Welcome!

https://cs342.stanford.edu

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Don’t forget to record lecture

Winter 2020
Does of Digital Health

Virtual Care Adoption 5-10 years ahead of where expected b/c of

Examples:
Washington based Providence 700/wk → 70,000/wk video visits
Pittsburgh UPMC 20-30/day → 6,000/day at height
CMS Reports March-Oct >24.5M / 63M (>1/3) received telemedicine service

Traditional Bottlenecks removed (unclear which will persist):
- payment parity w/ in-person visits
- waving geographic restrictions
- expansion to audio only care
- relaxed physician interstate licensure requirement

Estimated 20% of visits to be new baseline (vs. 2-5%)

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Announcements

Welcome!

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cardinalkit.slack.com

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Winter 2020
https://hackingmedicine.mit.edu/building-for-digital-health/
Assignment #1 Due Today
Assignment #2: ResearchKit + Firebase

Rev. 01.20.2021

Deliverables

For this assignment, you will use the ResearchKit open-source framework to create surveys for your project. You will also use the Firebase iOS SDK to store survey results in a database. This is a group assignment — work together to divide tasks, and submit one app per group. You will be graded for completion of the following:

1. Your project has a set of pre-defined surveys or patient-reported outcomes for collection. Read through these thoroughly here.
2. Write down the ResearchKit elements you will use to create your survey(s). Refer to the ORKCatalog. Include this list with your PR submission.
3. Create all required surveys using ResearchKit (75%)
4. Configure a Firebase instance for your team, and store survey results in a Firestore DB (15%)
5. Submit your code via a GitHub pull request, one per team [how-to]. Include every team member’s name on your PR submission.

Assignment #2
Due during Code Review session (week of Feb 2nd)

Aim to finish assignment #2 by the end of this week!
Assignment #3: Midterm Presentation & App (alpha)

Rev. 12.26.2020

Deliverables

For this assignment, each team will work together to create one app for their project. This is what you and your team will build upon for the remainder of the course.
Overview for today

- Overview of the Google Cloud Platform (backend)
- Coffee Time (breakout in groups of 3 for socializing)
- Intro to CardinalKit

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Don’t forget to record lecture
What is a “backend”?

- database / persistence layer
- server-side logic - (scheduling, pre-processing, triggers)
- ETL - extract/transform/load piping
- authentication
  hardware / compute + networking

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Client-Server Model vs Serverless

https://www.gocd.org/2017/06/26/serverless-architecture-continuous-delivery/
TRADITIONAL

COMPATIBLE DEVICES

iPhone
Token Stored in Keychain
(1) RS256 Token Key
(2) Request with RS256 Token Key

Computer
Authentication uses signed cookies
https://github.com/golang/sessions
(1) Signed Session Token
(2) Request with Signed Session Token

DEVICE

PUBLIC SERVER

USERNAME=PASSWORD

WEB SERVER

DATABASE

VASCTRAC
flow of network requests
March 8, 2017

Microsoft Azure

Golang

kubernetes

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What is Protected Health Information (PHI)?

- ~18 identifiers

1. Names
2. All geographical identifiers smaller than a state, except for the initial three digits of a zip code if, according to the current publicly available data from the U.S. Bureau of the Census: the geographic unit formed by combining all zip codes with the same three initial digits contains more than 20,000 people; and the initial three digits of a zip code for all such geographic units containing 20,000 or fewer people is changed to 000
3. Dates (other than year) directly related to an individual
4. Phone Numbers
5. Fax numbers
6. Email addresses
7. Social Security numbers
8. Medical record numbers
9. Health insurance beneficiary numbers
10. Account numbers
11. Certificate/license numbers
12. Vehicle identifiers and serial numbers, including license plate numbers;
13. Device identifiers and serial numbers;
14. Web Uniform Resource Locators (URLs)
15. Internet Protocol (IP) address numbers
16. Biometric identifiers, including finger, retinal and voice prints
17. Full face photographic images and any comparable images
18. Any other unique identifying number, characteristic, or code except the unique code assigned by the investigator to code the data

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SERVERLESS
(using client-side logic and third-party services)

GCP Available Services:
https://cloud.google.com/security/compliance/hipaa/
<table>
<thead>
<tr>
<th>Stanford Service</th>
<th>Low Risk</th>
<th>Moderate Risk</th>
<th>High Risk</th>
<th>Very High Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Audio and Video Conferencing: BlueJeans, WebEx, Zoom</td>
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<td>Backups: CrashPlanProe</td>
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<td>Calendar: Office 365</td>
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<td>Cardinal Fax</td>
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<td>Cardinal Print</td>
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<td>Cloud Infrastructure: AWS</td>
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<td>Cloud Infrastructure: Microsoft Azure, Google Cloud Platform</td>
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<td>Content Management: Drupal (Stanford Sites), Wordpress</td>
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<td>Database Hosting: MySQL</td>
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<td>Document Management: Box and Office 365 OneDrive</td>
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<td>Document Management: Google Drive and Google Shared drives</td>
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<tr>
<td>Document Management: Google G Suite: Docs, Sheets, Forms and Slides</td>
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<tr>
<td>Document Management: Google G Suite: All others (Sites, Photos, etc.)</td>
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</tbody>
</table>

**HIPAA-Compliant + BAA agreement in-place**

**source:**
https://uit.stanford.edu/guide/riskclassifications
SERVERLESS
(using client-side logic and third-party services)

Firebase
SDK & tools
What is an SDK?

