



Waterford Institute *of* Technology

INSTITIÚID TEICNEOLAÍOCHTA PHORT LÁIRGE

## Android Programming with Kotlin



OSTBAYERISCHE  
TECHNISCHE HOCHSCHULE  
REGENSBURG

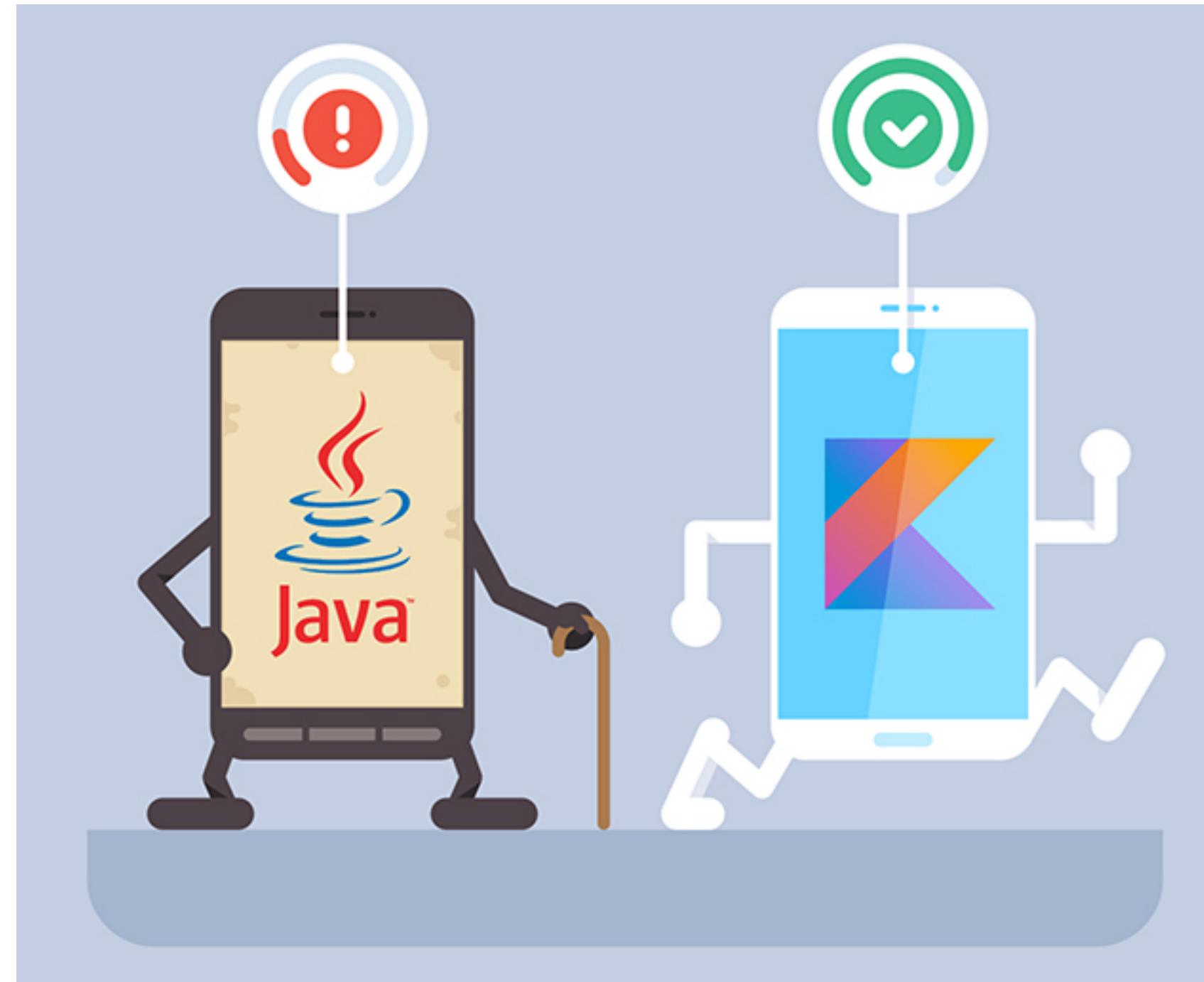


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# 2018

## Android Programming with Kotlin

Course Mission: *Accelerate into Android App development leveraging the power & expressiveness of Kotlin*



## 00: Overview

Module Overview

## 01: Activities

Kotlin Context

Evolution

Convergence

Android Activities

Android: Foundation

Lab-01 Activities

## Adapters

Kotlin Fundamentals

Kotlin Structure

Basic Syntax

Kotlin Deep Dive

Android Adapters

Android Application Object

Recycler View + Adapters

Lab-02 Adapters

## 03: Models

Kotlin Idioms

Idioms

J2K Variables & Expressions

Android Models

Toolbar

Memory Store

Adapter + Listener

Parcelable

Lab-03 Models

## 04: Images

Kotlin Deep Dive

Types

J2K Collections

Images

Resources

Model Updates

Images

Lab-04 Images

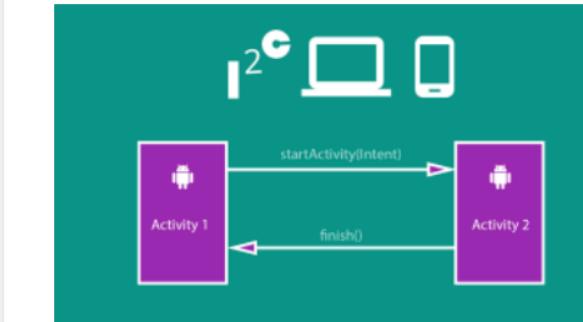
## 05: Maps

# Android Programming with Kotlin

Eamonn de Leastar, WIT

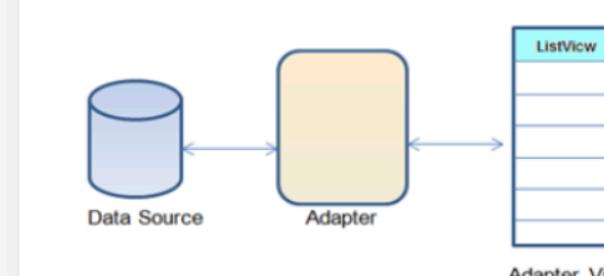


## 01: Activities



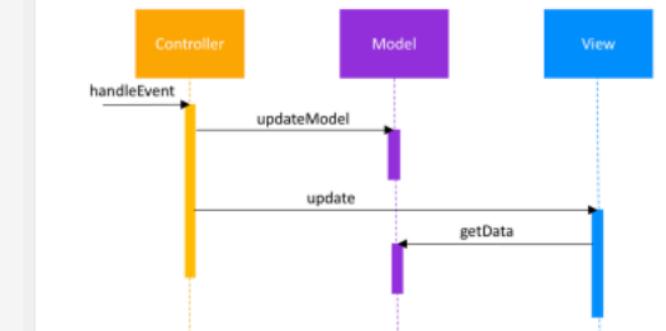
Trace the influences on the Kotlin Programming language. Create and explore a starter Kotlin Android application in detail.

## Adapters



Look at Kotlin in more depth. Deep dive into some of its features. Extend the app to manage lists of placemarks using the adapter pattern.

## 03: Models



Examine key Kotlin Idioms. Start comparing simple Java & Kotlin statements. Introduce a more complete model into Placemark.

## 05: Maps



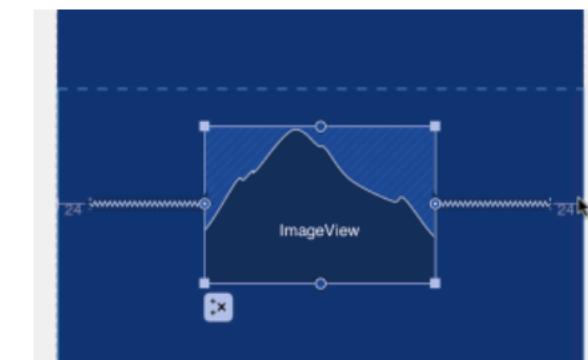
Review Kotlin Packages + Control flow. Introducing Google Maps into and android app.

## 06: Persistence



Kotlin Classes, inheritance, interfaces. Properties & fields. New Placemark Store class to save placemarks to the file system.

## 07: Layouts



Kotlin Data classes, sealed classes & extensions. Objects & Delegation. Include a Map widget onto an activity. Manage the map markers.

