

Design Review

Team Lora



Ryan Wallace, Benjamin Couey, Mohammed Alfouzan, Brandon Salter

Sponsor: Dr. Morgan Vigil-Hayes

Mentor: Scooter

Our Sponsor

- Dr. Vigil-Hayes
- Her research lab Community Aware Networks & Information Systems (CANIS)
 - Network traces, network scientific analysis, wireless network design, and software development



Problem Statement

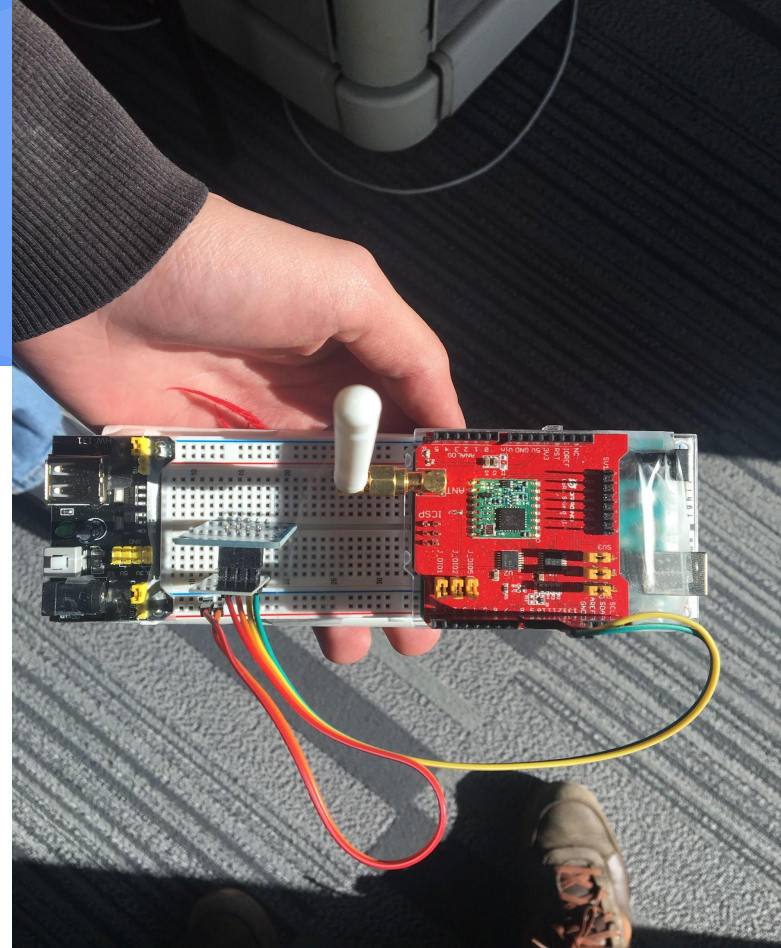
- Cell and satellite networks are expensive to install
 - Average cost of a cell tower is \$175,000
 - Unavailable in rural areas
- LoRaWAN is new and exciting
 - Fraction of the power and cost
 - Costs less than \$1000
- Our Clients goals
 - Enable mobile crowdsensing
 - Expand connectivity in rural areas



A LoRa Gateway

Problem Statement

- Currently no generic LoRaWAN interface for mobile development
 - Makes it harder to develop apps that communicate over LoRaWAN
 - Slows the adoption of LoRaWAN technology

