

Visualising Pathogen Spread with LiveView

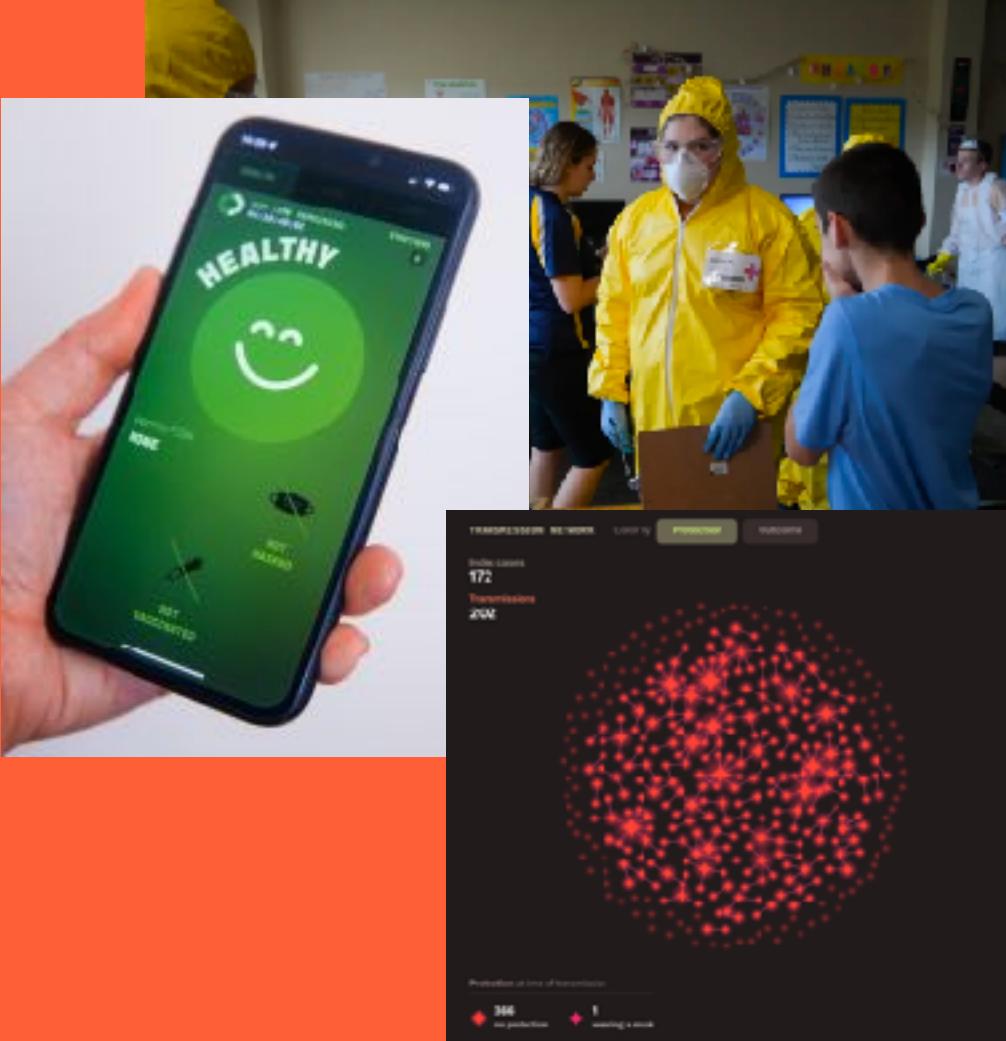
Kyle Oba | Fathom Information Design



A group photo of the Farbman office on the patio

operation outbreak

<https://operationoutbreak.org>



A collage of Operation Outbreak images, including a mobile app screen, students in full protective gear, and an infection network visualization



HEALTH

SCAN

INFO



SIM TIME REMAINING
01:22:33

HEALTHY

SYMPTOMS

0

PROTECTION
PARTIAL

TIME LEFT TO EAT
05:30



VACCINATED



NOT
MASKED

HEALTH

SCAN

INFO



SIM TIME REMAINING
01:22:33

VERY
SICK



SYMPTOMS

14

PROTECTION
PARTIAL

TIME LEFT TO EAT
05:30



MASKED



NOT
VACCINATED

HEALTH

SCAN

INFO



SIM TIME REMAINING
01:22:33

SICK



PROTECTION
NONE

TIME LEFT TO EAT
05:30



NOT
VACCINATED



NOT
MASKED

[a strained, but
simple analogy]



