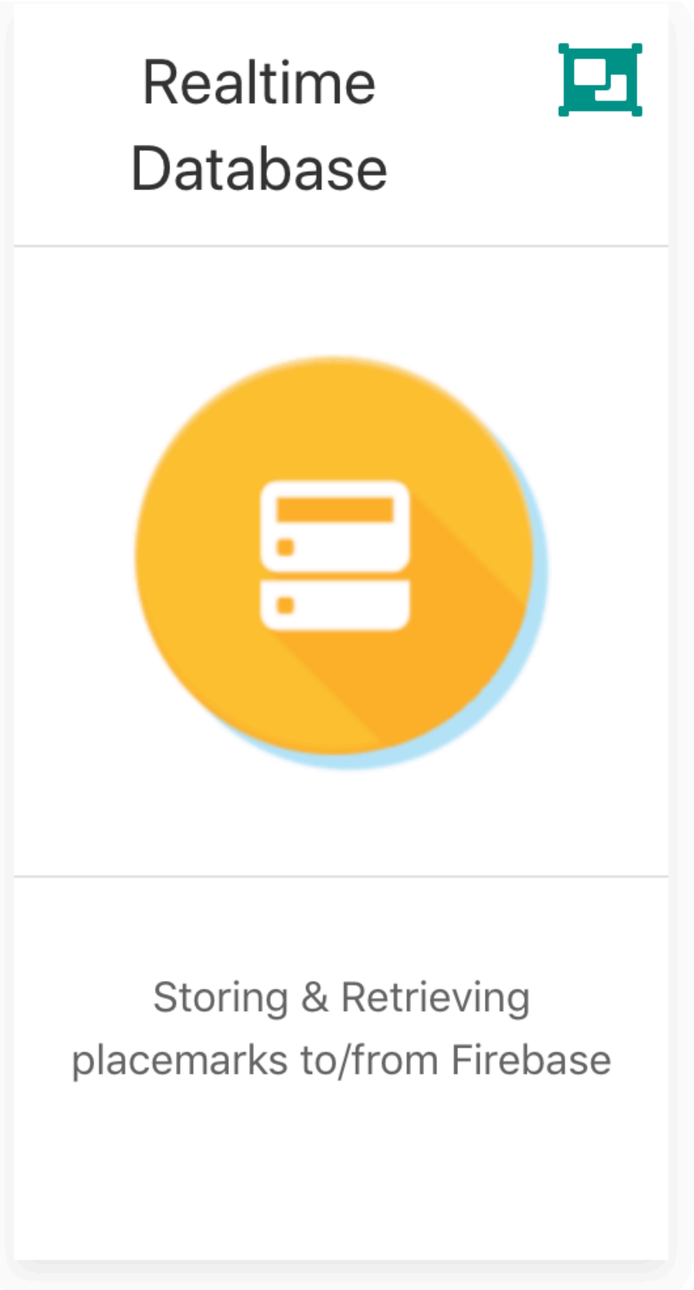
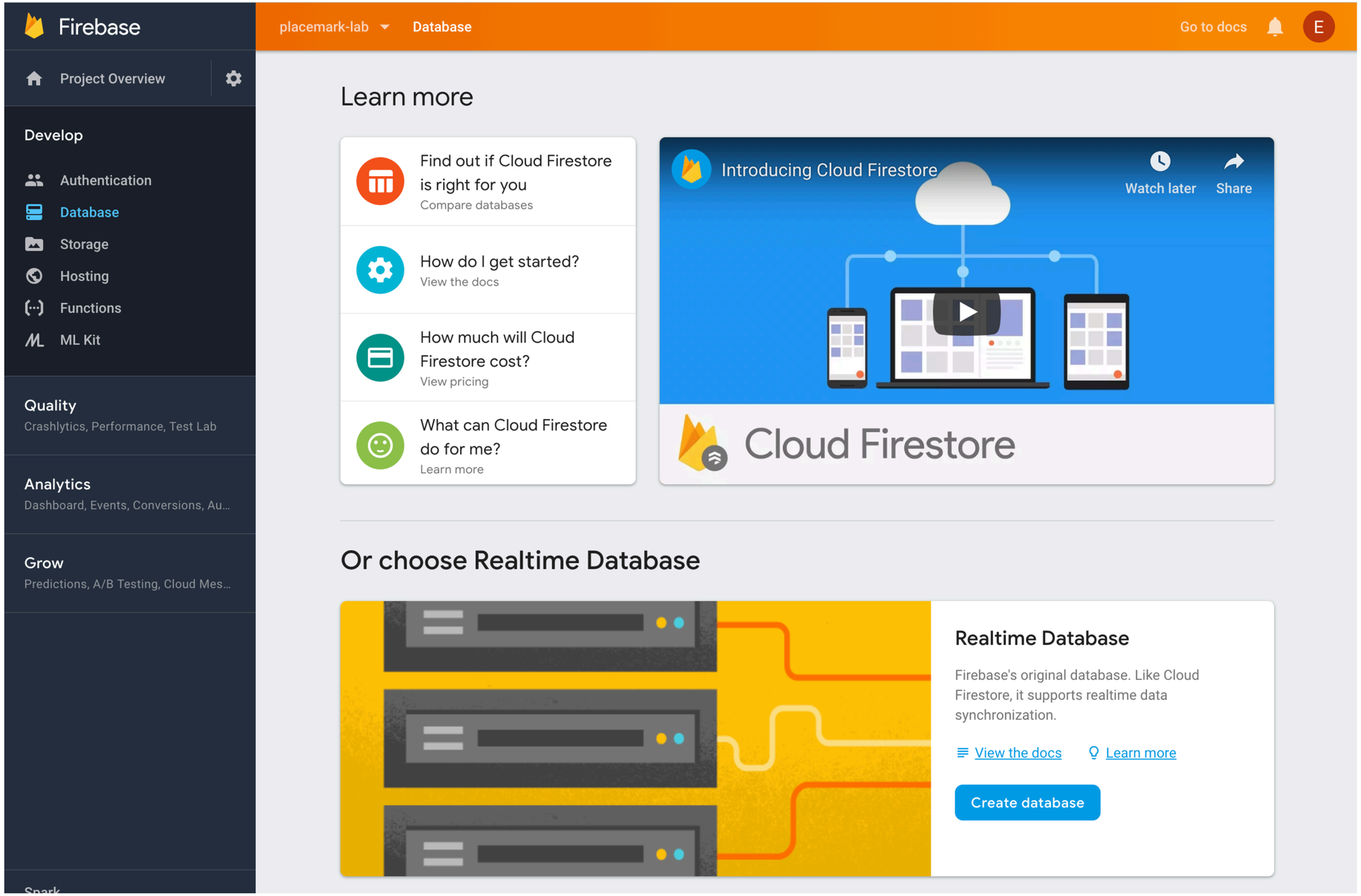
