twitch.tv/dancojocar
youtube.com/dancojocar

Lecture #11
Firebase Services

Mobile Applications
Fall 2024

2007 Chat App 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020

https://startupandrew.com/posting-experiences-in-the-haitian-earthquake/

Firebase

Analytics

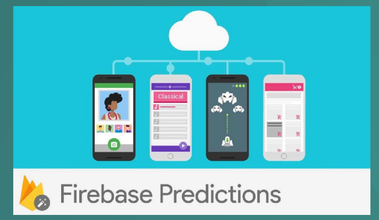
Cloud Function for Firebase

Firebase Authentication

Firebase Cloud Messaging

Cloud Firestore

Cloud Storage for Firebase



Firebase Realtime Database

Firebase Hosting

ML Kit for Firebase

2007 Chat App 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021

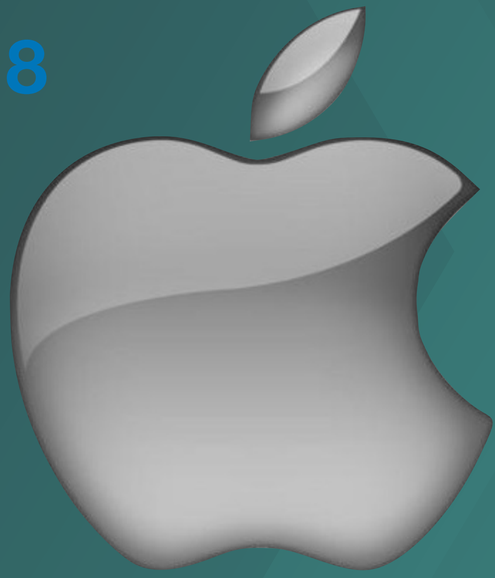
https://firebase.google.com/support/releases

Firebase

Over 2.5 million apps actively using Firebase every month!

2018

ANDROID



iOS

Firebase

Over 3 million apps actively using Firebase every month!

Add Firebase to Your Project

- Using the assistant, in Android Studio:

  1.Tools -> Firebase.

  2. Select the service.

  3. Connect to Firebase.

- Manually:
  - Create a project in console.firebase.google.com
  - Download the config file.
  - Add the SDK.

Add the SDK

Root-level build.gradle:

```
buildscript {
  // ...
  dependencies {
    // ...
    classpath ‘com.google.gms:google-services:<version>’ // google-services plugin
  }
}

allprojects {
  // ...
  repositories {
    // ...
    google() // Google's Maven repository
  }
}
```

Add the SDK

Module-level build.gradle:

```
dependencies {
  // ...

  // Import the Firebase BoM
  implementation platform(‘com.google.firebase:firebase-bom:<version>')

  // When using the BoM, you don't specify versions in Firebase library dependencies

  // Declare the dependencies for the desired Firebase products
  // For example, declare the dependencies for Firebase Authentication and Cloud Firestore
  implementation 'com.google.firebase:firebase-auth-ktx'
  implementation 'com.google.firebase:firebase-firestore-ktx'
}
```

Available Libraries

firebase.inappmessaging.display

firebase.perf

com.google.firebase.perf

com.google.firebase.perf.metrics

firebase.remoteconfig

com.google.firebase.remoteconfig

firebase.storage

com.google.firebase.storage

Inter-operational packages

com.google.firebase.auth.internal

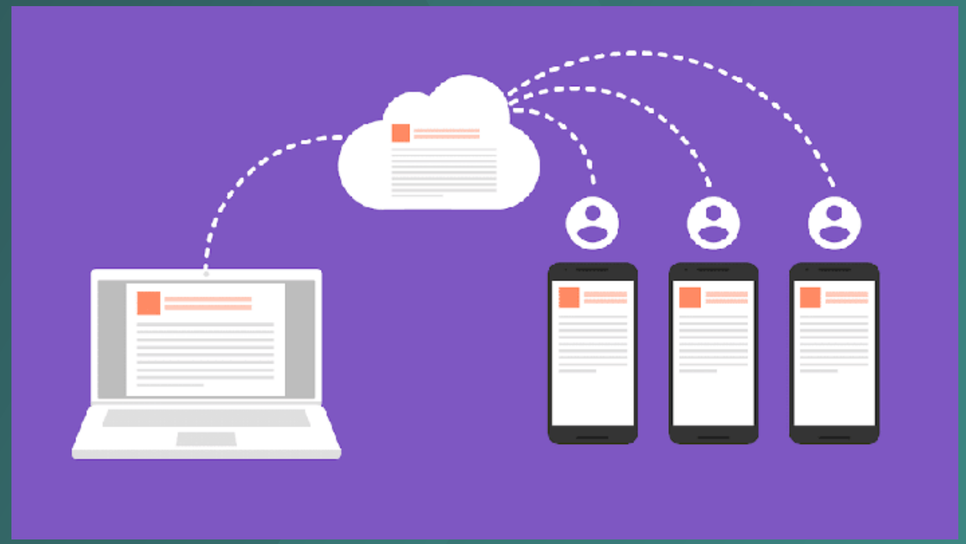
com.google.firebase.ml.naturallanguage.languageid

com.google.firebase.ml.naturallanguage.smartreply

firebase.google.com/docs/reference/android/packages

Realtime Database

- Realtime.
- Offline.
- Collaborate across devices with ease.
- Scale across multiple regions.



