

# What is CardinalKit?

Overview of iOS/GCP Framework

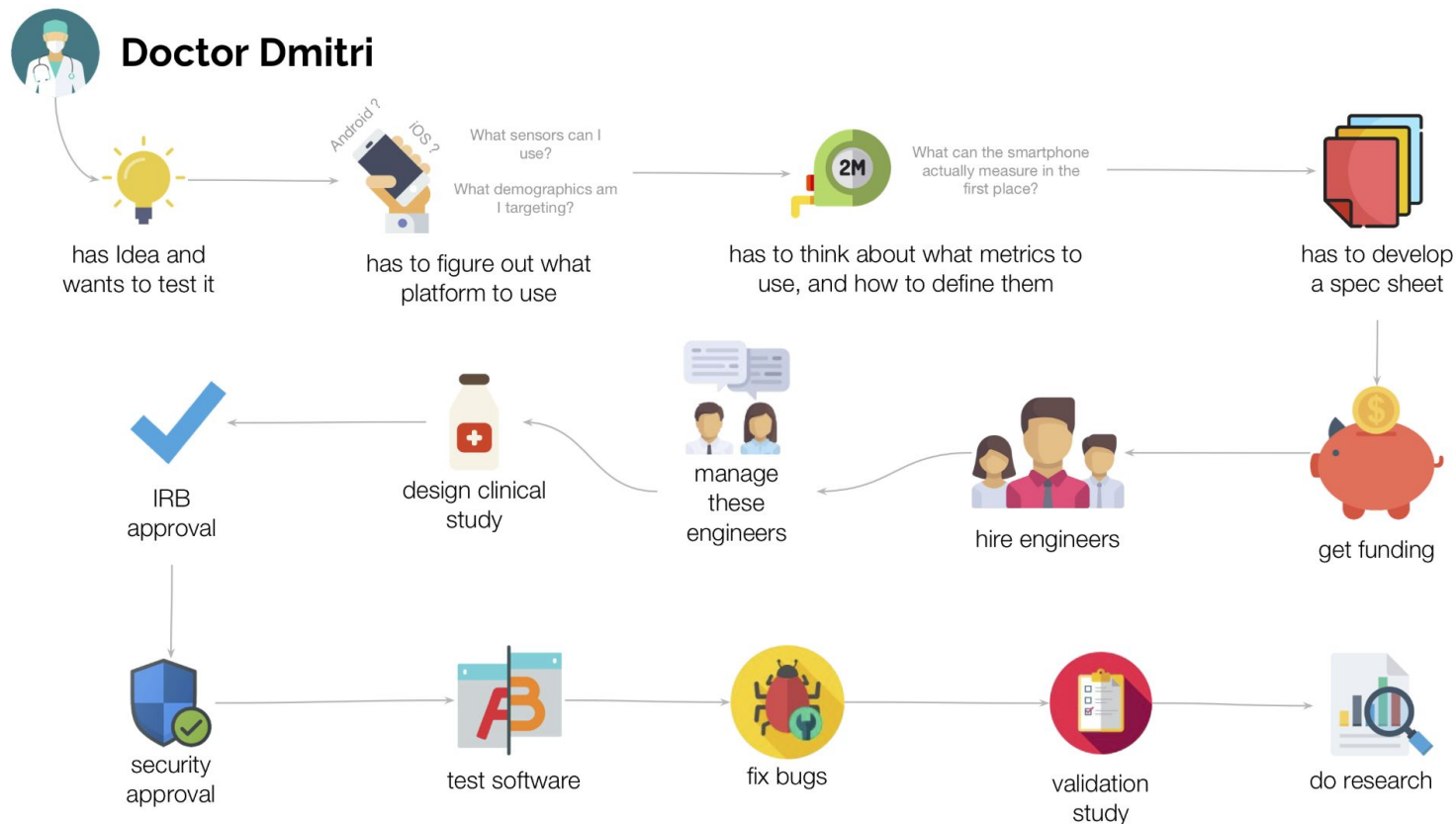


*Welcome!*  
**cardinalkit**