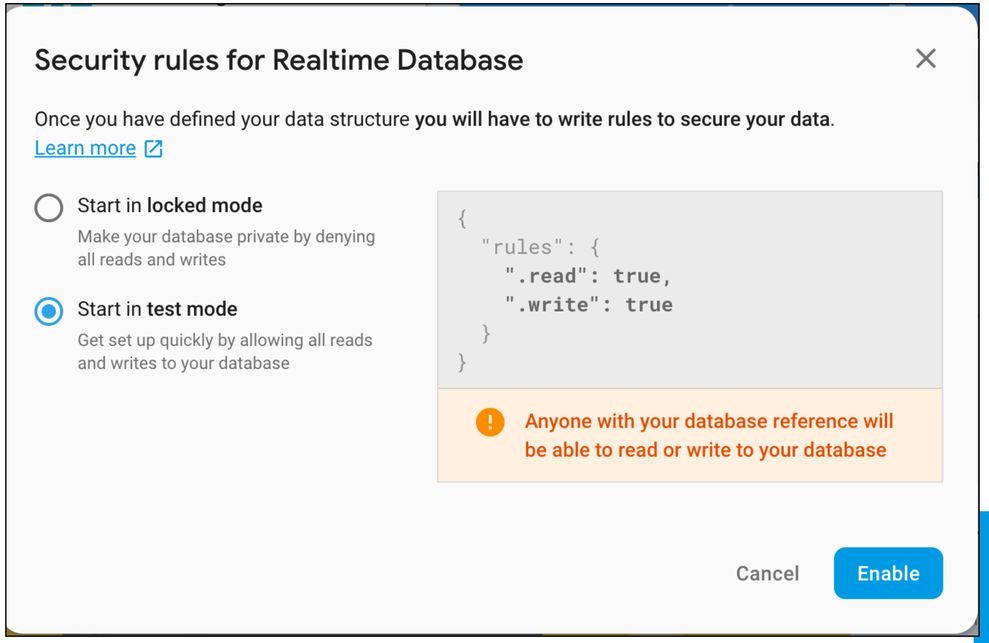
Firebase Database