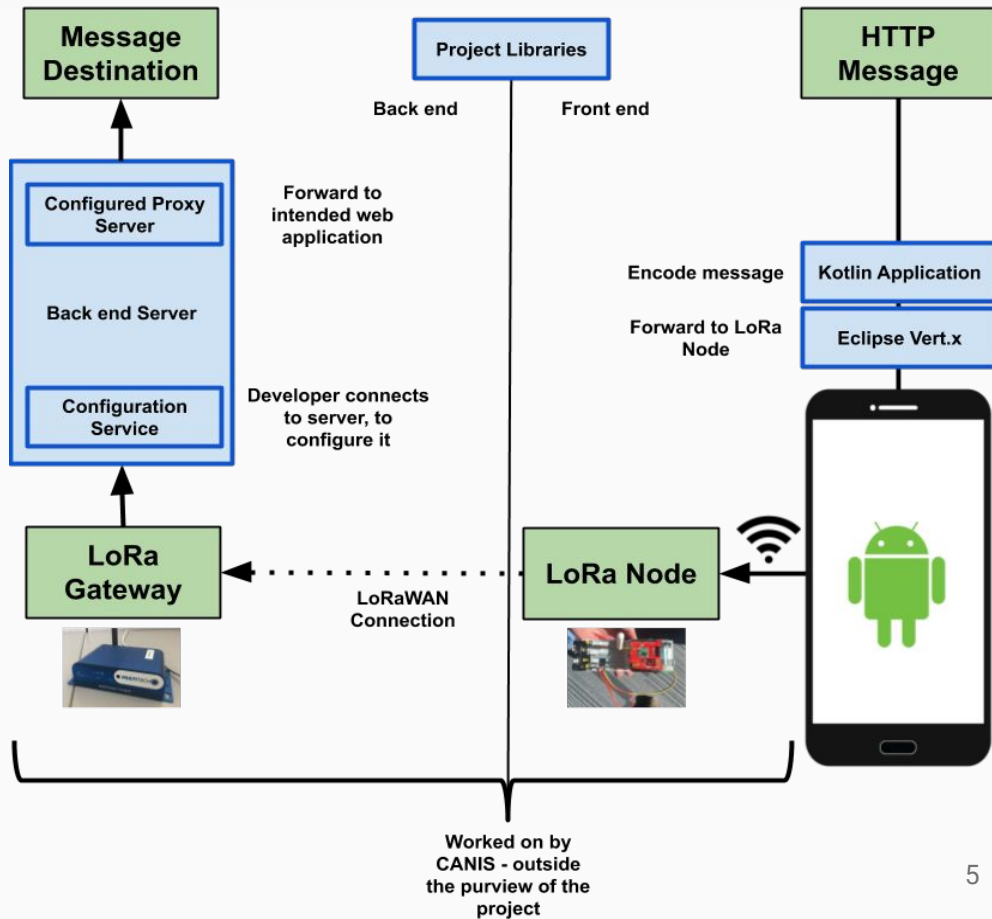


A LoRa Node

Solution Overview

- On the Android smartphones:
(Using Kotlin):
 - Simple Interface
 - Libraries
- CANIS lab is responsible for:
 - Fragmenting on LoRa Node
 - Resembling on LoRa Gateway
- A Proxy server that connects to the LoRa Gateway
(Using Python):
 - Extensible libraries
 - API hooks
 - Configuration Services

