lecture 7

Firebase

cs198-001 : fall 2018

announcements

- hw 3: snapchat clone part 1 via gradescope tonight
- HWs will sometimes require using the internet
- HW 3 is due tonight - late submissions open until Friday (half credit)
- custom apps!
- this week’s lab - help with setting up snapchat clone part 2
- final presentation day not finalized but will be announced soon (during dead week)

course policies reminders

- refer to the pinned post on piazza
- unexcused vs. excused absences
- lab policy that will be enforced from the lab released on wednesday:
    - on time = checked off by the end of the following week's lab
    - late (1/2 credit) = checked off by the end of the lab 2 weeks after the lab was released
    - no credit = any time afterwards
- 3 slip days (no extensions)

custom apps

Caffeinated: https://drive.google.com/file/d/11kaS6HgG-dNUbDJ5kGaTP32_ylEGaSJ9/view

Runestory Go: https://www.youtube.com/watch?v=5bKvJt4BPrQ

Overview : Today's Lecture

Sync vs. Async

Intro to Firebase and BaaS

Managing Users

Saving and Retrieving Data

File Storage

Sync vs. Async Tasks

The problem with network requests

Fact #1: Network requests are *slow*.

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Fact #2: Users hate waiting.

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Fact #1: Network requests are *slow.*
Fact #2: Users hate waiting.

- We have almost no control over the time it takes to make a request to a server and wait for its response (esp. with poor internet conn.).
- Our goal is to minimize the latency that the user actually sees at any point.
  - Users should never have to sit on a frozen screen.

Example

facebook.com

Synchronous Tasks: Example

```
func retrieveData {
    let query = PFQuery(classname: "cats")
    let cats = query.findObjects() //
        synchronous call
    for cat in cats {
        // do something
    }
}
```

Synchronous Tasks

Blocks a process until the task is complete

Pros:

- Guarantee that we get results before going on to the next task.
- Somewhat easier implementation (don't have to worry about thread management).

Cons:

- User has to wait for task to finish before being able to do anything else.
  - USERS HATE WAITING!!!

Asynchronous Tasks

Run out of order, in parallel with the main thread so that code can continue to execute while waiting.

- iOS apps perform network requests in the background
  - Example: loading a TableView and refreshing it once data is returned.
- Introduces a new challenge:
  - What if the next line of code after the network request is evaluated before the request finishes?

Closures Revisited

Closures: self-contained blocks of functionality that can be passed around in your code.

This means we can pass functions around as parameters to other functions!

Why might this be useful for solving our async task problem?
It can push

Using Closures as Completion Handlers

Suppose we made an asynchronous network request and wanted to trigger an action only **after** we knew the request had completed.

```
func retrieveData {
    let params = [1, 2, 3]
    makeRequest(params: params, completion:
        { (data) in
        if let data = data {
            // do something with data
        }
    })
    // continue rest of code here
}
```

Implementing functions with completion handlers

We usually look at functions with completion handlers as "black boxes" - we assume they do the heavy lifting, and we just tell them what to do at the end.

- What are they doing behind the scenes?

```
func makeRequest(params: [Int], completion:
    @escaping (Data?) -> Void) {
    // make some API call
    // get data back from call
```

Firebase

How is data usually stored?

Option 1 – Remotely: Make requests to server and let it do the dirty work of saving/retrieving from a database.

Option 2 – Locally: Use something like SQLite or CoreData independently from a server but with more tedious work in terms of actually managing the database.

Using BaaS tools

Backend as a Service tools provide backend cloud storage support to mobile developers through simple API calls.

