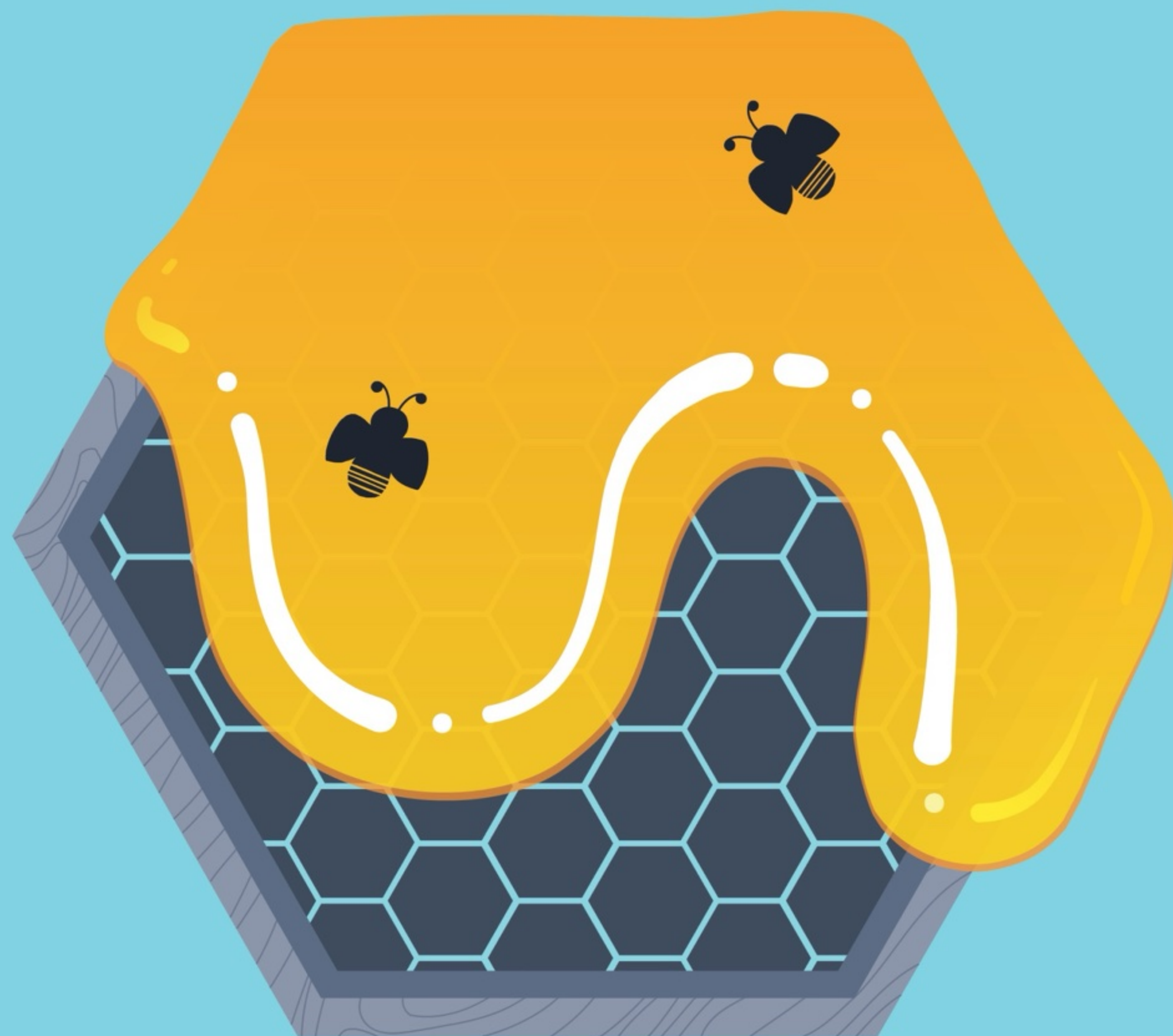




Accelerating clinical algorithm development
through secure collaboration via

Beekeeper AI



How might we
accelerate clinical
algorithm development
by enabling secure
collaboration between
data stewards &
algorithm developers?

Client

UCSF

**Duration**

3 + 6 months

RoleUX Lead Designer
UX Researcher**Tags**

Product Design

Workflow Diagramming

Qualitative Research

User Interviews

Service Blueprint

Sensemaking

MVP Prototype Development

Discovery

Mid-Fidelity Mockups

UX Management

Client Relationship Management

Sensemaking

Low-Fidelity Wireframing

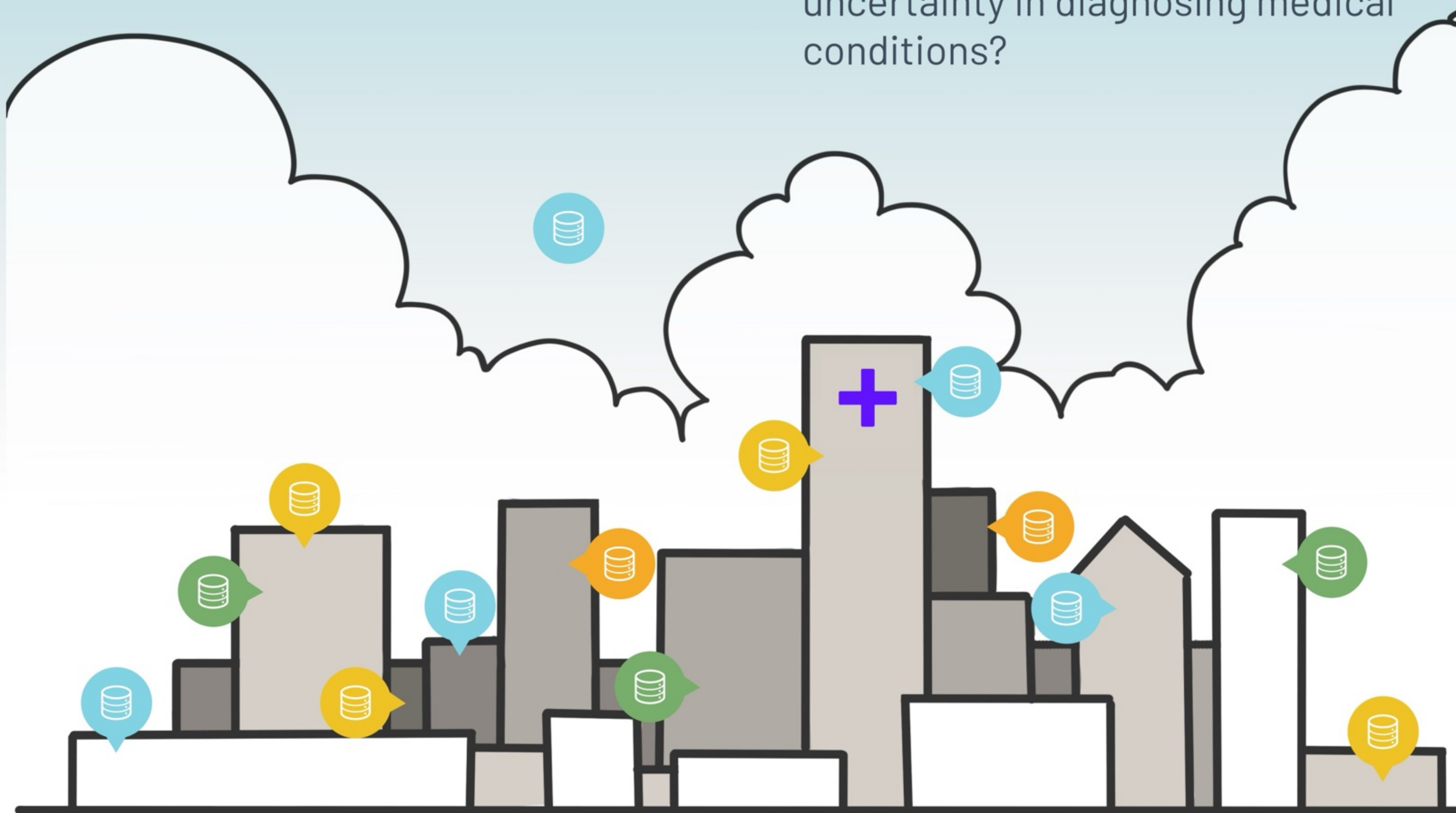
Part 2.1

Background

Healthcare & Technology
AI-based FDA-approved Algorithms
Pain Points

The future of technology
is **healthcare**.

What if we could improve patient
care by using data to eliminate
uncertainty in diagnosing medical
conditions?



A collaboration between



University of California
San Francisco

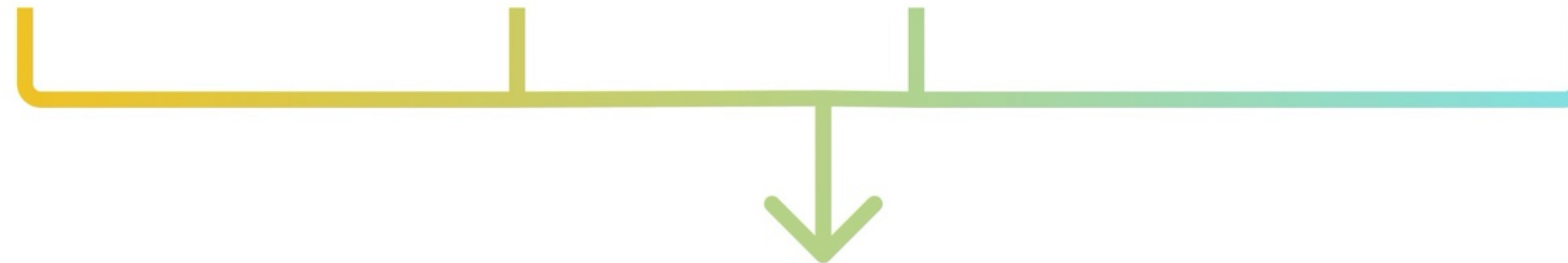


The **Use Case** that
brought everything
together

Prior usage of
Intel SGX

SGX Hardware

Azure Confidential
Computing



Built by Launch Consulting



How?

with ***Artificial Intelligence-based FDA-approved
algorithms***

... but what's standing in the way of this?



Time

It takes approximately **3 years*** for a single clinical algorithm achieve generalizability.



Money

In the same vein, it costs an average **\$5 million*** per algorithm.



Trust

Most significant is the mistrust between data owners and algorithm developers.

*in the United States. In other countries, clinical algorithm development is often even more difficult.

The case of Doctor D & Algorithm A –



Doctor D

+

=

More Accurate Diagnoses



Algorithm A

Part 2.2

About BeekeeperAI

Algorithm Owners vs. Data Stewards
What is BeekeeperAI?
How does it work?



Algorithm Owner

AI development teams
from 3rd parties or AMC's

Develop algorithms for FDA
approval and future clinical
usage

Goal: Create an algorithm that passes
FDA approval and achieves
generalizability (usable by practitioners)



Data Steward



Academic medical centers
(AMC's), often university
hospital systems

Guard & process vast lakes of
patient data

Goal: Advance healthcare technology
while keeping patient data safe (and
earning a bit of profit at the same time)

DATASET

BEEKEEPERAI

Data Steward



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DATASET

a zero-trust platform
connecting **data**
stewards and **algorithm**
owners (as a 2-sided
marketplace) in order to
collaborate for the
*advancement of clinical
algorithm development.*



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ALGORITHM

BEEKEEPER AI

Data
Steward



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earning a bit of profit at the same time)

DATASET

"Zero trust (ZT) is the term for an evolving set of cybersecurity paradigms that move defenses from static, network-based perimeters to focus on users, assets, and resources...

a zero-trust platform
Zero trust assumes there is no implicit trust granted to assets or user accounts based solely on their physical or network location or based on asset ownership."

**The National Institute of Standards and
Technology, U.S. Department of Commerce**

[https://nvlpubs.nist.gov/nistpubs/SpecialPublications/
NIST.SP.800-207.pdf](https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-207.pdf)



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ALGORITHM

BEEKEEPERAI

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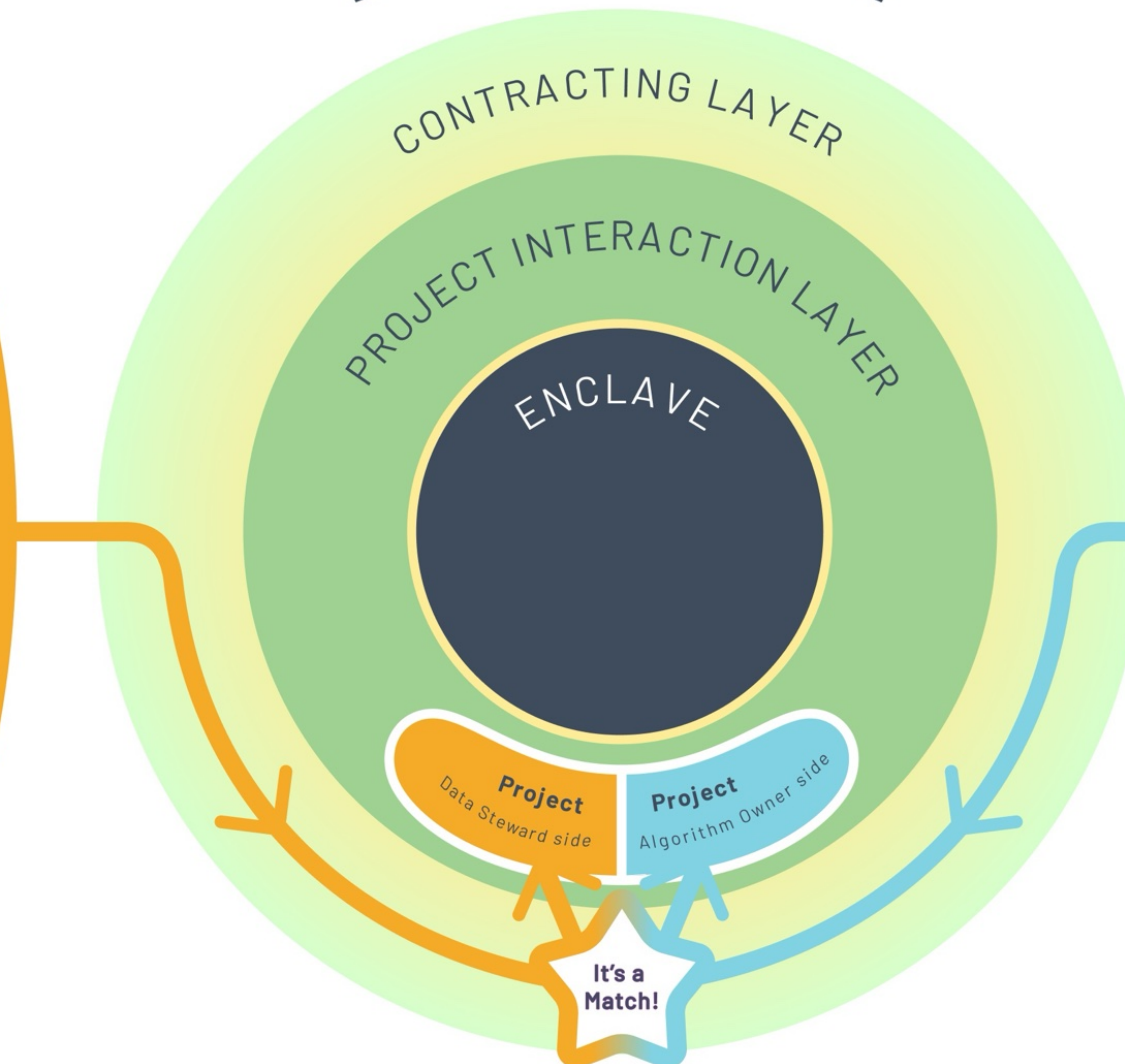
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ALGORITHM



BEEKEEPERAI

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Owner**

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usage

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FDA approval and achieves
generalizability (usable by practitioners)

DATASET

ALGORITHM

CONTRACTING LAYER

PROJECT INTERACTION LAYER

ENCLAVE

Project
Data Steward side

Project
Algorithm Owner side

It's a
Match!

BEEKEEPERAI

**Data
Steward**



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hospital systems

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patient data

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DATASET



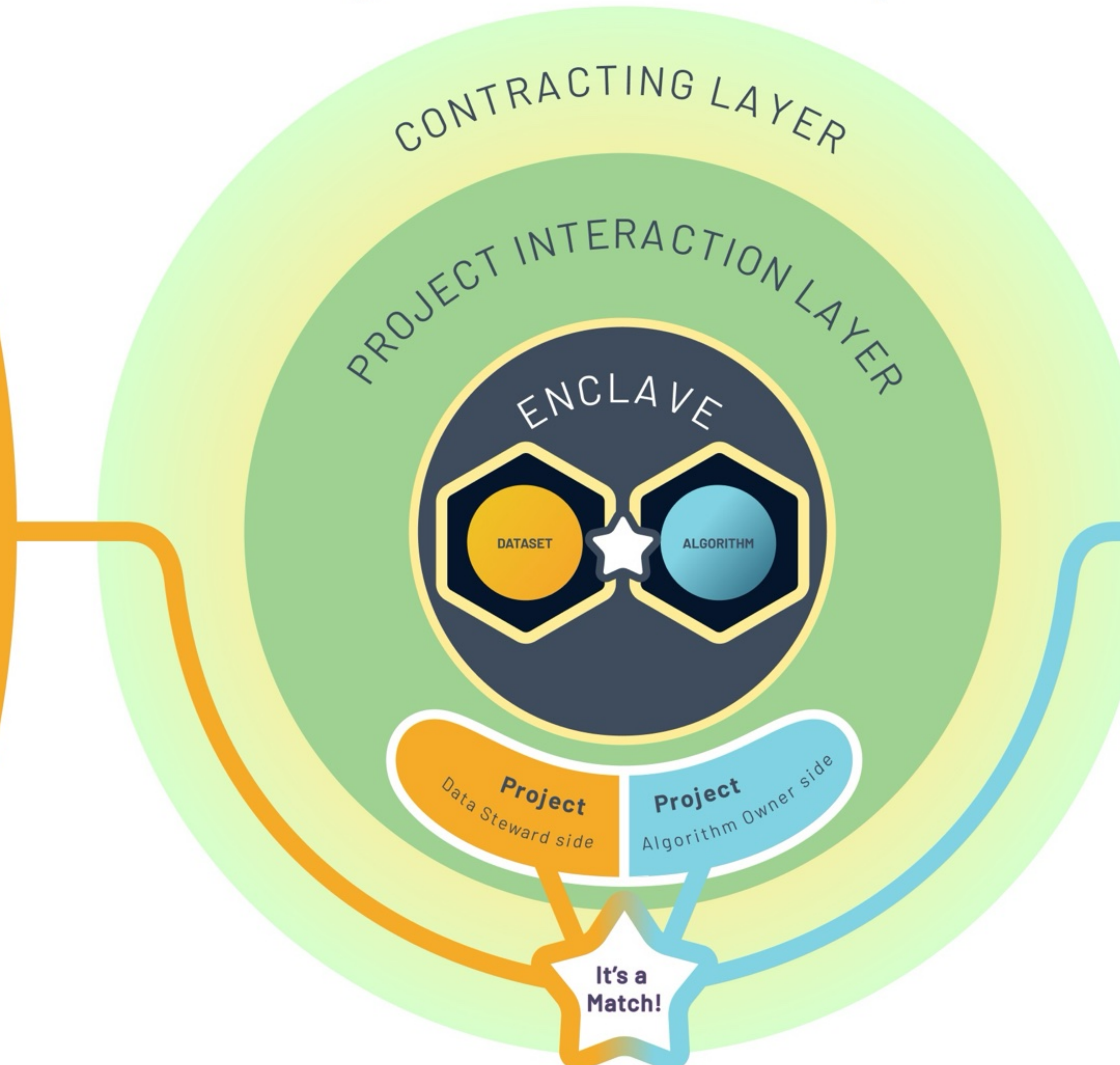
**Algorithm
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ALGORITHM



