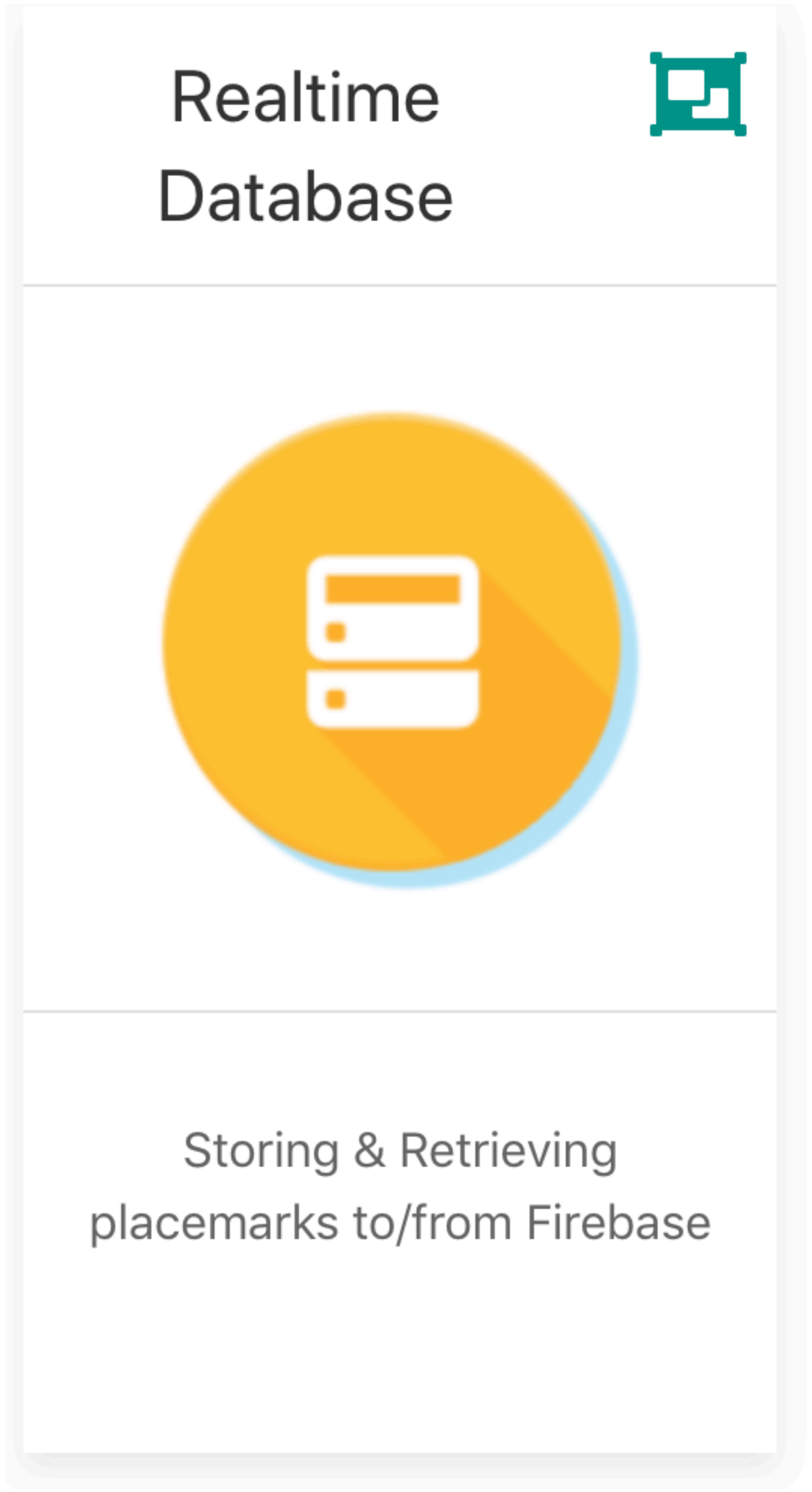
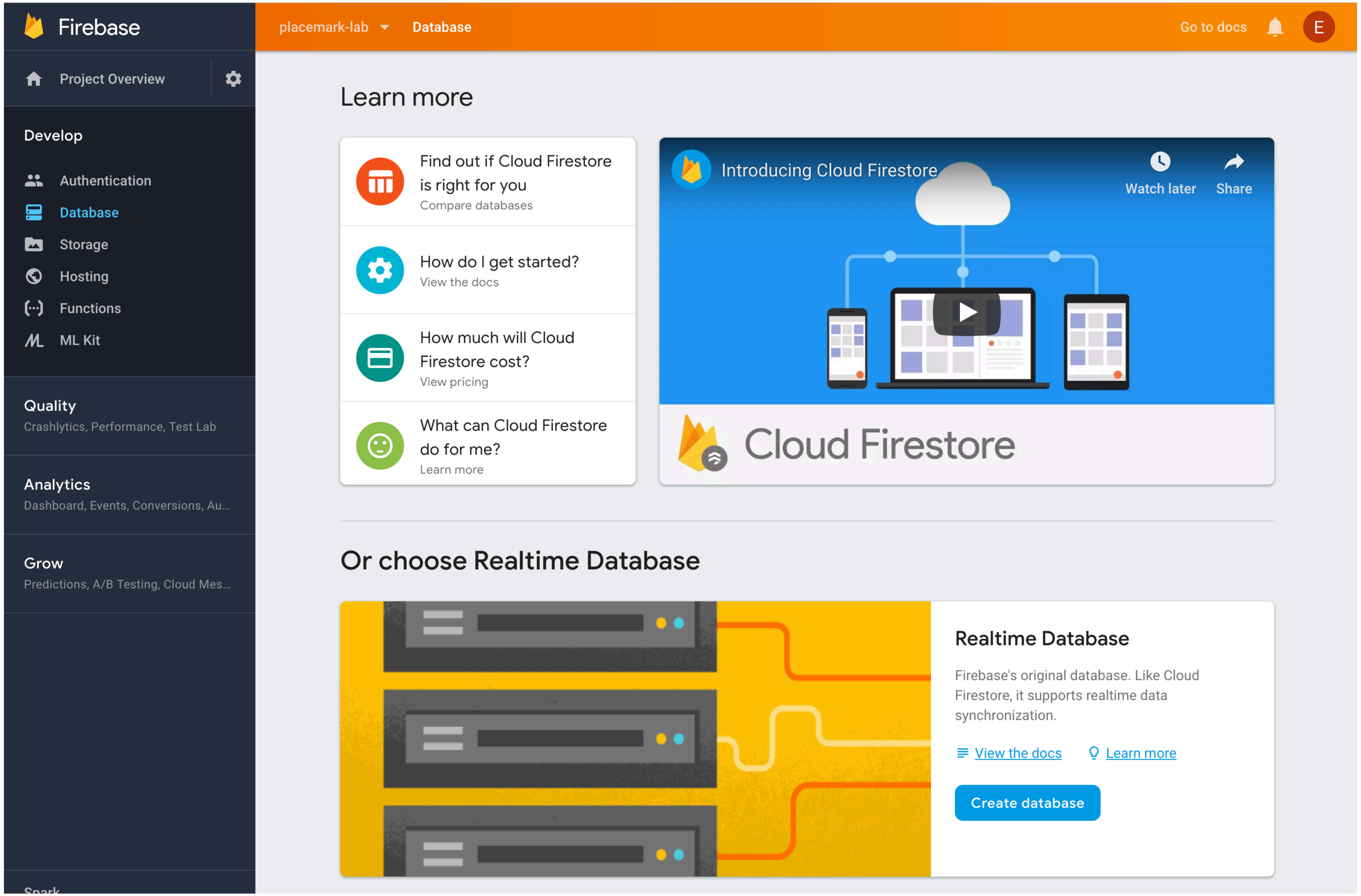
Firebase Database



Realtime Database

Storing & Retrieving placemarks to/from Firebase

Realtime Database



Firebase

placemark-lab Database Go to docs E

Project Overview

Develop

- Authentication
- Database
- Storage
- Hosting
- Functions
- ML Kit

Quality
Crashlytics, Performance, Test Lab

Analytics
Dashboard, Events, Conversions, Au...

Grow
Predictions, A/B Testing, Cloud Mes...