*“Building Android applications is both exciting and challenging. The diversity of the applications one can build is fascinating, however their complexity can be overwhelming. Kotlin, a new language fully supported by google, dramatically enhances the power and simplicity of the programmers task.”*



Kotlin is:

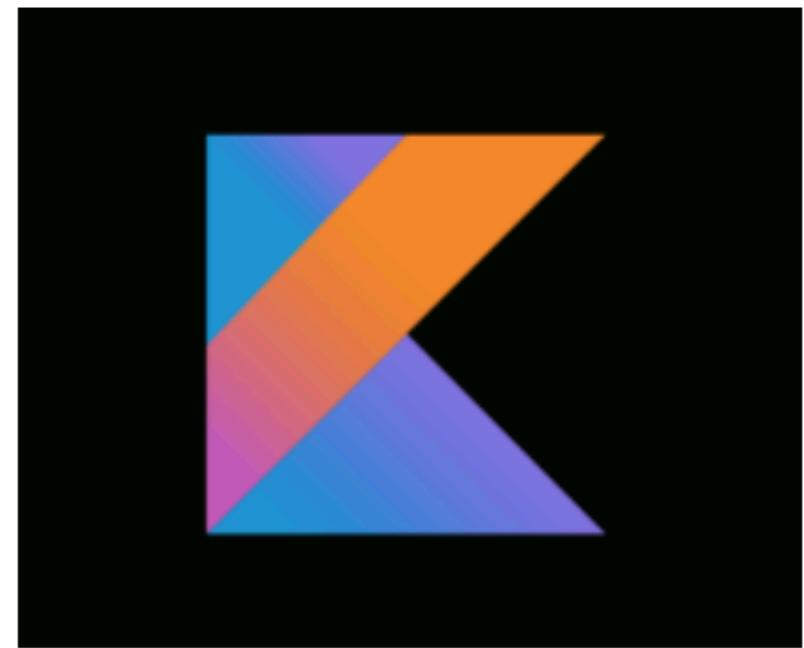
Modern

Secure

Typesafe

Expressive

Concise



*Assumptions:*  
Intermediate level Java or  
closely related language  
skills

Accelerate into the  
fundamentals of Kotlin we  
need

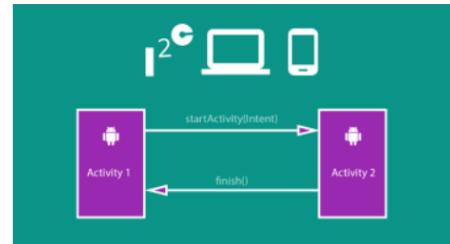
Every topic explores  
specific Kotlin features *in parallel* to android code

## 00: Overview



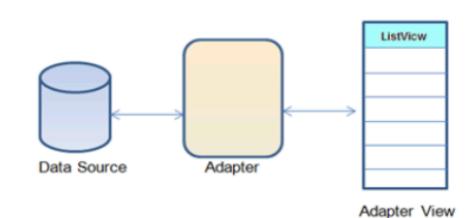
Preview the module, get a flavour of Kotlin. Introduce the Android platform

## 01: Activities



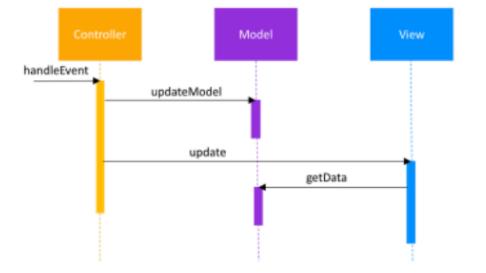
Take the first steps with a Kotlin Android. Explore the source in detail.

## 02: Adapters



Look at Kotlin in more depth. Deep dive into some of its features. Extend the app to manage lists of placemarks using the adapter pattern.

## 03: Models



Examine key Kotlin Idioms. Start comparing simple Java & Kotlin statements. Introduce a more complete model into Placemark.

## 04: Images



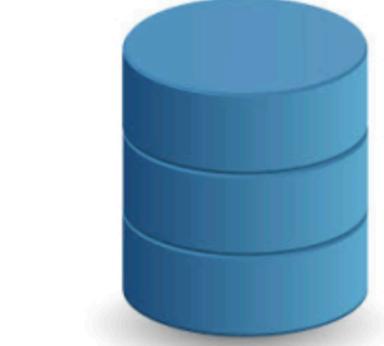
A more detailed look at the fundamental types in Kotlin. How to manage images in android, including selecting and displaying images from the phone gallery.

## 05: Maps



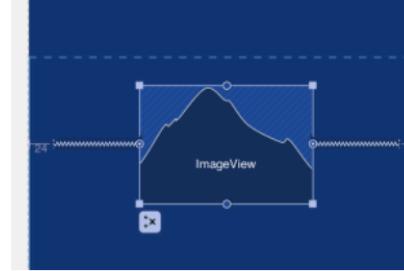
Review Kotlin Packages + Control flow. Introducing Google Maps into and android app.

## 06: Persistence



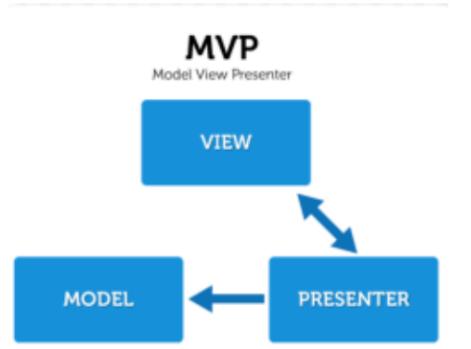
Kotlin Classes in detail. New Placemark Store class to save placemarks to the file system.

## 07: Layouts



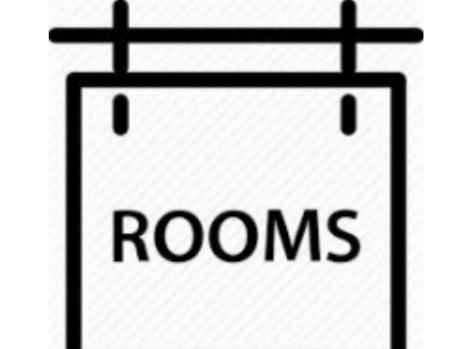
Kotlin properties, fields, & interfaces. Constraint Layout. Introduce activity to display all placemark locations + details.

## 08: Presenters



Introducing Model View Presenter - a pattern to enhance separation of concerns in the Activity classes

## 09: Rooms



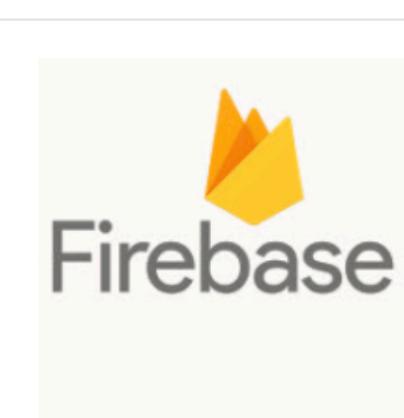
Kotlin Data & Sealed classes, Generics. Android Architecture Components. The Room framework. PlacemarkStoreRoom implementation

## 10: Tracking



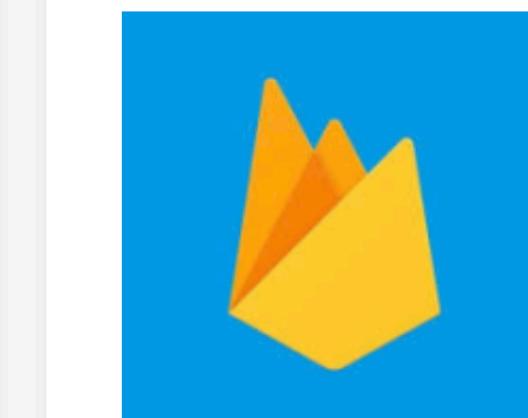
Kotlin Nested Classes, Enums and Objects. Tracking a users current location. Supporting Landscape perspective.

## 11: Authentication



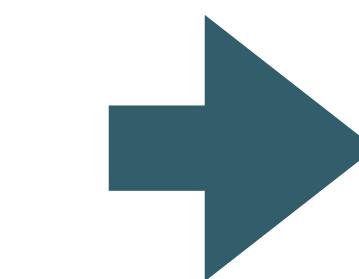
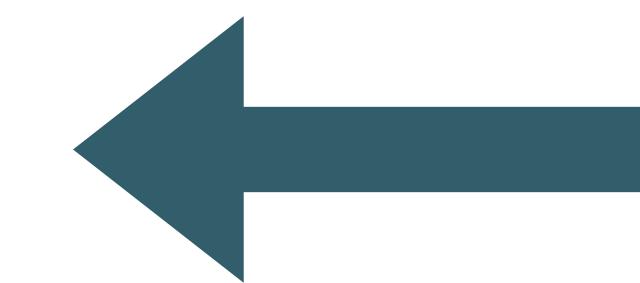
Kotlin Delegation. Support Authentication via the Firebase cloud service.