<https://cardinalkit.org/>

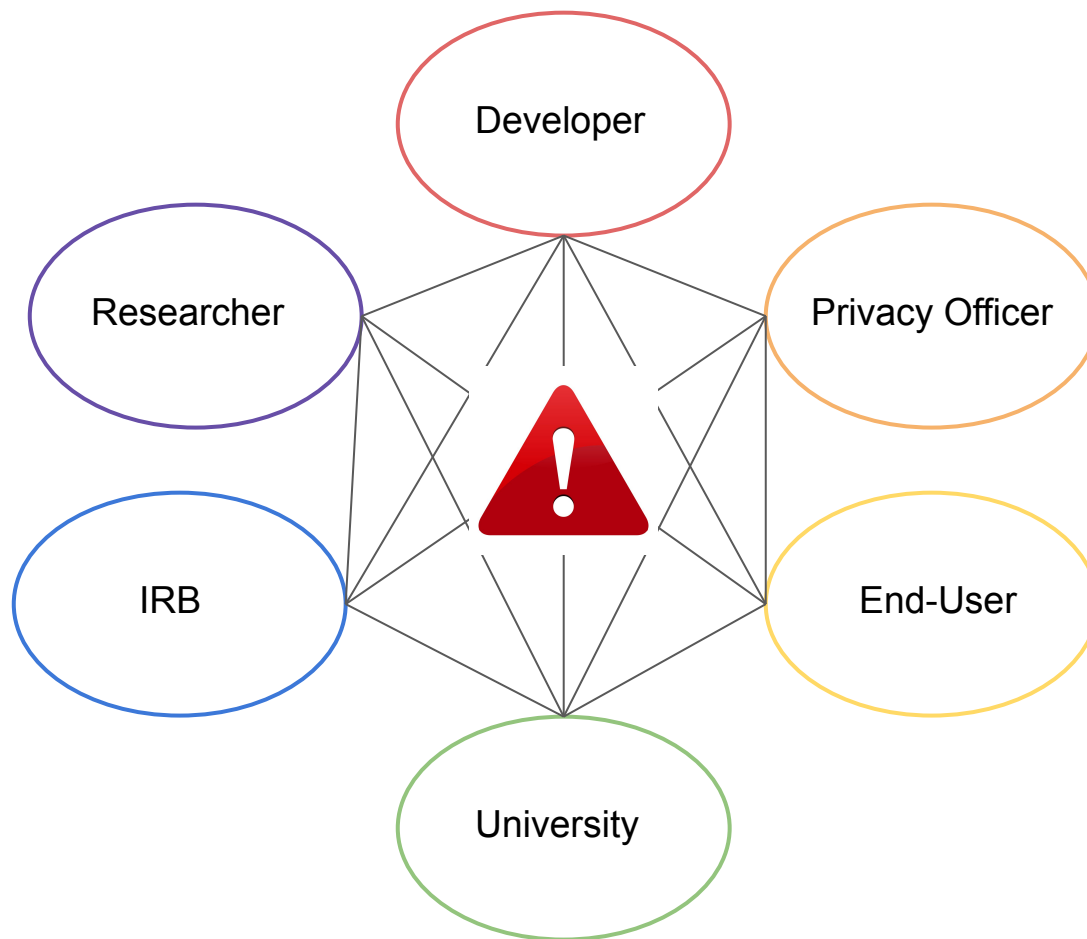
*Oliver Aalami, MD*  
[aalami@stanford.edu](mailto:aalami@stanford.edu)

