

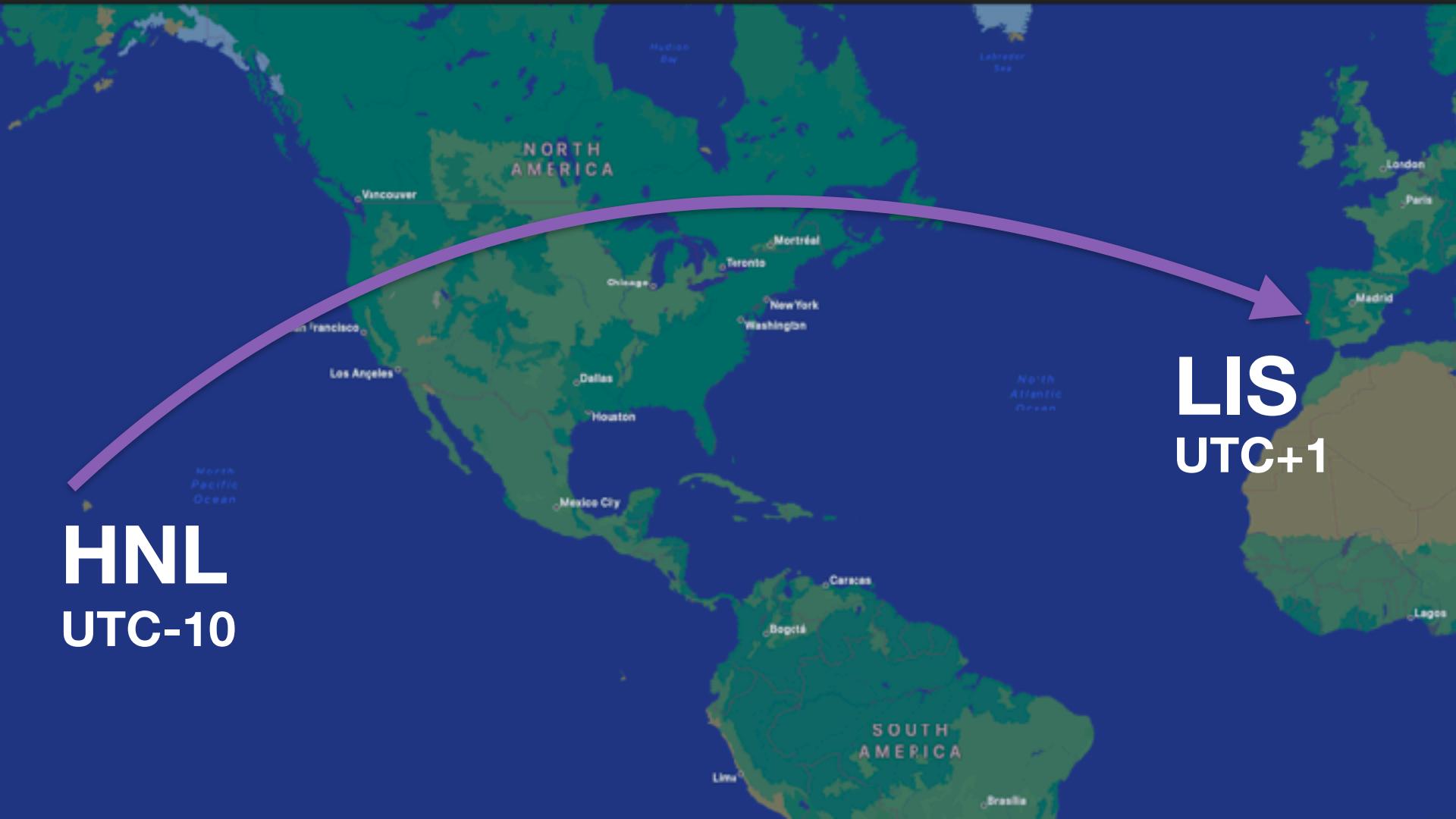


Kyle Oba [he/him] | Fathom Information Design

ElixirConf EU

# Visualising Pathogen Spread with LiveView

**HNL**  
UTC-10



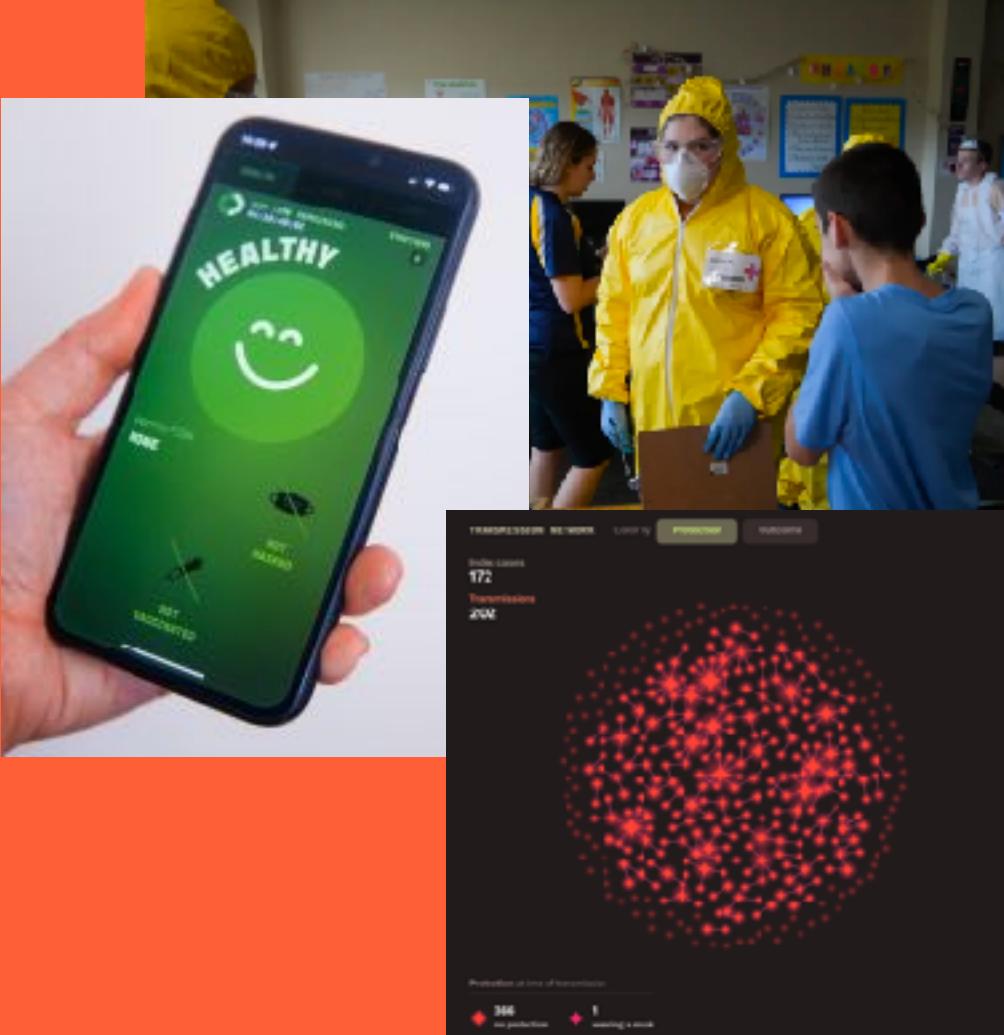
**LIS**  
UTC+1



A group photo of the Farbman office on the patio