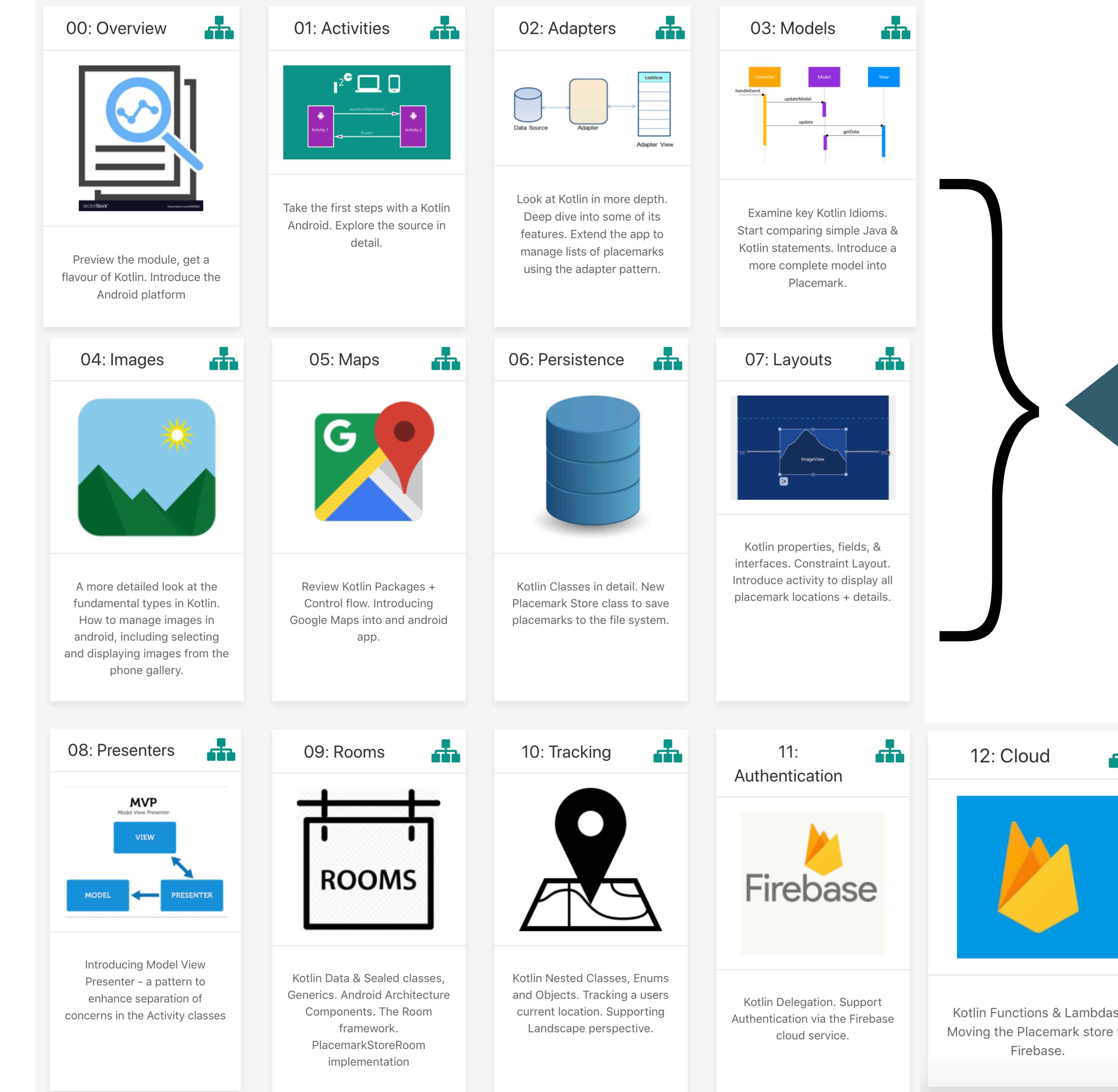
## 12: Cloud



Kotlin Functions & Lambdas. Moving the Placemark store to Firebase.