# Ingredients of a Digital Health App



# Stakeholders

## Risk Management

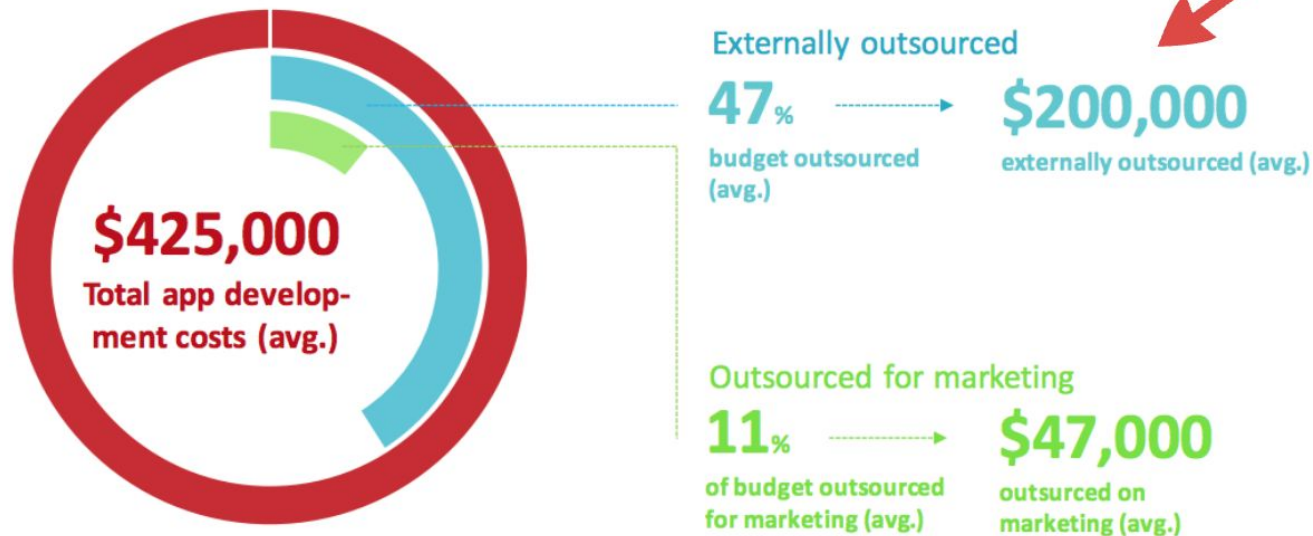


That's a tall order!



# The road ahead is long and expensive.

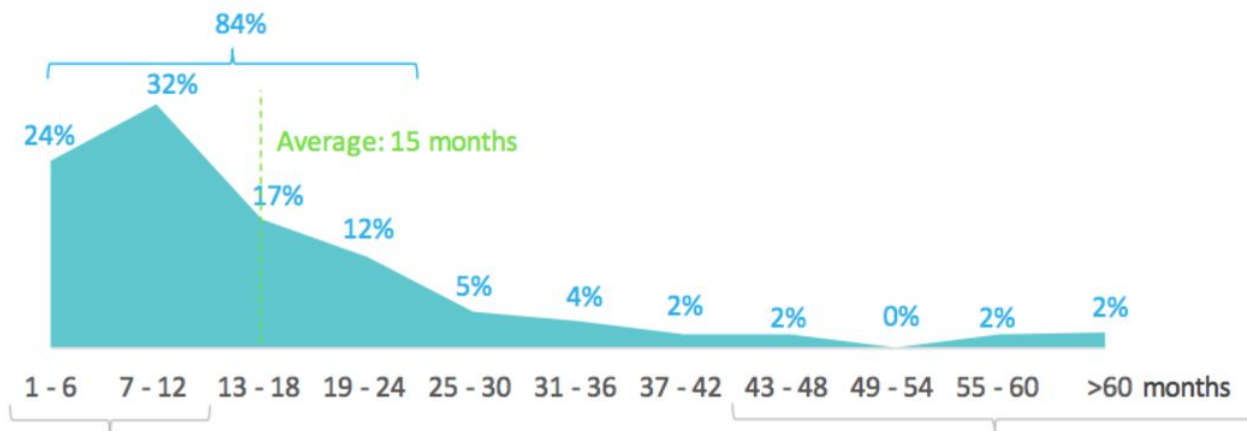
*External app development budget of last app until launch*



# The road ahead is long and expensive.

## 84% OF ALL HEALTH APPS NEED 2 YEARS UNTIL LAUNCH. THE AVERAGE DEVELOPMENT TIME IS 15 MONTHS.

*How many months did/will you invest in the development of your last/current mHealth app until launch?*





So we built a cable-car.



