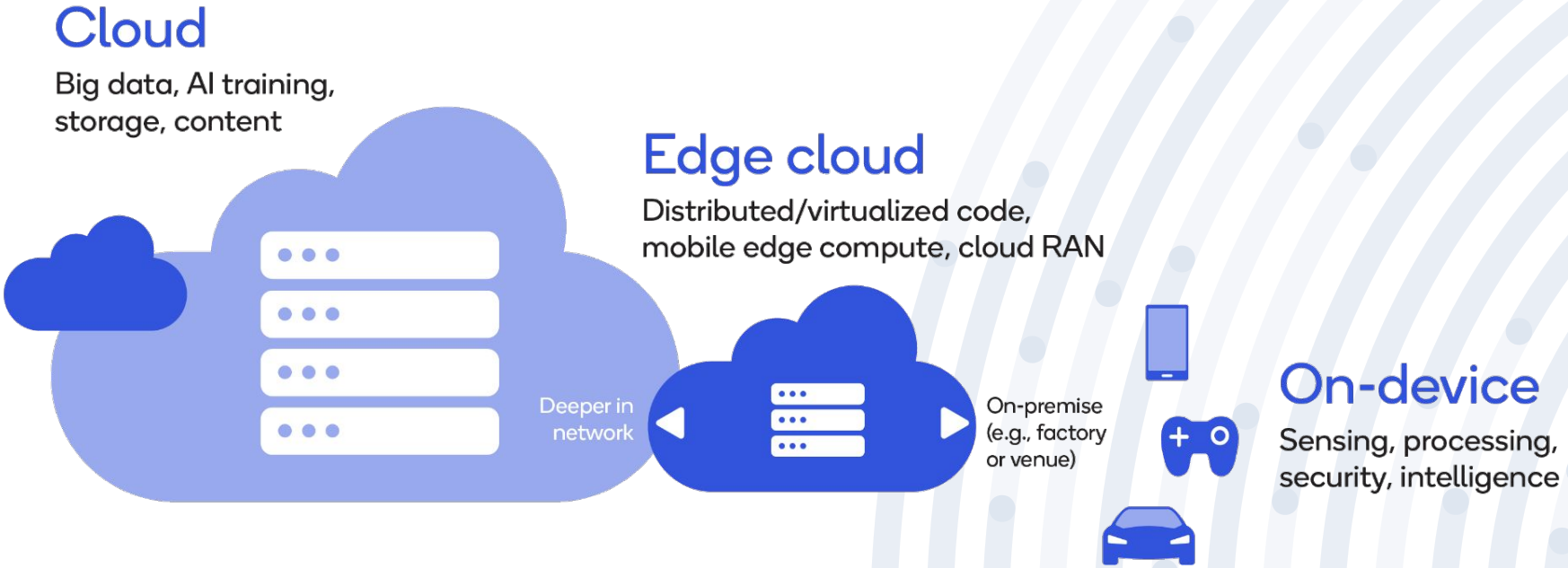
An Exploration of Edge Cloud Computing with Turing Pi and Kubernetes