A video of spinner dolphins

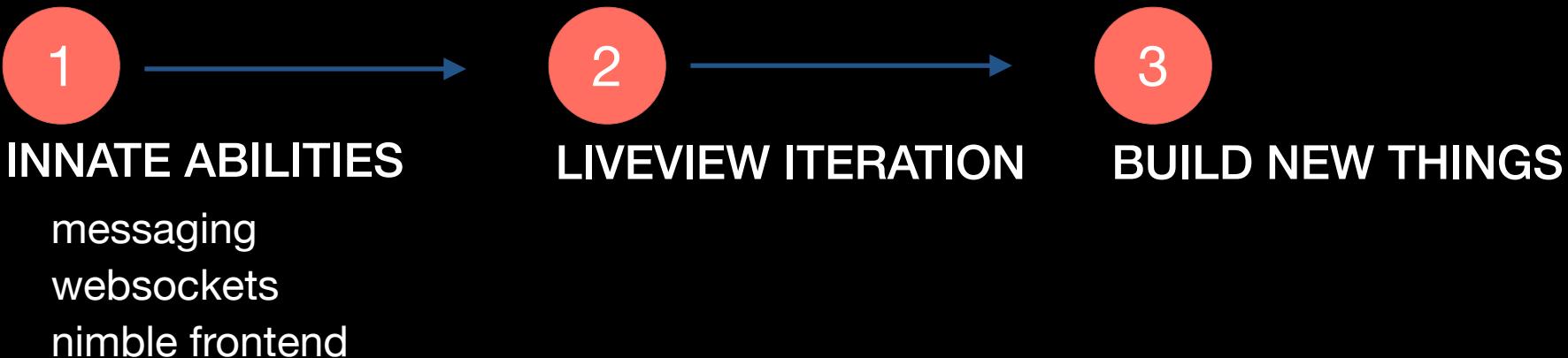
Freediving

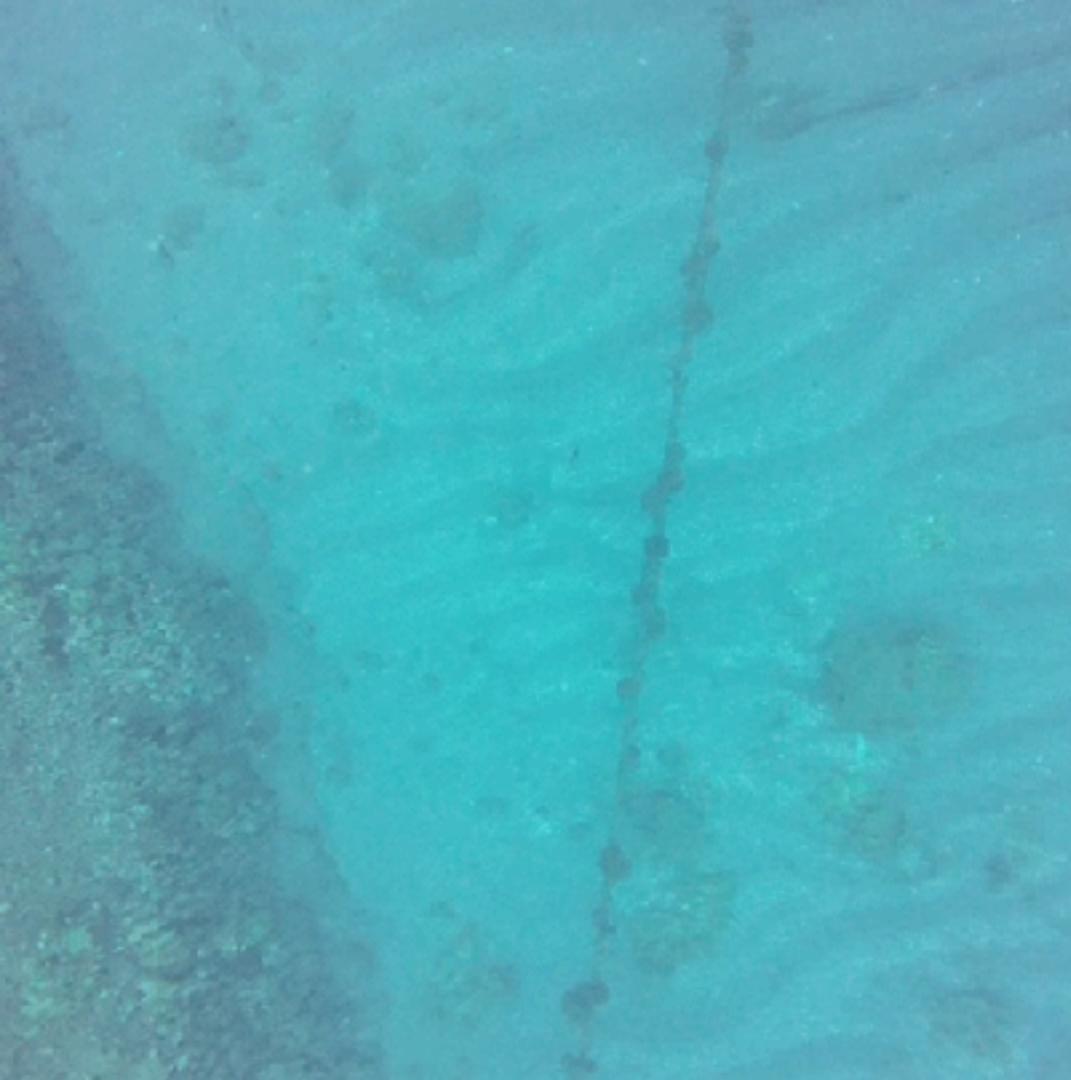


Freediving



Phoenix

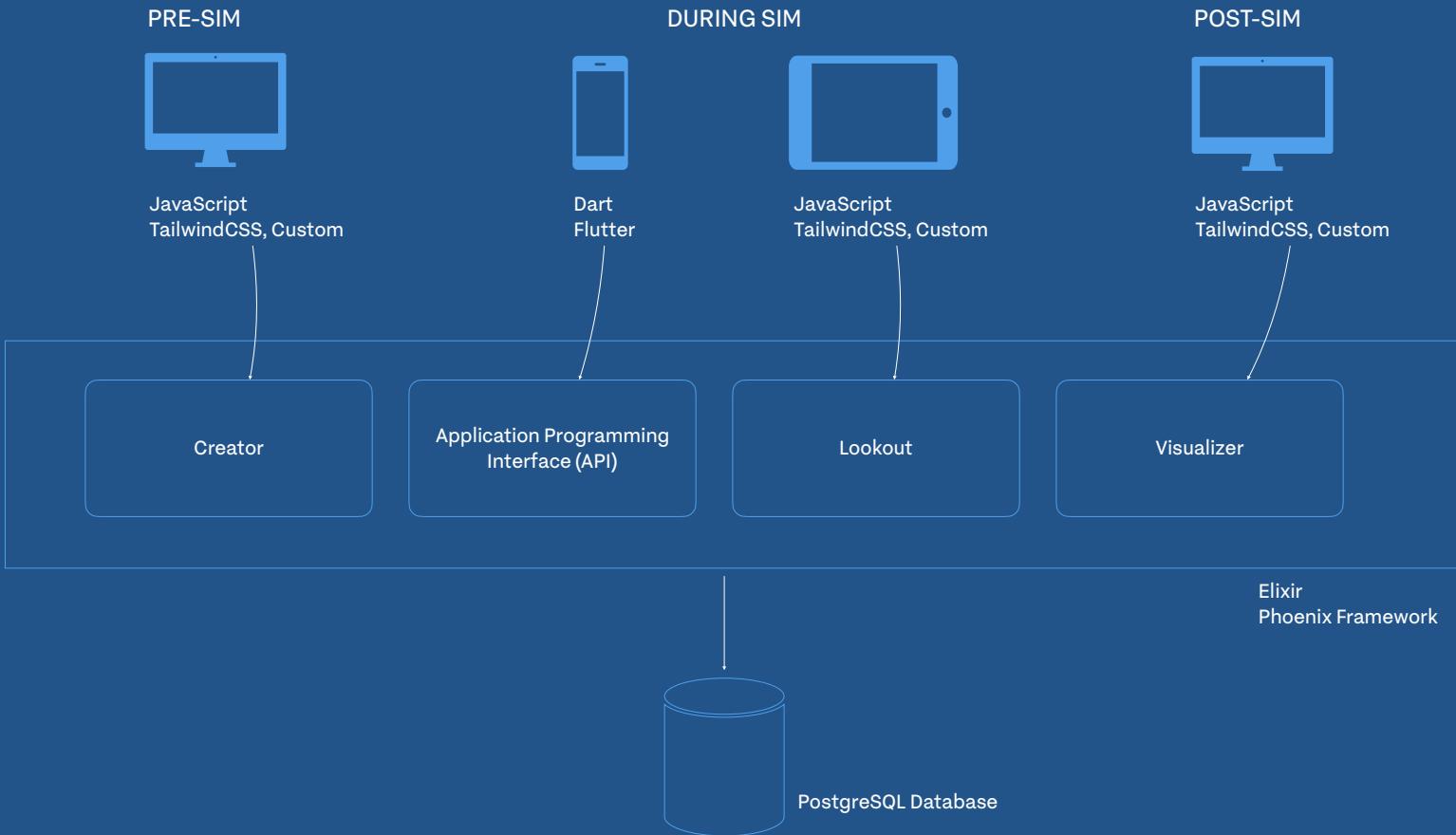




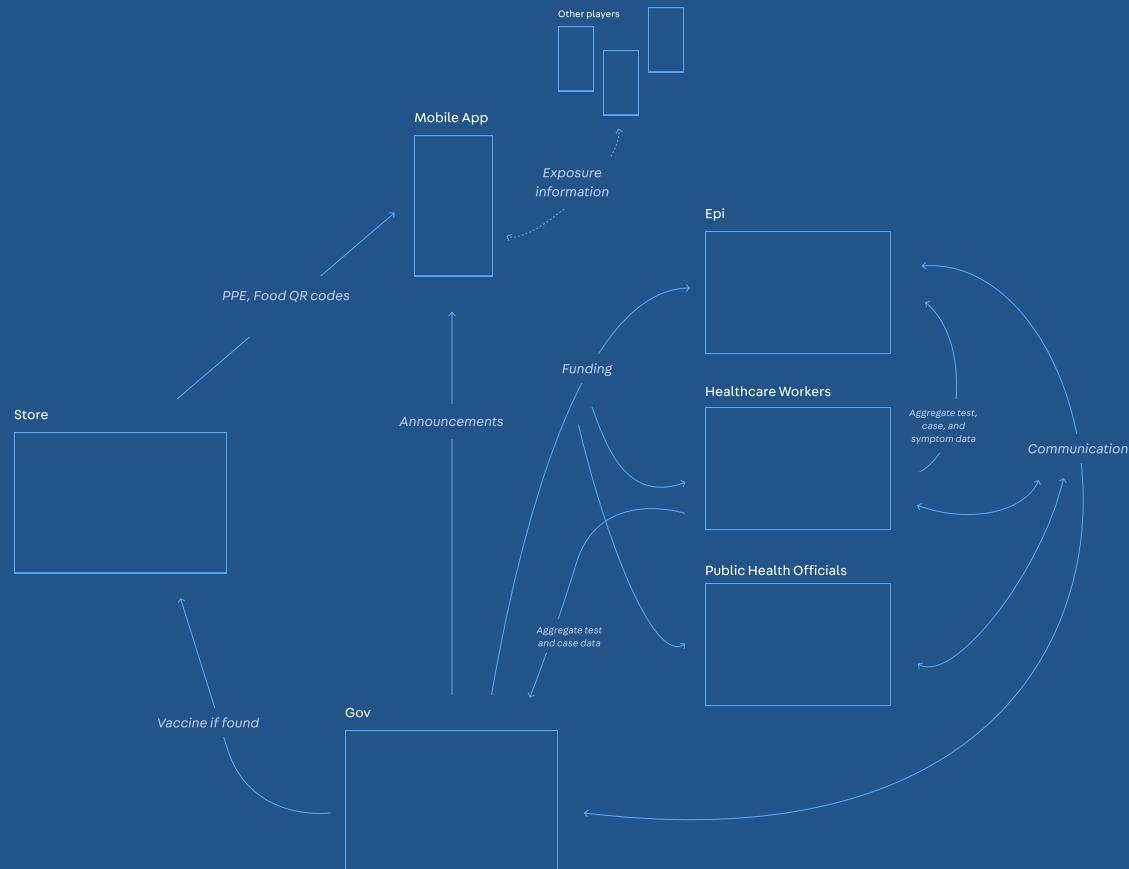
A dive video where a porcupinefish sits at the sandy bottom

- What worked
- What didn't work
- What we did to fix it

- What worked