Installation & Setup

Add the Realtime Database to your app

```
implementation ‘com.google.firebase:firebase-database-ktx’
```

Secure Your Data

```
{
"rules": {
  "messages": {
    "messages": {
      "message0": {
        "$message": {
          "content": "Hello",
          "timestamp": 1405704370369
        }
      },
      "message1": {
        "content": "Goodbye",
        "timestamp": 1405704395231
      }, ".validate": “newData.hasChildren(['content',
      ...                 'timestamp'])
    }             && newData.child('content').isString()
  }               && newData.child('timestamp').isNumber()"
        }
      }
    }
  }
}
```

```
// only messages from the last ten minutes can
// be read
".read": "data.child('timestamp').val() >
    (now - 600000)"
// new messages must have a string content
// and a number timestamp
```

https://firebase.google.com/docs/database/security/securing-data

Data Access

Write to your database

Read from your database

```
// Read from the database
    // Write a message to the database
myRef.addValueEventListener(object : ValueEventListener {
    val database = FirebaseDatabase.getInstance()
    override fun onDataChange(dataSnapshot: DataSnapshot) {
    val myRef = database.getReference("message")
        // This method is called once with the initial value and again
        // whenever data at this location is updated.
    myRef.setValue("Hello, World!")
        val value = dataSnapshot.getValue(String::class.java)
        Log.d(TAG, "Value is: $value")
    }

    override fun onCancelled(error: DatabaseError) {
        // Failed to read value
        Log.w(TAG, "Failed to read value.", error.toException())
    }
})
```

https://firebase.google.com/docs/database/android/read-and-write

Update Data

```
private fun writeNewPost(
    userId: String,
    username: String,
    title: String,
    body: String
){
// Create new post at /user-posts/$userid/$postid and at
// /posts/$postid simultaneously
val key = database.child("posts").push().key
if (key == null) {
  Log.w(TAG, "Couldn't get push key for posts")
  return
}
val post = Post(userId, username, title, body)
val postValues = post.toMap()
val childUpdates = HashMap<String, Any>()
childUpdates["/posts/$key"] = postValues
childUpdates["/user-posts/$userId/$key"] = postValues
database.updateChildren(childUpdates)
}
```

Using Transactions

```
private fun onStarClicked(postRef: DatabaseReference) {
  postRef.runTransaction(object : Transaction.Handler {
    override fun doTransaction(mutableData: MutableData): Transaction.Result {
      val p = mutableData.getValue(Post::class.java)
          ?: return Transaction.success(mutableData)
      if (p.stars.containsKey(uid)) {
        // Unstar the post and remove self from stars
        p.starCount = p.starCount - 1
        p.stars.remove(uid)
      } else {
        // Star the post and add self to stars
        p.starCount = p.starCount + 1
        p.stars[uid] = true
      }
      // Set value and report transaction success
      mutableData.value = p
      return Transaction.success(mutableData)
    }
    override fun onComplete(
      databaseError: DatabaseError?,
      b: Boolean,
```

Enabling Offline Capabilities

```
FirebaseDatabase.getInstance().setPersistenceEnabled(true);
```

https://firebase.google.com/docs/database/android/offline-capabilities

Enabling Offline Capabilities

```
FirebaseDatabase.getInstance().setPersistenceEnabled(true);
```

Keeping Data Fresh

```
DatabaseReference scoresRef = FirebaseDatabase.getInstance()
    .getReference("scores");
scoresRef.keepSynced(true);
```

https://firebase.google.com/docs/database/android/offline-capabilities

Enabling Offline Capabilities

```
FirebaseDatabase.getInstance().setPersistenceEnabled(true);
```

Keeping Data Fresh

```
DatabaseReference scoresRef = FirebaseDatabase.getInstance()
    .getReference("scores");
scoresRef.keepSynced(true);
scoresRef.keepSynced(false);
```

https://firebase.google.com/docs/database/android/offline-capabilities

Enabling Offline Capabilities

Detecting Connection State

```
val connectedRef = FirebaseDatabase.getInstance().getReference(".info/connected")
connectedRef.addValueEventListener(object : ValueEventListener {
  override fun onDataChange(snapshot: DataSnapshot) {
    val connected = snapshot.getValue(Boolean::class.java) ?: false
    if (connected) {
      Log.d(TAG, "connected")
    } else {
      Log.d(TAG, "not connected")
    }
  }

  override fun onCancelled(error: DatabaseError) {
    Log.w(TAG, "Listener was cancelled")
  }
})
```

https://firebase.google.com/docs/database/android/offline-capabilities

Enabling Offline Capabilities

Detecting Connection State

```
val connectedRef = FirebaseDatabase.getInstance().getReference(".info/connected")
connectedRef.addValueEventListener(object : ValueEventListener {
  override fun onDataChange(snapshot: DataSnapshot) {
    val connected = snapshot.getValue(Boolean::class.java) ?: false
    if (connected) {
      Log.d(TAG, "connected")
    } else {
      Log.d(TAG, "not connected")
    }
  }

  override fun onCancelled(error: DatabaseError) {
    Log.w(TAG, "Listener was cancelled")
  }
})
```

https://firebase.google.com/docs/database/android/offline-capabilities

Authentication

Key capabilities:

- Email and password based authentication.
- Federated identity provider integration:
  - Google, Facebook, Twitter, Github.
- Phone number authentication.
- Custom auth system integration.
- Anonymous auth.

Authentication

Key capabilities:

- Email and password based authentication.
- Federated identity provider integration:
  - Google, Facebook, Twitter, Github, Apple.
- Phone number authentication.
- Custom auth system integration.
- Anonymous auth.

Authenticate Using Google Sign-In

- Dependencies
- Integrate Google Sign-In
- Use shared auth
- Use the token

```
public override fun onActivityResult(requestCode: Int, resultCode: Int,
    data: Intent?) {
 super.onActivityResult(requestCode, resultCode, data)

 // Result returned from launching the Intent from
 // GoogleSignInApi.getSignInIntent(...);
 val task = GoogleSignIn.getSignedInAccountFromIntent(data)
 try {
  // Google Sign In was successful, authenticate with Firebase
  val account = task.getResult(ApiException::class.java)
  firebaseAuthWithGoogle(account!!)
 } catch (e: ApiException) {
  // Google Sign In failed, update UI appropriately
  Log.w(TAG, "Google sign in failed", e)
 }
}
```

```
// Configure Google Sign In
val gso = GoogleSignInOptions.Builder(GoogleSignInOptions.DEFAULT_SIGN_IN)
    .requestIdToken(getString(R.string.default_web_client_id))
    .requestEmail()
    .build()
val signInIntent = GoogleSignIn.getClient(this, gso).signInIntent
startActivityForResult(signInIntent, RC_SIGN_IN)
```

```
// [START auth_with_google]
private fun firebaseAuthWithGoogle(acct: GoogleSignInAccount) {
 Log.d(TAG, "firebaseAuthWithGoogle:" + acct.id!!)
 val credential = GoogleAuthProvider.getCredential(acct.idToken, null)
 auth.signInWithCredential(credential)
  .addOnCompleteListener(this) { task ->
   if (task.isSuccessful) {
    // Sign in success, update UI with the signed-in user's information
    Log.d(TAG, "signInWithCredential:success")
    val user = auth.currentUser
    updateUI(user)
   } else {
    // If sign in fails, display a message to the user.
    Log.w(TAG, "signInWithCredential:failure", task.exception)
   }
  }
}
// [END auth_with_google]
```

```
implementation 'com.google.firebase:firebase-auth-ktx'
implementation 'com.google.android.gms:play-services-auth'
```

```
// [START initialize_auth]
private lateinit var auth: FirebaseAuth
// [END initialize_auth]

// [START on_start_check_user]
public override fun onStart() {
 super.onStart()
 // Check if user is signed in (non-null) and update UI accordingly.
 val currentUser = auth.currentUser
 updateUI(currentUser)
}
// [END on_start_check_user]
```

