An Exploration of Turing Pi Based Edge Cloud with Docker/Kubernetes

Team SDMAY23-19

Iowa State University

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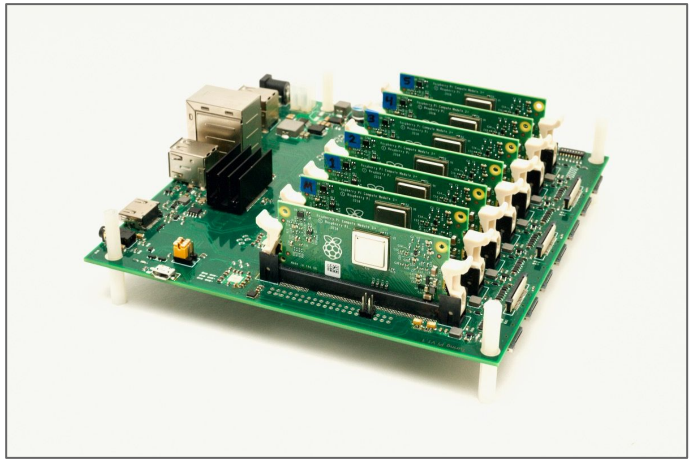
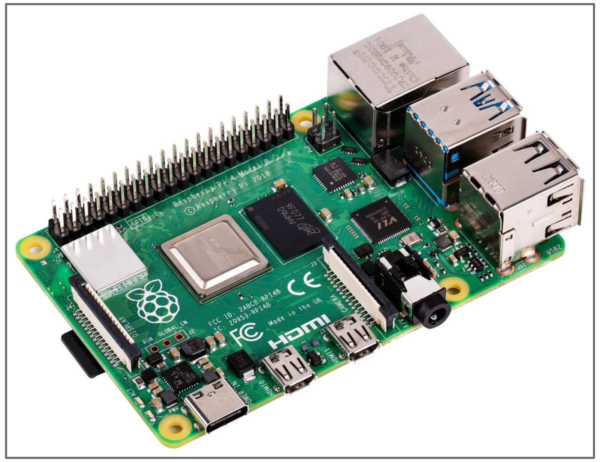
Project Vision