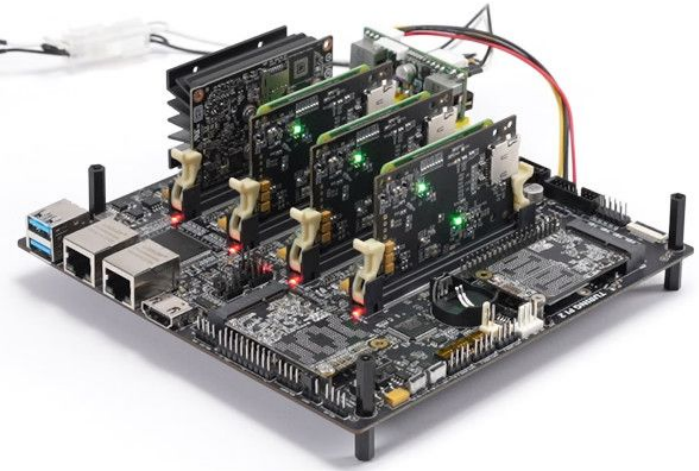
Introduction

Edge cloud computing

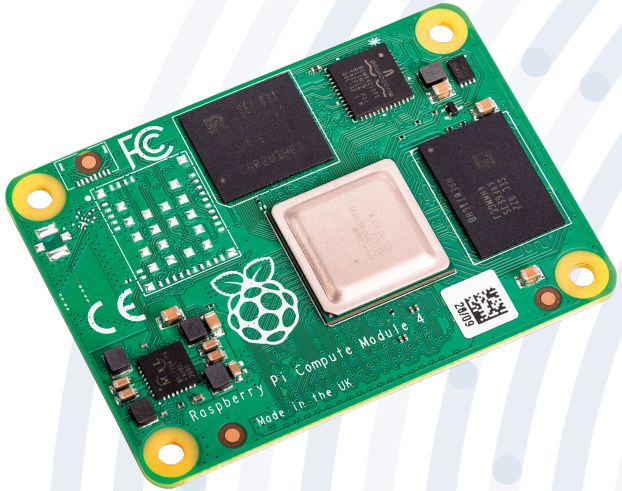


Hardware Components

Turing Pi as the Edge Computing Cluster



Raspberry Compute Modules for processing



Software Components

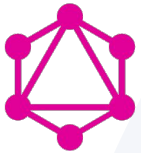
Lightweight Kubernetes

In-memory data structure store used as a database

Spatial database extender allowing location queries to be run in SQL

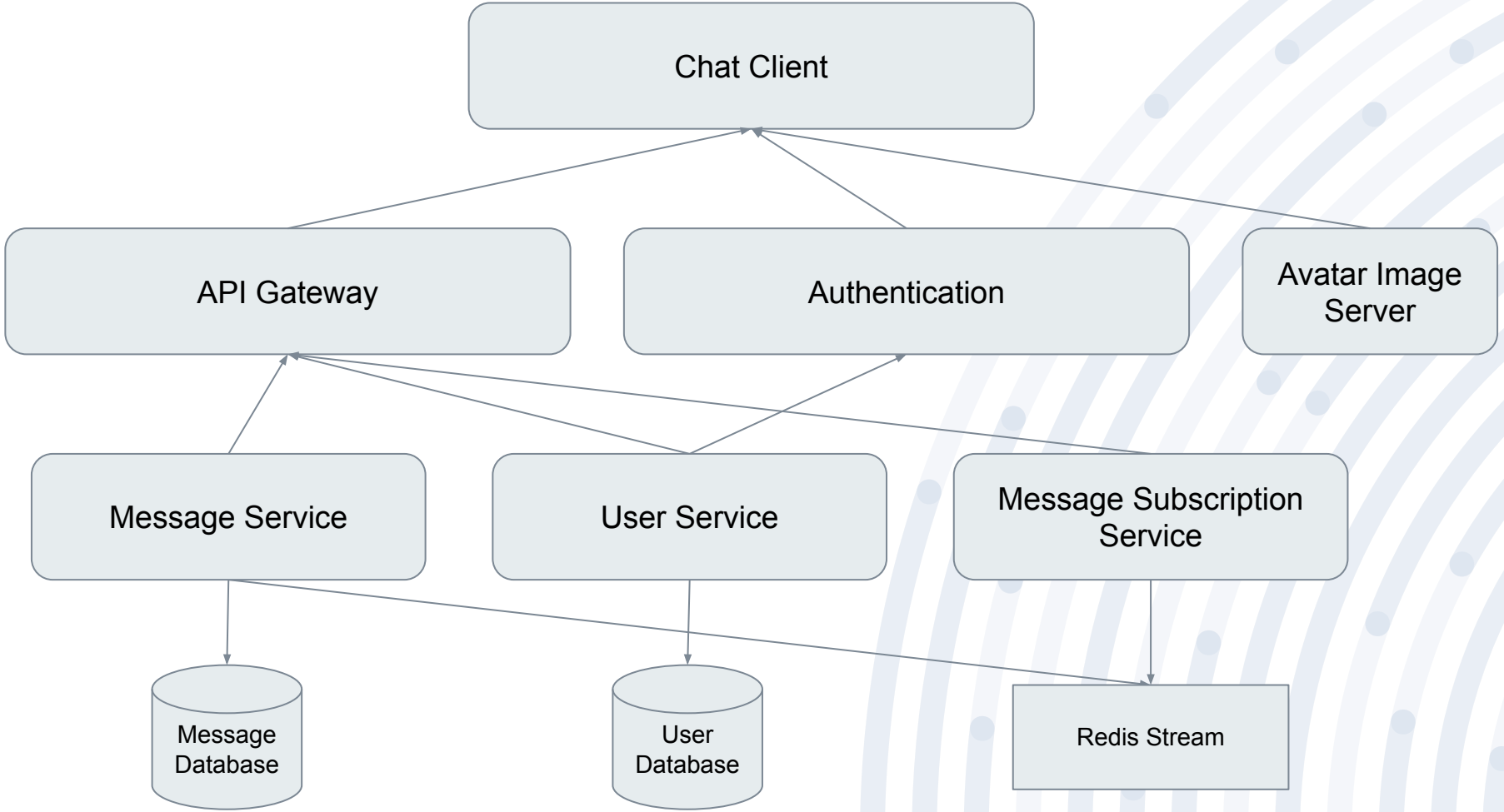
Software Components

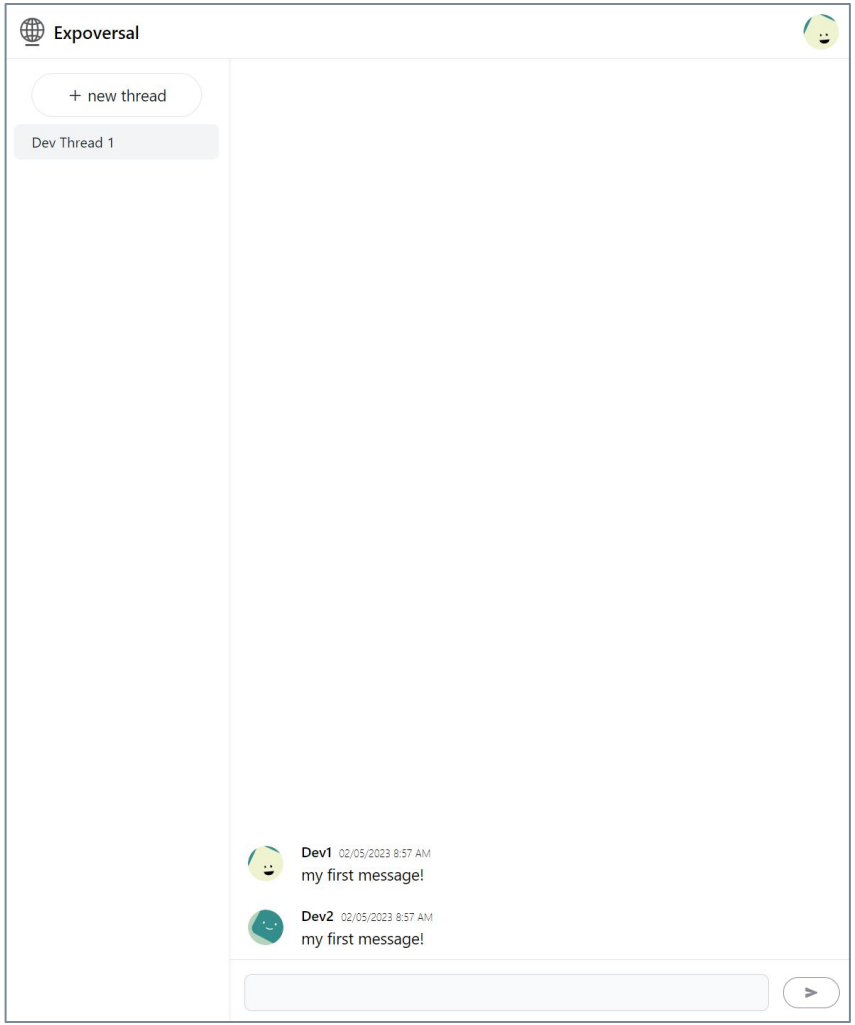
Vite for frontend tooling



Query language for our API

JavaScript runtime environment


Chat Client
API Gateway
Authentication
Avatar Image Server
Message Service
User Service
Message Subscription Service
Message Database
User Database
Redis Stream



- State management using Recoil
- Using Relay for GraphQL client

Example Query

```
# on gateway
query firstTenThreads {
 threads(first: 10) {
  edges {
   node {
    createdAt
    id
    name
    createdUser {
     avatarUrl
     createdAt
     id
     username
    }
   }
  }
 }
}
```

```