The Journey of an HTTP message through our implementation



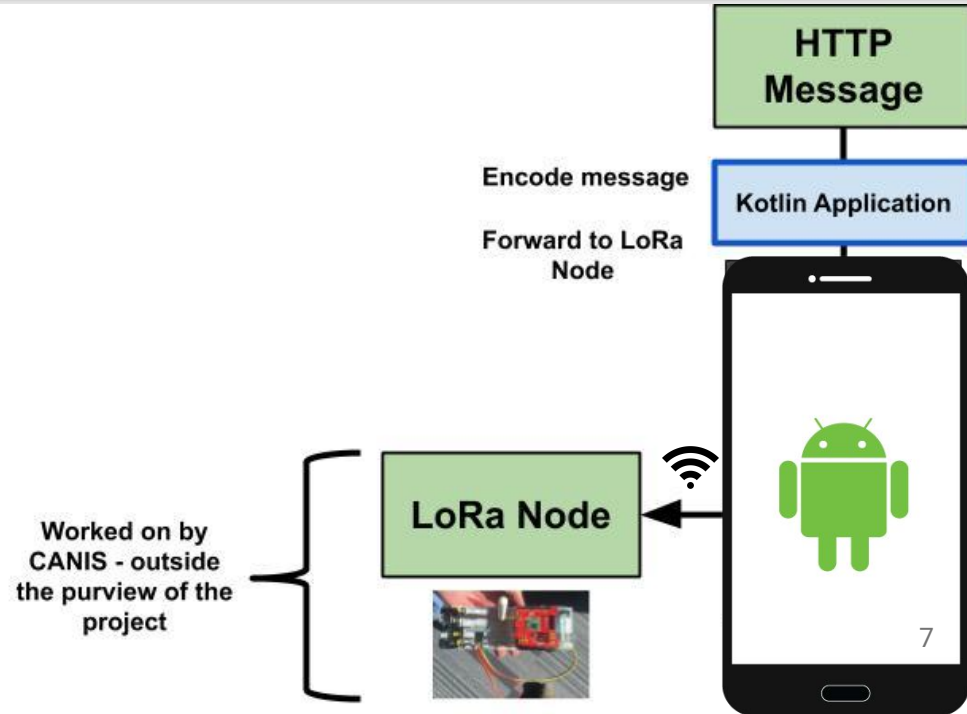
Domain Level Requirements

- Acquired these requirements from meetings with the client
 - An Android library for connecting to LoRaWAN
 - A configurable proxy server for the LoRa Gateway
 - A proof of concept Android application which implements the aforementioned library and server
 - The library and server must be easily usable and extendible



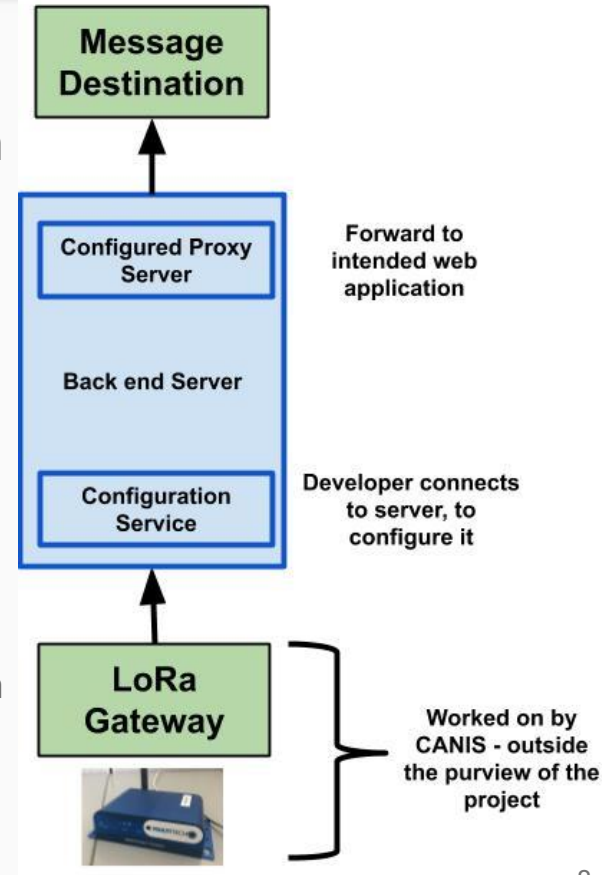
Functional Requirements

- Android library that abstracts data transmission over LoRa
 - Establish a wifi connection with the LoRaNode
 - Encapsulate dynamic messages in a modular manner
 - Send these newly created messages to the LoRaNode



Functional Requirements (continued)

- Configurable backend server to abstract receiving messages from the LoRa Gateway and forwarding them to their destination
 - A utility service running on the server which provides an interface which allows developers to connect to the server and configure it.
 - Accepts a secure remote connection from a developer
 - Accept a definition of the type of message to be received
 - A list of fields within the message's metadata.
 - The length of the messages expected.
 - The message's ultimate destination.
 - Accept a list of API hooks which the destination supports.
 - A proxy server which is generated based on the above information
 - Multiple proxy servers can run concurrently



