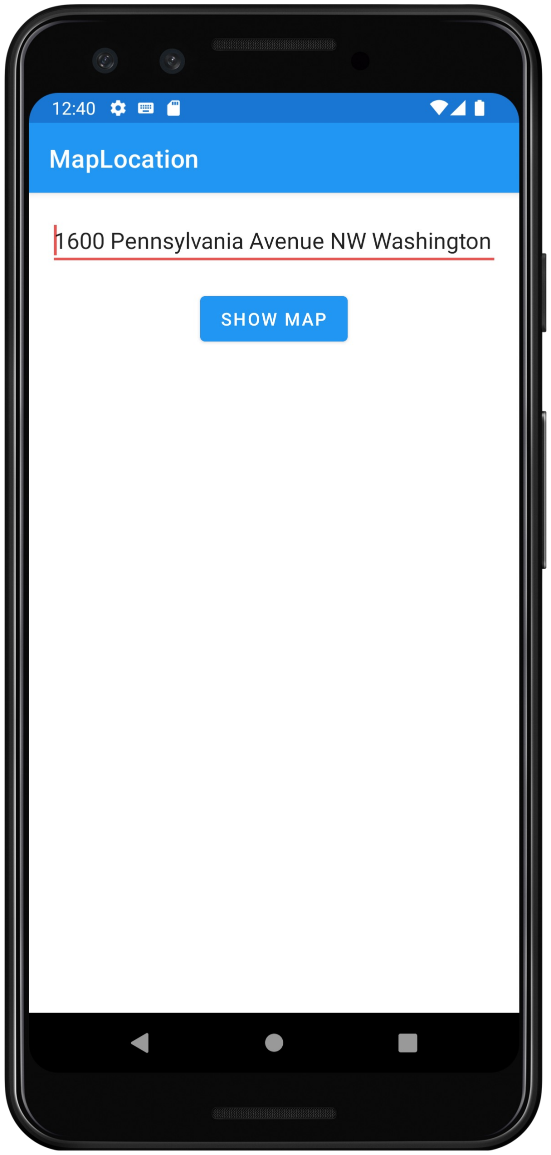
The Activity Lifecycle

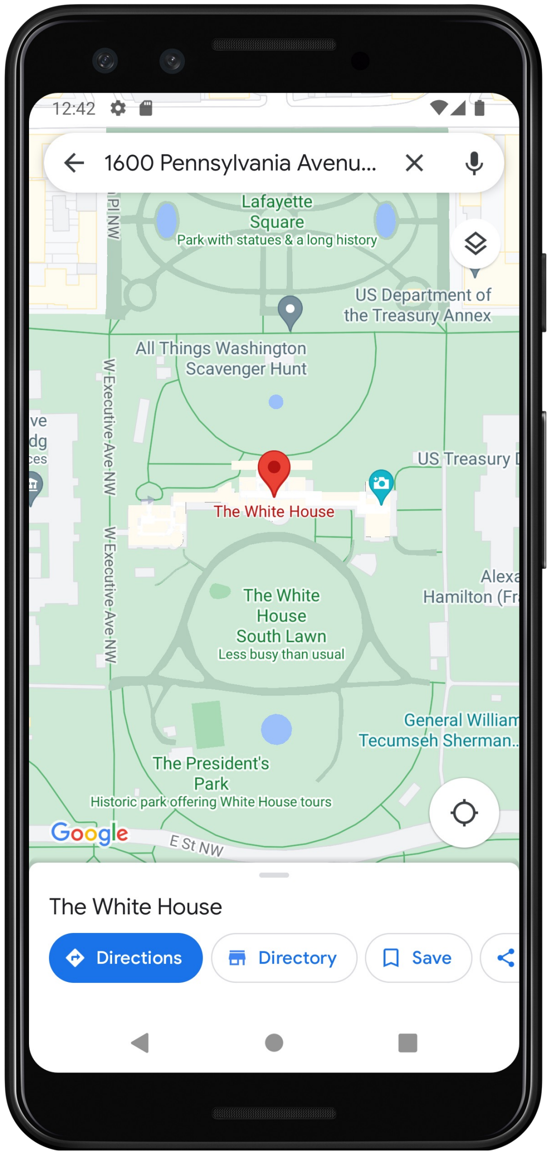




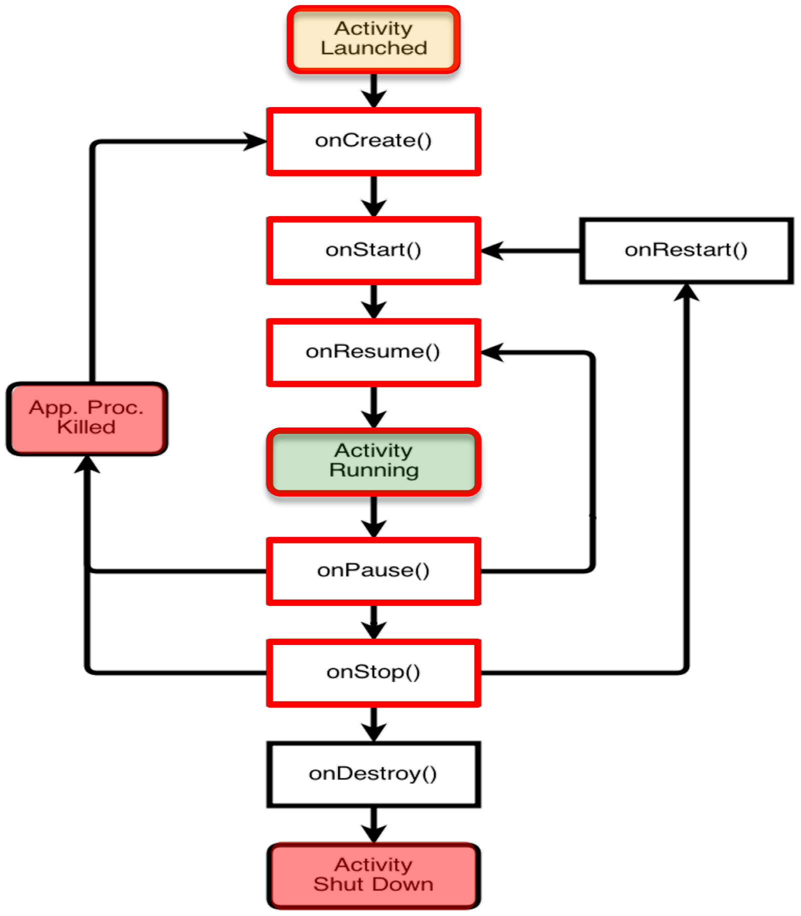
Visible & in Foreground

MapLocation

