Apollo Architecture Enhancement

Video URL: https://youtu.be/zJfWaaGPGs0
Presenters: All Group Members

Apollogizers

Group 25

Lavi Ionas - Group Leader, Use Cases, Impacts

Xinyu Chen - Introduction, Implementation Graph, Plans for Testing, Potential Risks

John Scott - Overview, implementation analysis and effect on architecture

Baorong Wei - SAAM Analysis, Conclusion

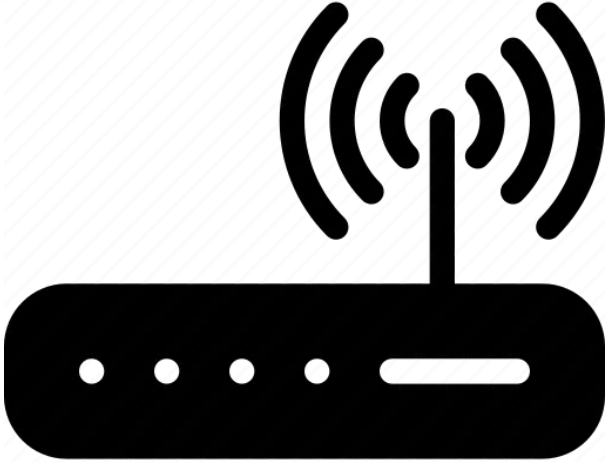
Zhihan Hu - SAAM Analysis, Presentation Editing

Anthony Galassi - Enhancement Motivation, Lessons Learned

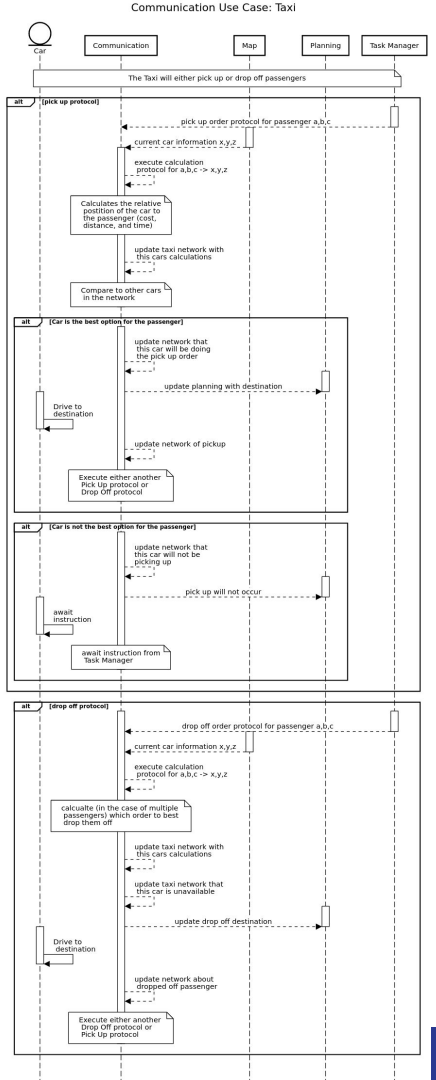
Introduction & Overview

Motivation

- Implement a new module in the Apollo software called Communication
- Would contain two sub-modules Parking and Taxi
- Add functionality for automatically parking and Taxi services



