PatientAdvocate

Access all of your medical information from anywhere.

CS410 Spring 2019

Red Team

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Our Team

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Project Lead

Alex Kostyn
Cloud Security Engineer

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Solutions Architect

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Algorithms Developer

Daniel Kent
UI/UX Developer

Josh Smith
Database Engineer

Problem Statement

    Healthcare patients do not have a central mobile environment to promptly access, organize, and share their medical information with various providers.

The Customer

   Our target customer for this application is anyone that uses a mobile smartphone and needs to access all of their medical records from one place. The Patient Advocate application would greatly benefit those in need of medical care outside the scope of their primary care provider's network, those with chronic conditions, and those who take care of dependents and the elderly.
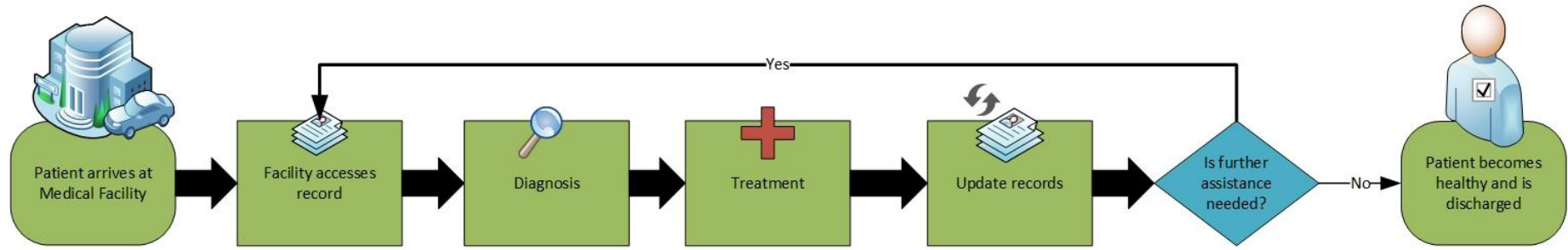
Problem Characteristics

- Patients' records are scattered throughout different electronic health record (EHR) systems, impacting record completeness.
- Patients do not have a way to update their daily regimen for their physicians, impacting emergency care.
- Patients do not have a way to access medical records outside of their provider office, impacting patient convenience.

Problem Statistics

- Roughly three million adults over the age of 65 and 1.5 million children under the age of 18 visited physicians' offices in 2015. [14]
- 6.7% of noninstitutionalized adults over the age of 65 reported needing help with personal care in 2017. [15]
- "In March 2017, 67% of all providers reported using an EHR."[11]
- "67% of providers reported not liking the functionality of their EHR systems."[11]
- "Currently, there are roughly 1100 vendors that offer an EHR."[10]
- "Only 40% of hospitals and 14% of doctors share data outside their organization."[12]

Perfect Process Flow

Patient arrives at Medical Facility → Facility accesses record → Diagnosis → Treatment → Update records → Is further assistance needed?
- Yes → (back to Facility accesses record)
- No → Patient becomes healthy and is discharged

Legend
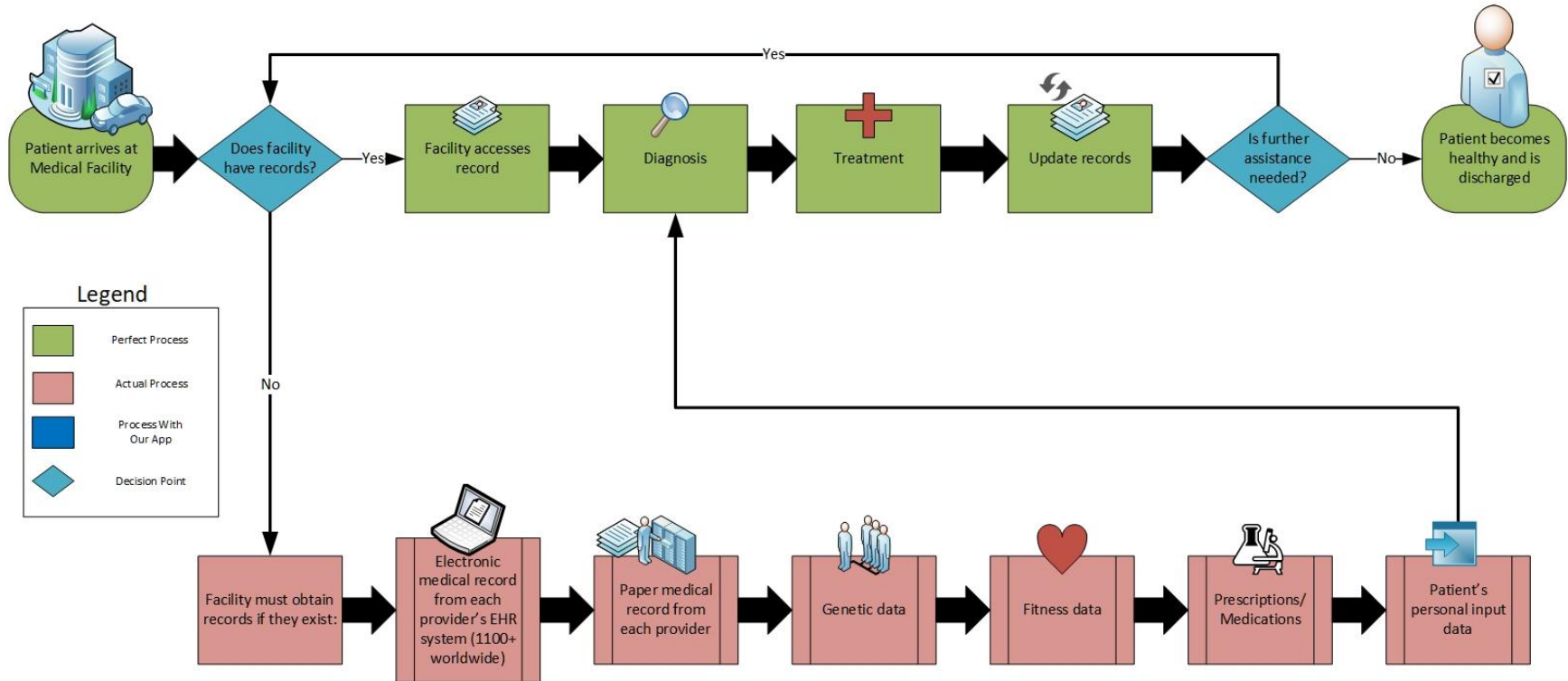- Perfect Process
- Actual Process
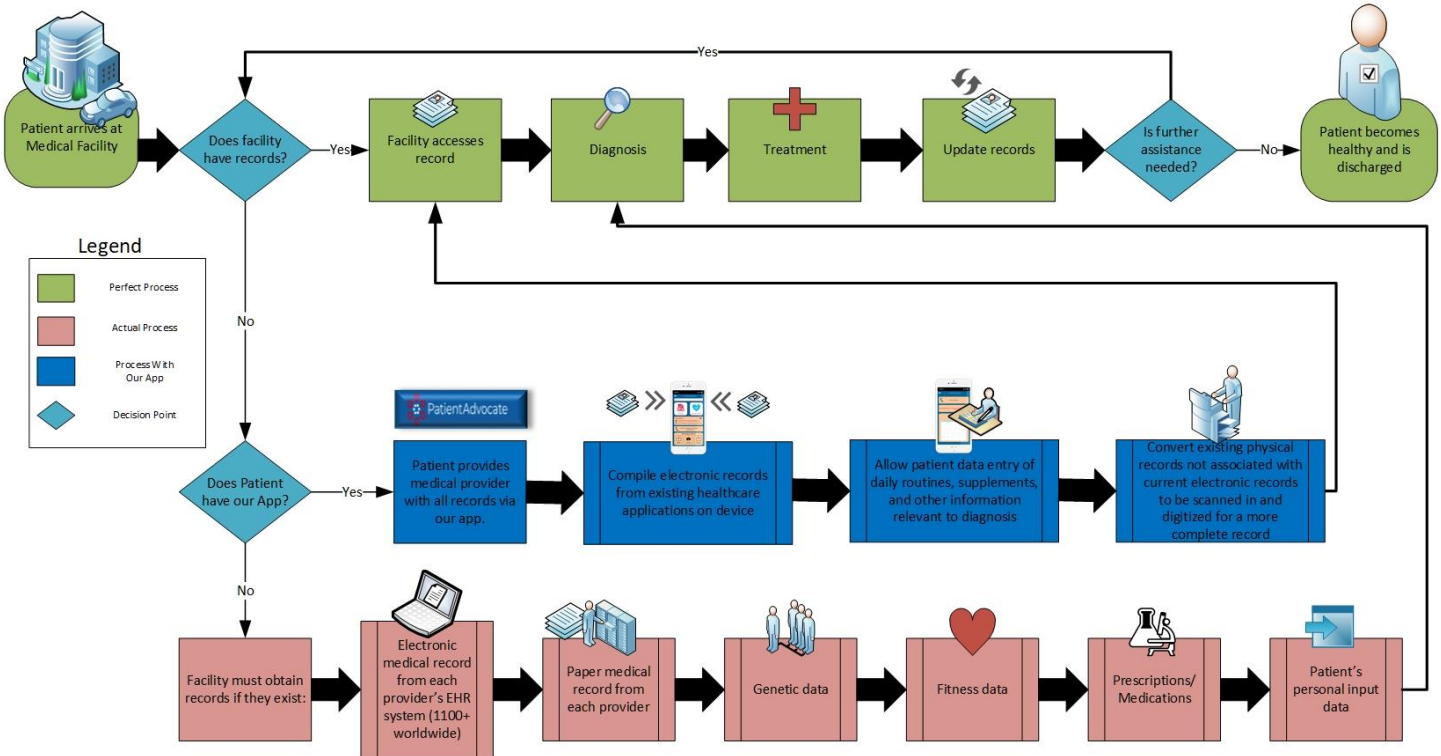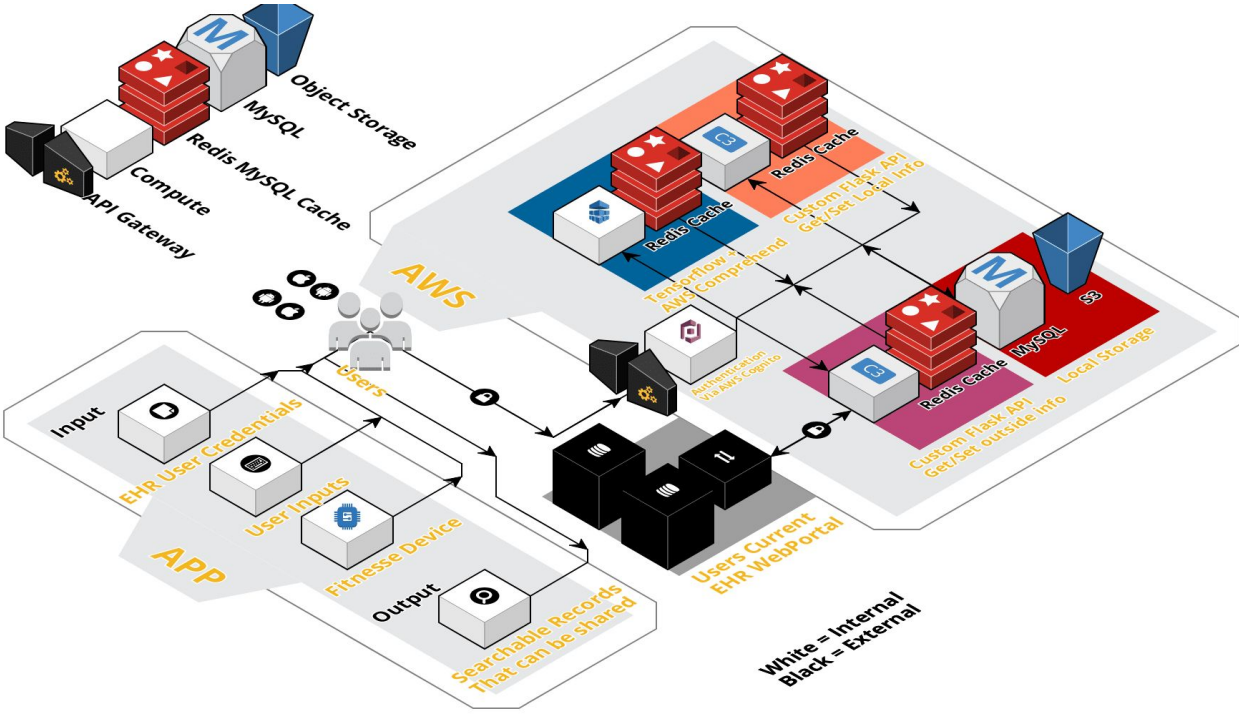- Process With Our App
- Decision Point