Spark

Learn more

Find out if Cloud Firestore is right for you
Compare databases

How do I get started?
View the docs

How much will Cloud Firestore cost?
View pricing

What can Cloud Firestore do for me?
Learn more

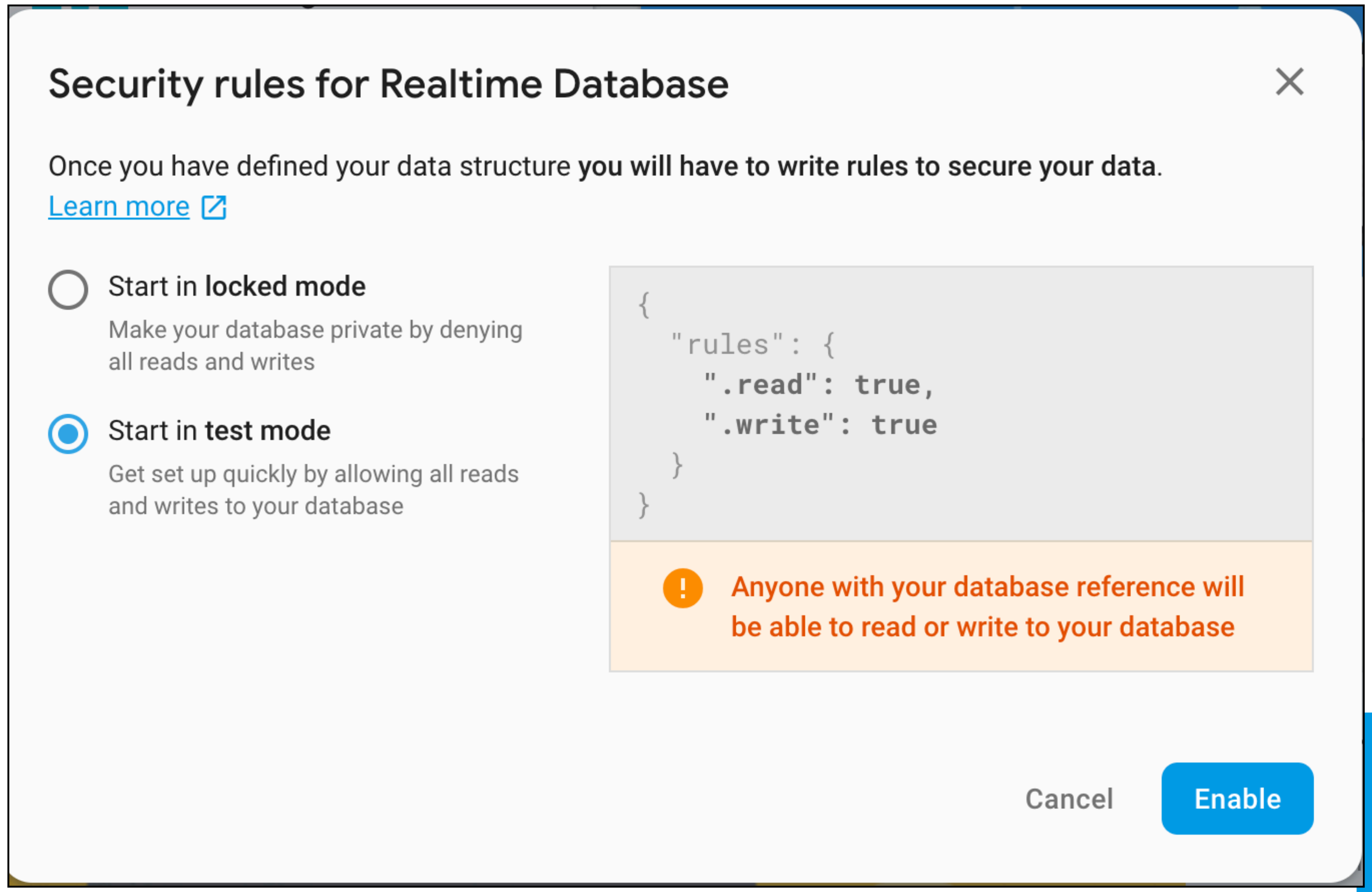
Or choose Realtime Database

Realtime Database

Firebase's original database. Like Cloud Firestore, it supports realtime data synchronization.

View the docs   Learn more

Create database



Security rules for Realtime Database

Once you have defined your data structure **you will have to write rules to secure your data**.
Learn more

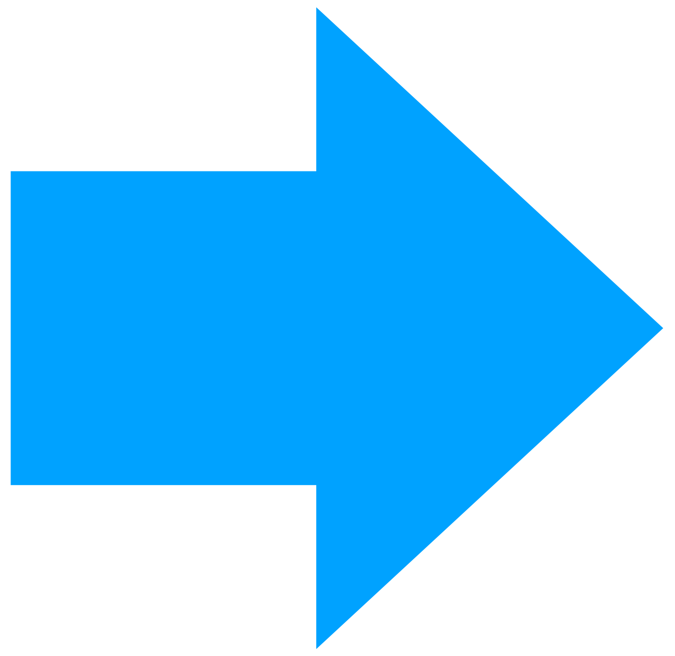
Start in **locked mode**
Make your database private by denying all reads and writes

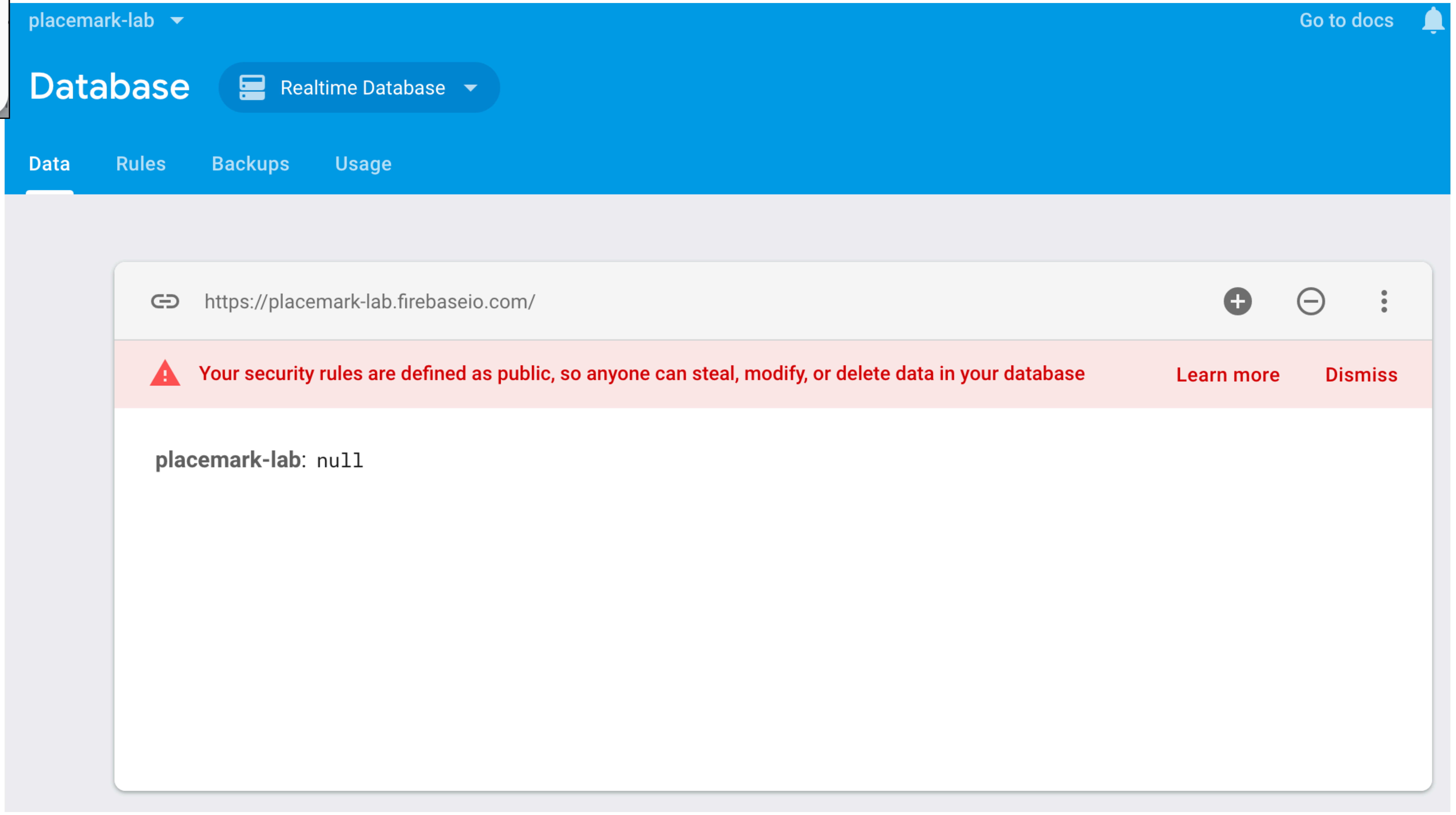
[✓ Start in **test mode**]
Get set up quickly by allowing all reads and writes to your database

```
{
  "rules": {
    ".read": true,
    ".write": true
  }
}
```

