Introduction to Mobile Application - Android Programming with Corona

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July 17-18, 2019

Variability Expedition

UCLA

Module Acknowledgement

- Bo-Jhang Ho, *NESL Hall of Famer*

I think you’re ready !!

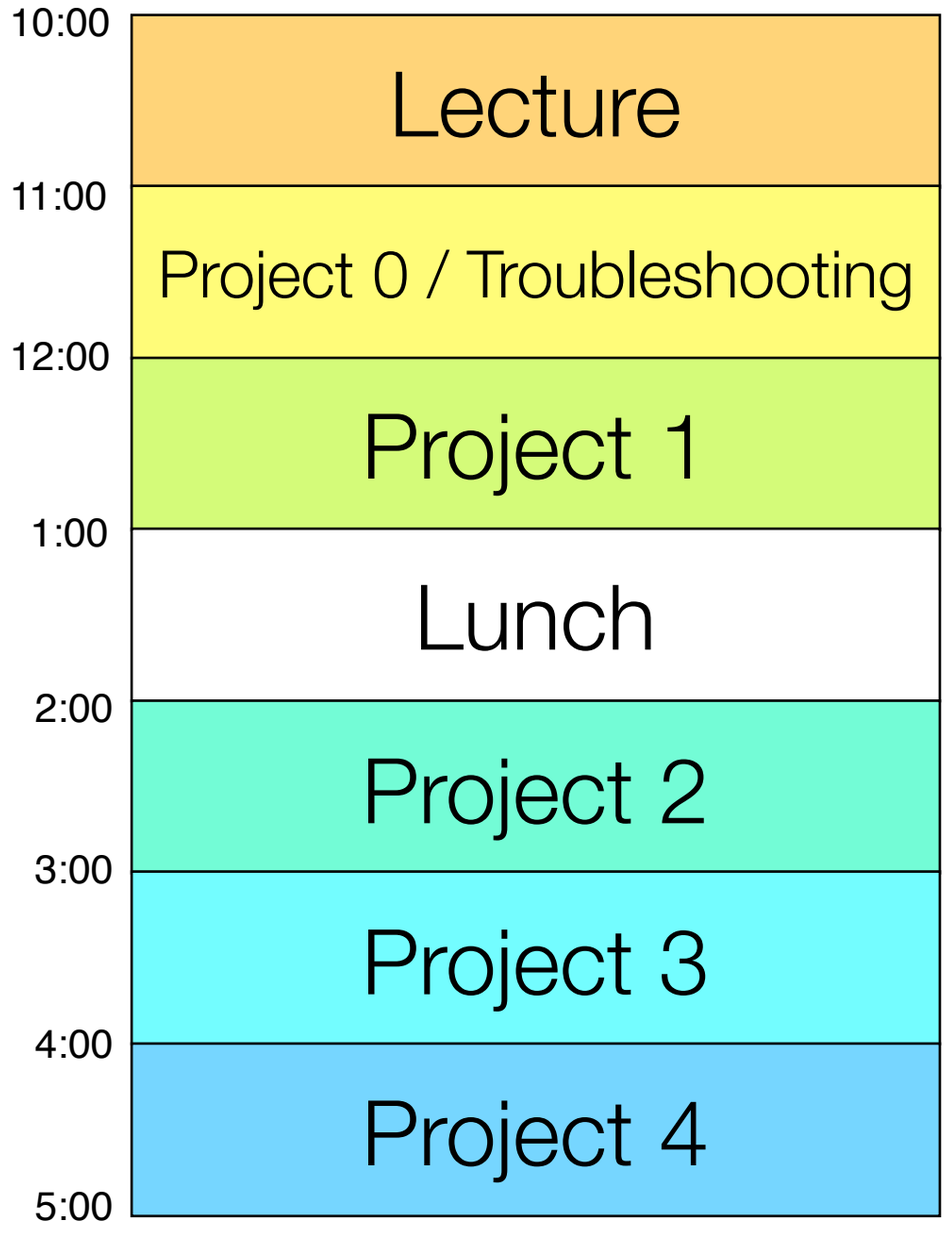
First things first

1. Download this

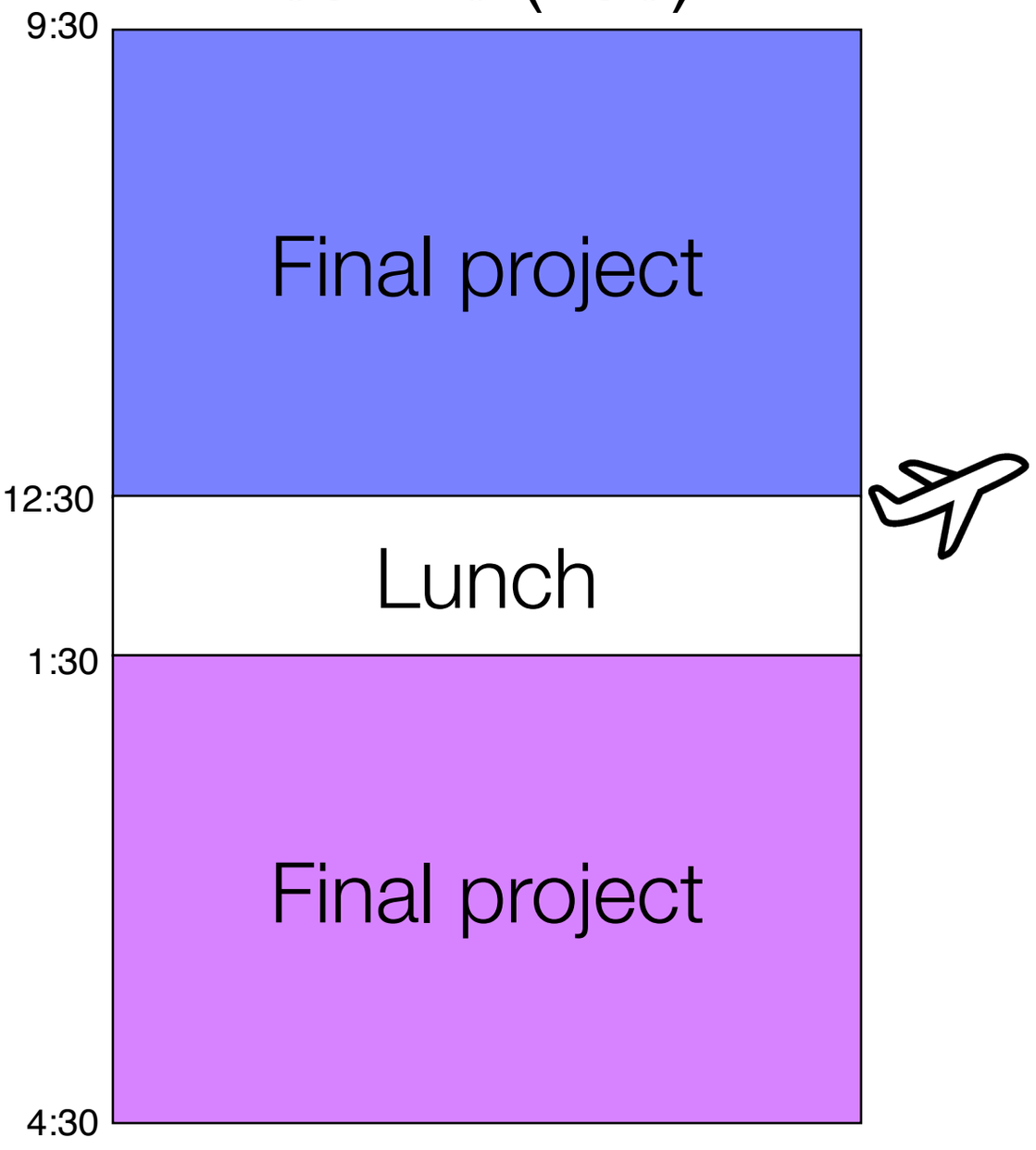
2. Download this

Agenda

Jul. 18 (Mon)



Jul. 19 (Tue)



Is a smartphone a phone?

Difference between a computer and a mobile phone nowadays??

Hi, I'm a PC!

I can do almost whatever you can do!

Difference between a computer and a mobile phone nowadays??

Faster computation

I can use WiFi to access Internet!

Huh?

Work at one place

What's that?

What?

What?

Stop…

Decent computation speed

I can use it too!

I can use LTE

I can move almost anywhere

I have a lot of sensors!

I can know where I am!

I can know how I was moved

I can …

Difference between a computer and a mobile phone nowadays??

I can only play Pokemon…

I can play Pokemon Go!

BTW, I have brothers & sisters!
Smart devices around us

Capability of modern smartphones

- Smartphones (and other smart devices) are everywhere!
  - The number of global smartphone users has surpassed 2 billion people!
- Multiple processor cores
- Multiple interfaces or ways to communicate with humans
  - touch, speech, haptic, blinking, …
- Many built-in sensors
  - Measure motion, orientation, location, temperature, …
- Radios for communication
  - Bluetooth, WiFi access points, NFC, ...
- Cameras + powerful CPU / GPU to enable augmented reality
  - Deep learning!

src: http://www.telegraph.co.uk/technology/mobile-phones/11287659/Quarter-of-the-world-will-be-using-smartphones-in-2016.html
http://www.idc.com/getdoc.jsp?containerId=prUS25224914

Mobile applications

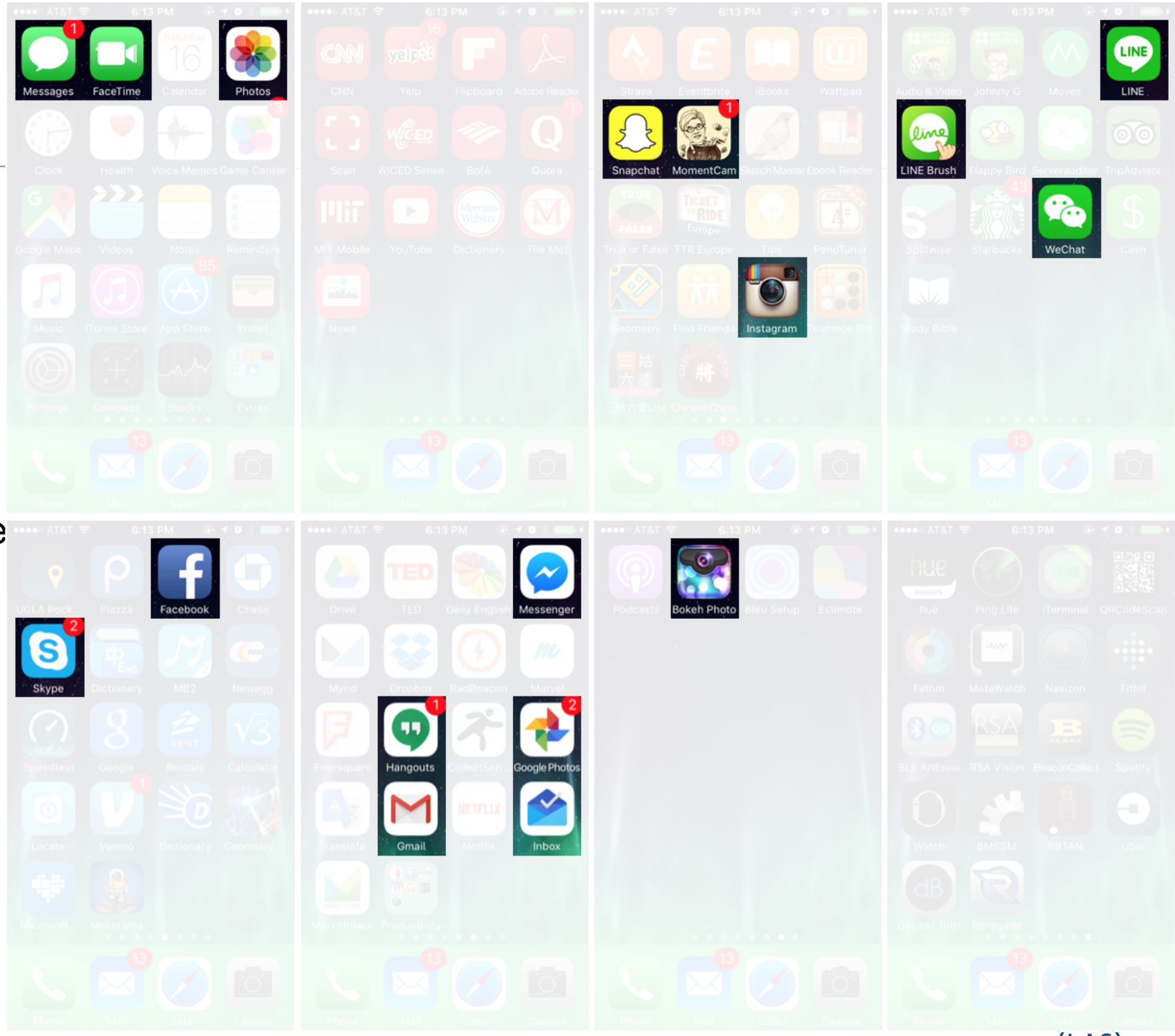
- Why are smartphones so popular? What do you love them for?

src: https://creativemarket.com/brentgalloway/4188-Round-Social-Media-Icon-Set

Real case study

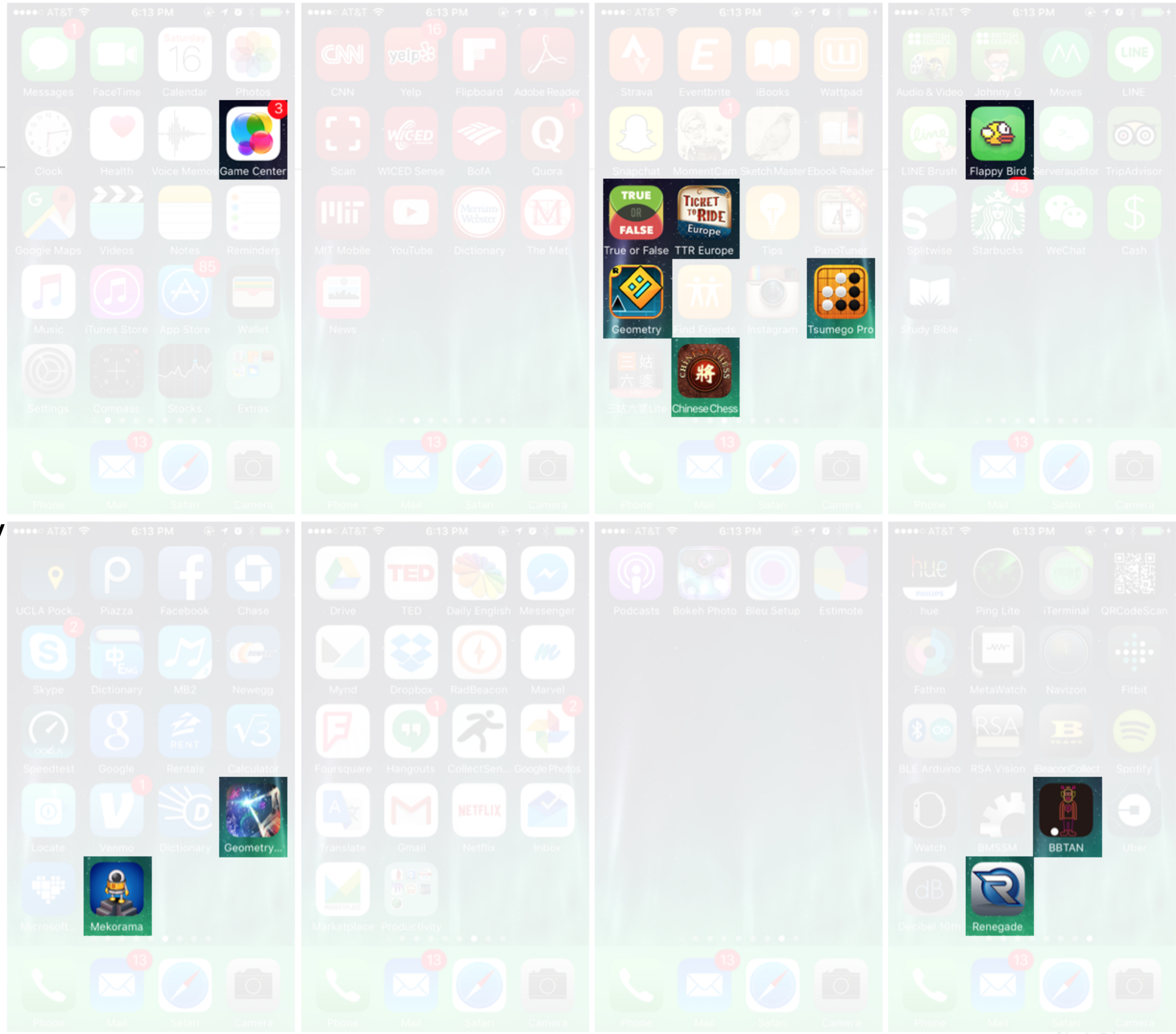
Real case study

- **Social**
- Instant message
- Networking
- Photo sharing



Real case study

- **Games**
- Do I need to say more?