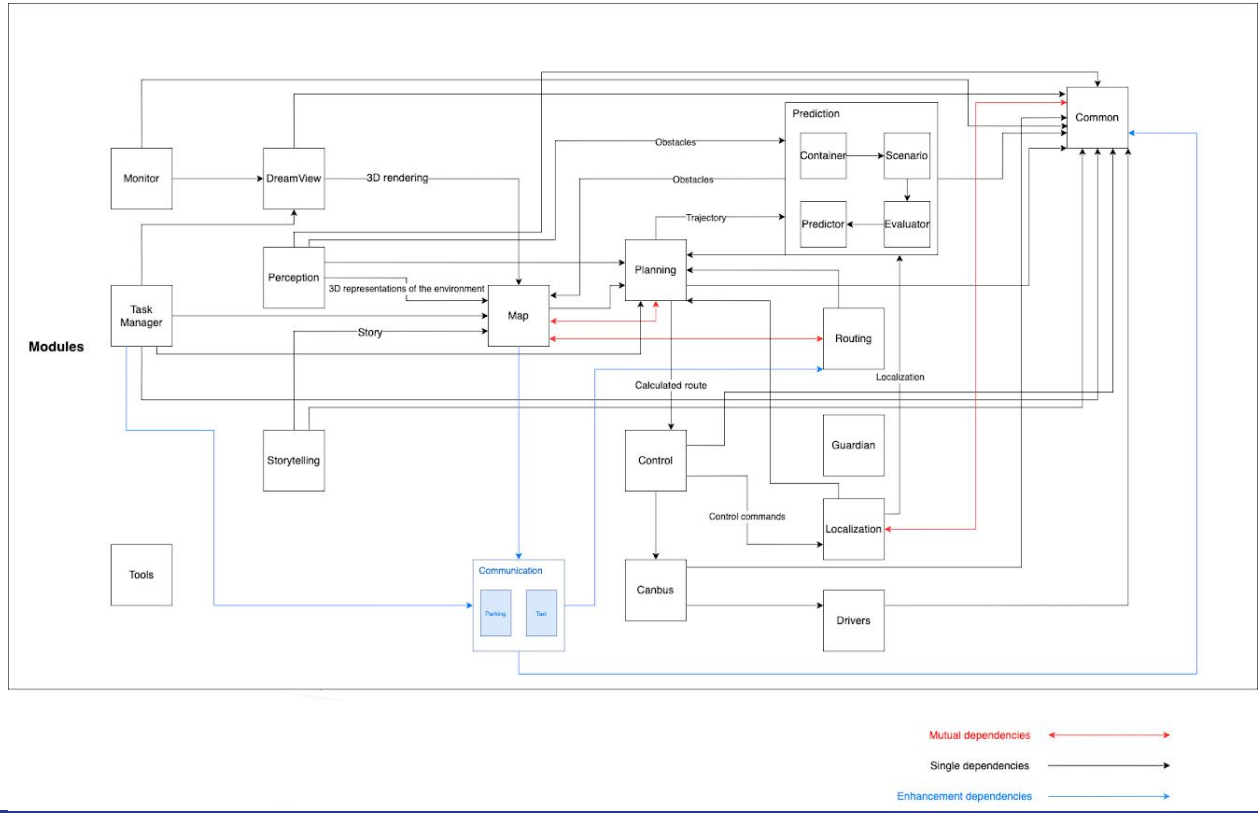
Sequence Diagram
Use Case: Taxi



Implementation

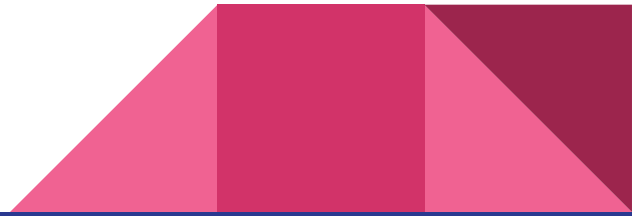
Use of

- V2X
- Perception
- Localization
- Routing
- HD Map



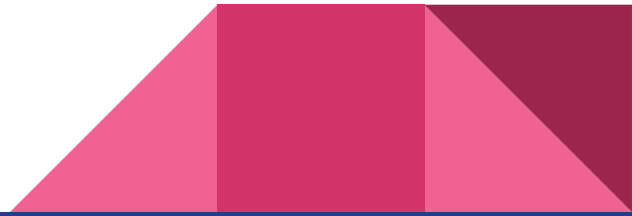
Plans for Testing

- Tests in the lab
- Tests on public roads



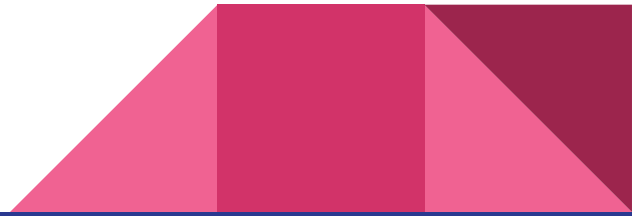
Potential Risks

- Lack of communication
- Traffic / Gridlock
- Accident liability
- Passenger’s security



SAAM Analysis

- Overview
- Stakeholders
  - Ride-hailing Service Providers and Users
  - Apollo Users and Developers
  - Parking Lot Owners and Users



Scenarios & Non-Functional Requirements

- Scenarios
  - Set to locate a parking lot
  - Help other Apollo Cars locate a parking spot
  - Updates the status of the current parking spot
  - Sets to turn to Ride-hailing Service
  - Gets data from Ride-hailing Service Providers
    - I.e., Passengers' location and destination
- NFRs
  - Locate easily and quickly
  - Find the closest passenger and plan the best route
  - Help to locate a parking space and minimize the energy consumption
  - Operates safely

Two Different Ways for this Enhancement & Comparison

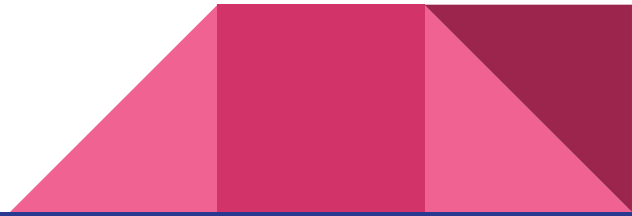
- The Chosen Implementation
  - Calculate the scenarios when the situation is settled
- The Alternative Implementation
  - Update the process along the way

Comparison & Evaluation

Scenarios	The Chosen Implementation	The Alternative Implementation
Locate a Parking Spot	Locate the spot before entering the parking lot. Pros: Saves memory & calculation process as it only considers parking before entering the parking lot Cons: May not find the optimal position	Update the located spot all along the way. Pros: Can find the optimal position as it gets updates of the parking lot along the way Cons: Use more memory & require continuous calculation of the parking lot & more difficult for developers