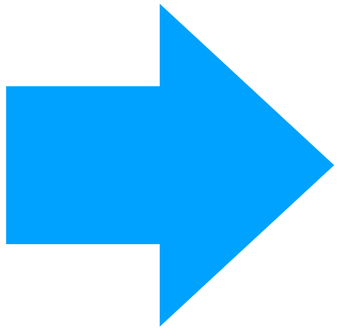


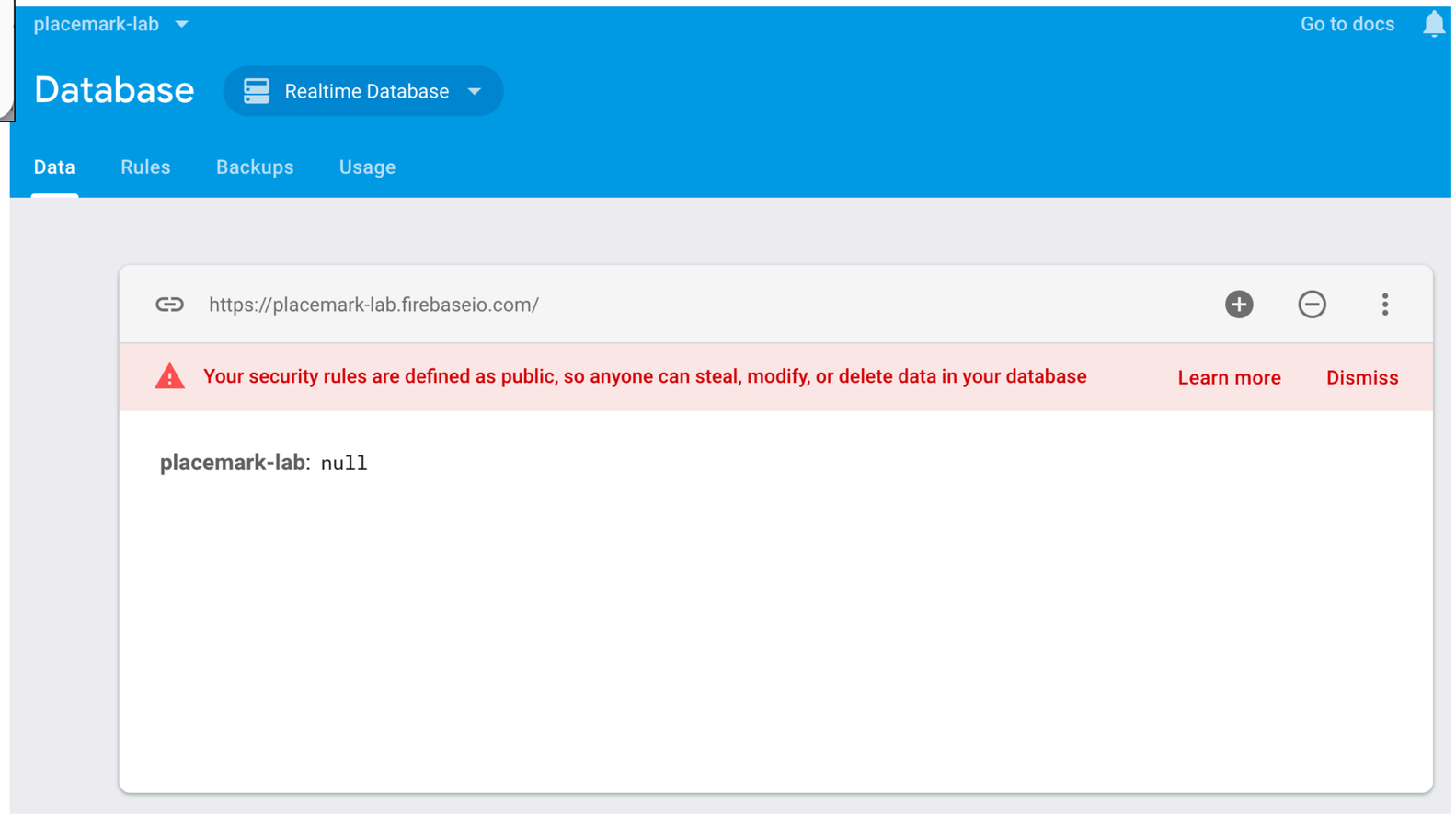
Realtime Database



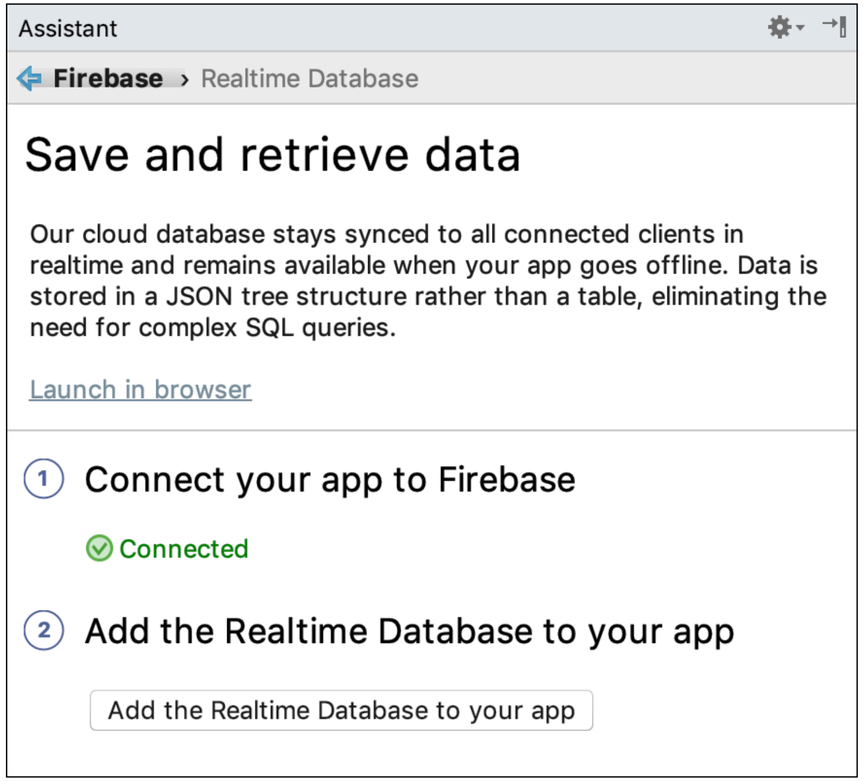
https://console.firebase.google.com

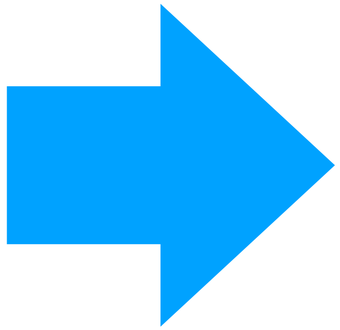






Android Studio






```
{
  "project_info": {
    "project_number": "4283XXXXX",
    "firebase_url": "https://placemark-XXXXd.firebaseio.com",
    "project_id": "placemark-XXXd",
  },
  "client": [
    {
      "client_info": {
        "mobilesdk_app_id": "1:428338485028:android:634c4XXXce143",
        "android_client_info": {
          "package_name": "org.wit.placemark"
        }
      },
      "oauth_client": [
        {
          "client_id": "4283XXXXX028-ntqXXXXXXXXXl9ot6ok3r.apps.googleusercontent.com",
          "client_type": 1,
          "android_info": {
            "package_name": "org.wit.placemark",
            "certificate_hash": "bcaa865ad78XXXXXXXXX731db4da8b"
          }
        },
        {
          "client_id": "42833848XXXXXX5cup7XXXXXXk8s.apps.googleusercontent.com",
          "client_type": 3
        }
      ],
      "api_key": [
        {
          "current_key": "AIzaSyBXXXXXXXXXXXoTeWhTqfKxbI"
        }
      ],
      "services": {
        "analytics_service": {
          "status": 1
        },
        "appinvite_service": {
          "status": 2,
          "other_platform_oauth_client": [
            {
              "client_id": "428338XXXXXXXXXXXXXXXXX1e4kk8s.apps.googleusercontent.com",
              "client_type": 3
            }
          ]
        },
        "ads_service": {
          "status": 2
        }
      }
    }
  ],
  "configuration_version": "1"
}
```