Anyone with your database reference will be able to read or write to your database

https://console.firebase.google.com



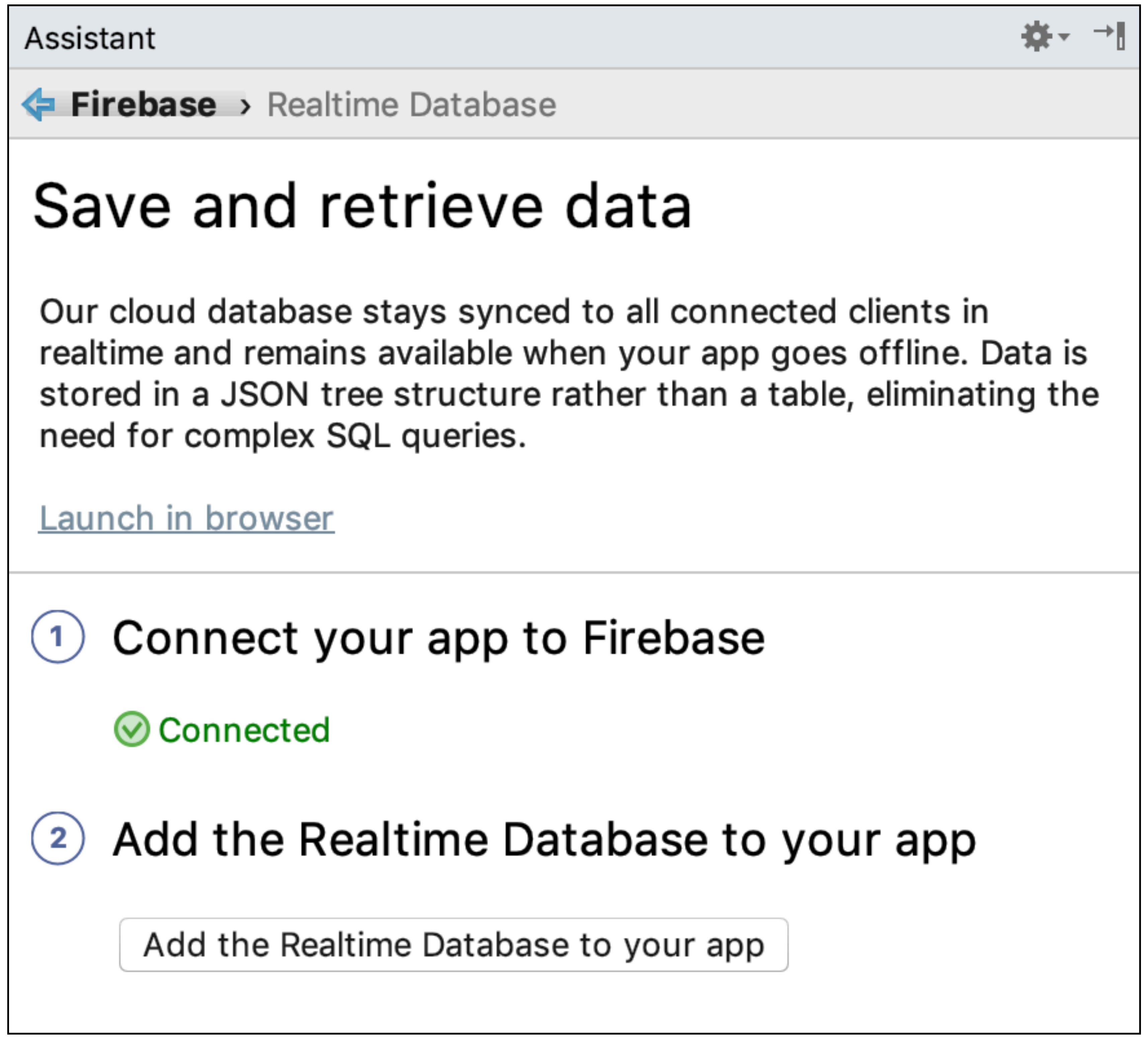


https://placemark-lab.firebaseio.com/

Your security rules are defined as public, so anyone can steal, modify, or delete data in your database

placemark-lab: `null`

Android Studio



Assistant

Firebase › Realtime Database

Save and retrieve data

Our cloud database stays synced to all connected clients in realtime and remains available when your app goes offline. Data is stored in a JSON tree structure rather than a table, eliminating the need for complex SQL queries.