BEEKEEPERAI

**Data
Steward**



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DATASET



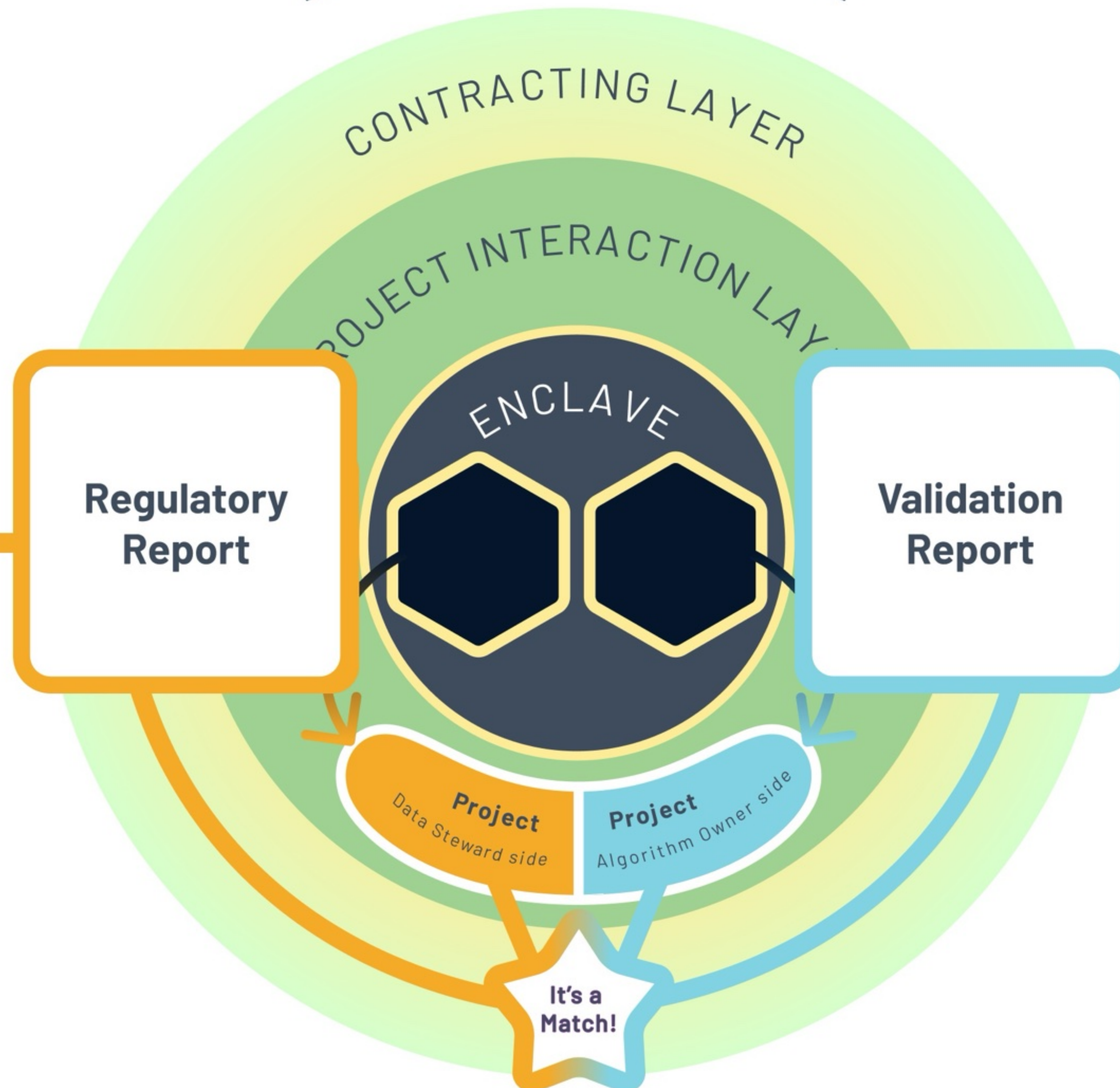
**Algorithm
Owner**

AI development teams
from 3rd parties or AMC's

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approval and future clinical
usage

Goal: Create an algorithm that passes
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generalizability (usable by practitioners)

ALGORITHM



BEEKEEPER AI

**Data
Steward**



Academic medical centers
(AMC's), often university
hospital systems

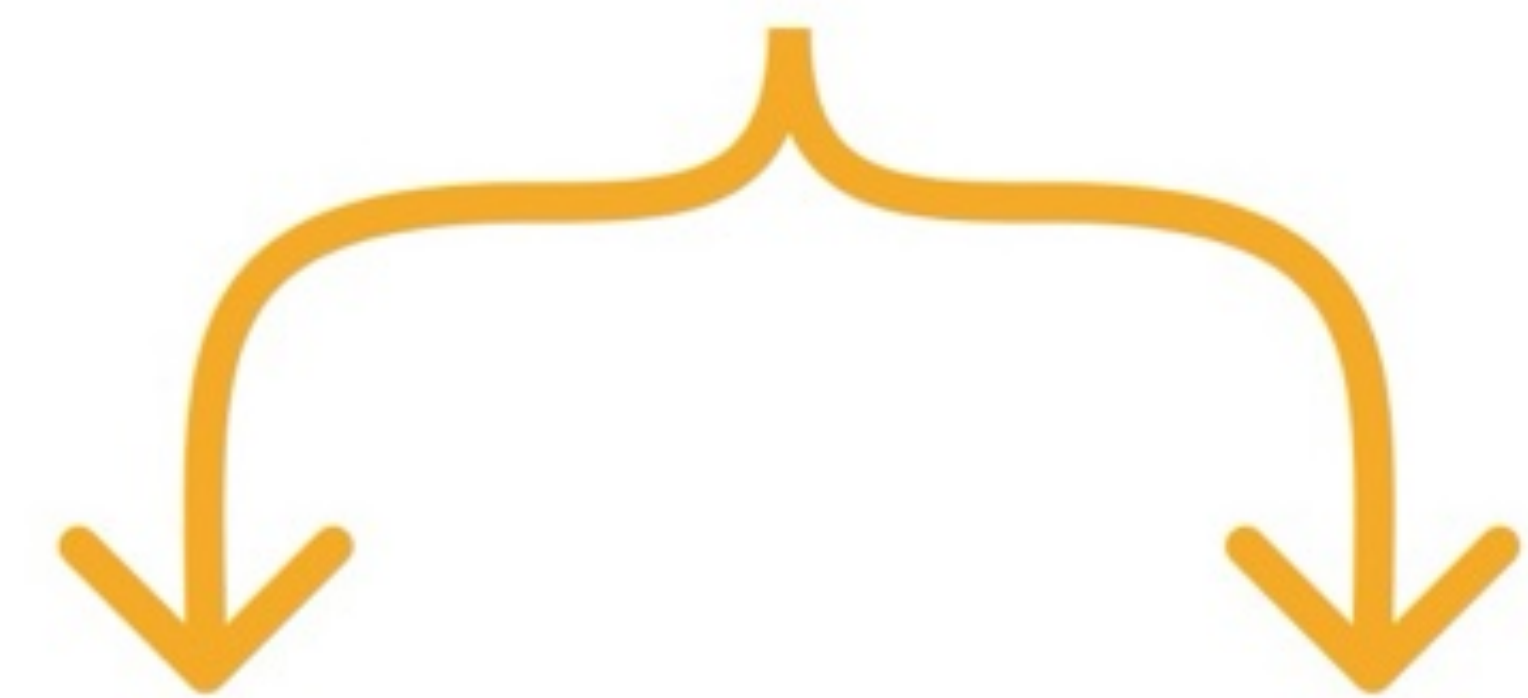
Guard & process vast lakes of
patient data

Goal: Advance healthcare technology
while keeping patient data safe (and
earning a bit of profit at the same time)

DATASET

**Regulatory
Report**

"I now have a record
that this algorithm ran
against my dataset."



**Utilization
Profit**

**Future
Academic Clout**

**Validation
Report**

"Does my algorithm
perform as expected
against this dataset?"



**Feedback for future
improvements**



**Algorithm
Owner**

AI development teams
from 3rd parties or AMC's

Develop algorithms for FDA
approval and future clinical
usage

Goal: Create an algorithm that passes
FDA approval and achieves
generalizability (usable by practitioners)

ALGORITHM

Part 2.3

Engagement 1: Proof of Concept

Planning & Research

Scope of Engagement

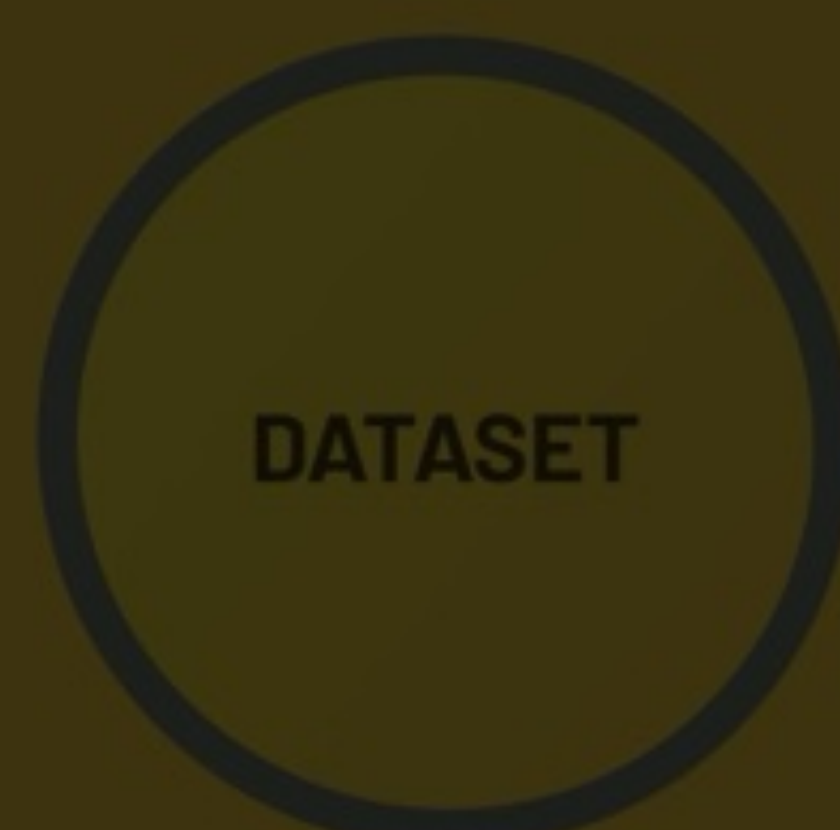
Preview of Final Deliverable

Research & IA process

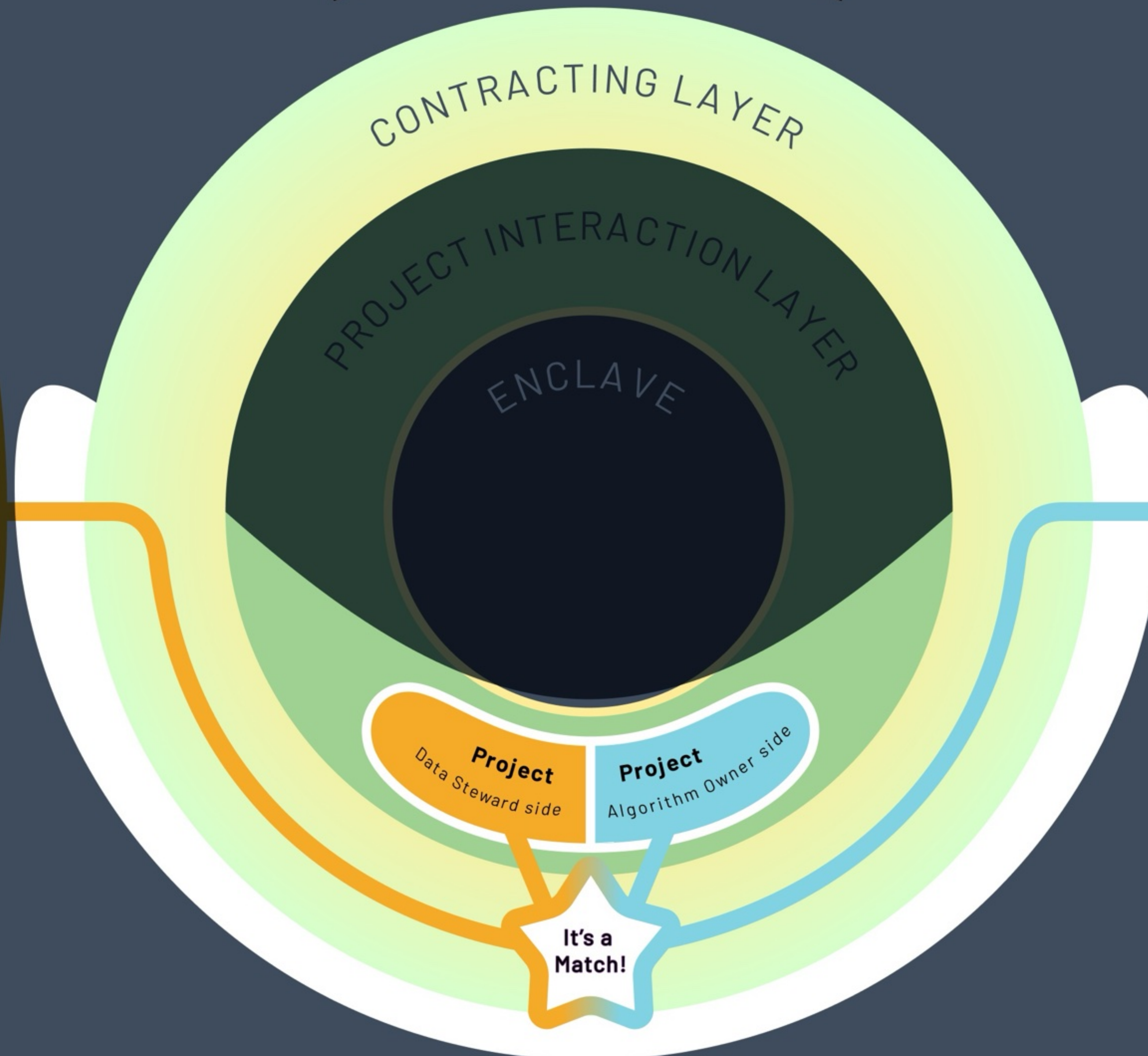
Engagement 1
Data
Steward
Proof of Concept