Data flow during simulation





Lookout Healthcare

Case Intake

Patient name: Alpha Beta

Symptoms: Select all that apply

FEVER	Chills	Cough	Loss of smell and taste	Fatigue	Malaria	Myalgia	Diarrhea	Headache
Selected				Selected				
Monitoring	Seizure	Headache	Eye irritation	Dysuria	Pneumonia	Delirium	Hemorrhage	
Acute respiratory distress syndrome	Kidney failure	Disseminated intravascular coagulation						
Neuroleptic	Incontinence	Esophageal bleeding	Skin rashes	Seizures	Intestinal infections			
Endocarditis	Joint failure	Multiple organ failure						

Diagnoses and prescriptions

Print QR

Print Response

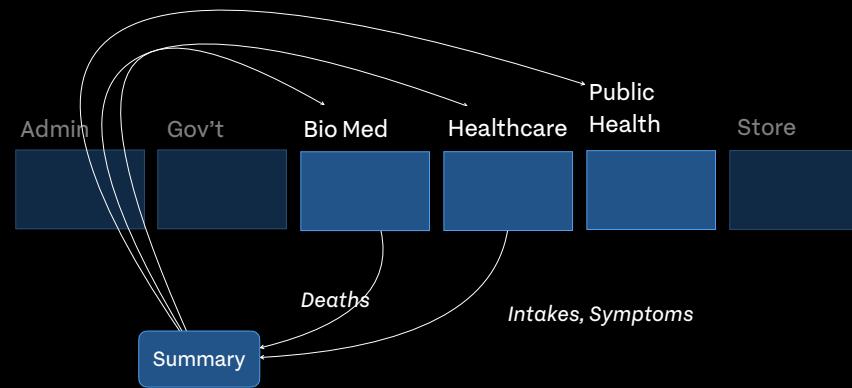
These patients are positive for the following:

Take them to world health to report outbreaks.