Launch in browser

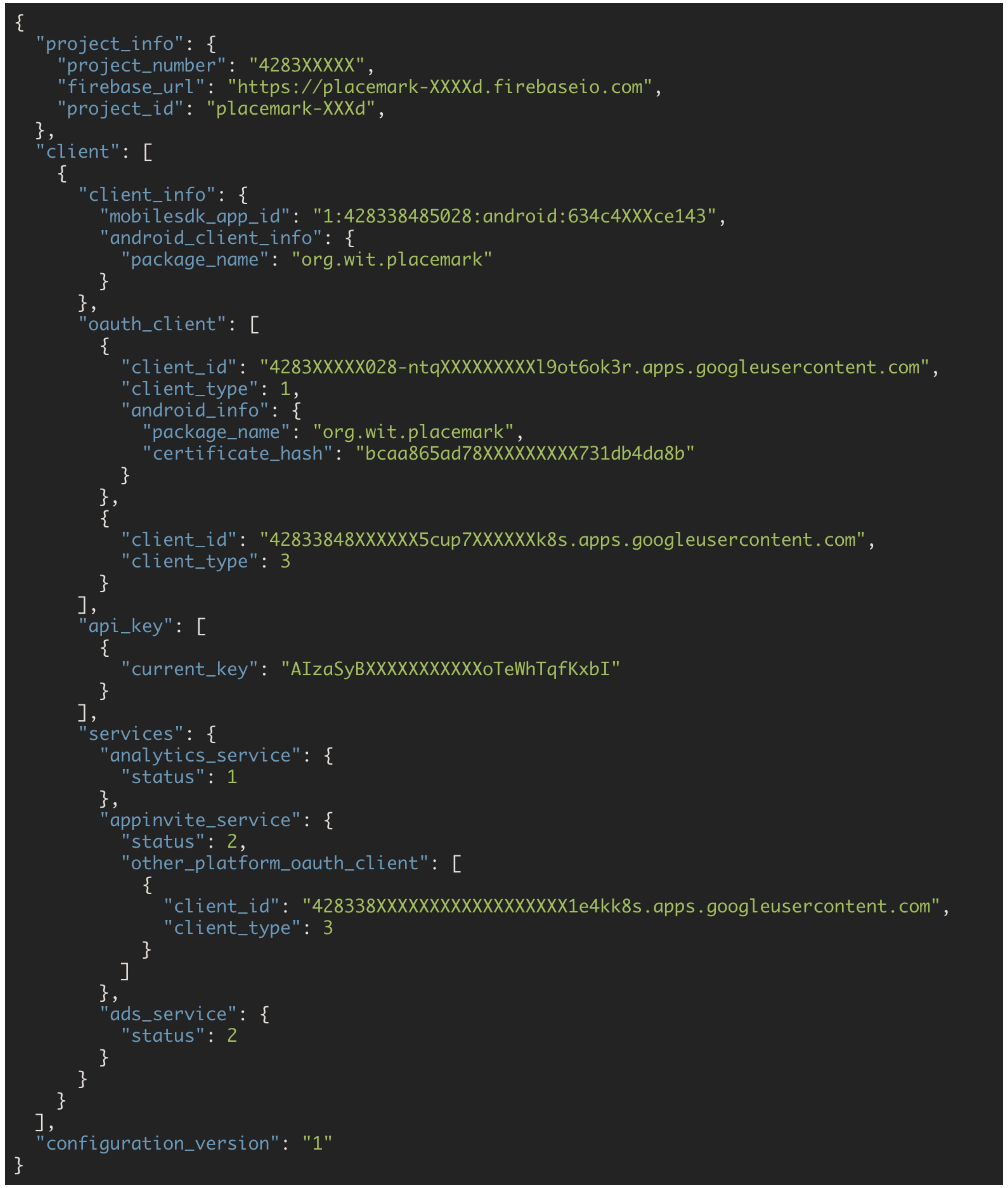
1. Connect your app to Firebase

   ✓ Connected

2. Add the Realtime Database to your app

   Add the Realtime Database to your app

Updates
app/google-services.json



```
{
  "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": "428338XXXXXXXXXXXXXXXXXX1e4kk8s.apps.googleusercontent.com",
              "client_type": 3
            }
          ]
        },
        "ads_service": {
          "status": 2
        }
      }
    }
  ],
  "configuration_version": "1"
}
```