Fill our information gap surrounding Docker and Kubernetes

Technology Background

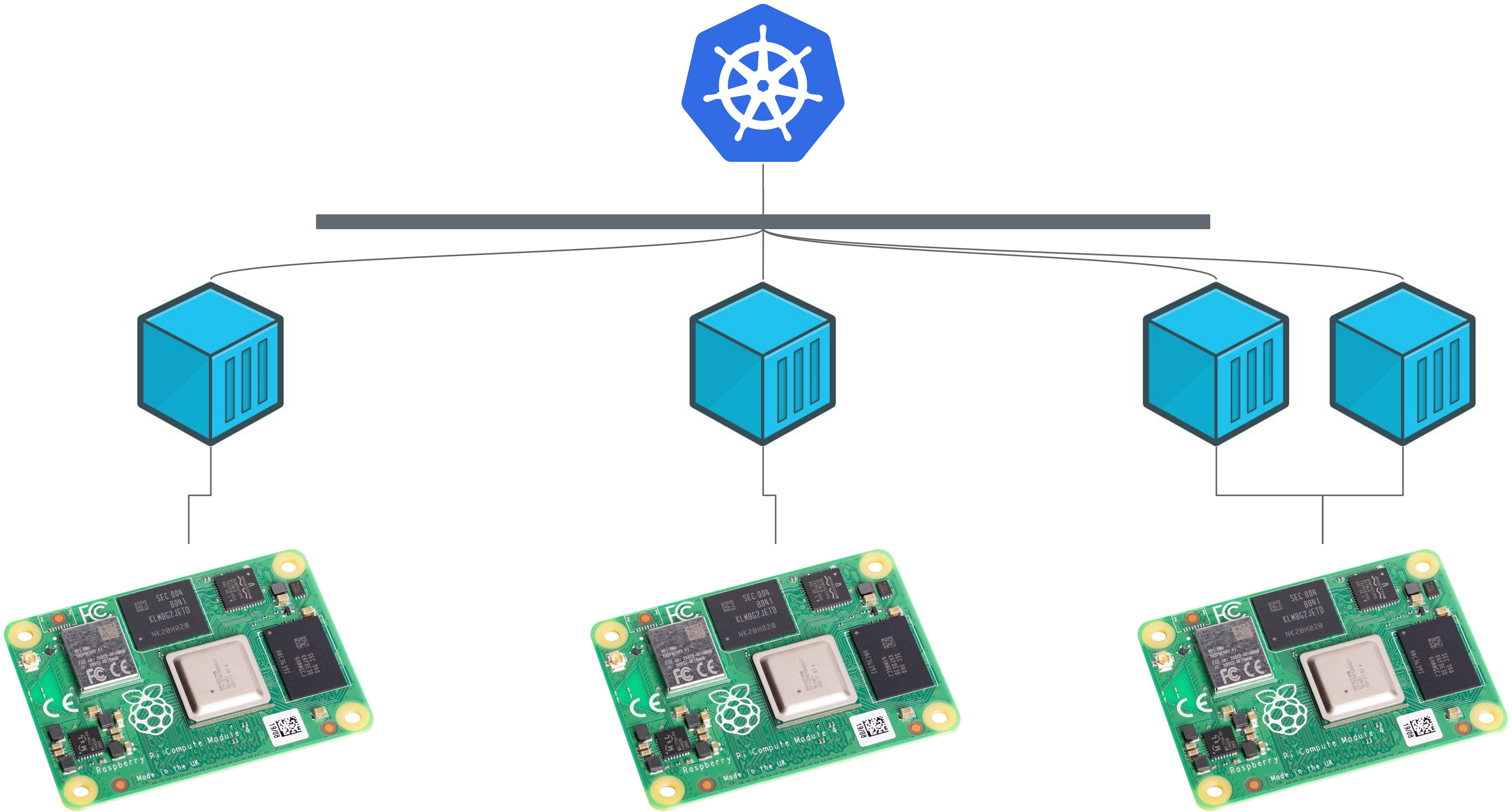




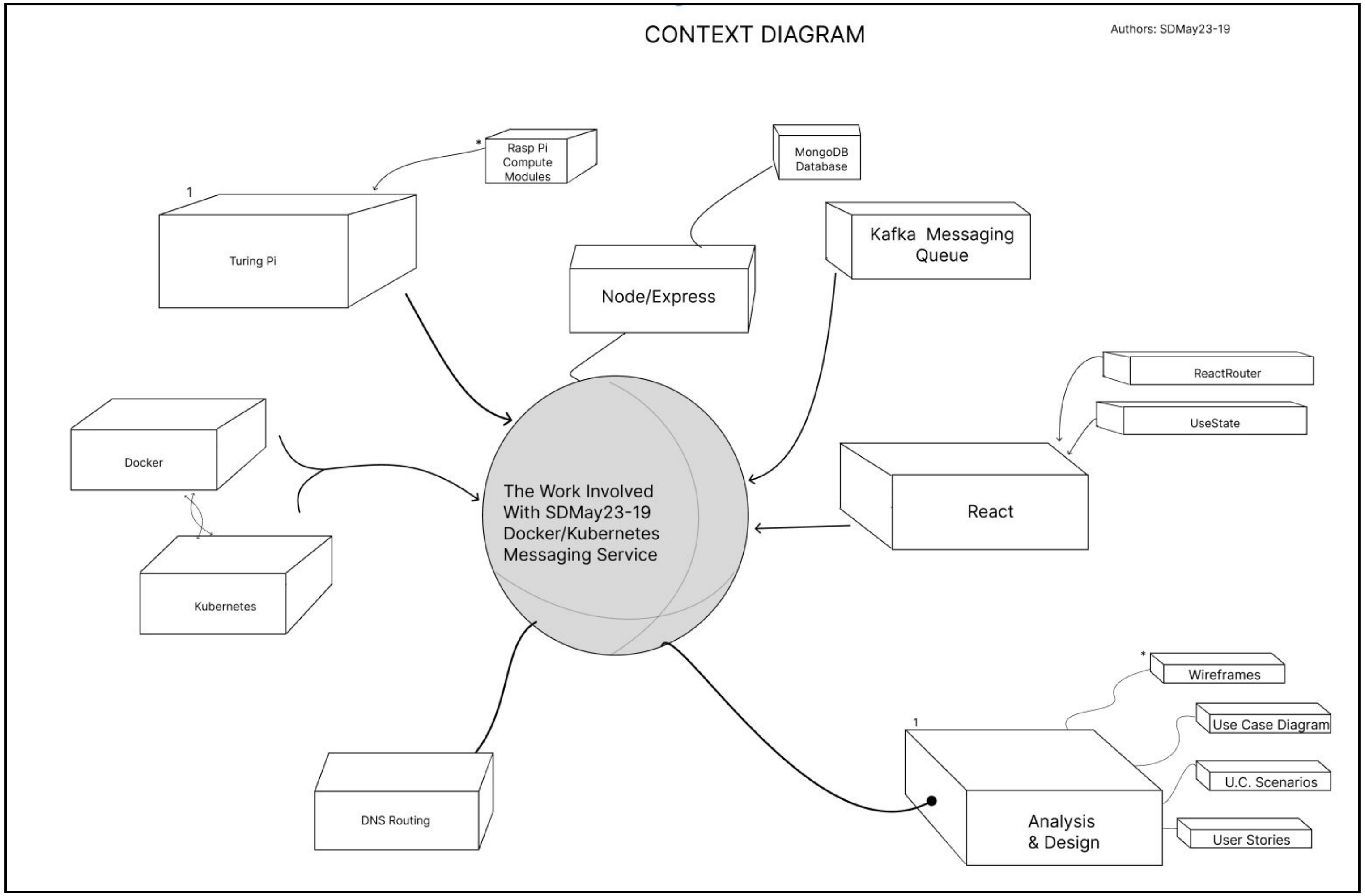
Technology Background

Google
kubernetes
docker

Conceptual/Visual Sketch



Context Diagram



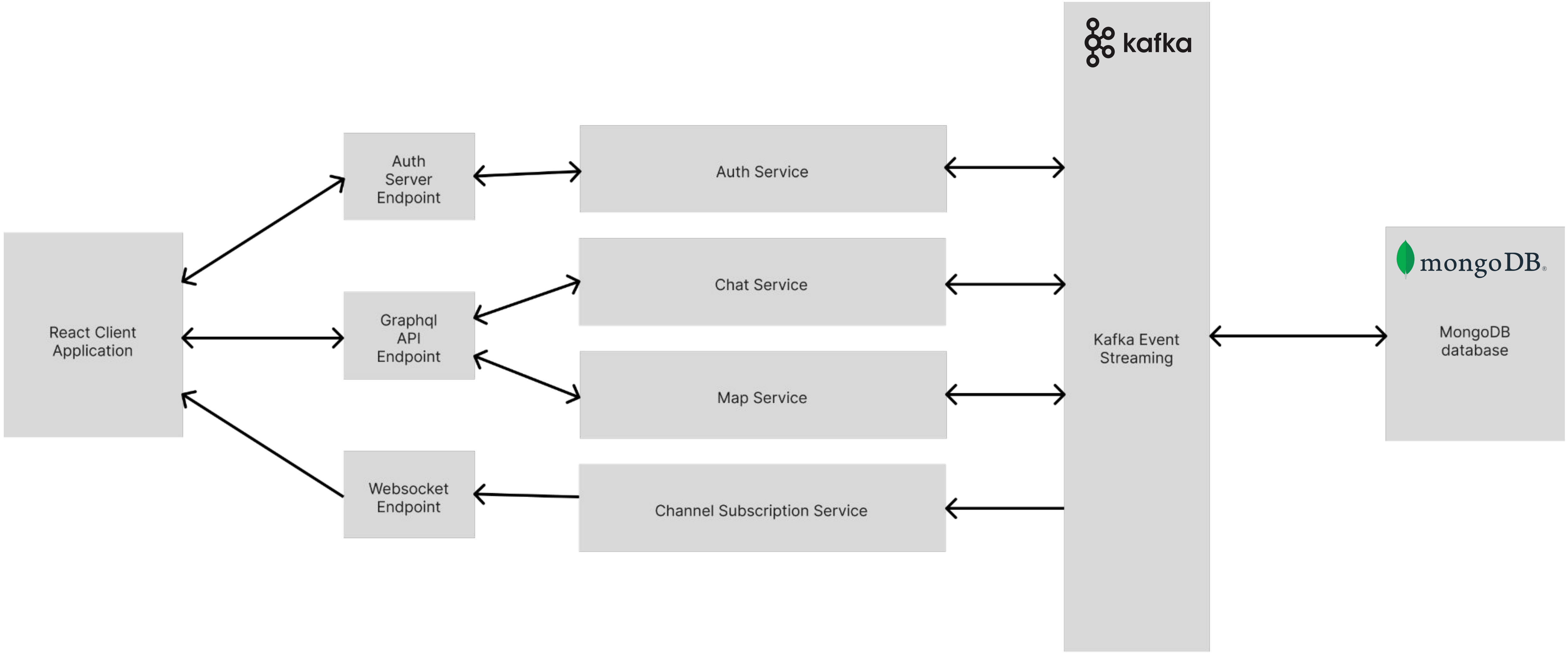
Functional Requirements

- Scalable message service
- Use phone number to authenticate account
- Users can start topics at location and reply to existing topics at location
- 24hr topics lifespan

Non-functional requirements

- Maintains smooth performance scalable to 30,000 requests per second.
- Propagates messages to the topic within .75 seconds.