Academic medical centers
(AMC's), often university
hospital systems

Own & process vast lakes
of patient data



BEEKEEPERAI



**Algorithm
Owner**

AI development teams
from 3rd parties or AMC's

Develop algorithms for FDA
approval and future clinical
usage

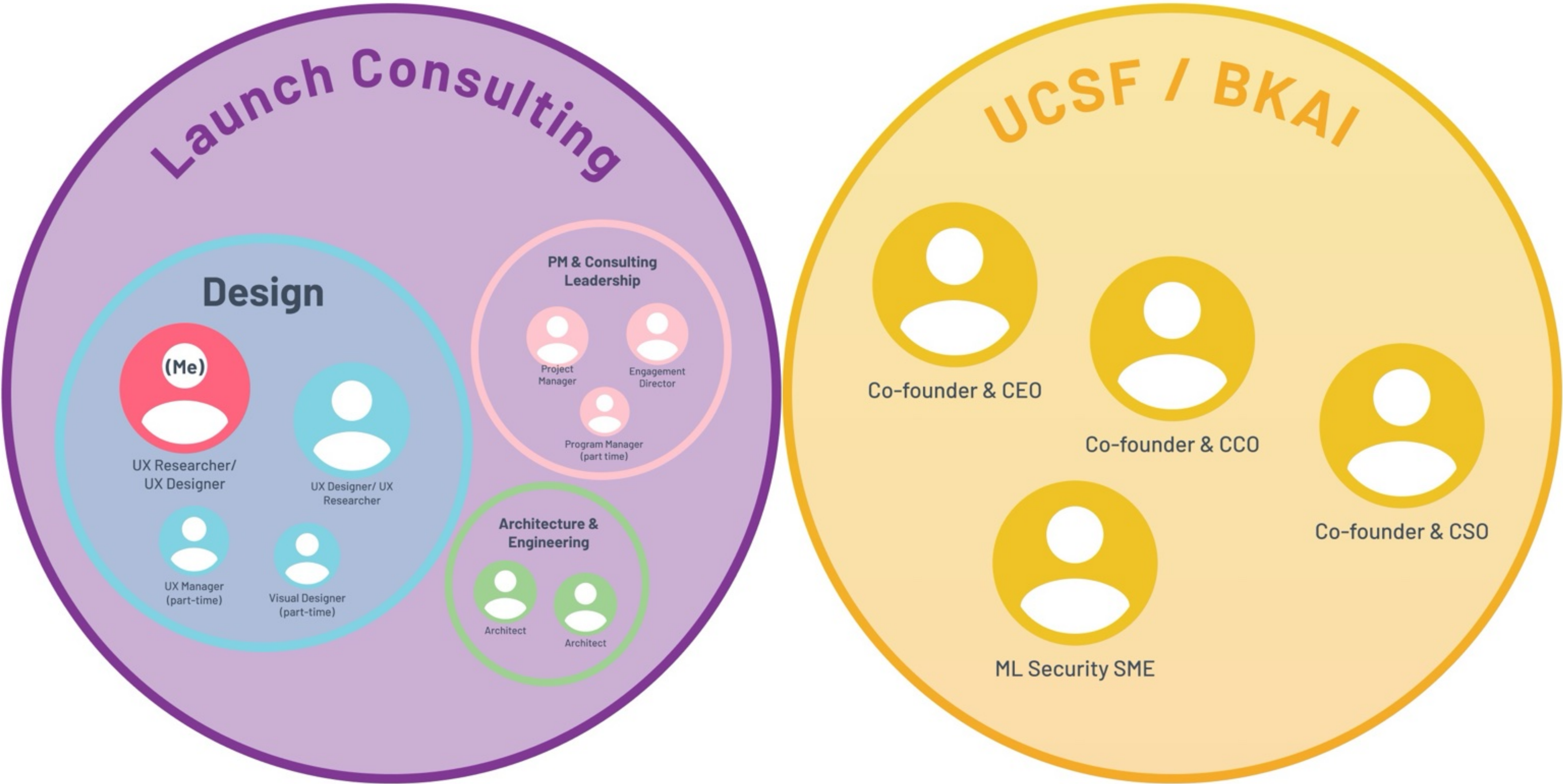


Engagement 1

Proof of Concept

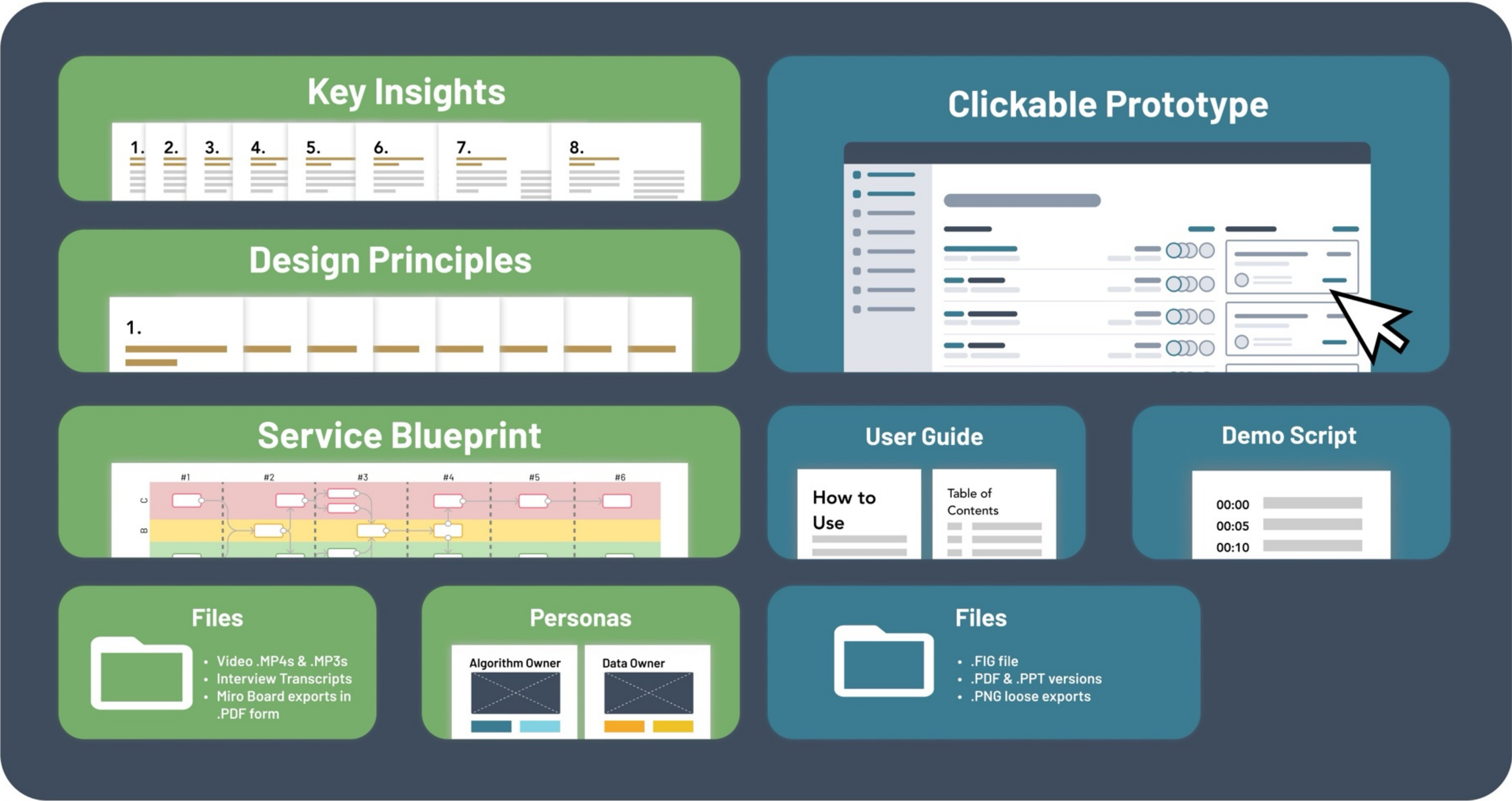
Create a demo-able **clickable prototype** so that BKAI can raise funding from investors & gauge interest with prospective customers

3 months



Proof of Concept

End result



Engagement 1

Proof of Concept

End result

BeeKeeperAI

Home

Projects

Data Sets

Community

Payments

Monitoring

Resources

Users

Welcome back to the Hive!

Your Projects

Pneumothorax Detection

Project

Project

Project

Project

Project

Team Lead

Team Lead

Team Lead

Team Lead

Team Lead

+7

+11

+5

+9

+9

VIEW ALL

Monitoring

Latest Runs

Pneumothorax Detection

Run Successful

Run Failed

Run Failed

Run Succ

VIEW MORE

Community

Frequent Collaborators

UCSF

University of California San Francisco

UNIVERSITY

UNIVERSITY

BeeKeeperAI

Home

Projects

Analytics & Reports

Data Sets

Community

Payments

Monitoring

Resources

Users

Pneumothorax Detection

Created

Therapeutic Area Description

Project Summary

SEE MORE

Reports

Basic Validation run 03

Test Report 02

Data Sets

Data Set

Data Set

University

University

University

PI Name here

Updated

SEE MORE

BeeKeeperAI

Home

Projects

Data Sets

Community

Payments

Monitoring

Resources

Users

UCSF Data Set 1782

Version 5

Data Set Summary

Summary Stats

File Type

of Samples

of Patients on File

of Files in Sample

Associated Projects

Pneumothorax Detection

UCSF

UCSF

University

University

Validation Test Report

Test ID

Report Generated

Overview

Model Name

Version

Date Submitted

Results

		Predicted	
		Positive	Negative
Actual	Positive		

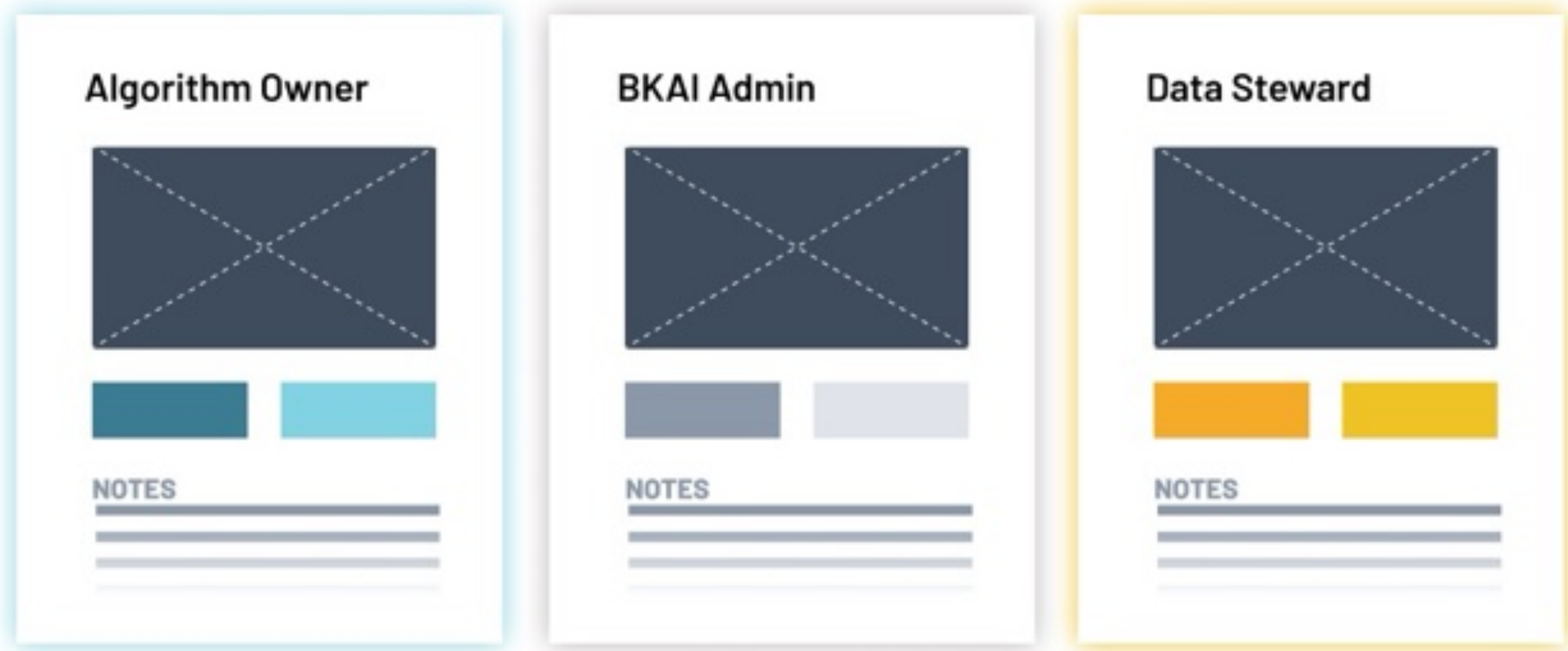
	Data Set 1	All Data
Sensitivity		
Specificity		
PPV		
NPV		

Engagement 1

Proof of Concept

START: User Personas

Client Product Owners prepared these 3 key personas as a starting point, which we confirmed & fleshed out with our research.



Clickable Prototype – Development Process Map

How did we build out this initial prototype within 3 months?

1. Secondary Research



- Key concepts from these industries:
- Data Science
 - Healthcare Regulation
 - AI/ML in Healthcare

2. Primary Research

5 Data Stewards & 6 Algorithm Owners

“What are the major pain points that you struggle with (and how can BKAI help)?”

I turned my notes into insights, which I then grouped & distilled 2x into overall insights.



Proof of Concept

3. Key Findings

Some particularly interesting data points I learned from our research distillation:



Algorithm Owner

- Any risk of algorithm IP leaking is too much risk.
- Building products = hitting milestones, improving the product, and achieving sign off from FDA
- The standard for good data is: de-identified, easily available, and have a lot of work put into it (good annotations & context/logic)
- AO's are at the mercy of the data they need to obtain, and just because a data point exists doesn't mean it's easy/feasible to extract it
- **Just about all the users we talked to (interested future customer representatives) are hopeful but doubtful of Beekeeper's future effectiveness**



Data Steward

- **#1 goal: DOs want to avoid risk of data loss/exposure**, and then #2 goal: create innovative health solutions to make clinicians' jobs easier. DOs do actually want to share their data for innovations in healthcare, but this goal is #2 after managing risk.
- Important for the DO to be aligned/ have trust in the AO. Collaboration between multiple sites is very hard (both data + interpersonal problems)
- Monetization (though beneficial) is a controversial topic to talk openly about with AMCs
- **Could Beekeeper be an opportunity to define standards for data?**

Engagement 1

Proof of Concept

4. Service Blueprint

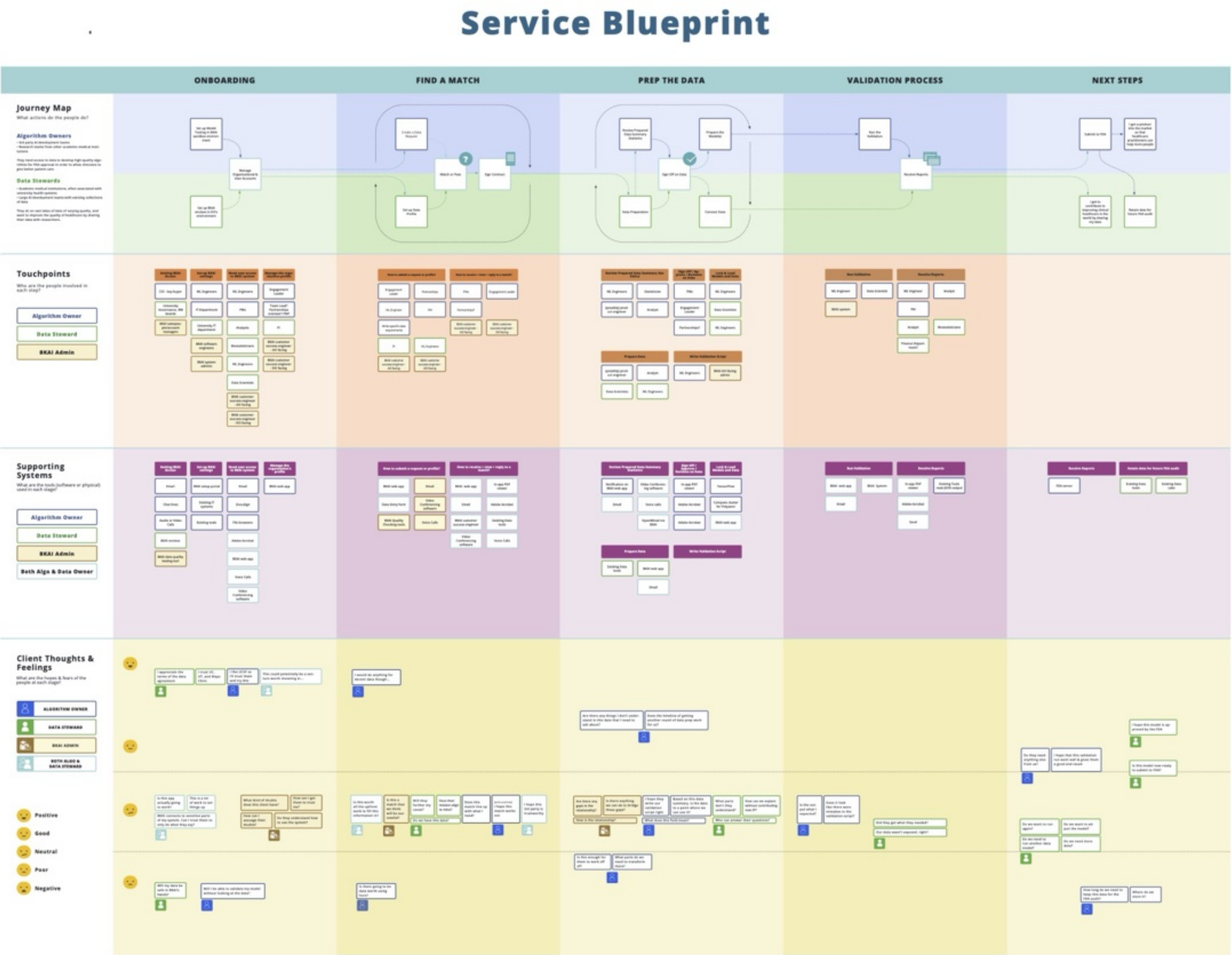
I mapped out the exact sequence of events that our prototype needs to support into a step-by-step journey, and overlaid possible future touchpoints on top.

Journey Map
Outlines the major steps that each user persona takes through each stage of the process

Touchpoints
Identifies the specific (hypothetical) people involved in each step

Supporting Systems
Identifies the specific (hypothetical) tools, both software & physical, used in each stage

Client Thoughts & Feelings
Extrapolates the (hypothetical) hopes & fears of each user persona through each stage, from positive -> negative

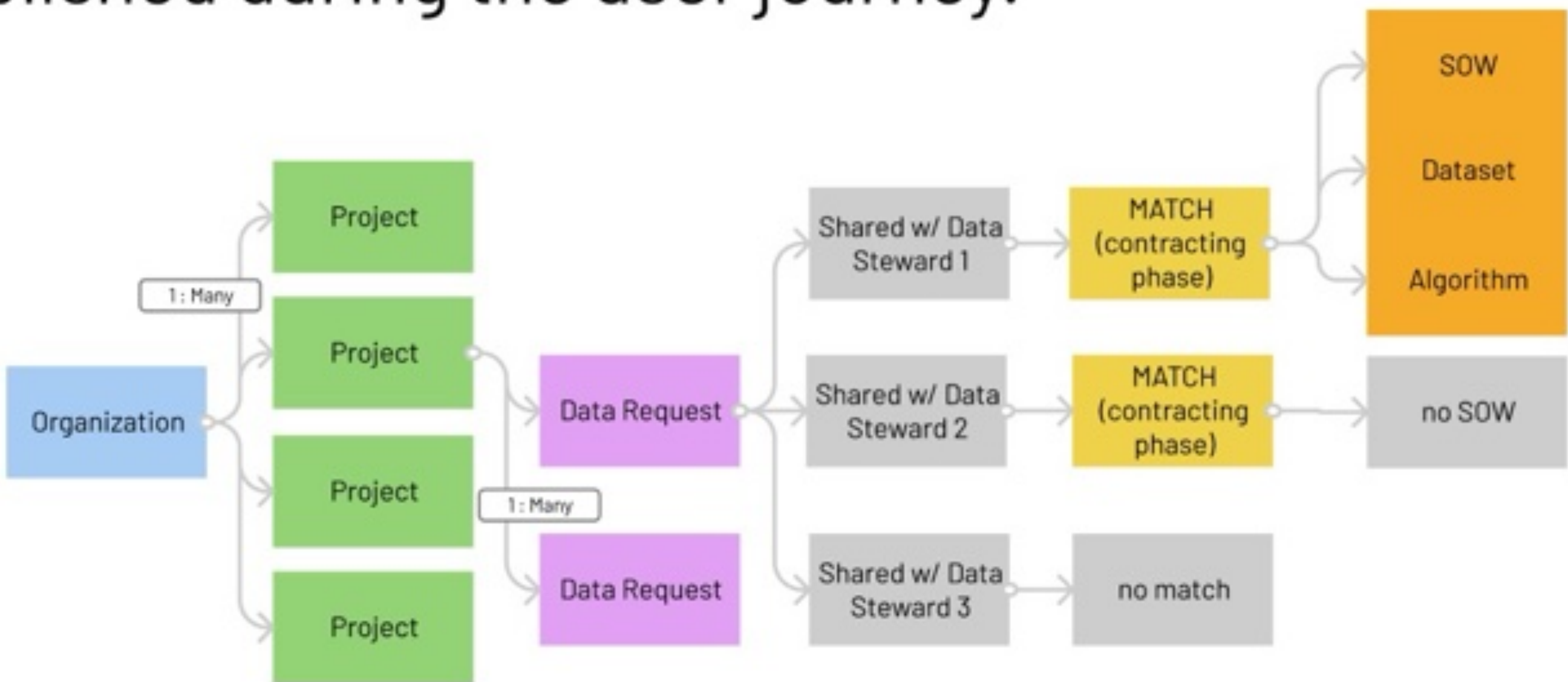


Engagement 1

Proof of Concept

6. Information Architecture

We developed the IA model based on the sequence of events established during the user journey.



7. Rough Story Sequence

We made some important decisions & finalized our storyline.

Question	Answer	Why/How
Point in Time: MVP or future?	2 years in the future	Client group via online workshop via Miro
POV: AO, DS, or Both?	Algorithm Owner only	Most actions are on the AO side, time limit, difficulty switching POV's
New user OR Existing user?	Existing User only	Onboarding/setup is non-essential, time limit
Fidelity of final prototype?	Medium Fidelity	No High Fidelity: viewers expect perfect data, time limit

5. Key Feature Selection

We asked the client Product Owners to decide what features were the most quintessential to BKA's story. This enabled us to concentrate on what's most important to build for the final solution.