Actual Process Flow

Patient Advocate App

Major Functional Component Diagram

Goals & Objectives

- Provide an easy-to-use mobile application for the user.

- Allow the user to pull all of their medical information into one application.

- Aid healthcare providers in obtaining patient's healthcare records.

- Ensure that all patient data is secure.

- Accelerate prerequisites needed for diagnosis.

- Digitize patients' non-electronic records.

Solution Characteristics

- Log into existing patient portals and gather available medical record information, improving record completeness.

- Allow access to self and dependent records, enhancing patient convenience.

- Detail patient daily regimen to share with providers, enhancing emergency responsiveness.

Application Features

- Calendar containing appointments and notifications

- Patient log/notes section

- Data encryption

- Comprehensive medication information

Competition

	PatientAdvocate	Seqster	Picnic Health
Share Records	X		
Patient Incidentals	X		X
Medical Data	X	X	X
Integrated Data	X	X	X
Auto Update	X	X	
Communication w/ Provider	X		x
Medication Data Advocate	X		

What Our App Will and Will Not Do

Our app will…

- Allow end users to log into their existing patient portals.
- Allow access to dependent records
- Gather available record information from existing patient portals.
- Allow users to specify their daily regimen to share with providers.
- Observe HIPAA laws.

Our app will not…

- Allow patients to change physician provided medical records.
- Allow unauthorized access to patient records.
- Modify providers' existing EHR systems.

Development Tools

Software Requirements

- Code Repository: GitHub
- Continuous Integration: CircleCI
- Containerization: Docker
- App: Java, C++, and Swift
- API: Python + Flask
- Machine Learning: Tensorflow, Tesseract, and NLTK
- Database: MySQL
- Database Cache: Redis
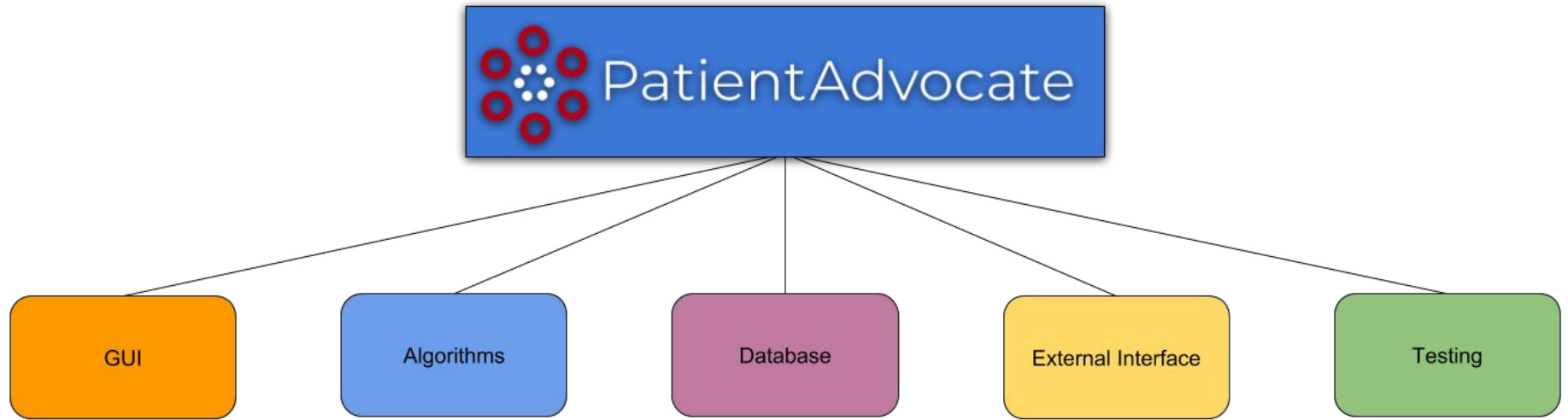
Hardware Requirements