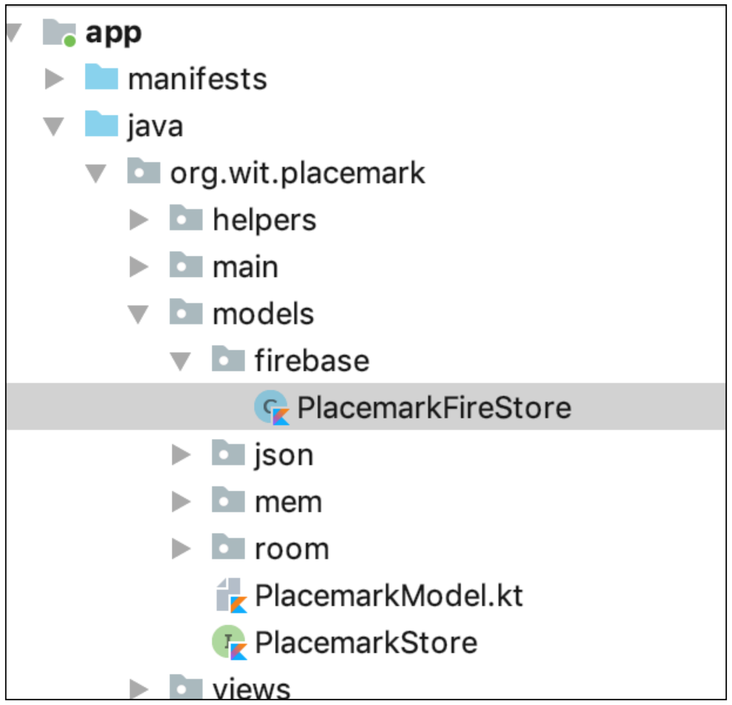

Updates
app/google-services.json

PlacemarkModel

```
@Parcelize
@Entity
data class PlacemarkModel(@PrimaryKey(autoGenerate = true) var id: Long = 0,
                          var fbId : String = "",
                          var title: String = "",
                          var description: String = "",
                          var image: String = "",
                          @Embedded var location : Location = Location()): Parcelable

@Parcelize
data class Location(var lat: Double = 0.0,
                    var lng: Double = 0.0,
                    var zoom: Float = 0f) : Parcelable
```

New Field: fbId - used to store Firebase key (a string)
Otherwise, model unchanged

PlacemarkFireStore

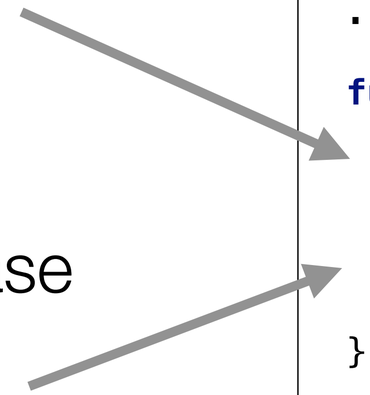



```kotlin
class PlacemarkFireStore(val context: Context) : PlacemarkStore, AnkoLogger {

  val placemarks = ArrayList<PlacemarkModel>()
  lateinit var userId: String
  lateinit var db: DatabaseReference

  suspend override fun findAll(): List<PlacemarkModel> {
    return placemarks
  }

  suspend override fun findById(id: Long): PlacemarkModel? {
    val foundPlacemark: PlacemarkModel? = placemarks.find { p -> p.id == id }
    return foundPlacemark
  }

  suspend override fun create(placemark: PlacemarkModel) {
    val key = db.child("users").child(userId).child("placemarks").push().key
    placemark.fbId = key!!
    placemarks.add(placemark)
    db.child("users").child(userId).child("placemarks").child(key).setValue(placemark)
  }

  suspend override fun update(placemark: PlacemarkModel) {
    var foundPlacemark: PlacemarkModel? = placemarks.find { p -> p.fbId == placemark.fbId }
    if (foundPlacemark != null) {
      foundPlacemark.title = placemark.title
      foundPlacemark.description = placemark.description
      foundPlacemark.image = placemark.image
      foundPlacemark.location = placemark.location
    }

    db.child("users").child(userId).child("placemarks").child(placemark.fbId).setValue(placemark)
  }

  suspend override fun delete(placemark: PlacemarkModel) {
    db.child("users").child(userId).child("placemarks").child(placemark.fbId).removeValue()
    placemarks.remove(placemark)
  }

  override fun clear() {
    placemarks.clear()
  }

  fun fetchPlacemarks(placemarksReady: () -> Unit) {
    val valueEventListener = object : ValueEventListener {
      override fun onCancelled(error: DatabaseError) {
      }
      override fun onDataChange(dataSnapshot: DataSnapshot) {
        dataSnapshot.children.mapNotNullTo(placemarks) { it.getValue<PlacemarkModel>(PlacemarkModel::class.java) }
        placemarksReady()
      }
    }
    userId = FirebaseAuth.getInstance().currentUser!!.uid
    db = FirebaseDatabase.getInstance().reference
    placemarks.clear()
    db.child("users").child(userId).child("placemarks").addListenerForSingleValueEvent(valueEventListener)
  }
}
```