Part 2.4

Engagement 1: Proof of Concept

Design

Storyline

Low Fidelity -> High Fidelity (x3 features) Designs

Conclusion

Engagement 1

Proof of Concept

8. Storyline & Wireframing

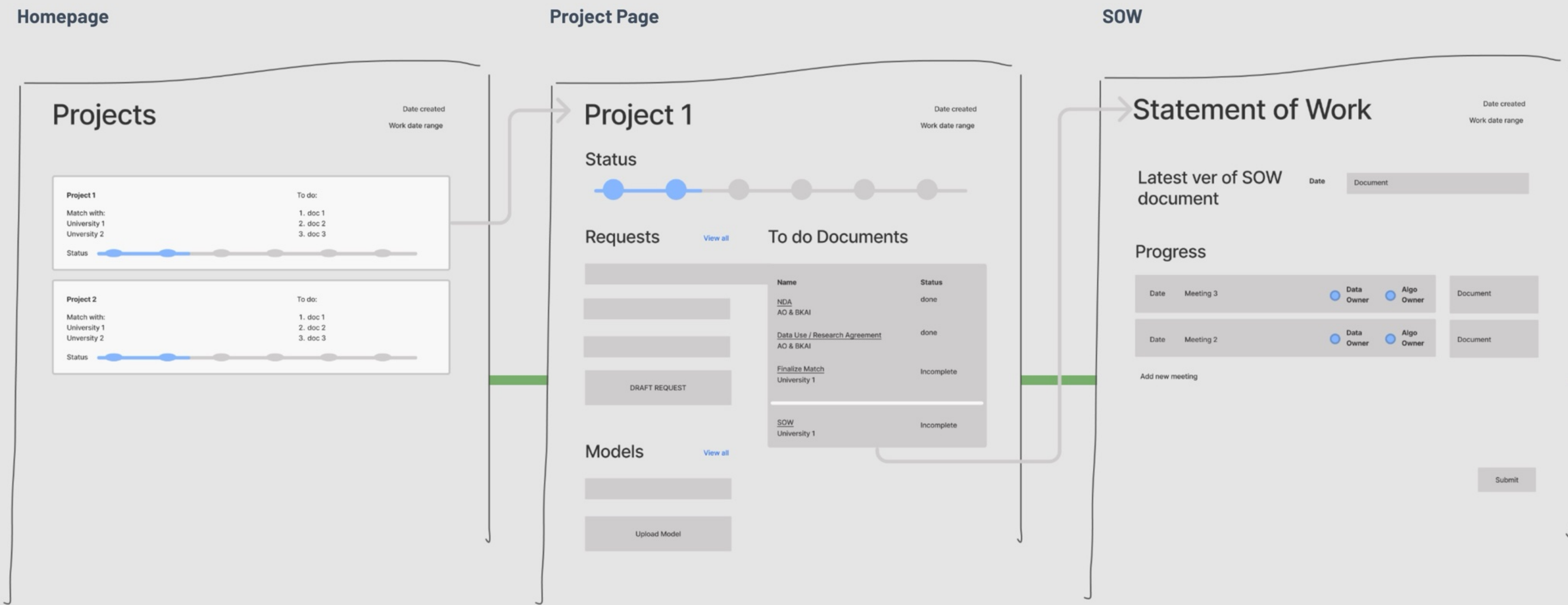
We finalized our prototype's story structure and built wireframes accordingly, pausing to test with our Product Owners and specific users.



Engagement 1

Proof of Concept

Low-Fidelity



Engagement 1

Proof of Concept

Low-Fidelity

Homepage

BeeKeeperAi			JD John Doe		
Hello, John Doe of Organization D!					
Project(s)			Sort By Data Owner		
Oncology Breast Cancer Diagnosis FDA Submission Model Training			SOW Needs Approval Action Required		
Model A XX/XX/XXXX – Ongoing			Lead Name 9 Team Member(s)		
Breast Cancer Diagnosis FDA Submission Model Training			Data Preparation Approval Action Required		
Model B XX/XX/XXXX – Ongoing			Lead Name 9 Team Member(s)		
Breast Cancer Treatment FDA Submission Model Validation			Data Specifications Approval Awaiting Response		
Model C End Date XX/XX/XXXX			Lead Name 5 Team Member(s)		
Latest Changes					
Entity Name		Date Updated	Updated By	Comment	
SOW/Data Specifications V5		HH:MM MM/DD/YYYY	First Last	Revised based on our meeting yesterday discussing fund...	
SOW/Data Specifications V4		HH:MM MM/DD/YYYY	First Last	Revised from Zoom call MM/DD	
Expedited Process WRG IRB		HH:MM MM/DD/YYYY	First Last	N/A	
See More					
Risks					
Risk Name		Severity	Updated By		
Lorem ipsum dolor sit amet, consectetur		Medium	First Last		
Lorem ipsum dolor sit amet, consectetur		High	First Last		
Lorem ipsum dolor sit amet, consectetur		Low	First Last		
See More					

Project Page

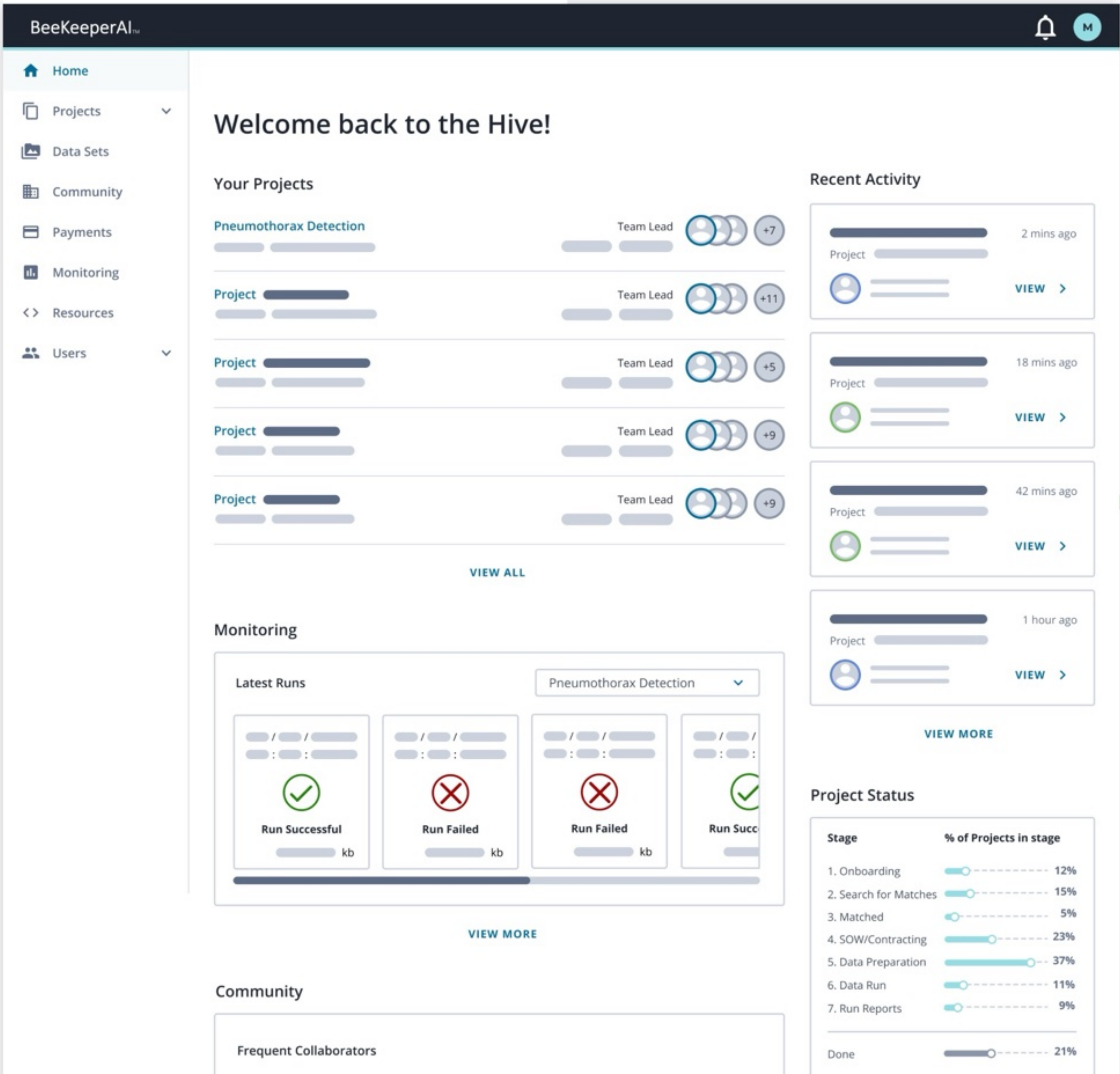
BeeKeeperAi			JD John Doe		
Model A			Active		
Oncology			Breast Cancer Diagnosis		
FDA Submission			Model Validation		
Model Training					
XX/XX/XXXX – Ongoing			Lead Name		
Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.			9 Team Members		
Data Set(s)			Sort By Update Date		
University C System			Model Validation		
Validation Model Run			Action Required		
Data Set 2					
Latest Update			Date Updated		
Validation Model Run			HH:MM MM/DD/YYYY		
			Updated By		
			First Last		
University C System			Model Training		
Training Model Run 3			Training Finished		
			Complete		
Data Set 1					
Latest Update			Date Updated		
Training Model Run 3			HH:MM MM/DD/YYYY		
			Updated By		
			First Last		
Match(es)			Sort By Update Date		
University C System			Document Needs Approval		
			Action Required		
Match 1					
Latest Update			Date Updated		
SOW/Data Specifications V5			HH:MM MM/DD/YYYY		
			Updated By		
			First Last		
University F System			Match Needs Approval		
			Awaiting Response		
Match 2					
Latest Update			Date Updated		
Match Agreement			HH:MM MM/DD/YYYY		
			Updated By		
			First Last		
Data Request(s)					
Submitted to 4 Data Owners			Submitted		
			Complete		

Engagement 1

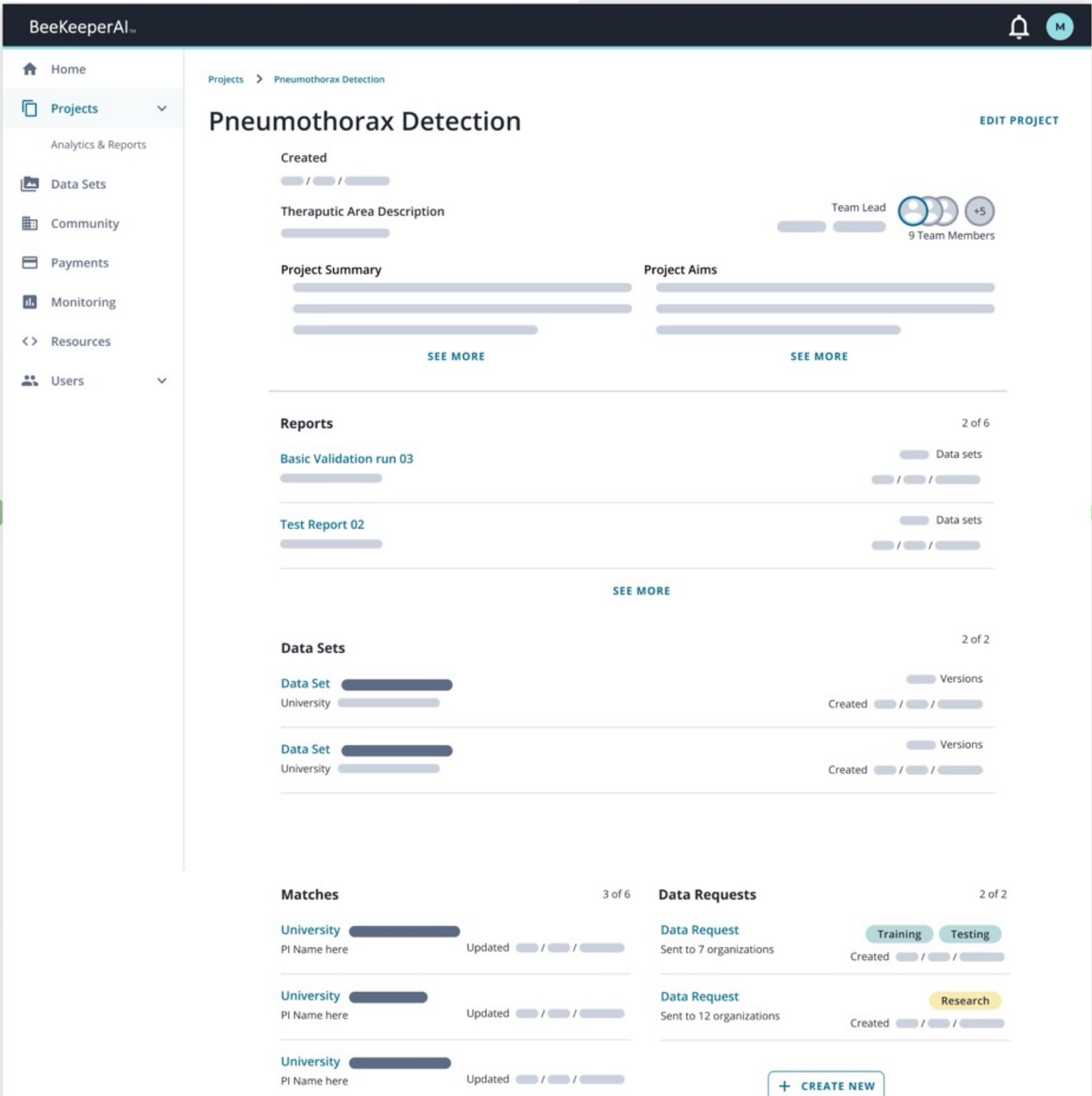
Proof of Concept

Mid/High-Fidelity

Homepage



Project Page



Engagement 1

Proof of Concept

Low-Fidelity

Matches

BeeKeeperAi

JD John Doe

Navigation

Navigation

Projects > Project Name > Data Request

Data Request 2837

Active

Created 01/01/2021

Algorithm Validation

FDA Approval

CONTACTS

Jane Doe (primary)

John Doe (secondary)

Files

Files

Files

View Form

Edit/Modify Form

Request sent to

Send to more data owners

University of California San Francisco

Pending

Expand

Rejected by 1 lab group - 05/06/2021

O'Neil Lab

"Unfortunately our image data set is too small (roughly 200 images) for this project. I'd suggest contacting the Perera Lab (pereralab@ucsf.edu) if you haven't already."

Sent to 3 lab groups - 04/29/2021

Dumont Lab

Fong Lab

O'Neil Lab

Reviewed by UCSF admin - 04/29/2021

Contact Admin

Request sent to UCSF - 04/27/2021

University of Texas Austin

Matched

View Match

University of California San Francisco

Data Set

View Data Set

Sign SOW

BeeKeeperAi

JD John Doe

SOW/Data Specifications

University C System

Document Needs Approval

Action Required

Version 5

Comment

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt...

Date Updated

HH:MM MM/DD/YYYY

Updated By

First Last

PDF version of Document

Back

Request Revisions

Approve

Proof of Concept

Mid/High-Fidelity

Home

Projects

Data Sets

Community

Payments

Monitoring

Resources

Users

Projects > Pneumothorax Detection > Data Request

Data Request

Validation

FDA approval

EDIT REQUEST

Primary Contact

Secondary Contact

Attachments

Request Sent to

+ ADD NEW DATA ORG

University

Pending

Sent

Response from 1 Research Group

Sent to 3 Research Groups

Reviewed by Admin

CONTACT ADMIN

University

Matched

Matched

VIEW

University

Rejected

Rejected

EXPAND

[illegible]

Engagement 1

Proof of Concept

Low-Fidelity

View Dataset

DATA SET

Version #

Show me earlier versions of it

Data Owner

Link to match & contracting documents

Image Histogram

021200

Summary Information

of samples

of patients it represents

what properties are available in this set?

Ages?

range, distribution map

Diagnostic outcomes

versioning: which version is the GO procuring this time?

(still considered the same data set?)

annotate a bit at a time

table of annotators: discover annotator overlaps

expert cardiologists don't even agree with themselves often

#s close to 1 = good, 0 = disagreement (% possible)

Annotator Agreement Rate

A

B

C

D

Age

Lowest14Highest73

Sex

Myocardial Infarction?

Review + iterate or approve in process

Validation Report

Data Science

What is the AUC - ROC Curve?

AUC - ROC curve is a performance measurement for the classification problems at various threshold settings. ROC is a probability curve and AUC represents the degree or measure of separability. It tells how much the model is capable of distinguishing between classes. Higher the AUC, the better the model is at predicting 0s as 0s and 1s as 1s. By analogy, the Higher the AUC, the better the model is at distinguishing between patients with the disease and no disease.

The ROC curve is plotted with TPR against the FPR where TPR is on the y-axis and FPR is on the x-axis.

ROC

TPR

FPR

AUC

AUC - ROC Curve (Image 2) (Image courtesy: (b) Photostopped Collection)

<https://www.data-science.com/understanding-auc-roc-curves/4882363c7c7d>

AUC is rated between 0 and 1 where 1=perfect, 0.5=cannot tell and 0=always wrong

Rachael feels like we need a .92 or above for use in UC hospitals

What is the Gold standard test?

The diagnostic test or benchmark that is available under reasonable conditions or without restrictions.

Basically, what is the expected best diagnostic tool with the highest sensitivity and specificity and is available?

For example, the MRI is the gold standard for brain tumor diagnosis, but it's not as good as a biopsy. This is because while the accuracy is lower, it is less invasive and less risky for patients.

Study1

Positive561Negative225

Ground Truth

Positive297(297/561) (Sensitivity: 100%)

Negative489(489/225) (FNR: 0.0%)

264(264/561) (FPR: 54.0%)

225(225/225) (Specificity: 46.0%)

AI Positive (P)

AI Negative (N)

Medical

Data Science

Gold Standard Positive (P)

True Positive (TP)

False Negative (FN)

Sensitivity

Recall, True Positive Rate

Gold Standard Negative (N)

False Positive (FP)

True Negative (TN)

Specificity

True Negative Rate

Medical

Positive Predictive Value

Negative Predictive Value

Data Science

Precision

Fig. 1

Estimating the sensitivity and specificity of diagnostic tests¹

True diagnosis 'gold standard'

Disease presentDisease absent

Test results

Positive

Negative

a

b

c

d

a + b

c + d

a + c

b + d

Sensitivity = a / (a + c)

Specificity = d / (b + d)

Positive predictive value = a / (a + b)

Negative predictive value = d / (c + d)

Positive likelihood ratio = a / (a + c) / b / (b + d)

Negative likelihood ratio = c / (a + c) / d / (b + d)

Engagement 1

Proof of Concept

Mid/High-Fidelity

View Dataset

BeeKeeperAI

Home

Projects

Data Sets

Community

Payments

Monitoring

Resources

Users

Projects > Data Sets > UCSF Data Set 1782

UCSF Data Set 1782

Data Set Needs Approval ACTION REQUIRED

LATEST VERSION

HISTORY

Version 5

Data Set Summary

Last Updated

Updated By

Summary Stats

File Type

of Samples

of Patients on File

of Files in Sample

Total File Size

of Rows in Sample

Associated Projects

Pneumothorax Detection

UCSF

UCSF

University

University

Actions

REQUEST REVISION

APPROVE

Statistics

Demographic Distributions

Data Point

Visualization

Validation Report

Validation Test Report

BeeKeeperAI

Test ID

Report Generated

Overview

Model Name

Version

Date Submitted

Results

		Predicted	
		Positive	Negative
Actual	Positive		
	Negative		

	Data Set 1	All Data
Sensitivity		
Specificity		
PPV		
NPV		

Data Set 1

Data Set Version

Data Steward

Samples

Patients

Classes

Class Distribution

Demographic Distribution

Proof of Concept

9. Final Delivery

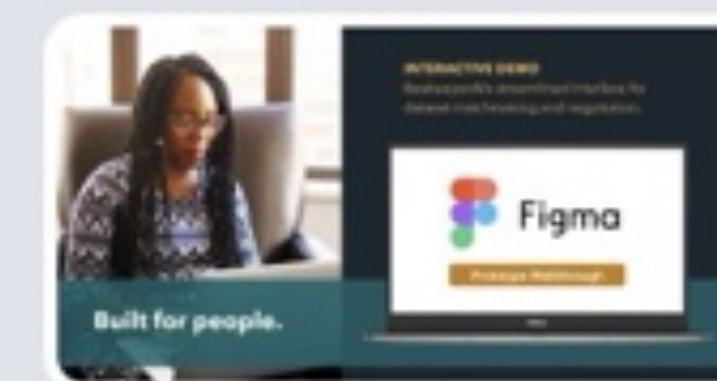
We built out our final mid-fidelity pages using our own custom elements kit, added clickability, and delivered the following to our clients:



Intro of materials & where to find them, what situations to use them in



Example verbal script to use to tell the clickable prototype story



The Clickable Prototype itself via Figma (.fig) and URL, and exported .png & .pdf files

Conclusion

As of June 2021, BeekeeperAI is ready to publicly use our demo-able prototype to gain investor funding & potential customers to go out and build the real thing.