- Server: single compute instance
- Client: smartphones for testing:
  - iPhone
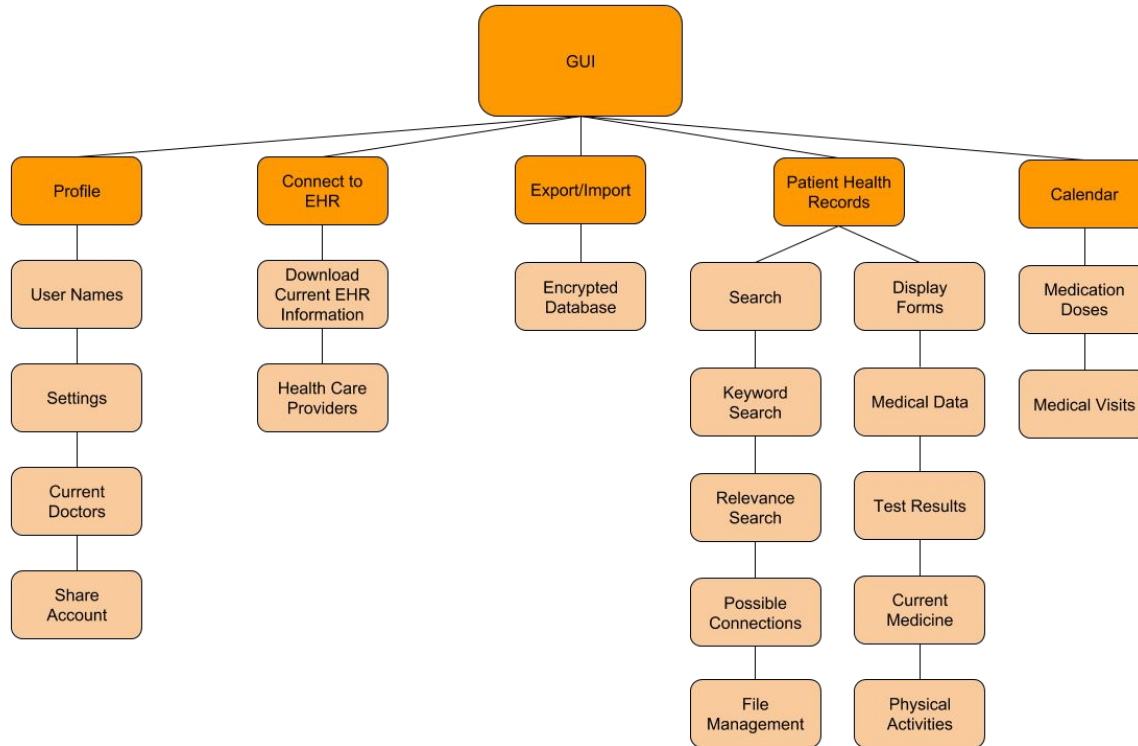 - Android