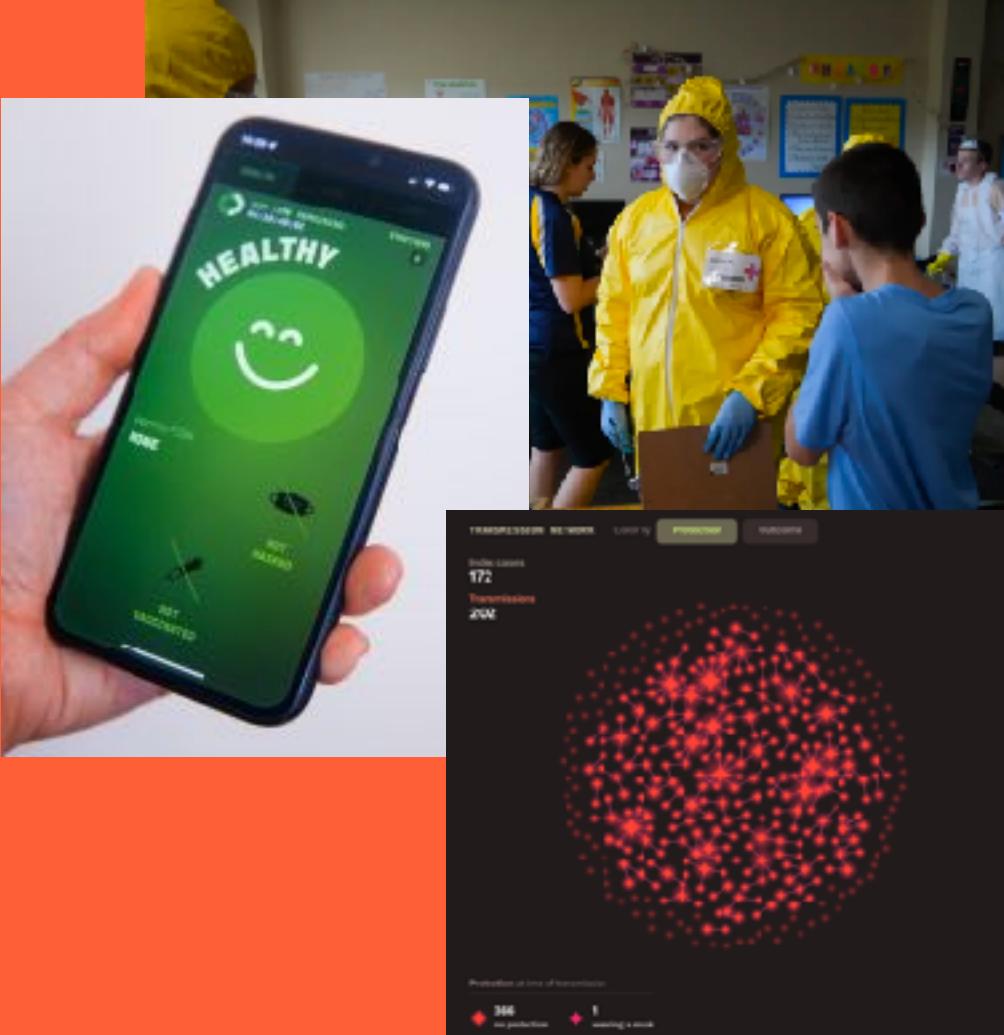
<https://operationoutbreak.org>

# operation outbreak



<https://operationoutbreak.org>

# operation outbreak





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

[ please indulge me  
this simple analogy ]