PlacemarkFireStore - Initialisation

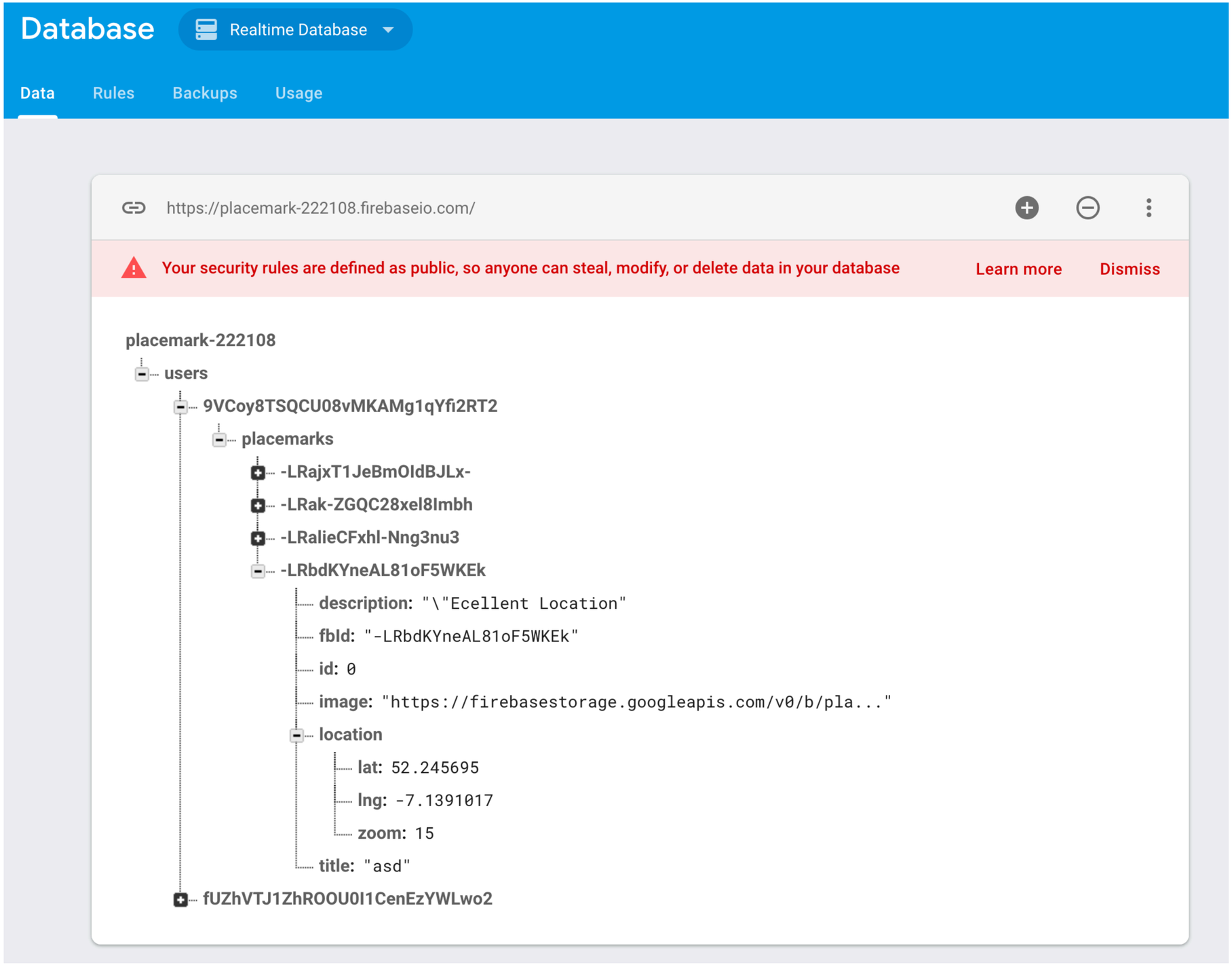
Firebase UserID
(from Auth)

Firebase Database
Reference



```
class PlacemarkFireStore(val context: Context) : PlacemarkStore, AnkoLogger {

  val placemarks = ArrayList<PlacemarkModel>()
  lateinit var userId: String
  lateinit var db: DatabaseReference

  suspend override fun findAll(): List<PlacemarkModel> {
    return placemarks
  }

  suspend override fun findById(id: Long): PlacemarkModel? {
    val foundPlacemark: PlacemarkModel? = placemarks.find { p -> p.id == id }
    return foundPlacemark
  }

  ...

  fun fetchPlacemarks(...) {

    userId = FirebaseAuth.getInstance().currentUser!!.uid

    db = FirebaseDatabase.getInstance().reference

    ...
  }
  ...
}
```

Database Structure



Application Database

Application Database

Collection of all Users

Application Database

Collection of all Users

Individual user (based in Auth ID)

Application Database

Collection of all Users

Individual user (based in Auth ID)