Sign out a User

DEMO

```
FirebaseAuth.getInstance().signOut()
```


Error
Lorem ipsum dolor sit amet, consectetur adipiscing elit. Maecenas rutrum est ac ultrices porttitor. Suspendisse pellentesque risus vehicula, vehicula erat a, tempor nisi. Donec vel suscipit sapien, vitae sollicitudin dui. Fusce vitae nulla ornare, sollicitudin nibh et, malesuada eros. In nec nisi consequat, laoreet massa et, molestie nisi. Proin eget dui lacus. Phasellus auctor faucibus facilisis.
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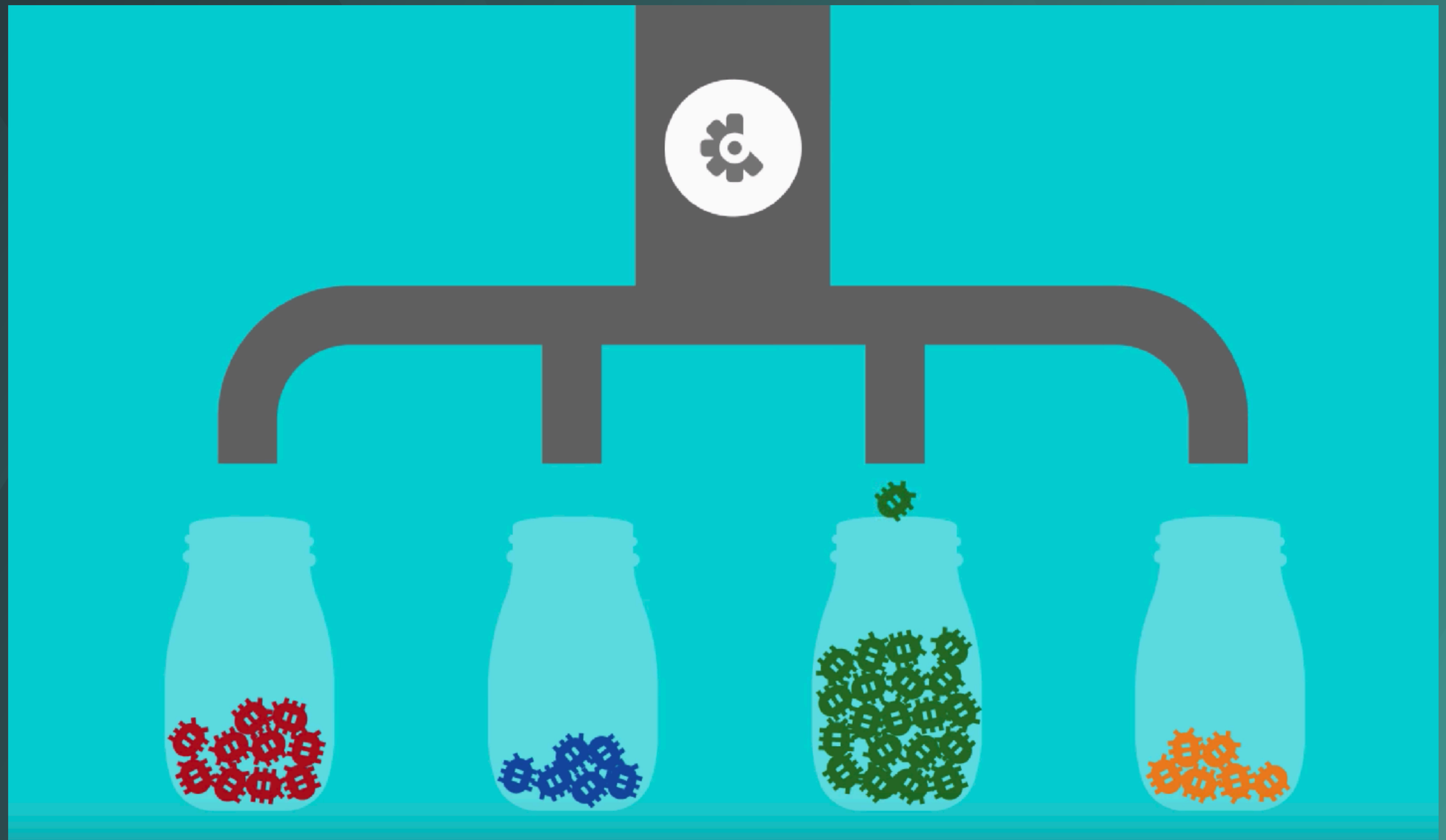
Crashlytics



Enable the SDK

```
buildscript {
    repositories {
      // Make sure that you have the following two repositories
      google()  // Google's Maven repository
      mavenCentral()  // Maven Central repository
    }

    dependencies {
        ...
        classpath 'com.android.tools.build:gradle:<version>'

        // Make sure that you have the Google services Gradle plugin dependency
        classpath 'com.google.gms:google-services:<version>'

        // Add the dependency for the Crashlytics Gradle plugin
        classpath 'com.google.firebase:firebase-crashlytics-gradle:<version>'
    }
}
```

Enable the SDK

```
plugins {
    id 'com.android.application'

    // Make sure that you have the Google services Gradle plugin
    id 'com.google.gms.google-services'

    // Add the Crashlytics Gradle plugin
    id 'com.google.firebase.crashlytics'
    ...
}

dependencies {
    // Import the BoM for the Firebase platform
    implementation platform('com.google.firebase:firebase-bom:<version>')

    // Add the dependencies for the Crashlytics and Analytics libraries
    // When using the BoM, you don't specify versions in Firebase library dependencies
    implementation 'com.google.firebase:firebase-crashlytics-ktx'
    implementation 'com.google.firebase:firebase-analytics-ktx'
}
```

Test Implementation

```
val crashButton = Button(this)
crashButton.text = "Test Crash"
crashButton.setOnClickListener {
   throw RuntimeException("Test Crash") // Force a crash
}
```

Customize

AndroidManifest.xml

```
<meta-data
    android:name="firebase_crashlytics_collection_enabled"
    android:value="false" />
```

Customize

AndroidManifest.xml

```
<meta-data
    android:name="firebase_crashlytics_collection_enabled"
    android:value="false" />
```

Enable collection for selected users:

```
val crashlytics = FirebaseCrashlytics.getInstance()
Crashlytics.setUserIdentifier("myAppUserId")
```