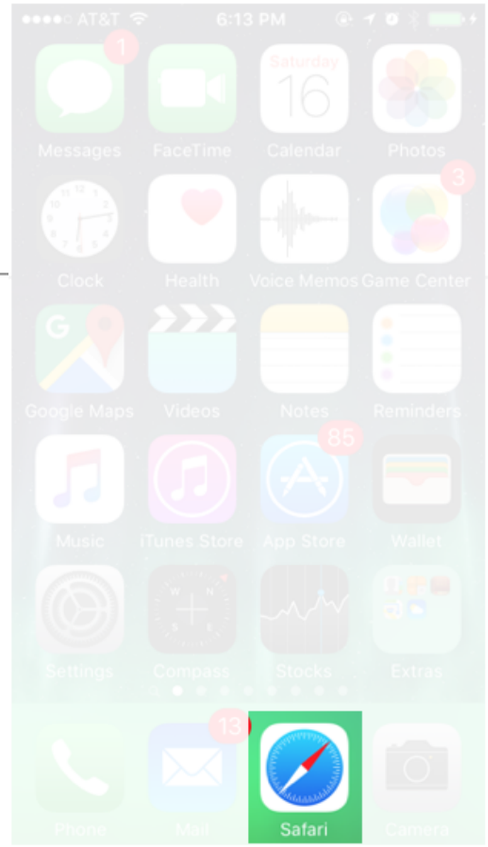


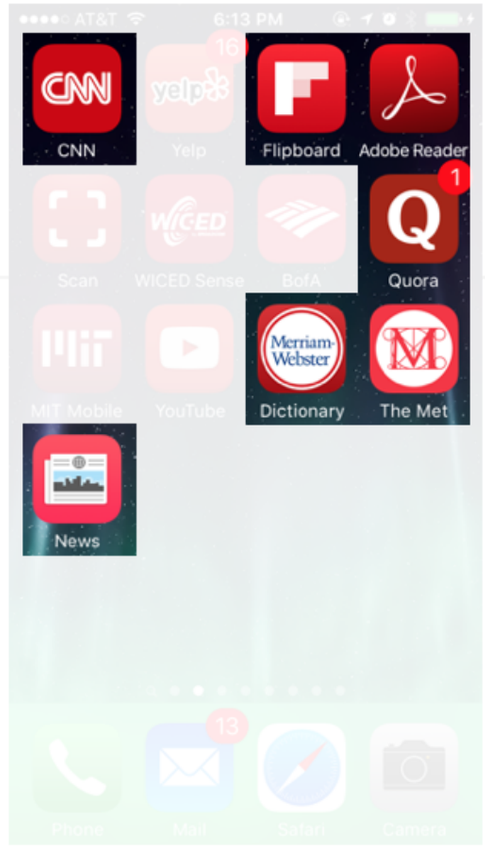
Real case study

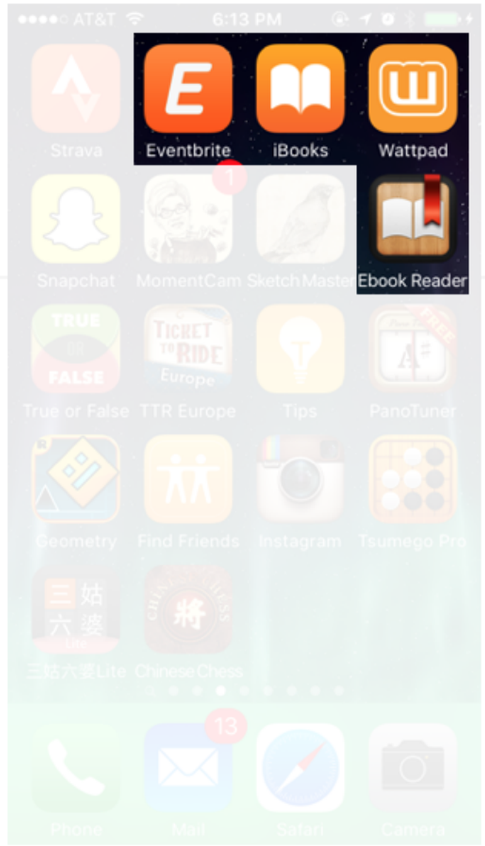
- **Location service**
- Maps
- Restaurant recommendation
- Travel recommendation
- Indoor navigation

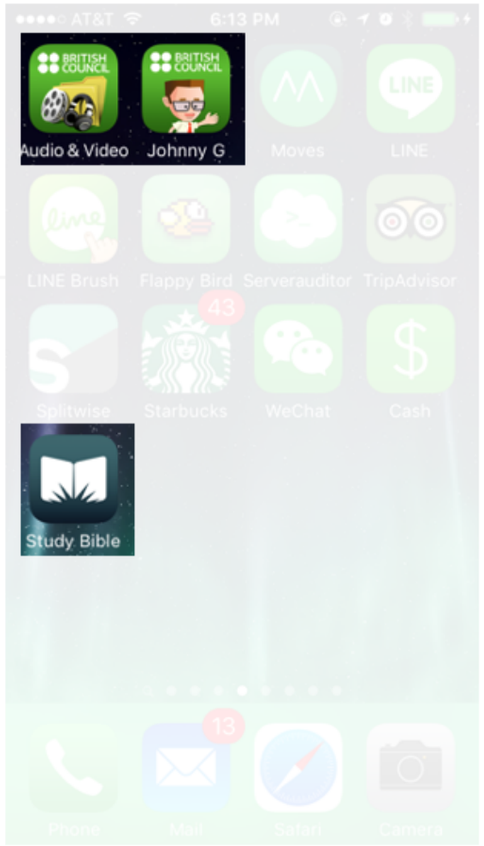
Real case study

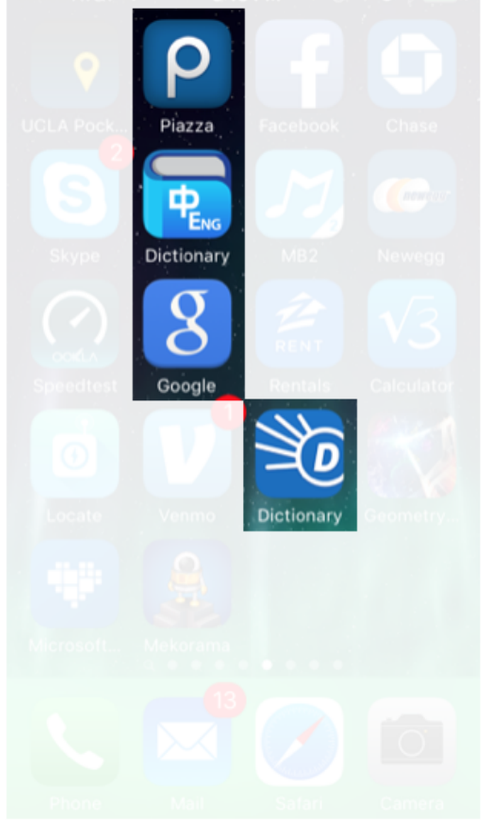
- **Learning**
- News
- Readings
- Dictionaries
- Piazza!

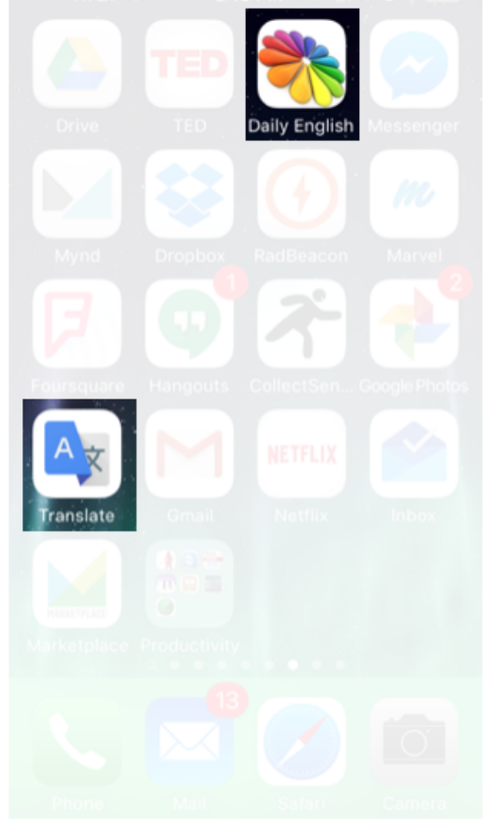


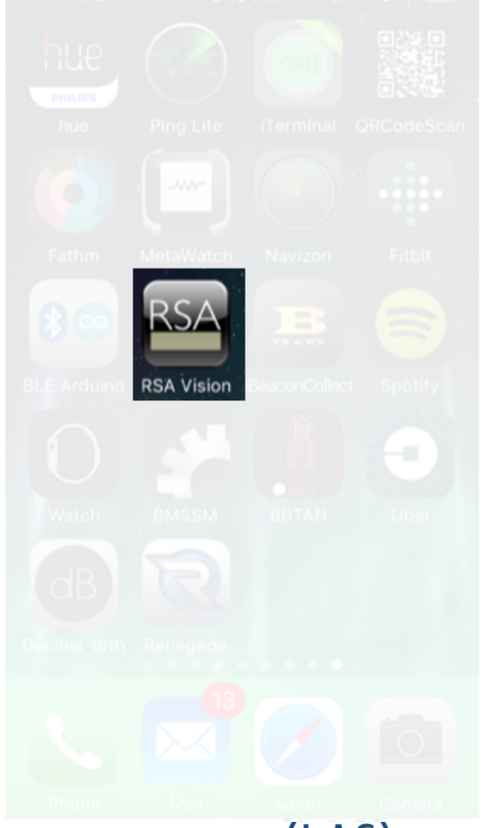












Real case study

- **Health**
- Workout tracking

Real case study

- **Scheduling**
- Calendar
- Reminder

Real case study

- **Financial**
  - Stock
  - Banking
  - Online shopping

Real case study

- **Productive**
- Tools
- Online storage

Real case study

- Whoa! That's why you need your phone every day!

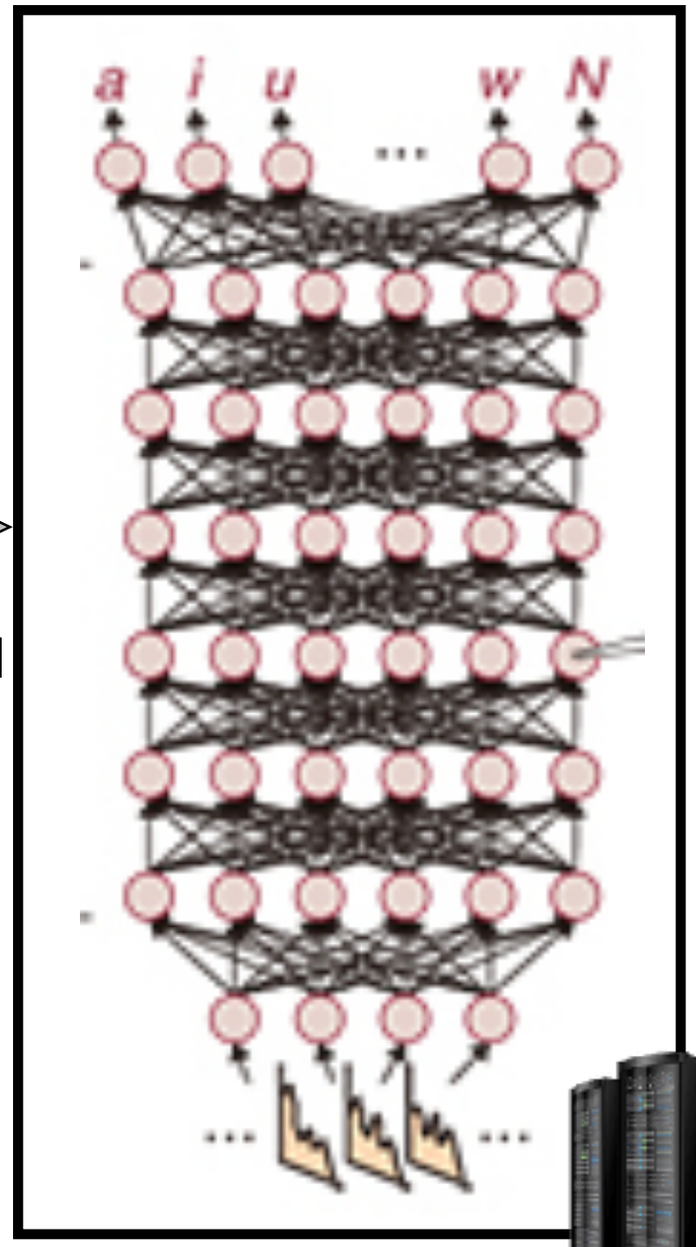
Popular mobile app development model

Popular mobile app development model

Popular mobile app development model

Audio data

Text-based command



Mobile development ecosystem

Mobile development ecosystem

Users

Mobile development ecosystem

Developers

Users

Mobile development ecosystem

Developers

Users

Google

App store provider

Mobile development ecosystem

Developers

Users

Google

App store provider

Phone manufactures

Mobile development ecosystem

Developers

ANDROID APP ON Google play

Users

Google

App store provider

Phone manufactures

Mobile development ecosystem

Accessories

Advertisements

Developers

ANDROID APP ON Google play

Users

Google

App store provider

Phone manufactures

Mobile development ecosystem

Wireless providers

Accessories

Advertisements

Developers

ANDROID APP ON Google play

Google

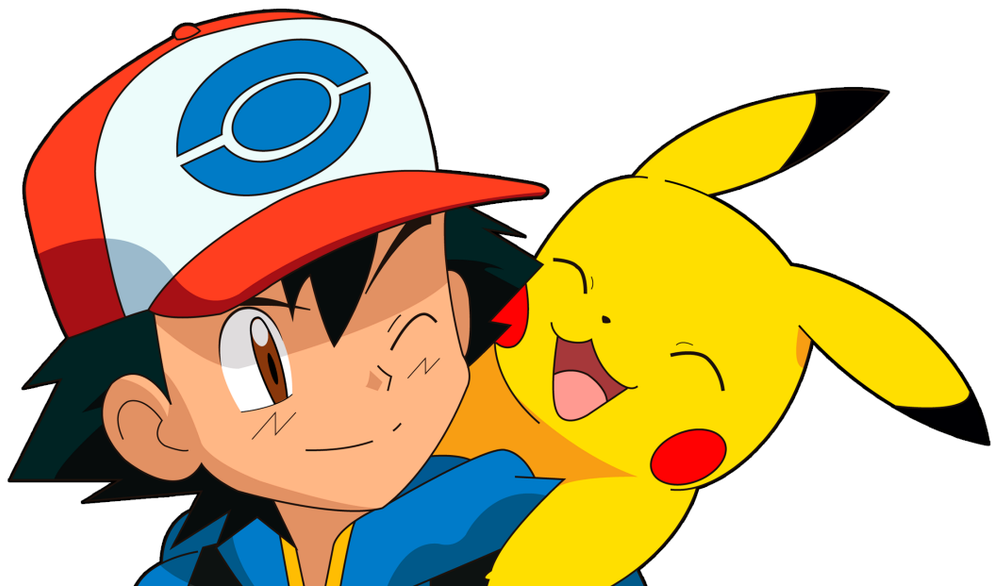
App store provider

Users

Phone manufactures

Hold your Poke balls and identify your Pokemon!