A video of spinner dolphins

# Freediving



# Freediving



# Phoenix



# Freediving

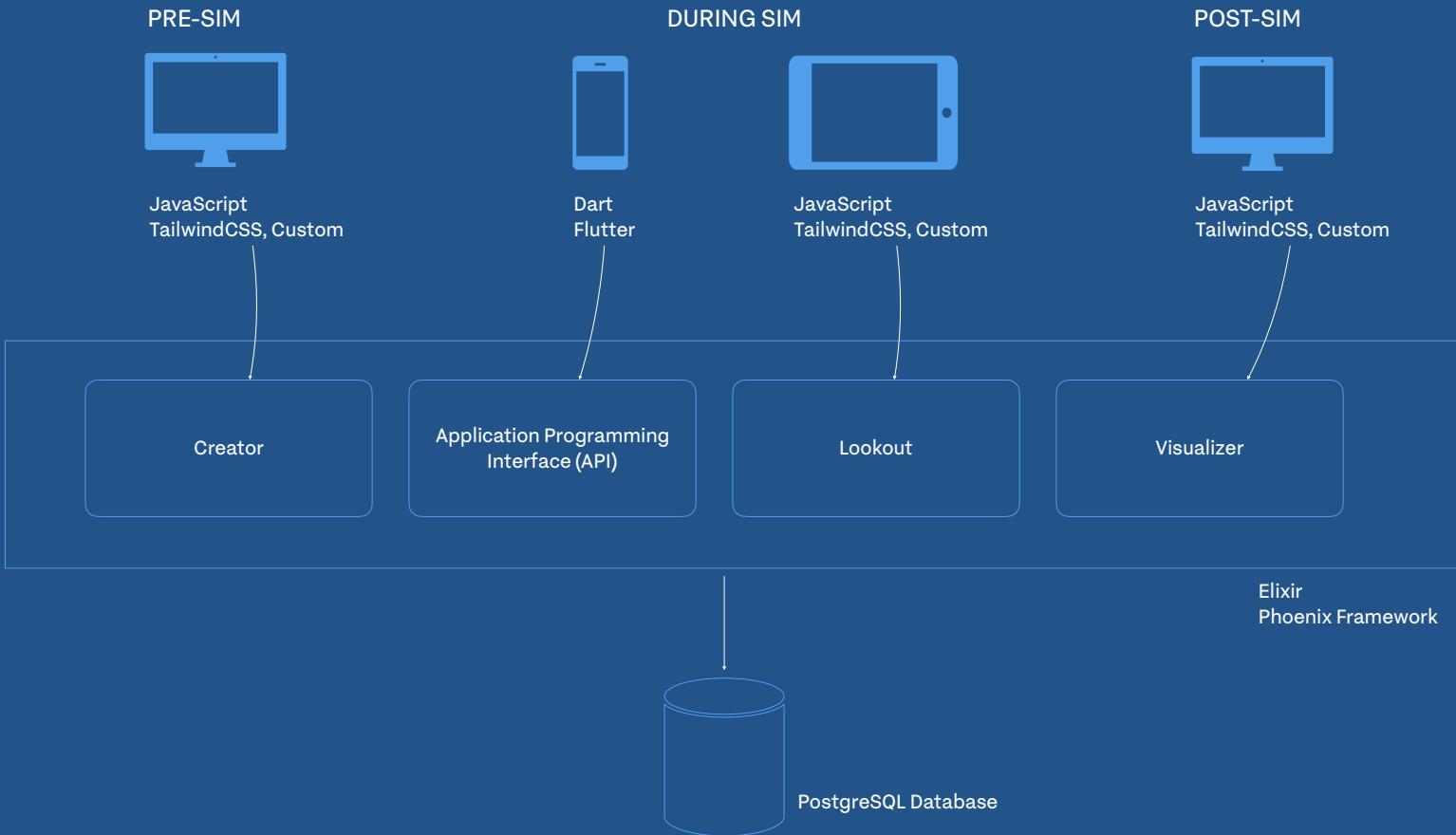




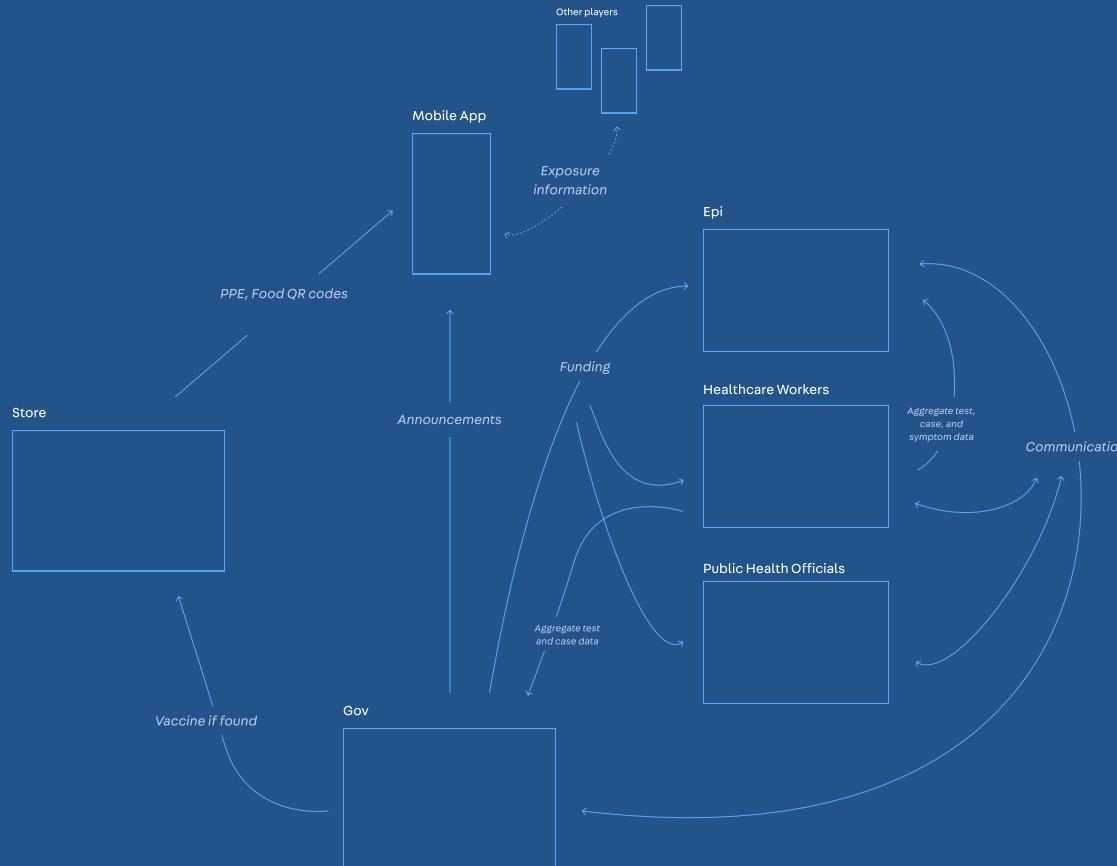
A dive video where a porcupinefish sits at the sandy bottom