Customize

AndroidManifest.xml

```
<meta-data
    android:name="firebase_crashlytics_collection_enabled"
    android:value="false" />
```

Enable collection for selected users:

```
val crashlytics = FirebaseCrashlytics.getInstance()
Crashlytics.setUserIdentifier("myAppUserId")
```

Crash report and `Log.println`:

```
Crashlytics.log(Log.DEBUG, "tag", "message")
```

Customize

AndroidManifest.xml

```
<meta-data
    android:name="firebase_crashlytics_collection_enabled"
    android:value="false" />
```

Enable collection for selected users:

```
val crashlytics = FirebaseCrashlytics.getInstance()
Crashlytics.setUserIdentifier("myAppUserId")
```

Crash report and `Log.println`:

```
Crashlytics.log(Log.DEBUG, "tag", "message")
```

Crash report only:

```
Crashlytics.log("message")
```

Customize

Log non-fatal exceptions

```
Crashlytics.logException(e)
```

Add custom keys:

```
Crashlytics.setString(key, "foo" /* string value */)
Crashlytics.setBool(key, true /* boolean value */)
Crashlytics.setDouble(key, 1.0 /* double value */)
Crashlytics.setFloat(key, 1.0f /* float value */)
Crashlytics.setInt(key, 1 /* int value */)
```

Customize

Log non-fatal exceptions

```
Crashlytics.logException(e)
```

Add custom keys:

```
Crashlytics.setString(key, "foo" /* string value */)
Crashlytics.setBool(key, true /* boolean value */)
Crashlytics.setDouble(key, 1.0 /* double value */)
Crashlytics.setFloat(key, 1.0f /* float value */)
Crashlytics.setInt(key, 1 /* int value */)
```

https://firebase.google.com/docs/crashlytics/customize-crash-reports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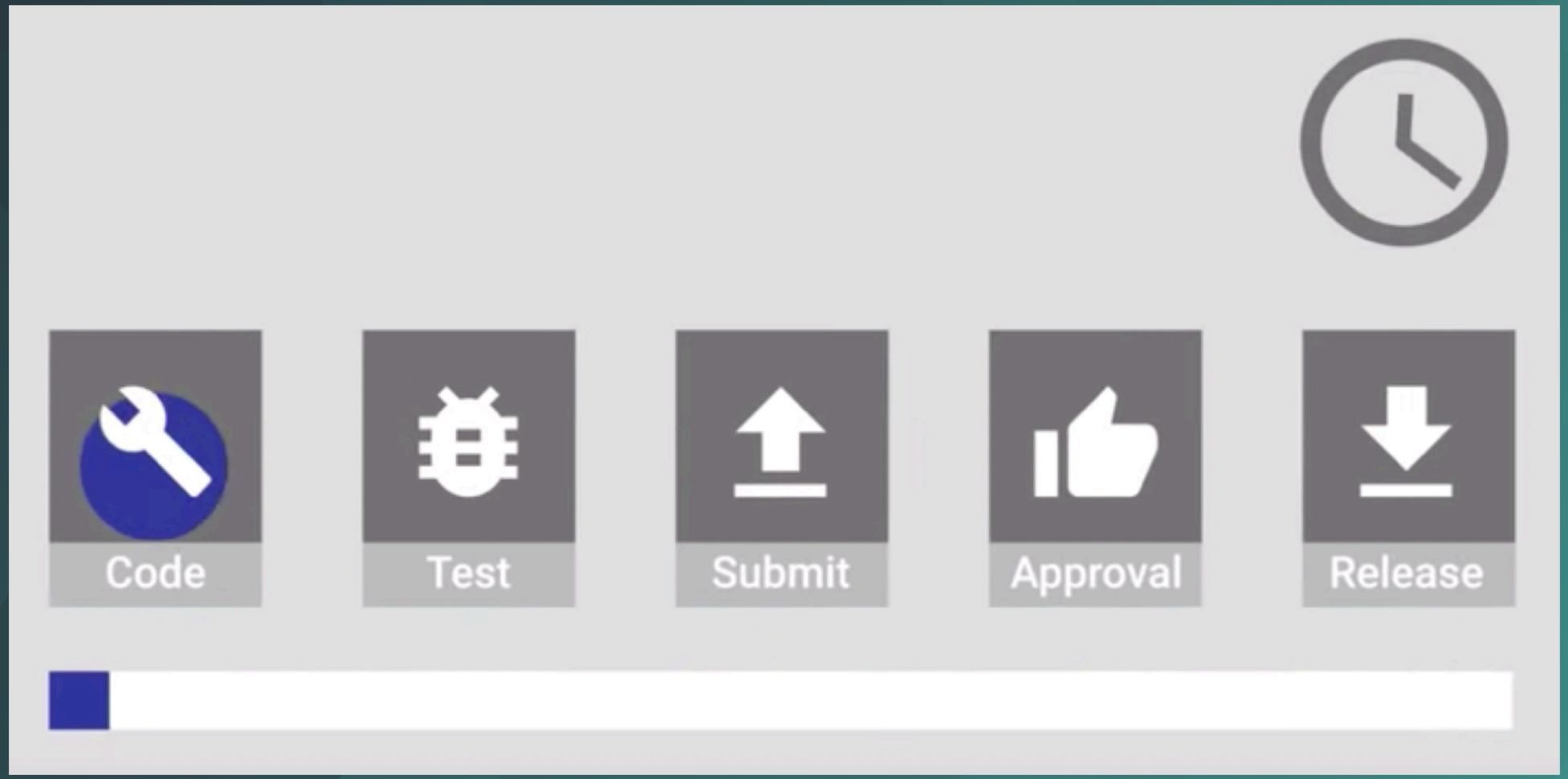
Code
Test
Submit
Approval
Release