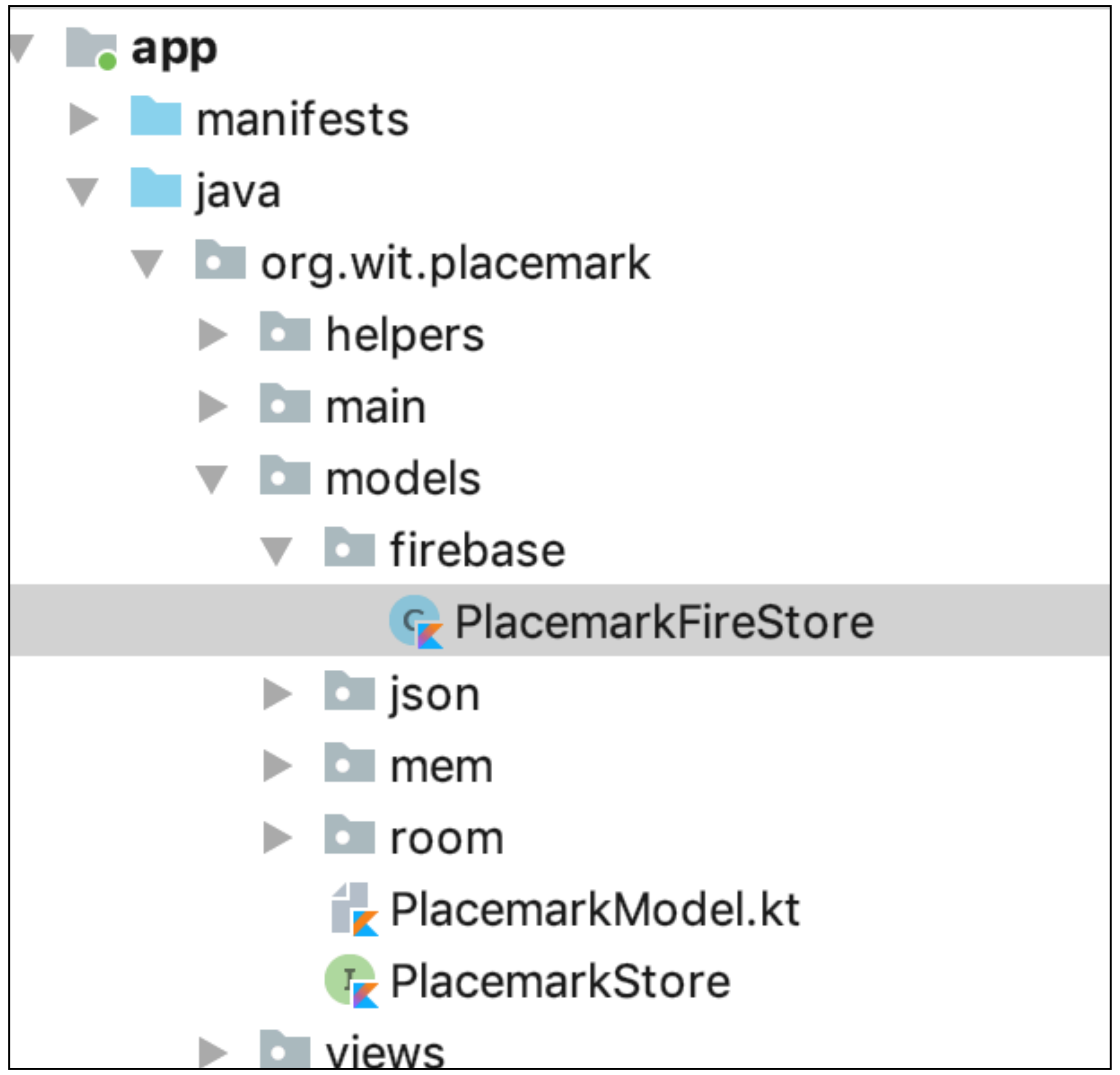
PlacemarkModel

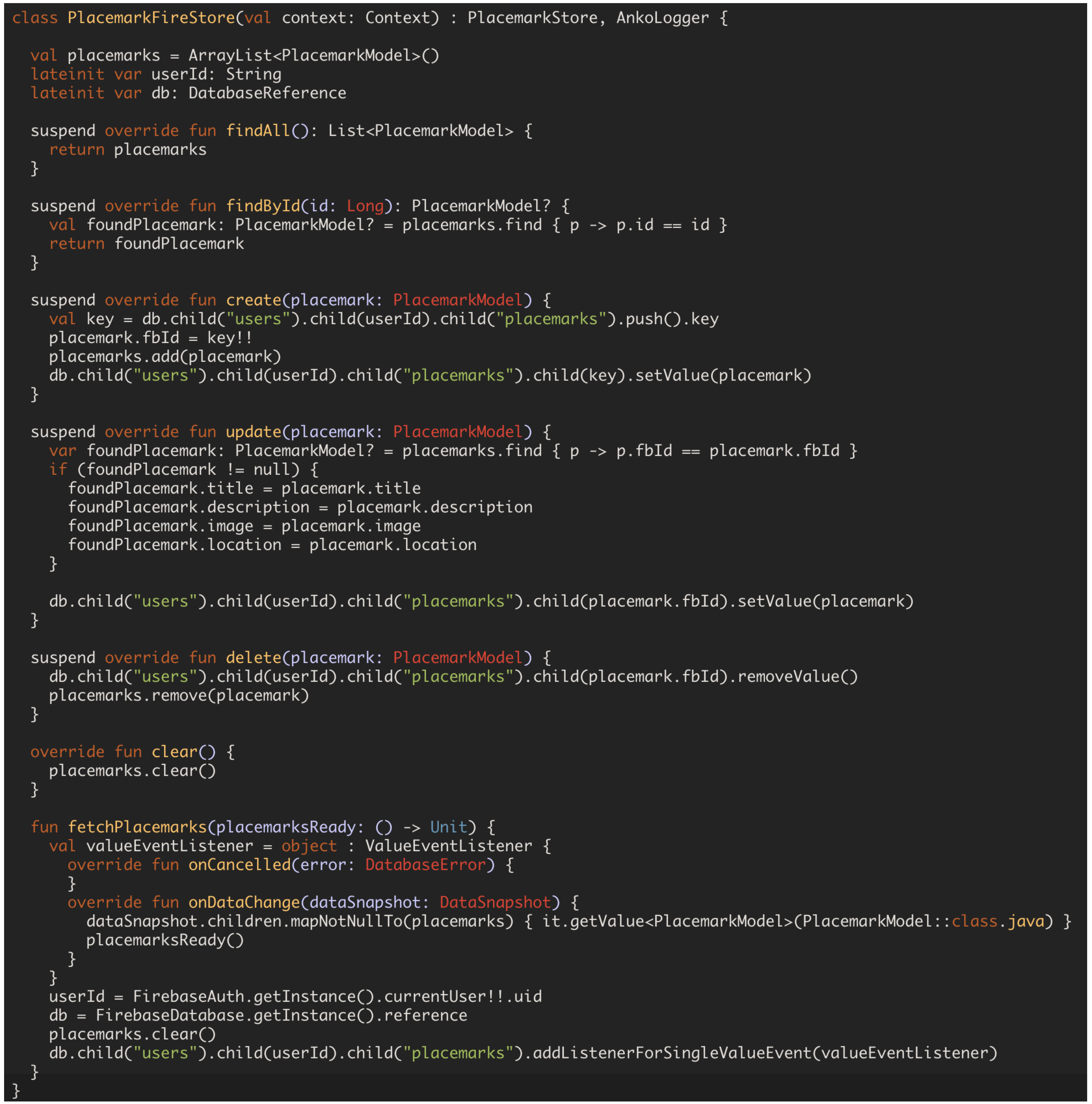
```kotlin
@Parcelize
@Entity
data class PlacemarkModel(@PrimaryKey(autoGenerate = true) var id: Long = 0,
                          var fbId : String = "",
                          var title: String = "",
                          var description: String = "",
                          var image: String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

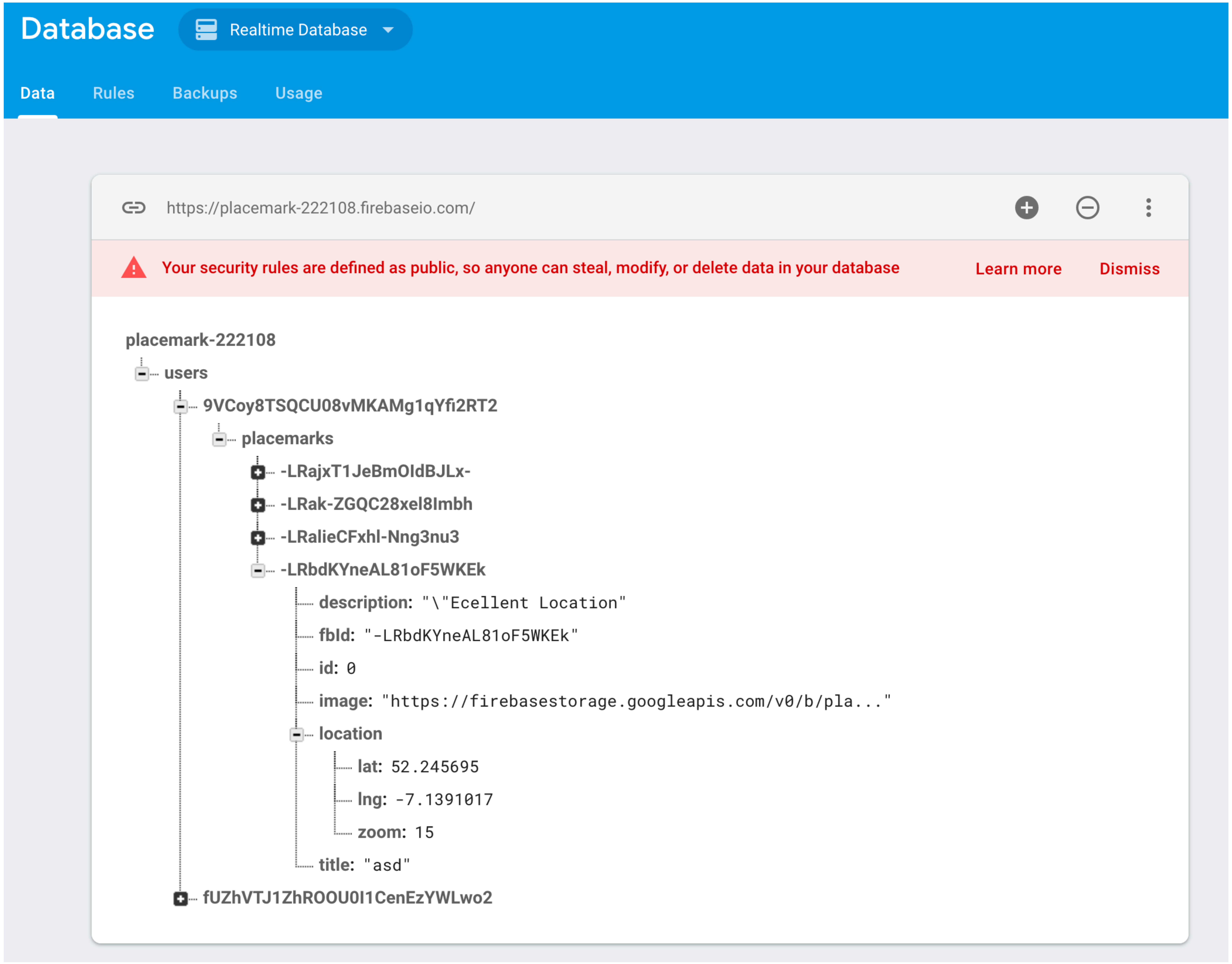
PlacemarkFireStore - Initialisation

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

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

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

  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
    ...
  }
  ...
}
```

Firebase UserID
(from Auth)