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

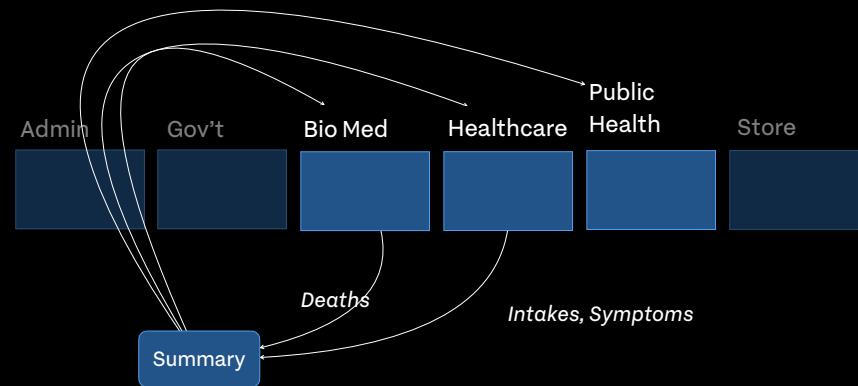
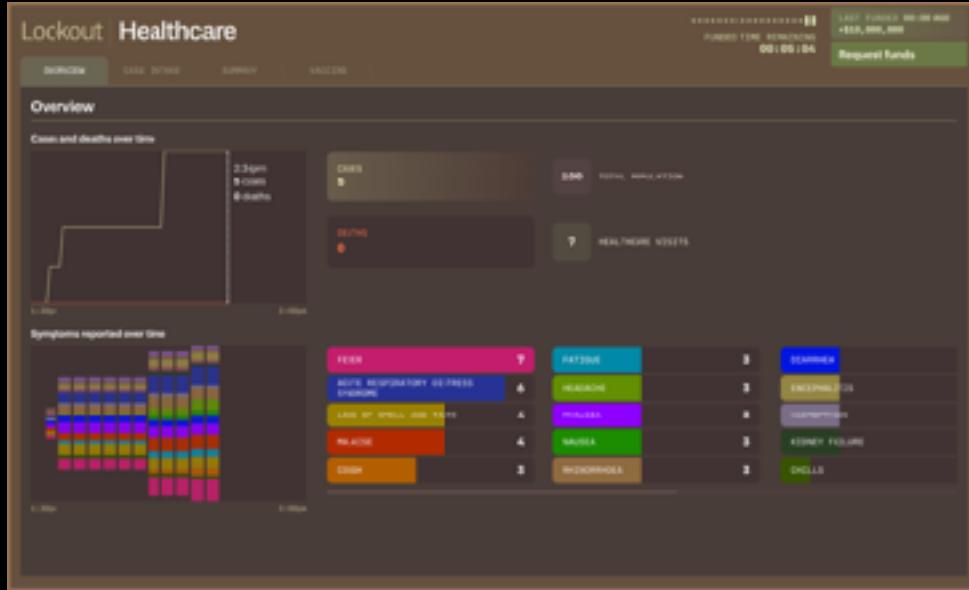
- What worked



# Data flow during simulation







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

**Lookout Healthcare**

OVERVIEW CASE INTAKE SUMMARY

### Case Intake

Patient name: [redacted]

Symptoms: Select all that apply

Fever	Chills	Cough	Loss of smell and taste	Fatigue	Malaise	Migraine	Diarrhea	Nausea
Vomiting	Sore throat	Headache	Rhinorrhoea	Dyspnoea	Pneumonia	Delirium	Haemoptysis	
Acute respiratory distress syndrome			Kidney failure	Disseminated intravascular coagulation			Tongue spots	
Skin rash	Paroxysms	Encephalitis	Bleeding	Skin bumps	Skin abscess	Internal infection	Abdominal pain	
Jaundice	Liver failure	Multiple organ failure						

Diagnostic test:

Barcode result: [redacted]

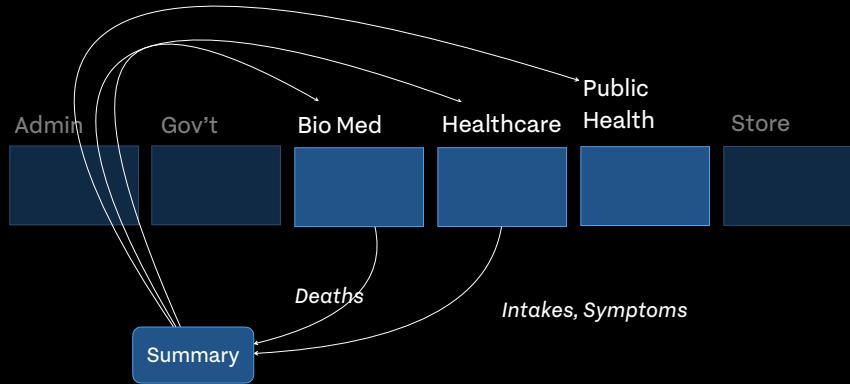
Positive Negative

Your patient is positive for the pathogen. Advise them to visit Public Health to report contacts.