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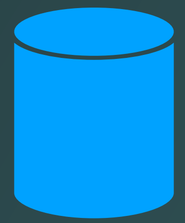
Realtime

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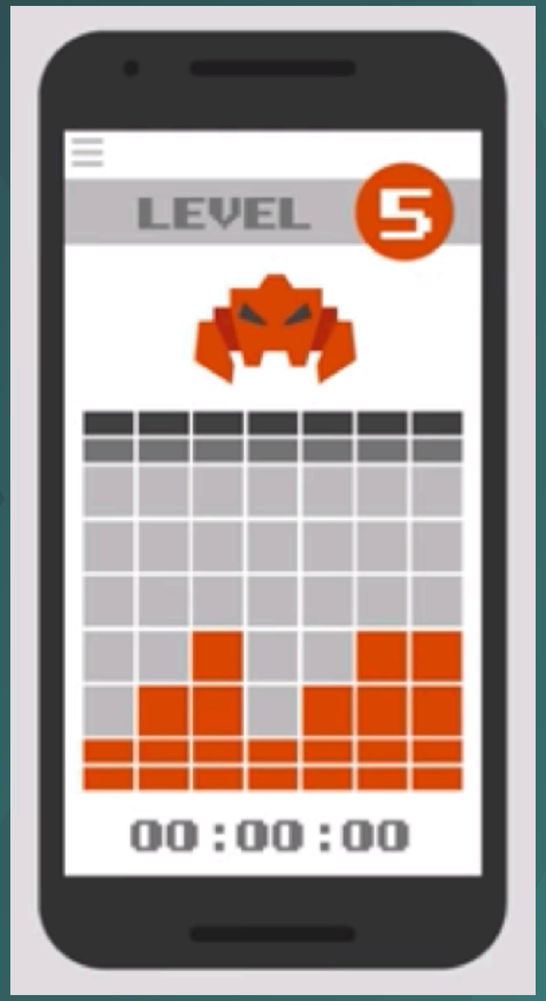
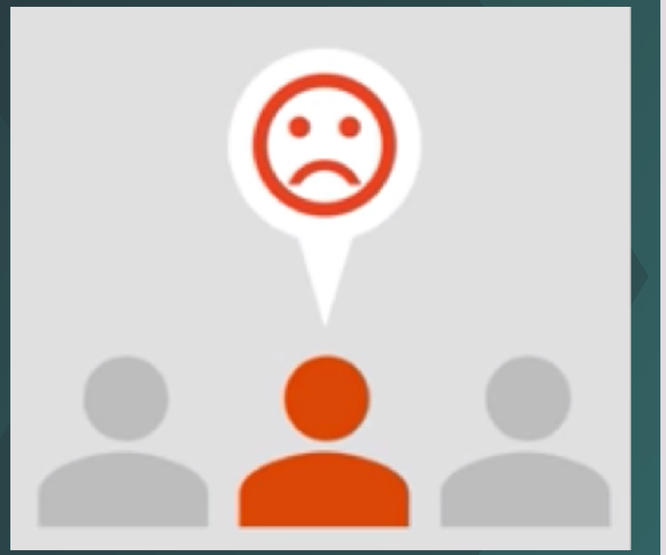
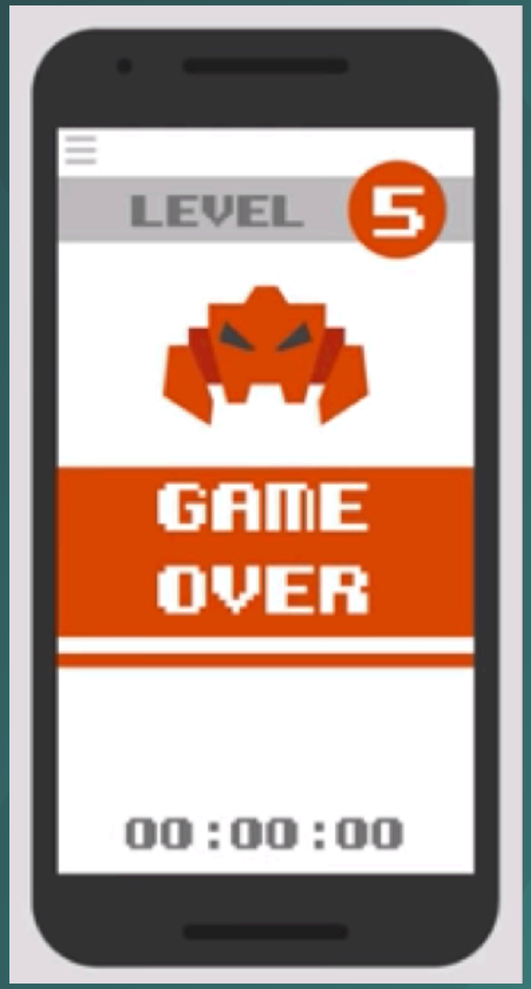