Android app development using Corona SDK



Popular mobile development platforms

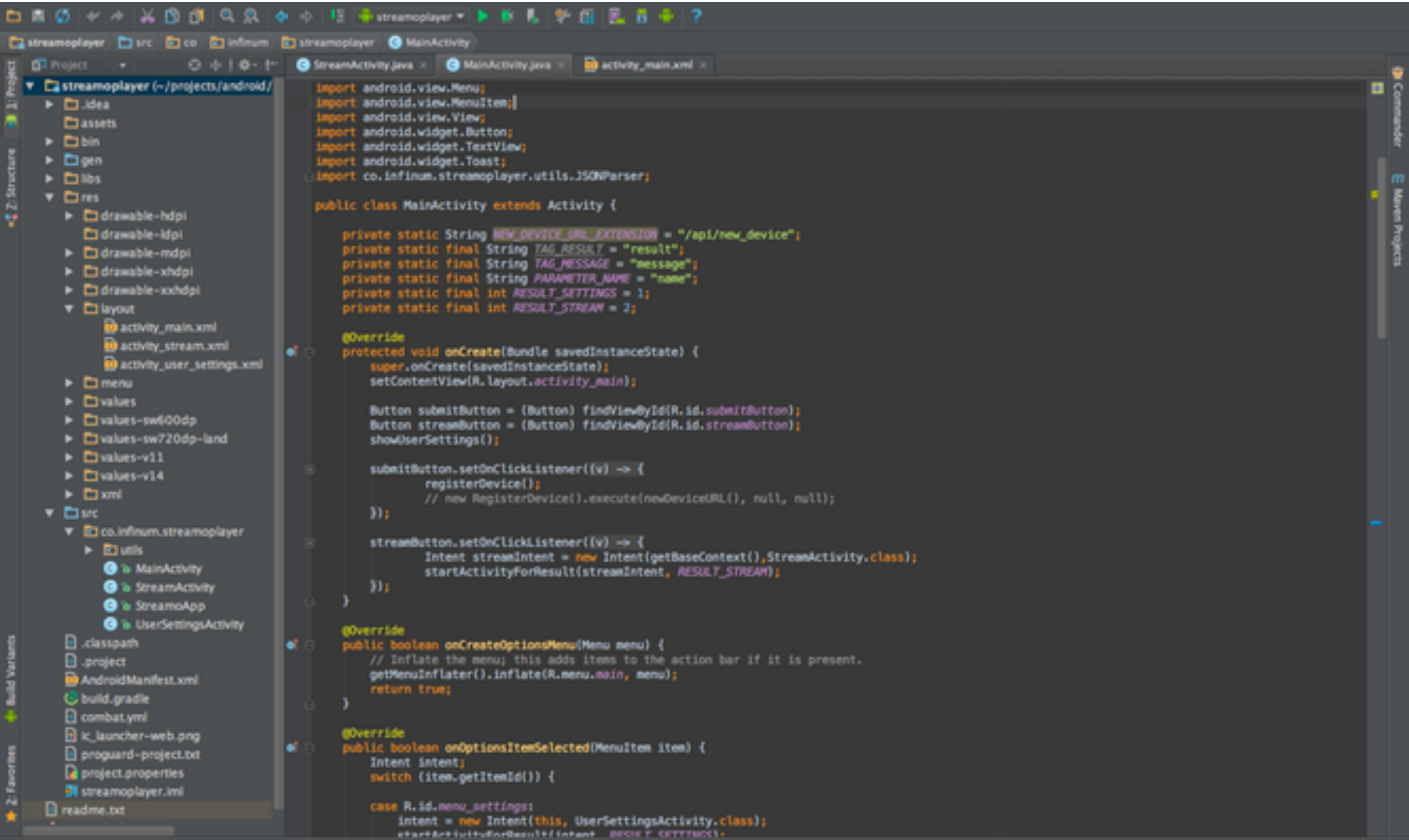
Popular mobile development platforms

Java

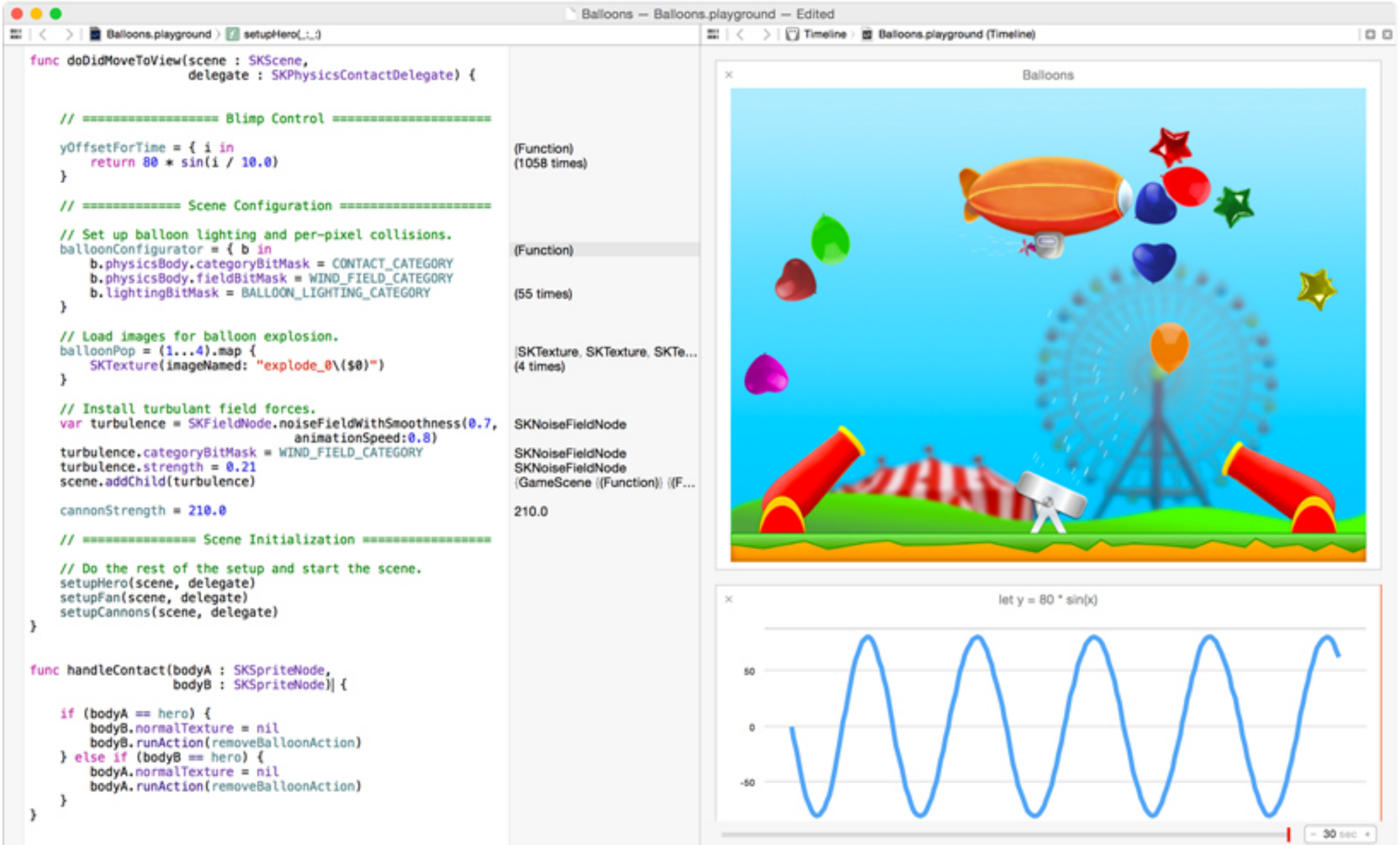
Objective-C

Swift

Popular mobile development platforms

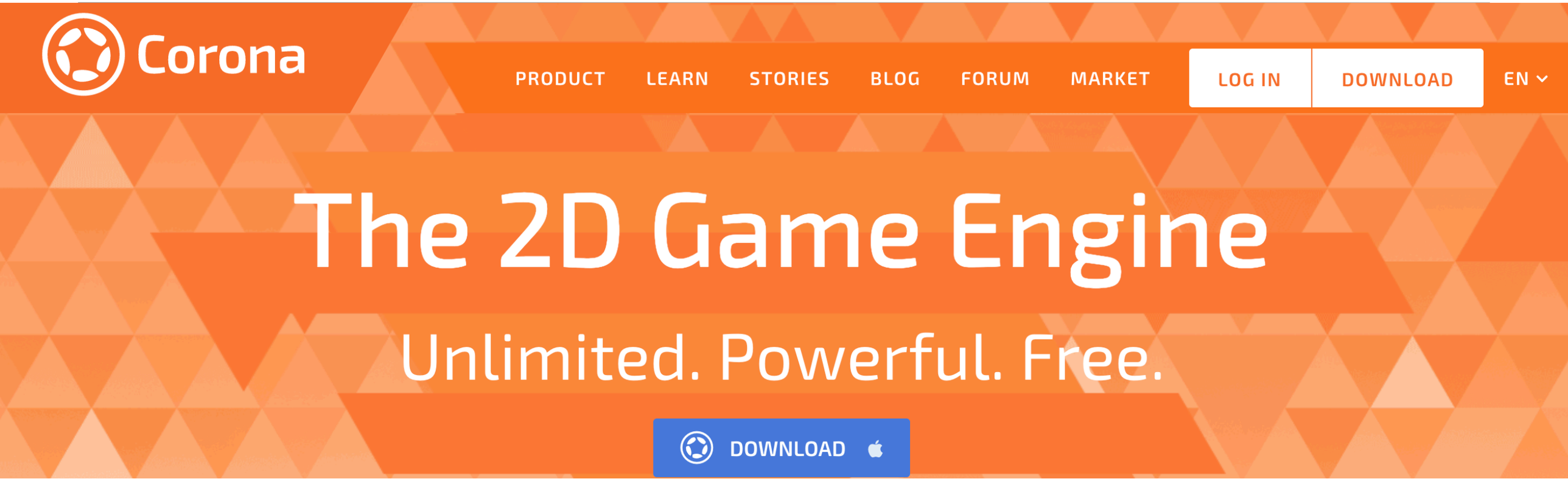


Popular mobile development platforms



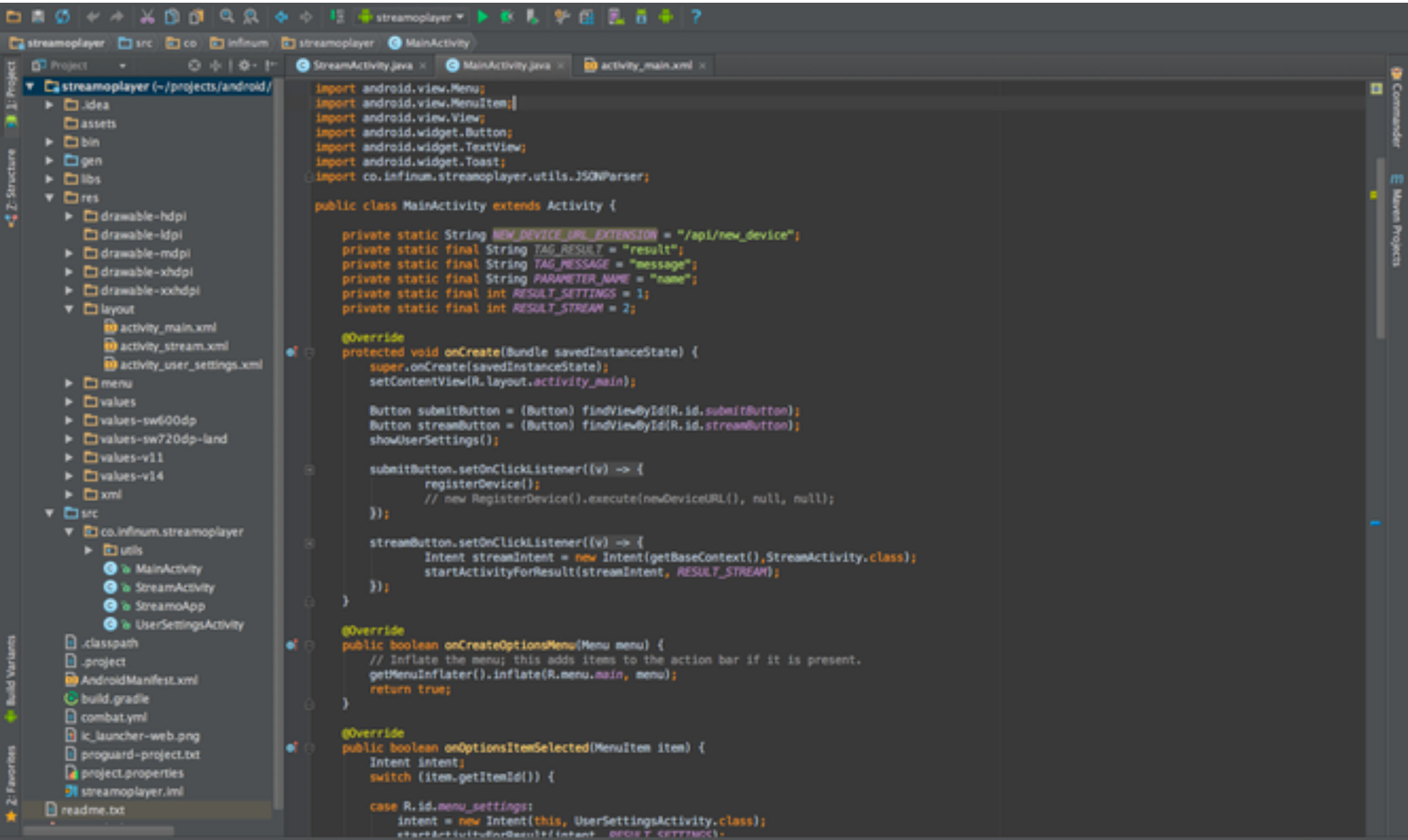
A lot of code!!

Why do we choose Corona SDK?