# Introducing

# cardinalkit

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



iOS



ResearchKit



HealthKit



Firestore /  
SOM IT



Google Cloud



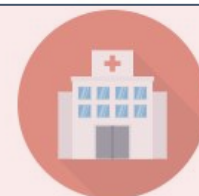
# What is CardinalKit?

- Compliant starting point for **mHealth Researcher**
  - Save \$150,000
  - Save 18 months development time
- leverages existing code to connect critical services
- HealthKit, ResearchKit, Bluetooth Sensor Harness
- Fork & Customize for quick iteration



mHealth  
Researcher

- Scalable **University IT** managed back-end
  - Access controls, low maintenance & overhead, BAA
  - Analytics
  - Staging & Production Environment



University  
Research IT

# The cardinalkit framework

## Frontend



## Backend



iOS



ResearchKit



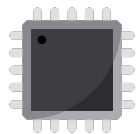
HealthKit



Bluetooth



watchOS



CoreMotion  
(sensors)



Google Cloud



Cloud Identity



Google  
Cloud Storage



Firebase



Google  
BigQuery



Cloud  
Firestore

... and more!

# Data Pipeline and Architecture



**Wearables**

**Bluetooth  
pairing**

**iOS data encryption at  
rest**

**Two factor authentication  
(biometric)**

**Data sharing permissions**

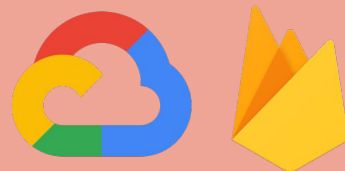
**Serverless backend**

**Manage users and  
groups**

**Two factor  
authentication**

**GCP services  
(BigQuery, etc.)**

**Stanford  
MEDICINE**



**SOM managed  
instance**

**Custom rules / IAM**

**Stanford managed  
Two factor  
authentication**

**Own BAA**

# The cardinalkit framework

Is just PART of the HIPAA equation.

## The 7 Elements of HIPAA Compliance


1. Implementing written policies, procedures, and standards of conduct.
2. Designating a compliance officer and compliance committee.
3. Conducting effective training and education.
4. Developing effective lines of communication.
5. Conducting internal monitoring and auditing.
6. Enforcing standards through well-publicized disciplinary guidelines.
7. Responding promptly to detected offenses and undertaking corrective action.

Ref: <https://compliance-group.com/what-is-hipaa-compliance/>

More info about Google Cloud and HIPAA Compliance can be found here:


<https://cloud.google.com/security/compliance/hipaa>

# Shared Responsibility Matrix

	Server 	Mobile App iOS	Patient	Team
<b>Security Rule</b>	Data Encryption at rest	Data Encryption at rest / in flight		BAA
	Data center / infrastructure / operations security standards - annual security audits			HIPAA training
<b>Privacy Rule</b>	2-factor authentication	Data Access Permissions	Obtain consent to collect and share data	Access Controls
<b>Breach Notification Rule</b>	Breach Notification			Breach Notification



# Shared Responsibility Matrix

	Server 	Mobile App iOS	Web App	Patient	Team
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CardinalKit