- If under >90% load, then propagate messages to topic within 2 seconds.
- Service online to users 98.99% of the month.
- Messaging service encrypts user messages in transit.

Conceptual Design Diagram


kafka
Auth Server Endpoint
Auth Service
React Client Application
Chat Service
Graphql API Endpoint
Kafka Event Streaming
mongoDB
MongoDB database
Map Service
Websocket Endpoint
Channel Subscription Service

GraphQL

Design Decision: Anticipating the limits of REST

kafka

Kafka: designed to run in a distributed environment

RedPanda

mongoDB®

MongoDB: built in support for replica sets.

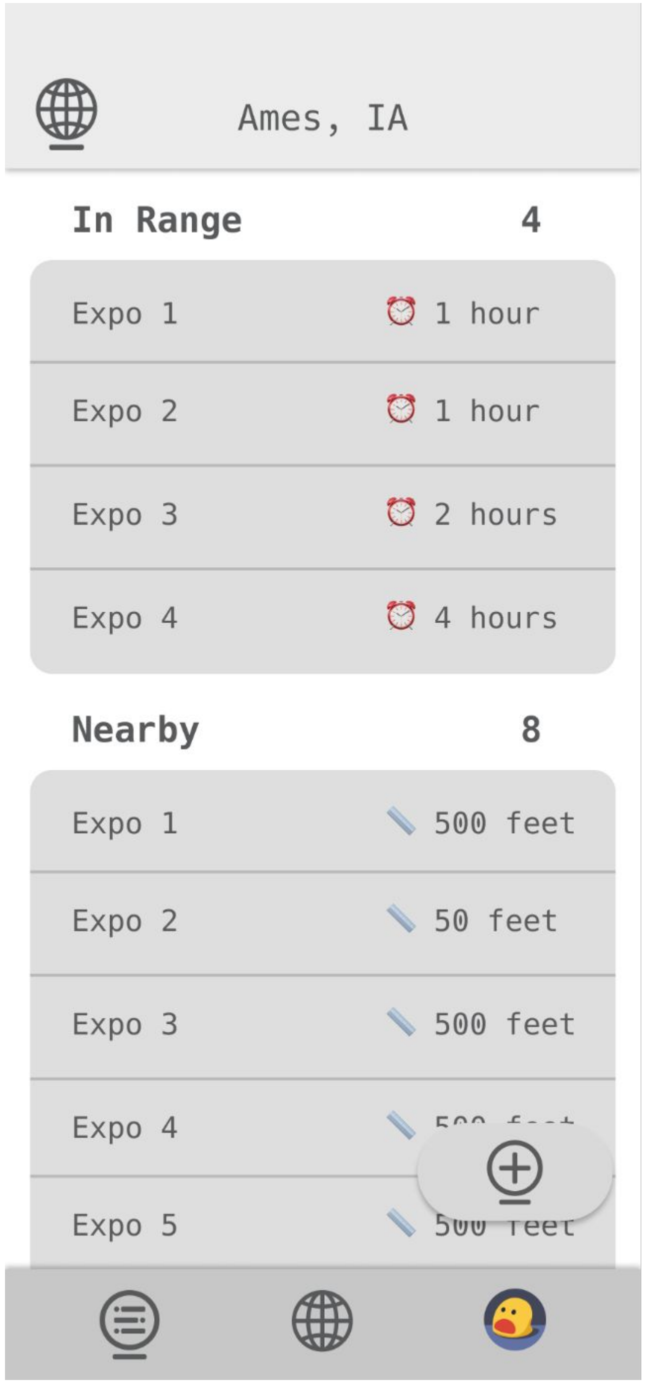
nest

Design Decision: Implementing the backend using nest.js framework.