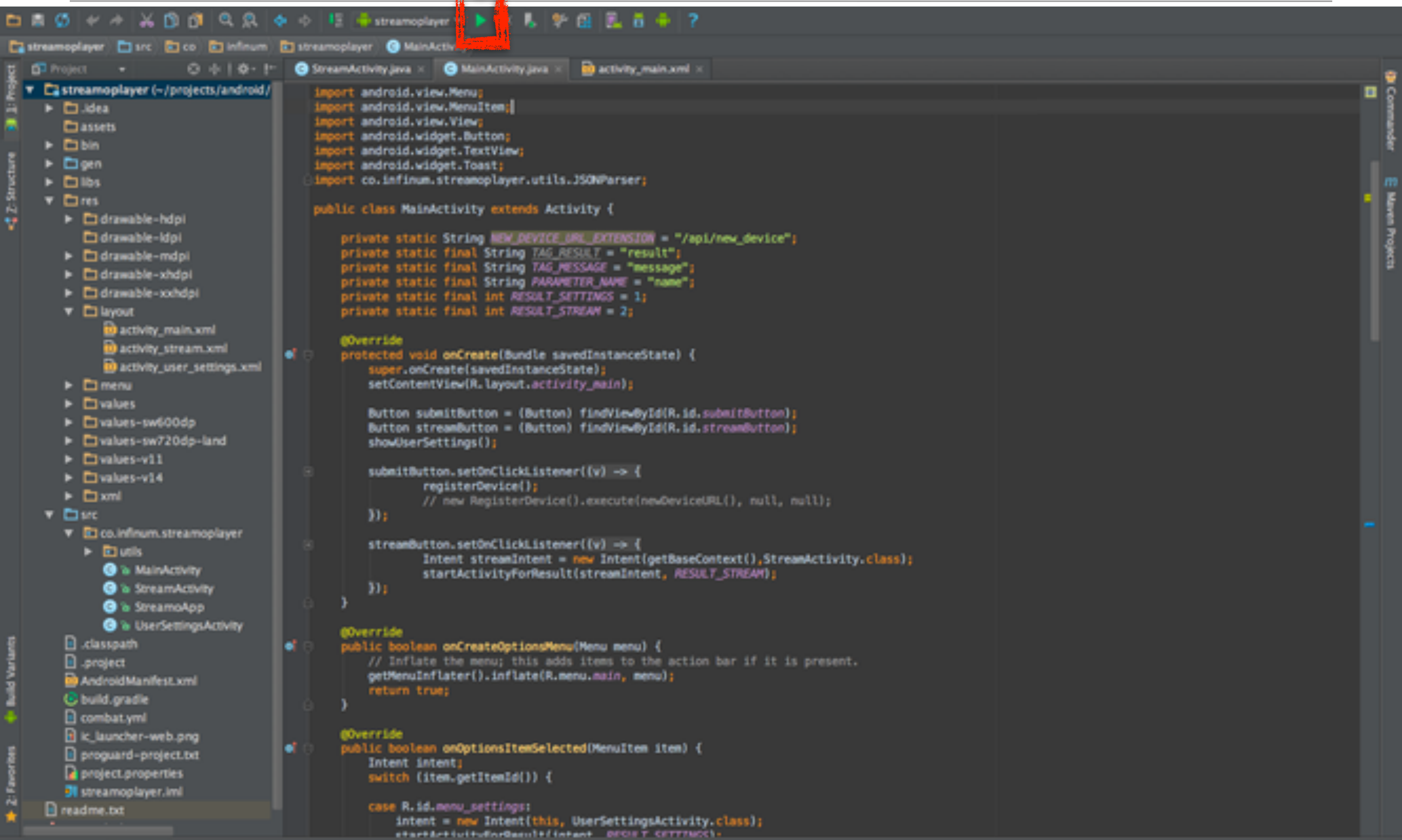
- Plus, you can compile on both iOS and Android platforms!
- No need to deal with the complex library and build systems
- Provides a bunch of common libraries

Recall Android Studio

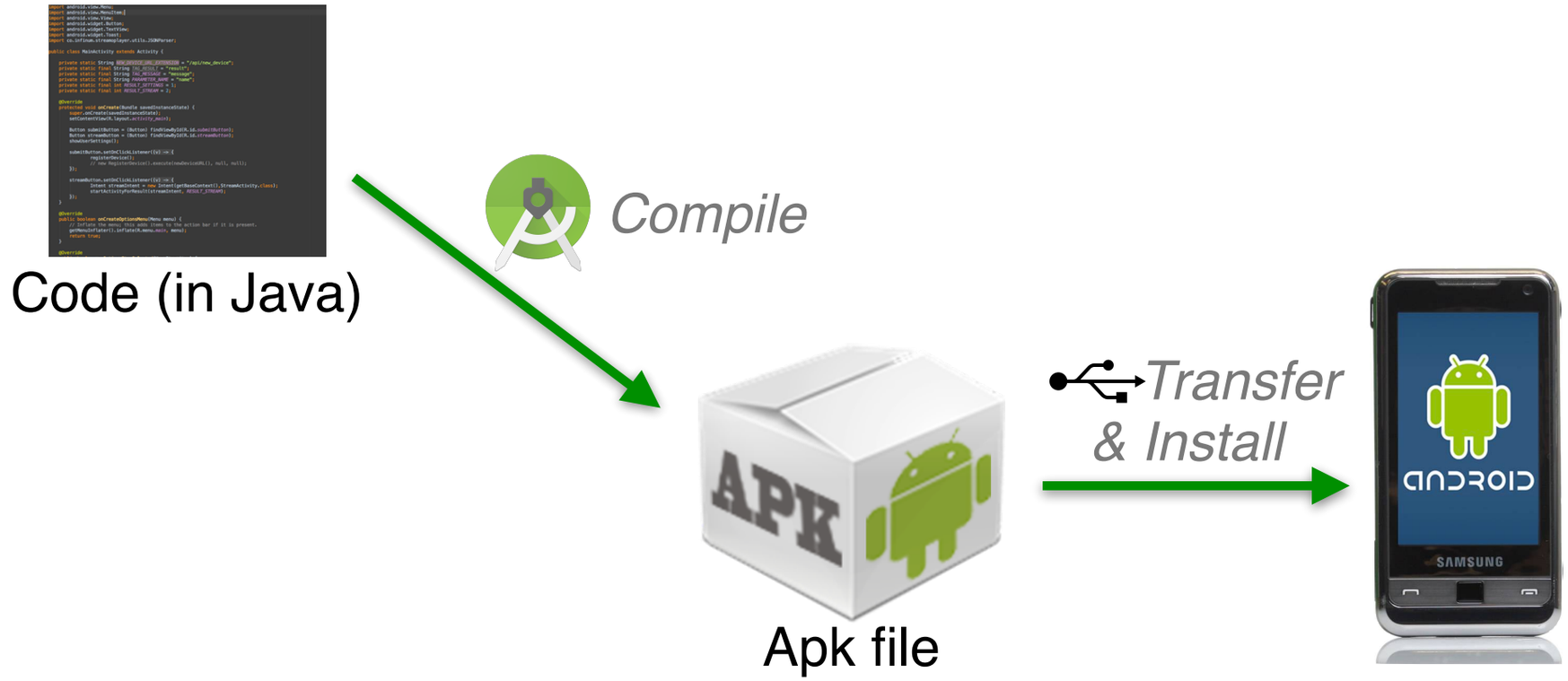


Recall Android Studio

Run
1. Compile
2. Transfer file to the phone



Compilation path of Android



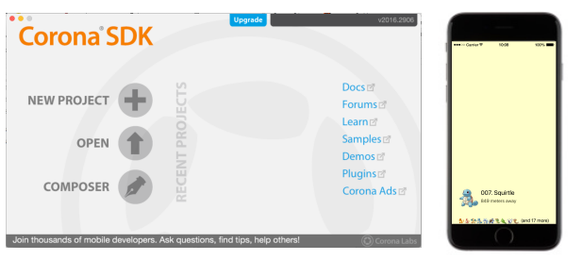
Working flow in Corona SDK

Code (in Java)

Compile

Apk file
(Installation package)

1. Create a project



Working flow in Corona SDK

Code (in Java)

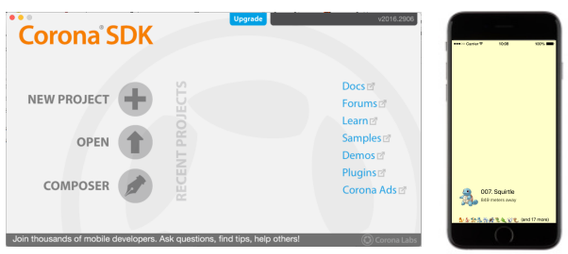
Compile

Apk file
(Installation package)

Transfer
& Install

2. Program in an editor using Lua

1. Create a project



Working flow in Corona SDK

Code (in Java)

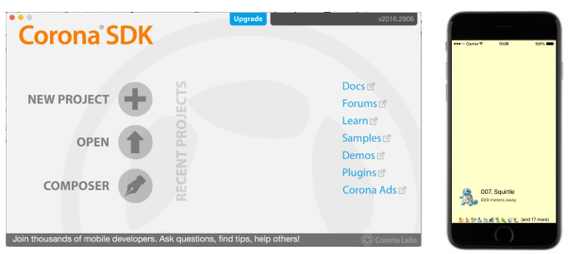
Compile

Apk file
(Installation package)

Transfer
& Install

2. Program in an editor using Lua

1. Create a project



3. Click “Build”

Working flow in Corona SDK

Code (in Java)

Compile

Apk file
(Installation package)

Transfer
& Install

Compile

2. Program in an editor using Lua

1. Create a project

3. Click “Build”

Working flow in Corona SDK

Code (in Java)

Compile

Apk file
(Installation package)

Transfer
& Install

4. Manually install the app

```
adb install -r yourapp.apk
```

Compile

2. Program in an editor using Lua

1. Create a project

3. Click “Build”

Episode 0 - There is a Gym…

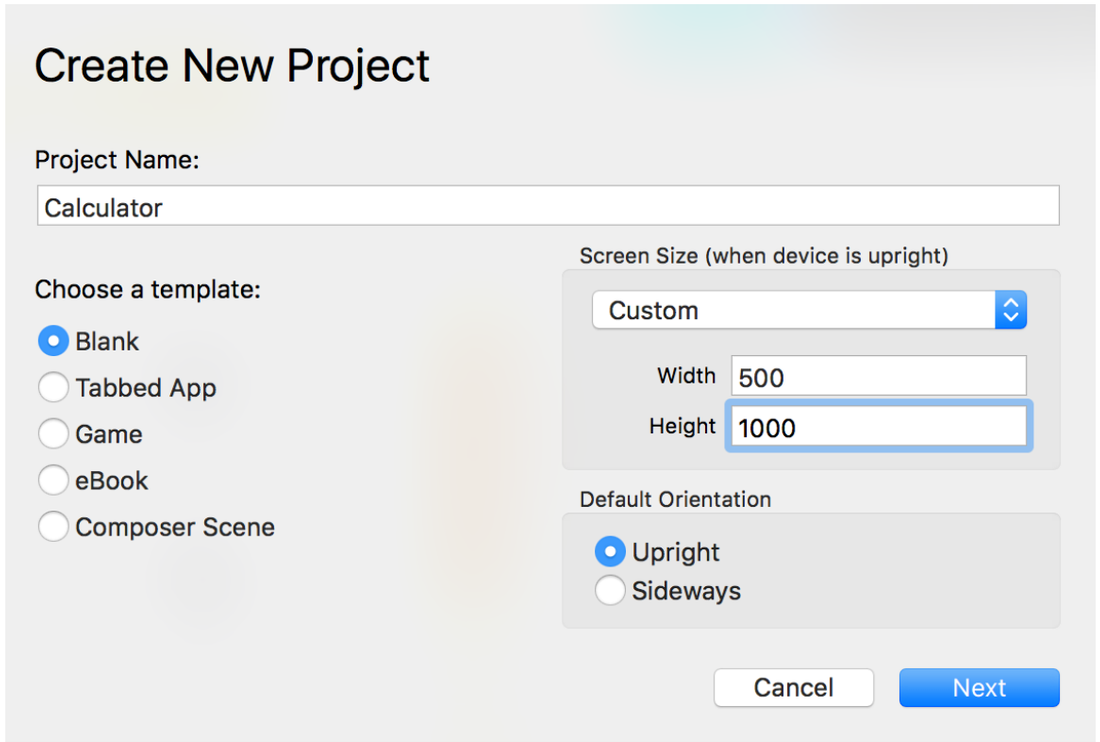
Warm up

Project 00:
Run a sample program using Corona

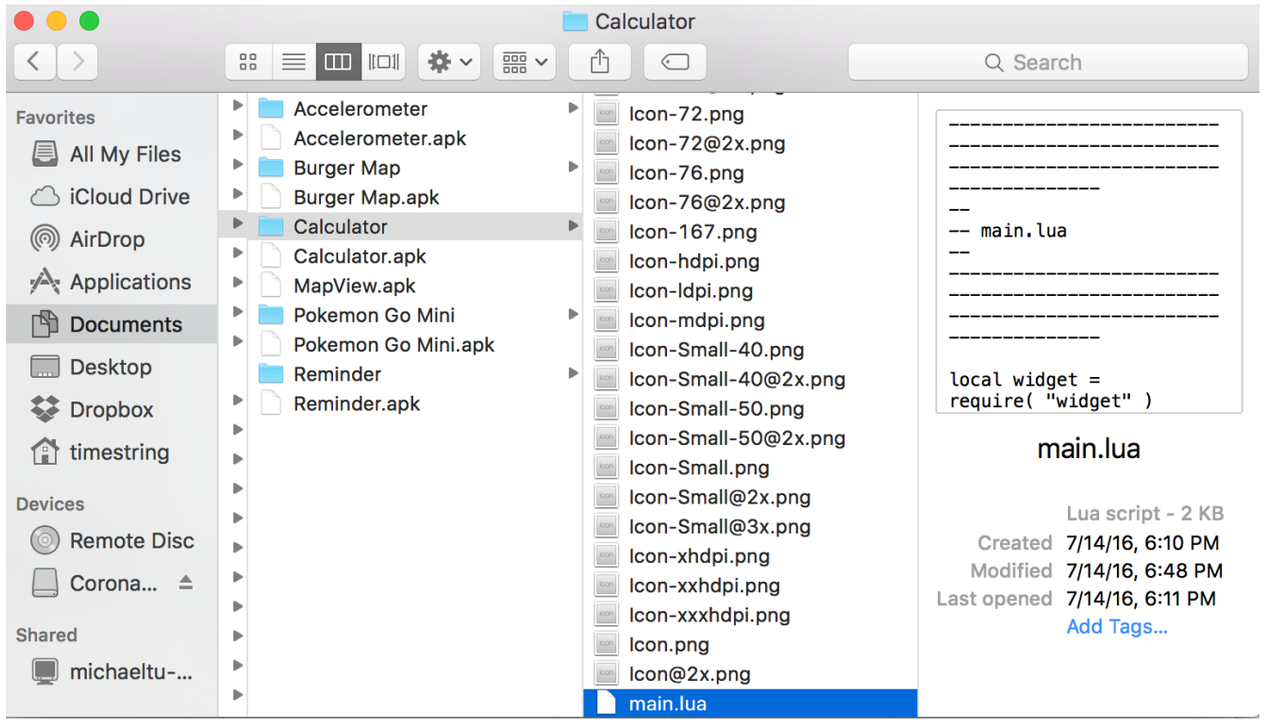
- Checkpoint 1: Be able to open Corona SDK
- Checkpoint 2: Build the app
- Checkpoint 3: Run the app on a phone

Project 00:
Run a Sample Program with Corona

- Step 1: Create a new project



- Step 2: Open main.lua in your editor



Introduction to Lua - general conventions

- Tip 1: Use variables
  - When the variable first time appear in your code, put keyword `local` in front of it (Don't ask!)
  - A variable can be a number, a boolean, a string a function, a table (?!)
  - Examples:

```lua
local a = 34
local b = "This is a string"
local c = true

local d = function(arg1, arg2)
    return arg1 + arg2
end

local e = {1, 2, "three", 4.1}
```

- Tip 2: Don't use **reserved** keywords as variable names!

and	break	do	else	elseif	end	false
for	function	if	in	local	nil	not
or	repeat	return	then	true	until	while

Can you tell me more about a table?

```lua
local d = {1, 2, "three", 4.0}
```

is equivalent to

```lua
local d = {}
d[1] = 1
d[2] = 2
d[3] = "three"
d[4] = 4.0
```

Field (index)	Value
1	1
2	2
3	three
4	4.0

- The field can be a string, too

```lua
local d = {}
d.name = "Bo-Jhang"
d.occupation = "Student"
d.city = "Los Angeles"
```

=

```lua
local d = {}
d["name"]  = "Bo-Jhang"
d["occupation"] = "Student"
d.city = "Los Angeles"
```

=

Field	Value
name	Bo-Jhang
occupation	Student
city	Los Angeles

Expressions

- Tip 3: Use arithmetic operators

```lua
local a = 34
local b = 1.5 * 2.0
local c = (a + 6) * b
print(c)
```

```
+   (addition)          -   (subtraction)
*   (multiplication)    /   (division)
%   (modulo)            ^   (exponentiation)
```

- Tip 4: Relational operators

```lua
if a > 20 then
    print("apple")
end
```

```lua
if a < 20 then
    print("Bulbasour")
else
    print("Ivysaur")
end
```

```lua
if a < 20 then
    print("Eevee")
elseif a < 30 then
    print("Vaporeon")
elseif a < 40 then
    print("Jolteon")
else
    print("Flareon")
end
```

```
==   (equal to)
~=   (not equal to)
<    (less than)
>    (greater than)
<=   (less than or equal to)
>=   (greater than or equal to)
```

- Tip 4.2: Logical Operators - `and`, `or`, `not`

```lua
if a < 20 or b < 4 then
    print("Delta Airline")
elseif a > 20 and b < 6 then
    print("Virgin America")
end
```

