FINAL PROJECT PRESENTATION

Team FHIR When Ready

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THE PLAN

- Build a Clinical Decision Support App
- Utilize the SMART-on-FHIR JavaScript framework
- Use Cerner's infrastructure (SMART/Oauth & FHIR resources)
- Apply a mathematical model to queried FHIR data to generate a recommendation
- Serve recommendation on UI

THE RESEARCH

- Our Organization mentors were comprised of experts in various fields that came together to create the vision for this SMART on FHIR app
- We leveraged their robust knowledge of the clinical situational space to understand user needs
- We leveraged a reference mathematical model created in Excel that was able to calculate risks based on patient observations over a time period

A PEEK INTO THE MODEL

PROCEDURE	CPT	N
1	2	13.47
1	3	11.22
1	4	15.37
2	22	18.02
2	56	25.06
3	26	10.59
3	105	18.1
3	110	15.35
3	112	42.282
3	113	17.14
3	127	6
4	7	10.6
4	8	1.53
4	62	9.45
5	10	.
5	31	31.7956

=1 if BR=1	WhiteRace								0	0	0
=1 if BR=2	BlackRace								1	1	1
=1 if BO=2 3 4 5 or 6	IVDU								0	0	1
=1 if AB=1 or 2	NPO								1	0	1
C	Albumin	4.15	-1.00	3.92	3.50	4.80	0.00	20.00	1.313776	1.313776	1.313776
D	AlkPhos	61.5	-1.00	59.50	32.00	91.00	0.00	1000.00	1.05042	1.05042	1.05042
E	AST/ALT	28	-1.00	48.93	15.00	41.00	0.00	10000.00	0.592683	0.592683	0.592683
F	BUN	16.5	-1.00	6.55	8.00	25.00	0.00	500.00	1.068702	1.068702	1.526718
G	Calcium	9.6	-1.00	0.61	8.90	10.30	0.00	20.00	15.40984	15.40984	15.90164
H	Bicarb	27	-1.00	1.82	22.00	32.00	0.00	50.00	14.28571	14.28571	15.38461
I	Cr	0.7	-1.00	0.65	0.40	1.00	0.00	100.00	2.784615	2.784615	2.446154

PLT	PLT1	3.299	* PLT1= Ln (PLT/10)	-0.89992	-0.89992	-1.11356	-1.31437	-1.20916	-1.12297	-1.12297
	PLT2	0.986	* PLT2= PLT1 ^2	0.809847	0.809847	1.240004	1.727562	1.462076	1.261068	1.261068
	PLT2*Cr	0.147		2.255113	2.255113	3.033241	4.837174	3.666437	3.317579	3.317579
PTT	PTT	0.042		4.888889	4.888889	4.888889	4.888889	4.888889	4.888889	4.888889
TBili	TBili	0.030		1.944444	1.944444	1.944444	1.944444	1.944444	1.944444	1.944444
WBC	WBC	0.070		4.507576	4.507576	4.128788	2.840909	2.272727	2.613636	2.613636
Katz Score	Katz Score1	0.784	* Katz Score 1 = (Katz Score)^(-2)	0.068252	0.068252	0.485344	0.485344	0.485344	0.485344	0.068252
	Katz Score2 when CHF==0	1.593	* =Katz Score 2 = (Katz Score)^(-2) * ln(Katz Score) if CHF==0; =0 if CHF	0.091613	0.091613	0.175427	0.175427	0.175427	0.175427	0.091613
	Katz Score2 when CHF==1	-1.018	* =Katz Score 2 = (Katz Score)^(-2) * ln(Katz Score) if CHF==1; =0 if CHF	0	0	0	0	0	0	0
	Katz Score2 * INR	0.138	* = Katz Score 2 * INR	0.525425	0.525425	1.006125	1.006125	1.006125	1.006125	0.525425
Stool+	Stool+	-0.098		0.952381	0.952381	0.952381	0.952381	0.952381	0.952381	0.952381
	Stool+ * LOS	0.026	* = Stool+ * LOS	0.952381	1.904762	2.857143	3.809524	4.761905	5.714286	6.666667
BMI	BMI	0.014		0.655271	0.655271	0.655271	0.655271	0.655271	0.655271	0.655271