Development Model - Agile

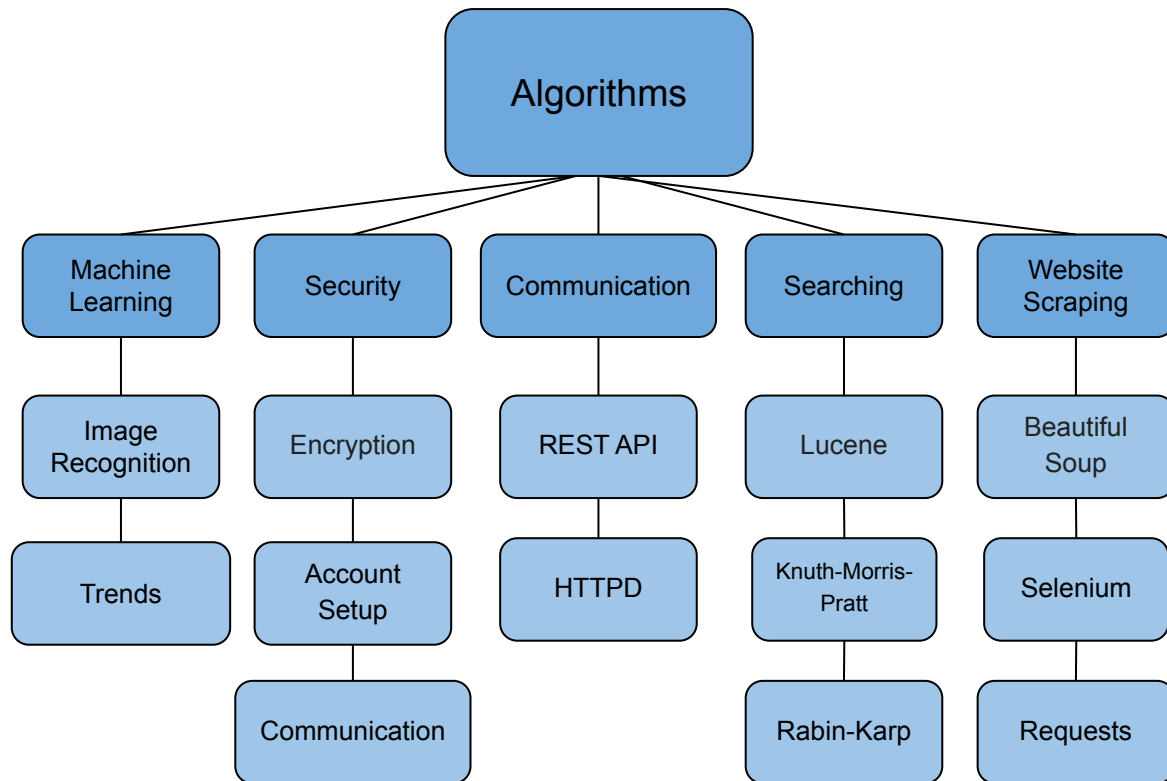
Agile Methodology

Work Breakdown Structure

Work Breakdown Structure - User Interface

Work Breakdown Structure - Algorithms

Algorithms - Machine Learning: Image Recognition

Key Terms

Tensorflow
- Deep learning powered by Google for Python

NLTK
- Natural language processing library

PyTesseract
- Optical character recognition for Python
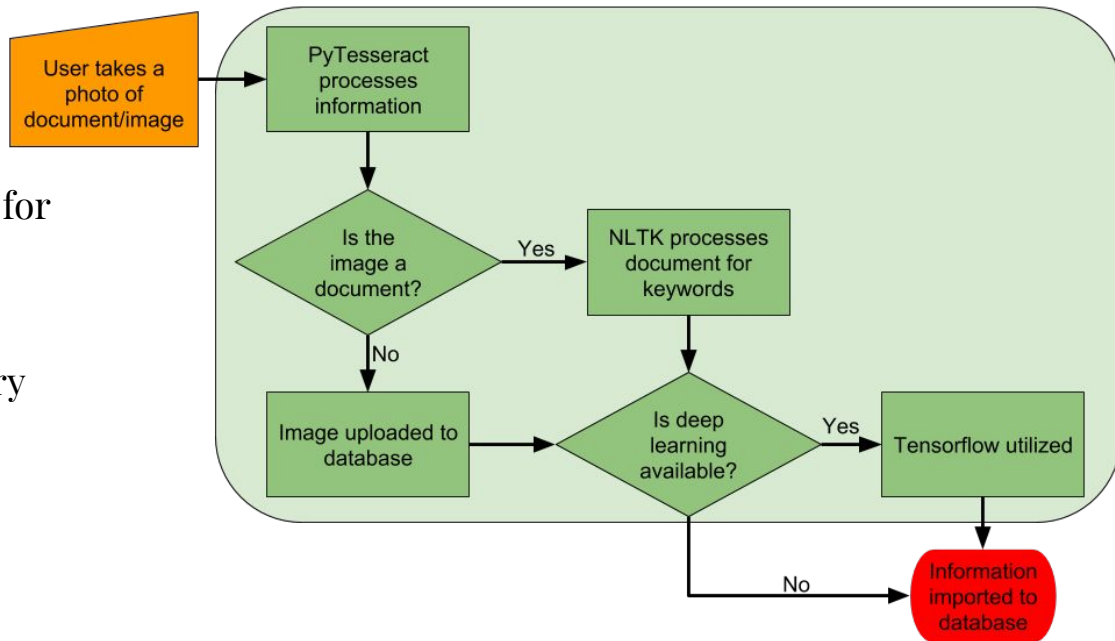
Algorithms - Machine Learning: Trends
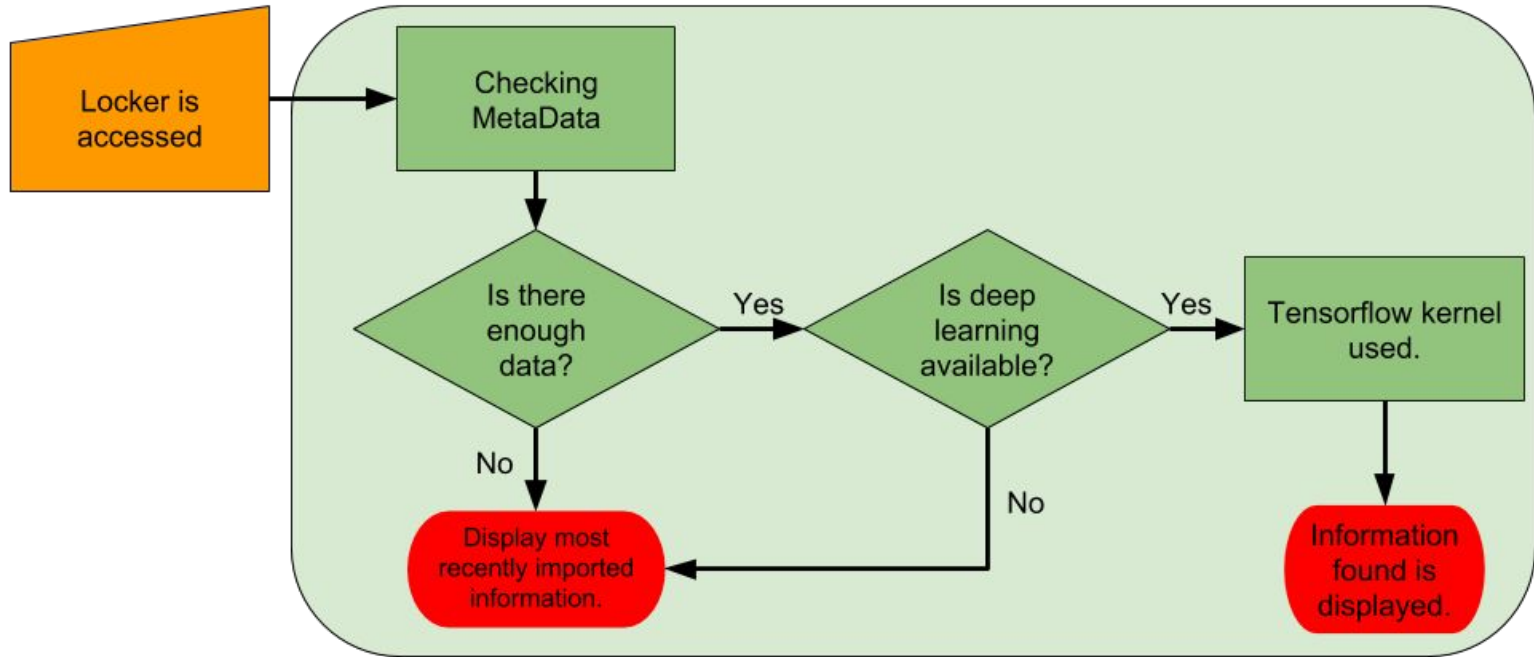
Algorithms - Security: Encryption

Encrypted data is stored in a *locker*.

A Locker is:
- A folder that contains:
  - Database
    - Profile
    - Medical Records
  - Patient personal logs
  - Images
  - Release of Information waiver
- Locker is split into chunks

MetaData is:
- List of chunks
  - MD5 Sum per chunk
  - Last modified
- Date Uploaded
- Total Size

Secure Transmission
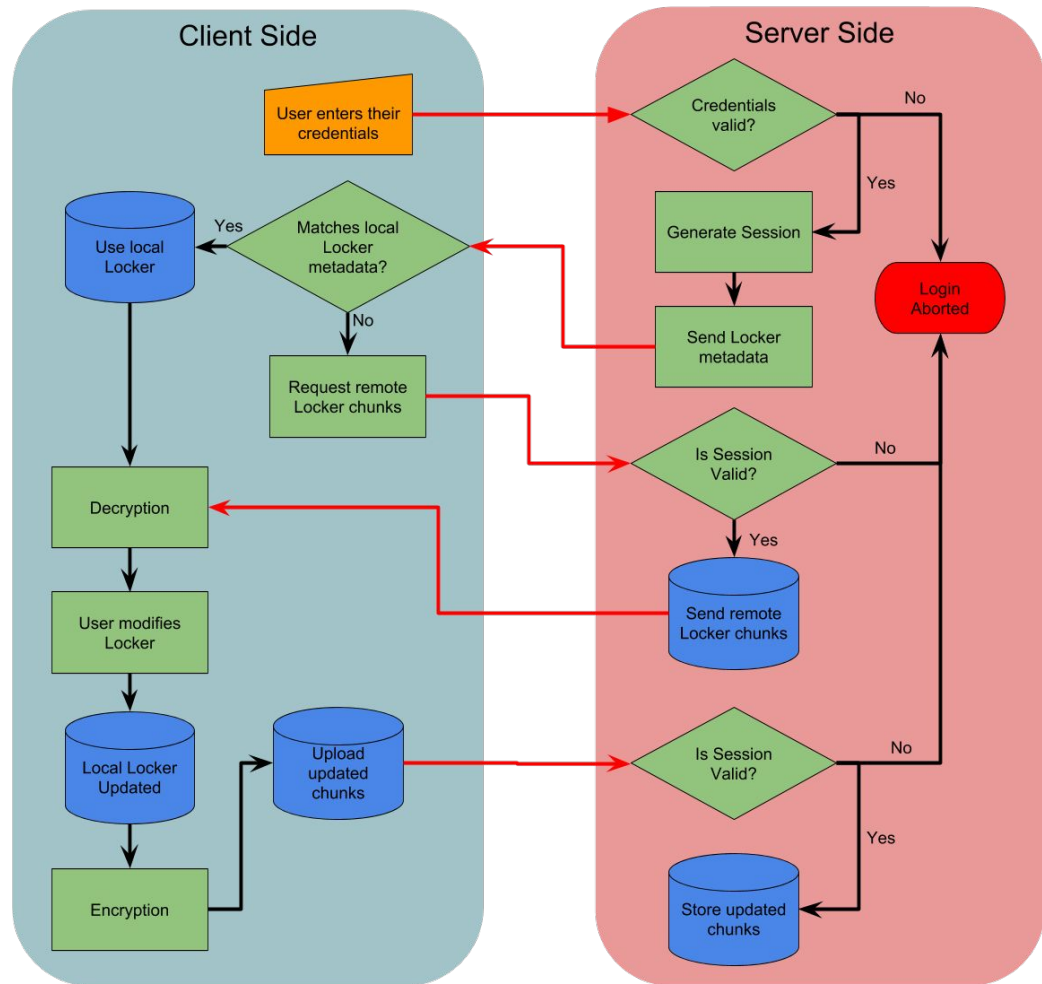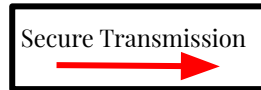
Technical Approach - Encryption

- All of the data is stored in a safe.