React

Design Decision: Going with React

ionic



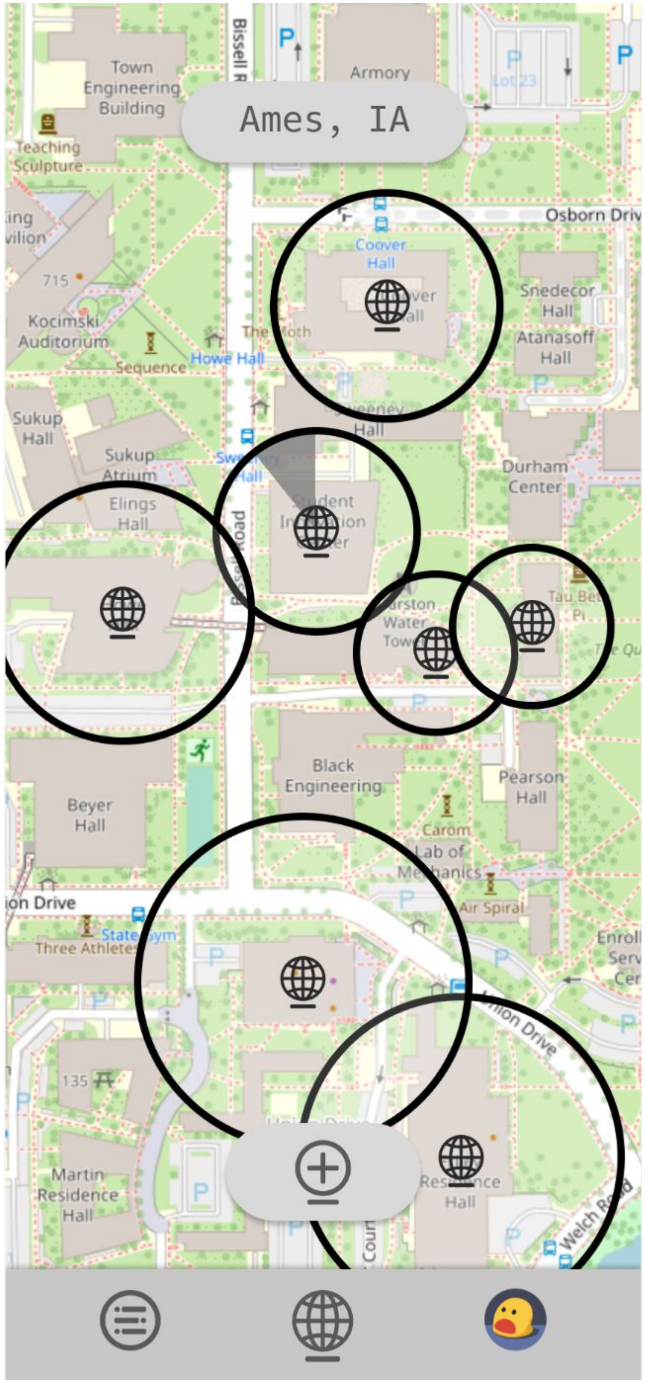
Ames, IA

In Range 4

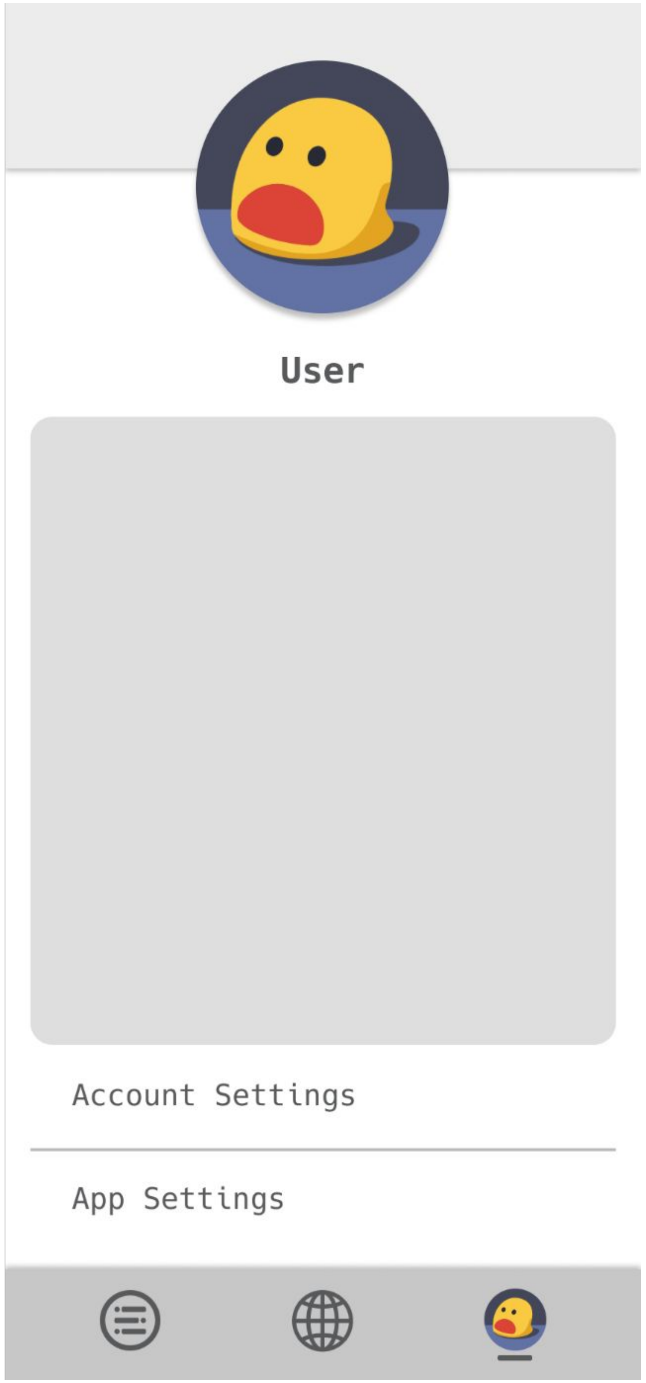
Expo 1	⏰ 1 hour
Expo 2	⏰ 1 hour
Expo 3	⏰ 2 hours
Expo 4	⏰ 4 hours

Nearby 8

Expo 1	📏 500 feet
Expo 2	📏 50 feet
Expo 3	📏 500 feet
Expo 4	📏 500 feet
Expo 5	📏 500 feet



