

# Report for IPWAVE Basic Protocols Project @ IETF-104 Hackathon



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**Champion: Jaehoon Paul Jeong**  
**pauljeong@skku.edu**  
**Sungkyunkwan University**

# Goal of IPWAVE Basic Protocols Project

## ❖ Implementation of IPv6 Over IEEE 802.11-OCB and **IPv6 Vehicular Neighbor Discovery**

1. Router and Prefix Discovery along with IPv6 Address Autoconfiguration
2. Address Registration and Duplicate Address Detection Procedure
3. Multihop DAD Procedure via V2V Communications

# IPWAVE Hackathon Project Poster

## IP Wireless Access in Vehicular Environments (IPWAVE) Basic Protocols Project

Champion: Jaehoon Paul Jeong (SKKU)



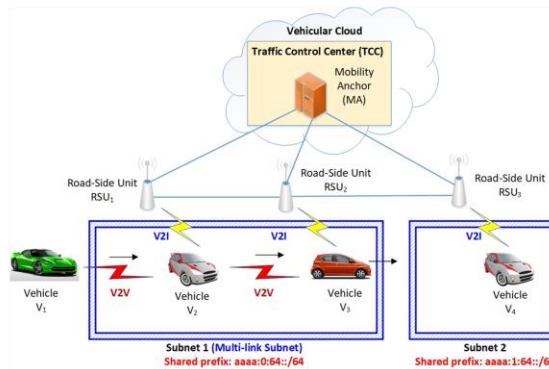
### Professors

- Jaehoon Paul Jeong (SKKU)
- Younghan Kim (SSU)

### Students

- Zhong Xiang (SKKU)
- Yiwen Chris Shen (SKKU)
- Kyoungjae Sun (SSU)

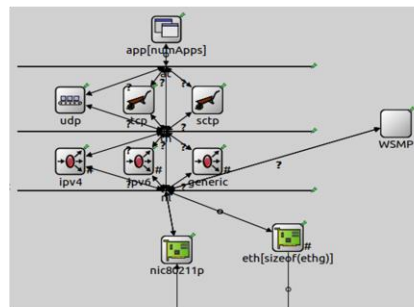
### Vehicular Network Architecture



### WAVE Stack



### Node Structure in OMNeT++



### Objective of this Hackathon

- Demonstrate IPWAVE basic protocols
- Discover technology gaps

### Where to get code

- Github – Source Code  
✓ <https://github.com/ipwave-hackathon-ietf>

### Where to get video clip

- Youtube – Demonstration  
✓ <https://youtu.be/sKYfa0MC6Jg>

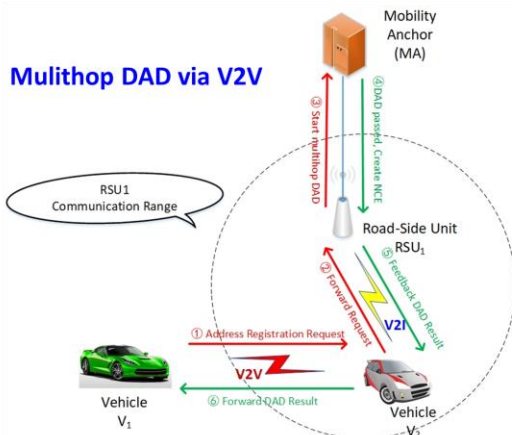
### What to pull down to set up an environment

- OS: Ubuntu 16.04
- OMNeT++: 5.4.1
- SUMO: 0.32.0
- Veins: 4.7.1
- INET Framework: 4.0.0

### Contents of Implementation

- Transmission of IPv6 Packets over IEEE 802.11-OCB
- IPv6 Neighbor Discovery for IP-Based Vehicular Networks
  - ✓ Router and Prefix Discovery along with IPv6 Address Autoconfiguration
  - ✓ Address Registration and Duplicate Address Detection Process
  - ✓ Multihop DAD Process via V2V communications
- Build IPv6/TCP/UDP protocol stack based on VEINS-4.7.1 and INET-4.0
- Build a basic IPWAVE running scenario via V2I and V2V based on VEINS-4.7.1 and SUMO-0.32.0