# Module Topics





Delivered  
On Site

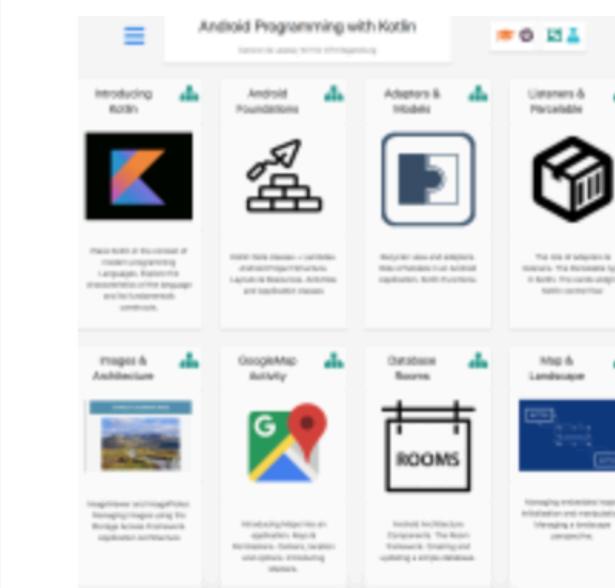
Delivered  
Online  
later

# 00: Overview



Preview the module, get a flavour of Kotlin. Introduce the Android platform

## Module Overview



Outline of the structure and content of the module

## Android Overview

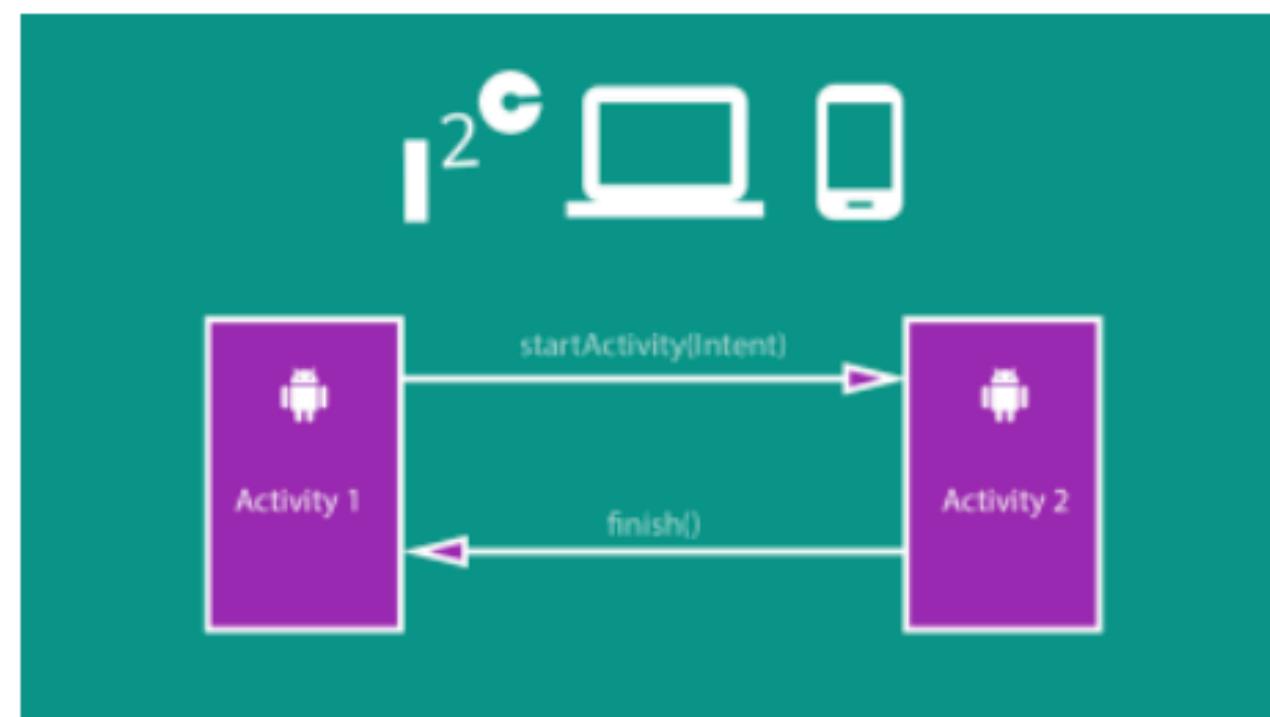


Introduction to the Android platform - its goals and major components

## Convergence

```
import java.util.ArrayList  
import java.util.List  
  
class Base {  
    public void main(String[] args) {  
        String[] names = new String[args.length];  
        names[0] = "Tom";  
        names[1] = "Bob";  
        names[2] = "Sue";  
        names[3] = "Sam";  
        names[4] = "Tina";  
        names[5] = "John";  
        names[6] = "Jane";  
        names[7] = "Mike";  
        names[8] = "Lisa";  
        names[9] = "David";  
        names[10] = "Sarah";  
        names[11] = "Emily";  
        names[12] = "Jordan";  
        names[13] = "Olivia";  
        names[14] = "Ava";  
        names[15] = "Noah";  
        names[16] = "Liam";  
        names[17] = "Mia";  
        names[18] = "Aiden";  
        names[19] = "Elijah";  
        names[20] = "Isabella";  
        names[21] = "Carter";  
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        names[374] = "Aaliyah";  
        names[375] = "Jaxson";  
        names[376] = "Ariyah";  
        names[377] = "Zion";  
        names[378] = "Aaliyah";  
        names[379] = "Jaxson";  
        names[380] = "Ariyah";  
        names[381] = "Zion";  
        names[382] = "Aaliyah";  
        names[383] = "Jaxson";  
        names[384] = "Ariyah";  
        names[385] = "Zion";  
        names[386] = "Aaliyah";  
        names[387] = "Jaxson";  
        names[388] = "Ariyah";  
        names[389] = "Zion";  
        names[390] = "Aaliyah";  
        names[391] = "Jaxson";  
        names[392] = "Ariyah";  
        names[393] = "Zion";  
        names[394] = "Aaliyah";  
        names[395] = "Jaxson";  
        names[396] = "Ariyah";  
        names[397] = "Zion";  
        names[398] = "Aaliyah";  
        names[399] = "Jaxson";  
        names[400] = "Ariyah";  
        names[401] = "Zion";  
        names[402] = "Aaliyah";  
        names[403] = "Jaxson";  
        names[404] = "Ariyah";  
        names[405] = "Zion";  
        names[406] = "Aaliyah";  
        names[407] = "Jaxson";  
        names[408] = "Ariyah";  
        names[409] = "Zion";  
        names[410] = "Aaliyah";  
        names[411] = "Jaxson";  
        names[412] = "Ariyah";  
        names[413] = "Zion";  
        names[414] = "Aaliyah";  
        names[415] = "Jaxson";  
        names[416] = "Ariyah";  
        names[417] = "Zion";  
        names[418] = "Aaliyah";  
        names[419] = "Jaxson";  
        names[420] = "Ariyah";  
        names[421] = "Zion";  
        names[422] = "Aaliyah";  
        names[423] = "Jaxson";  
        names[424] = "Ariyah";  
        names[425] = "Zion";  
        names[426] = "Aaliyah";  
        names[427] = "Jaxson";  
        names[428] = "Ariyah";  
        names[429] = "Zion";  
        names[430] = "Aaliyah";  
        names[431] = "Jaxson";  
        names[432] = "Ariyah";  
        names[433] = "Zion";  
        names[434] = "Aaliyah";  
        names[435] = "Jaxson";  
        names[436] = "Ariyah";  
        names[437] = "Zion";  
        names[438] = "Aaliyah";  
        names[439] = "Jaxson";  
        names[440] = "Ariyah";  
        names[441] = "Zion";  
        names[442] = "Aaliyah";  
        names[443] = "Jaxson";  
        names[444] = "Ariyah";  
        names[445] = "Zion";  
        names[446] = "Aaliyah";  
        names[447] = "Jaxson";  
        names[448] = "Ariyah";  
        names[449] = "Zion";  
        names[450] = "Aaliyah";  
        names[451] = "Jaxson";  
        names[452] = "Ariyah";  
        names[453] = "Zion";  
        names[454] = "Aaliyah";  
        names[455] = "Jaxson";  
        names[456] = "Ariyah";  
        names[457] = "Zion";  
        names[458] = "Aaliyah";  
        names[459] = "Jaxson";  
        names[460] = "Ariyah";  
        names[461] = "Zion";  
        names[462] = "Aaliyah";  
        names[463] = "Jaxson";
```

# 01: Activities



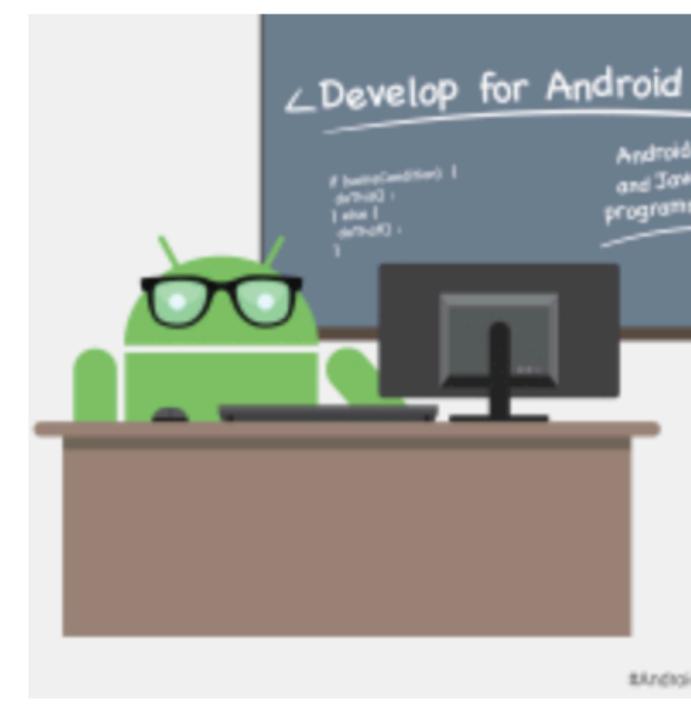
Take the first steps with a Kotlin  
Android. Explore the source in  
detail.

## Android Anatomy



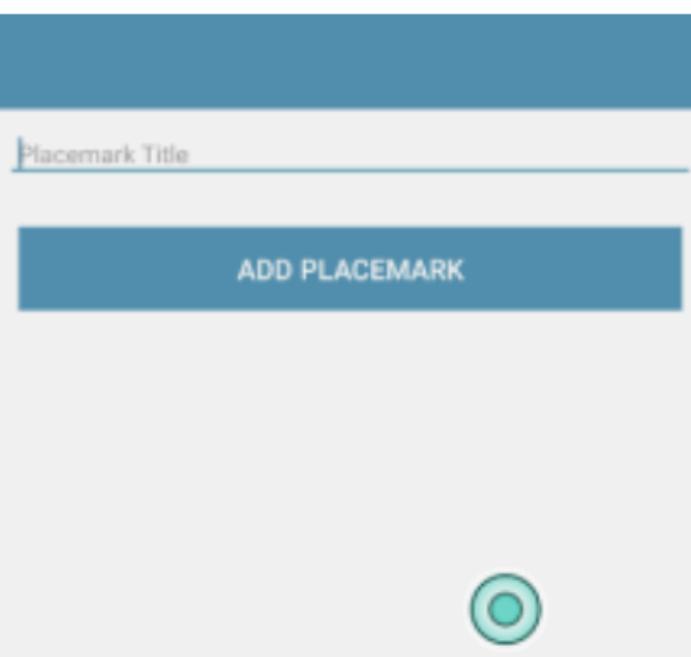
Explore the major features in  
an android application

## Android: Foundation



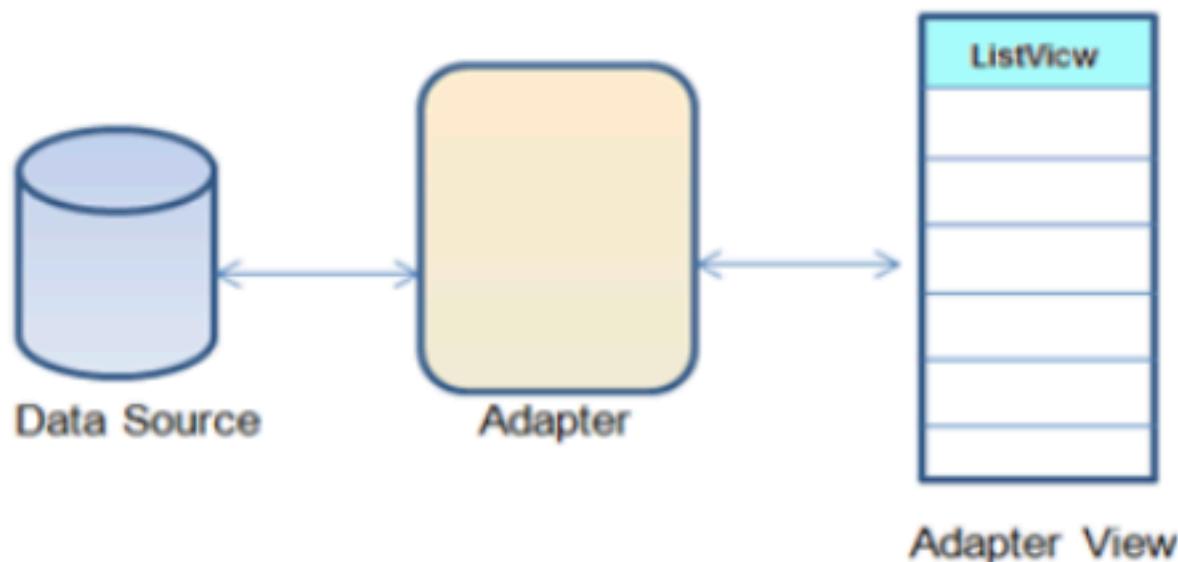
A first look at the structure  
of a simple Kotlin Android  
application