- This safe is encrypted with your password.

- You use this password like a key to un-encrypt the safe on your APP or Desktop Application

- When you add to this safe, it encrypts it and then sends it up to our servers.

- There we make sure that your safe is always accessible via the internet.

- No one, not even the administrators, will be able to access your safe.

Algorithms - Security: Update
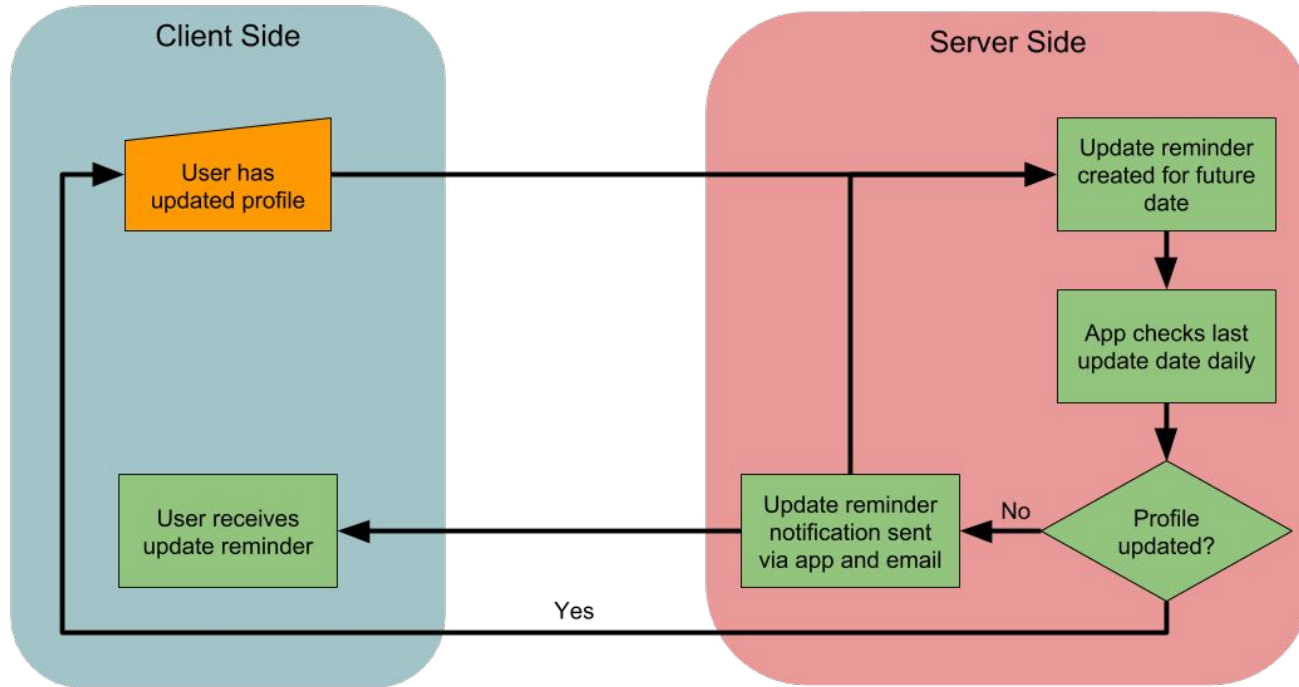
Algorithms - Security: Account Setup
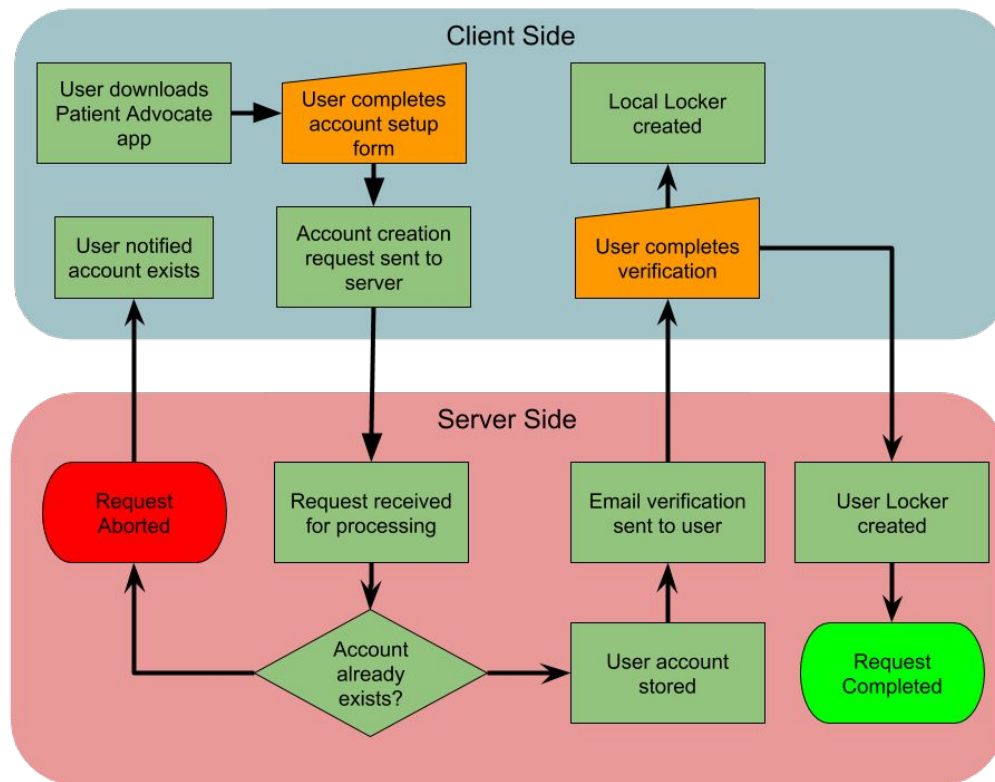
Algorithms - Communication
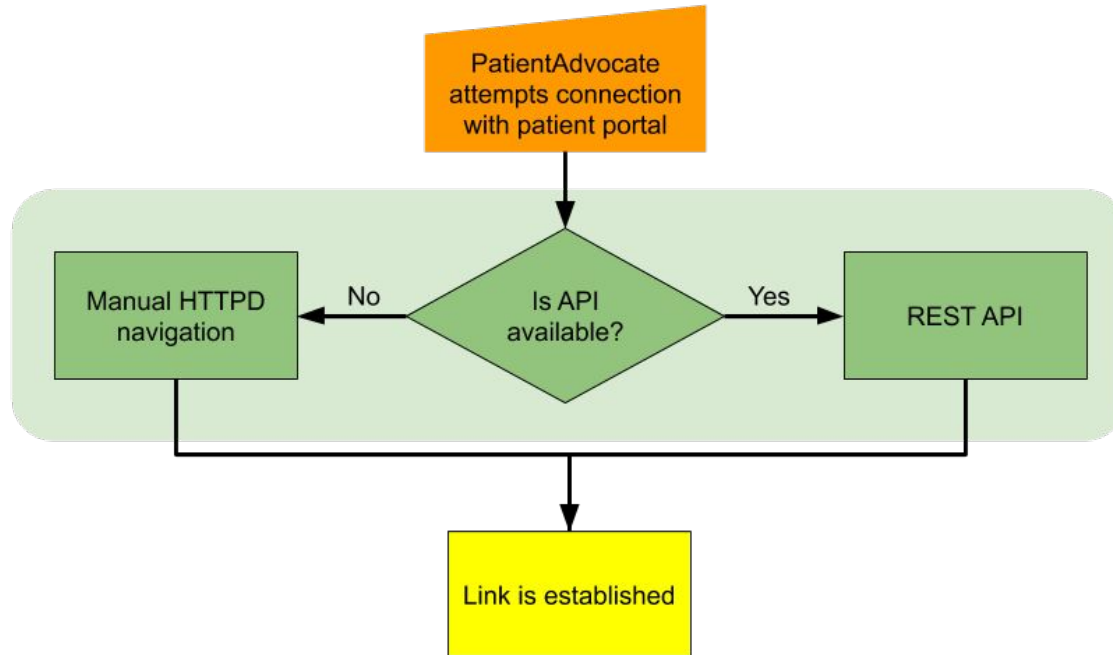
Algorithms - Searching