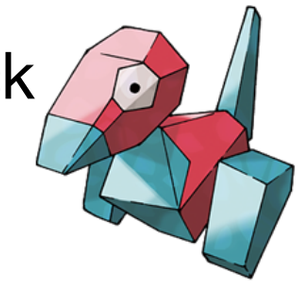
Expressions

- Tip 5: String concatenation

```
local a = "one"
local b = "two"
local c = a .. b
local d = 10
local e = c .. d
```

one
two
onetwo
10
onetwo10

Two dots do the trick



- Tip 6: Repetition - using loops
  - Two versions, don’t get confused

Start End

```
for i = 1, 10 do
    print(i)
end
```

I get 10 numbers:
1, 2, 3, 4, 5, 6, 7, 8, 9, 10

Start End End

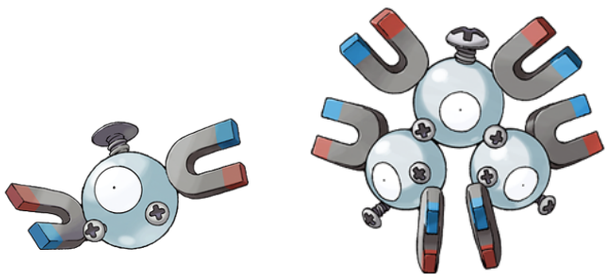
```
for i = 1, 10, 3 do
    print(i)
end
```

I get 4 numbers:
1, 4, 7, 10

Accessing attributes of objects

- Tip 7: Sometimes it’s a dot, sometimes it’s a colon!
  - If you want to become a master in this class, don’t question!

```
local textMorePoke = display.newText("")
textMorePoke.x = 420
textMorePoke.y = 980
textMorePoke:setFillColor(0, 0, 0)
```



- Tip 8: See sample codes
- Tip 9: Be confident! Ask the Instructor and TAs!
  - Search on Google, copy and paste, modify

Project 00:
Run a Sample Program with Corona

- Step 3: Always put this in the beginning of your code

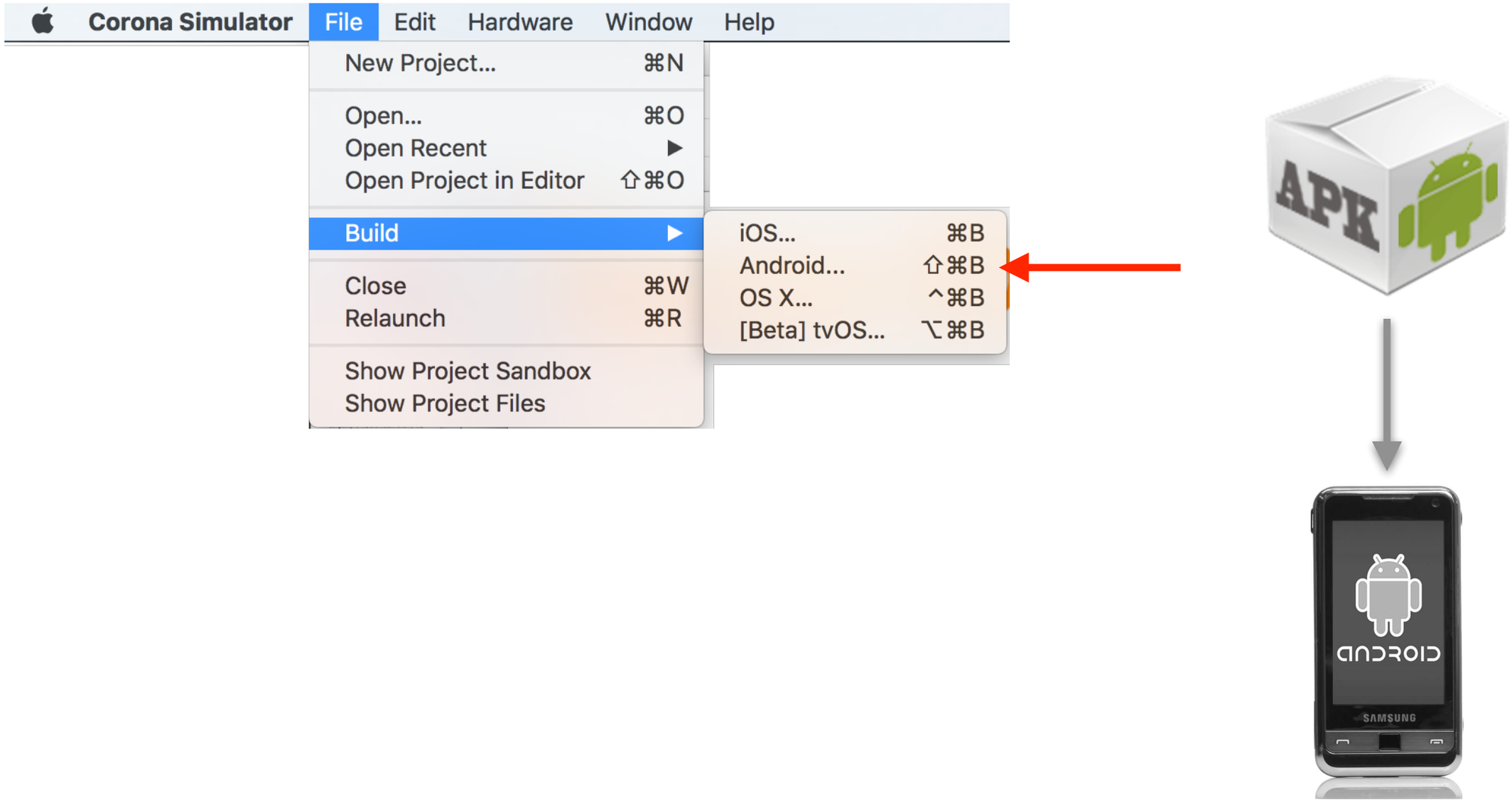
```
local widget = require( "widget" )
```

- Step 4: Say “Hello” to the world

```
local helloWorld = display.newText("HelloWorld", display.contentCenterX, display.contentCenterY, native.systemFont, 32)
```

Project 00:
Run a Sample Program with Corona

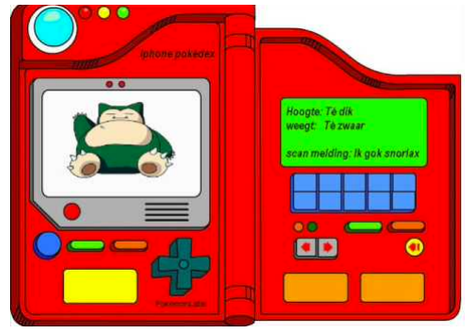
- Step 5: Build the app

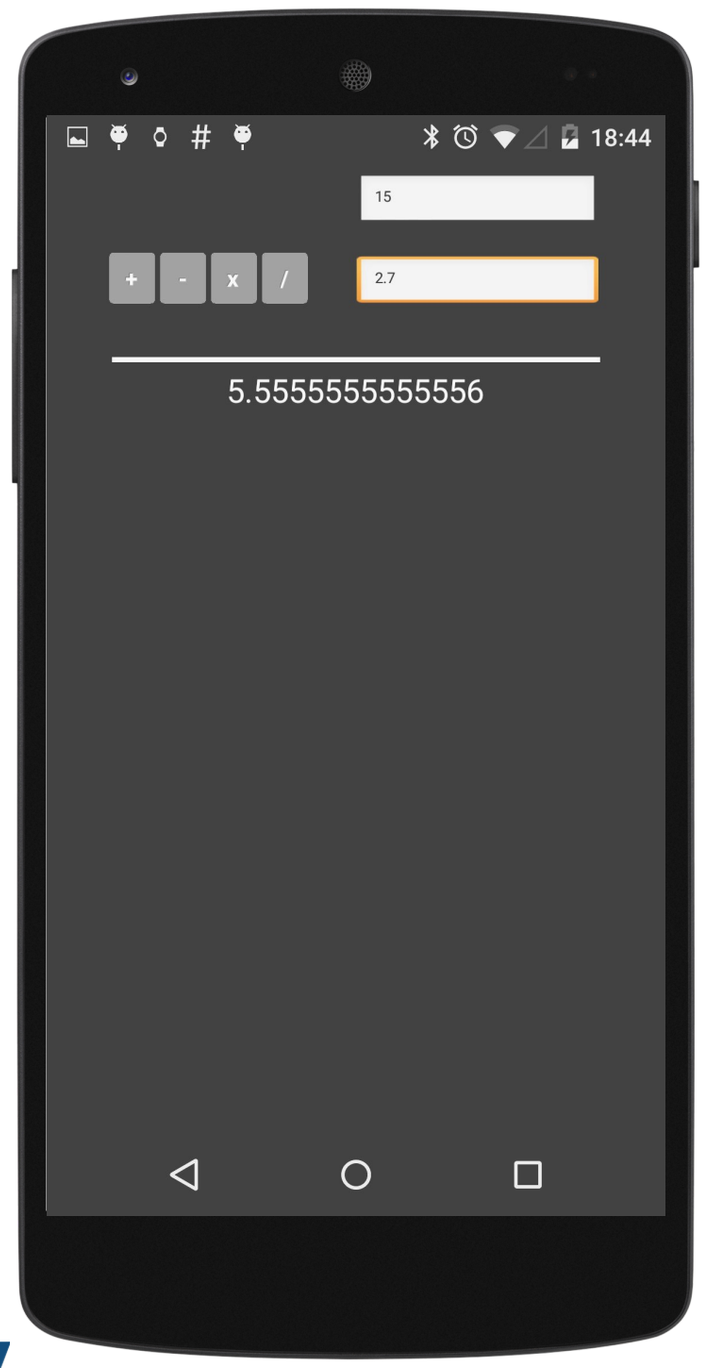


Episode 1 - Pokedex

Calculator App

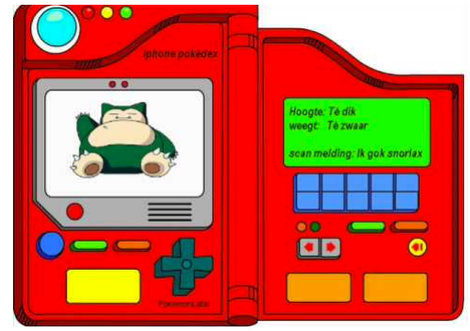
Project 01: Calculator App



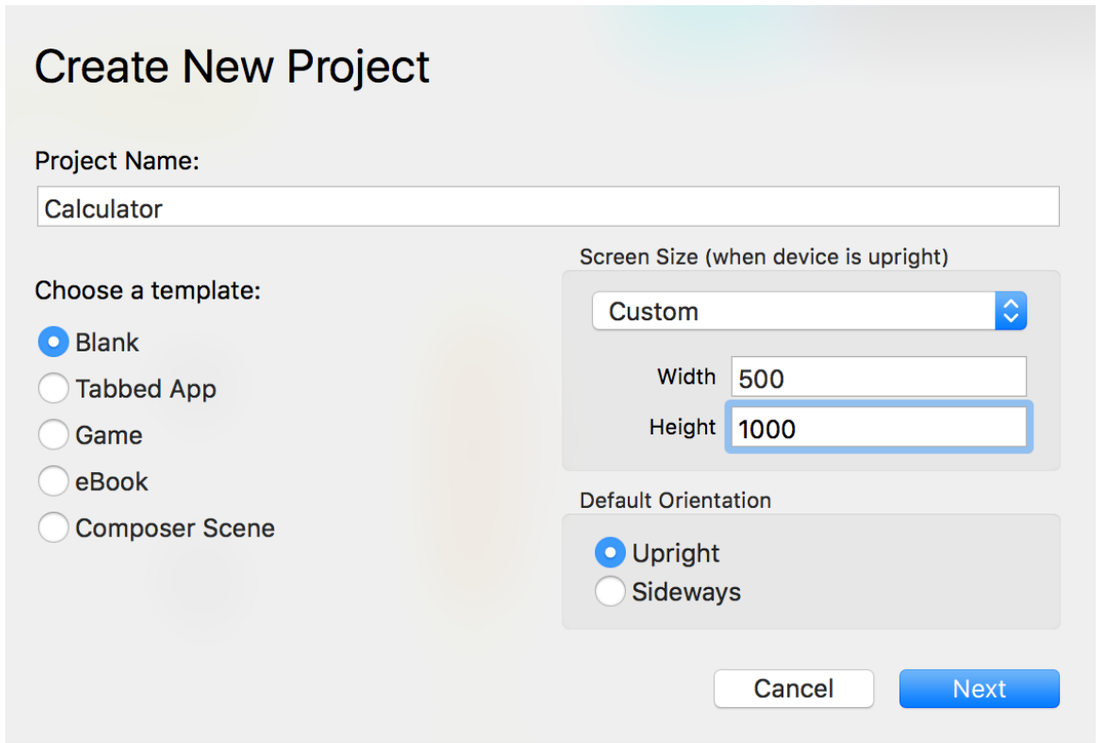


- Two blanks for users to enter numbers
- Arithmetic buttons
- Give results

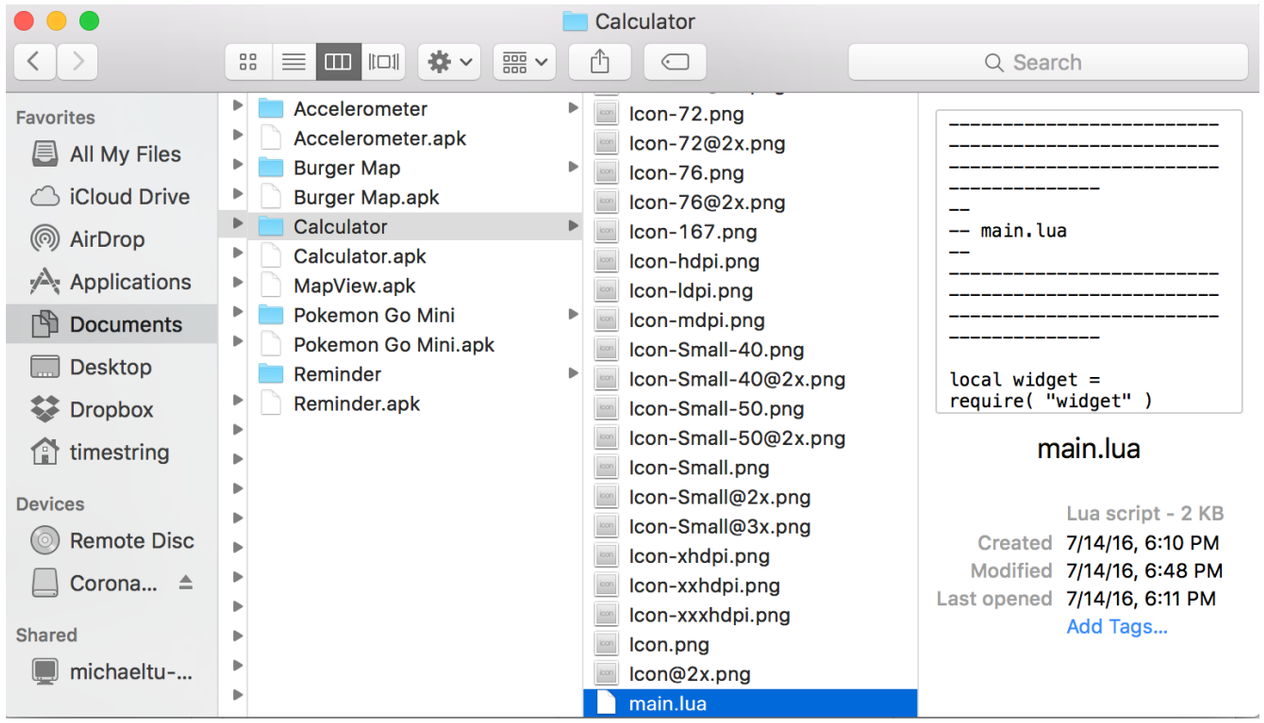
Project 01: Calculator App



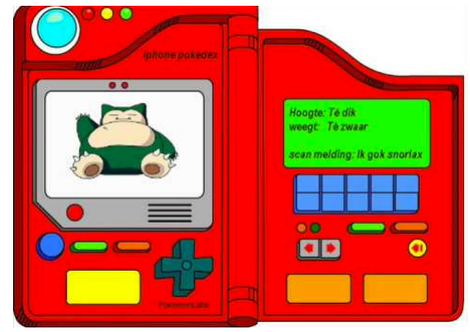
- Step 1: Create a new project



- Step 2: Open main.lua in your editor



Project 01: Calculator App



- Step 3: Always put this in the beginning of your code

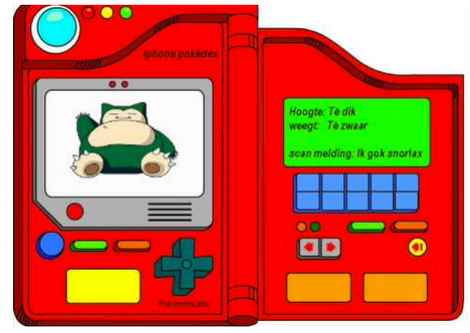
```
local widget = require( "widget" )
```