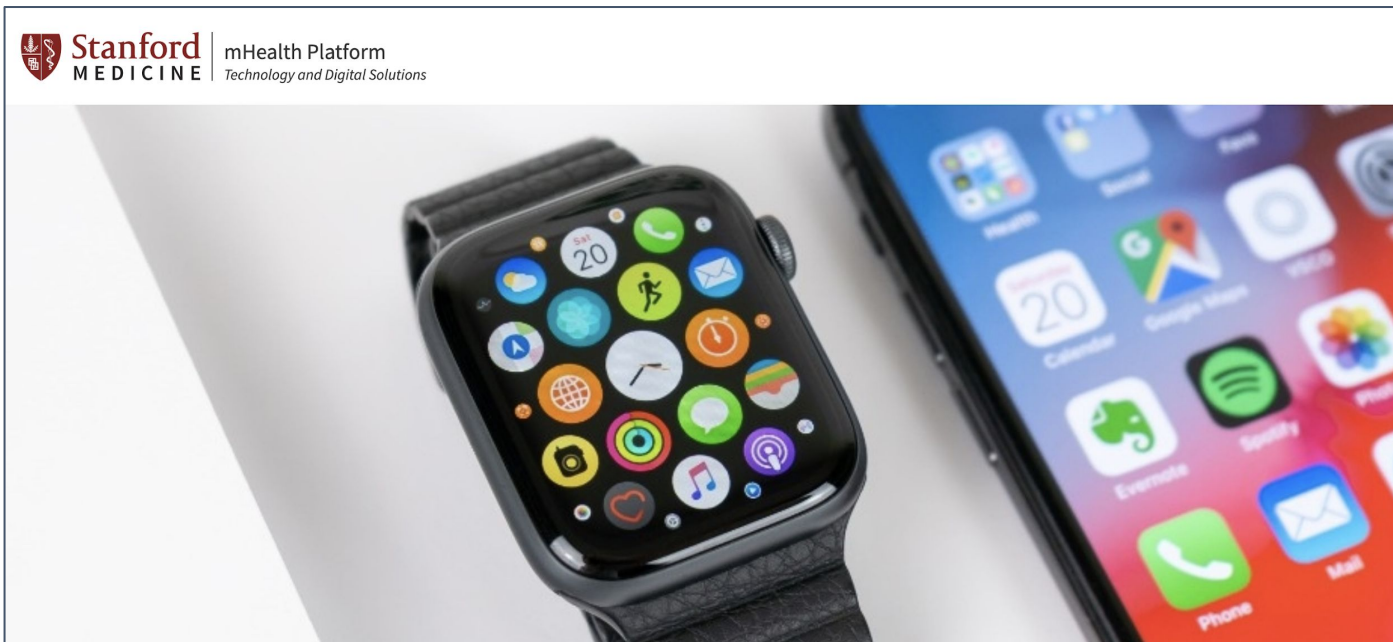


Developer



University IT

# @ Stanford Partner with University Research IT





# @ Stanford Partner with University Research IT

## Mobile Health Research Platform

Get Started

Learn More

Request a consultation »

## Stanford Medicine mHealth platform

HIPAA compliant platform for mobile health studies

A powerful, and capable HIPAA-compliant platform for mobile studies

The mHealth Platform is a set of HIPAA-compliant services operated and maintained by Research IT to provide a secure place for mobile applications to store data and perform tasks that cannot be accomplished directly on a device.

Two different architectures are supported. The original platform supports BridgeSDK based client mobile apps and a newer platform supports Firebase SDK based apps.

The first version of the mHealth Platform (v1) provides services for mobile applications to handle participant sign up, email verification, consent, and participation status. It also provides services for getting sensor and participant data off the device and into our environment. Data can be accessed via dashboards or downloaded via researcher APIs. The mHealth Platform has been used in support of large-scale population health studies such as [MyHeartCounts](#), and targeted research studies such as [STREAM](#) (Studying TRiggers in Everyday Activity for Migraine).

The next generation of the mHealth Platform (v2), adds support for Google's Firestore database via the Firebase SDK, and related services such as identity management.