This Users' placemark collection

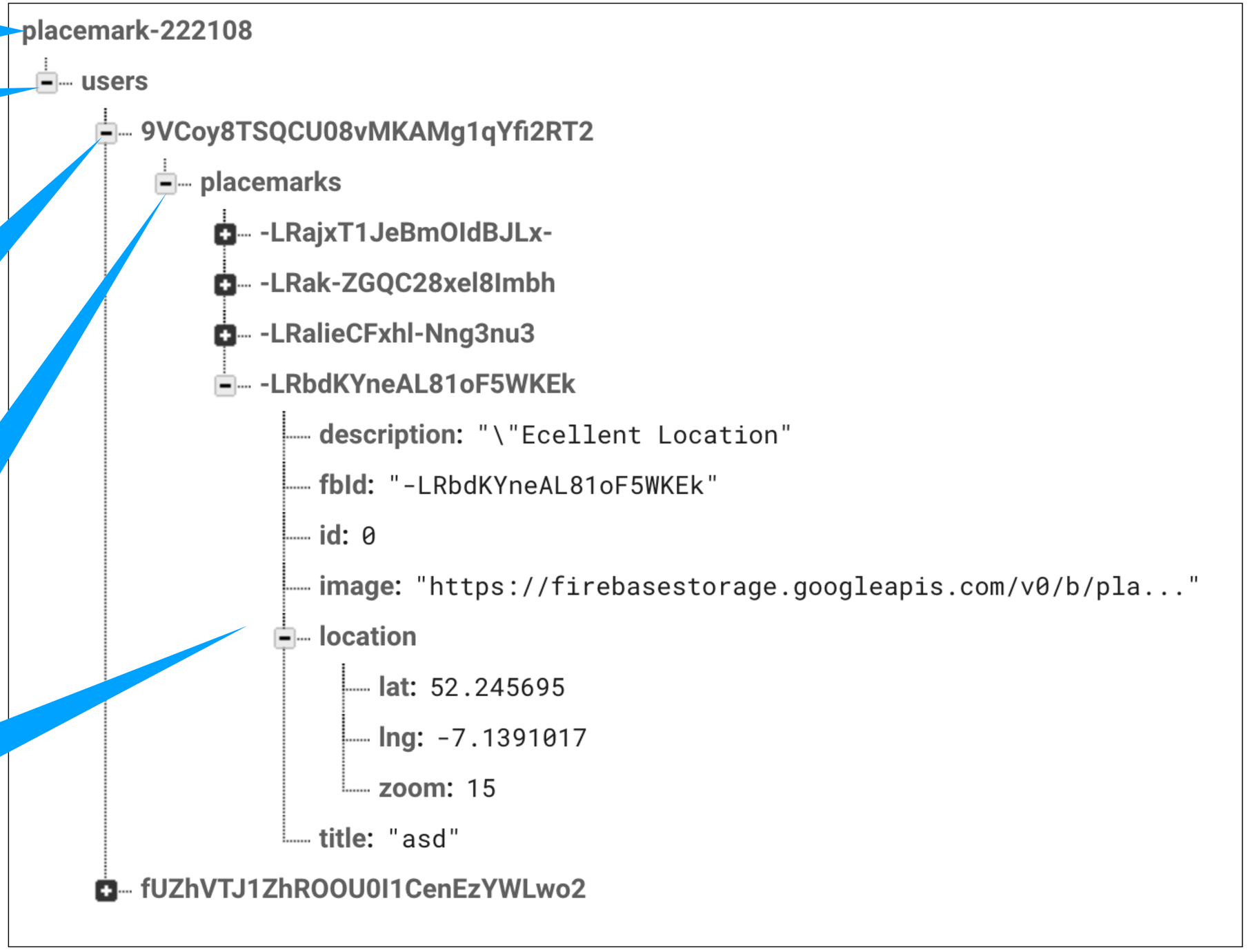
Application Database

Collection of all Users

Individual user (based in Auth ID)

This Users' placemark collection

Individual Placemark



PlacemarkFireStore - Create

Create a new Placemark object in the Database

Retain firebase key in place mark object

Populate the object with Placemark details

```
class PlacemarkFireStore(val context: Context) : PlacemarkStore, AnkoLogger {

  val placemarks = ArrayList<PlacemarkModel>()
  lateinit var userId: String
  lateinit var db: DatabaseReference

  suspend override fun create(placemark: PlacemarkModel) {

    val key = db.child("users").child(userId).child("placemarks").push().key

    key?.let {

      placemark.fbId = key

      placemarks.add(placemark)

      db.child("users").child(userId).child("placemarks").child(key).setValue(placemark)

    }
  }

  …
}
```

Keep local copy of Placemark in placemarks array

PlacemarkFireStore - update

Update pacemark in local array

```
suspend override fun update(placemark: PlacemarkModel) {
  var foundPlacemark: PlacemarkModel? = placemarks.find { p -> p.fbId == placemark.fbId }
  if (foundPlacemark != null) {
    foundPlacemark.title = placemark.title
    foundPlacemark.description = placemark.description
    foundPlacemark.image = placemark.image
    foundPlacemark.location = placemark.location
  }


  db.child(“users").child(userId).child("placemarks").child(placemark.fbId).setValue(placemark)
}
```

Replace placemark in database with new values

PlacemarkFireStore - delete

```
suspend override fun delete(placemark: PlacemarkModel) {
  db.child("users").child(userId).child("placemarks").child(placemark.fbId).removeValue()
  placemarks.remove(placemark)
}
```

PlacemarkFireStore - fetchPlacemarks

```
fun fetchPlacemarks(placemarksReady: () -> Unit) {

  val valueEventListener = object : ValueEventListener {
    override fun onCancelled(dataSnapshot: DatabaseError) {
      // Error connecting to database
    }
    override fun onDataChange(dataSnapshot: DataSnapshot) {
      dataSnapshot!!.children.mapNotNullTo(placemarks) {
        it.getValue<PlacemarkModel>(PlacemarkModel::class.java)
      }
      placemarksReady()
    }
  }

  userId = FirebaseAuth.getInstance().currentUser!!.uid
  db = FirebaseDatabase.getInstance().reference
  placemarks.clear()

  db.child("users").child(userId).child("placemarks").addListenerForSingleValueEvent(valueEventListener)
}
```

PlacemarkFireStore - fetchPlacemarks

```
fun fetchPlacemarks(placemarksReady: () -> Unit) {

  val valueEventListener = object : ValueEventListener {
    override fun onCancelled(dataSnapshot: DatabaseError) {
      // Error connecting to database
    }
    override fun onDataChange(dataSnapshot: DataSnapshot) {
      dataSnapshot!!.children.mapNotNullTo(placemarks) {
        it.getValue<PlacemarkModel>(PlacemarkModel::class.java)
      }
      placemarksReady()
    }
  }

  userId = FirebaseAuth.getInstance().currentUser!!.uid
  db = FirebaseDatabase.getInstance().reference
  placemarks.clear()

  db.child("users").child(userId).child("placemarks").addListenerForSingleValueEvent(valueEventListener)
}
```