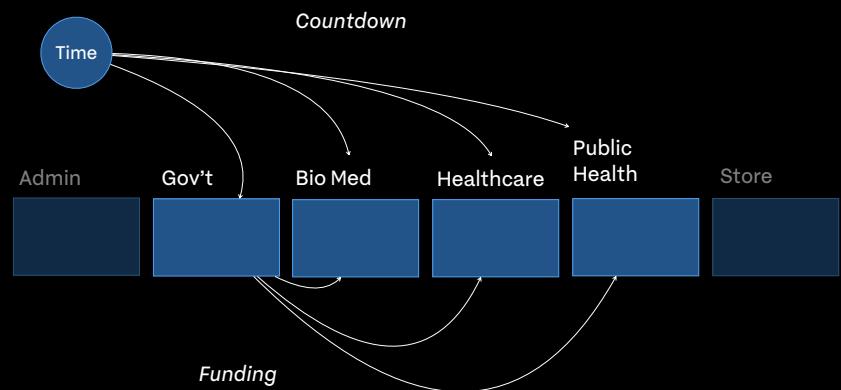
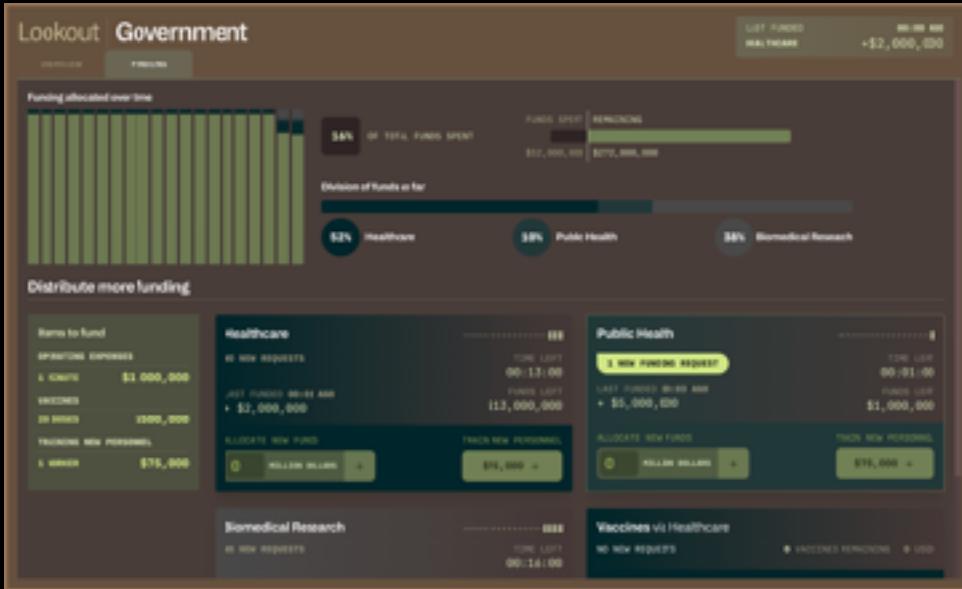
Prescription?

Yes No

Write your patient a prescription for medicine. Tell them to bring the prescription to the Store to buy medicine.



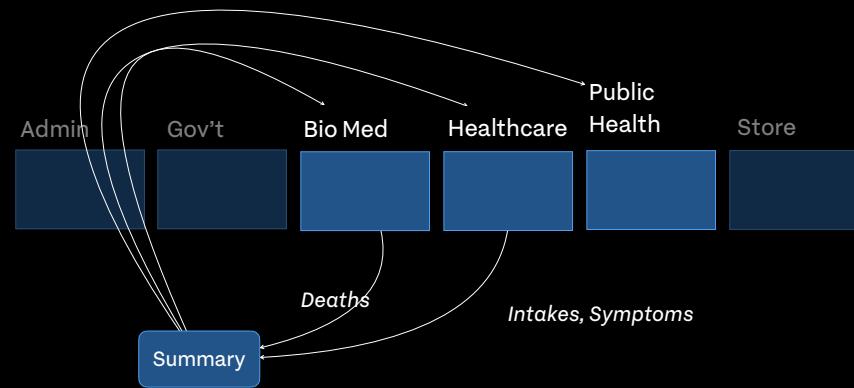
Healthcare overview and case intake screens, and a diagram of message passing between stations



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



**Lockout Healthcare**

OVERVIEW CASE INTAKE SUMMARY REQUEST FUNDS

LAST FUNDING: 00:00:00 AM  
FUNDING TIME REMAINING: 00:00:00  
00:00:04 REQUEST FUNDS

**Case Intake**

PATIENT: CASE INTAKE SUMMARY REQUEST FUNDS

LAST FUNDING: 00:00:00 AM  
FUNDING TIME REMAINING: 00:00:00  
00:00:04 REQUEST FUNDS

**Case Intake**

Patients name: Alpha patient

Symptoms: Select all that apply

- Fever
- Chills
- Cough**
- Loss of smell and taste
- Fatigue
- Muscle
- Migraine
- Diarrhea
- Rashes
- Vomiting
- Sore throat
- Headache
- Ethosphenitis
- Dyspnea
- Nasogastritis
- Delirium
- Hemoptysis
- Acute respiratory distress syndrome
- Kidney failure
- Disseminated intravascular coagulation
- Tongue spots
- Skin rash
- Paroxysms
- Encephalitis
- Bleeding
- Skin bumps
- Skin abscess**
- Internal infection
- Abdominal pain
- Jaw ulcers
- Liver failure
- Multiple organ failure