### Co-created with our community

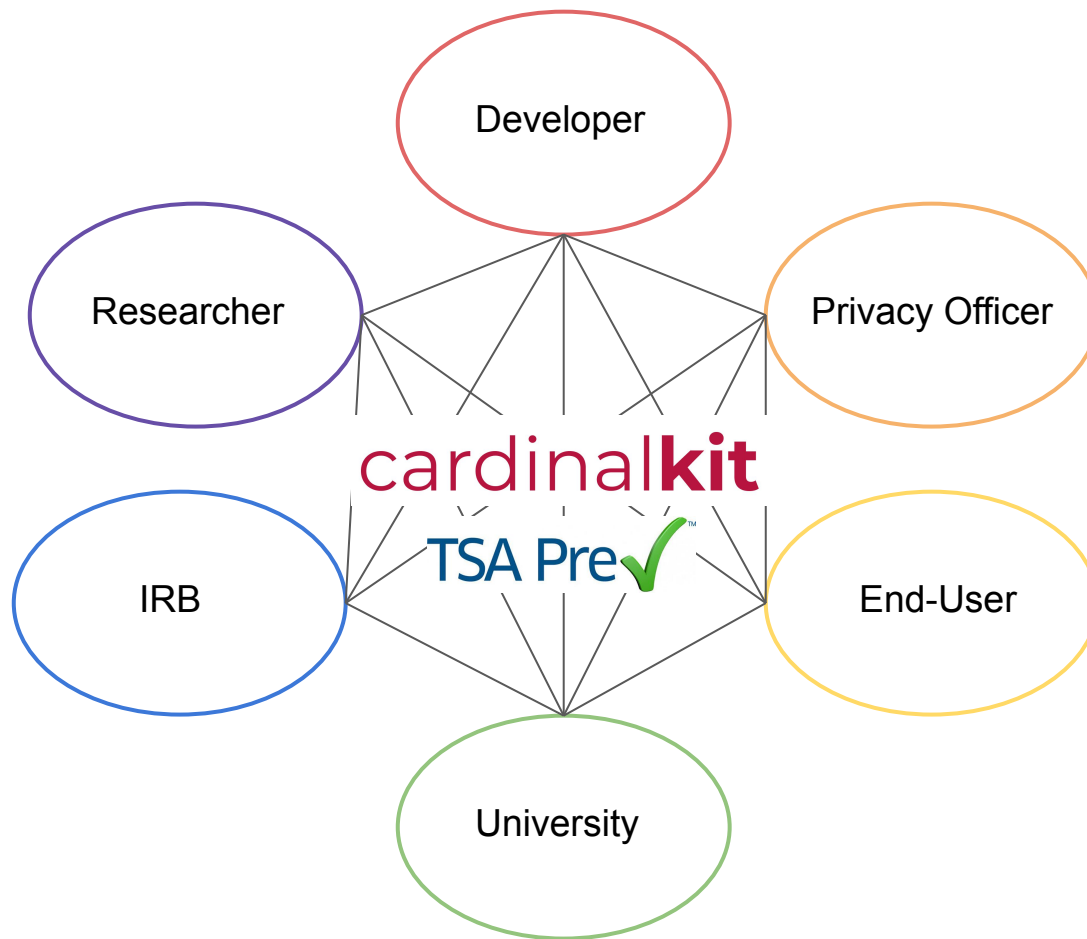
Research IT has collaborated with the [Stanford Byers Center for Biodesign](#) to ensure the new Open Source mobile development framework [CardinalKit](#) is pre-integrated with the mHealth v2 Platform to make it easier, faster, and cheaper than ever to build new mobile applications for research.