Listener Callback object for Database updates

Listen for single update - in this case will be triggered with complete placemark collection

PlacemarkFireStore - fetchPlacemarks

```
fun fetchPlacemarks(placemarksReady: () -> Unit) {

  val valueEventListener = object : ValueEventListener {
    override fun onCancelled(dataSnapshot: DatabaseError) {
      // Error connecting to database
    }
    override fun onDataChange(dataSnapshot: DataSnapshot) {
      dataSnapshot!!.children.mapNotNullTo(placemarks) {
        it.getValue<PlacemarkModel>(PlacemarkModel::class.java)
      }
      placemarksReady()
    }
  }

  userId = FirebaseAuth.getInstance().currentUser!!.uid
  db = FirebaseDatabase.getInstance().reference
  placemarks.clear()

  db.child("users").child(userId).child("placemarks").addListenerForSingleValueEvent(valueEventListener)
}
```

Copy retrieved peacemakers to local array

PlacemarkFireStore - fetchPlacemarks

Lambda we will call when placemarks have been retrieved

```
fun fetchPlacemarks(placemarksReady: () -> Unit) {

  val valueEventListener = object : ValueEventListener {
    override fun onCancelled(dataSnapshot: DatabaseError) {
      // Error connecting to database
    }
    override fun onDataChange(dataSnapshot: DataSnapshot) {
      dataSnapshot!!.children.mapNotNullTo(placemarks) {
        it.getValue<PlacemarkModel>(PlacemarkModel::class.java)
      }
      placemarksReady()
    }
  }

  userId = FirebaseAuth.getInstance().currentUser!!.uid
  db = FirebaseDatabase.getInstance().reference
  placemarks.clear()

  db.child("users").child(userId).child("placemarks").addListenerForSingleValueEvent(valueEventListener)
}
```

Trigger lambda - as place marks have been retrieved

PlacemarkFireStore - fetchPlacemarks

Lambda we will call when placemarks have been retrieved

```
fun fetchPlacemarks(placemarksReady: () -> Unit) {

  val valueEventListener = object : ValueEventListener {
    override fun onCancelled(dataSnapshot: DatabaseError) {
      // Error connecting to database
    }
    override fun onDataChange(dataSnapshot: DataSnapshot) {
      dataSnapshot!!.children.mapNotNullTo(placemarks) {
        it.getValue<PlacemarkModel>(PlacemarkModel::class.java)
      }
      placemarksReady()
    }
  }

  userId = FirebaseAuth.getInstance().currentUser!!.uid
  db = FirebaseDatabase.getInstance().reference
  placemarks.clear()

  db.child("users").child(userId).child("placemarks").addListenerForSingleValueEvent(valueEventListener)
}
```

Copy retrieved peacemakers to local array

Trigger lambda - as place marks have been retrieved

Listener Callback object for Database updates

Listen for single update - in this case will be triggered with complete placemark collection

LoginPresenter

```
class LoginPresenter(view: BaseView) : BasePresenter(view) {

  var auth: FirebaseAuth = FirebaseAuth.getInstance()
  var fireStore: PlacemarkFireStore? = null

  init {
    if (app.placemarks is PlacemarkFireStore) {
      fireStore = app.placemarks as PlacemarkFireStore
    }
  }

  fun doLogin(email: String, password: String) {
    view?.showProgress()
    auth.signInWithEmailAndPassword(email, password).addOnCompleteListener(view!!) { task ->
      if (task.isSuccessful) {
        if (fireStore != null) {
          fireStore!!.fetchPlacemarks {
            view?.hideProgress()
            view?.navigateTo(VIEW.LIST)
          }
        } else {
          view?.hideProgress()
          view?.navigateTo(VIEW.LIST)
        }
      } else {
        view?.hideProgress()
        view?.toast("Sign Up Failed: ${task.exception?.message}")
      }
    }
  }
  ...
}
```

LoginPresenter : doLogin

```
fun doLogin(email: String, password: String) {
  view?.showProgress()
  auth.signInWithEmailAndPassword(email, password).addOnCompleteListener(view!!) { task ->
    if (task.isSuccessful) {
      if (fireStore != null) {
        fireStore!!.fetchPlacemarks {
          view?.hideProgress()
          view?.navigateTo(VIEW.LIST)
        }
      } else {
        view?.hideProgress()
        view?.navigateTo(VIEW.LIST)
      }
    } else {
      view?.hideProgress()
      view?.toast("Sign Up Failed: ${task.exception?.message}")
    }
  }
}
```

lambda to be called when place marks have been retrieved

LoginPresenter -> PlacemarkStore -> LoginPresenter

```
fun fetchPlacemarks(placemarksReady: () -> Unit) {

  val valueEventListener = object : ValueEve
    override fun onCancelled(dataSnapshot: Da
      // Error connecting to database
    }
    override fun onDataChange(dataSnapshot: Da
      dataSnapshot!!.children.mapNotNullTo(pla
        it.getValue<PlacemarkModel>(PlacemarkM
      }
      placemarksReady()
    }
  }

  userId = FirebaseAuth.getInstance().currentU
  db = FirebaseDatabase.getInstance().referenc
  placemarks.clear()

  db.child("users").child(userId).child("place
}
```

```
fun do  in(email: String, password: String) {
  view?.sh  rogress()
  auth.signIn  EmailAndPassword(email, password).addOnCompleteListener(v
    if (task.isSu  sful) {
      if (fireStore !=  ll) {
        fireStore!!.fetchPlacemarks {
          view?.hideProgress()
          view?.navigateTo(VIEW.LIST)
        }
      } else {
        view?.hideProgress()
        view?.navigateTo(VIEW.LIST)
      }
    } else {
      view?.hideProgress()
      view?.toast("Sign Up Failed: ${task.exception?.message}")
    }
  }
}
```