Diagnostic test:

QR code: Green screen

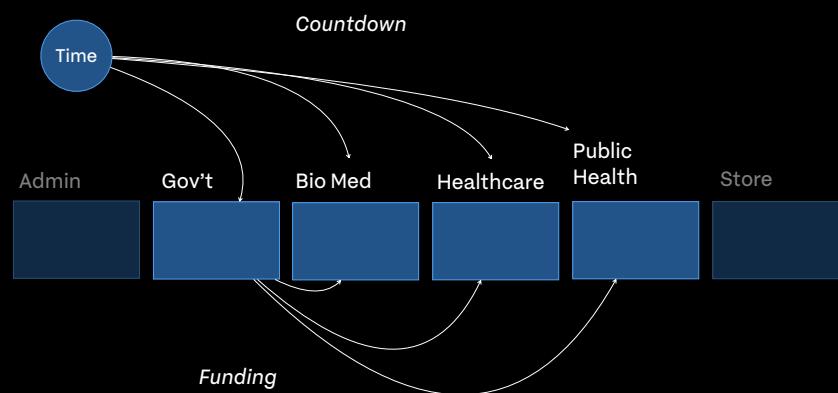
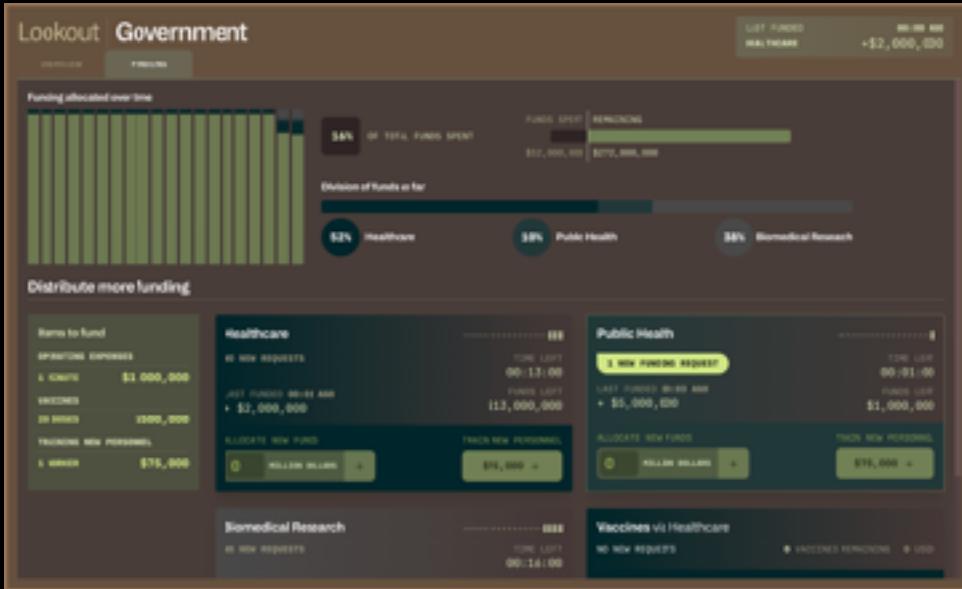
Positive Negative

Your patient is positive for the pathogen. Advise them to visit Public Health to report contacts.

Prescription? Yes No

Will your patient a prescription for medicine? Tell them to bring the prescription to the Store to buy medicine.

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



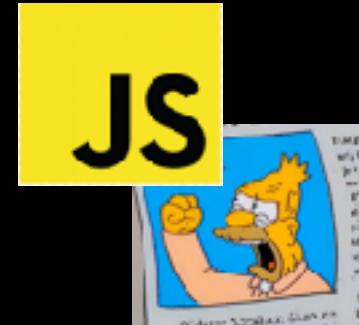
The government station's screen and a diagram of how funds and timers pass messages to the other stations

- **What worked**

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

- What worked

JS Client Hooks to  
handle boilerplate UI  
lifecycle code



- What worked

TailwindCSS & LiveView  
Components for FREE!