TSA Pre✓

cardinalkit

<https://med.stanford.edu/mhealth.html>

# Catalyst



## Recap

# cardinalkit

Saves you 18 months of design and development

Saves you \$150,000 in development cost

### What you get:

- Basic Application to start with
- 2FA Authentication
- Modern and scalable architecture
- Secure GCP schema
- Data pipeline and integrity (heart rate, steps, activity etc.)
- Informed Consent
- HIPAA - ready (compliance involves more than code)
- Community of mHealth developers
- Native HealthKit, CareKit integration
- Open mHealth mobile/wearable data interoperability
- FHIR data store

# Thank You!

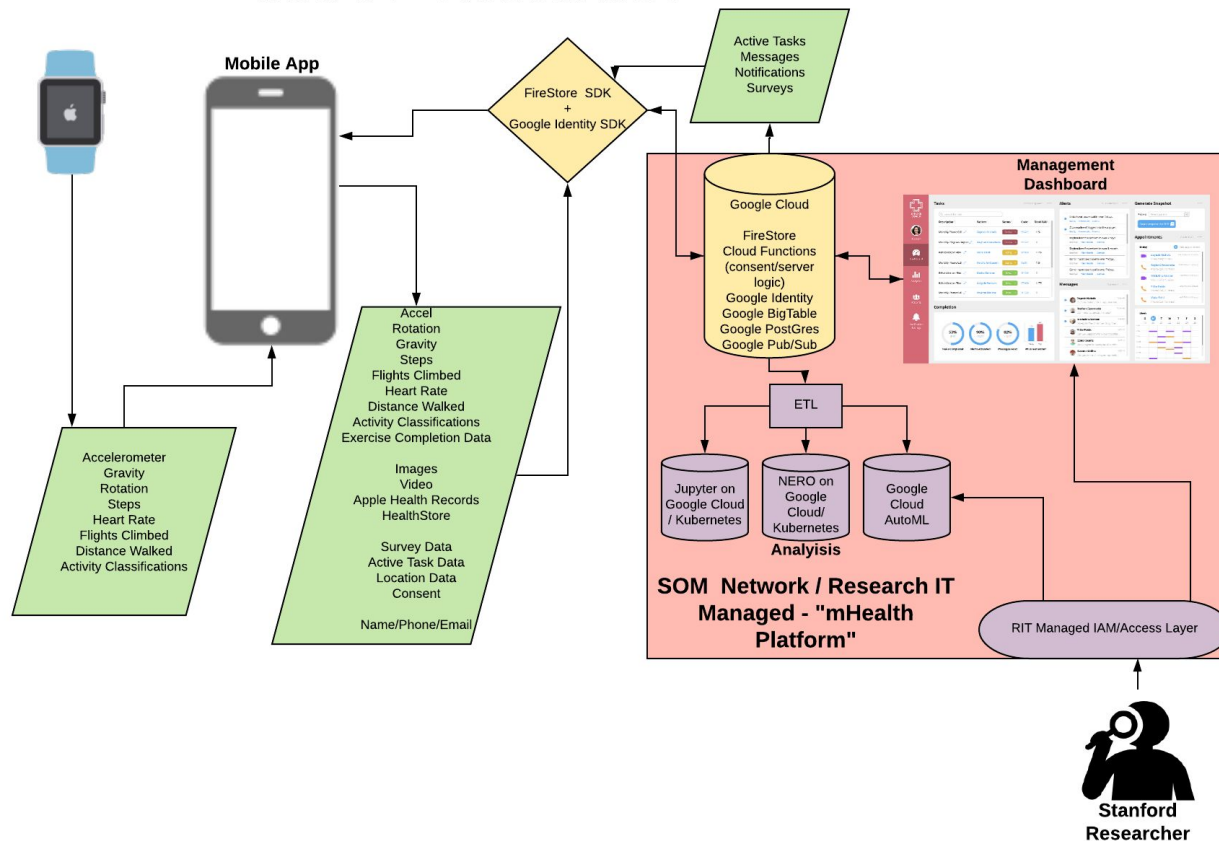
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# Data Pipeline and Architecture



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