## Lab-01 Activities



Layout the  
PlacemarkActivity -  
supporting create/edit of  
placemarks

## 02: Adapters



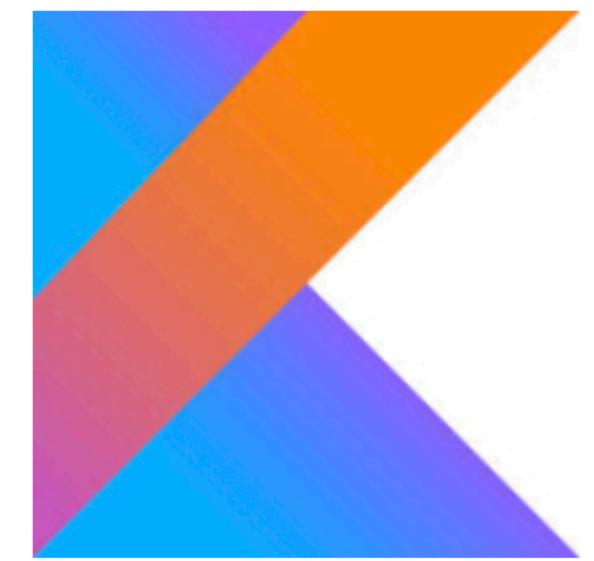
Look at Kotlin in more depth.  
Deep dive into some of its features. Extend the app to manage lists of placemarks using the adapter pattern.

### Kotlin Structure



The fundamental characteristics of the language

### Basic Syntax



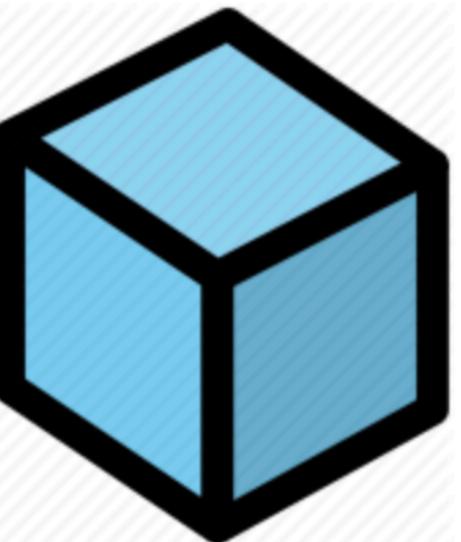
Rapid tour of the basic syntax of Kotlin

### Kotlin Deep Dive



A deep dive into some key Kotlin features: Data Classes & Lambdas

### Android Application Object



This class enables a global application object to be defined, accessible from all activities

### Recycler View + Adapters



Managing lists is facilitated by the RecyclerView + Adapters - 2 key patterns in Android development

### Lab-02 Adapters

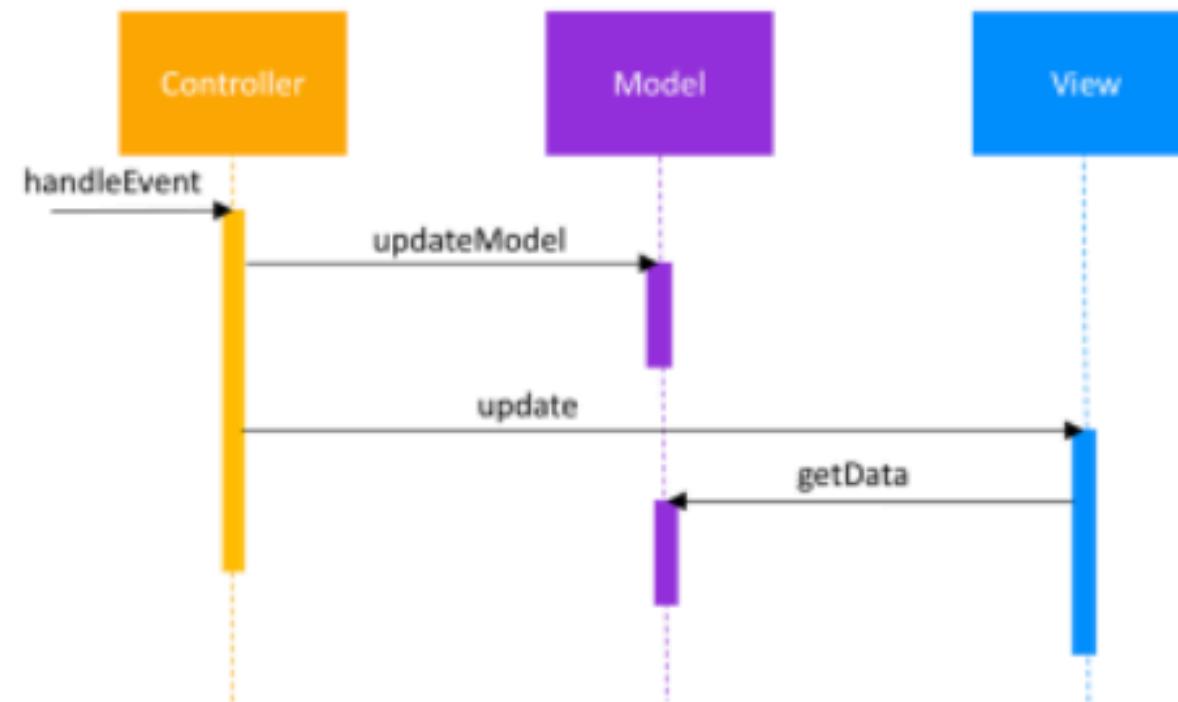
Placemark

Here  
the place to be!

There  
not so good..

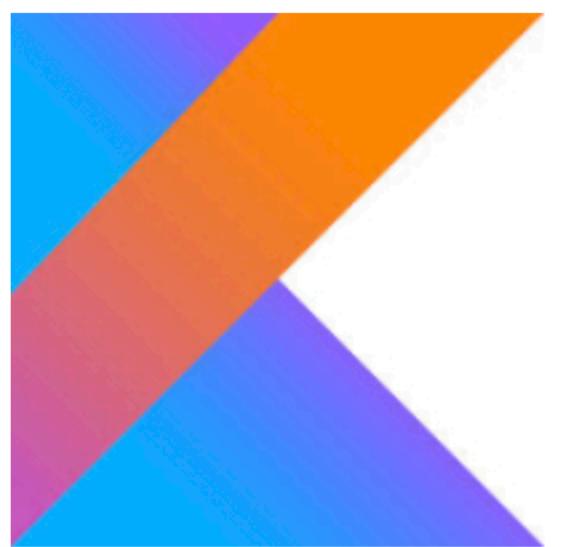
Introduce new activity to display a list of placemarks. Support adding to this list.

## 03: Models



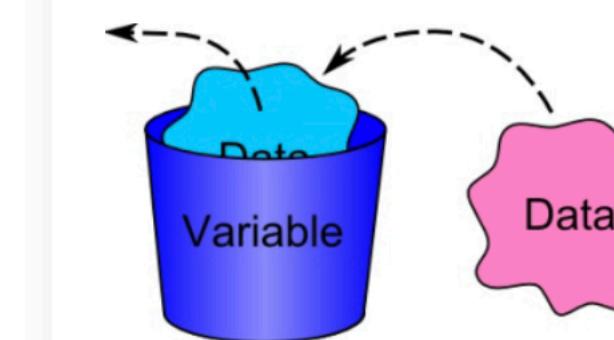
Examine key Kotlin Idioms.  
Start comparing simple Java & Kotlin statements. Introduce a more complete model into Placemark.

### Idioms



A tour of the common idioms in Kotlin

### J2K Variables & Expressions



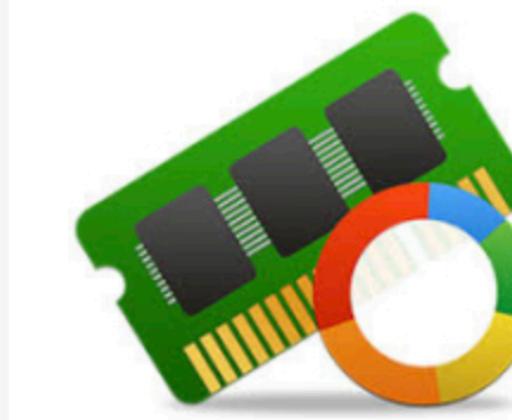
Snippets of the same code in Java & Kotlin

### Toolbar



The Android Support Library implements AppCompatActivity + a range of general purpose components, including a Toolbar

### Memory Store



Abstract the Placemarks data structure into PlacemarkStore interface + in-memory implementation.