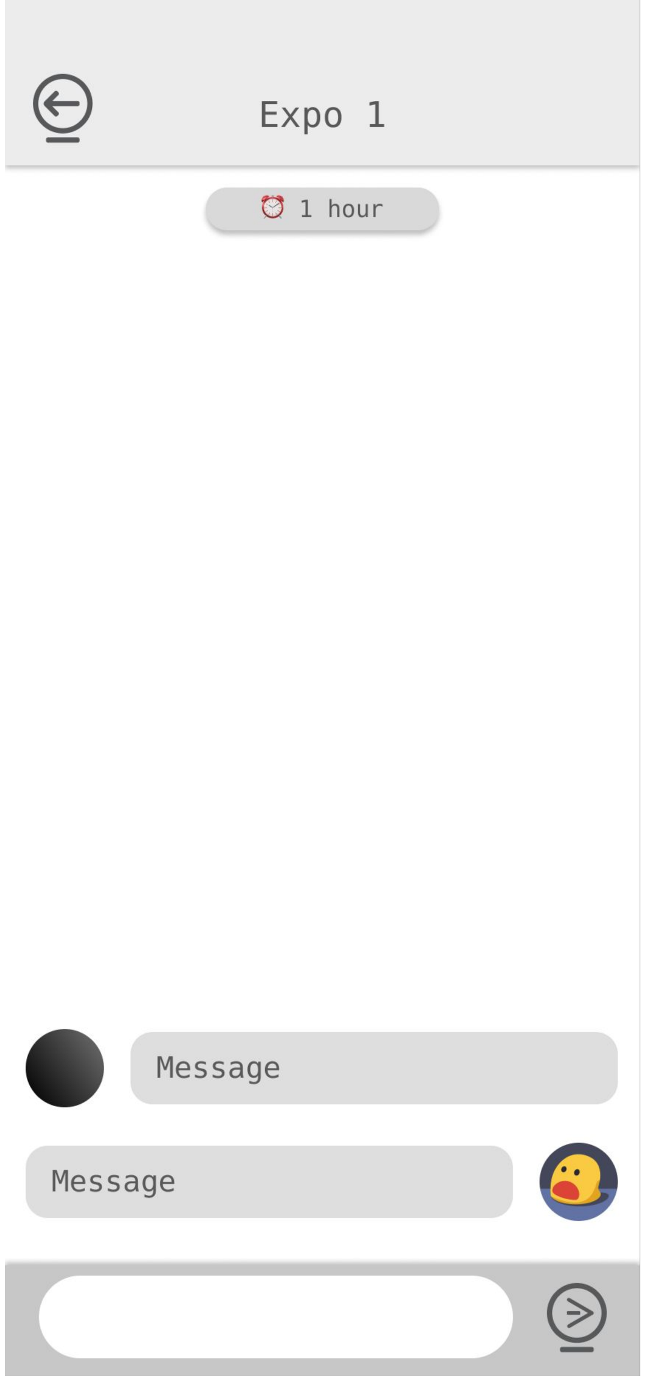
Ames, IA

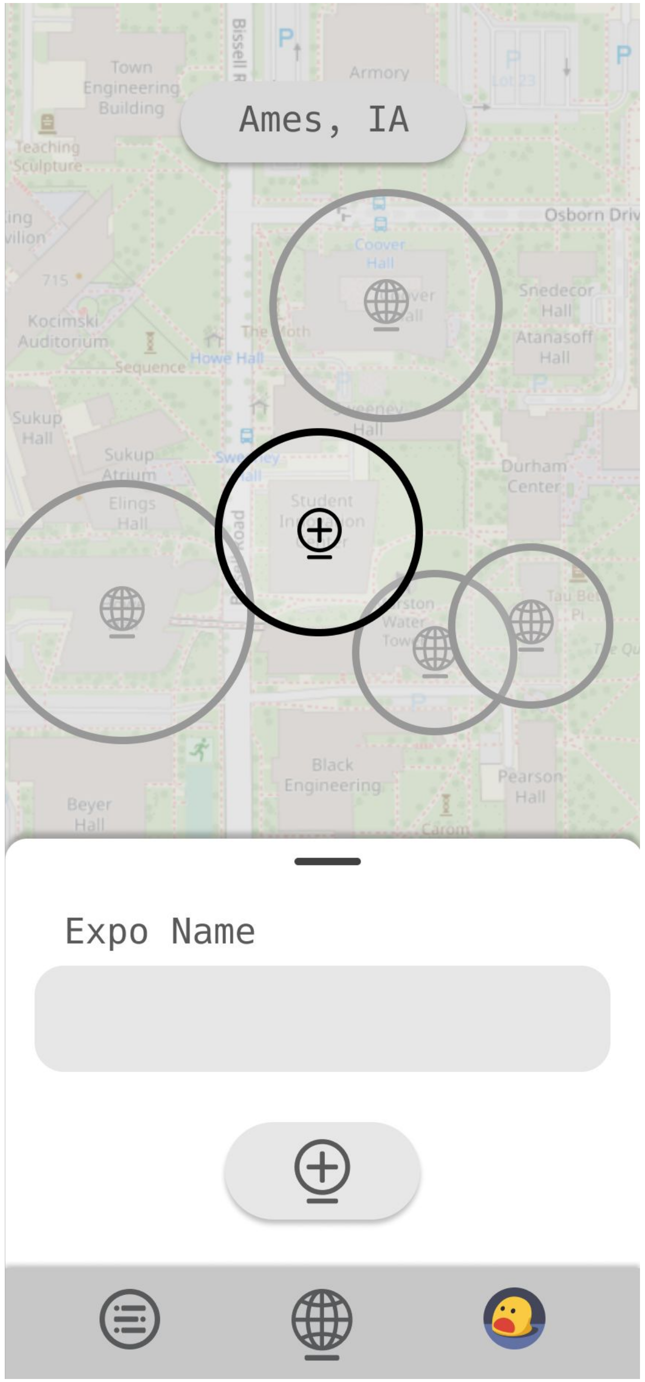


User

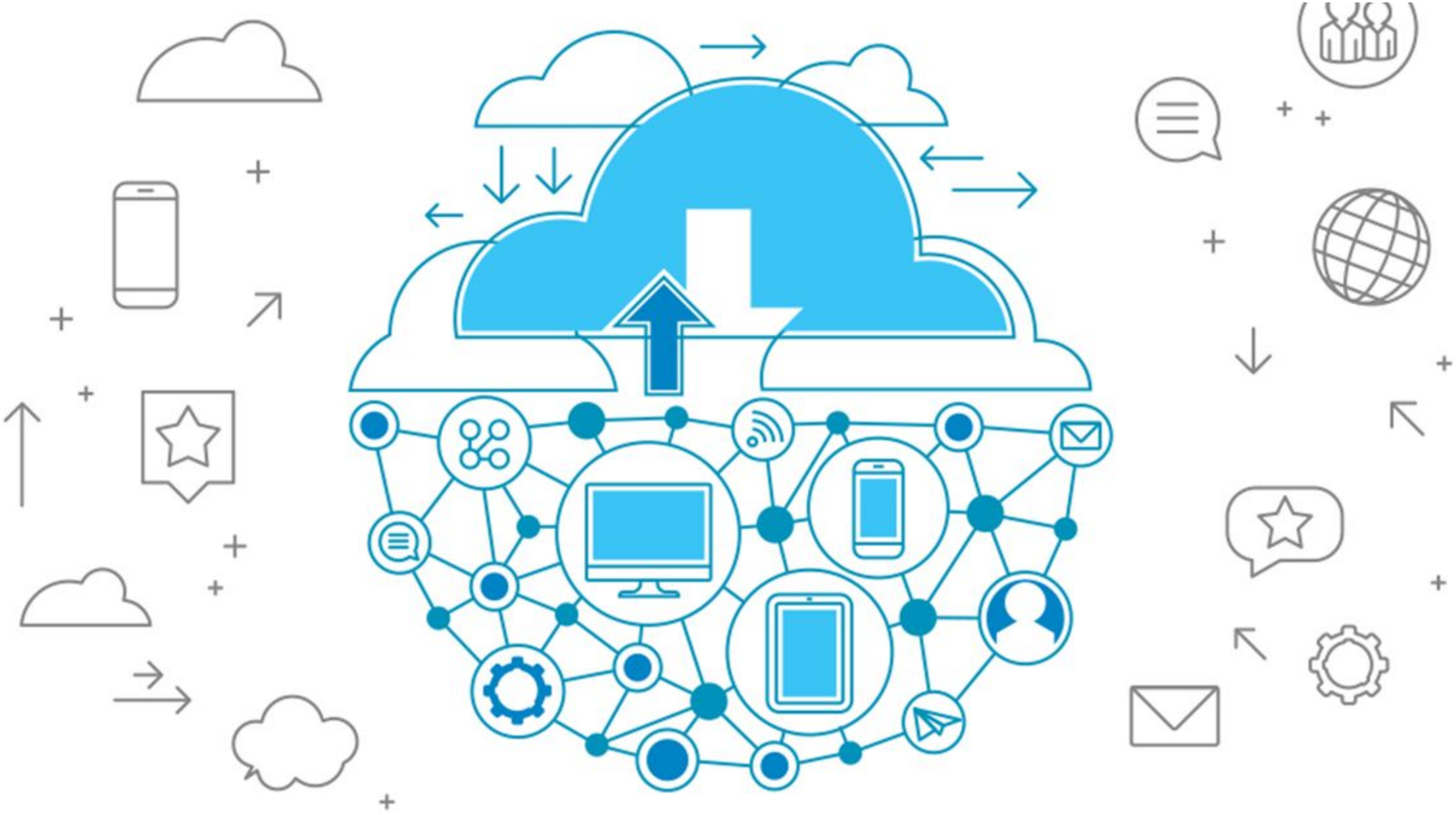
Account Settings

App Settings

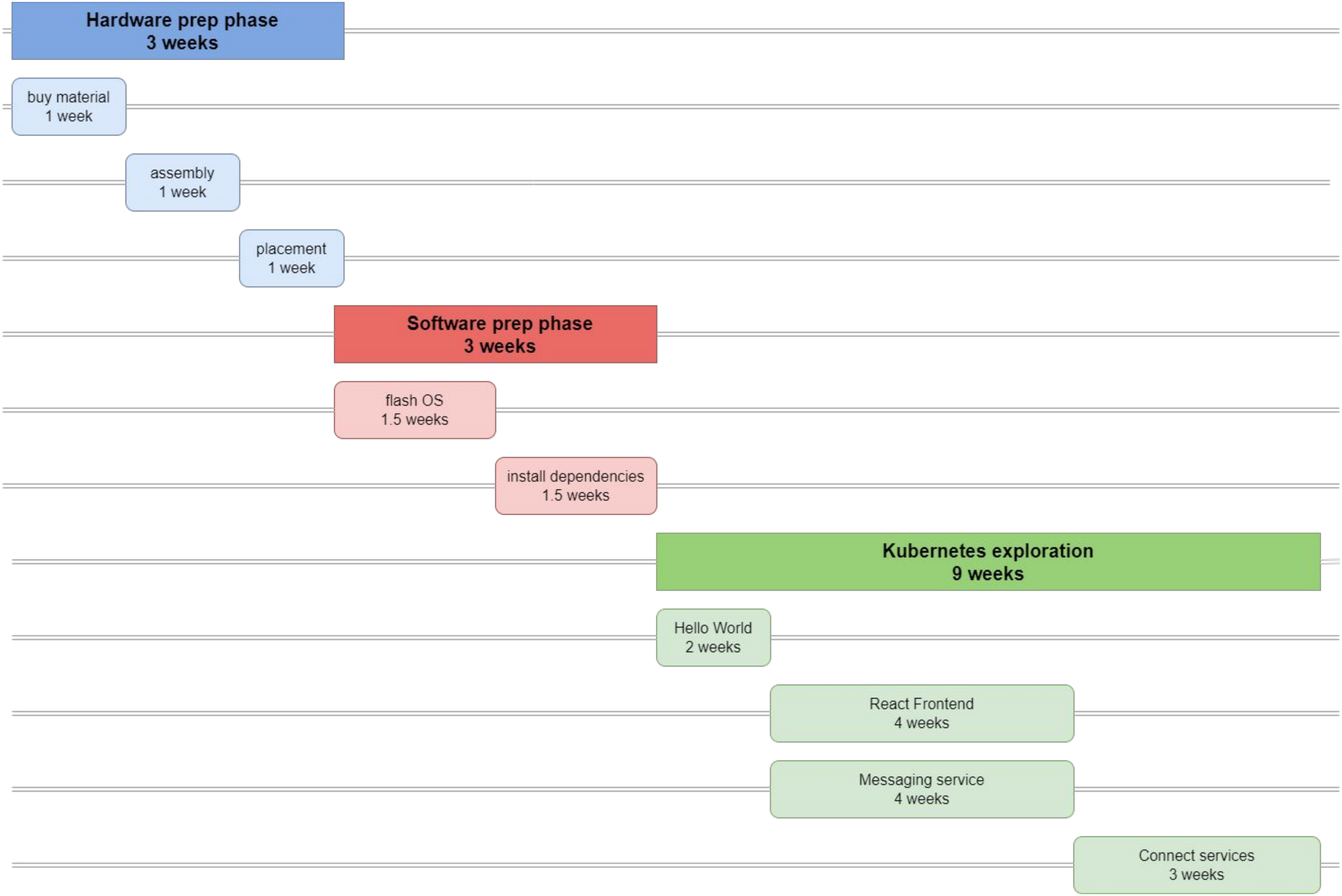

Expo 1
⏰ 1 hour
Message
Message


Ames, IA
Town Engineering Building
Armory
Teaching Sculpture
Osborn Driv
Coover Hall
Snedecor Hall
Atanasoff Hall
Kocimski Auditorium
Sequence
Howe Hall
Sukup Hall
Sukup Atrium
Elings Hall
Durham Center
Black Engineering
Pearson Hall
Beyer Hall
Expo Name