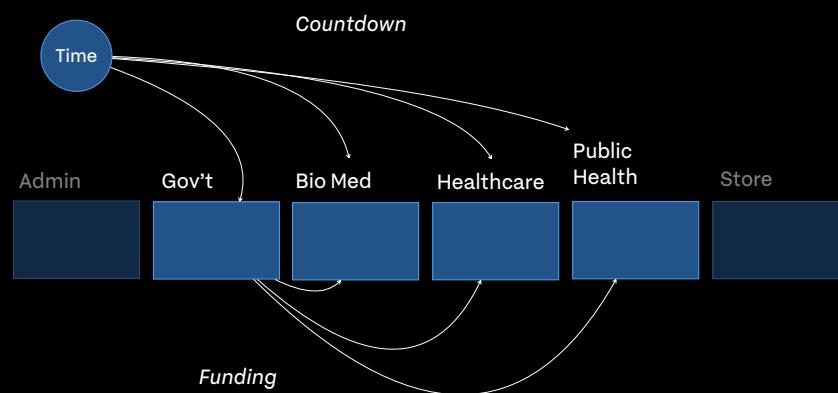
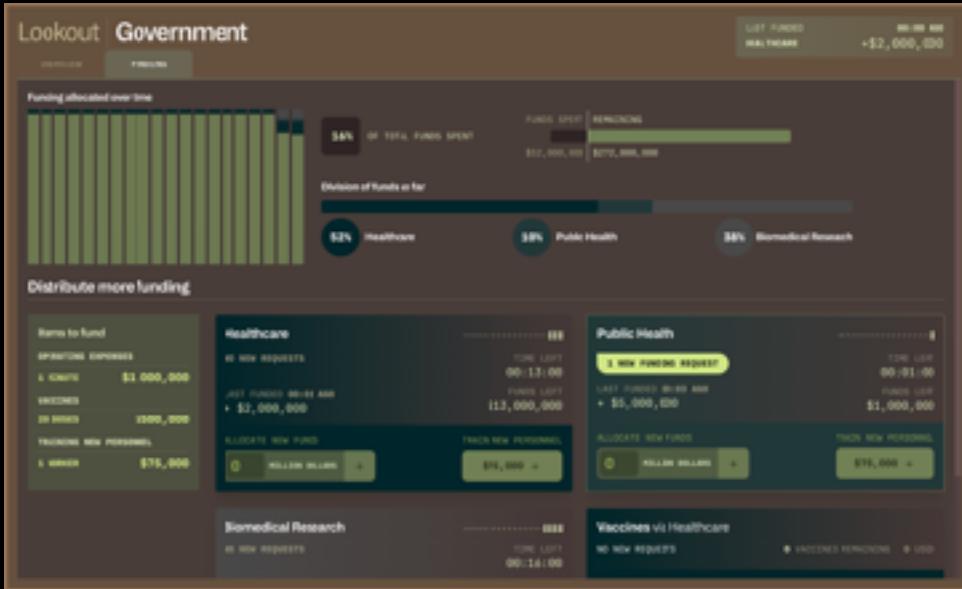
Write your patient's prescription for you.

Tell them to bring the prescription to the clinic to get medicine.

Prescription? Yes No



Healthcare overview and case intake screens, and a diagram of message passing between stations



The government station's screen and a diagram of how funds and timers pass messages to the other stations

- What worked

Phoenix's abstractions over
soft real-time messaging



Lookout Healthcare

Case Intake

Patient name: Alpha Beta

Symptoms: Select all that apply

Fever	Chills	Cough	Loss of smell and taste	Fatigue	Malaria	Myalgia	Diarrhea	Headache
Monitoring	Ischaemic heart disease	Headache	Efficiency loss	Dyspepsia	Pneumonia	Delirium	Hemorrhoids	
Adult respiratory distress syndrome	Kidney failure							
Seizures	Incontinence	Esophagitis	Bleeding	Skin lesions	Seizures	Intestinal infections		

Diagnoses and prescriptions

Print QR code

Print response

These patients are positive for the following:

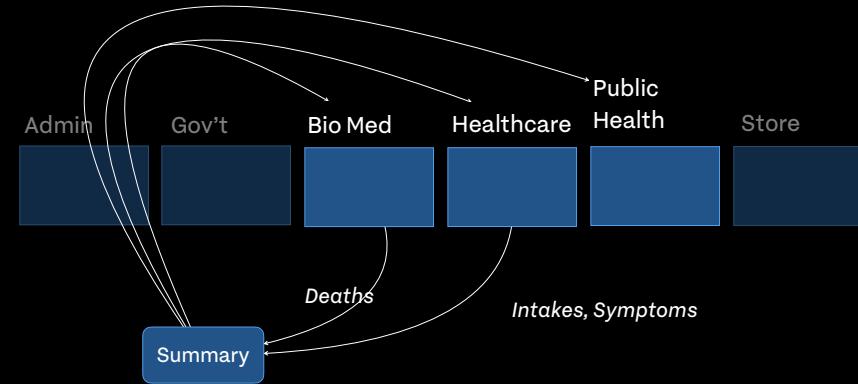
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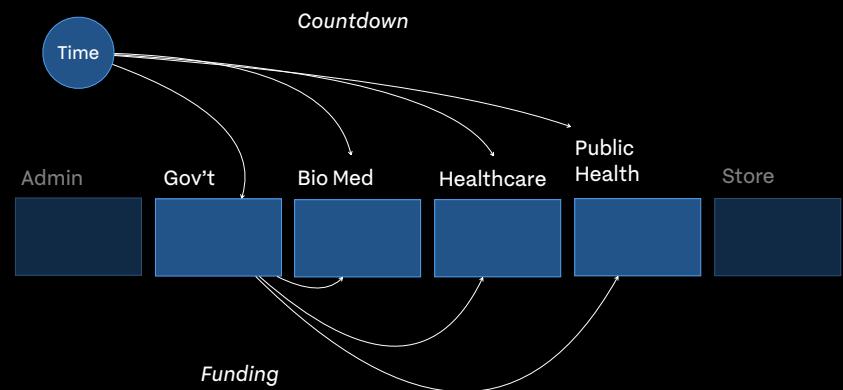
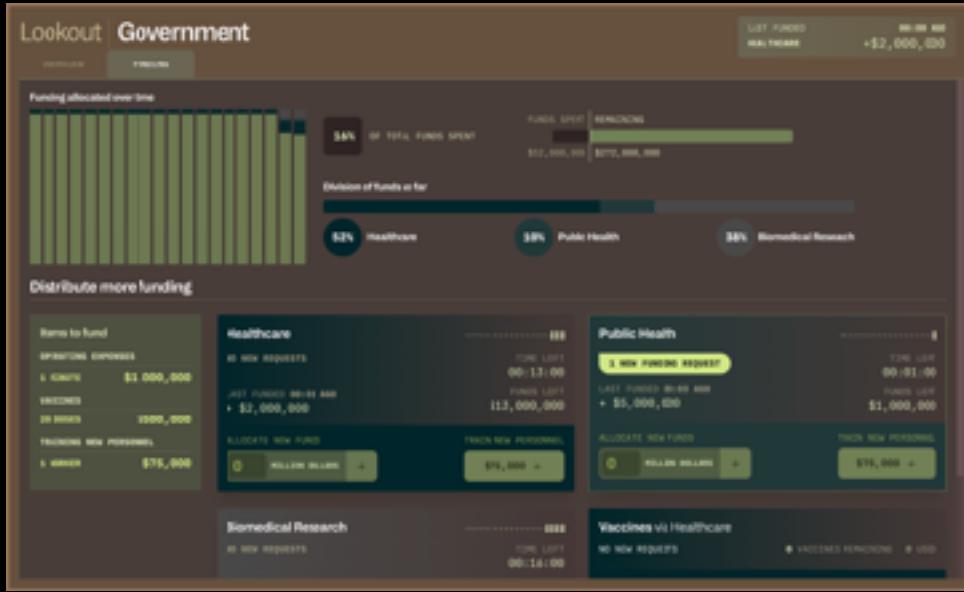
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Prescription?

YES NO



Healthcare overview and case intake screens, and a diagram of message passing between stations



The government station's screen and a diagram of how funds and timers pass messages to the other stations

- **What worked**

Building LiveViews during
the iterative design process,
and throwing the bad ones

- What worked

TailwindCSS & LiveView
Components for FREE!

- What worked

Using Phoenix to build a
FAST API

- **What didn't work**

Sending large amounts of data
to LiveViews over websockets is
slow and uses a lot of server
memory

3 Interacting at 8:00 am on
2/22/2023

191
total participants

88
HEALTHY

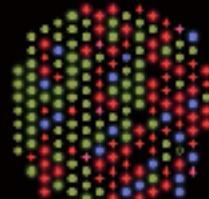
82
INFECTED

21
RECOVERED

0
DECEASED

IRI not currently interacting.