Part 2.5

Engagement 2: MVP

Planning & Research

Scope of Engagement

Preview of Final Deliverable

Requirements Planning & Usability Testing Process

BEEKEEPERAI

Engagement 2
Data Stewardship
MVP

Academic medical centers
(AMC's), often university
hospital systems

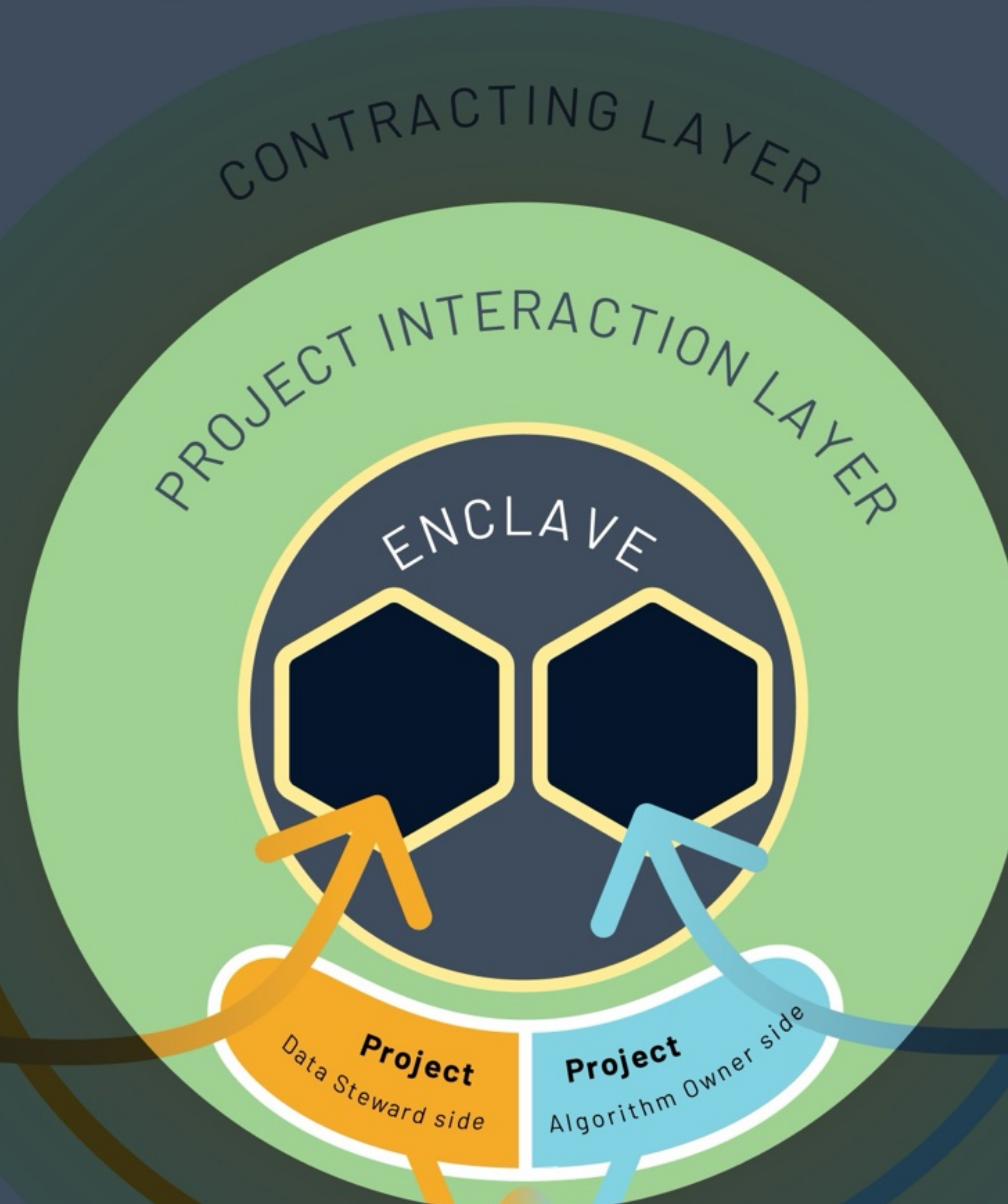
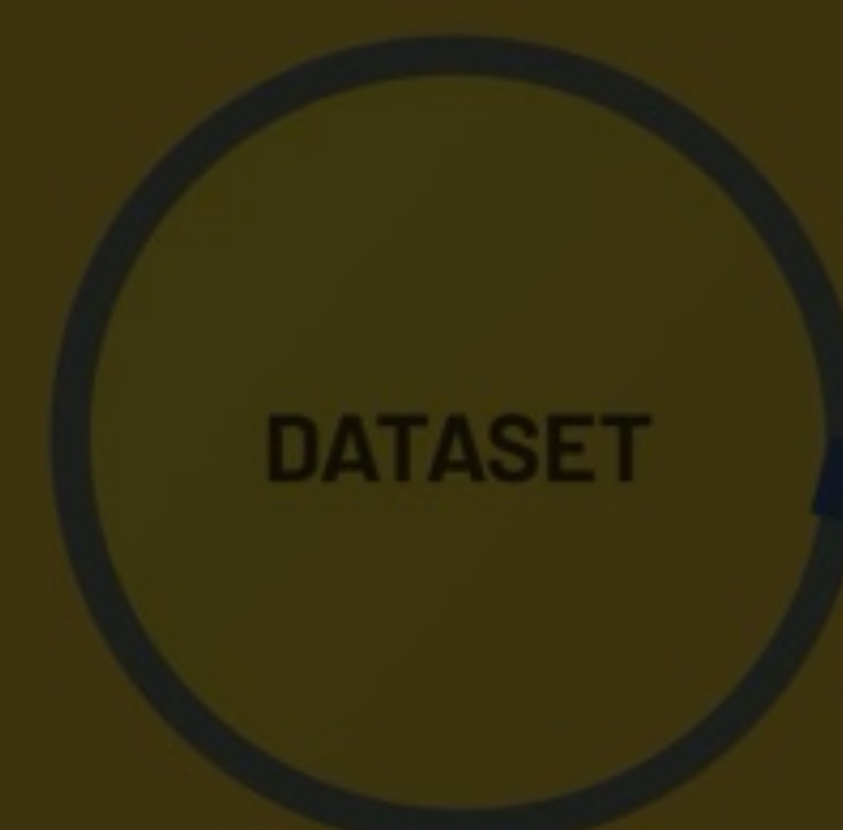
Own & process vast lakes
of patient data



**Algorithm
Owner**

AI development teams
from 3rd parties or AMC's

Develop algorithms for FDA
approval and future clinical
usage

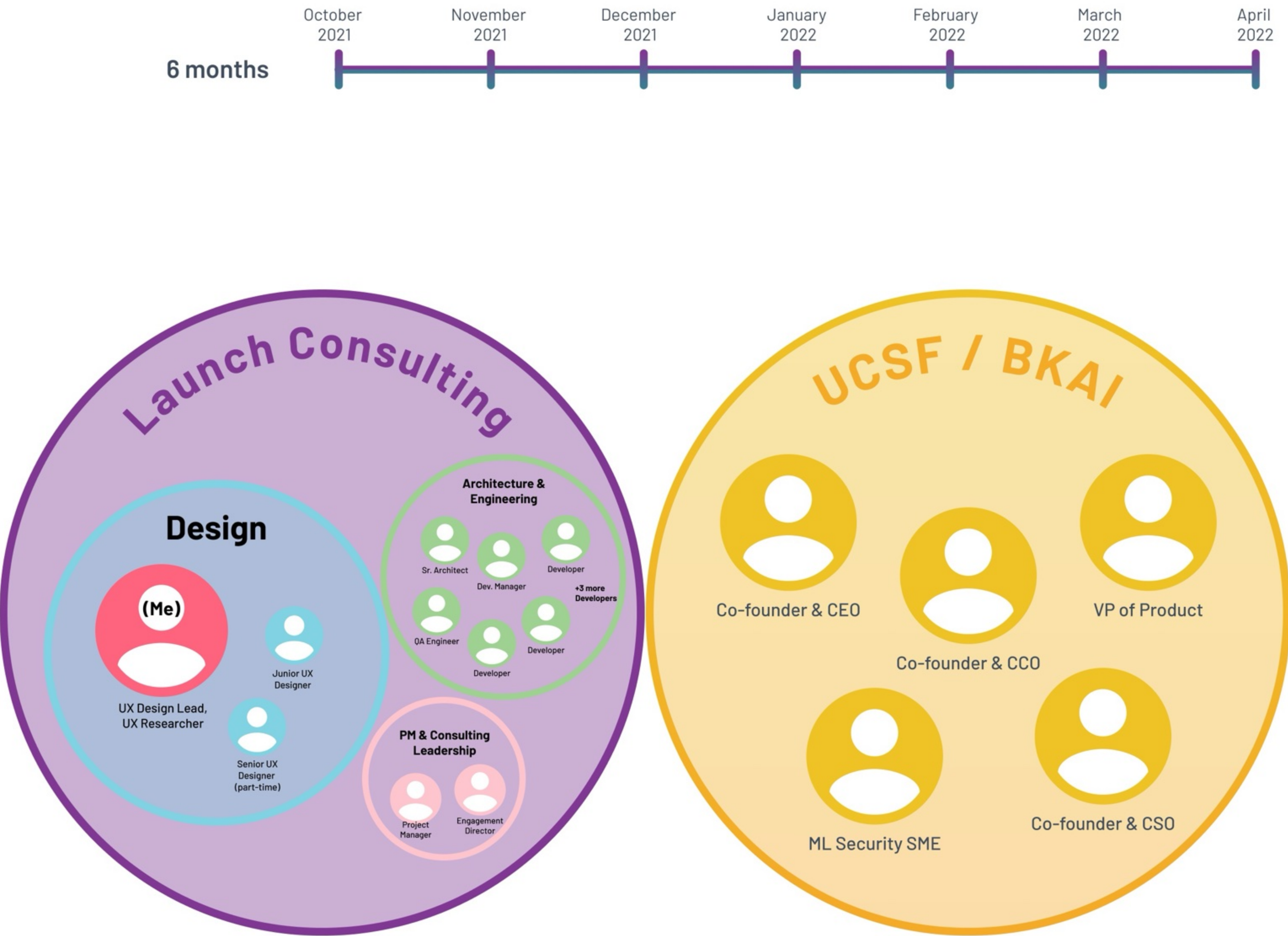


It's a
Match!

Engagement 2

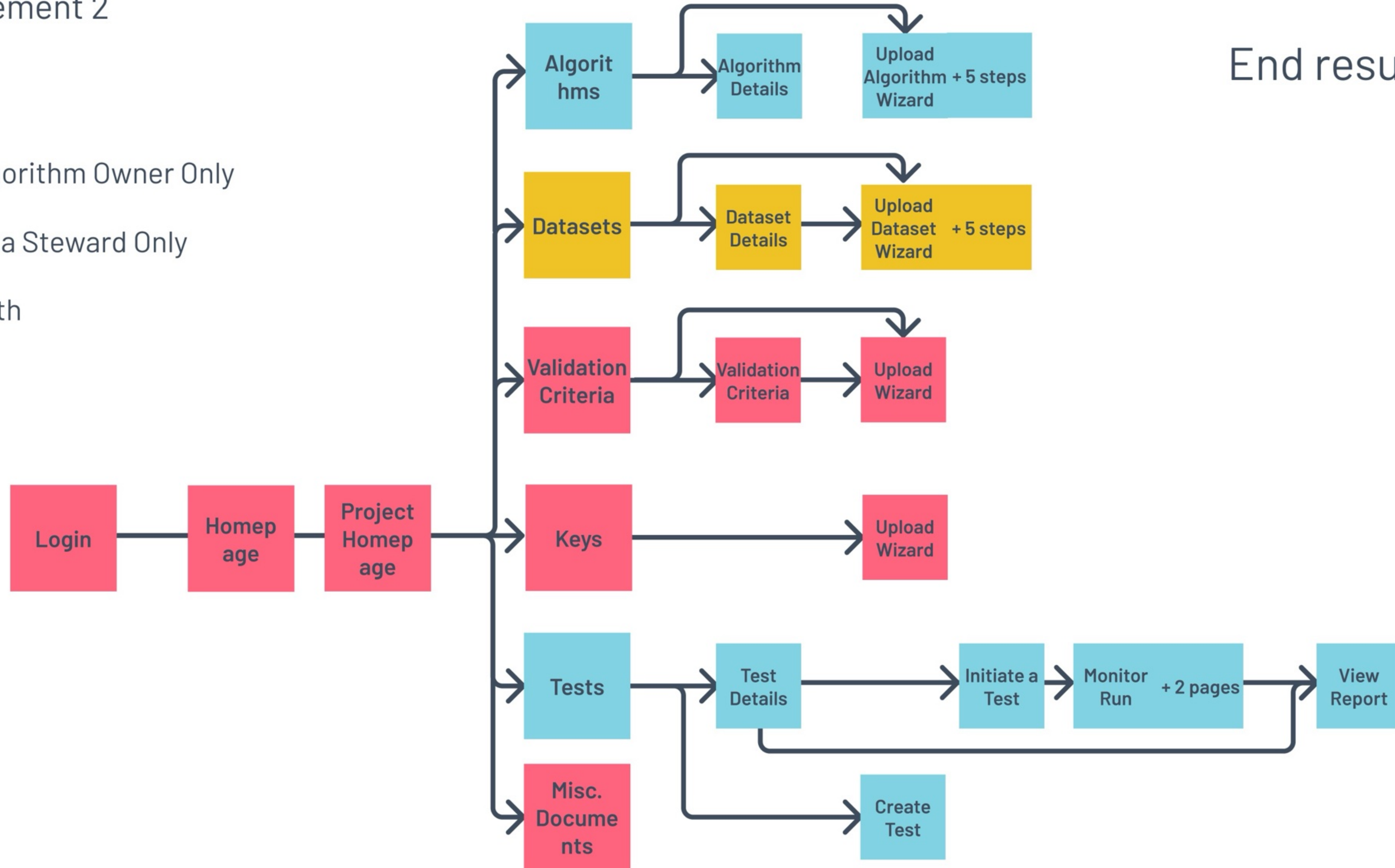
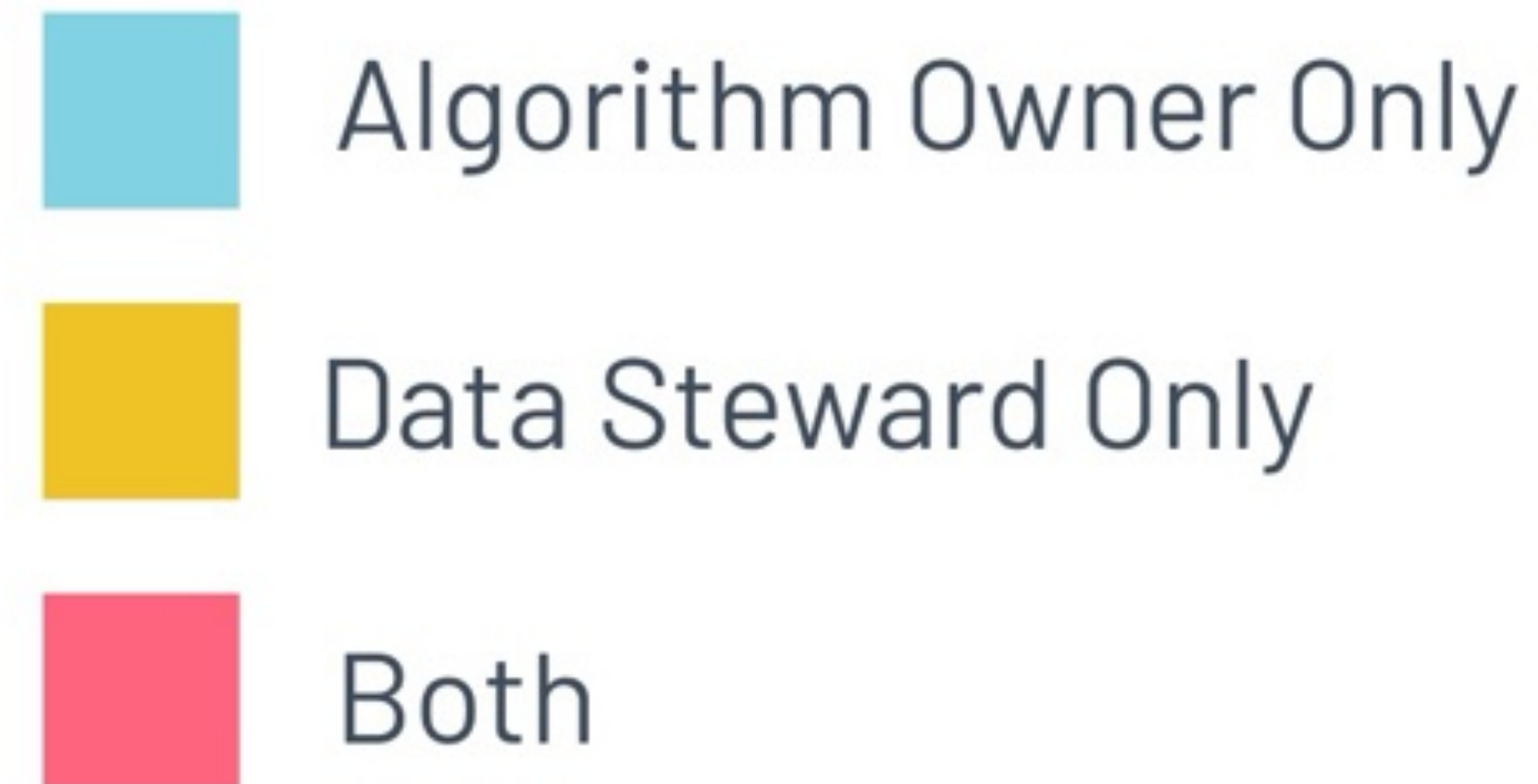
MVP

Build the EscrowAI
(excluding Matching) **MVP**
product so that 1st priority
pilot customer users can
perform their first
commercial runs



Engagement 2

MVP



End result

Engagement 2

MVP

End result

BeeKeeperAI

DATA STEWARD

Search...