THE PROBLEMS

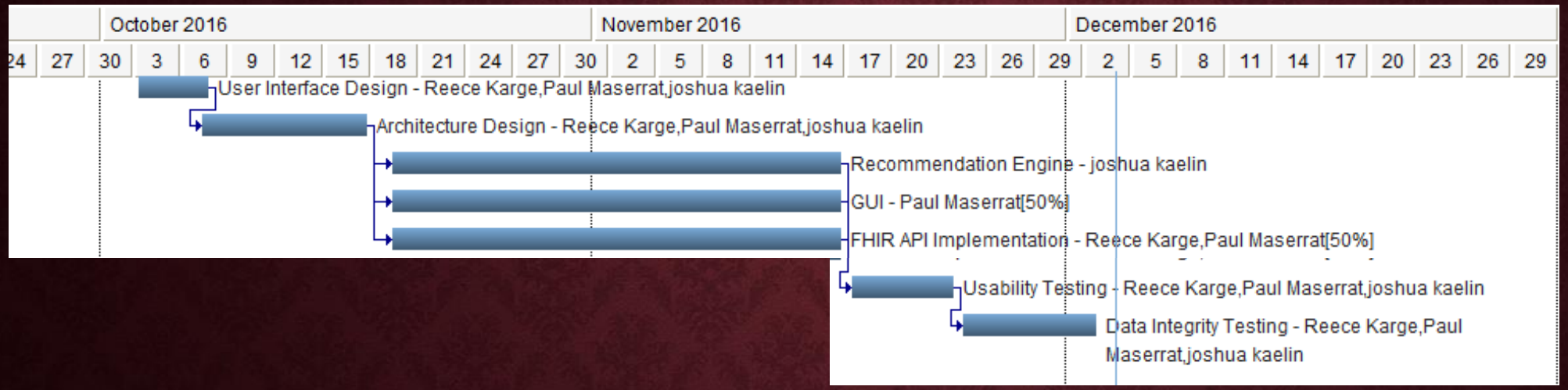
- FHIR data availability
  - The mathematical model used for recommendation requires a multi-day period of observations
  - Many of the required variables are simply not present in bulk (if at all) on the FHIR server
  - There was some hope that Emory would have their own FHIR server available with this data that we could use but it did not pan out in time
- Adjusted Framework
  - Our OM's determined that they needed a Java Web Server application instead of a client-based JavaScript application

THE NEW PLAN

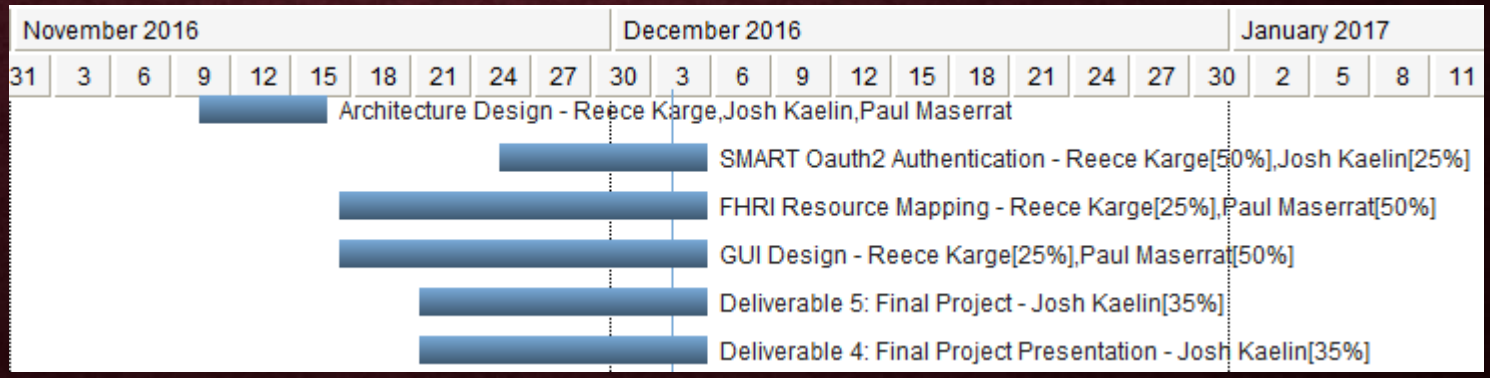
- Develop a basic SMART-on-FHIR server-based application in Java
- Publish application on Cerner's developer portal
- Prioritize OAuth functionality
- Connect to Cerner's FHIR server
- Develop a hand-off document to replace our developer keys with our OM's production keys at some future date
- Build some UI that can be tested (retrieving one or more resources from the FHIR server)