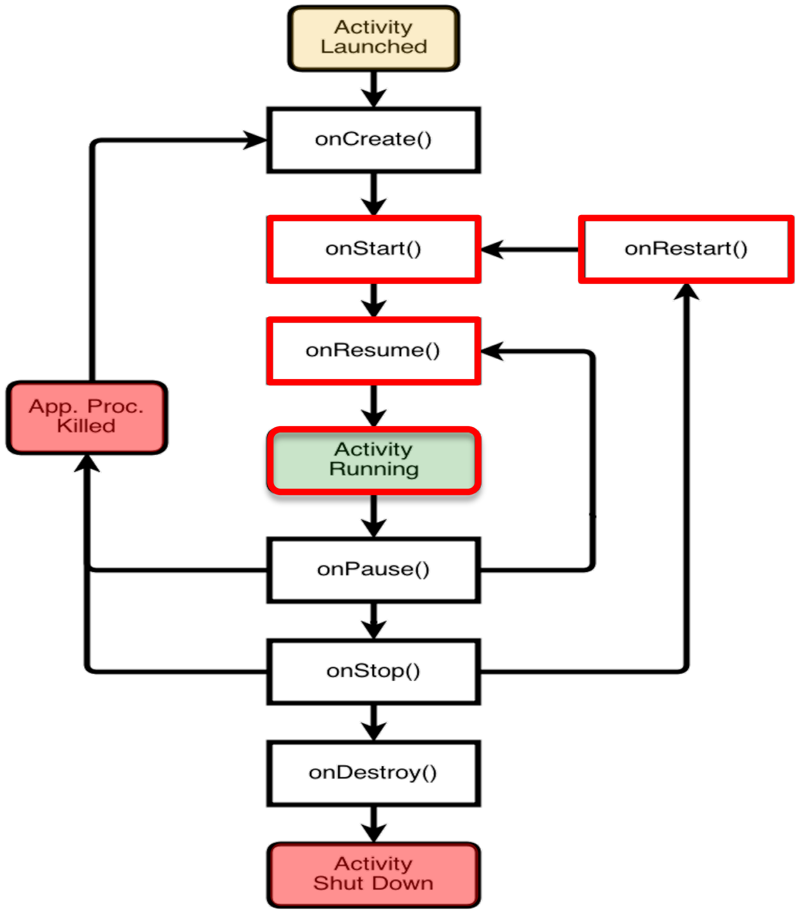




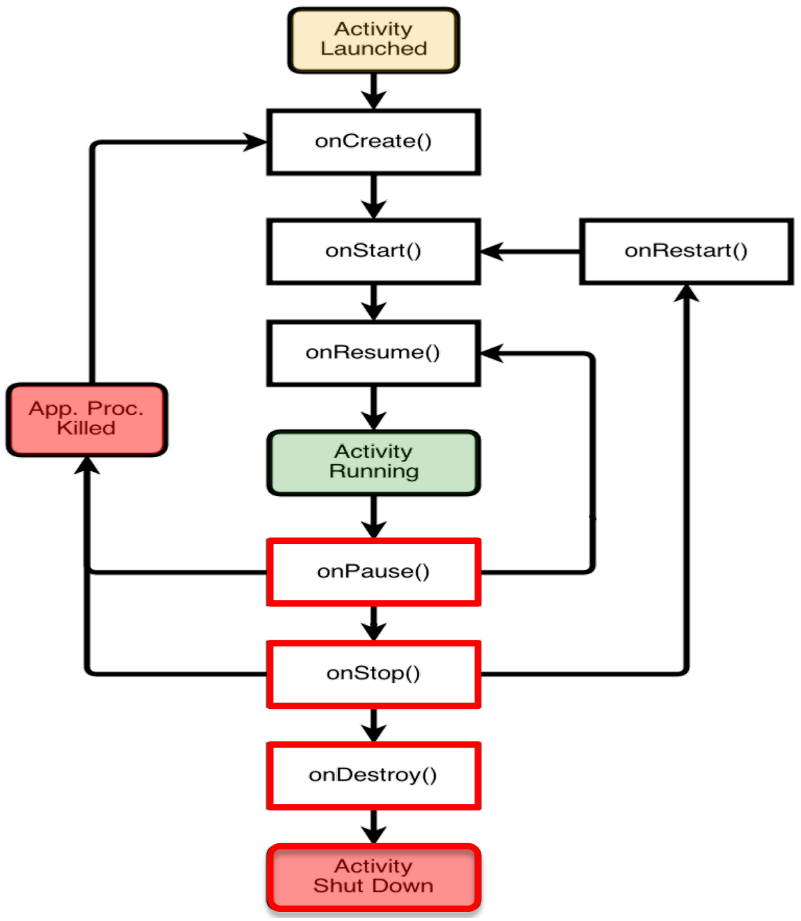
The Activity Lifecycle: MainActivity



The Activity Lifecycle: MainActivity



The Activity Lifecycle: MainActivity



onCreate()

- Called when Activity is created
- Sets up initial state
  - Call super.onCreate()
  - Set the Activity’s content view
  - Retain references to UI views as necessary
  - Configure views as necessary

onStart()