Design Complexity



Project Plan



Hardware prep phase
3 weeks

buy material
1 week

assembly
1 week

placement
1 week

Software prep phase
3 weeks

flash OS
1.5 weeks

install dependencies
1.5 weeks

Kubernetes exploration
9 weeks

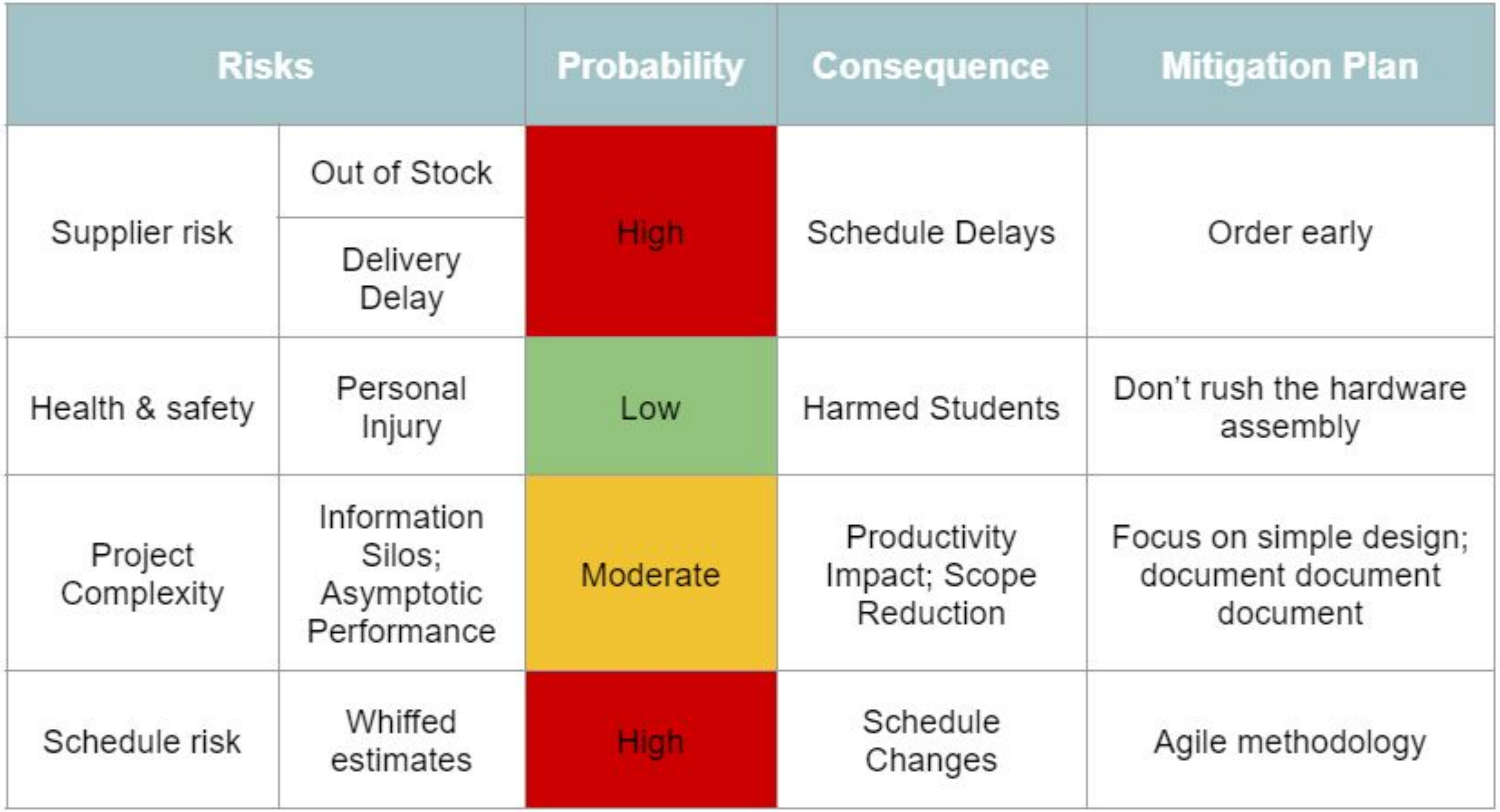
Hello World
2 weeks

React Frontend
4 weeks

Messaging service
4 weeks

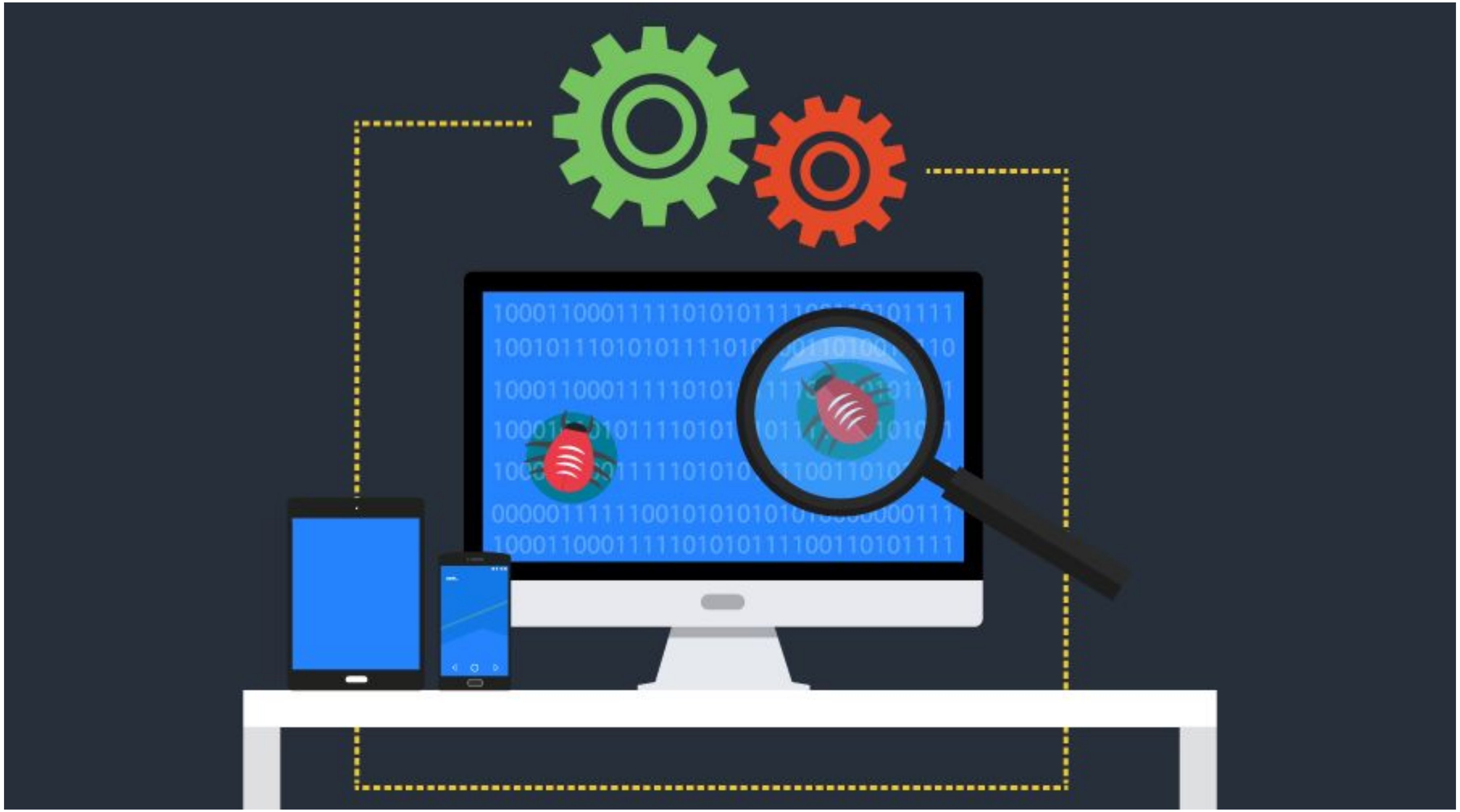
Connect services
3 weeks

Risk Mitigation



Risks		Probability	Consequence	Mitigation Plan
Supplier risk	Out of Stock	High	Schedule Delays	Order early
	Delivery Delay			
Health & safety	Personal Injury	Low	Harmed Students	Don’t rush the hardware assembly
Project Complexity	Information Silos; Asymptotic Performance	Moderate	Productivity Impact; Scope Reduction	Focus on simple design; document document document
Schedule risk	Whiffed estimates	High	Schedule Changes	Agile methodology

Test Plan



Unit and Interface Testing

- Unit testing
    - JEST

Unit and Interface Testing

- Unit testing
  - JEST
- Interface testing
  - JEST

Unit and Interface Testing

- Unit testing
  - JEST
- Interface testing
  - JEST
- Integration testing
  - JEST

Unit and Interface Testing

- Unit testing
  - JEST
- Interface testing
  - JEST
- Integration testing
  - JEST
- Load testing
  - K6

Unit and Interface Testing

- Unit testing
    - JEST
- Interface testing
    - JEST
- Integration testing
    - JEST
- Load testing
    - K6
- Regression testing
    - CI/CD Pipeline integration

Unit and Interface Testing

- Unit testing
  - JEST
- Interface testing
  - JEST
- Integration testing
  - JEST
- Load testing
  - K6
- Regression testing
  - CI/CD Pipeline integration
- Acceptance testing
  - User acceptance phase after sprints

Conclusion

Thank you!

Questions

Extra Slides

Prototype Implementations

Tinkering with the dev environment