GANTT CHANGES

- Original Plan

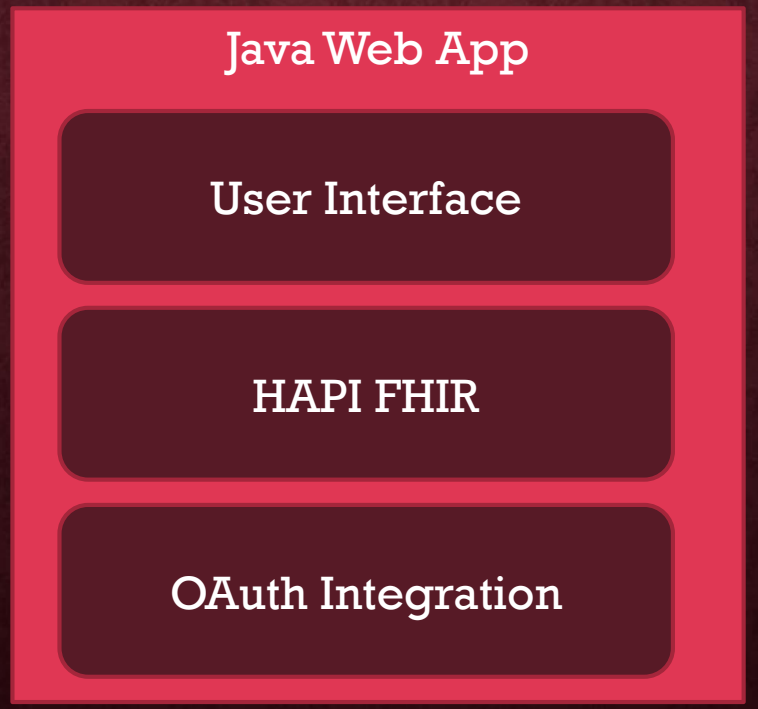


- Starting Over



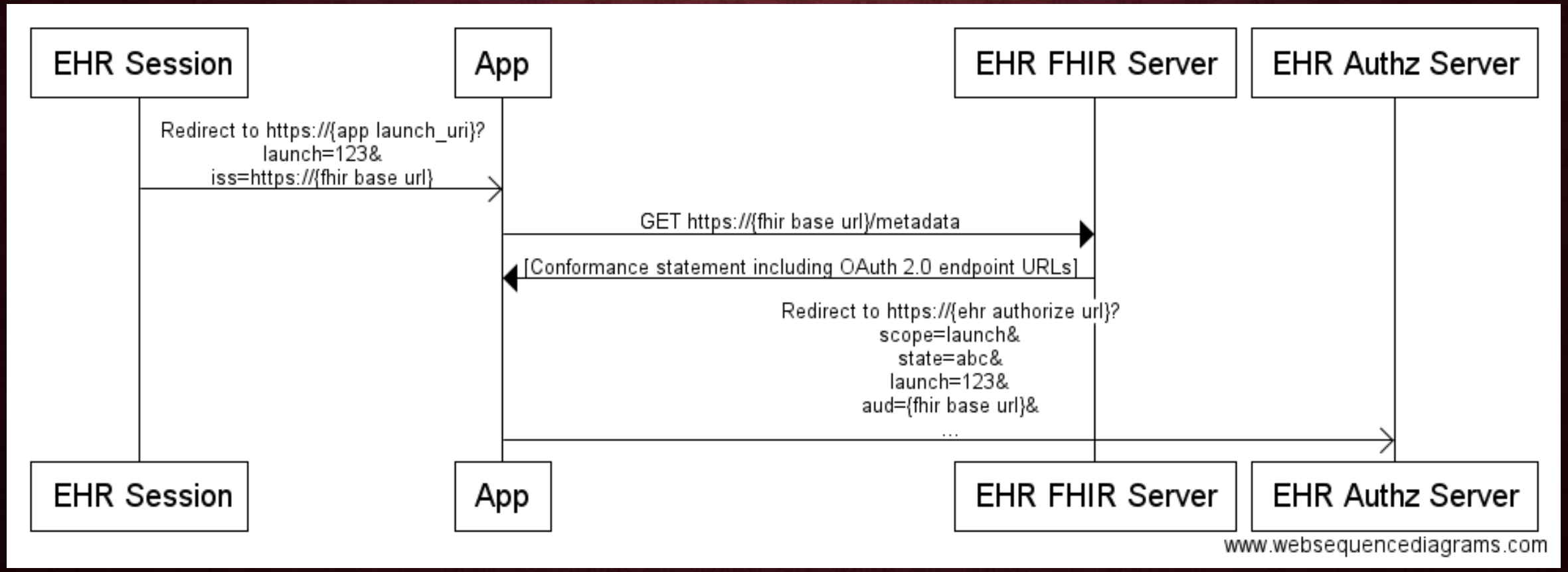
MODIFIED DESIGN

- Server-based application changes SMART-on-FHIR integration
  - The SMART app changes from a Public App profile to a Confidential App profile.