Key Terms

Lucene
- Full-text search library
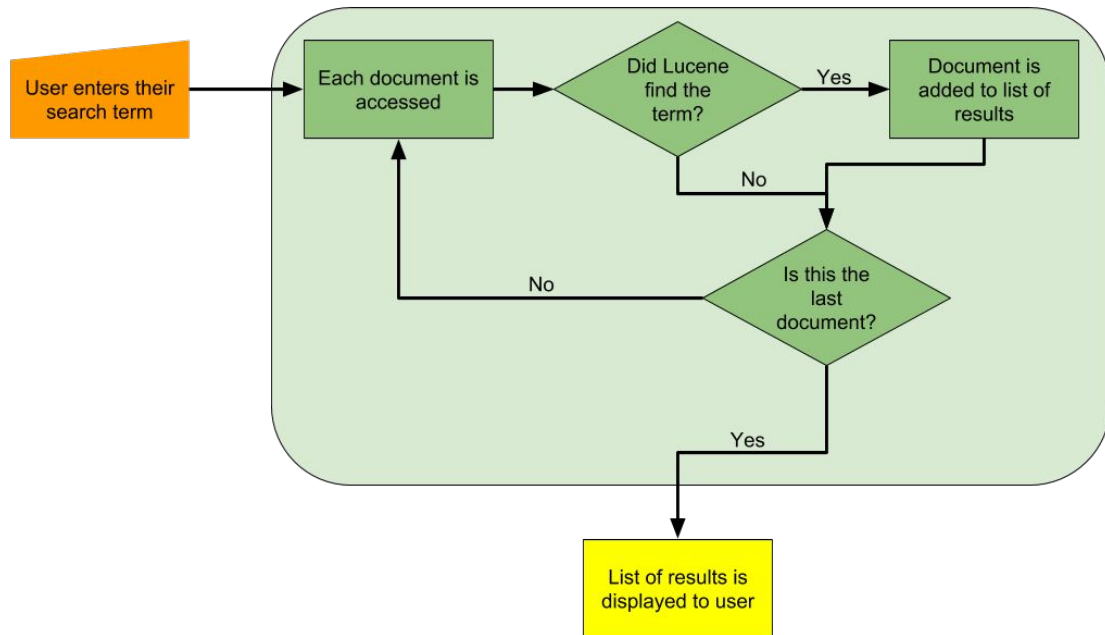
Algorithms - Website Scraping