- What worked

Using Phoenix to build a  
*FAST API*

- What didn't work



- 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

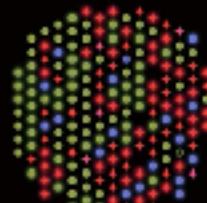
**82**  
INFECTED

**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

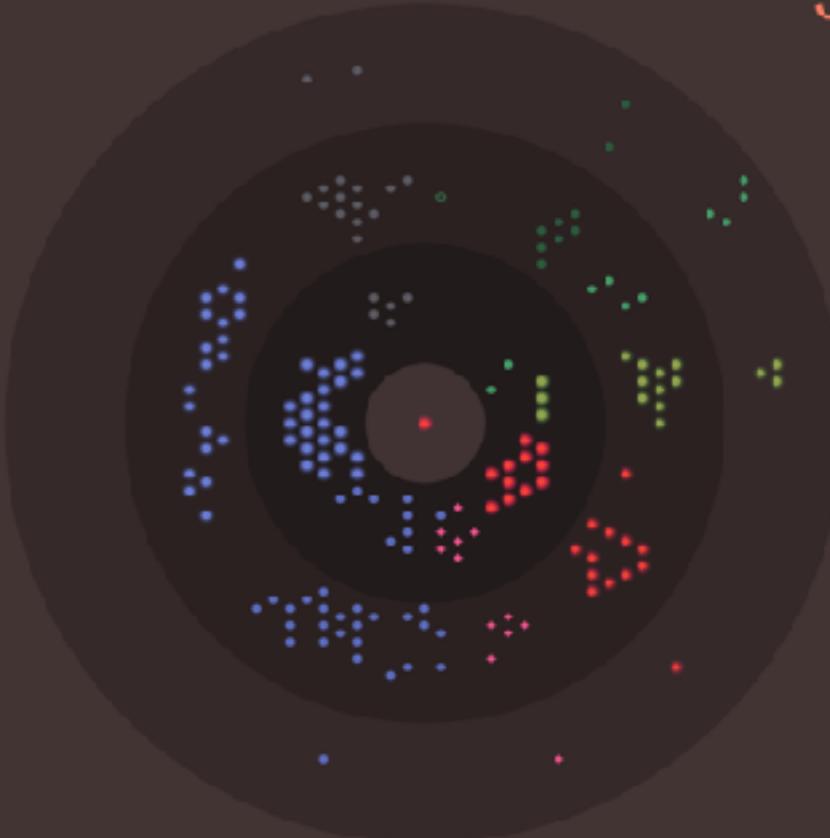
Vaccinated 0% of the time

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

██████████

immediate + 2nd-degree contacts

██████████

immediate, 2nd and 3rd-degree contacts

██████████

## 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
------------	----------	---	-----

Omega Tampa	Unknown	0	240
-------------	---------	---	-----

Phi Iota Alpha	Infected	5	233
----------------	----------	---	-----

Sigma Memphis	Infected	2	231
---------------	----------	---	-----

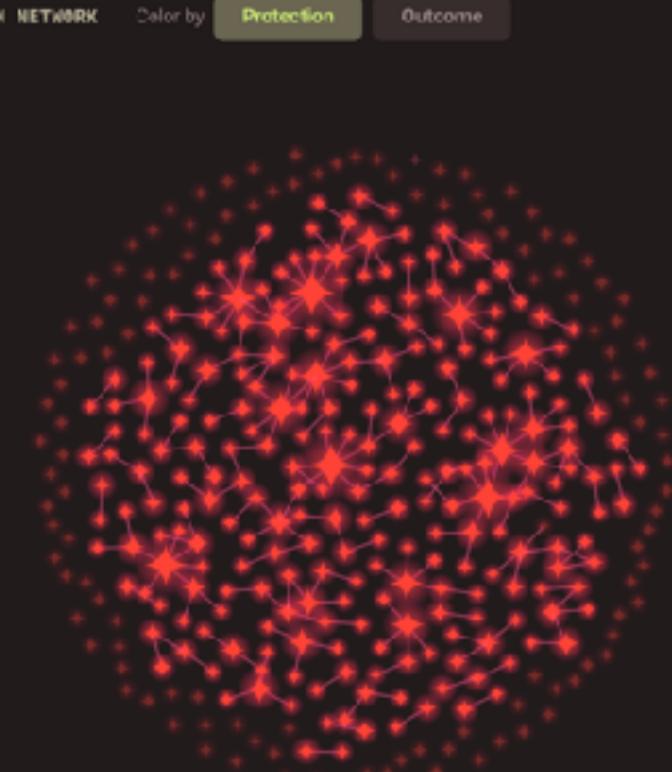
Lambda Wichita	Unknown	0	226
----------------	---------	---	-----

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

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

Lambda	Infected	0	226
--------	----------	---	-----

Protection at time of transmission

 366  
no protection 1  
wearing a mask

- What we did to fix it

- What we did to fix it

Switch from LiveView  
websockets to file downloads  
(w/ cache tags, temp files)