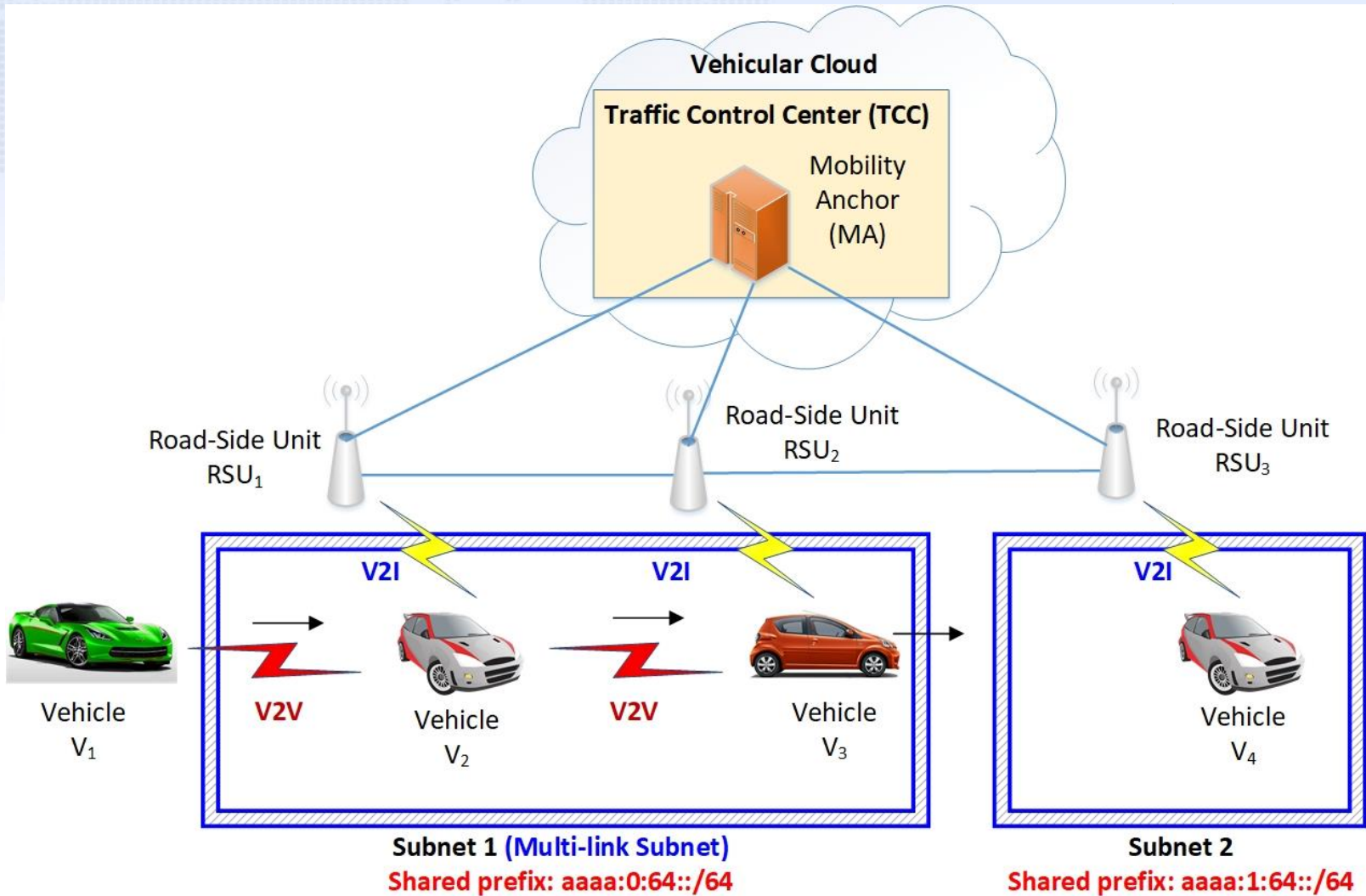
### Multihop DAD via V2V



# IPWAVE Hackathon Project Activity