3

LO

Home

Droid Project with Coruscant Data

1

Droid Project with Bespin Data

1 item awaiting review

A project to verify the droid classification algorithm.

Latest Update

New algo uploaded.

Droid Project with Bespin Data

A project to verify the droid classification algorithm.

Latest Update

New algo uploaded.

Droid Project with Republic Data

A project to verify the droid classification algorithm.

Latest Update

New algo uploaded.

Hyperdrive Diagnostics Project with Couscant Data

A project to verify the droid classification algorithm.

Latest Update

New algo uploaded.

Home

Droid Project with Coruscant Data

Overview

Droid Project

Active

A project to verify the droid classification algorithm.

Tests

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Test 01

Needs Approval

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Datasets

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Dataset 01

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Keys

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Key 01

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Default - Key Encryption Key

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Home

Droid Project with Coruscant Data

Droid Algorithm

Overview

Active

Droid Project

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.

All Versions

+ UPLOAD NEW VERSION

Droid Algo v4

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Version 4

Minor rev update to check integration progress

Droid Algo v3

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Version 3

Minor rev update to check integration progress

Droid Algo v2

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Version 2

Minor rev update to check integration progress

Home

Droid Project with Coruscant Data

Custom Validation

Overview

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Current Version

1

Schema (JSON):

{

f1: float

accuracy: float

}

2

3

4

5

6

7

8

f1: 0.99

accuracy: 0.99

9

10

11

12

13

14

15

16

Previous Versions

Version 3

Lorem ipsum over

Version 2

Lorem ipsum over

Version 1

Lorem ipsum over

Projects

Project Dyno

Test 01

Test 01

Test Overview

Active

Project Dyno

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Date Updated

03/14/2022 at 8:16:14UTC

Updated By

AS Astrid Stardust

Version

1.0

Active Algorithm

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod.

Algorithm C V4

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod.

Active

Project Dyno

Date Updated

03/14/2022 at 8:16:14UTC

Updated By

LO Leia Organa

Action Items

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Need approval for run 02

DUE BY: 03/14/2022 at 8:16:14UTC

Action Needed

Need approval for run 021

DUE BY: 03/14/2022 at 8:16:14UTC

Completed

Validation Criteria

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Validation Criteria 01

8:16:13 UTC on 03/02/2022

Version 1

Datasets

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Dataset 01

12:10:11 UTC on 03/01/2022

Version 3

Recent Activity

Sort By Update Date

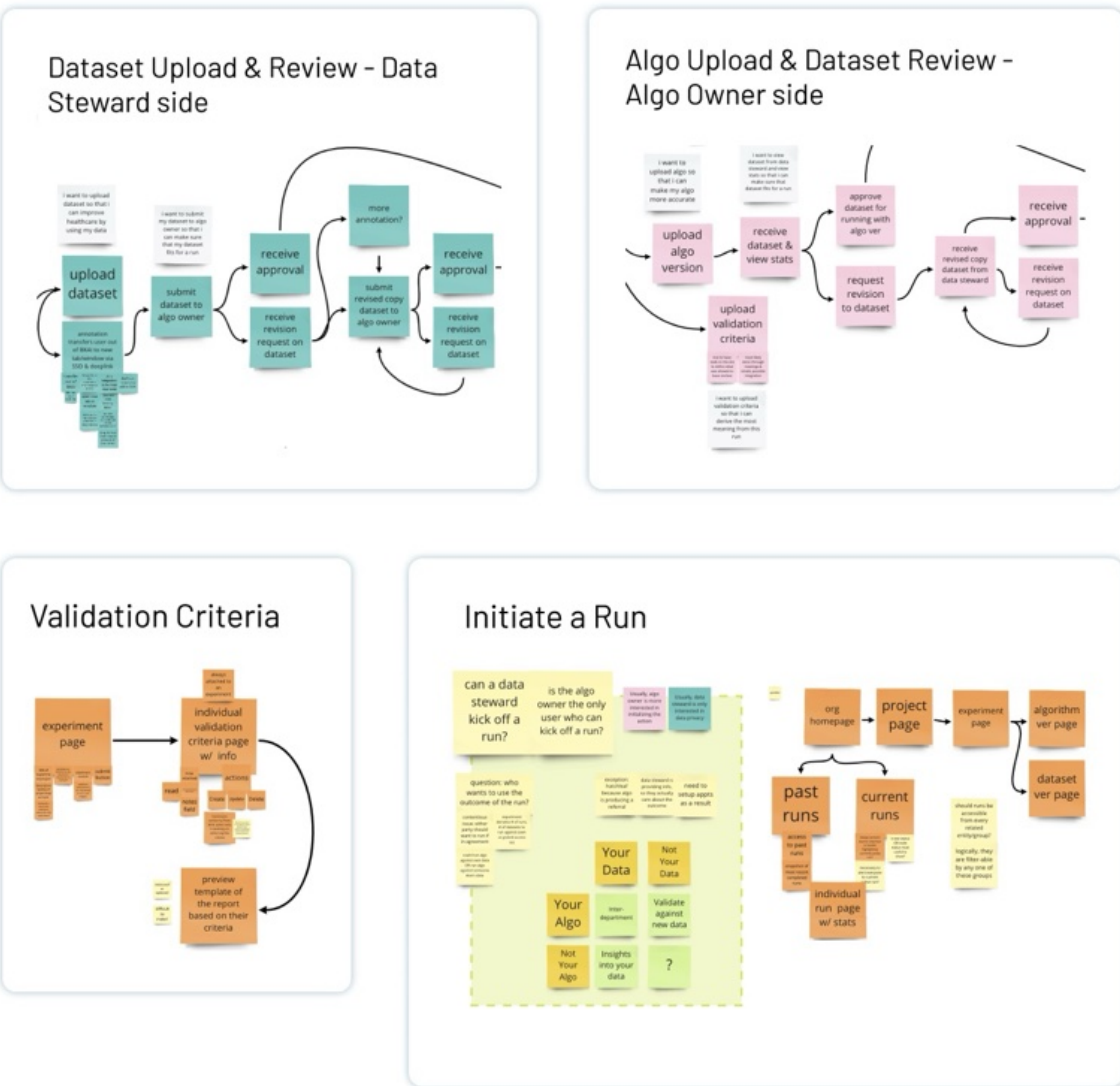
A run has completed on Algo B

2 min ago

View Report

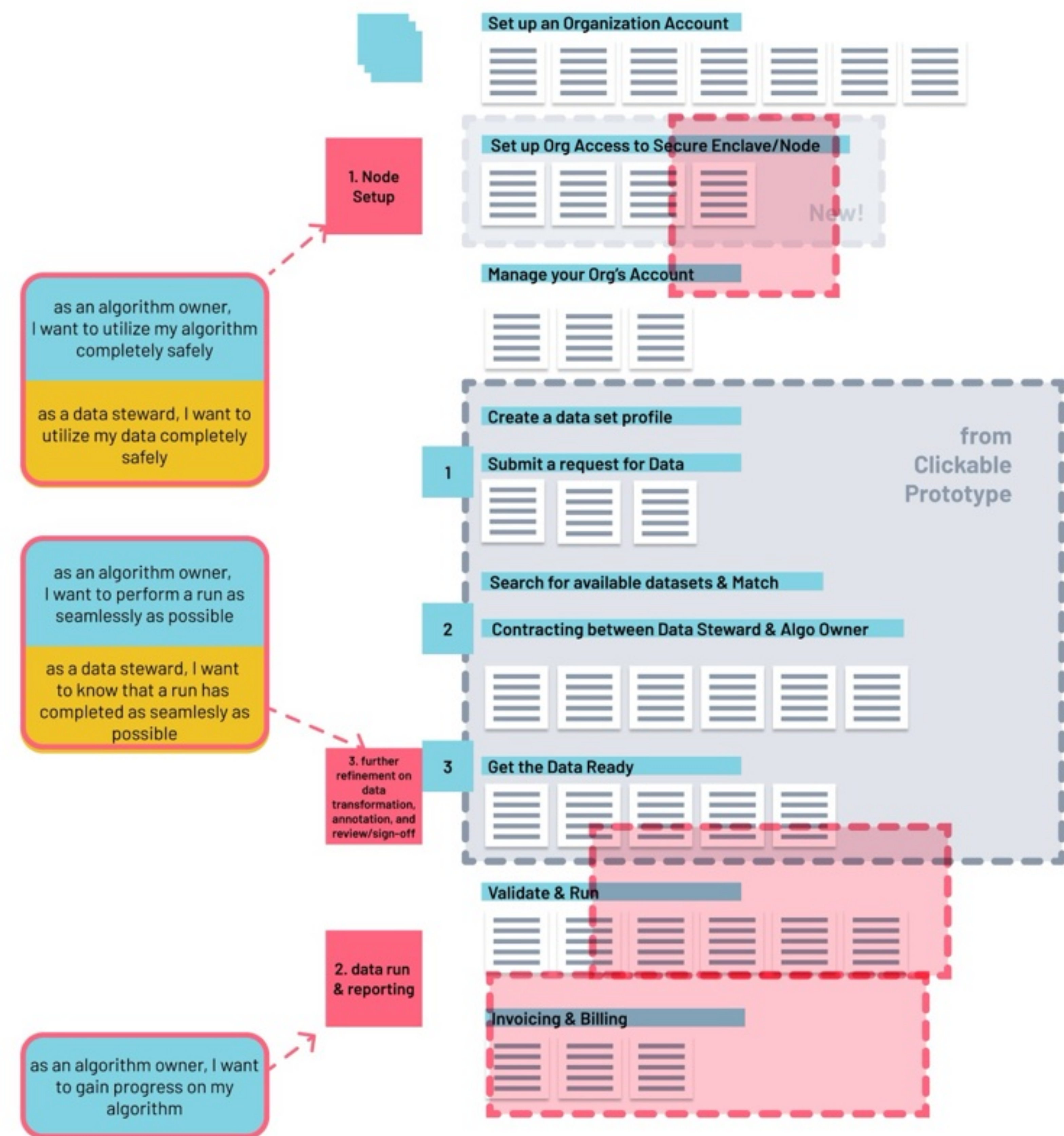
3. Workflow Mapping Features

I broke out portions of the key features into workflows and spent a lot of time with the architect & client Product Owners to fill in gaps in product knowledge.



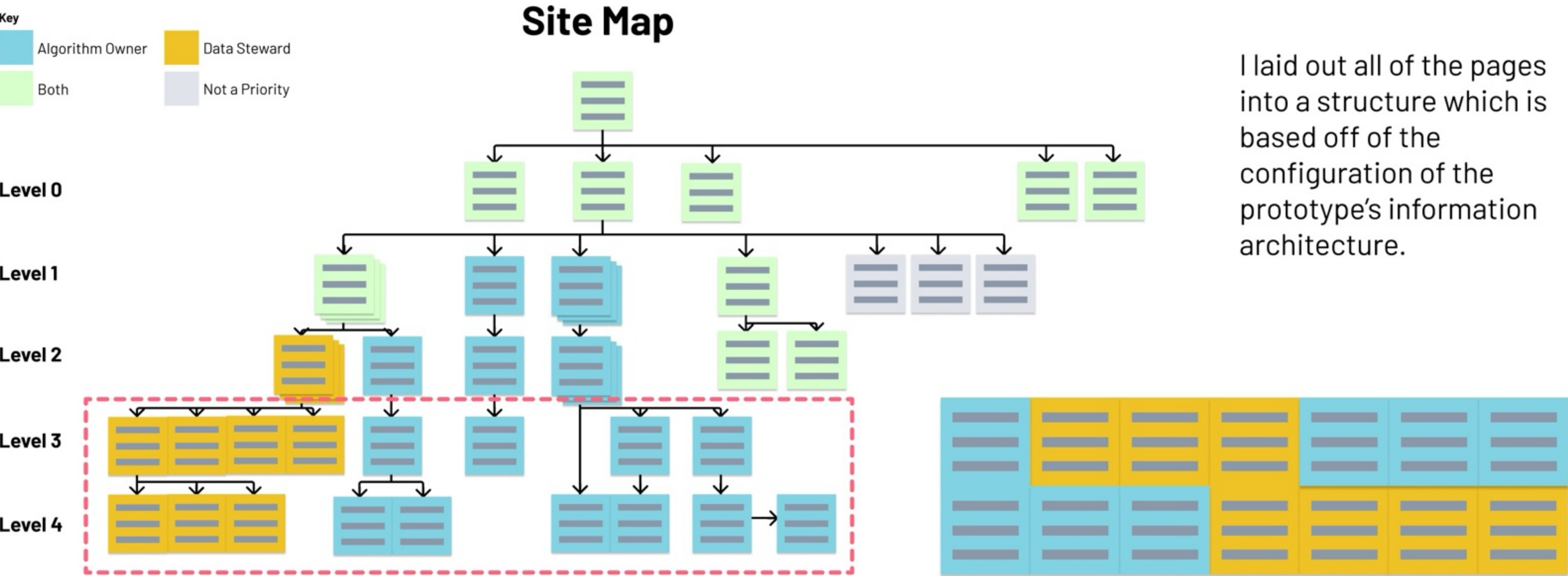
2. Confirm Key Features & Use Cases

Now that I had information on key clients and use cases, I needed the client's help to pin down the highest-priority feature groups.



4. Site Map & Workshop

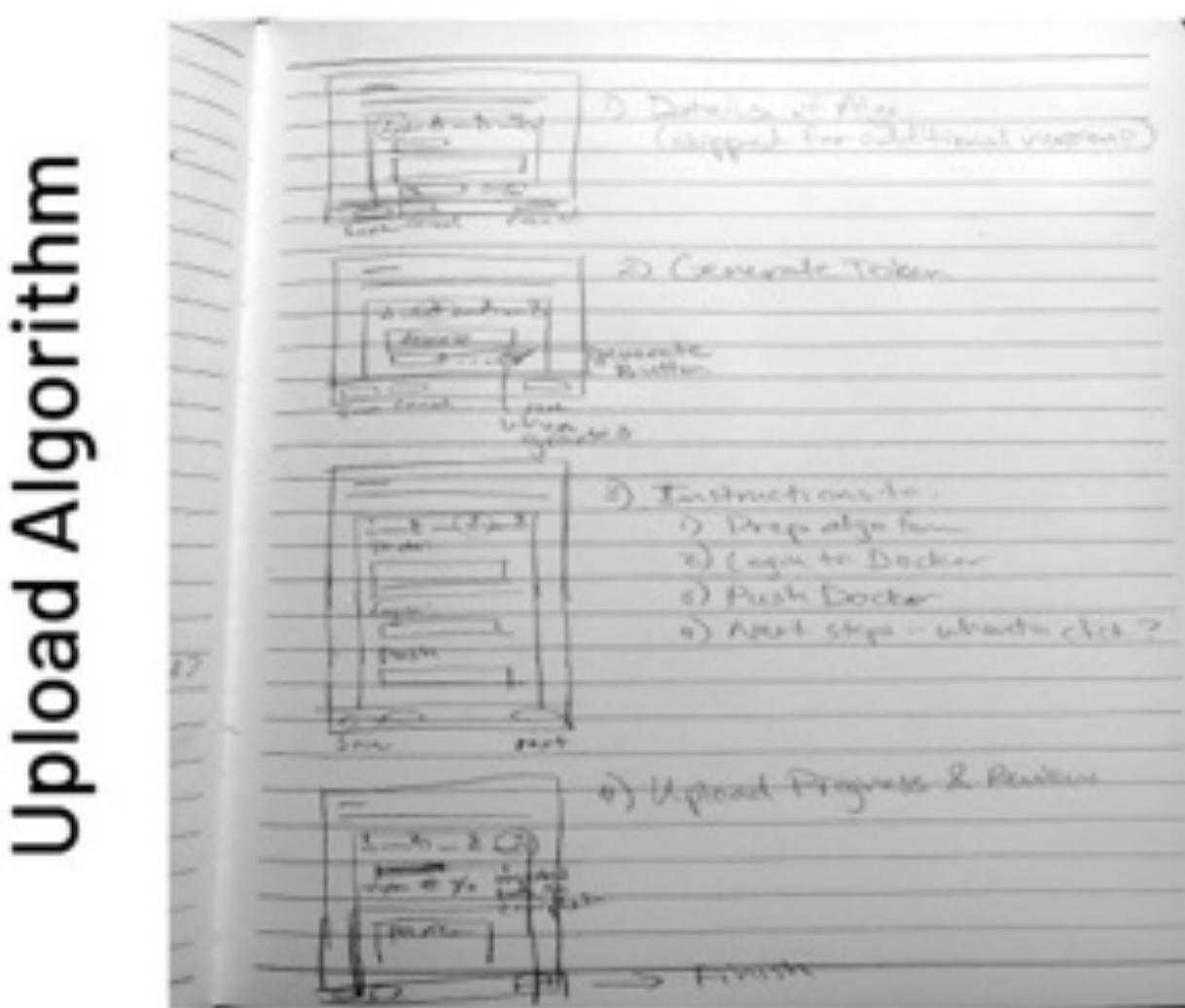
Now that all the steps have been unfurled, how do I figure out which specific ones I should concentrate on building out? Enter the **Site Map**.



5. Low-Fidelity Wireframes

I have a shortlist of steps, so now I know exactly what pages & processes I need to prototype.

Napkin Sketch



Low-Fidelity Wireframes + revision notes & questions

Algorithm Upload (by the Algorithm Owner)



Data Profile



Validation Criteria



Example Data Set



V2 Experiment -> Test -> Initiate Run – Lisa Ver



6. Usability Testing

I developed a usability test for each persona to test understanding of the prototype.

I compiled my findings so I knew what revisions to make to the wireframes.



Algorithm Owner (3)

Hierarchy & Main Page, Algorithm Upload, Initiate a Run

- Most users are data scientists and are not specialized in Azure/enclaves
- '% Missing Data' is an important data point when viewing stats about a dataset
- Agree that a project is defined as 1 data steward x 1 algorithm owner



Data Steward (3)

Dataset Upload/Viewing/Approval, Hierarchy & Main Page, Reporting

- Need differentiation between role permissions, ex. a technical IT person vs. summer intern
- Very wary about the algo owner seeing anything about their dataset
- Experimental project vs. production project have very different needs

Part 2.5

Engagement 2: MVP

Design

- Sitemap of Features

- Low Fidelity -> High Fidelity (x3 features) Designs

- Documentation/Handoff

- Conclusion

Engagement 2

MVP

Low-Fidelity

Homepage

BeeKeeperAi

3

JD

Homepage

Projects >

Contracts

Data Profiles

Algorithms

Example Datasets

Datasets

Experiments

Datasets

Reports

Help Center

Profile

Settings

Welcome!