8:00 am
Wednesday, February 22
0 NEW INFECTIONS



Participant Phi Washington

FINAL OUTCOME • Infected

PERFORMANCE
COMPARED TO PEERS

60 direct contacts

21 AVERAGE

HIGHEST 93

Masked 86% of the time

100% AVERAGE

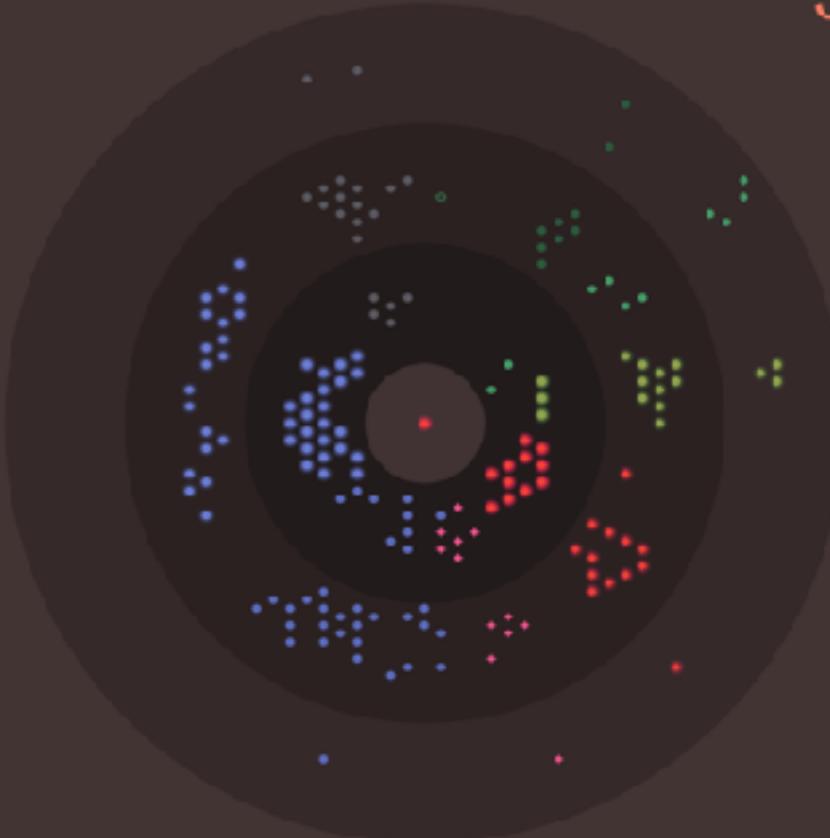
Vaccinated 0% of the time

22% AVERAGE

Infected 39% of the time

10% AVERAGE

CONTACT NETWORK

55 direct contacts
infected190 infected contacts
in entire network

Likelihood of infection

with immediate contacts only

[Progress bar]

immediate + 2nd-degree contacts

[Progress bar]

immediate, 2nd and 3rd-degree contacts

[Progress bar]

All participants

Q. Search by username

Sorted by

Number of Contacts

Number of Transmissions

TRANSMISSION NETWORK

Color by

Protection

Outcome

Index cases

172

Transmissions

202

USERNAME	OUTCOME	TRANSMISSIONS	ACTUAL CONTACTS
----------	---------	---------------	-----------------

Alpha Mesa	Infected	2	240
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Omega Tampa	Unknown	0	240
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Phi Iota Alpha	Infected	5	233
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Sigma Memphis	Infected	2	231
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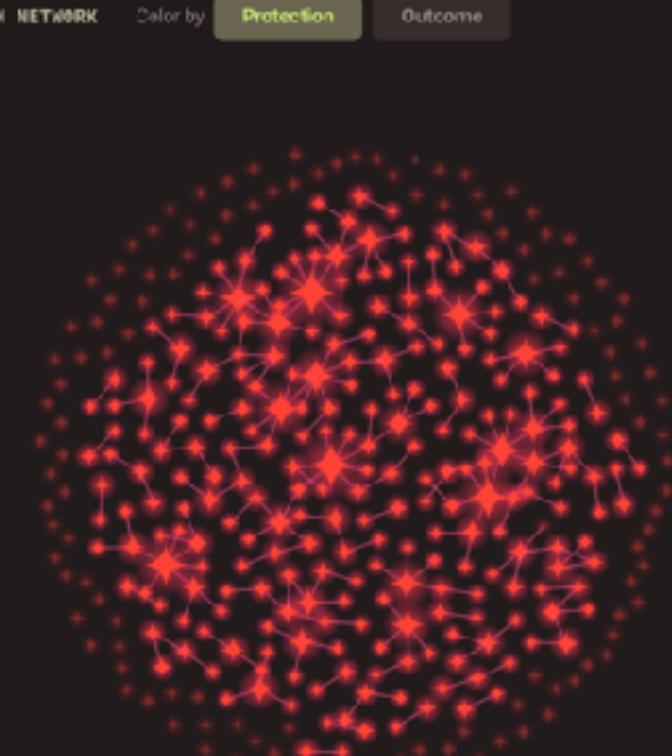
Lambda Wichita	Unknown	0	226
----------------	---------	---	-----