Non-Functional & Environment Requirements

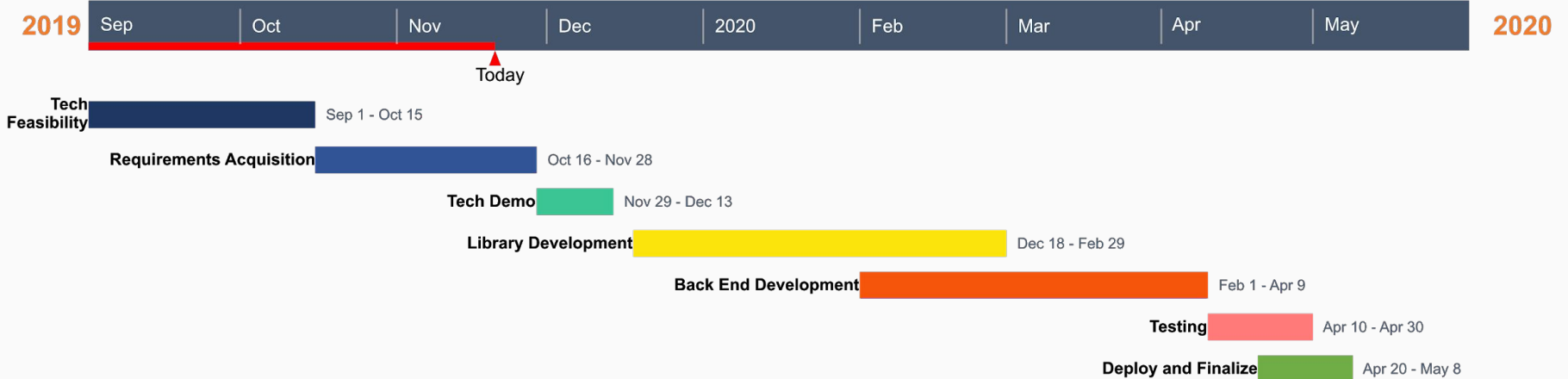
- The library will maintain the security of data entrusted to it
 - Security standards for wifi connections
- The library will be easily usable by future developers
 - Extensive wiki on Github repo
- The library will be easily extensible by future developers
 - Avoid Android-specific implementation
- Compatibility with CANIS lab with the LoRa Node
 - WiFi connection with LoRa Node's ESP32 chip.
- Compatibility with CANIS lab with the LoRa Gateway
 - MQTT connection with LoRa Gateway MQTT client

Potential Risks and Feasibility

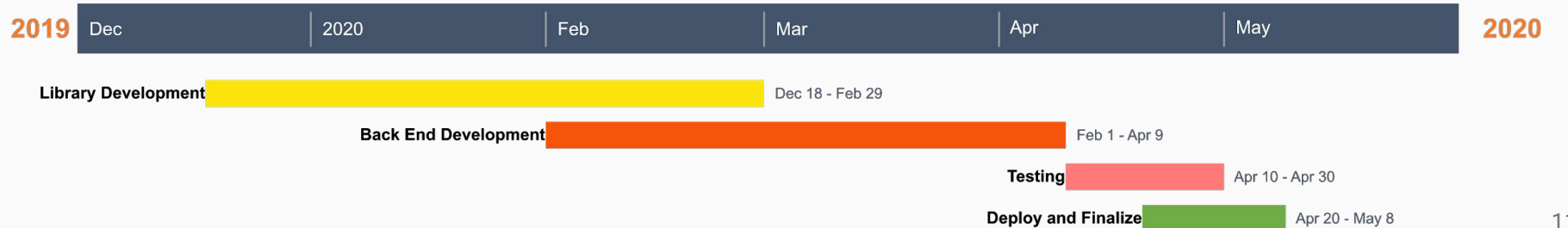
- Security Vulnerability in Library [Unlikely Chance]
 - Would make the library unusable
 - Somewhat unlikely; Wifi and IP connections are mature technologies
- Competing Standard [Medium Chance]
 - Someone else builds library or service similar to the project's
- Changing Technology [Small Chance]
 - LoRaWAN changes its technology in some major way that depreciates our library.
- Android OS Technology Changes [Small Chance]
 - Android Operating System gets updated making our libraries no longer functional.

Project Schedule

Year Schedule



Spring Schedule



Conclusion

- LoRaWAN is a new technology that saves money and energy
- Our clients goal is to increase connectivity in rural areas
- Client needs tools to ease development
- Building libraries on both side of the pipeline

Questions?



Range of LoRaWAN

- **In an urban area:**
 - 5 - 10 Miles
 - Between 4 - 6 Buildings
- **With clear line of sight:**
 - 100 - 300 Miles

23 - 60 Bytes