- Step 4: Put a text input on the screen

```
local input1 = native.newTextField( 370, 80, 230, 40 )
```

center x, center y, width, height

Project 01: Calculator App



- (Optional) Step 5: Put a flat rectangle as a line

center x, center y, width, height

```
local flatRect = display.newRect(250, 240, 480, 5)
flatRect:setFillColor(1, 1, 1)
```

r, g, b

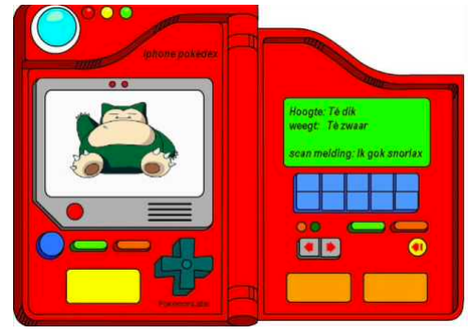
- Step 6: Put a text field to show the answer

default content, width, height, font, font size

```
local textAnswer = display.newText("???", 450, 40, native.systemFont, 32)
textAnswer.x = 250
textAnswer.y = 270
```

Remember it's center-x and center-y

Project 01: Calculator App



- Step 7.**2**: Make a button

```
local button1 = widget.newButton
{
    label = "+",
    shape = "roundedRect",
    fillColor =
    {
        default = {0.5, 0.5, 0.5},
        over = {0.6, 0.6, 0.6},
    },
    labelColor =
    {
        default = {1, 1, 1},
    },
    fontSize = 22,
    font = native.SystemFont,
    onRelease = addHandler,
    width = 45,
}

button1.x = 30
button1.y = 160
```

It's called a ***callback***, which gives us an opportunity to specify the action when button is pressed (released)

We haven't seen the variable `addHandler` before, that's why we are one step ahead

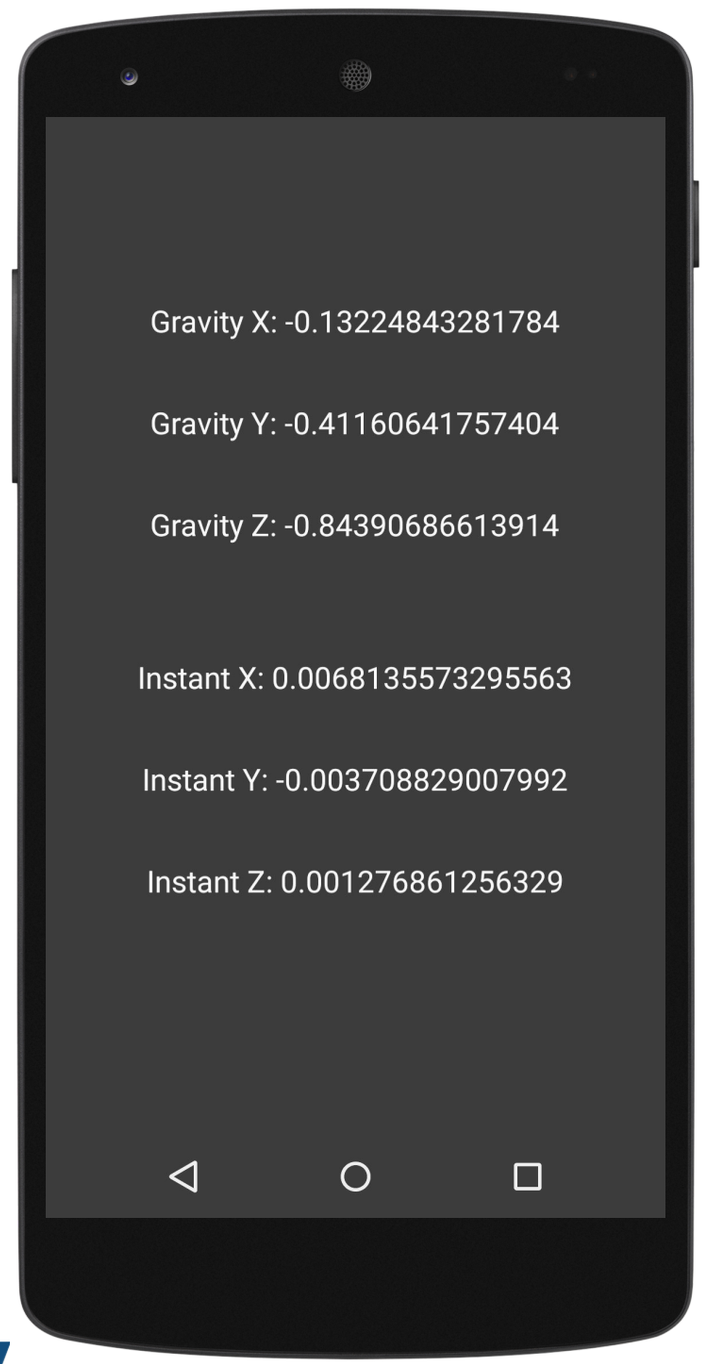
- Step 7: Specify the action when the button is clicked

```
local addHandler = function(event)
    textAnswer.text = input1.text + input2.text
end
```

Episode 2 - How to Capture a Pokemon?

Accelerometer App

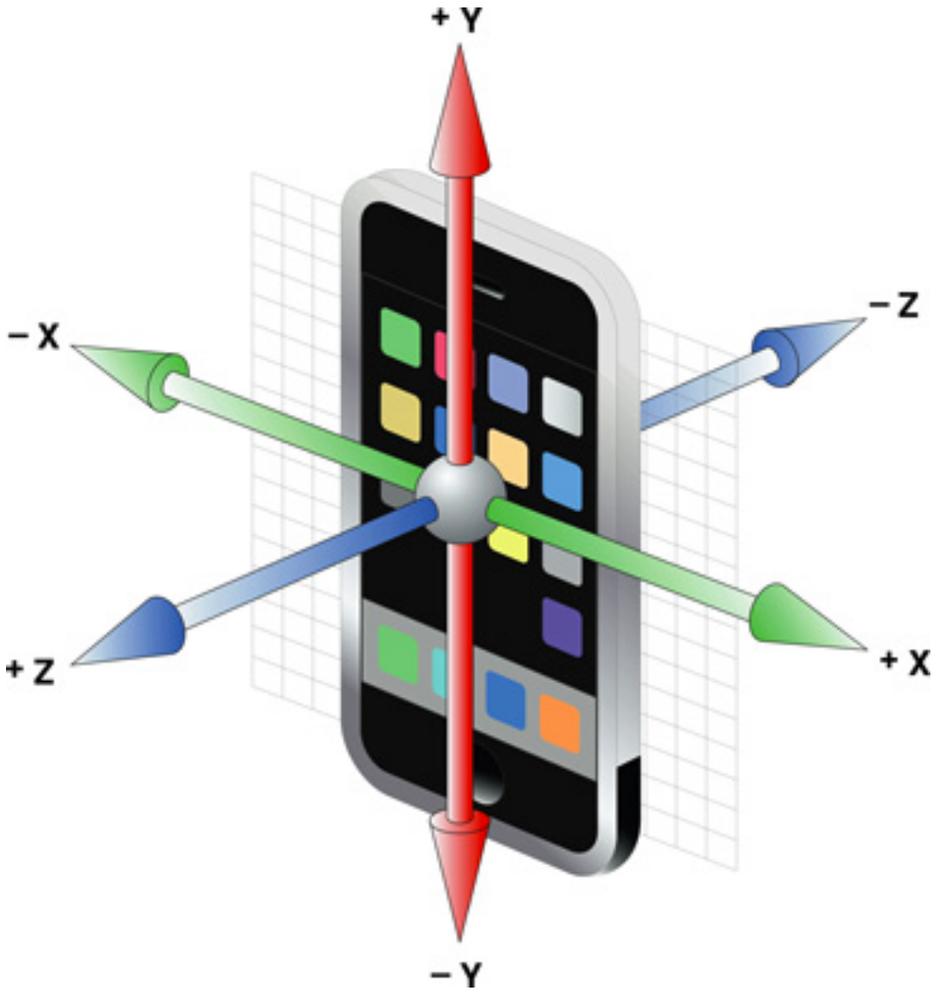
Project 02: Accelerometer App

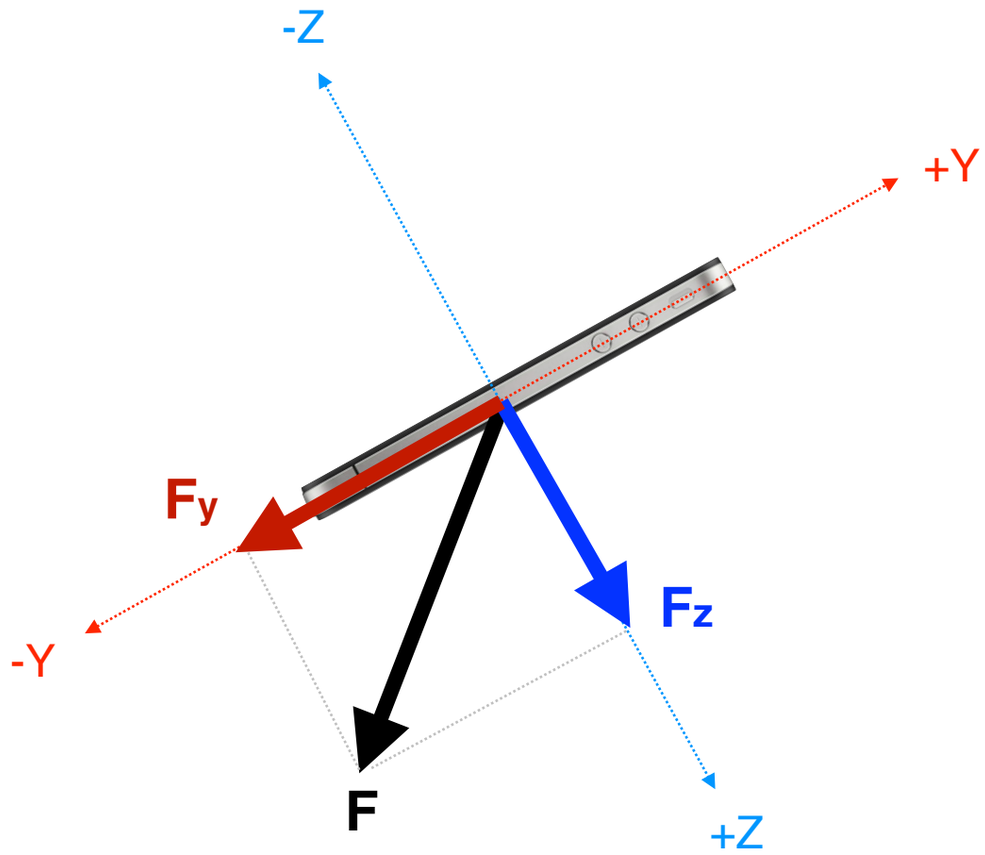


- Read values from accelerometer sensor
- Get gravity X, Y, Z and instant force X, Y, Z