Key Terms

- Beautiful Soup
  - Python data extraction library for HTML and XML.
- Selenium
  - Web browser automation tools for grabbing HTTP data without an API.
- Requests
  - Python library for sending HTTP requests using an API.
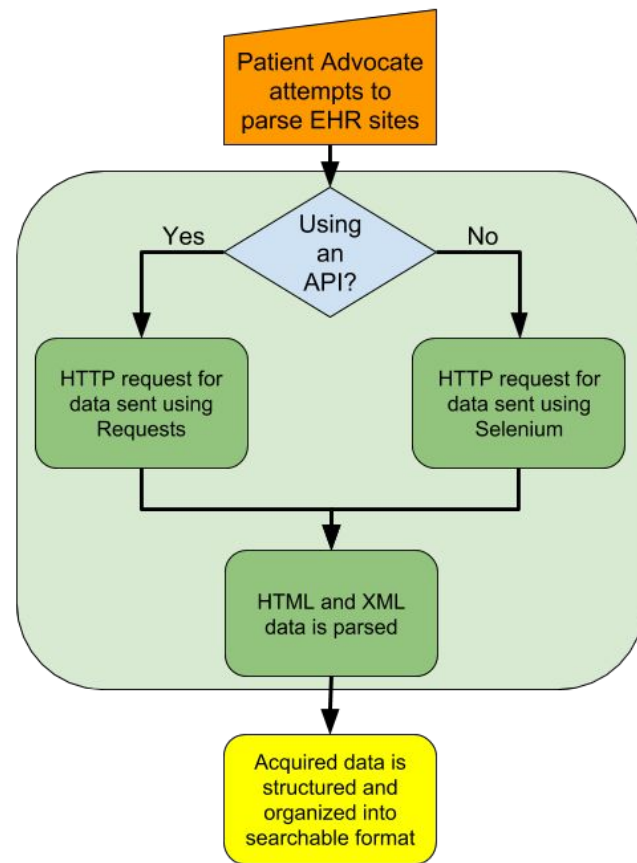
Work Breakdown Structure - Database
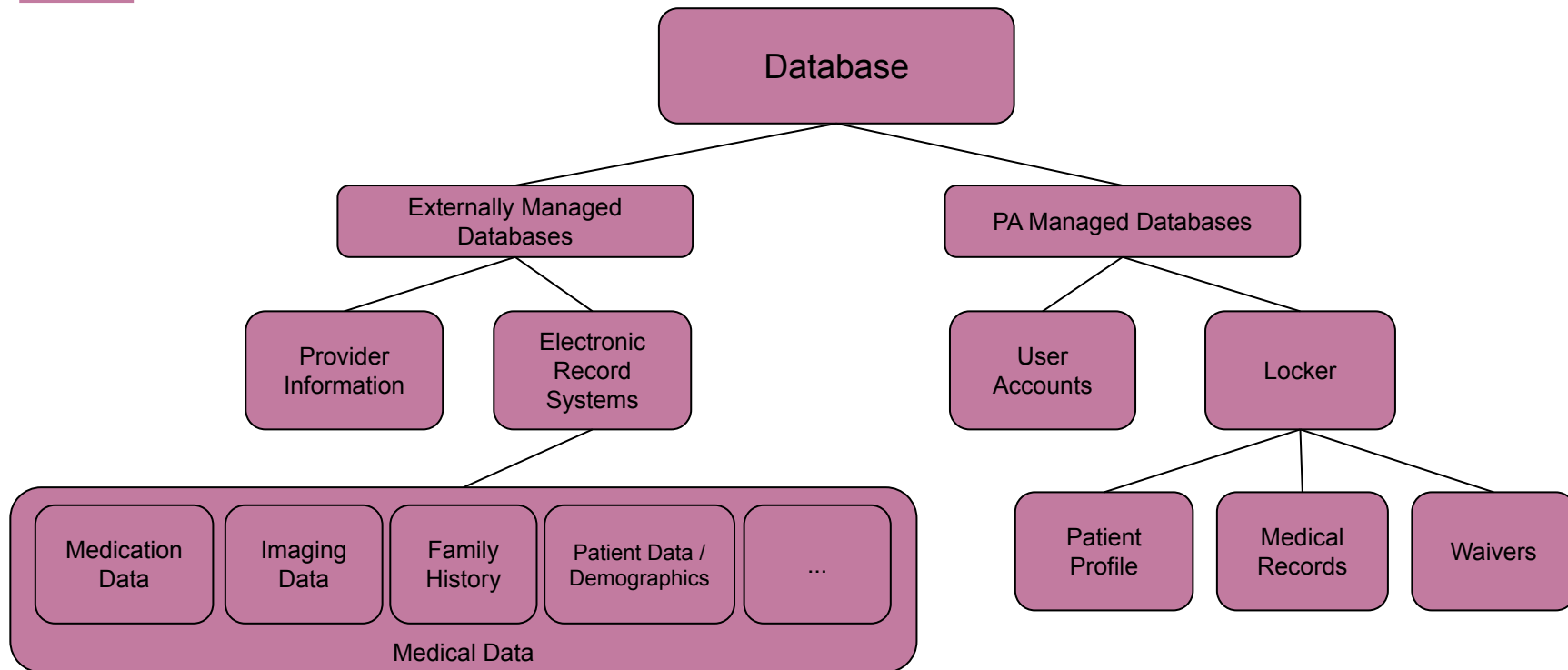
Database Schema - PA Managed Databases
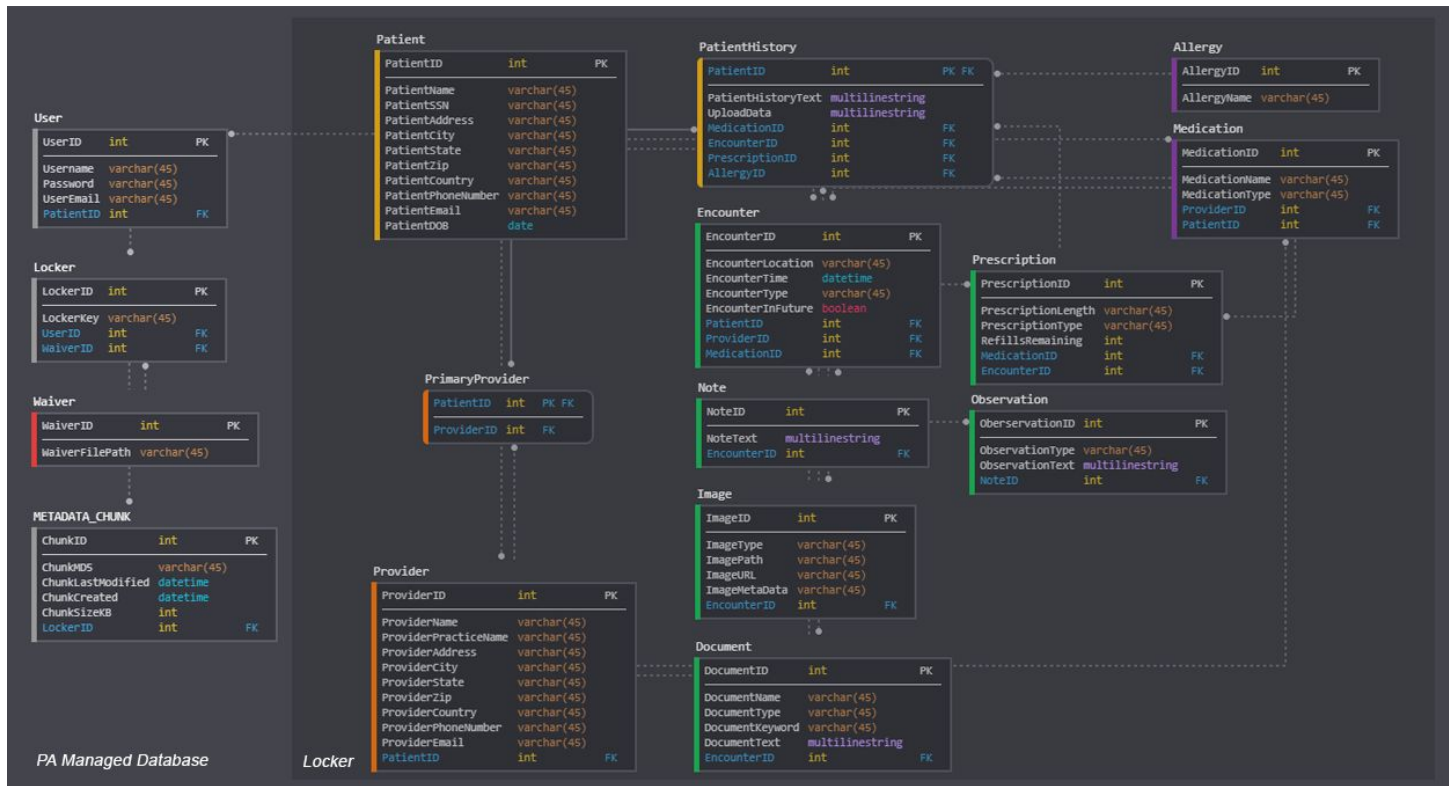
Work Breakdown Structure - External Interface
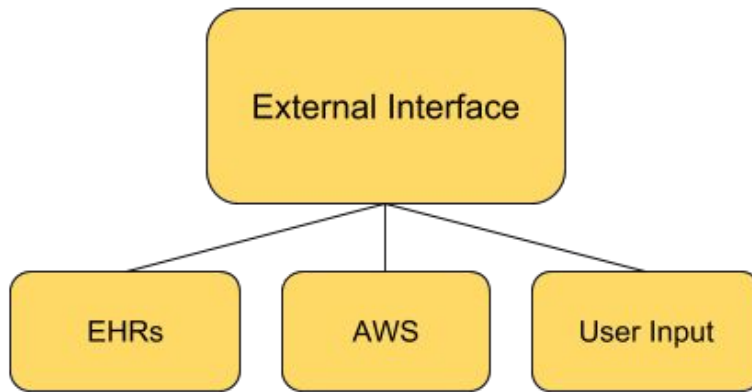
Work Breakdown Structure - Testing
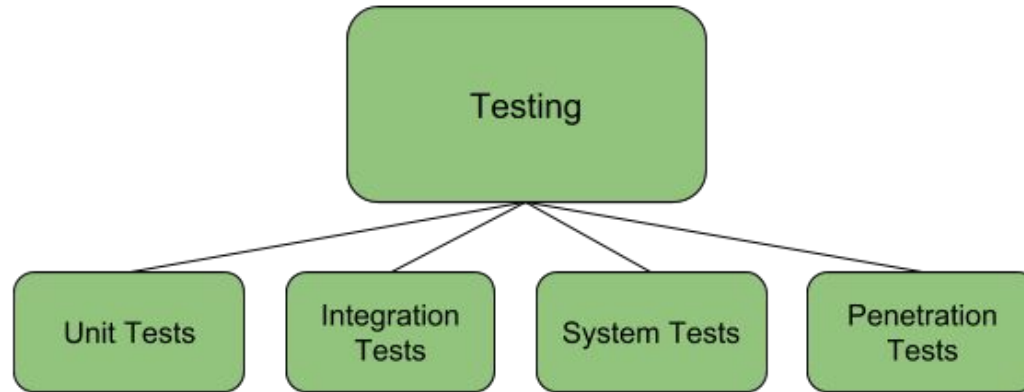
Risk Matrix

Probability

Severity	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very High (5)	S2	S1			
High (4)	S3	T4,C2	T1		
Medium (3)		T2,T3,C3		C1	
Low (2)					
Very Low (1)				T5	

Legend

T - Technical Risk   C - Customer Risk   S - Security Risk

S1 – Meet all HIPAA security requirements.
S2 – Application or cloud breach.
S3 – User losses their password.

T1 - Dependant on record formats that we receive.
T2 - Patient unable to access the internet.
T3 - We have difficulties establishing a link with various patient portals.
T4 - Data loss within the network.
T5 - Local data version conflict with server version.

C1 – Patients input incorrect data into their profile.
C2 – Patient's medical record completeness is self-dependent.
C3 – Patient has difficulties establishing multiple dependent profiles.

Security Risk - S1

Probability

	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very High (5)	S2	S1			
High (4)	S3	T4,C2	T1		
Medium (3)		T2,T3,C3		C1	
Low (2)					
Very Low (1)				T5	

Severity

Risk
Meet all HIPAA security requirements.

Risk Mitigation
Communication between the client and server are encrypted using HIPPA approved methods.

Legend

T - Technical Risk   C - Customer Risk   S - Security Risk

Security Risk - S2

Probability

	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very High (5)	S2	S1			
High (4)	S3	T4,C2	T1		
Medium (3)		T2,T3,C3		C1	
Low (2)					
Very Low (1)				T5	

Severity (axis label)

Legend

T – Technical Risk   C – Customer Risk   S – Security Risk

Risk
Application or cloud breach.