LEVEL
5
00 : 00 : 00

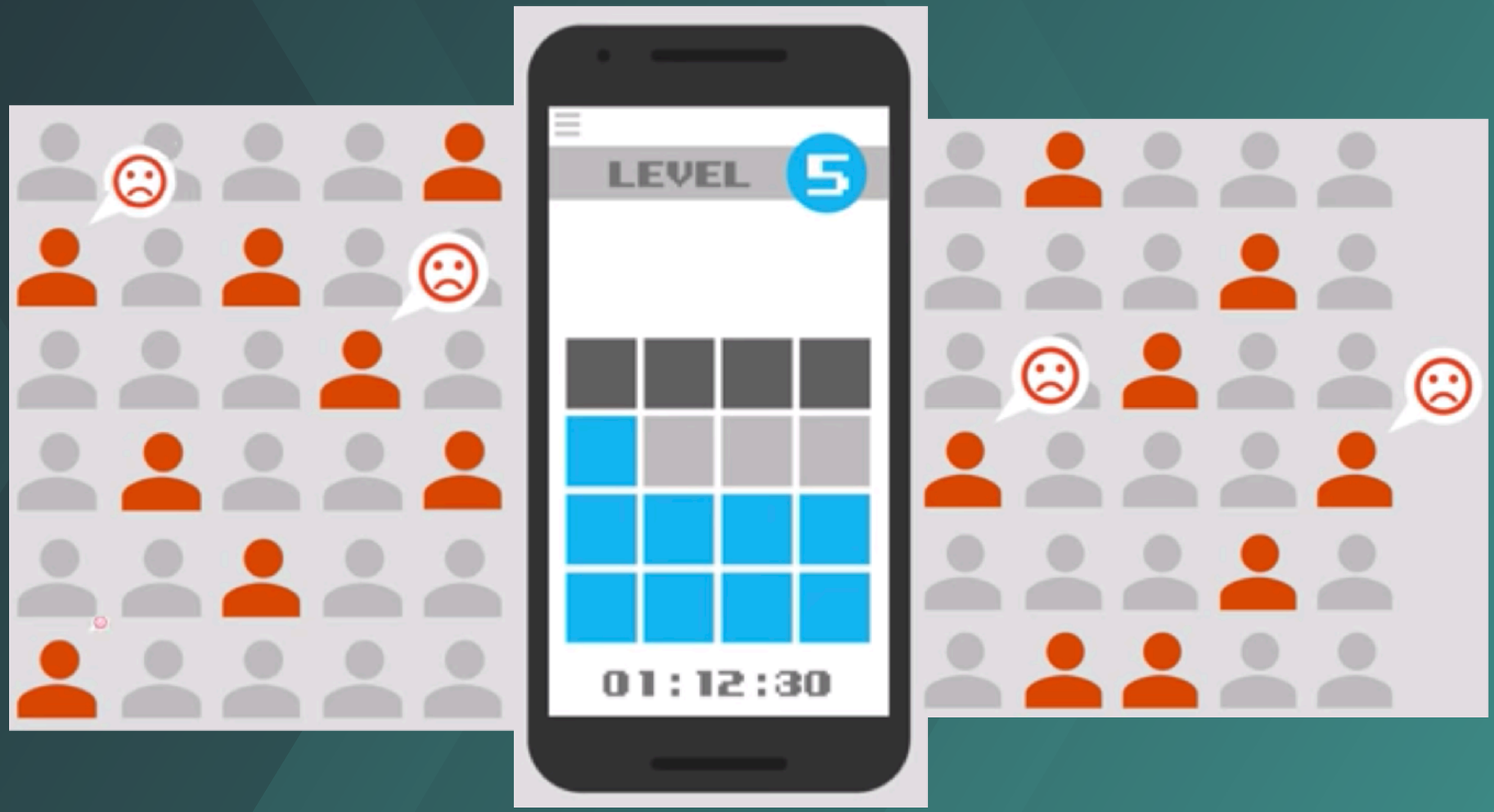



LEVEL
5
GAME
OVER
00 : 00 : 00


Realtime
LEVEL
5
GAME
OVER
00 : 00 : 00


Realtime
LEVEL
5
GAME
OVER
00 : 00 : 00


LEVEL
5
01:12:30


LEVEL
5
01:12:30

Remote Config

Using Remote Config

1. Add Firebase to your app

```
implementation 'com.google.firebase:firebase-config-ktx'
```

2. Get the Remote Config singleton object

```
FirebaseRemoteConfig.getInstance()
```

5. Set parameter values in the service (as needed)

6. Fetch and activate values from the service (as needed)

https://firebase.google.com/docs/remote-config/use-config-android

Make $

- In-app purchases.
- Subscriptions.
- Advertising.
- Paid apps.
- E-commerce.