- Abstracts away the complexities of database implementation
- No need to write any server-side code
- Many offer a lot of additional tools that simple MySQL/ SQLite databases don't support

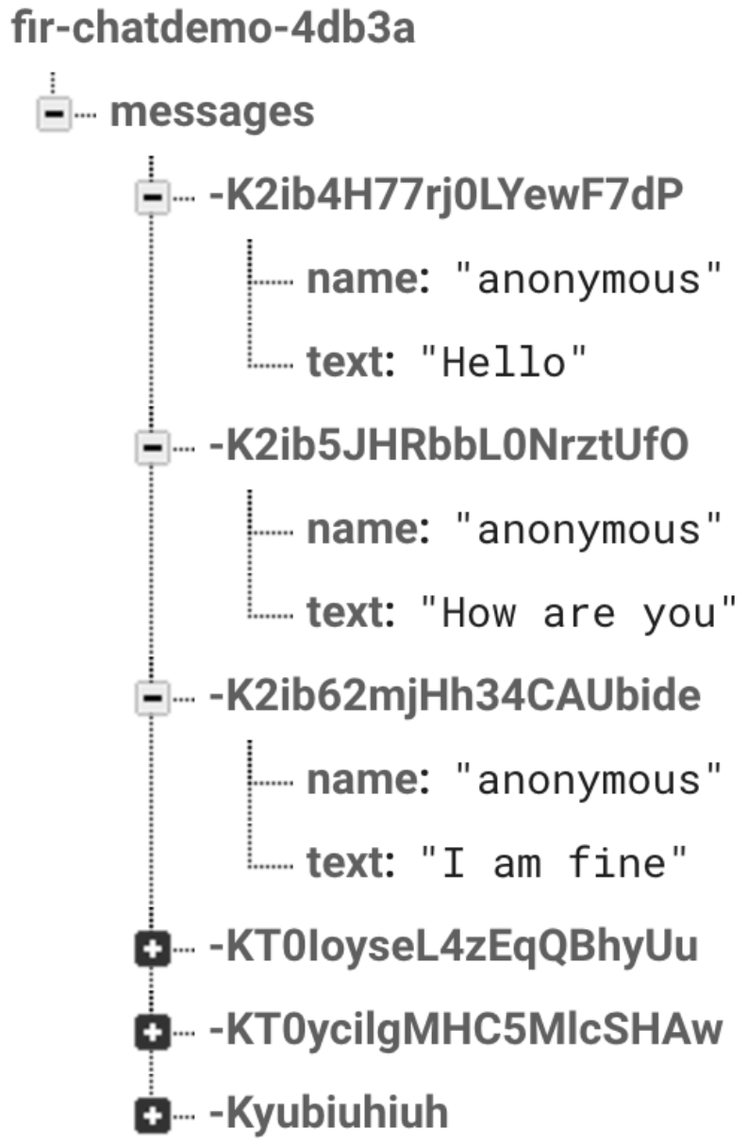
Why Firebase?

1. It's real-time! Allows us to update the view as soon as something in the database changes
2. Has strong support for iOS and Android as well as Web, Unity, C++
3. Thorough documentation - see https://firebase.google.com/docs/ios/setup
4. Can be easily incorporated into project via Cocoapods
5. Supports not only simple data storage but also authentication, file storage, cloud messaging, analytics, and more.
6. Biggest competitor, Parse (by Facebook), shut down in 2015. Now it’s open source but less user-friendly.

How does Firebase work?

Firebase is built on a NoSQL database

- Literally no SQL involved - data stored as a JSON tree



- Data represented as a set of nodes, each with corresponding child nodes
- Retrieve data within app as a dictionary with key-value pairs.

Configuring Firebase

Initializing Firebase

```
import Firebase

class AppDelegate: UIApplicationDelegate... {

    func application(_ application: UIApplication,
    didFinishLaunchingWithOptions...) -> Bool {

      FirebaseApp.configure()

       return true

    }

}
```

Managing Users

User-Driven Data

For many applications, we need to be able to:

- Create accounts for users
- Store a user's authentication state
- Store a user's basic information (name, profile pic, etc)
- Associate data objects (messages, photos, etc.) to the user who created them.