- Activity is about to become visible
- Typical actions
  - Start visible-only behaviors
  - Load persistent application state

onResume()

Activity is visible and about to start interacting with user

Typical actions

- Start foreground-only behaviors

onPause()

- Focus about to switch to another Activity
- Typical actions
  - Shutdown foreground-only behaviors
  - Save persistent state

onStop()

- Activity is no longer visible to user
  - may be restarted later
- Typical actions
  - Save persistent state
  - Do CPU-intensive save procedures
- Note: Pre-Honeycomb - this method may not be called if Android kills your application

onRestart()

Called if the Activity has been stopped and is about to be started again

Typical actions

- Special processing needed only after having been stopped

onDestroy()

Activity is about to be destroyed

Typical actions

- Release Activity-wide resources

Note: may not be called if Android kills your application

Lifecycle Methods in MapLocation.kt

```
2022-09-12 10:47:02.018 12821-12821/course.examples.maplocation
I/MapLocation: Another activity is taking focus (this activity is about to
be "paused")
2022-09-12 10:47:04.145 12821-12821/course.examples.maplocation
I/MapLocation: The activity is no longer visible (it is now "stopped")
2022-09-12 10:47:19.454 12821-12821/course.examples.maplocation
I/MapLocation: The activity is visible and about to be restarted.
2022-09-12 10:47:19.454 12821-12821/course.examples.maplocation
I/MapLocation: The activity is visible and about to be started.
2022-09-12 10:47:19.455 12821-12821/course.examples.maplocation
I/MapLocation: The activity is visible and has focus (it is now "resumed")
```

Starting Activities

Create an Intent object matching the Activity to start

Pass Intent to methods, such as:

- Activity.startActivity()
- ActivityResultCaller.registerForActivityResult()

Starting Activities

Pass Intent to methods, such as:

- Activity.startActivity()
- ActivityResultCaller.registerForActivityResult()

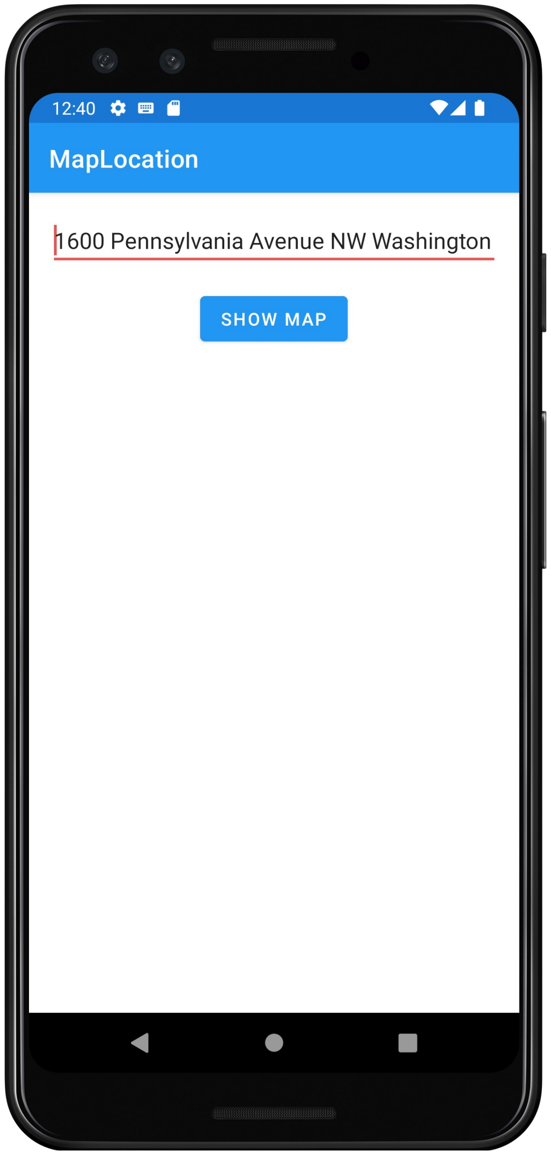
Activity.startActivity()