MODIFIED DESIGN

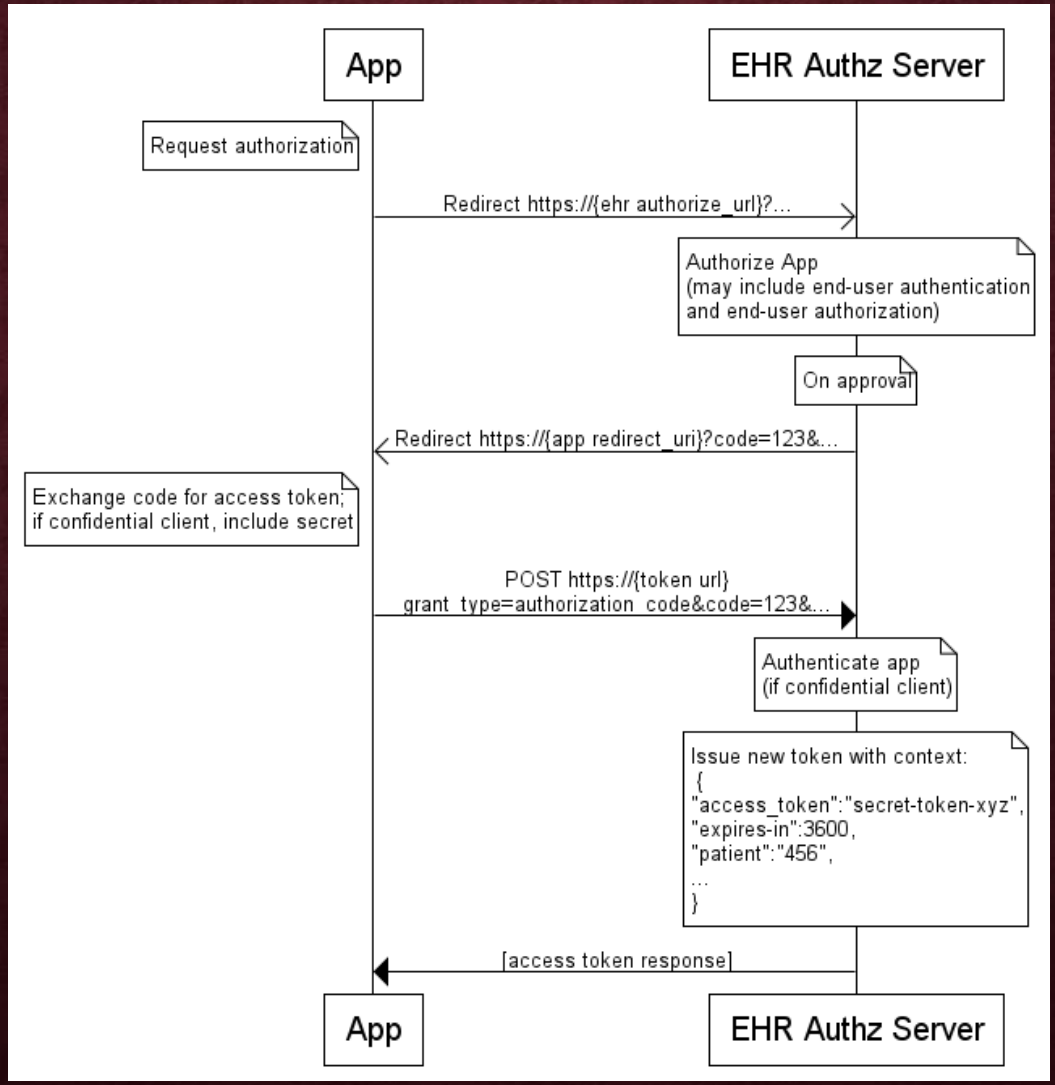
SMART Launch Sequence



http://docs.smarthealthit.org/authorization/

MODIFIED DESIGN

SMART Authorization Sequence



http://docs.smarthealthit.org/authorization/

MODIFIED DESIGN

- Deploy Strategy
  - Requirement to be a Java Web App
  - Currently deployed on a personal AWS instance
  - Utilizing standard libraries and HAPI FHIR library to maximize portability
  - Hand-off document to replace client/secret keys once final app team is established

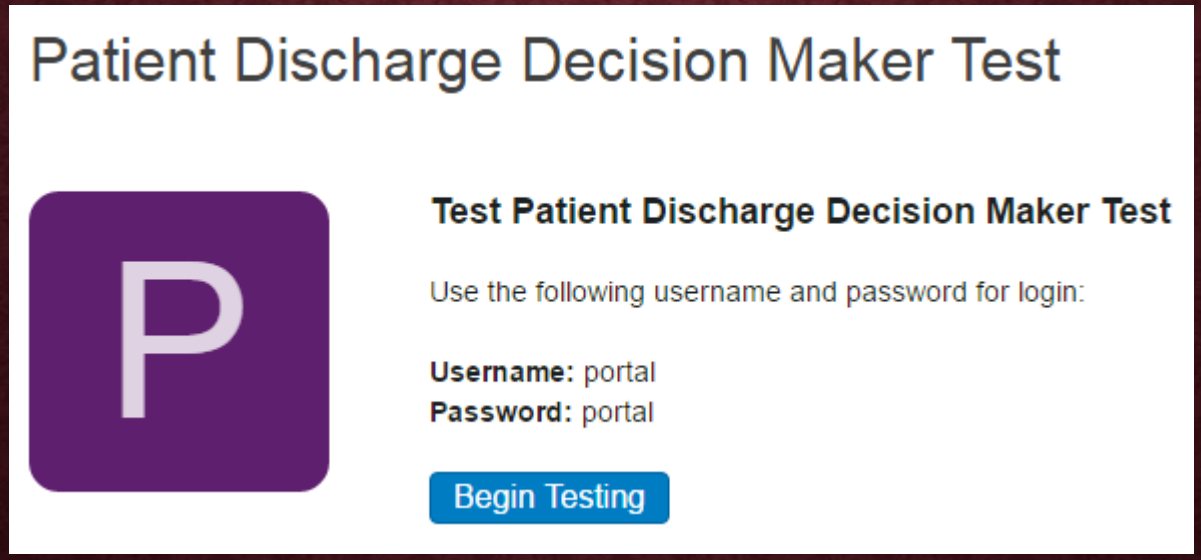
VALUE DRIVERS

- Functionality
  - A web-based Java application was created
  - It is able to successfully connect to Cerner's SMART on FHIR platform
  - It displays specific resources returned from the Cerner FHIR server
- Usability
  - Post-pivot, the web-based application is very simple
    - Select a Patient from the dropdown and view the relevant data
  - One primary concern was the ability to adapt the delivered codebase to an account controlled by the OM's at some point in the future
    - Part of the application manual covers this transition in detail