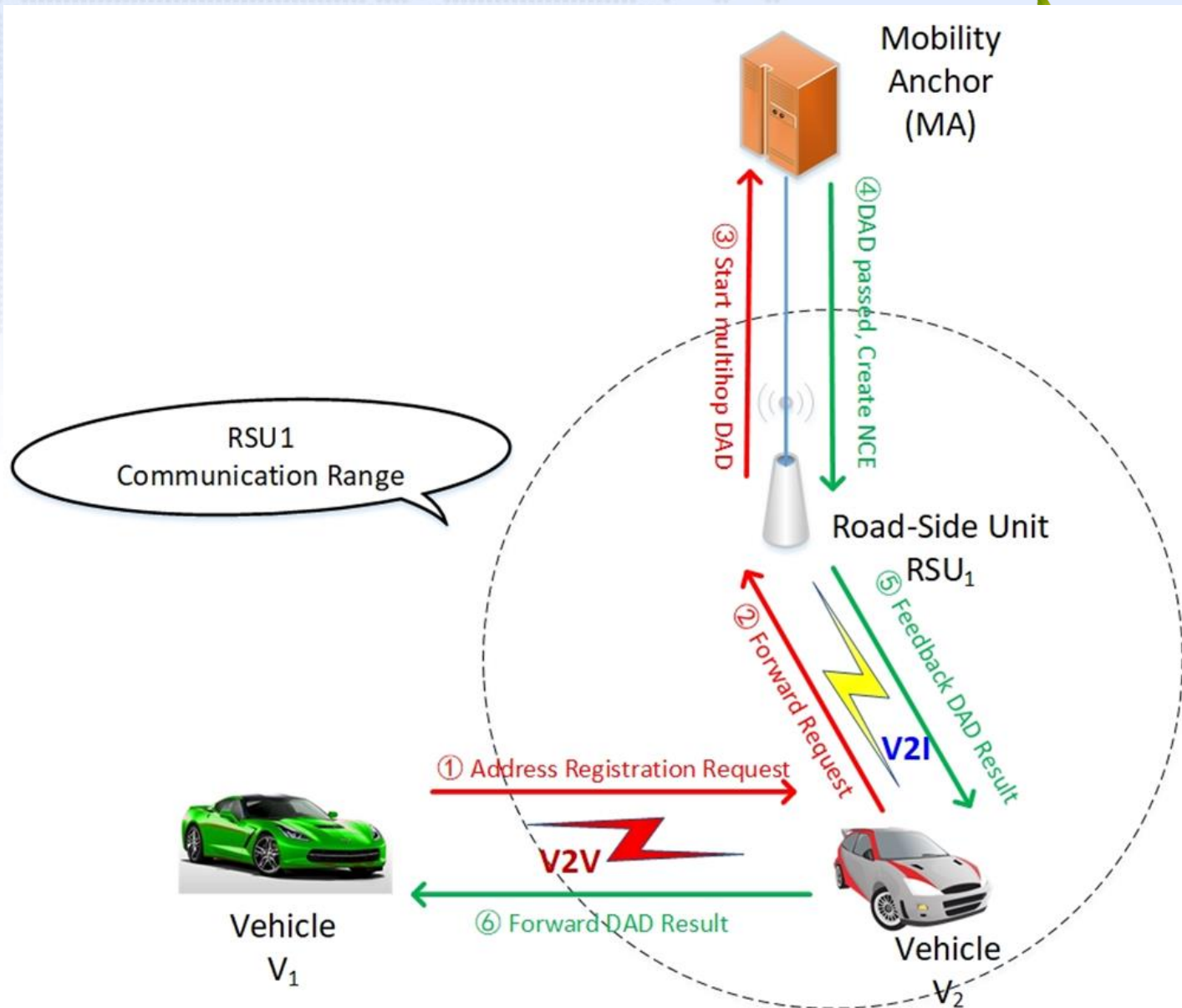


# Vehicular Network Architecture



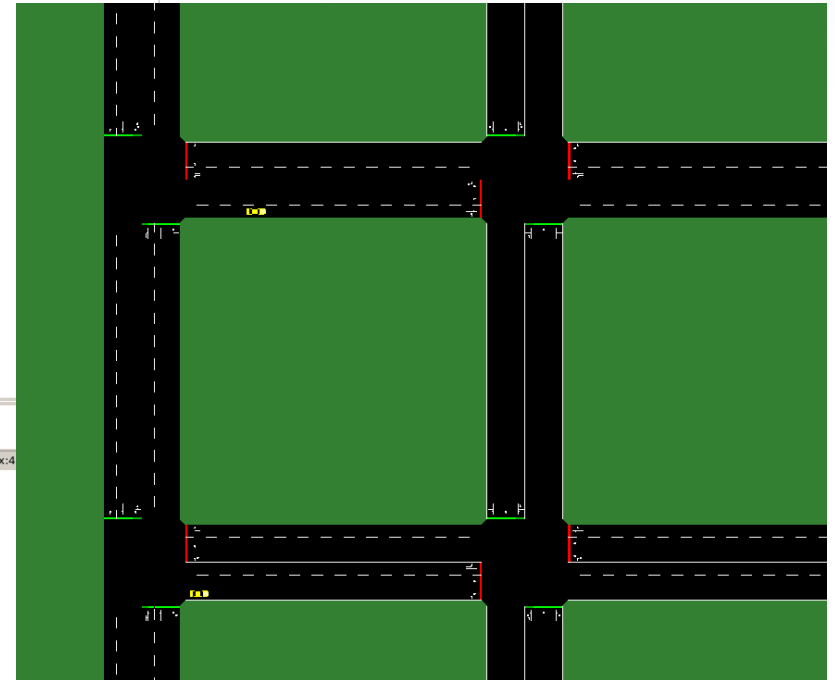