### Adapter + Listener



Equip the Adapter with a Listener interface. Use this interface to communicate from the adapter to the host Activity

### Parcelable



Encapsulate model data for transmission between Activities

### Lab-03 Models

Placemark CANCEL

Here \_\_\_\_\_

wish you were...

SAVE PLACEMARK

Application object + Model classes to manage placemarks.

## 04: Images



A more detailed look at the fundamental types in Kotlin.  
How to manage images in android, including selecting and displaying images from the phone gallery.



### Types



Summary of the basic types in the Kotlin programming language

### J2K Collections



Collection examples: Java & Kotlin equivalents



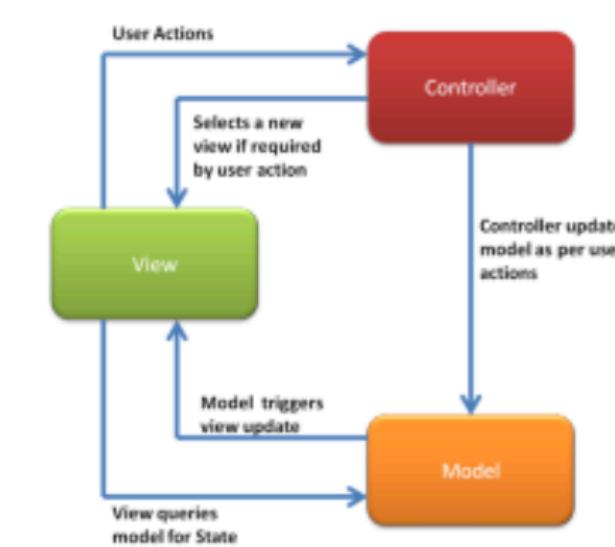
### Resources



A general term for all layout, strings, bitmaps and other XML artefacts in an Android Project

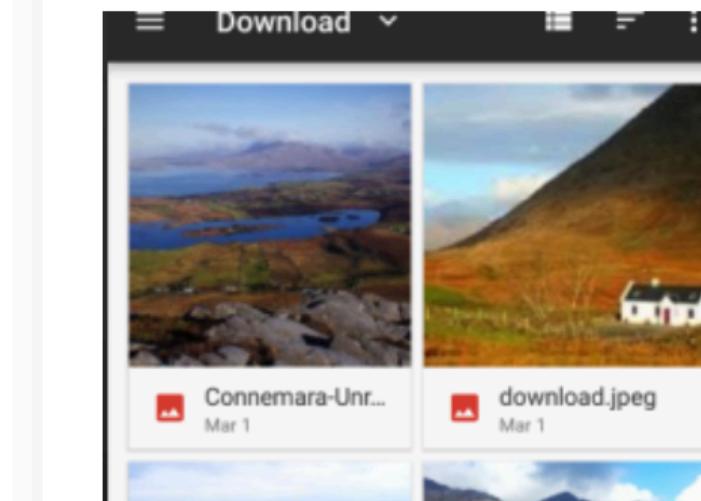


### Model Updates



Creating and updating a Placemark. Updating the placemark list.

### Images



Support selecting image from phone gallery, and then displaying them in an activity.



### Lab-04 Images



Allow an image to be selected from the phones photos, and stored with the placemark



## 05: Maps



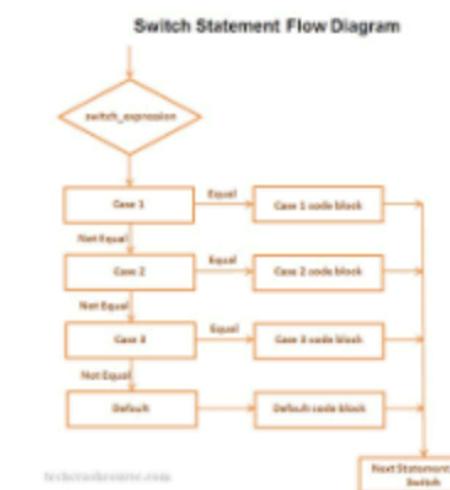
Review Kotlin Packages + Control flow. Introducing Google Maps into and android app.

### Kotlin Packages



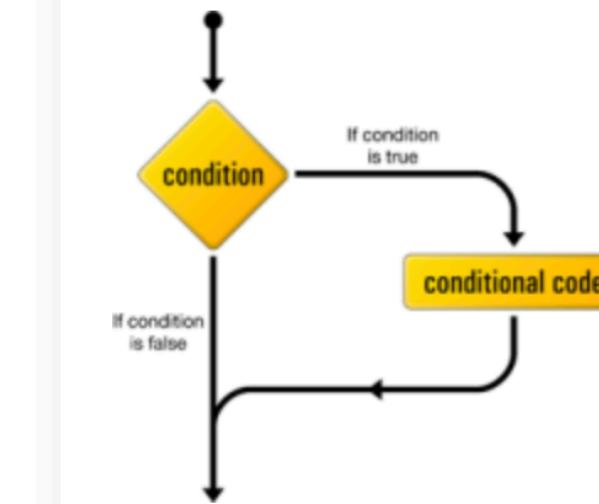
Source files start with a package declaration. This can be used to access (import) features from the source file.

### Kotlin Control Flow



if, when, for and while statements

### J2K Control Flow



Control flow examples in Java and Kotlin

### App Structure



Key classes and relationships in the application.

### Map Activity



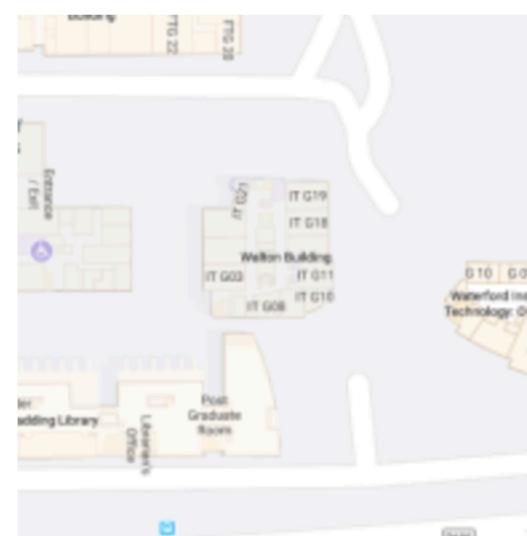
Google Map Activity can be inserted into an app via a Wizard from Studio. API Keys must be acquired from google directly.

### Cameras & Markers



These abstractions enable the map view to be manipulated programmatically, and facilitate direct manipulation by the user.

### Lab-05 MapActivity



Include a MapActivity, enabling the user to select the location of the placemark

## 06: Persistence



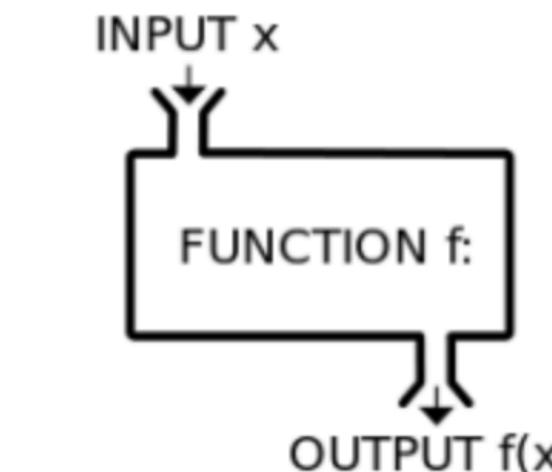
Kotlin Classes in detail. New Placemark Store class to save placemarks to the file system.