Create Intent

Check for presence of Intent handler

Call Activity.startActivity()

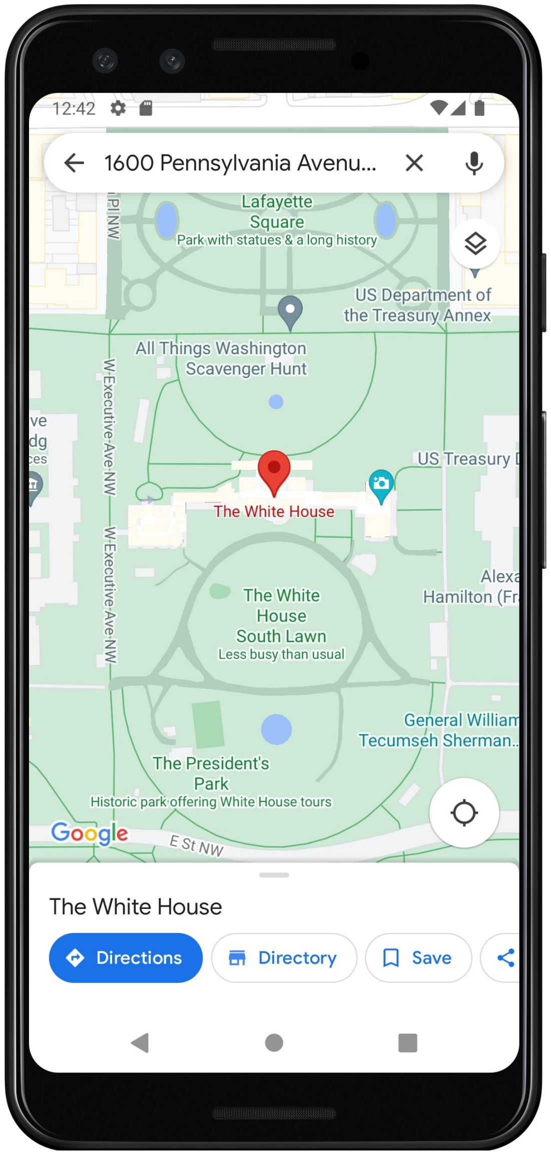
MapLocation


12:40

MapLocation

1600 Pennsylvania Avenue NW Washington

SHOW MAP


12:42

1600 Pennsylvania Avenu...

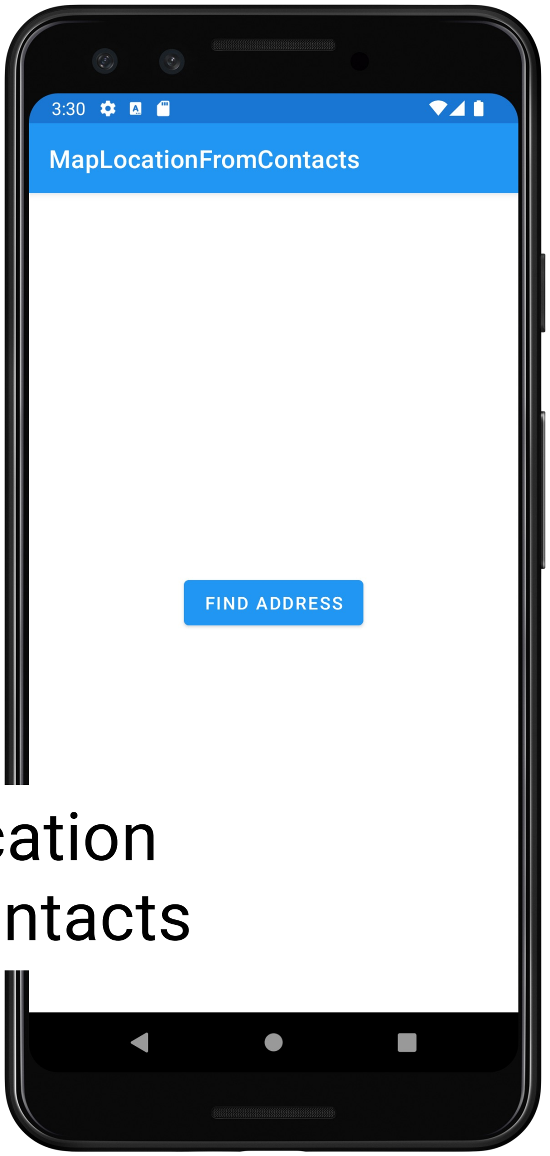
Lafayette Square
Park with statues & a long history
US Department of the Treasury Annex
All Things Washington Scavenger Hunt
W Executive Ave NW
US Treasury
The White House
The White House South Lawn
Less busy than usual
General William Tecumseh Sherman...
The President's Park
Historic park offering White House tours
Google
E St NW