- 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

# Thank you!

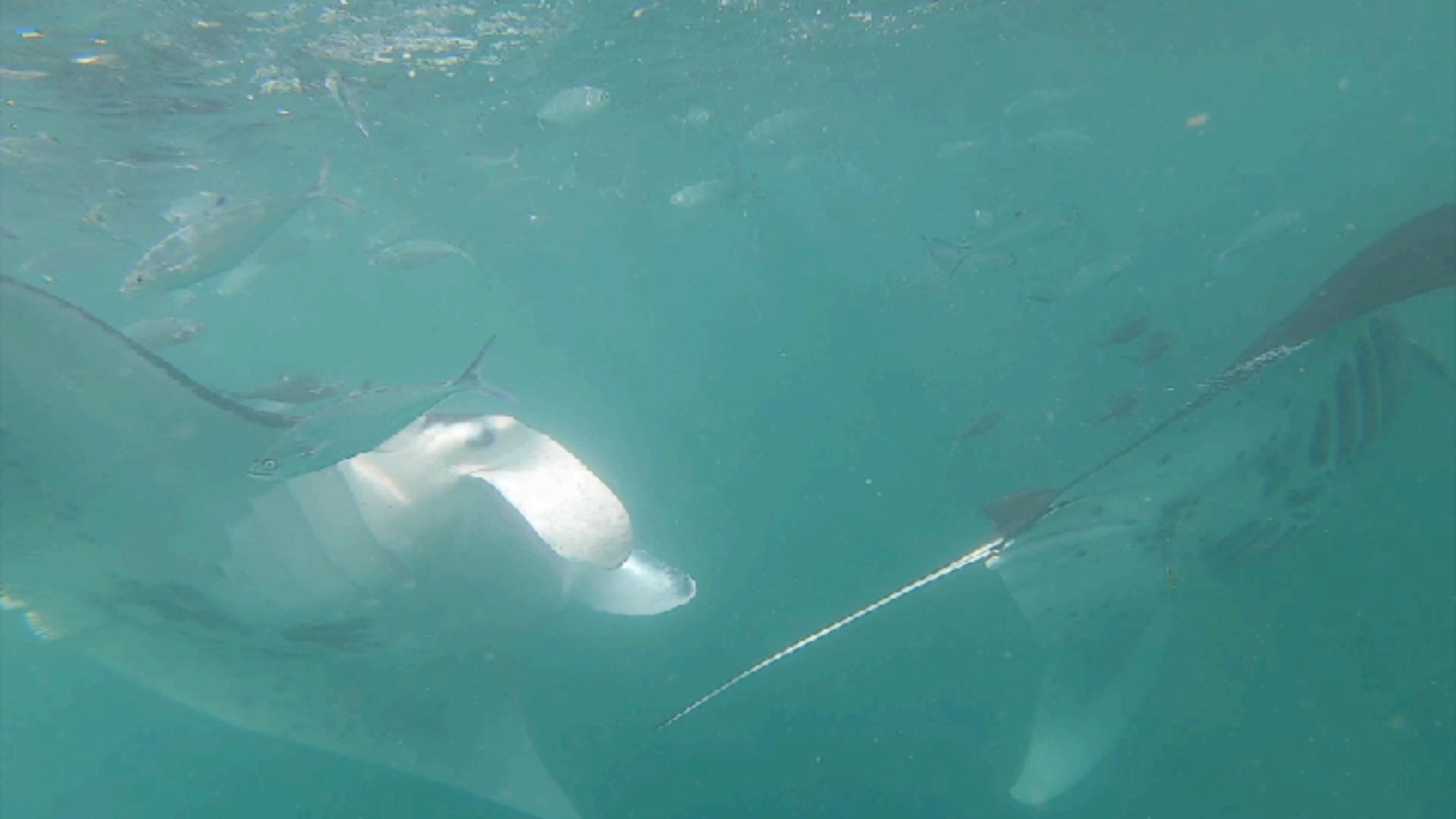


# Obrigado!



# **Extras (secret fun stuff)**

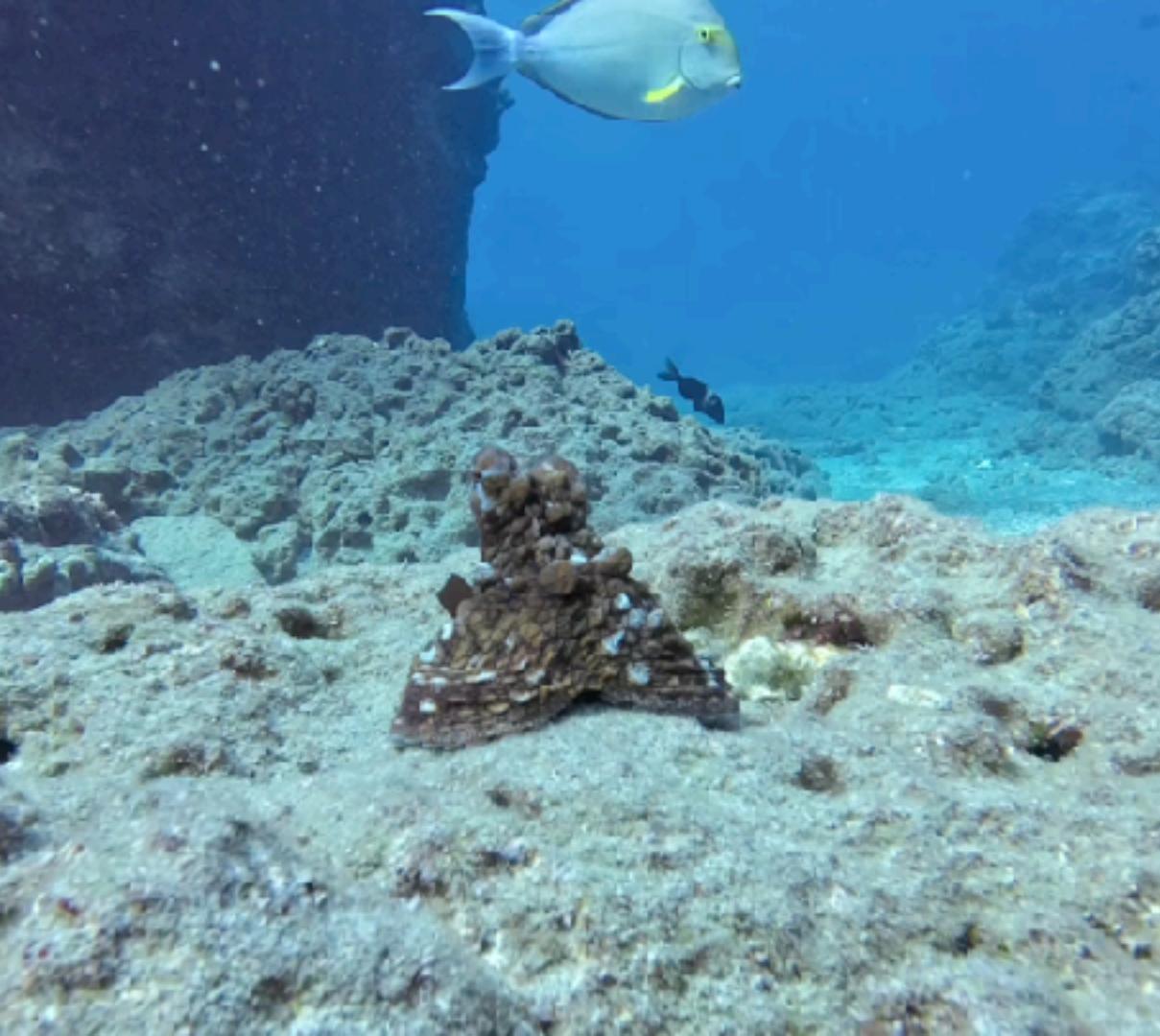






ElixirConf EU







A video of a green sea turtle which comes to investigate