Alpha Orlando	Unknown	0	226
---------------	---------	---	-----

Sigma Houston	Unknown	1	228
---------------	---------	---	-----

Lambda	Infected	0	228
--------	----------	---	-----

Protection at time of transmission

 366
no protection 1
wearing a mask

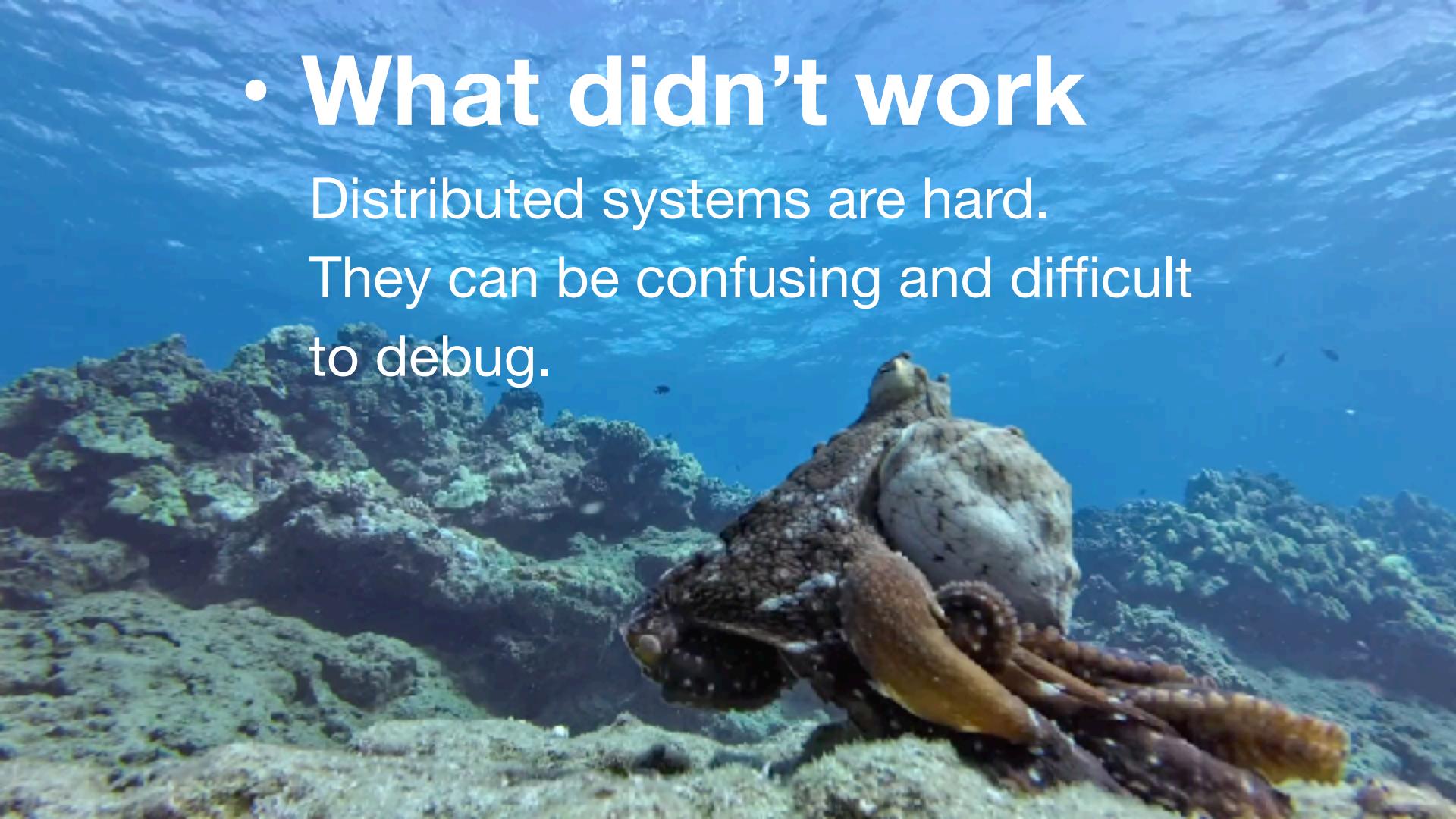
- **What we did to fix it**

Switch from LiveView
websockets to file downloads

- **What didn't work**

Distributed systems are hard.

They can be confusing and difficult
to debug.



- **What we did to fix it**

We leaned on a simple
Phoenix monolith

- **What we did to fix it**
- Name everything with structs

Name everything with structs

```
1  defmodule LandOf0o.Health.PopStats do
2    defstruct [
3      :num_participants,
4      :num_pos_cases: 0, :cases_pct: 0,
5      :num_deaths: 0, :deaths_pct: 0,
6      :num_visits: 0,
7      :num_quarantined: 0,
8      :num_vaccinated: 0,
9      :positive_intakes: [],
10     :death_counts: []
11   ]
12 end
```



A video of another curious green sea turtle

A photograph of three monk seals swimming in clear, turquoise-blue ocean water. One seal is in the foreground, facing right, another is in the middle ground facing left, and a third is above them facing right. They have light-colored bodies with dark flippers and a dark dorsal fin.

Thank you!