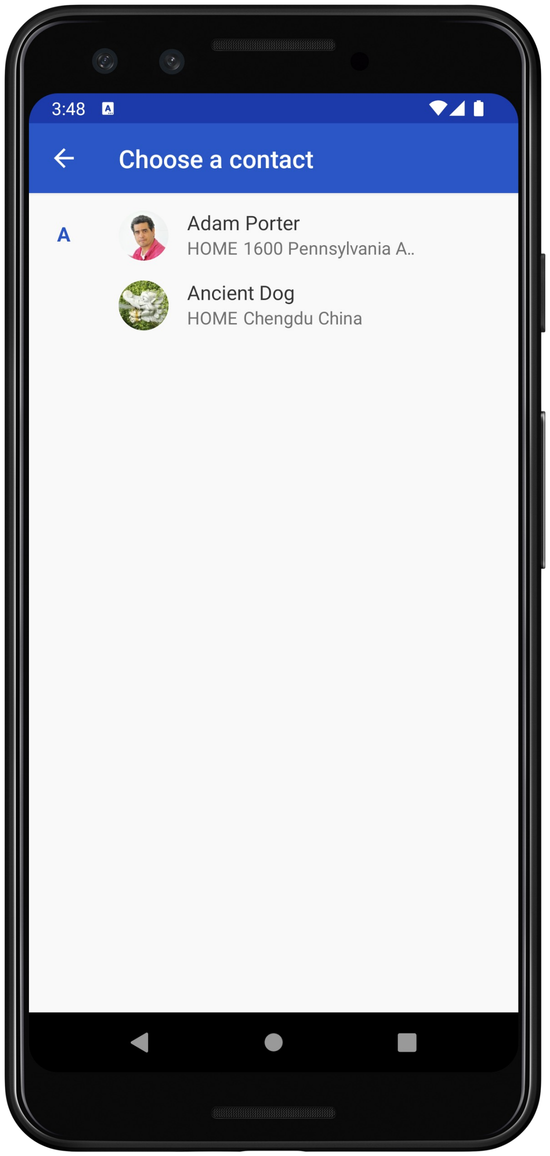
The White House

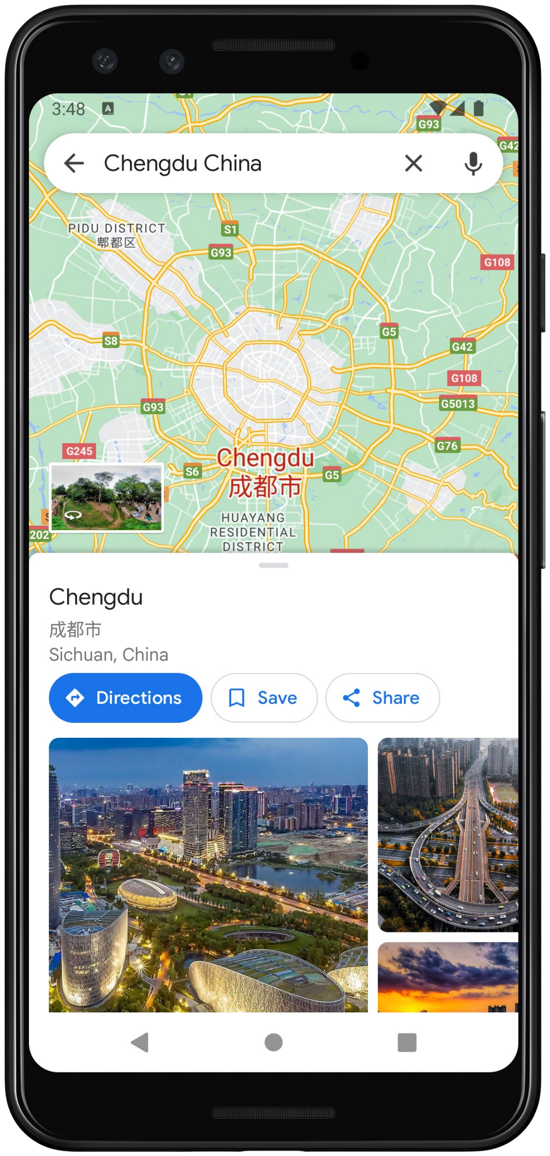
Directions
Directory
Save

MapLocationFromContacts

Similar to MapLocation, but gets address from Contacts database







MapLocation FromContacts

ActivityResultCaller.registerForActivityResult()

- Example use case
- Define ActivityResultLauncher<Intent> instance
    - This instance calls registerForActivityResult(), passing in necessary callback info
    - This info includes ActivityResultContracts.StartActivityForResult() contract interface instance
- Call ActivityResultLauncher<Intent>.launch(intent) to start desired Activity
    - Registered callback is started when Activity returns

Configuration Changes

Keyboard, orientation, locale, etc.

Device configuration can change at runtime

On configuration changes, Android usually kills the current Activity & then restarts it

Configuration Changes

Activity restarting should be fast

Options

- Save Activity state in Bundle
- Use a separate Object (i.e., ViewModel)
- Manually handle the configuration change (not usually recommended)

Saving Activity State

Android saves some information such as View state in a Bundle

You must save other state yourself

Saving Activity State

Android calls onSaveInstanceState(Bundle)