- **Software Development Kit**
- In our case, the Firebase SDK is a collection of tools (pre-packaged functions and methods) that let’s us easily code using Firebase.
- [https://firebase.google.com/docs/ios/setup](https://firebase.google.com/docs/ios/setup)
SERVERLESS
(using client-side logic and third-party services)

```swift
Auth().sendSignInLink(toEmail: email, actionCodeSettings: actionCodeSettings) {
    (error) in
    if let error = error {
        print(error.localizedDescription)
        completion(false)
        return
    }
    completion(true)
}
```
SERVERLESS
(using client-side logic and third-party services)

Firebase
SDK & tools

Cloud Identity
Authentication
SERVERLESS
(using client-side logic and third-party services)

db.collection("users").addDocument(data: {"eID": eid, "userID": user.uid, "lastActive": Date().ISOStringFromDate()})

db.collection(stanfordRITBucket + "/surveys").document(identifier).setData(surveyDataJson)
HIPAA Compliance on Google Cloud Platform

This guide covers HIPAA compliance on Google Cloud Platform. HIPAA compliance for G Suite is covered separately.

Disclaimer

This guide is for informational purposes only. Google does not intend the information or recommendations in this guide to constitute legal advice. Each customer is responsible for independently evaluating its own particular use of the services as appropriate to support its legal compliance obligations.

Covered Products

The Google Cloud BAA covers GCP’s entire infrastructure (all regions, all zones, all network paths, all points of presence), and the following products:

- AI Platform Training and Prediction
- App Engine
- Cloud AI Notebooks
- Cloud Armor
- Cloud AutoML Natural Language
- Cloud AutoML Tables
- Cloud AutoML Translation
- Cloud AutoML Vision
- BigQuery
- BigQuery Data Transfer Service

Resource:
https://cloud.google.com/security/compliance/hipaa/
Stanford UIT:

- Defines how services can communicate with each other, securely, so you don’t have to.

- Already understands your system, which means your studies get expedited DRA review.

- Helps you get started with premium GCP services at a low-cost — and helps you scale up when needed.
What is a DRA?

- **Data Risk Assessment**
- **Collaboration between Information Security Office (ISO) and the University Privacy Office (UPO) - unsung heros**
  - Usually involves a lawyer
  - Usually involves an engineer or other tech expertise
- **Required by the IRB**
  - More people requiring care and fewer people paying into system
- **Thorough review of the data you collect and methods of storage and transfer**
  - Data flow diagram
  - Form, documentation submission
  - Interview/Meeting(s)
- **Takes 2 weeks to ∞**
Live Project: Setting up your Firebase/GCP Instance using Assignment 2
What are we going to do?

- Starting from where we left off from last week...
- We had two surveys set up in Assignment 2

- How can we store this data in Firebase?
- With some CardinalKit utilities and Firebase!
  - What is CardinalKit? We’ll find out in a bit...
CardinalKit

An Open Source Platform & Codebase for Digital Health Research and Applications

We provide you a suite of tools to build your digital health experience from the ground up, from the app itself to storing collected data in the cloud.

Currently in beta.
CardinalKit is an open-source framework for digital health innovators and institutions designed to accelerate rapid prototyping of digital health applications by reducing costs by $150,000 (75%) and timelines by 12 months.
CardinalKit

https://github.com/CardinalKit

- Informed consent process using ResearchKit.
- Track day-to-day adherence with CareKit.
- Monitor health data with HealthKit.
- Collect and upload EHR data.
- CoreMotion data demo.
- Awesome SwiftUI templates.
- Zero-code customizable configuration file.
- GCP Firebase Integration.
Saving data to Firestore

Set a document

To create or overwrite a single document, use the `set()` method:

```swift
// Add a new document in collection "cities"
db.collection("cities").document("LA").setData(
  
  "name": "Los Angeles",
  "state": "CA",
  "country": "USA"

) {
  err in
    if let err = err {
      print("Error writing document: \(err)"")
    } else {
      print("Document successfully written!")
    }
}
```

ViewController.swift
Accessing data to Firestore


Get a document

The following example shows how to retrieve the contents of a single document using `get()`:

```swift
let docRef = db.collection("cities").document("SF")

docRef.getDocument { (document, error) in
    if let document = document, document.exists {
        let dataDescription = document.data().map(String.init(describing:)) ?? "nil"
        print("Document data: \(dataDescription)"
    } else {
        print("Document does not exist")
    }
}
```
Upcoming guest lecture on Jan 28th

Ricky Bloomfield
@rickybloomfield

Empowering patients through technology at Apple Health. Med-Peds physician & clinical informatician. Jazz saxophonist and swimmer. Most importantly: husband and dad

📍 Cupertino, CA
Attendance Check 🙋‍♂️

- Use the following link to mark your attendance for today:

https://cs342.stanford.edu
Thank you!