### Classes & Inheritance

```
class class_name {  
    class variables  
    secondary constructors  
    functions (methods)  
}
```

In kotlin, classes are more concise, explicit and fine-grained than Java

### J2K: Functions



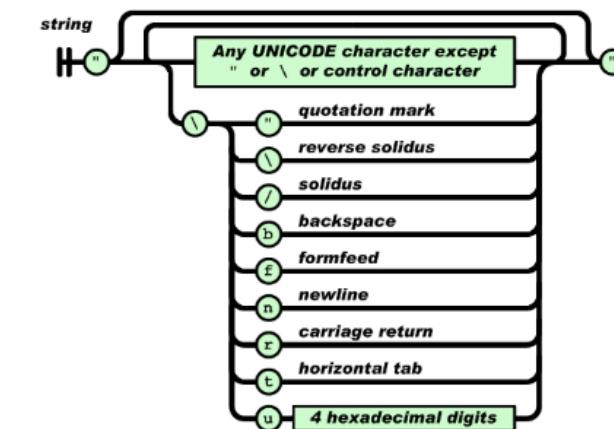
Functions in Java & Kotlin

### File Formats

```
<?xml version="1.0"  
encoding="UTF-8"?>  
  
<coffee objname="c1">  
    <name> mocha </name>  
    <shop> costa </shop>  
    <price> 2.0 </price>  
    <rating> 3.5</rating>  
    <favourite> 0 </favourite>  
</coffee>
```

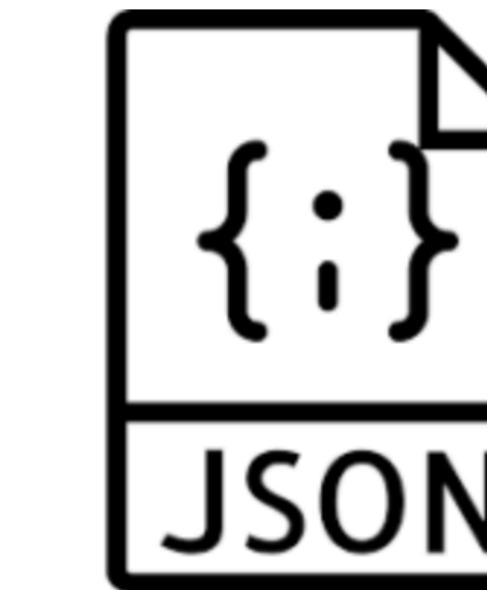
When a simple file persistence strategy, CSV, Name/Value, YAML, XML & JSON are all potential candidate formats for file-based storage.

### JSON



A detailed look at the syntax of JSON

### JSON Store



A new PlacemarkStore implementation - PlacemarkJSONStore - to persist placemarks to a JSON file.

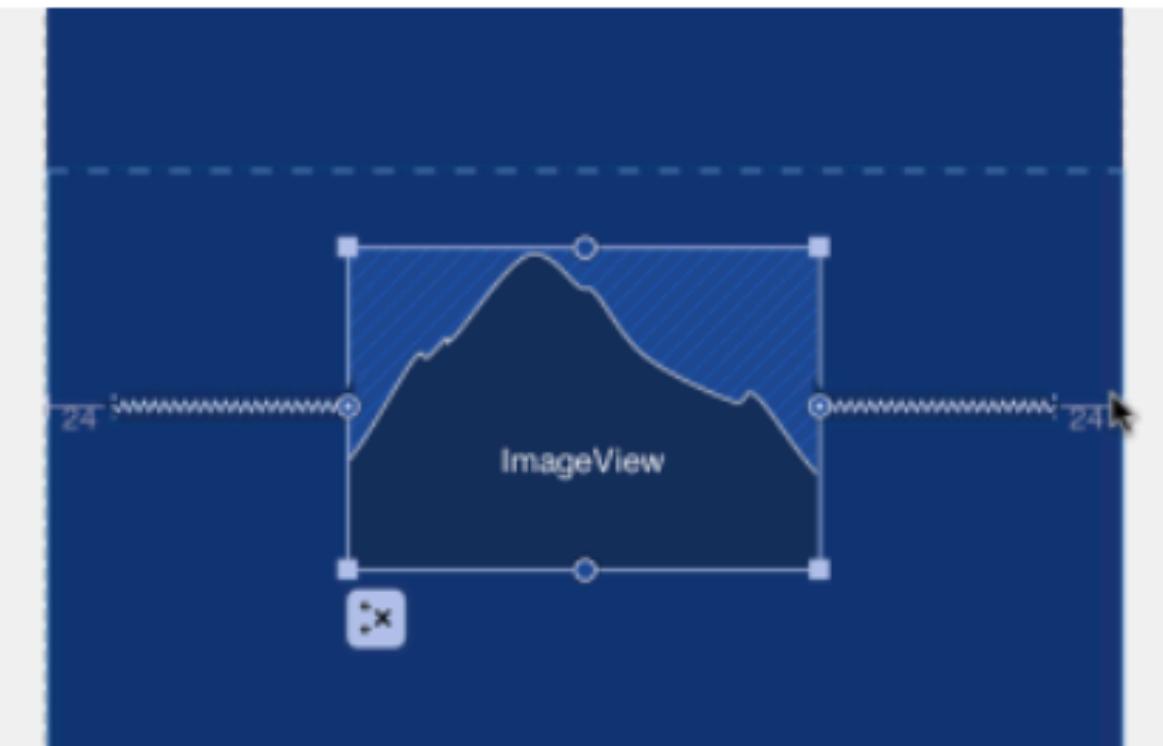
### Lab-06 JSON



Save and restore placemarks from a JSON formatted file



## 07: Layouts



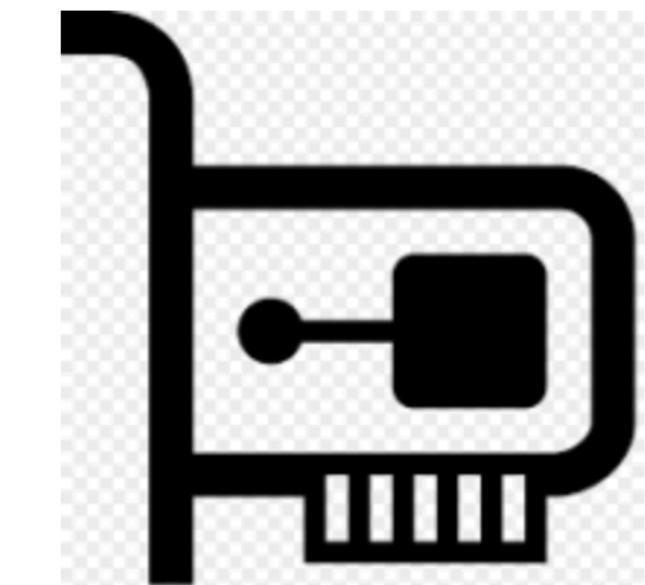
Kotlin properties, fields, & interfaces. Constraint Layout. Introduce activity to display all placemark locations + details.

### Properties & Fields



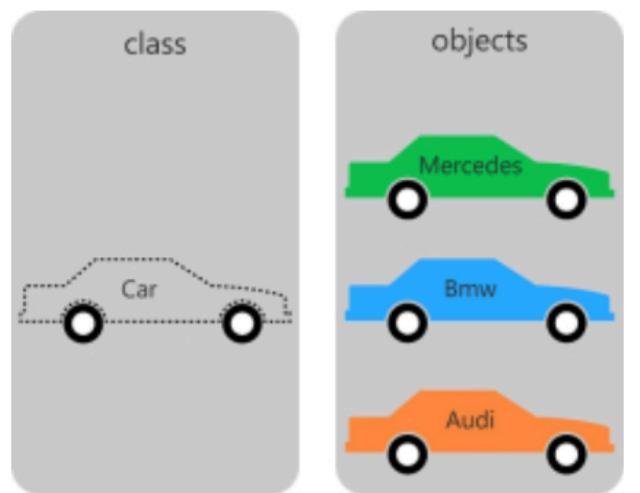
Kotlin properties and fields offer a richer set of features and variants over Java

### Interfaces



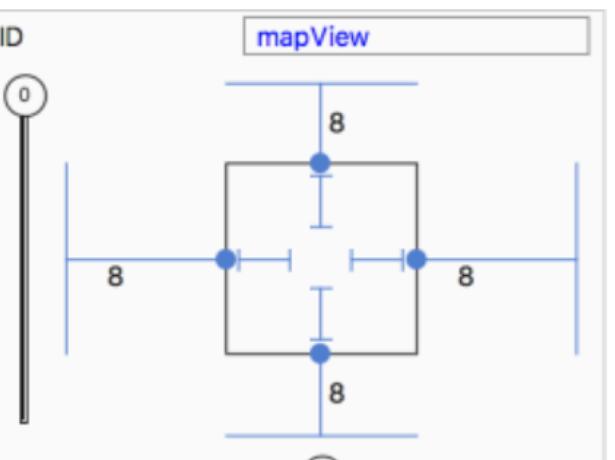
Kotlin interfaces largely follow Java 8 conventions