Intro of accelerometer

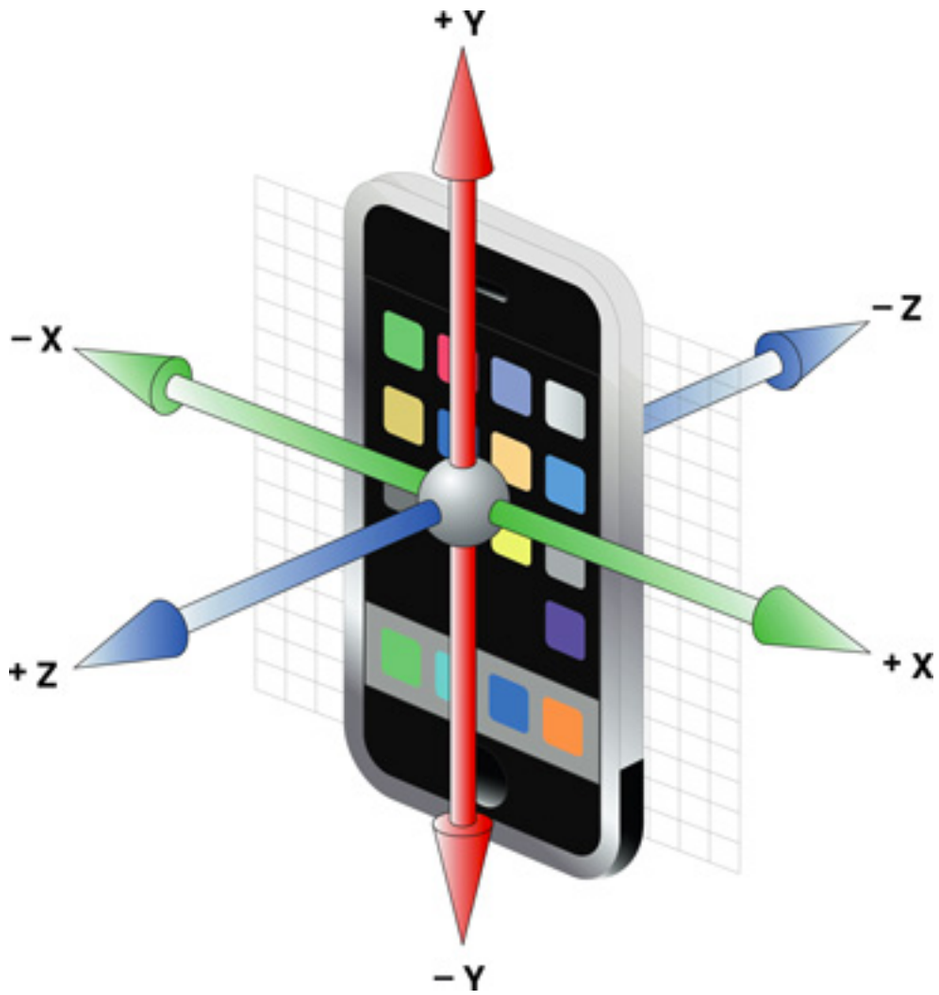
- Newton's First Law: F = m * ***a***



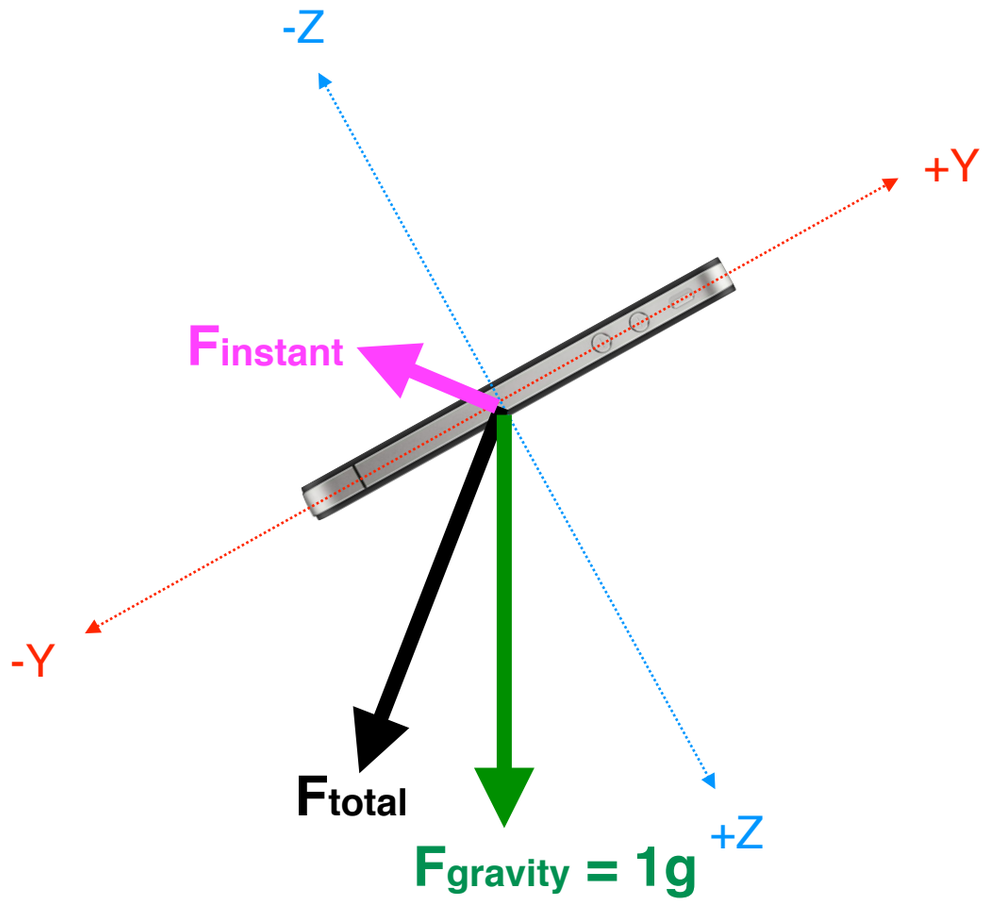


Intro of accelerometer

- Newton's First Law: F = m * ***a***

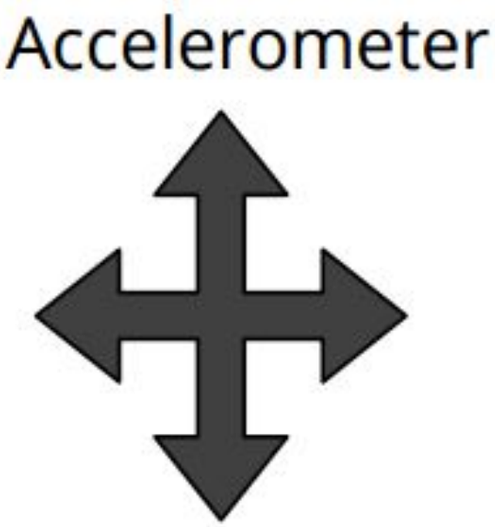


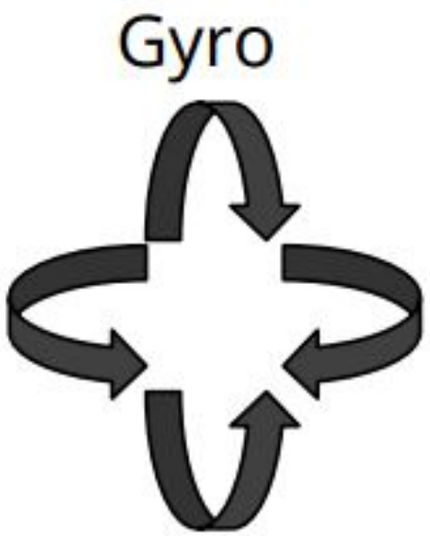
- Corona further helps us decompose to gravity and instant vector



More sensors

- There are more hardware in phones, but we don’t have time to explore them





Project 02: Accelerometer App

- Step 1: Get the UI done
- Step 2.**2**: Request accelerometer service

sampling rate in hertz

```
system.setAccelerometerInterval(60)

Runtime:addEventListener("accelerometer", onAccelerate)
```

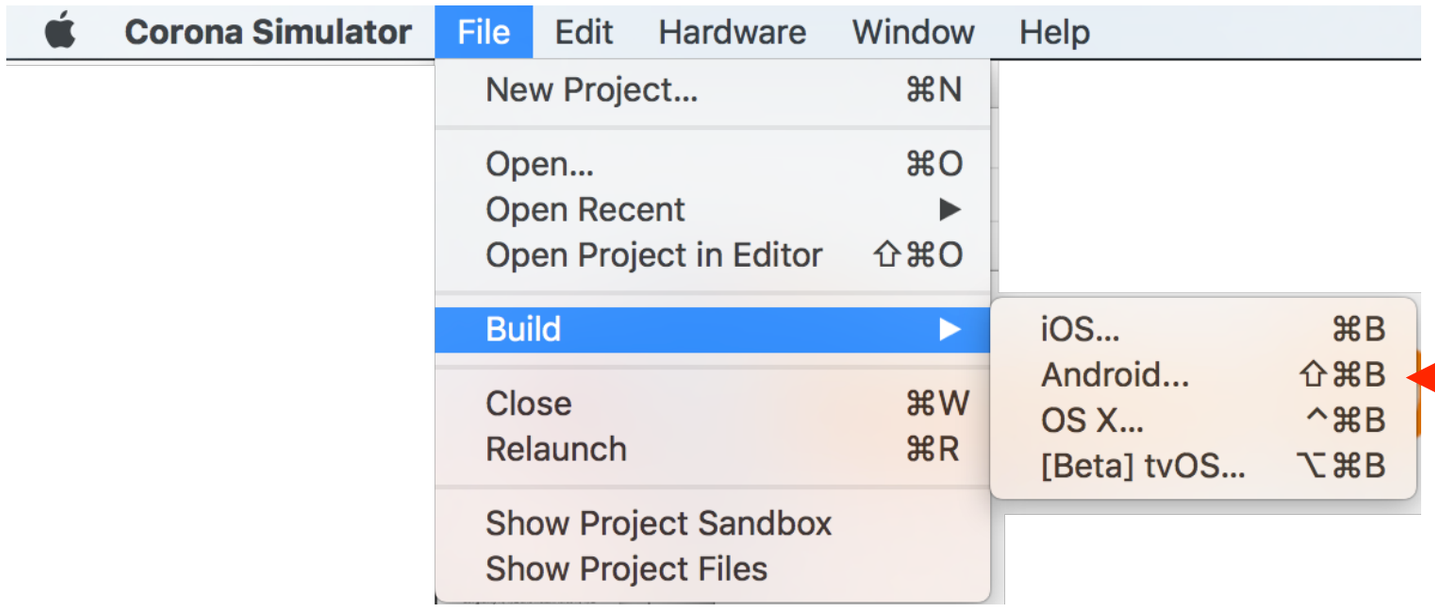
- Step 2: What are we going to do when getting an pack of accelerometer values? Show them!

```
local onAccelerate = function(event)
    textGravX.text = "Gravity X: " .. event.xGravity
    textGravY.text = "Gravity Y: " .. event.yGravity
    textGravZ.text = "Gravity Z: " .. event.zGravity
    textInstantX.text = "Instant X: " .. event.xInstant
    textInstantY.text = "Instant Y: " .. event.yInstant
    textInstantZ.text = "Instant Z: " .. event.zInstant



end
```

Why leaving so much space?

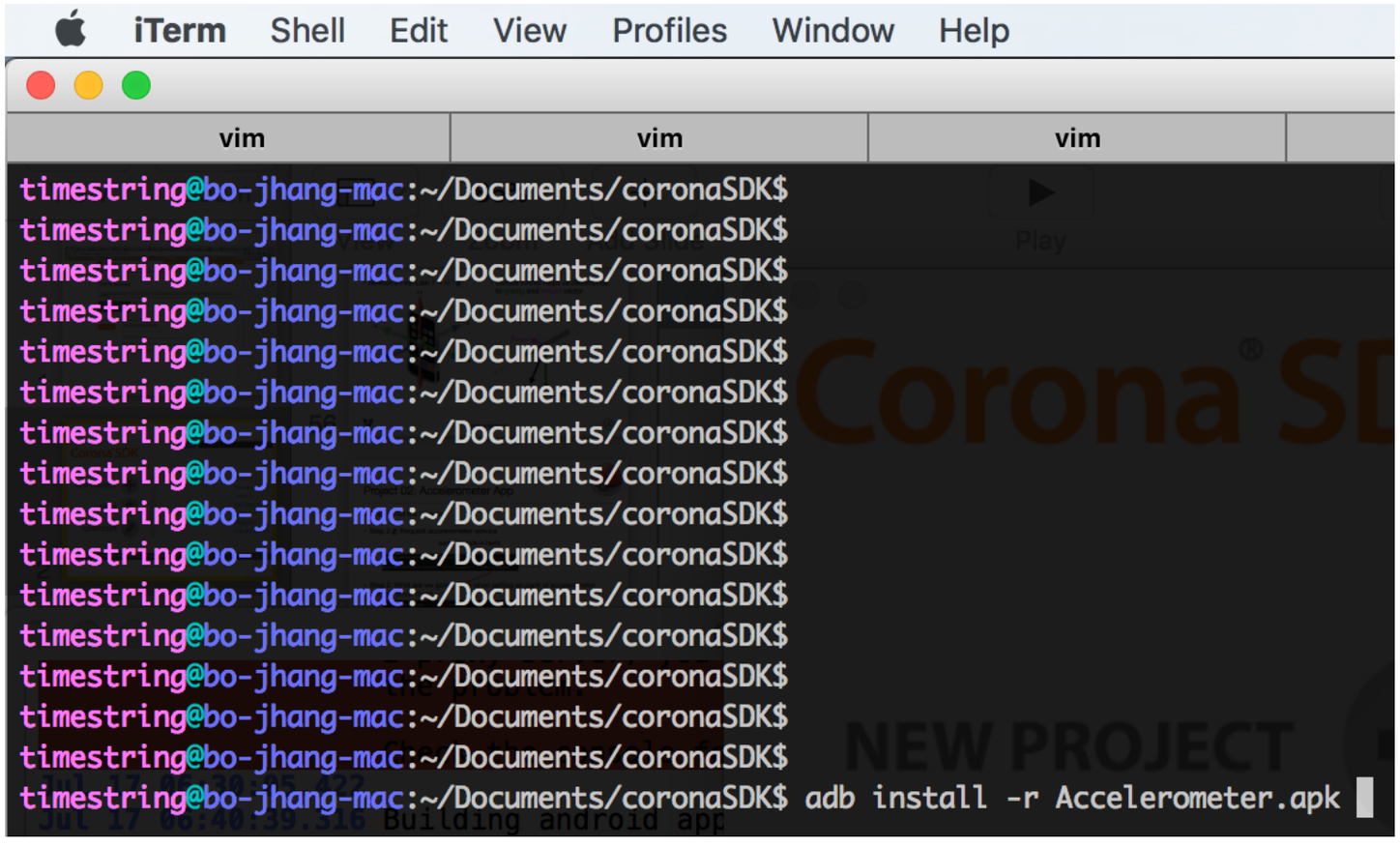
Project 02: Accelerometer App

- Step 3: Build the app



Project 02: Accelerometer App

- Step 4: Upload to the mobile phone
  - Connect your computer to the phone
  - Open your terminal
    (in Windows, it's called *command prompt* or *cmd*)



Project 02: Accelerometer App

- Secret step: Shaking detection! (shhhhh)

```
local onAccelerate = function(event)
    textGravX.text = "Gravity X: " .. event.xGravity
    textGravY.text = "Gravity Y: " .. event.yGravity
    textGravZ.text = "Gravity Z: " .. event.zGravity
    textInstantX.text = "Instant X: " .. event.xInstant
    textInstantY.text = "Instant Y: " .. event.yInstant
    textInstantZ.text = "Instant Z: " .. event.zInstant
    if event.isShake == true then
        toggleColor()
    end
end
```

Project 02: Accelerometer App

Episode 3 - I will Come Back!

Reminder App

Project 03: Reminder App

- A reminder app which for users to take notes
- Support save/load function
- File reading/writing

Project 03: Reminder App

- Step 1: UI. Since we need to let user enter multiple lines, we have to use `newTextBox`.

center x, center y, width, height

```
input = native.newTextBox( 250, 280, 480, 480 )
input.isEditable = true
```

Project 03: Reminder App

- Step 2: Specify the file name.

file name

```lua
local filePath = system.pathForFile("data.txt", system.DocumentsDirectory)
```

Follow me and don't worry about it

- Step 2.1: Read the file

```lua
local file = io.open(filePath, "r")
if file then
    local content = file:read("*a")
    io.close(file)
    input.text = content
end
```

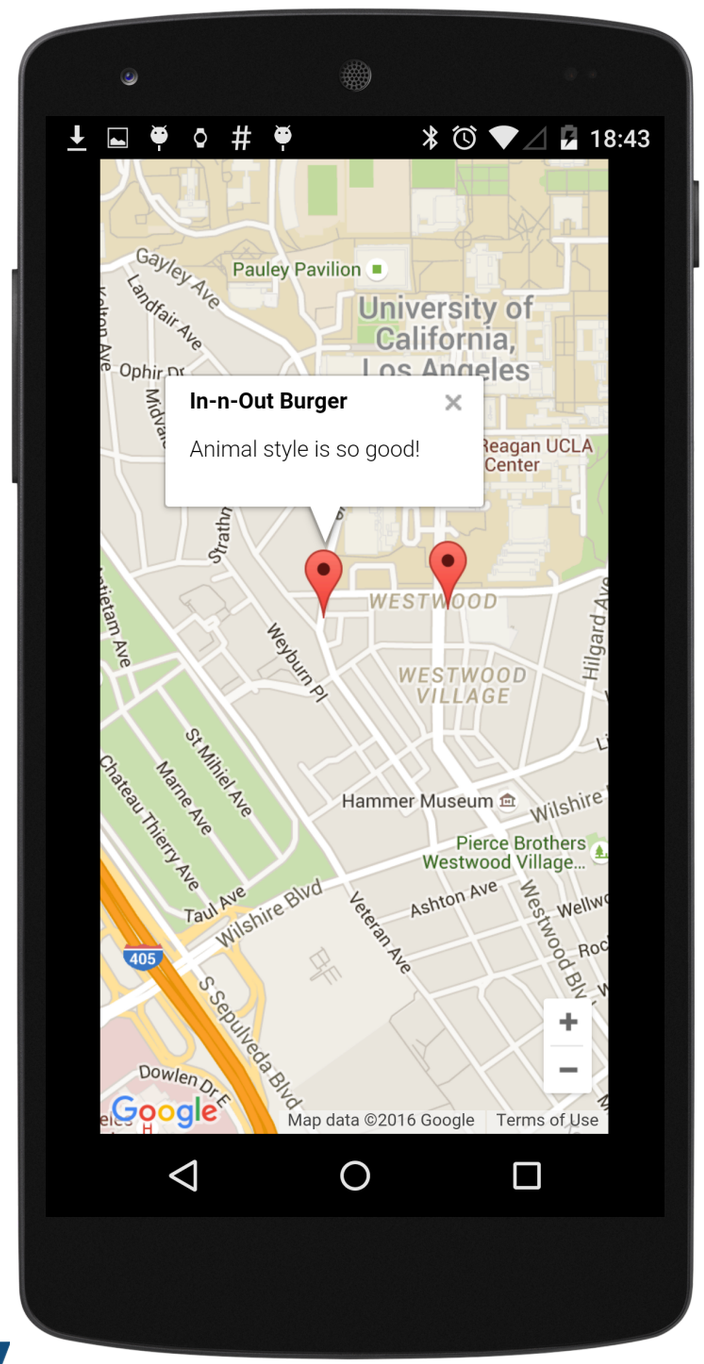
- Step 2.2: Write the file

```lua
local file = io.open(filePath, "w")
if file then
  ???
end
```

Episode 4 -
Battle, I’m the Master!