Risk Mitigation
Encryption and Decryption are done on the device only. This protects users in the event of a system compromise.

Security Risk - S3

Probability

	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very High (5)	S2	S1			
High (4)	(S3)	T4,C2	T1		
Medium (3)		T2,T3,C3		C1	
Low (2)					
Very Low (1)				T5	

Severity (vertical axis label)

Legend

T – Technical Risk   C – Customer Risk   S – Security Risk

Risk
User loses their password.

Risk Mitigation
Introduce account recovery codes at the creation of the account which can be used to recover information stored in the account. Additionally a validation process is put in place to recover account passwords. For instance, recovery codes or secret passphrases.

Technical Risk - T1

Probability

	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very High (5)	S2	S1			
High (4)	S3	T4,C2	T1		
Medium (3)		T2,T3,C3		C1	
Low (2)					
Very Low (1)				T5	

Severity

Legend

T - Technical Risk   C - Customer Risk   S - Security Risk

Risk
Dependant on record formats that we receive.

Risk Mitigation
Transcribe records to a format that is acceptable.

Technical Risk - T2

Probability

	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very High (5)	S2	S1			
High (4)	S3	T4,C2	T1		
Medium (3)		T2,T3,C3		C1	
Low (2)					
Very Low (1)				T5	

Severity (left axis)

Legend

T – Technical Risk   C – Customer Risk   S – Security Risk

Risk
Patient unable to access the internet.

Risk Mitigation
An encrypted local copy of the record will be kept on the local device for a limited time.

Technical Risk - T3

Probability / Severity risk matrix

Risk
We have difficulties establishing a link with various patient portals.

Risk Mitigation
Work with patient portal administrators to remedy link issues.

Legend

T – Technical Risk   C – Customer Risk   S – Security Risk

Technical Risk - T4

Probability

	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very High (5)	S2	S1			
High (4)	S3	T4,C2	T1		
Medium (3)		T2,T3,C3		C1	
Low (2)					
Very Low (1)			T5		

Severity

Risk
Data loss within the network.

Risk Mitigation
Data is replicated in the data center, and disaster recovery plans created.

Legend

T – Technical Risk   C – Customer Risk   S – Security Risk

Technical Risk - T5

	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very High (5)	S2	S1			
High (4)	S3	T4,C2	T1		
Medium (3)		T2,T3,C3		C1	
Low (2)					
Very Low (1)				(T5)	

Severity

Risk
Local data version conflict with server version.

Risk Mitigation
Prompt user to either save changes or force upload.

Legend

T - Technical Risk   C - Customer Risk   S - Security Risk

Customer Risk - C1

Probability

	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very High (5)	S2	S1			
High (4)	S3	T4,C2	T1		
Medium (3)		T2,T3,C3		C1	
Low (2)					
Very Low (1)				T5	

Severity

Legend

T - Technical Risk	C - Customer Risk	S - Security Risk

Risk
Patients input incorrect data into their profile.

Risk Mitigation
Allow patients to edit profile settings and implement a type of "auto-complete" feature.

Customer Risk - C2

Customer Risk - C3

Probability

	Very Low (1)	Low (2)	Medium (3)	High (4)	Very High (5)
Very High (5)	S2	S1			
High (4)	S3	T4,C2	T1		
Medium (3)		T2,T3,C3		C1	
Low (2)					
Very Low (1)			T5		

Severity

Legend

T – Technical Risk   C – Customer Risk   S – Security Risk

Risk
Patient has difficulties establishing multiple dependent profiles.

Risk Mitigation
Provide a walkthrough that details how to set up additional profiles within the Patient Advocate app.

GUI Mockups & Rapid Prototype

Home Screen
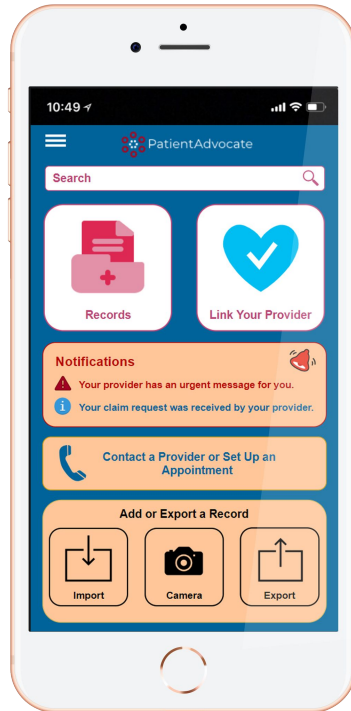
Contact a Provider Screen

https://xd.adobe.com/view/8c647f77-31f7-42ed-75ff-52388727ee1c-fa55/?fullscreen
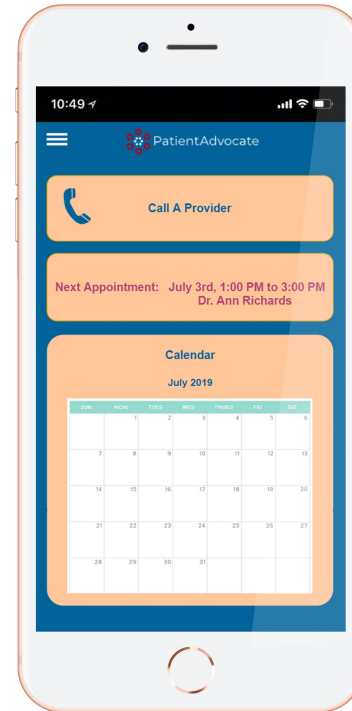
Conclusion

The Patient Advocate application seeks to enhance the ability of patients to use the healthcare industry by expediting the gathering and sharing of patient healthcare data.

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https://www.cdc.gov/nchs/data/hus/2017/076.pdf

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https://www.statista.com/statistics/244628/share-of-us-adults-who-who-need-help-with-personal-care/

16. Agile Image
https://cdn-images-1.medium.com/max/1600/1*6ExaS0RT-9JOUyadF47eqQ.jpeg

Appendix

User Stories - Administrator

I need to be able to:

1. Make changes to the application's user interface.
2. Create user accounts.
3. Modify user accounts.
4. Remove user accounts.
5. Have any requests traceable to PatientAdvocate.
6. Log user activity.
7. Provide robust data backups.
8. Facilitate communication with major EHR systems through custom interface designs.

I wish to be able to:

1. Receive user feedback to resolve issues.

I must not be able to:

1. View encrypted patient records to ensure patient privacy.

User Stories - Patient/Legal Guardian

I need to be able to:

1. Download the PatientAdvocate application.
2. Create a user profile.
3. Log into my account.
4. Log into each of my health care providers' websites to link them to the application.
5. Access dependant health care records.
6. Manually import my medical data.
7. Share my medical record via email.
8. Share my medical record in PDF format.
9. Take pictures of non-digital records for importation into the application.
10. Take notes of my daily activities.
11. Take notes of reactions to medications.
12. Search the application for certain medical criteria.

I wish to be able to:

1. Receive notifications from my health care providers.
2. Contact health care providers through the application via email or phone.
3. View health care appointments in the application.
4. View information about medications and how they interact with each other.
5. Link my other health applications like Fitbit, Garmin, Ancestry.com, etc.

I must not be able to:

1. Modify existing medical record information obtained through linking to the patient portal.
2. Access patient portal information without having signed a release of information.

User Stories - Health Care Provider

I need to be able to:

1. View the exported medical records from the application.

I wish to be able to:

1. View patient information in PDF format.

I must not be able to:

1. View any impertinent patient information without expressed consent of the patient/legal guardian.

User Stories - Guest/Visitor

I need to be able to:

1. View the website.
2. View mockups.
3. Request an account.

I wish to be able to:

1. Link to the app store from the website.
2. Download the app from a desktop computer or smartphone.
3. Attempt to log in to the app.

I must not be able to:

1. Access any internal features of the app without having an account.