### J2K : Classes



Classes in Java & Kotlin

### Constraint Layout



ConstraintLayout allows you to create large and complex layouts with a flat view

### Map Widget



The map widget can be placed directly onto an existing layout

### Lab-07a MapView



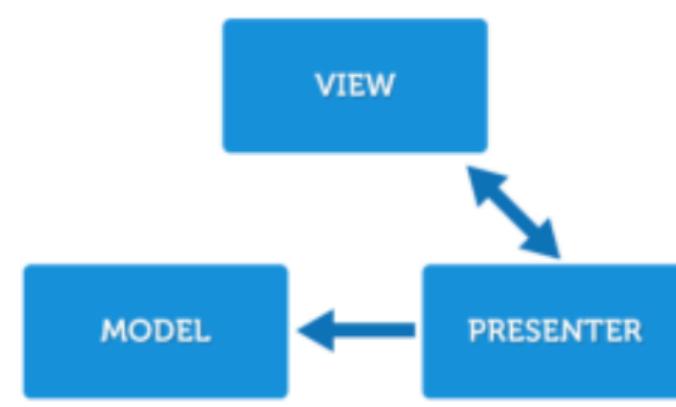
Display all placemarks on a map in a new activity

## 08: Presenters



### MVP

Model View Presenter



Introducing Model View  
Presenter - a pattern to  
enhance separation of  
concerns in the Activity classes

## 09: Rooms



Kotlin Data & Sealed classes,  
Generics. Android Architecture  
Components. The Room  
framework.  
PlacemarkStoreRoom  
implementation

## 10: Tracking



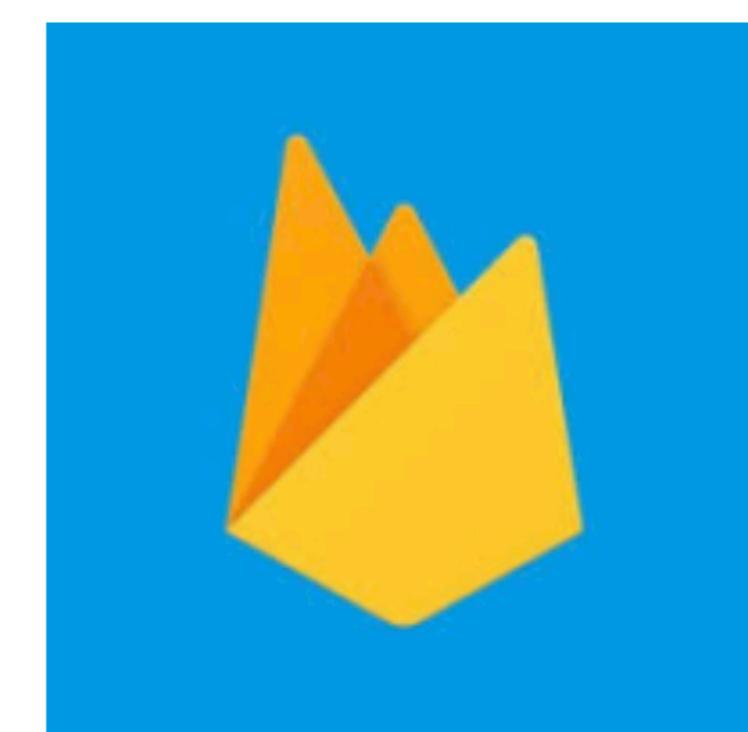
Kotlin Nested Classes, Enums  
and Objects. Tracking a users  
current location. Supporting  
Landscape perspective.

## 11: Authentication



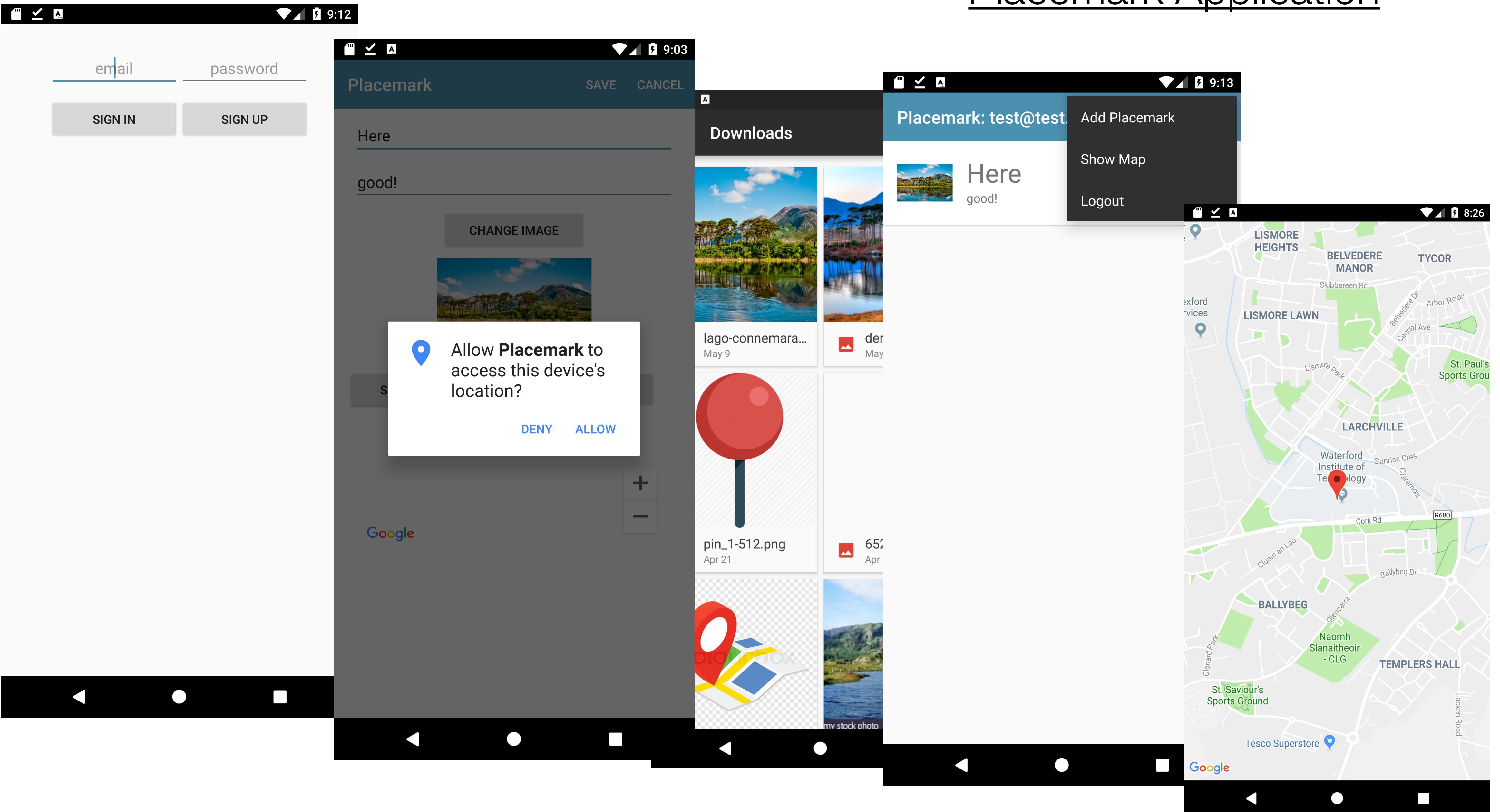
Kotlin Delegation. Support  
Authentication via the Firebase  
cloud service.

## 12: Cloud



Kotlin Functions & Lambdas.  
Moving the Placemark store to  
Firebase.

# Placemark Application



	<i>Thursday</i>	<i>Friday</i>	<i>Saturday</i>	<i>Monday</i>	<i>Tuesday</i>	<i>Wednesday</i>
	25/10/2018	26/10/2018	27/10/2018	29/10/2018	30/10/2018	31/10/2018
<b>10:00 11:30</b>			Lecture 04: Images  Kotlin Types  Images & Architecture			
<b>11:45 13:15</b>		Lecture 02: Adapters  Basic Syntax Deep Dive  AppObject, Recycler + Adapters	Lab 04: Images			
<b>13:15 15:00</b>		Lunch	Lunch			
<b>14:00 15:00</b>		Lab 02: Adapters	Lecture 05: Maps  Google Map Setup & Models			
<b>15:15 16:45</b>		Lecture 03: Models  Kotlin Idioms  Toolbars, MemoryStore, Adapter + Listener, Parcelable	Lab 05: Maps	Guest Talk		
<b>17:00 18:30</b>	Lecture 01: Activities  Activities	Lab 03: Models			Lab 06: Persistence	
<b>18:45 20:15</b>	Lab 01: Activities			Lecture 06: Persistence  Classes & Objects I  JSON, JSONStore,	Lecture 07: Layouts  Classes & Objects II  Map Widget & Markers	Lecture 08: Assignment Specification  Lab 07: Layouts

# Schedule

All classes in K140