AO

DS

Your Projects

Sort By Date Updated

Project Name

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

Latest Update

NEW Upload

Date Updated

HH:MM MM/DD/YYYY

Project Z

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

Latest Update

NEW Upload

Date Updated

HH:MM MM/DD/YYYY

Project Y

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Latest Update

NEW Upload

Date Updated

HH:MM MM/DD/YYYY

Project X

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Latest Update

NEW Upload

Date Updated

HH:MM MM/DD/YYYY

Project W

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

Latest Update

NEW Upload

Date Updated

HH:MM MM/DD/YYYY

Recent Runs

Sort By Update Date

Project Name

Lorem ipsum dolor sit amet, consectetur

2 min ago

First Last

Organization Name

View

>

Run 01 DD/MM/YYYY

Queued

Time Elapsed

HH:MM:SS

Run Initiated By

First Last

View

>

Run 01 DD/MM/YYYY

Queued

Time Elapsed

HH:MM:SS

View

>

View More

>

Page 1 of 1

View All

>

Project Page

BeeKeeperAi

3

JD

Algorithm Owner

Homepage

Projects >

Data sets

Algorithms

Experiments

Reports

Contracts

Invoices

Latest Runs

Profile

Settings

Projects > Project Name

Project Name

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Data Steward Partner

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Tests

1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

Test 01

Version 1

Lorem ipsum dolor sit amet, consectetur

Self Test 01

Version 1

Lorem ipsum dolor sit amet, consectetur

Add New

+

Algorithms

1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

Algorithm C

Version 4

Lorem ipsum dolor sit amet, consectetur

Date Updated

HH:MM MM/DD/YYYY

Updated By

First Last

Datasets

1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua.

Data set 1

Version 1

Lorem ipsum dolor sit amet, consectetur

Data set 2

Version 2

Lorem ipsum dolor sit amet, consectetur

Data set 3

Version 1

Lorem ipsum dolor sit amet, consectetur

Documents

1

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SOW [AO version]

[Link to Smartsheet]

Date Updated

HH:MM MM/DD/YYYY

Updated By

First Last

Project Plan

[Link to Smartsheet]

Date Updated

HH:MM MM/DD/YYYY

Updated By

First Last

Data Profiles

1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore

Data Specification 01

Version 1

HH:MM MM/DD/YYYY

Date Updated

HH:MM MM/DD/YYYY

Updated By

First Last

Population Description 01

Version 1

HH:MM MM/DD/YYYY

Date Updated

HH:MM MM/DD/YYYY

Updated By

First Last

Validation Criteria

1

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore

Validation Criteria 01 (pdf)

Version 1

49

Engagement 2

MVP

Mid/High-Fidelity

Homepage

BeeKeeperAI

| DATA STEWARD

Search...

3

LO

Welcome, Leia!

Your Projects

DATA STEWARD

ALGORITHM OWNER

1

Droid Project with Bespin Data

1 item awaiting approval

Droid Project

In Progress

A project to verify the droid classification algorithm.

Latest Update

New algo uploaded.

Date Updated

03/14/2022 at 8:16:14UTC

Droid Project with Bespin Data

A project to verify the droid classification algorithm.

Latest Update

New algo uploaded.

Date Updated

03/14/2022 at 8:16:14UTC

Droid Project with Republic Data

A project to verify the droid classification algorithm.

Latest Update

New algo uploaded.

Date Updated

03/14/2022 at 8:16:14UTC

Hyperdrive Diagnostics Project with Couscant Data

A project to verify the droid classification algorithm.

Latest Update

New algo uploaded.

Date Updated

03/14/2022 at 8:16:14UTC

Project Page

BeeKeeperAI

| ALGO OWNER

Search...

3

LO

Home > Droid Project with Coruscant Data

Droid Project with Coruscant Data

Overview

Droid Project

Active

A project to verify the droid classification algorithm.

Tests

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Test 01

Needs Approval

Version 1

Updated By

LO Leia Organa

Documents

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

SOW

Version 3

Date Updated

03/14/2022 at 8:16:14UTC

Updated By

PA Padme Amidala

Datasets

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Dataset 01

Version 1

Updated By

LO Leia Organa

Data Profiles

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Data Profile 101

Date Updated

03/14/2022 at 8:16:14UTC

Updated By

PA Padme Amidala

Data Profile 101

Date Updated

03/14/2022 at 8:16:14UTC

Updated By

LO Leia Organa

Validation Criteria

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Data Profile 101

Date Updated

03/14/2022 at 8:16:14UTC

Updated By

LO Leia Organa

Keys

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Key 01

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Default - Key Encryption Key

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50

Low-Fidelity

Algorithm Upload



Engagement 2

MVP

Low-Fidelity

Algorithm Upload



Engagement 2

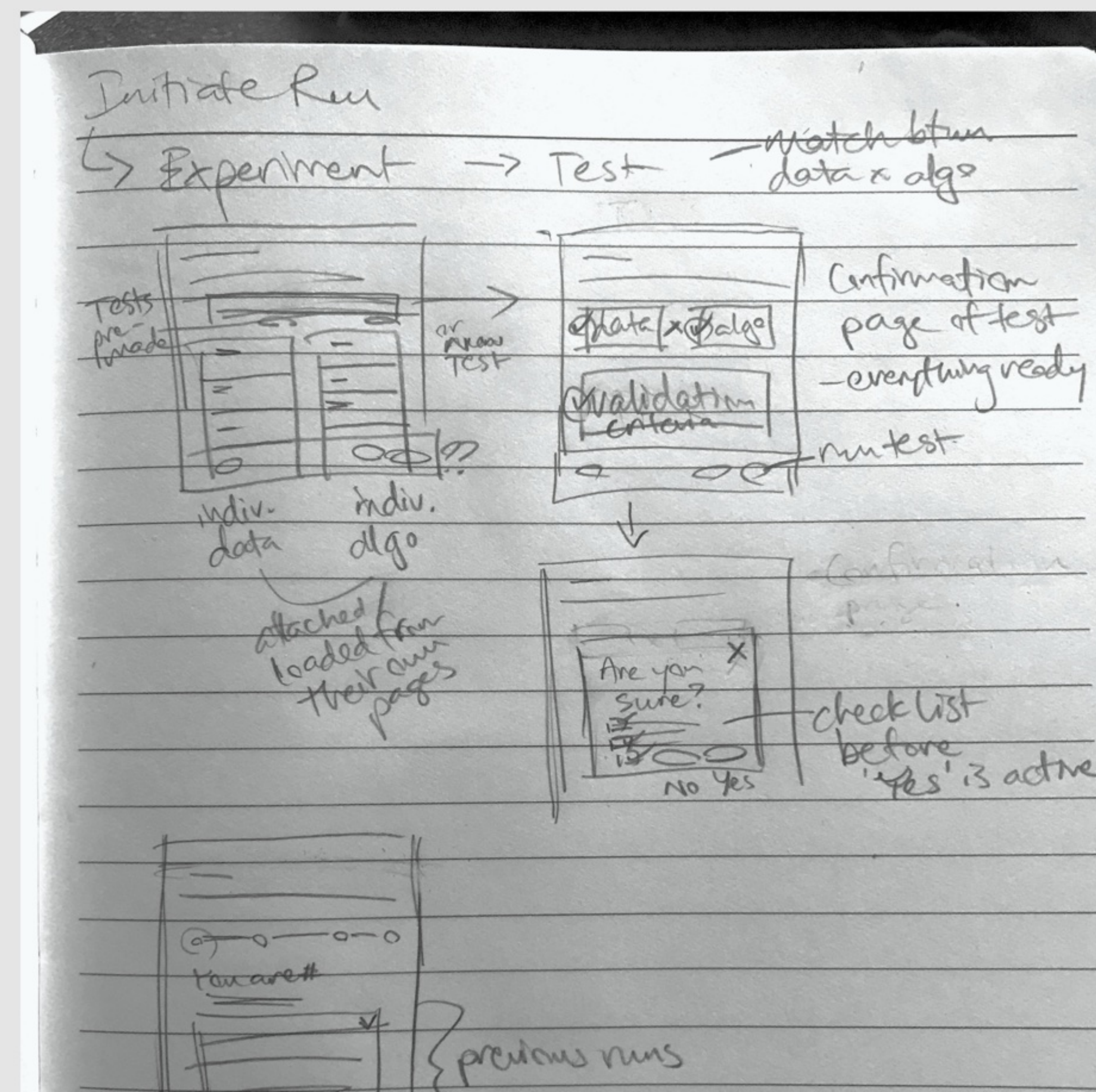
MVP

Low-Fidelity

Create a Test



Initiate a Run



Create a Test

BeeKeeperAi

3JD

Homepage

Projects >
Data sets
Reports
Contracts
Invoices

Latest Runs

Profile

Settings

Projects > Project Name > Tests > Test 01 > Initiate Run

Create a Test

1Metadata2Import Entities

Import Entities

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Select Validation Criteria

Search

Sort By Update Date

Name	Version	Last Updated
☒ Custom Validation Criteria 01	1	HH:MM MM/DD/YYYY

Select Algorithm

Search

Sort By Update Date

Name	Version	Last Updated
☒ Algorithm C	4	HH:MM MM/DD/YYYY
☐ Algorithm C	3	HH:MM MM/DD/YYYY
☐ Algorithm C	2	HH:MM MM/DD/YYYY
☐ Algorithm C	1	HH:MM MM/DD/YYYY

Initiate a Run

BeeKeeperAi

3JD

Homepage

Projects >
Data sets
Reports
Contracts
Invoices

Latest Runs

Profile

Settings

Projects > Project Name > Tests > Test 01 > Run 03 DD/MM/YYYY

Run 03 DD/MM/YYYY

Notification
Run 01 DD/MM/YYYY of algo A has Completed!
2 min ago
View Report >Completed

Run Overview

Re-Run

Total Time Elapsed
HH:MM:SS

Run Time Elapsed
HH:MM:SS

Run Ended
HH:MM:SS MM/DD/YYYY

Run Initiated By

First Last
Organization Name

Actions

1. Run Initiated - HH:MM:SS

2. Run Started - HH:MM:SS

3. Run Finished - HH:MM:SS

Run Ended at HH:MM:SS MM/DD/YYYY
Elapsed Time: HH:MM:SS
of records run: ###
Total File Size Processed: XXX GB
☒ Run Successful
0 Errors encountered

View Report

Download

55

Engagement 2

MVP

Test Page - Low-Fidelity

BeeKeeperAi

3JD

Homepage

Projects >

Data sets

Reports

Contracts

Invoices

Latest Runs

Profile

Settings

Projects > Project Name > Tests > Test 01

Notification

A run of algo A has completed.

2 min ago

View Report >

Test 01

Test Overview

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex ea commodo consequat.

Version

1

Date Updated

MM/DD/YYYY ###.##

Updated By

First Last

Organization Name

Validation Criteria

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore

Validation Criteria 1

Version 1

HH:MM MM/DD/YYYY

Datasets

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Data set 1

Version 3

HH:MM MM/DD/YYYY

Algorithms

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Algorithm C / Version 4

Version 4

HH:MM MM/DD/YYYY

Messages

Sort By Update Date

Notification

A run of algo A has completed.

2 min ago

Test Page - High Fidelity

BeeKeeperAI | ALGO OWNER

3LO

Projects > Project Dyno > Test 01

Run 01 has just concluded.

2 min ago

View Report →

Test 01

Test Overview

ActiveProject Dyno

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex lorem.

Date Updated

03/14/2022 at 8:16:14UTC

Updated By

AS

Astrid Stardust

Version

1.0

Active Algorithm

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod.

Algorithm C V4

ActiveProject Dyno

Lorem ipsum dolor sit amet, consectetur adipiscing elit, sed do eiusmod.

Date Updated

03/14/2022 at 8:16:14UTC

Updated By

LO

Leia Organa

Action Items

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Need approval for run 02

Action Needed

DUE BY: 03/14/2022 at 8:16:14UTC

Need approval for run 021

Completed

DUE BY: 03/14/2022 at 8:16:14UTC

Validation Criteria

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Validation Criteria 01

Version 1

8:16:13 UTC on 03/02/2022

Datasets

Lorem ipsum dolor sit amet, consectetur adipiscing elit.

Dataset 01

Version 3

12:10:11 UTC on 03/01/2022

Recent Activity

Sort By Update Date

A run has completed on Algo B

2 min ago

View Report →

56

7. Research Design Kits

I mapped out the specific UI elements needed and noticed that BKAI had no need for custom UI elements. To save time, we should use an **existing UI kit**.

Standard	UI Kit #1	UI Kit #2	UI Kit #3
Size of User Base	████████	████████	████████
Has quality developer documentation?	████████	████████	████████
License Price	████████	████████	████████

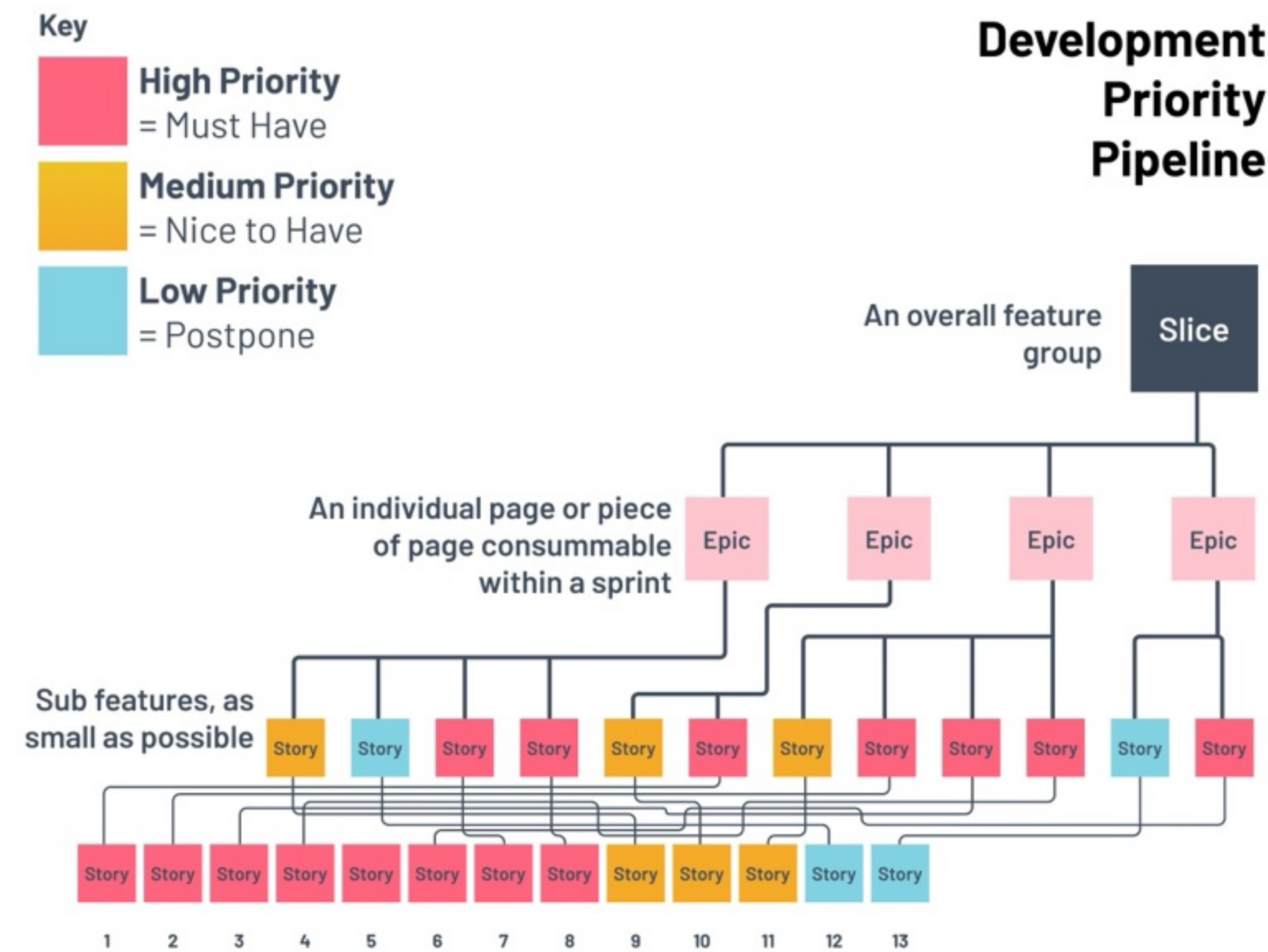
I assigned my junior designer to research which existing UI kit we could use based on these **standards**:

Collectively, we decided on MUI.

8. Slice Model for Jira

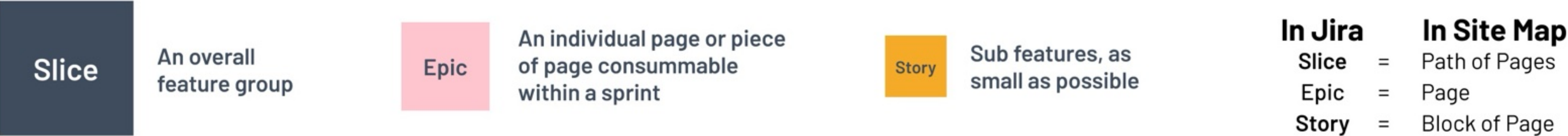
I developed this framework (alongside the development manager & the PM) and presented it to the whole BKAI team to help the client Product Owners **prioritize different-sized pieces of functionality**.

This marks the point where we begin UI development, and so we begin filling up the Jira backlog.



9. Sliced Site Map Workshops

I led **10+ requirements refinement workshops** with developers & client Product Owners in order to pin down exact priorities, feature dependencies, and important details.



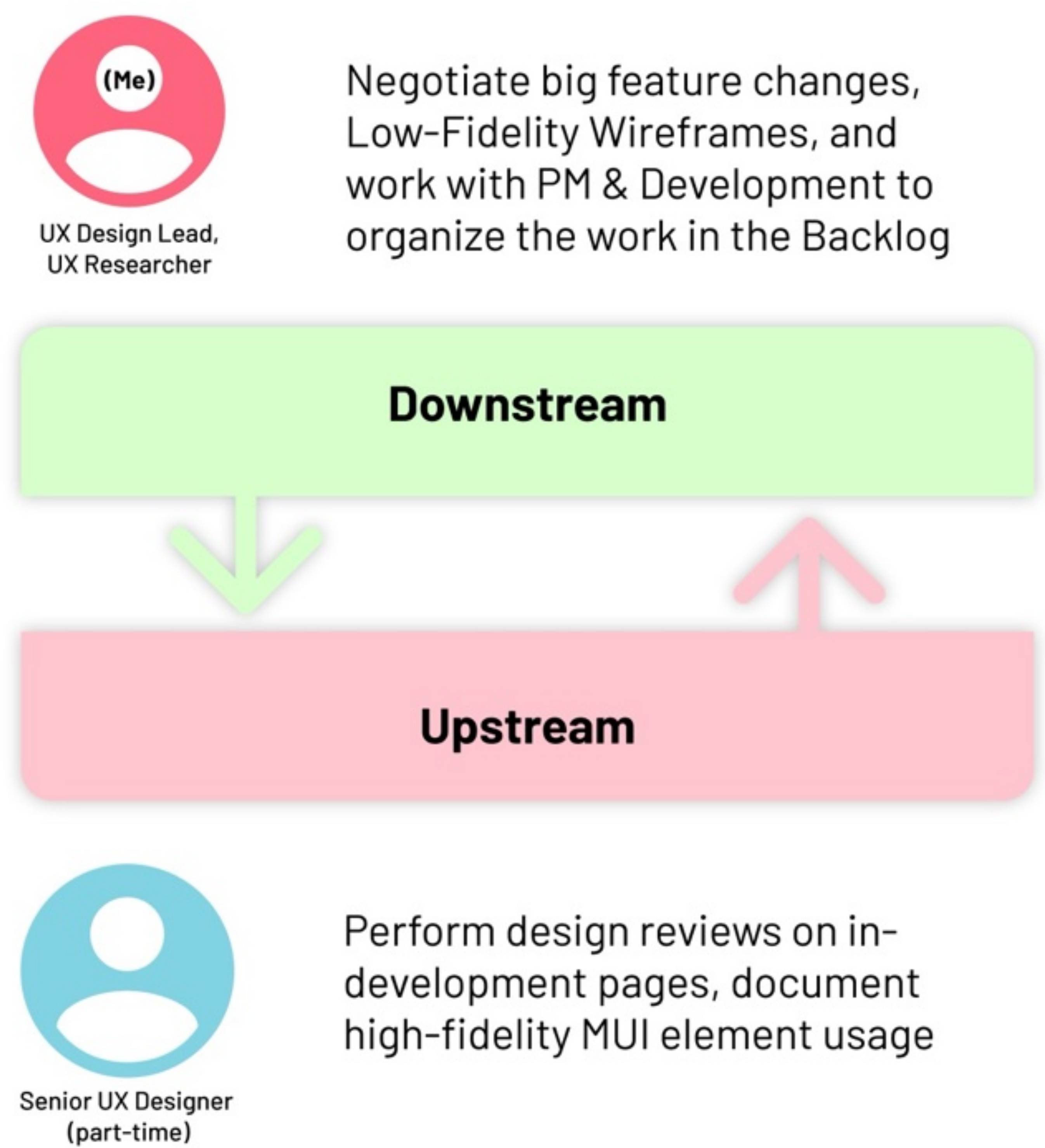
11. Knowledge Transfer

As a core member of the project team, I took responsibility of documenting & transferring all of my **product knowledge**.