after onStop() for API 28+

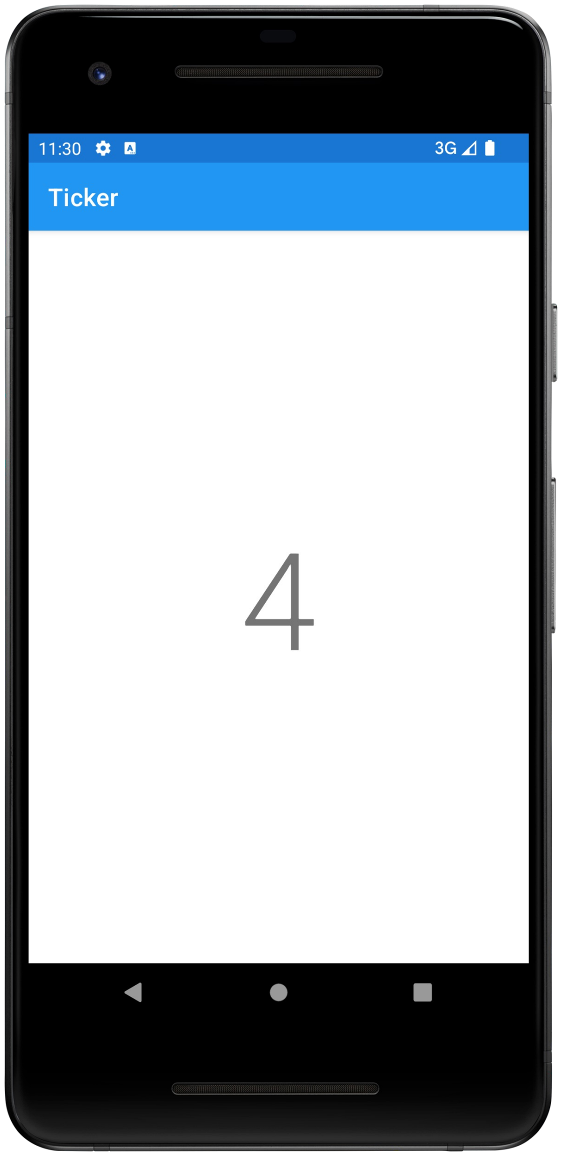
before onStop() for API <28

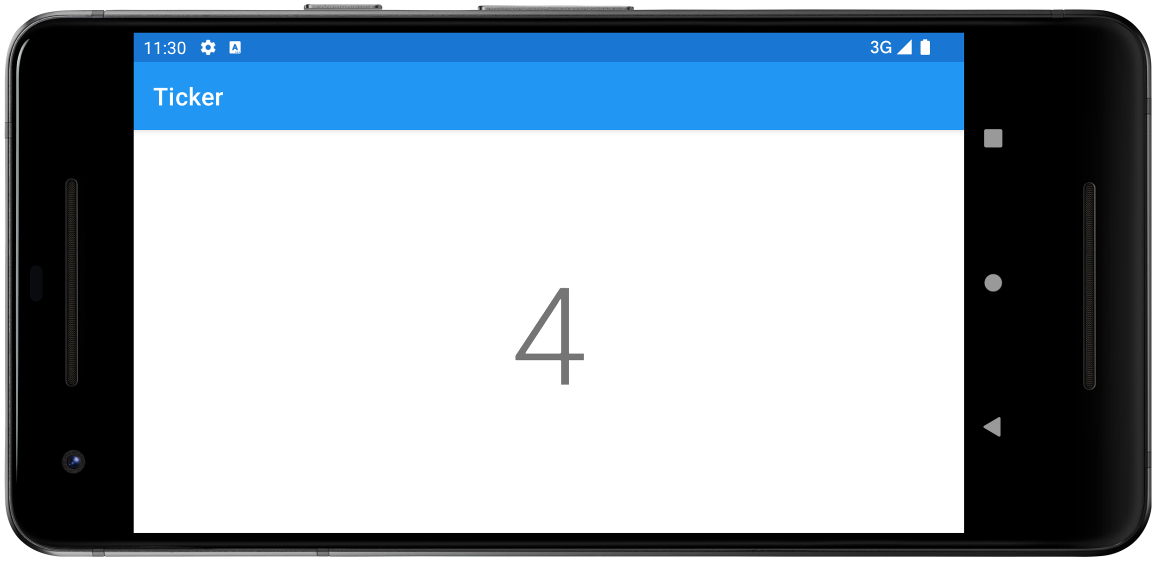
Save Activity instance state to system-provided Bundle

Saving Activity State

When Activity is restarted, you can restore Activity state from a system-provided Bundle in:

- onCreate(Bundle)
- onRestoreInstanceState(Bundle), which is called between onStart() and onPostCreate()





Ticker

Retaining an Object

Hard to recompute data can be cached to speed up handling of configuration changes

Current recommendation uses ViewModel class

We’ll come back to this in a later lesson

Manual Reconfiguration

Can prevent system from restarting Activity

Declare the configuration changes your Activity handles in AndroidManifest.xml file, e.g.,

```
<activity android:name=".MyActivity“
    android:configChanges=
        "orientation|screensize|keyboardHidden”…>
```

Manual Reconfiguration

When configuration changes, Activity’ s onConfigurationChanged() method is called

Passed a Configuration object specifying the new device configuration

Manual Reconfiguration Caveat

Should generally avoid manual approach

- Hard to get right
- Fragile to system changes

Next

The Intent Class

Example Applications

MapLocation

MapLocationFromContacts

Ticker