# on message service
query {
 threads(first: 10) {
  edges {
   node {
    createdAt
    id
    createdUser {
     id
    }
   }
  }
 }
}
```

$ids: [ID!]

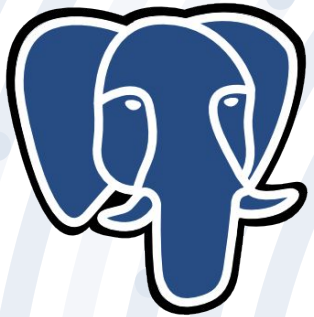
```
# on user service
query ($ids: [ID!] ) {
 nodes(ids: $ids) {
  ... on User {
   id
   avatarUrl
   username
  }
 }
}
```

Accomplishments

- Set up hardware
- Explored new technologies
- Implemented a complex architecture
- Developed a frontend

Challenges

- Delays in receiving hardware
- Team reorganization
- Architecture redesigns



PostgreSQL

Future Work

- Complete messaging application features
- Connecting the hardware and the software
- Continuing future explorations on edge cloud computing
- Quantifying latency, bandwidth, etc.

Contributions

Bryce Carter:

- Market Research

Chee Hau:

- Setting up Turing Pi

James Gibbs:

- Frontend/Backend

Kyoungkeun Lee:

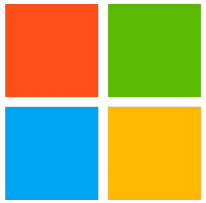
- Building hardware
- Configuration setup

Theodore Thayib:

- Hardware/configuration setup

Conclusion

Distributed computation is already a reality



Microsoft

Google