Firebase allows us to handle this by assigning unique user ID's

Firebase Users

For any user, Firebase stores:

- A unique user ID
- Email address
- Display name
- Photo URL

Firebase maintains a User instance which keeps track of the current user.

- Persists the user's state so that closing the app or losing connection doesn't sign the user out.

Creating a new user

```
Auth.auth().createUser(withEmail: email, password: password)
{ (authResult, error) in
  // ...
  guard let user = authResult?.user else { return }
}
```

Signing in

```
Auth.auth().signIn(withEmail: email, password:
password) { (user, error) in
  // ...
}
```

Getting the current user

If we want to access the properties of the currently signed in user, we can do something like:

```
let user = Auth.auth().currentUser
let name = user?.displayName
let email = user?.email
let uid = user?.uid
let photoURL = user?.photoURL
```

We can also use the currentUser variable to check if a user is already signed in (instead of logging in every time). It'll be nil.

Setting a user's display name

```
let changeRequest = user!.createProfileChangeRequest()
changeRequest.displayName = newName

changeRequest.commitChanges() { (error) in
    if let error = error {
        // handle error
    }

}
```

Saving/Retrieving Data

Structuring Data

Recall that data is stored on Firebase as a JSON tree.

- Each time we add data to the tree, it becomes a node in the tree with a key and value.
- We can access a value in the tree by following its key-path in the tree.
- If we attempt to access a node in the database, we get access to all of its children as well.

```
"chats": {
  "one": {
    "title": "Historical Tech Pioneers",
    "messages": {
      "m1": { "sender": "ghopper", "message": "Relay malfunction found. Cause:
      "m2": { ... },
      // a very long list of messages
    }
  },
  "two": { ... }
}
```

Writing Data to Firebase

Create a reference to the root node:

```
import FirebaseDatabase
let dbRef = Database.database().reference()
```

Save data to a node:

```
dbRef.child("Users").child(user.uid).setValue(username,
    forKey: "username")
```

We can also specify the entire path directly:

```
dbRef.child("Users/\(user.uid)/username").setValue(username)
```

Save multiple values to a node:

```
let dict: [String: Any] = ["email": email,
                           "preferences": preferences]
dbRef.child("Users/\(user.uid)").setValue(dict)
```

Reading Data from Firebase

Create a listener (called when a particular node changes):

```
let refHandle = dbRef.child("Users/\(user.uid)").observe(.value,
    with: { (snapshot) in

    if snapshot.exists() {
        if let userDict = snapshot.value as? [String : Any] {
            let newValue = userDict["username"] as! String
        }
    }
})
```

Note that the code inside the closure will execute *every* time the user's node on Firebase (or any of its children) changes.

- We can also query Firebase a single time by calling the observeSingleEvent function instead.

Storing Files

How does Firebase store files?

Firebase's database is only capable of storing numbers, arrays, dictionaries, and strings.

What if we want to store an image? (e.g. Snapchat Clone)

Firebase has a separate module for storage where we can upload all of our files - then we can just store its path in the storage section as a string in the database.

Store an image on Firebase

Just like with the database, we need a reference to the root node of the storage module:

```
import FirebaseStorage
let storageRef = Storage.storage().reference()
```

Then we can upload a file to a specific path as:

```
storageRef.child("images/img.jpg").putData(imageData, metadata: nil) { (metadata
error) in

    guard let metadata = metadata else {
        //handle error
        return
    }
    let downloadURL = metadata.downloadURL
}
```

Download an image from Firebase

We can download an image either by using its path:

```
let imageRef = storageRef.child("images/img.jpg")
imageRef.getData(maxSize: 1*1024*1024) { (data, error) in
    if let error = error {
        // handle error
    } else {
        let image = UIImage(data: data!)
    }
}
```

Or by its download URL:

```
let imageRef = Storage.storage().reference(forURL: downloadURL)
imageRef.getData(maxSize: 1*1024*1024) { (data, error) in
    if let error = error {
        // handle error
    } else {
        let image = UIImage(data: data!)
    }
}
```