Firebase Database
Reference

Database Structure

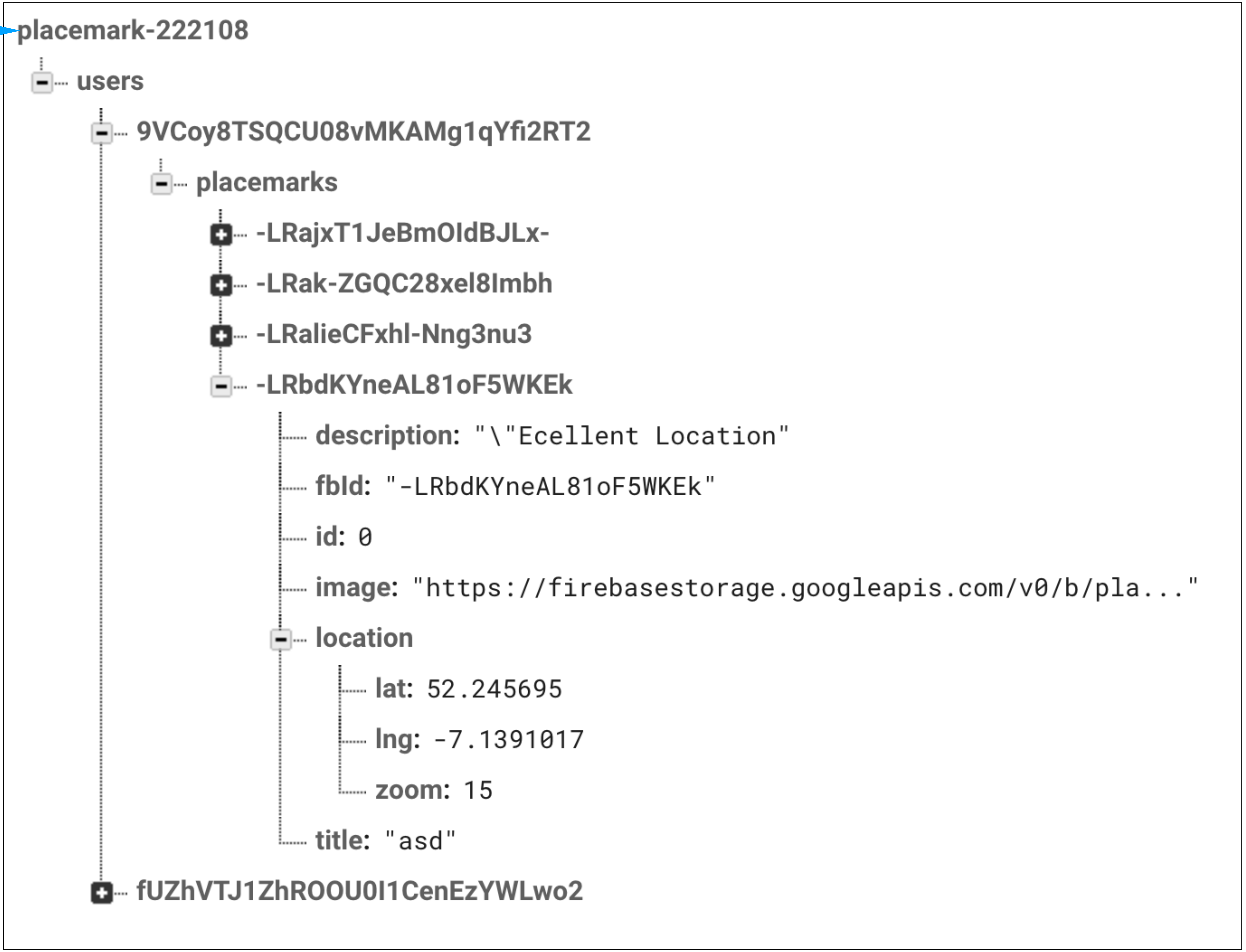


https://placemark-222108.firebaseio.com/

Your security rules are defined as public, so anyone can steal, modify, or delete data in your database

```
placemark-222108
  users
    9VCoy8TSQCU08vMKAMg1qYfi2RT2
      placemarks
        -LRajxT1JeBmOldBJLx-
        -LRak-ZGQC28xel8Imbh
        -LRalieCFxhl-Nng3nu3
        -LRbdKYneAL81oF5WKEk
          description: "\"Ecellent Location"
          fbId: "-LRbdKYneAL81oF5WKEk"
          id: 0
          image: "https://firebasestorage.googleapis.com/v0/b/pla..."
          location
            lat: 52.245695
            lng: -7.1391017
            zoom: 15
          title: "asd"
    fUZhVTJ1ZhROOU0I1CenEzYWLwo2
```

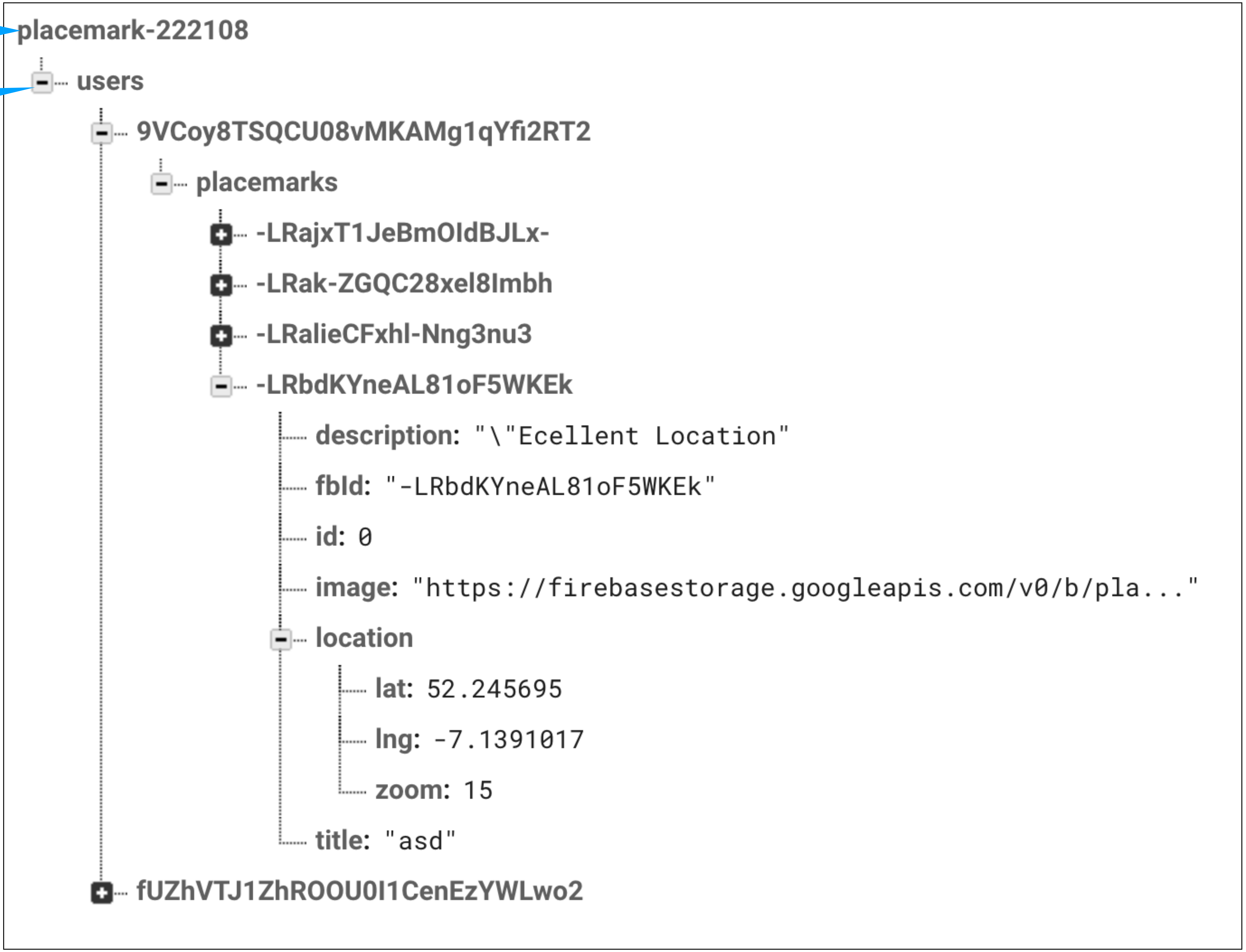
Application Database



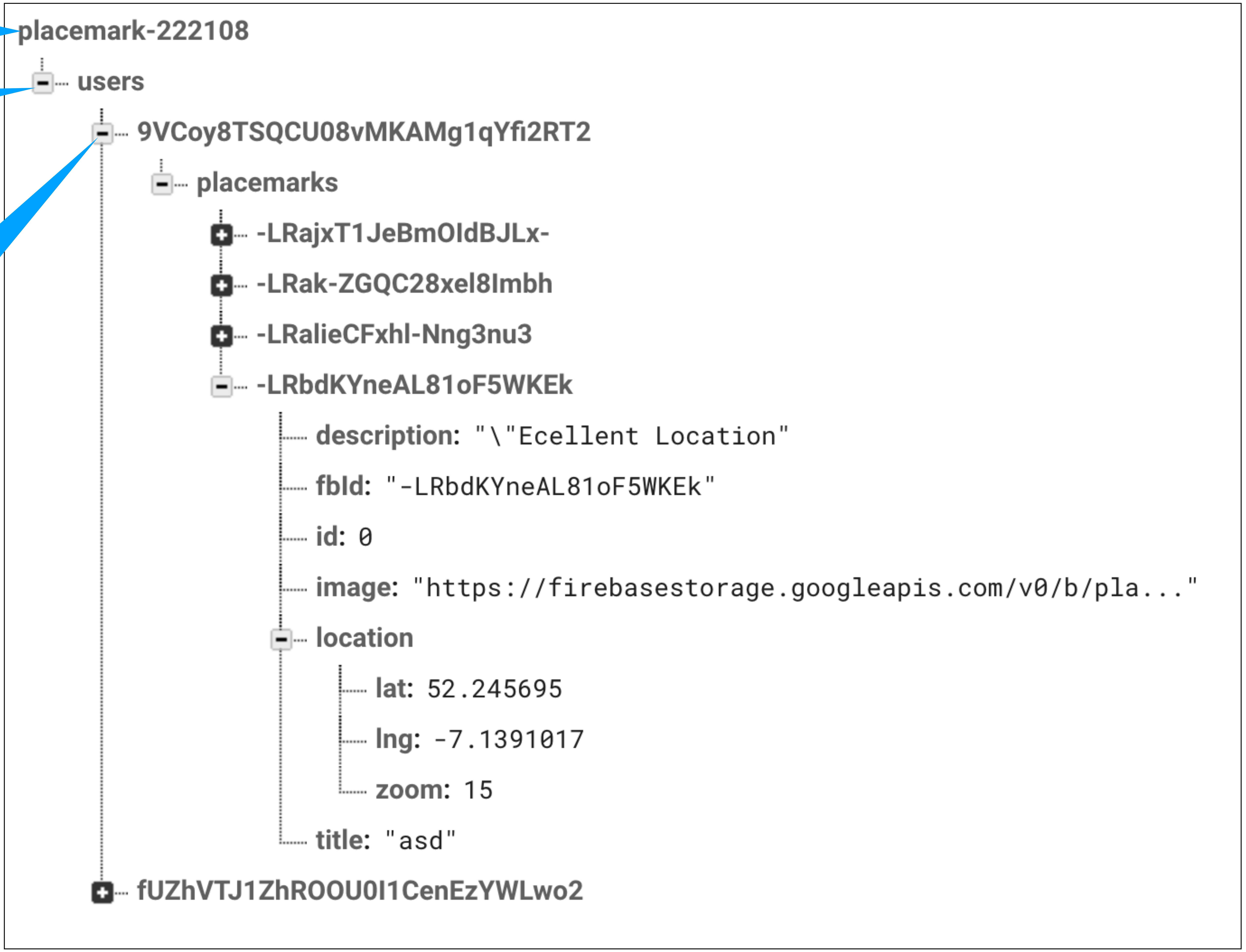
```
placemark-222108
  users
    9VCoy8TSQCU08vMKAMg1qYfi2RT2
      placemarks
        -LRajxT1JeBmOIdBJLx-
        -LRak-ZGQC28xel8Imbh
        -LRalieCFxhl-Nng3nu3
        -LRbdKYneAL81oF5WKEk
          description: "\"Ecellent Location"
          fbId: "-LRbdKYneAL81oF5WKEk"
          id: 0
          image: "https://firebasestorage.googleapis.com/v0/b/pla..."
          location
            lat: 52.245695
            lng: -7.1391017
            zoom: 15
          title: "asd"
    fUZhVTJ1ZhROOU0I1CenEzYWLwo2
```