Help Locate a Parking Spot	Use cameras to help locate a parking spot before a car is entering Pros: More energy-saving & use less memory Cons: May not help find the optimal position	Continuously use cameras to help locate a parking spot Pros: Can help find the optimal position Cons: Less energy-saving as the cameras and other functionalities require to be on continuously & more memory-consuming
Turn to Ride -hailing Service	Lock to a specific client before starting Pros: More memory-saving as it only needs to focus on a single client & safer as all the requirements are settled before leaving Cons: May not find the optimal/closest passenger	Update the client along its way Pros: Can find the most suitable passenger as it constantly gets updates of new clients Cons: Use more memory & may be less safe as it may suddenly turn to a closer client

Lessons Learned

- Large software systems such as Apollo can be enhanced through innovative technology and ideas
- Improved our report workload organization
- Kept our ideas grounded and concurrent throughout the conceptual and concrete architecture of our software enhancements
- We’ve learned how a real-world idea can be implemented into existing software



Conclusion

Within this report, we discussed our thoughts on the enhancement, the Communication Module, and its functionalities. We clearly stated the motivation and implementation of this enhancement, by using diagrams and tables, and we pointed out the effect of the enhancement on software architecture. We also discussed the testing of our enhancement, both in labs and on roads, and thought of the potential risks. We used 2 Use Case Diagrams to represent the interactions between the Communication Module and other subsystems. We also did a SAAM Analysis to compare the implementation methods based on the stakeholders and the non-functional requirements, and we showed our evaluation of this analysis.