https://developer.android.com/distribute/best-practices/earn/monetization-options

AdMob

Import the Mobile Ads SDK

```
implementation ‘com.google.android.gms:play-services-ads’
```

Update your AndroidManifest.xml

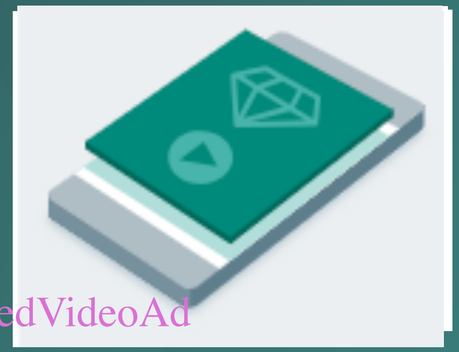
```
<manifest>
  <application>
    <!-- Sample AdMob App ID: ca-app-pub-3940256099942544~3347511713 -->
    <meta-data
      android:name="com.google.android.gms.ads.APPLICATION_ID"
      android:value="[ADMOB_APP_ID]"/>
  </application>
</manifest>
```

Initialize the SDK

```
override fun onCreate(savedInstanceState: Bundle?) {
    super.onCreate(savedInstanceState)
    // Sample AdMob app ID: ca-app-pub-3940256099942544~3347511713
    MobileAds.initialize(this)
}
```

Ad Formats

- Banner
- Interstitial
- Native
- Rewarded Video



DEMO

```
import com.google.android.gms.ads.AdRequest
import com.google.android.gms.ads.MobileAds
import com.google.android.gms.ads.reward.RewardedVideoAd
```

```
class MainActivity : AppCompatActivity(), RewardedVideoAdListener {
    private lateinit var mInterstitialAd: InterstitialAd
    private lateinit var mRewardedVideoAd: RewardedVideoAd

    override fun onCreate(savedInstanceState: Bundle?) {
        super.onCreate(savedInstanceState)
        setContentView(R.layout.activity_main)

        MobileAds.initialize(this, "ca-app-pub-3940256099942544~3347511713")
        // Use an activity context to get the rewarded video instance.
        mRewardedVideoAd = MobileAds.getRewardedVideoAdInstance(this)
        mRewardedVideoAd.rewardedVideoAdListener = this

        mInterstitialAd = InterstitialAd(this).apply {
            adUnitId = "ca-app-pub-3940256099942544/1033173712"
            loadAd(AdRequest.Builder().build())
        }
    }
```

```
<com.google.android.gms.ads.AdView
    xmlns:ads="http://schemas.android.com/apk/res-auto"
    android:id="@+id/adView"
    android:layout_width="wrap_content"
    android:layout_height="wrap_content"
    android:layout_centerHorizontal="true"
    android:layout_alignParentBottom="true"
    ads:adSize="BANNER"
    ads:adUnitId="ca-app-pub-3940256099942544/6300978111">
</com.google.android.gms.ads.AdView>
```

```
val adView = AdView(this)
adView.adSize = AdSize.BANNER
adView.adUnitId = "ca-app-pub-3940256099942544/6300978111"
// TODO: Add adView to your view hierarchy.
```

```
adLoader = AdLoader.Builder(this, "ca-app-pub-3940256099942544/2247696110")
        .forUnifiedNativeAd { ad : UnifiedNativeAd ->
            // Show the ad.
        }
        .withAdListener(object : AdListener() {
            override fun onAdFailedToLoad(errorCode: Int) {
                // Handle the failure by logging, altering the UI, and so on.
            }
        })
        .withNativeAdOptions(NativeAdOptions.Builder()
                // Methods in the NativeAdOptions.Builder class can be
                // used here to specify individual options settings.
                .build())
        .build()
```

https://developers.google.com/admob/android/rewarded-video

Google Play Billing Overview

DEMO

- Types of in-app products:
  - One-time products.
  - Subscriptions.
- In-app product configuration options:
  - Title.
  - Description.
  - Product ID.
  - Price / Default Price.

https://developer.android.com/google/play/billing/billing_overview

Lecture outcomes

- Use Firebase Realtime Database.
- How to use Remove Config with A-B testing.
- Authenticate your users using Firebase, with GoogleSignIn and EmailPassword methods.
- How to use Firebase Realtime Database.
- Using AdMob to display ads.