Application Database

Collection of all Users



```
placemark-222108
  users
    9VCoy8TSQCU08vMKAMg1qYfi2RT2
      placemarks
        -LRajxT1JeBmOIdBJLx-
        -LRak-ZGQC28xel8Imbh
        -LRalieCFxhl-Nng3nu3
        -LRbdKYneAL81oF5WKEk
          description: "\"Ecellent Location"
          fbId: "-LRbdKYneAL81oF5WKEk"
          id: 0
          image: "https://firebasestorage.googleapis.com/v0/b/pla..."
          location
            lat: 52.245695
            lng: -7.1391017
            zoom: 15
          title: "asd"
    fUZhVTJ1ZhROOU0I1CenEzYWLwo2
```



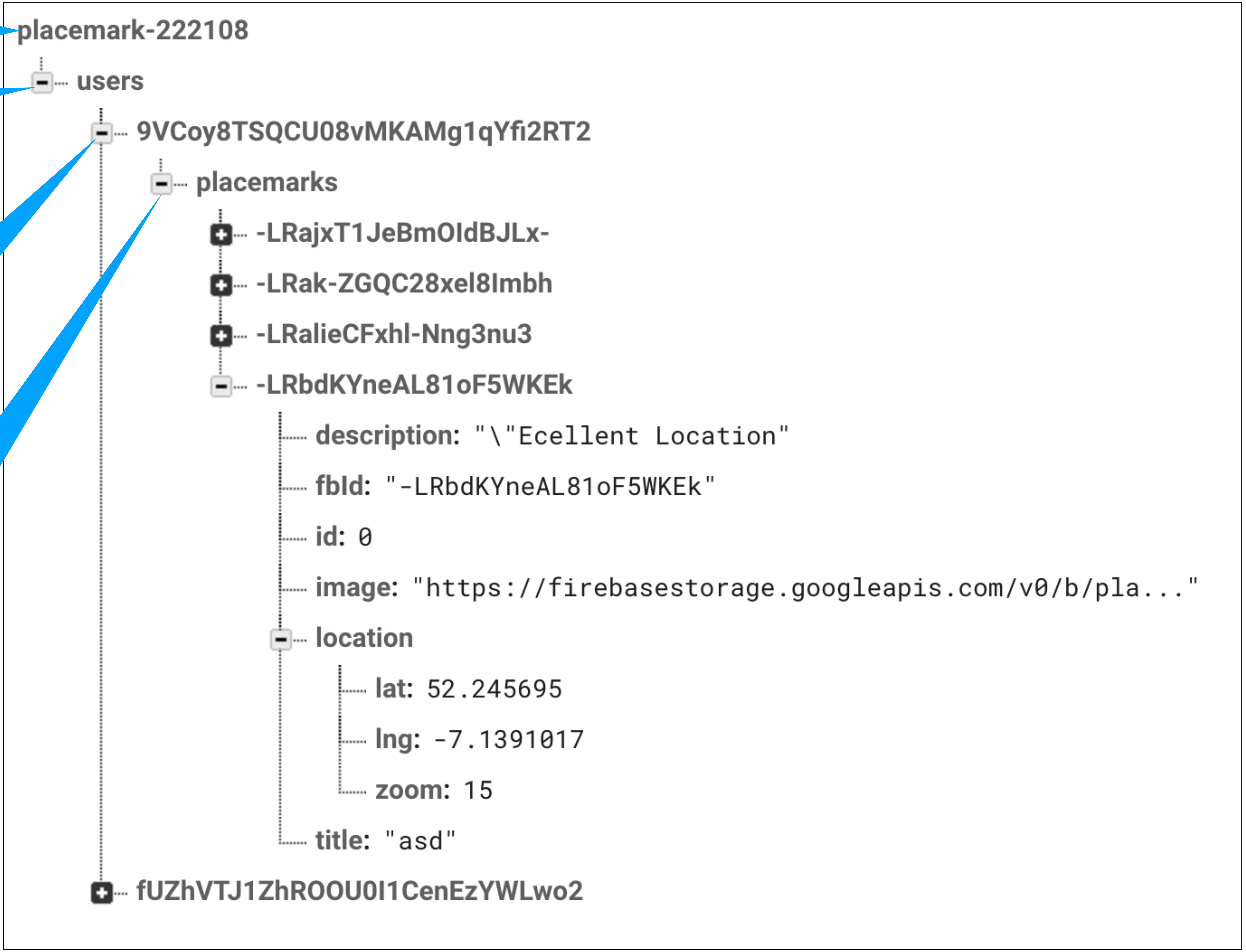
```
placemark-222108
  users
    9VCoy8TSQCU08vMKAMg1qYfi2RT2
      placemarks
        -LRajxT1JeBmOIdBJLx-
        -LRak-ZGQC28xel8Imbh
        -LRalieCFxhl-Nng3nu3
        -LRbdKYneAL81oF5WKEk
          description: "\"Ecellent Location"
          fbId: "-LRbdKYneAL81oF5WKEk"
          id: 0
          image: "https://firebasestorage.googleapis.com/v0/b/pla..."
          location
            lat: 52.245695
            lng: -7.1391017
            zoom: 15
          title: "asd"
    fUZhVTJ1ZhROOU0I1CenEzYWLwo2
```