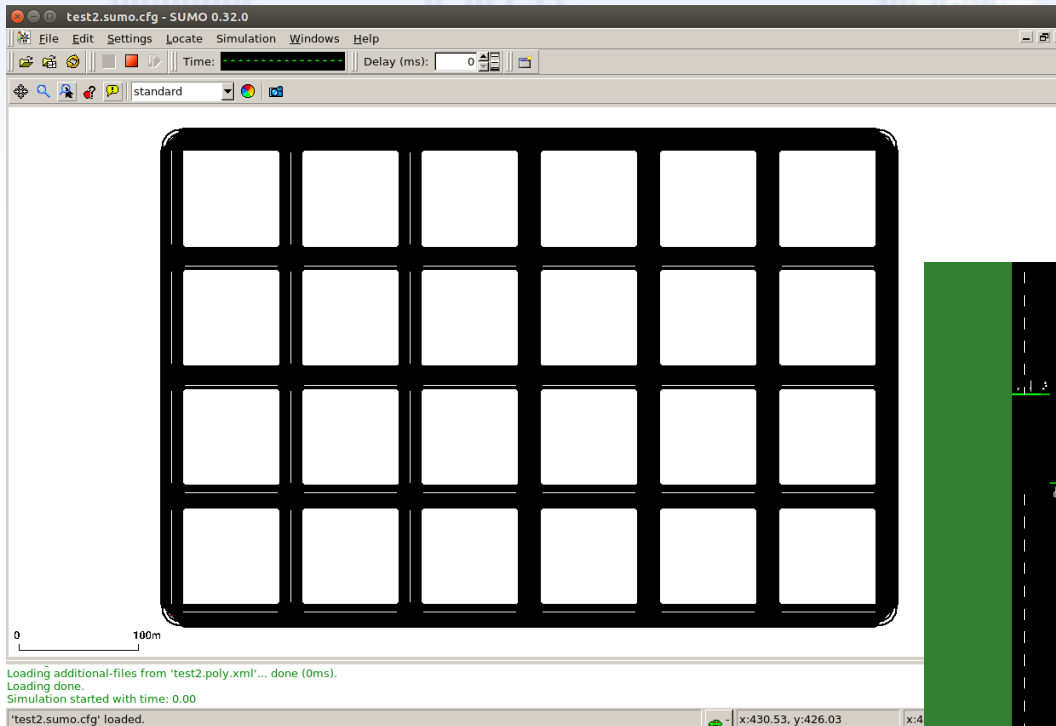
## Vehicular Network Architecture for V2I and V2V Networking