Burger Map App

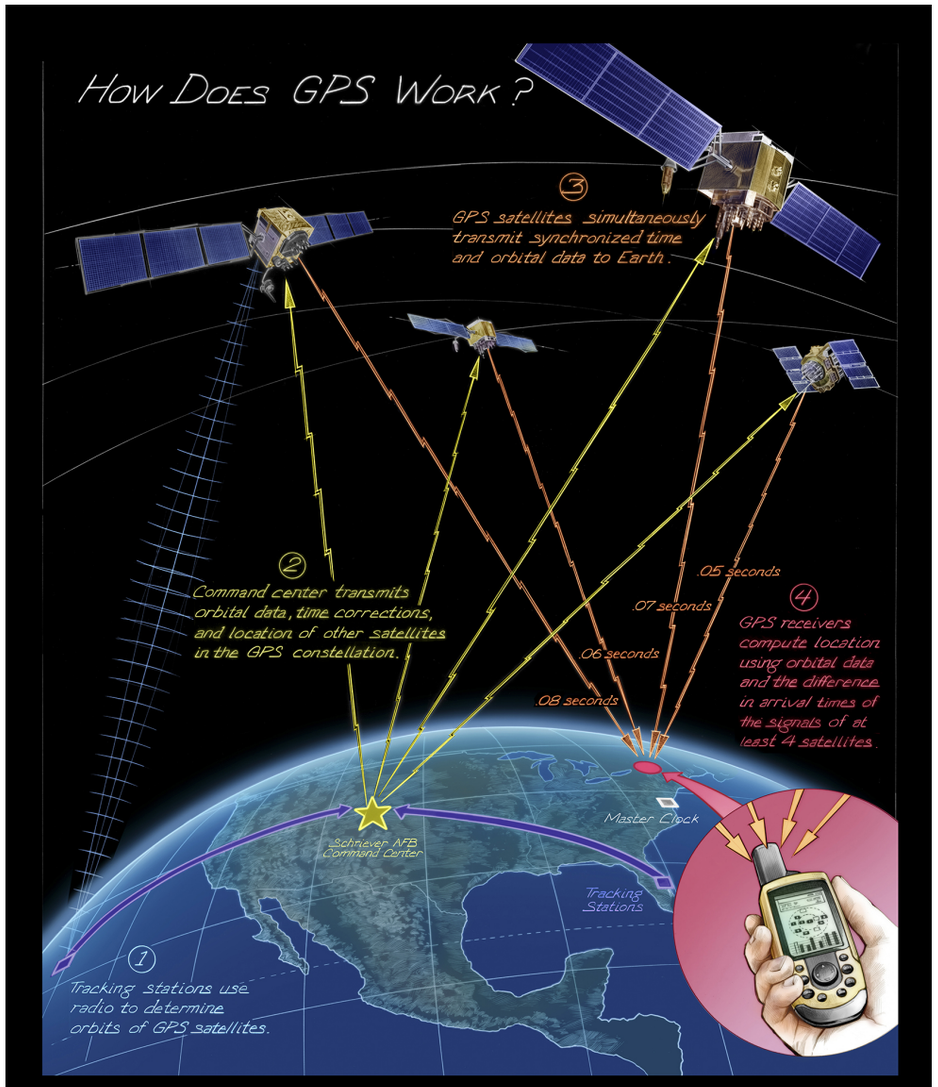
Project 04: Burger Map App



- Create a map app and select two places you want to introduce

Project 04: Burger Map App

- How do we get location? GPS! (Global Positioning System)
- The issue is that GPS is unavailable indoor
- People usually forget that WiFi plays an important role in indoor positioning



Project 04: Burger Map App

- Step 1: Open your browser and go to Google Maps, choose two places, remember their *latitude* and *longitude*
- Step 2: Create a map view

```
-- maps
local myMap = native.newMapView( 250, 500, 500, 1000 )









if myMap then
    myMap.mapType = "normal"

    -- need to delay for a while so that poke can appear after the map is ready
    timer.performWithDelay( 5000, mapmarker )
end
```

Project 04: Burger Map App

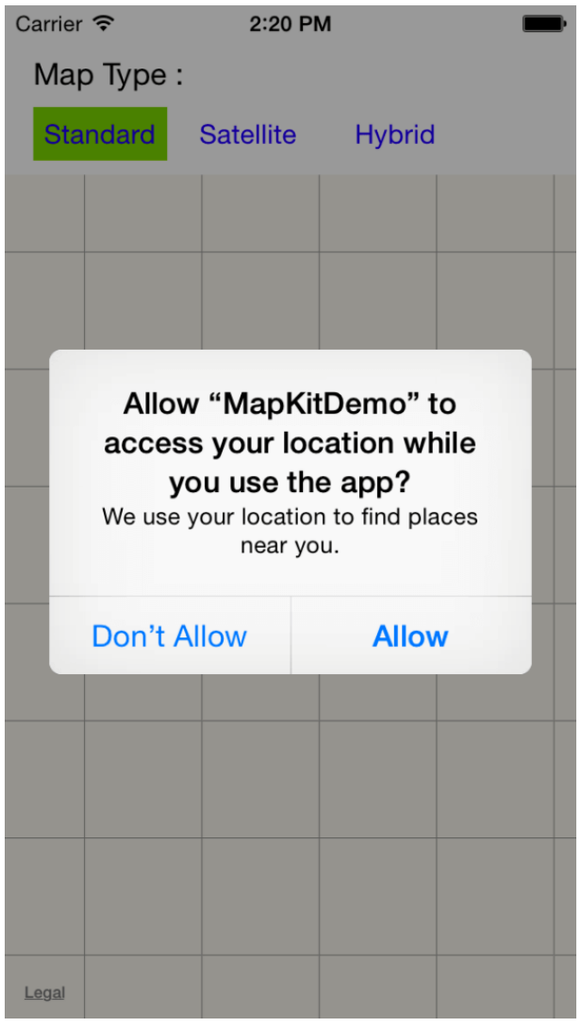
- Step 3: Put markers

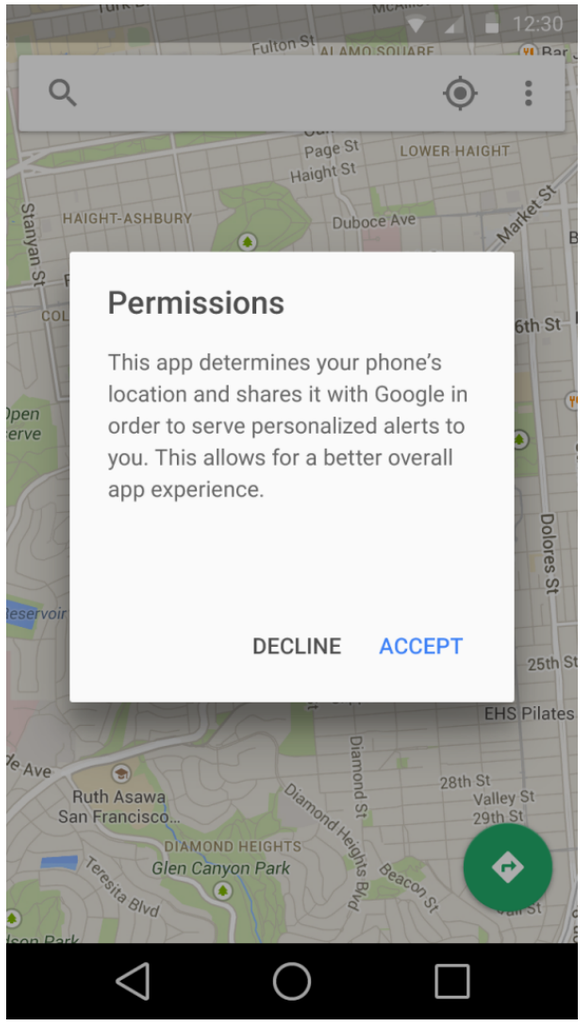
Note: Make sure your phone is connected to WiFI

```
-- maps
local myMap = native.newMapView( 250, 500, 500, 1000 )

local function mapmarker( event )
    local opt1 =
    {
        title = "Chick-fil-A",
        subtitle = "Discount in Monday evening",
    }
    myMap:addMarker(34.063327, -118.445130, opt1 )
end

if myMap then
    myMap.mapType = "normal"

    -- need to delay for a while so that poke can appear after the map is ready
    timer.performWithDelay( 5000, mapmarker )
end
```

Project 04: Burger Map App

- Step 4: Show my location on the map
  - Location is a sensitive information, both Android and iOS require developers to ask for user permissions





Project 04: Burger Map App

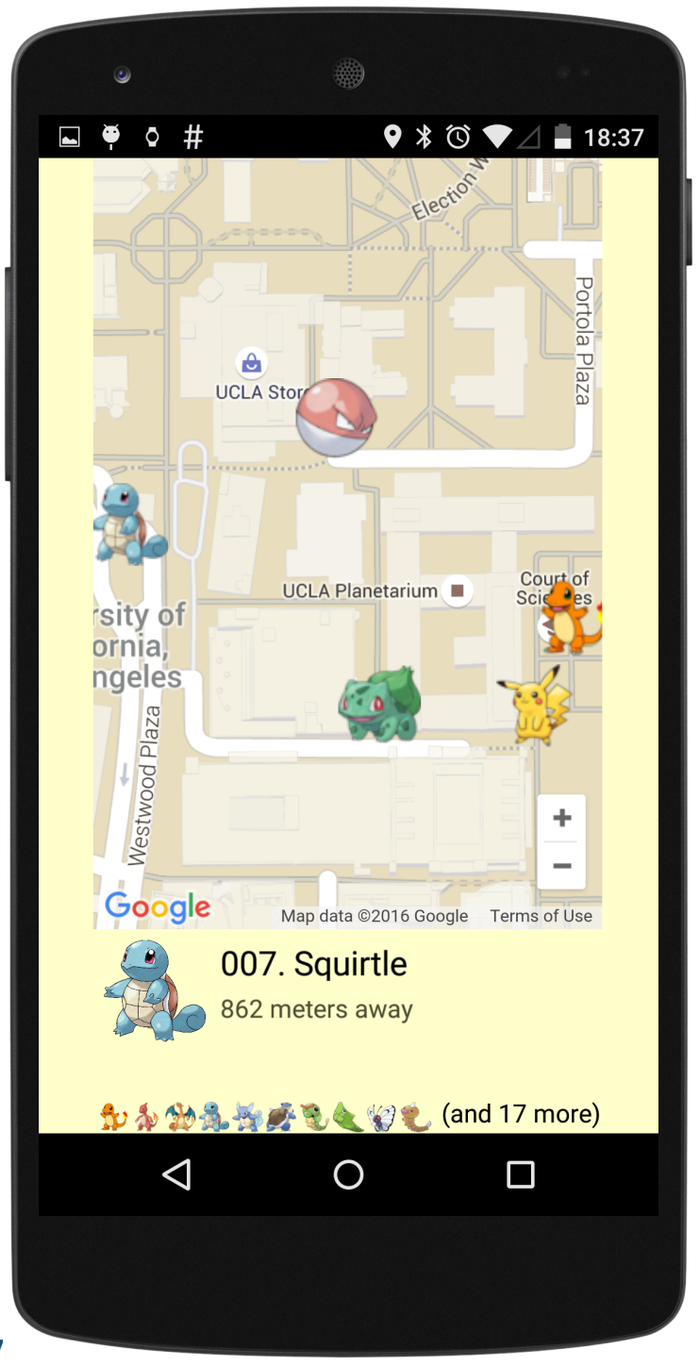
- Step 4: Show my location on the map
  - Location is a sensitive information, both Android and iOS require developers to ask for user permissions
  - Declare location permission in `build.settings`
    - Open `build.settings` in your editor and add the following block

```
--
-- Android Section
--
android =
{
    usesPermissions =
    {
        "android.permission.INTERNET",
        -- Optional permission used to display current location via the GPS.
        "android.permission.ACCESS_FINE_LOCATION",

        -- Optional permission used to display current location via WiFi or cellular service.
        "android.permission.ACCESS_COARSE_LOCATION",
    },
},
```

Episode 5 - The Unknown Rival

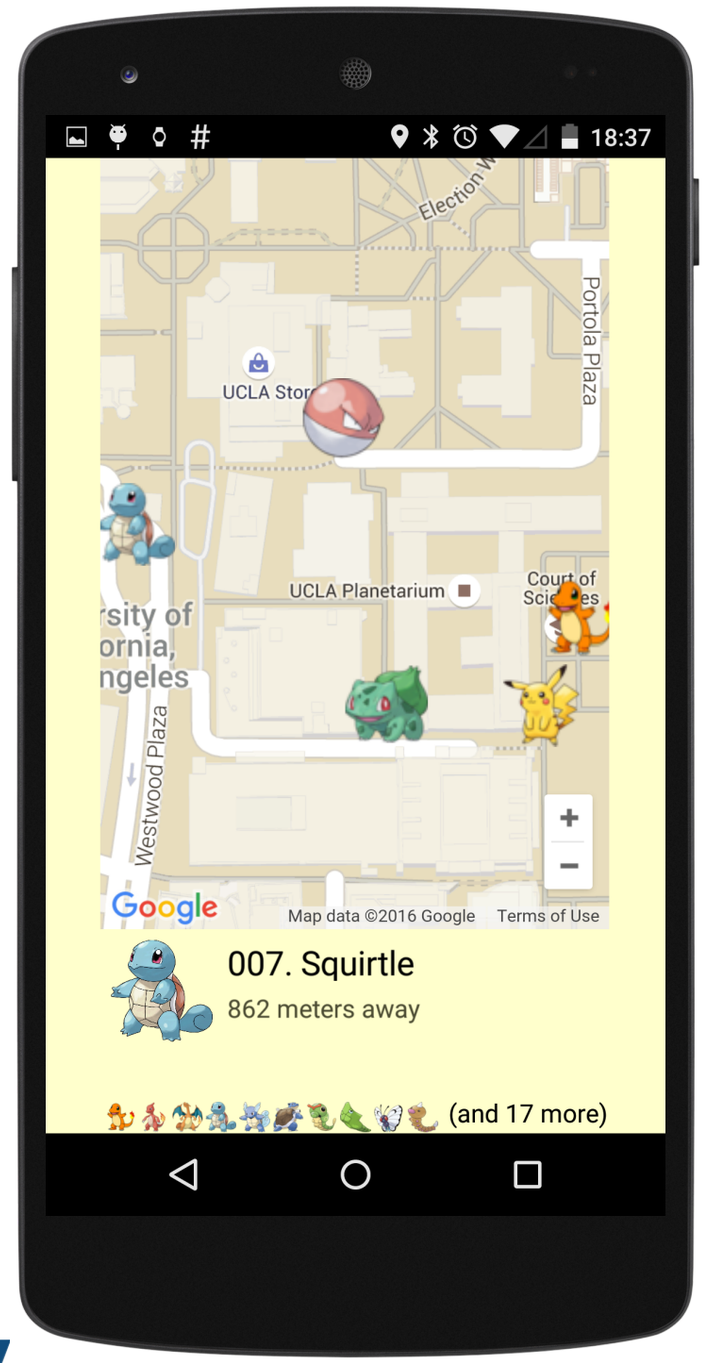
Pokemon Go Mini

Project 05: Pokemon Go Mini



- Basic requirements
  - A map to show locations of Pokemon and yourself
  - Show distance between you and the nearest Pokemon
  - Detect Poke ball throwing action by using accelerometer

Project 05: Pokemon Go Mini



- Extra: Now it's your time to be creative!
  - Show different Pokemon at different locations every time
  - The app can automatically save the progress
  - Make a story for your app
  - Sound? Animation?
  - …

Project 05: Pokemon Go Mini

- Step ?: Put images on a map

```
local opt1 =
{
    imageFile = "image.png"
}
myMap:addMarker(34.063327, -118.445130, opt1 )
```

Homework submission

- Create a folder called `FirstName_LastName_Module3`
  - Inside, there should be 5 folders: `project1`, `project2`, ..., `project5`
- Compress the outside folder and submit to the dropbox link (to be appeared)
- (Optional) A report to show your “selling points” of your projects, itemize them, each project no more than 5 items

Research topics

- What is rooting an Android phone? Why do you need it? How do you do it?
- Augmented reality and Google Cardboard
- Google glass - why and why not?
- Smart watch and fitness trackers
- Different radios on a smartphone: Wifi, LTE/4G, Bluetooth, NFC, etc.
- Integrated Development Environment (IDE): Eclipse ADT vs Android Studio
- Extending battery life and Android WakeLock

Send any question to
garcialuis@ucla.edu