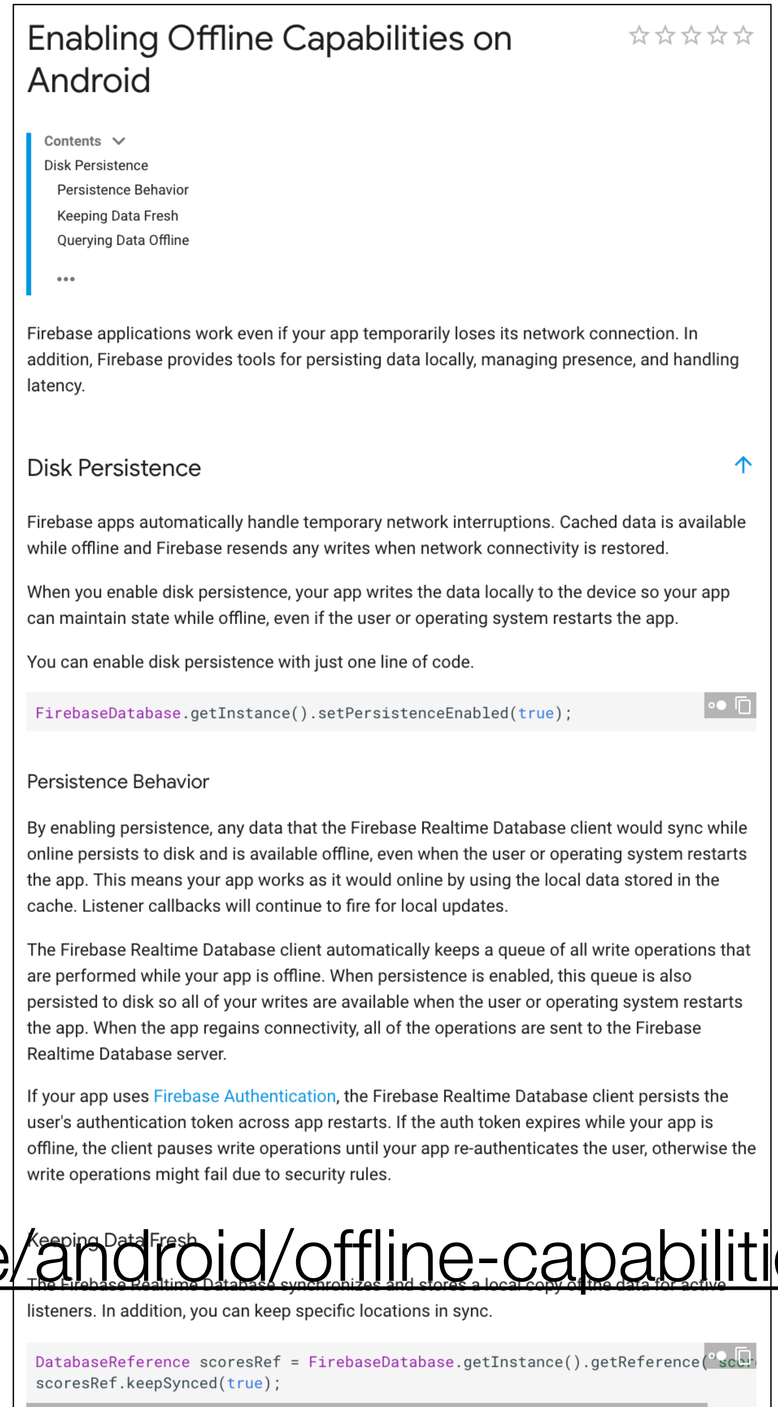
Supplementary Approach: Enabling Offline Capabilities

Firebase apps automatically handle temporary network interruptions.

Cached data is available while offline and Firebase resends any writes when network connectivity is restored.

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

Persistence Behaviour
Keeping Data Fresh
Querying Data Offline
Handling Transactions Offline
Managing Presence
Detecting Connection State



Enabling Offline Capabilities on Android

Contents
- Disk Persistence
  - Persistence Behavior
  - Keeping Data Fresh
  - Querying Data Offline
  - ...

Firebase applications work even if your app temporarily loses its network connection. In addition, Firebase provides tools for persisting data locally, managing presence, and handling latency.

Disk Persistence

Firebase apps automatically handle temporary network interruptions. Cached data is available while offline and Firebase resends any writes when network connectivity is restored.

When you enable disk persistence, your app writes the data locally to the device so your app can maintain state while offline, even if the user or operating system restarts the app.

You can enable disk persistence with just one line of code.

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

Persistence Behavior

By enabling persistence, any data that the Firebase Realtime Database client would sync while online persists to disk and is available offline, even when the user or operating system restarts the app. This means your app works as it would online by using the local data stored in the cache. Listener callbacks will continue to fire for local updates.

The Firebase Realtime Database client automatically keeps a queue of all write operations that are performed while your app is offline. When persistence is enabled, this queue is also persisted to disk so all of your writes are available when the user or operating system restarts the app. When the app regains connectivity, all of the operations are sent to the Firebase Realtime Database server.

If your app uses Firebase Authentication, the Firebase Realtime Database client persists the user's authentication token across app restarts. If the auth token expires while your app is offline, the client pauses write operations until your app re-authenticates the user, otherwise the write operations might fail due to security rules.

Keeping Data Fresh

The Firebase Realtime Database synchronizes and stores a local copy of the data for active listeners. In addition, you can keep specific locations in sync.

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

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