# Multihop DAD in Vehicular ND



# Road Network Architecture (1/2)

- ✓ A 7\*6 grid map with 3 lanes for a road network



# Road Network Architecture (2/2)

## ✓ Two RSUs :

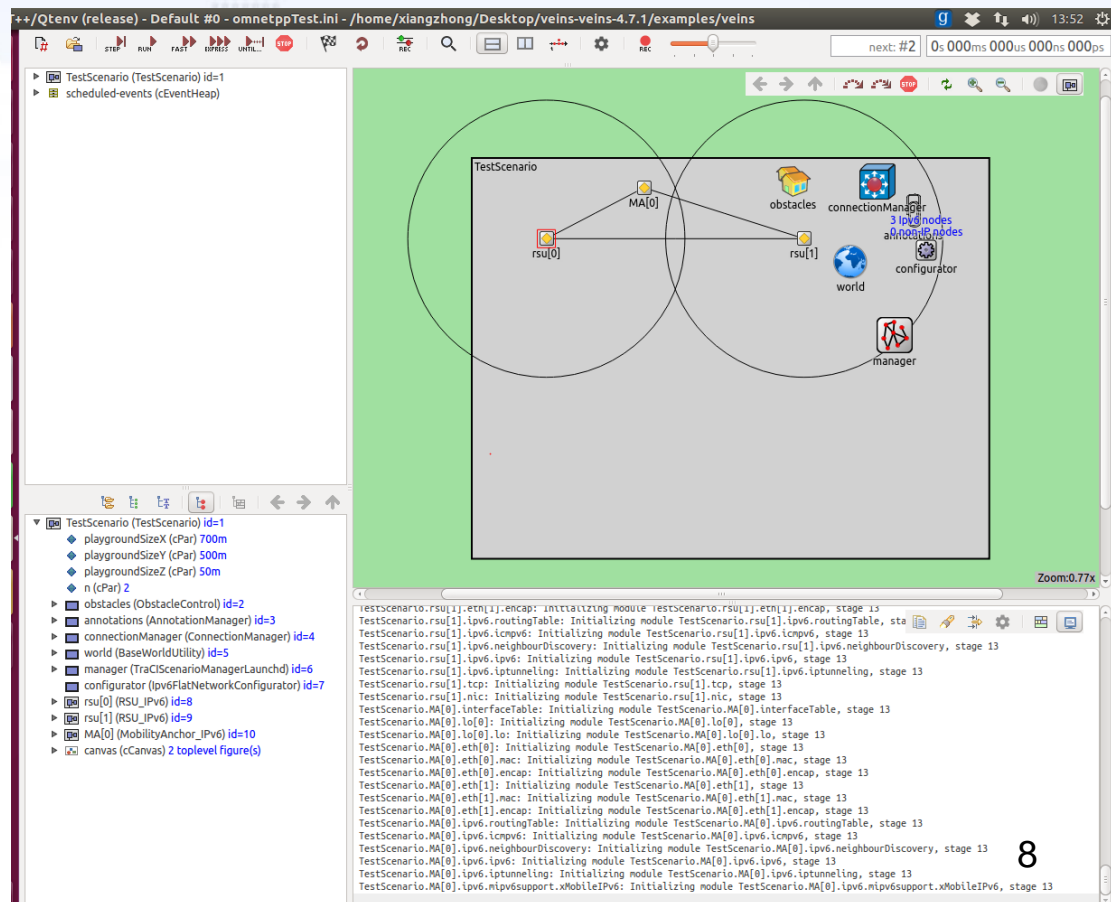
- Belong to one subnet.
- Connect with each other through Ethernet.

## ✓ Two Vehicles :

- One is outside the coverage of RSUs.

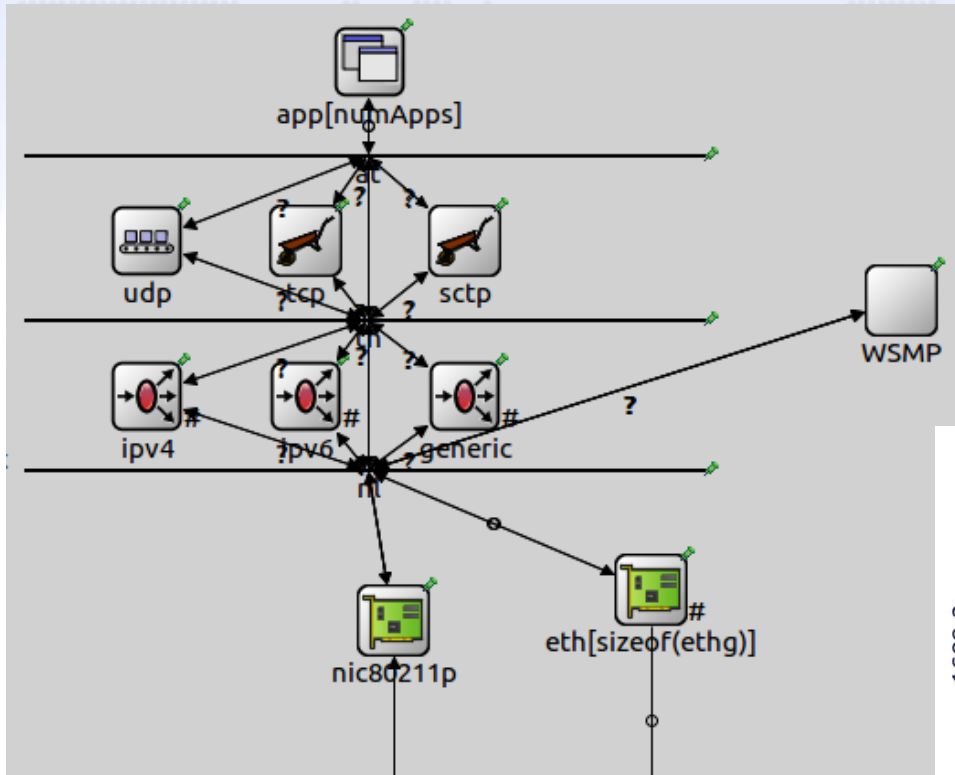
## ✓ Mobility Anchor:

- Manage RSUs and Vehicles.



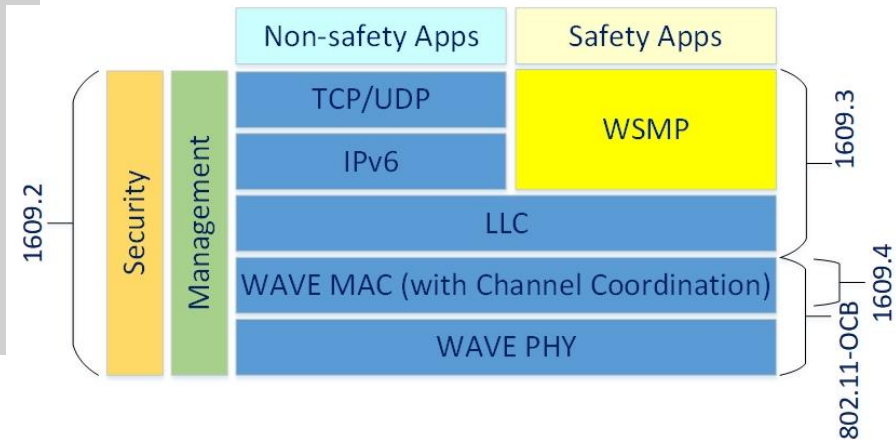


# Vehicle Structure in Network Simulator



Vehicle Structure

## WAVE Stack



# Lessons from IETF-104 Hackathon Project

## ➤ **Proof of Concept (POC) of IPWAVE-VND Protocol**

- **IPWAVE- Vehicular Neighbor Discovery (VND)**

## ➤ **Design and Implementation of IPWAVE-VND in OMNeT++ and SUMO**

- **Design of IPWAVE-VND Framework in OMNeT++**
- **Implementation of IPv6 over IEEE 802.11-OCB**

## ➤ **Proposal of Flexible Mobility Management for IPWAVE-VND**

- **Simplify handover procedure between adjacent RSUs**
- **Alleviate flow pressure at Mobility Anchor**



# Appendix

- Hackathon Development Environment
- Open-Source Depository of IPWAVE Basic Protocols Project
- Demonstration Video Clip of IPWAVE Basic Protocols Project

# Hackathon Development Environment

<b>OS</b>	<b><u>Ubuntu Linux 16.04</u></b>
<b>OMNeT++</b>	<b>Version 5.4.1</b>
<b>SUMO</b>	<b>Version 0.32.0</b>
<b>Veins</b>	<b>Version 4.7.1</b>
<b>INET Framework</b>	<b>Version 4.0.0</b>

# Open-Source Depository of IPWAVE Basic Protocols Project

Github link:

<https://github.com/ipwave-hackathon-ietf>

The screenshot shows the GitHub repository page for `ipwave-hackathon-ietf / ipwave-hackathon-ietf-104`. The repository has 1 watch, 0 stars, and 0 forks. The navigation bar includes links for Code, Issues (0), Pull requests (0), Projects (0), and Insights. A message states "No description, website, or topics provided." The repository statistics show 1 commit, 1 branch, 0 releases, and a "Fetching contributors" indicator. The current branch is `master`, and there is a "New pull request" button. A "Find File" button and a green "Clone or download" button are also visible. The commit history shows a single commit by `chinentori` on Mar 18, 2019, with the latest commit hash `c8cb3ba`. The commit details show a folder `inet4` and a file `veins-veins-4.7.1` with a "First commit" label and the date "Mar 18, 2019".

# Demonstration Video Clip of IPWAVE Basic Protocols Project

Youtube link:

<https://youtu.be/sKYfa0MC6Jg>