10. Divide UX Efforts

In the face of frequent dialogue & reprioritization during development, I implemented a **downstream-upstream approach** for subsequent UX work:



12. Beyond MVP

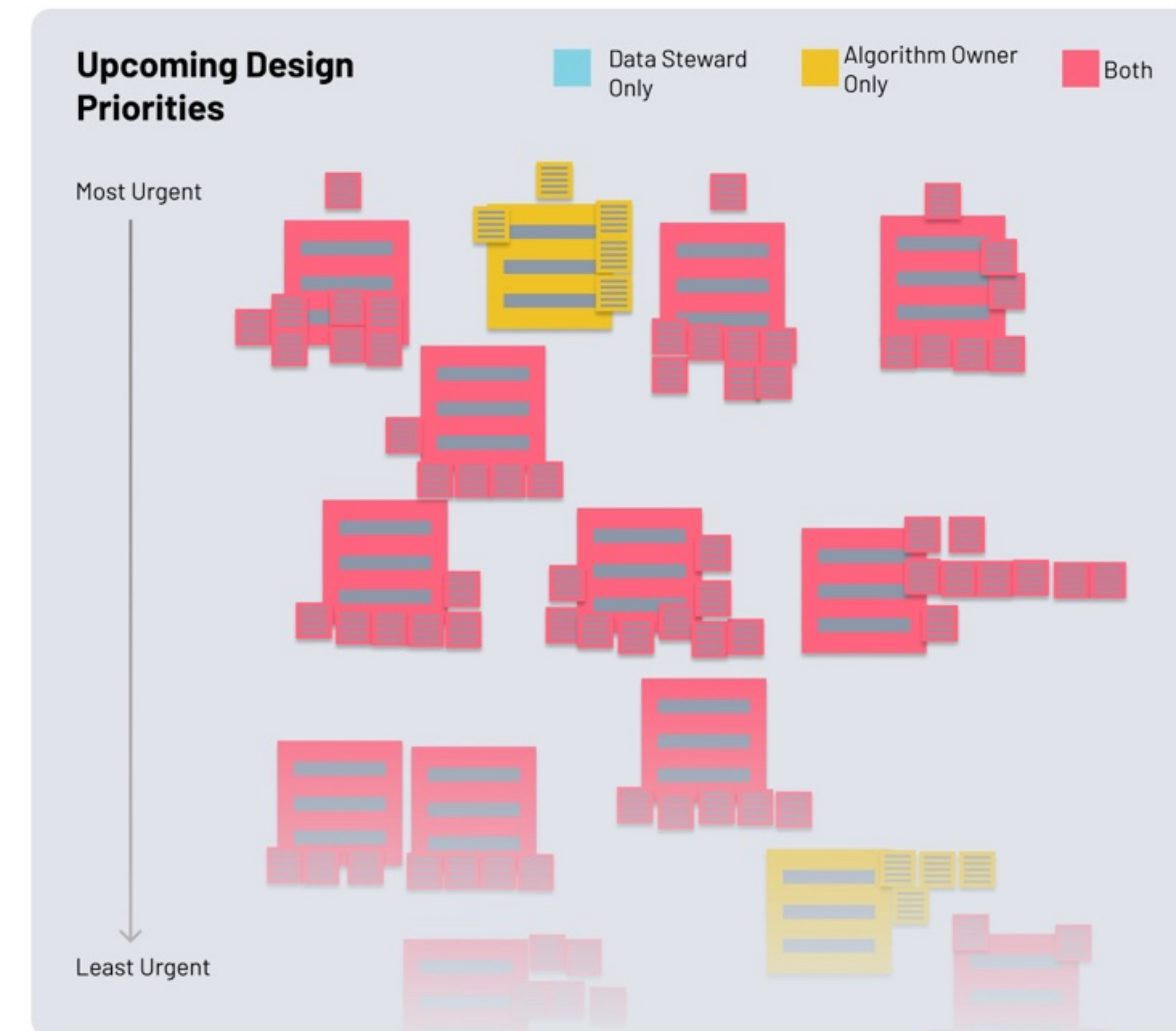
We've finished the major design initiatives necessary to launch the MVP – now what?

I gathered all the initiatives that were discussed but ultimately deprioritized for MVP. These included such efforts as:

- Solution-wide notifications
- Context-switching from a user's Data Steward view to their Algorithm Owner view & vice versa
- the BKAI Admin experience
- (and much more)

I consider these the next major design initiatives for V2.

I submitted this mapping to core project & client leadership to consider as the next set of features for design work for the next engagement.



The MVP is live!

BeekeeperAI lives through its deepest and most important features & is currently listed on Azure Marketplace.

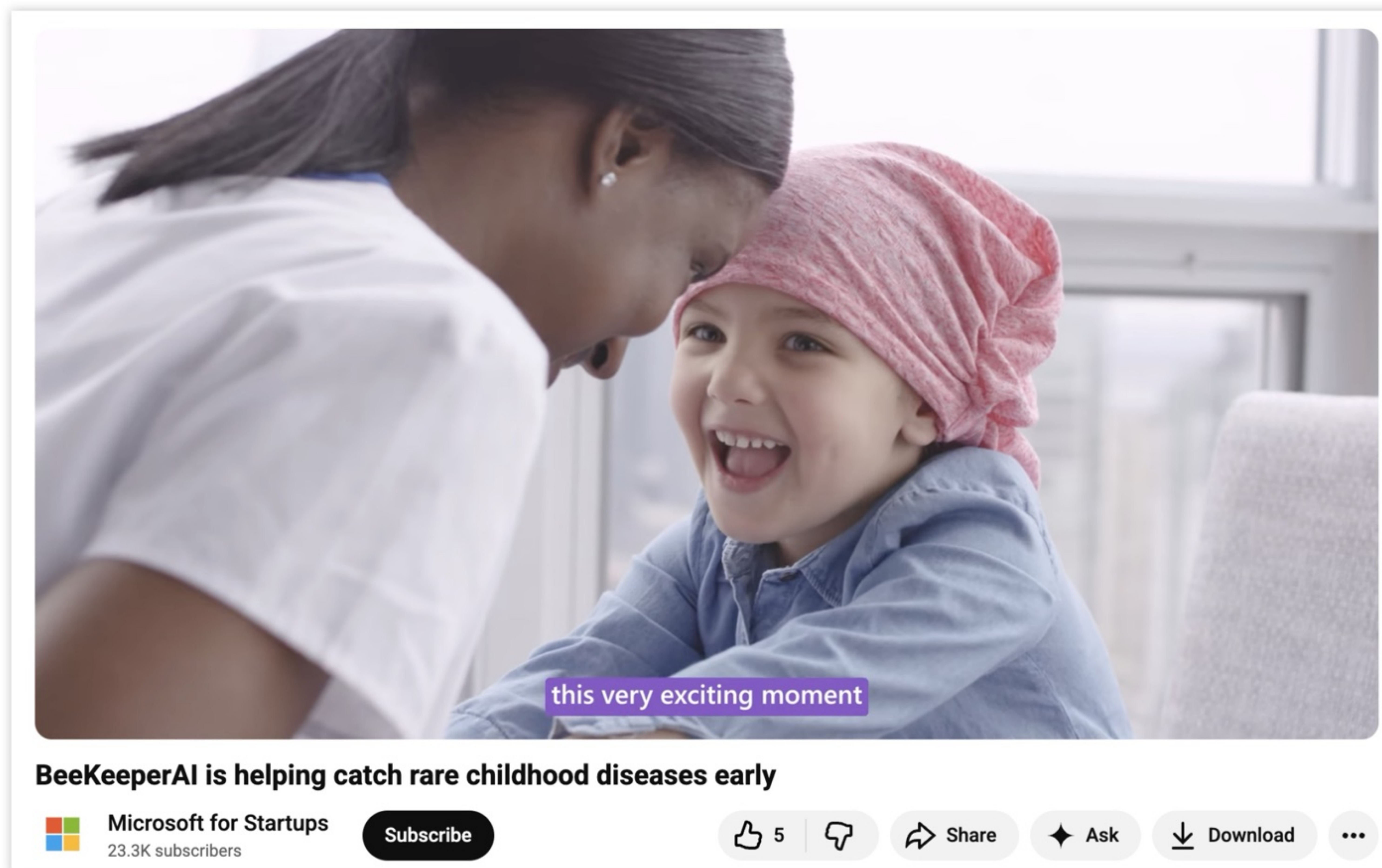
Conclusion

Engagement 2

MVP

As of April 2022, MVP “EscrowAI” is Live! Try it on Azure Marketplace [here](#)

Latest publicity video [here](#)



Part 2.6

Impact

MVP is Live

High Visibility

Reduced Time/Money/Mistrust

What I Learned



Time

It takes approximately ~~3 years*~~ for a single clinical algorithm achieve generalizability.

12-24 months



Money

In the same vein, it costs an average ~~\$5 million*~~ per algorithm.

\$2.5-4M



Trust

Most significant is the ~~mistrust between data owners and algorithm developers.~~

**Zero Trust!
(and future marketplace)**

*in the United States. In other countries, clinical algorithm development is often even more difficult.

The case of Doctor D & Algorithm A –



Doctor D

+

=



Algorithm A

More Accurate Diagnoses

For such conditions as:

- Breast Cancer
- Diabetic Retinopathy
- COVID (via chest X-Rays)

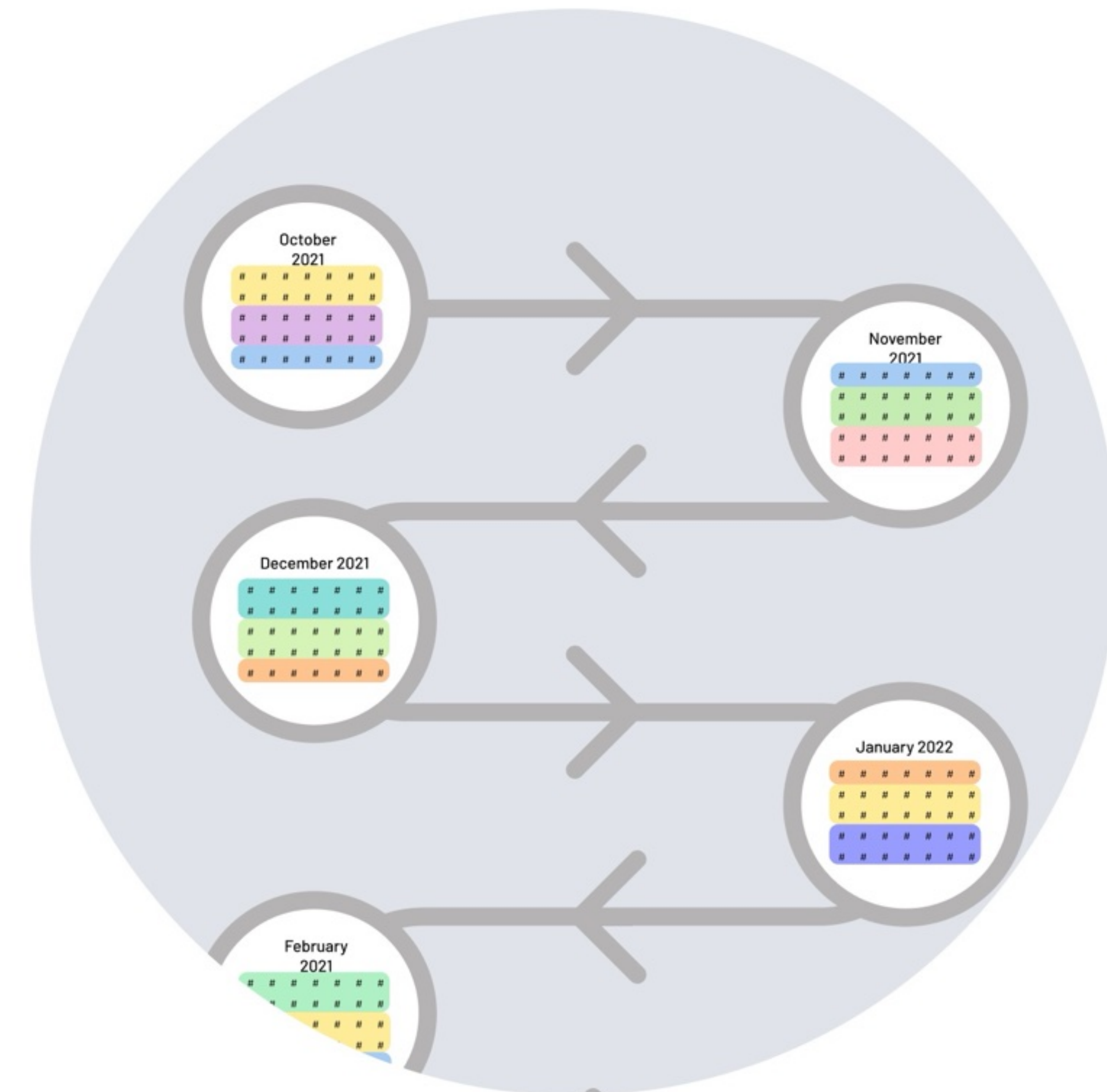
What did I Learn?

Take initiative! Have a specific roadmap & vision just for Design.

Design thinking is best applied sooner rather than later.

As lead designer, I don't have time to wait to take action until a product roadmap finally materializes. Instead, I build my own roadmap and form my own vision on the design side.

As I gather more information and progress in my journey, the entire product formation accelerates because I've pioneered a way forward. Everybody wins!

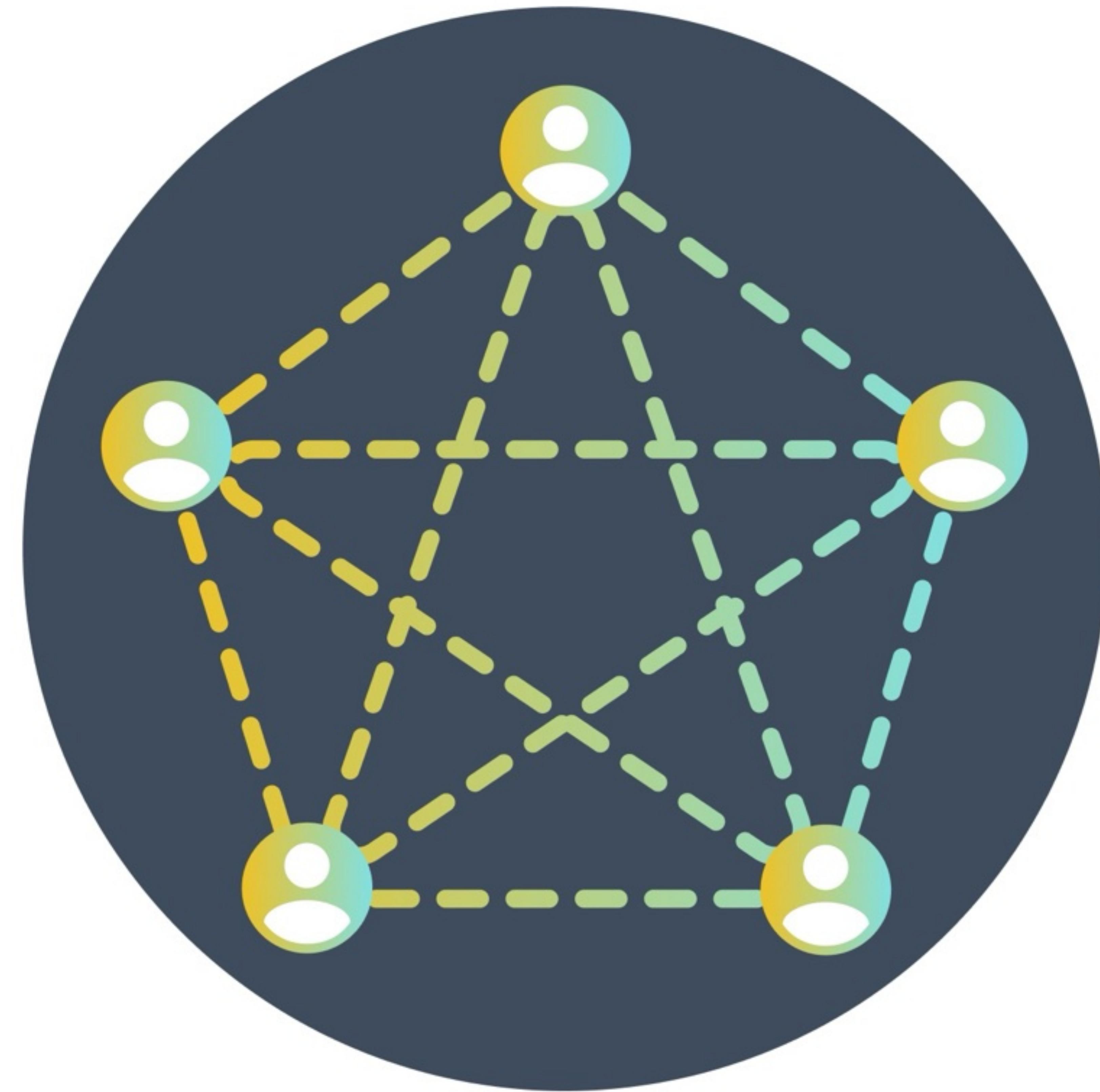


What did I Learn?

Your team members
are your best
resources.

My teammates and I create product magic between us because we both challenge & support each other by utilizing our complimentary skill sets.

There's amazing comfort in knowing exactly who to call when I'm stuck because I know that person is willing to whatever it takes to get me what I need.



What did I Learn?

Don't stop searching
for the truth.

I've learned that if I don't understand something, it usually means other people don't understand either. I will (nicely) ask until I arrive at a satisfactory level of detail or I know precisely who/where to target next.

The product will suffer if team members lack the clarity to do their jobs properly. It's always, always worth the extra time & resources to ask questions even if it means feeling a bit silly in the moment.



End

For more projects, check out
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