Application Database

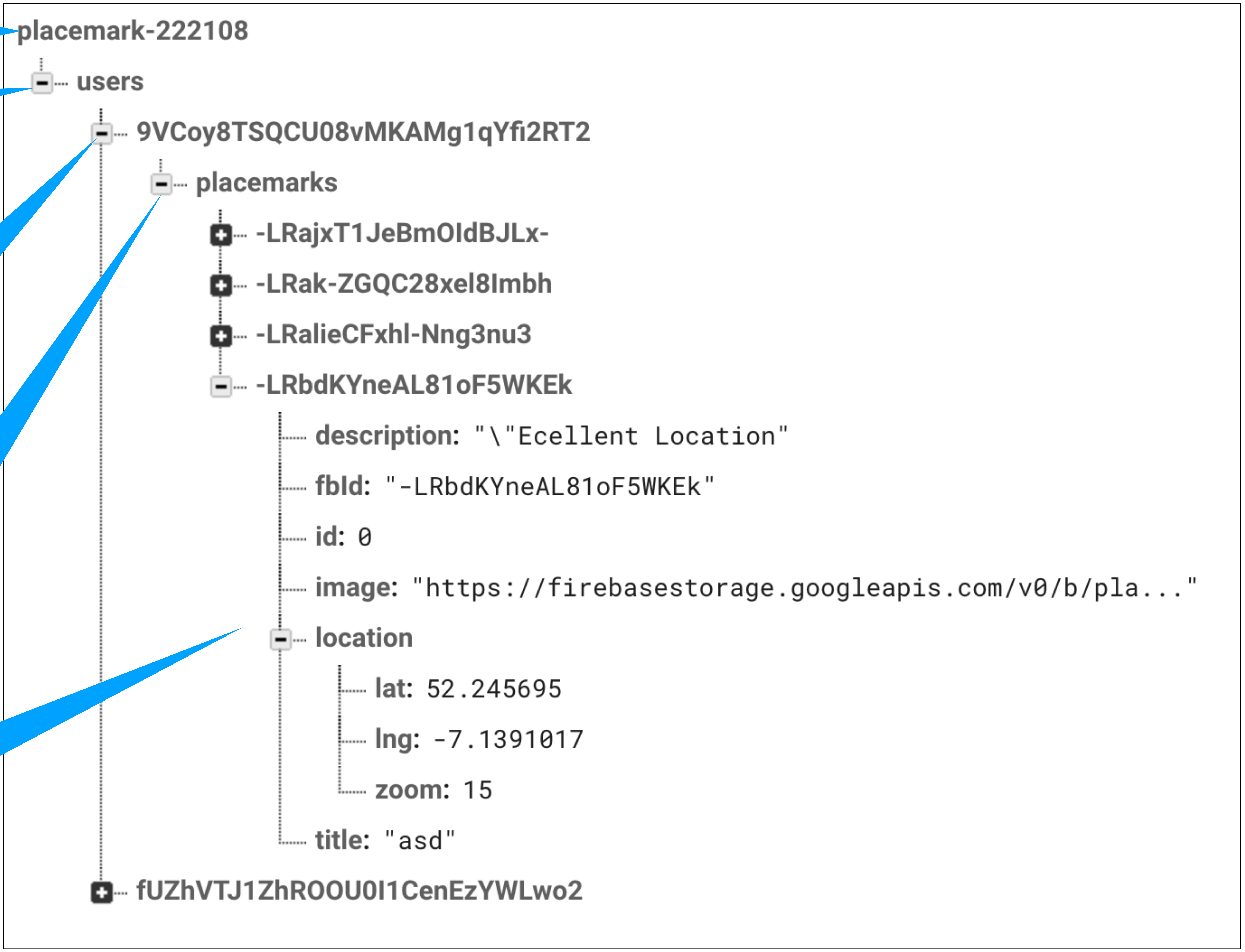
Collection of all Users

Individual user (based in Auth ID)

This Users' placemark collection



```
placemark-222108
  users
    9VCoy8TSQCU08vMKAMg1qYfi2RT2
      placemarks
        -LRajxT1JeBmOldBJLx-
        -LRak-ZGQC28xel8Imbh
        -LRalieCFxhl-Nng3nu3
        -LRbdKYneAL81oF5WKEk
          description: "\"Ecellent Location"
          fbId: "-LRbdKYneAL81oF5WKEk"
          id: 0
          image: "https://firebasestorage.googleapis.com/v0/b/pla..."
          location
            lat: 52.245695
            lng: -7.1391017
            zoom: 15
          title: "asd"
    fUZhVTJ1ZhROOU0I1CenEzYWLwo2
```



```
placemark-222108
  users
    9VCoy8TSQCU08vMKAMg1qYfi2RT2
      placemarks
        -LRajxT1JeBmOldBJLx-
        -LRak-ZGQC28xel8Imbh
        -LRalieCFxhl-Nng3nu3
        -LRbdKYneAL81oF5WKEk
          description: "\"Ecellent Location"
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          id: 0
          image: "https://firebasestorage.googleapis.com/v0/b/pla..."
          location
            lat: 52.245695
            lng: -7.1391017
            zoom: 15
          title: "asd"
    fUZhVTJ1ZhROOU0I1CenEzYWLwo2
```

Application Database

Collection of all Users

Individual user (based in Auth ID)

This Users' placemark collection

Individual Placemark

PlacemarkFireStore - Create

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

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

  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)

    }
  }

  …
}
```

Create a new Placemark object in the Database

Retain firebase key in place mark object

Populate the object with Placemark details

Keep local copy of Placemark in placemarks array

PlacemarkFireStore - update

Update pacemark in local array

```
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

```
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

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

  val valueEventListener = object : ValueEventListener {
    override fun onCancelled(dataSnapshot: DatabaseError) {
      // Error connecting to database
    }
    override fun onDataChange(dataSnapshot: DataSnapshot) {
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        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: Dat
      // 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 doLogin(email: String, password: String) {
  view?.showProgress()
  auth.signInWithEmailAndPassword(email, password).addOnCompleteListener(v
    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}")
    }
  }
}
```

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

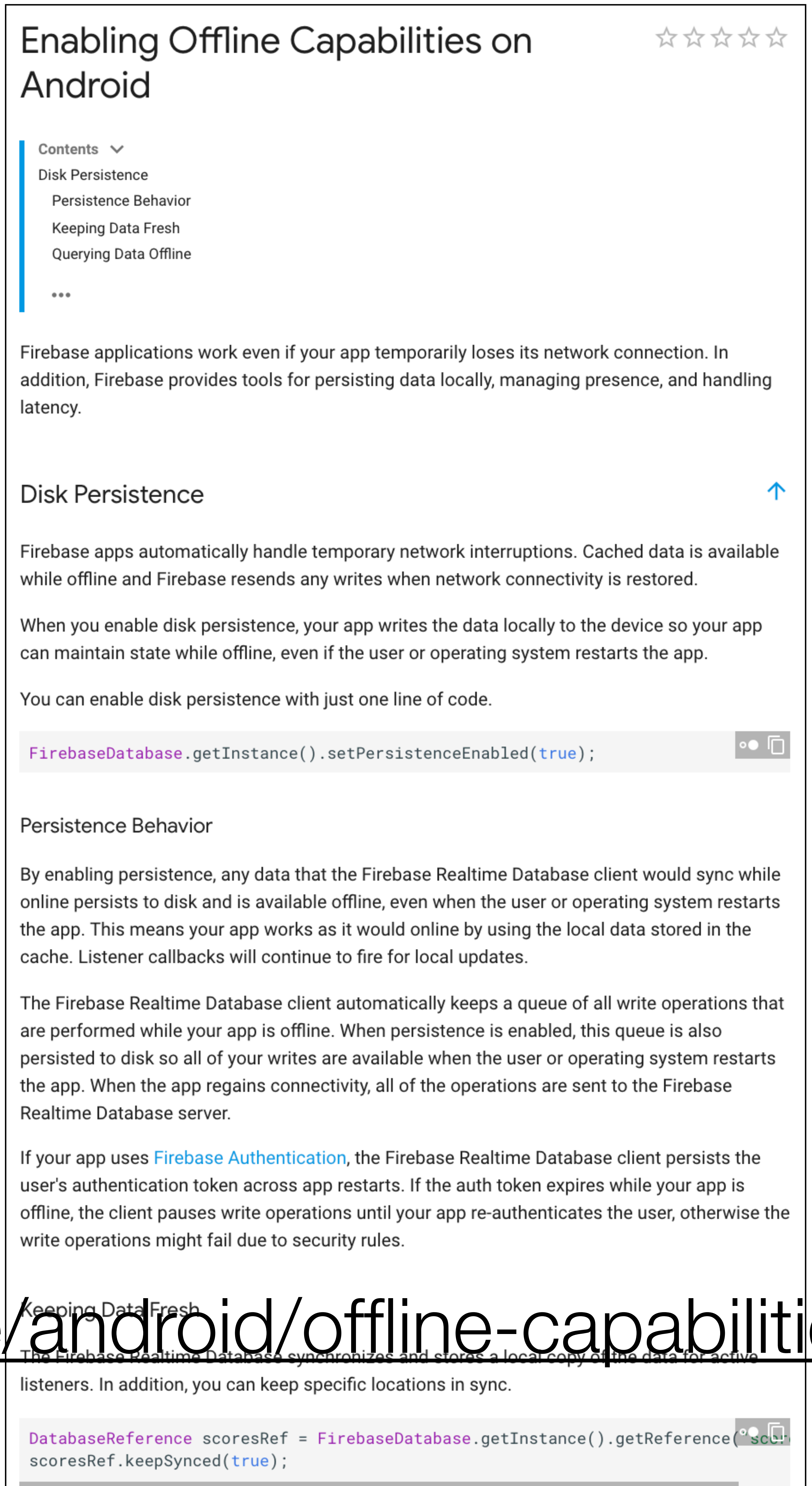
Keeping Data Fresh

Querying Data Offline

Handling Transactions Offline

Managing Presence

Detecting Connection State



Enabling Offline Capabilities on Android

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