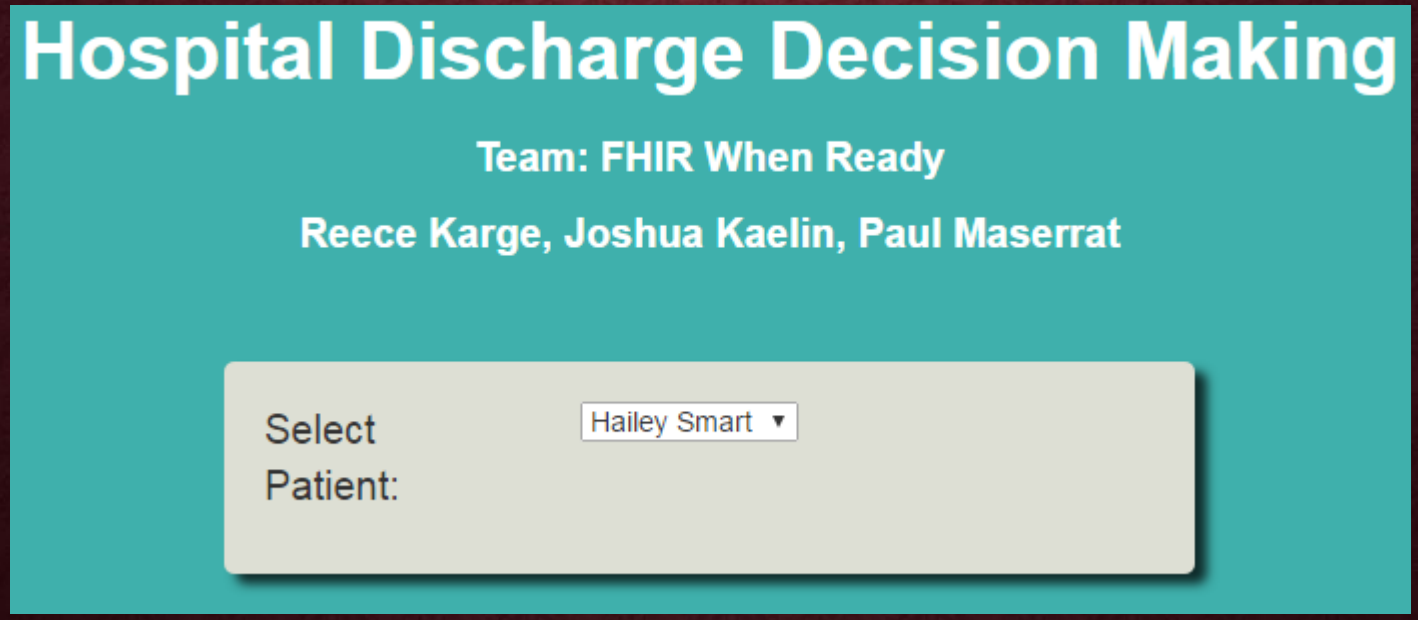
VALUE DRIVERS

- Design
  - UI
    - Very simplistic, a scaffolding upon which to build future efforts
  - Server-side
    - Utilizes HAPI FHIR interface to maximize future compatibility and upgrades
- Innovation
  - Unfortunately, the late pivot limited our ability to innovate
  - We only had a few weeks to redesign the application, including:
    - Discarding existing user interface
    - Changing design pattern to server-based
    - Changing language to Java

DELIVERY WALKTHROUGH



DELIVERY WALKTHROUGH



DELIVERY WALKTHROUGH

Patient Information

Name: Hailey Smart

Gender: female

Date of Birth: Tue Dec 02 00:00:00 UTC 2003

Address:

Encounters

Encounter:

Date: 2016-06-22T21:13:00.000Z
Location: Medical Pavilion
Reason: Left Knee Abrasion

Encounter:

Date: 2016-06-22T21:11:00.000Z
Location: 1N 0152 B
Reason: Influenza

Observations

Observation

Patient: 4342011

Status: In Error

Code: BSA Measured

Result: 1 m2

Date: 2016-06-27T15:48:00.000Z

Observation

Patient: 4342011

Status: In Error

Code: Body Mass Index Measured

Result: 17 kg/m2

Risk Level: Below low normal

Date: 2016-06-27T15:48:00.000Z

Risk Level Detail: Low: 18 kg/m2 High: 25 kg/m2

Observation