



bienaime  
bienaime

# IETF-114

# IPWAVE Hackathon Project

July 23-24, 2022

Champion: Jaehoon (Paul) Jeong

Members: Bien Aime Mugabarigira and Junhee Kwon

Department of Computer Science and Engineering at SKKU

Email: {pauljeong, bienaime, juun9714}@skku.edu



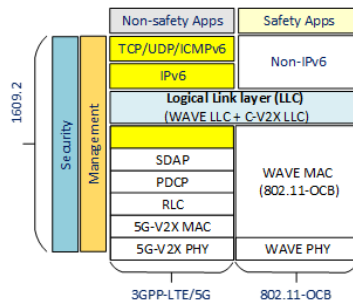
# IP Wireless Access in Vehicular Environments (IPWAVE) Basic Protocols Project

Champion: Jaehoon (Paul) Jeong (SKKU)

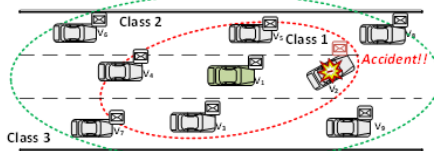
IETF-114 IPWAVE Hackathon Project:  
Context-Aware Navigator Protocol (CNP)



## WAVE Protocol Stack



## IPv6 ND Option



- ✉ IPv6 ND with Cooperation Context Message (CCM)
- ✉ IPv6 ND with Emergency Context Message (ECM)

## Objectives

- To Demonstrate IPWAVE Basic Protocols
- New IPv6 ND option for road safety
- Simulation of Context-Aware Navigation Protocol over C-V2X
- To Discover technology gaps for IPWAVE

Where to get source code:

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

How to set up an environment:

- OS: Ubuntu 16.04
- SUMO 1.0.0
- OMNeT++ 5.3
- GNU GCC7.3
- Veins 5.0
- INET 3.6.6

Implementation Contents:

- To Support IETF Vehicular Mobility Information (VMI) Option in IPv6-based vehicular networks over C-V2X.
  - ✓ VMI: <https://datatracker.ietf.org/doc/draft-jeong-ipwave-context-aware-navigator/>
- To support the cooperation Context Message (CCM) and Emergency Context Message (ECM) for CNP application in 3GPP-LTE
- Text the adaptability of IEEE 802.11-OCB vehicular protocol stack to the C-V2X access layer.

## Professors:

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

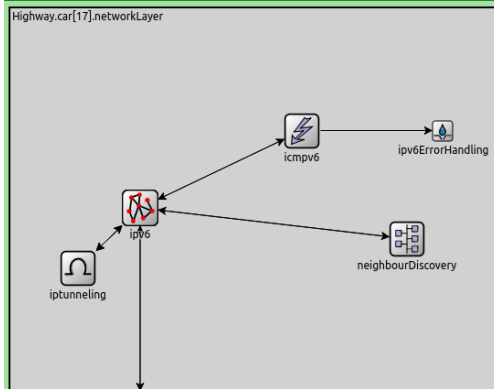
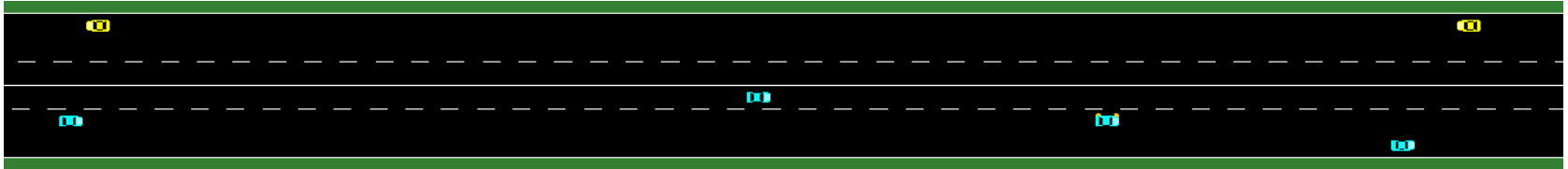
## Students:

- Bien Aime Mugabarigira (SKKU)
- Junhee Kwon (SKKU)
- Yiwen (Chris) Shen (SKKU)
- Hyeonah Jeong (SKKU)

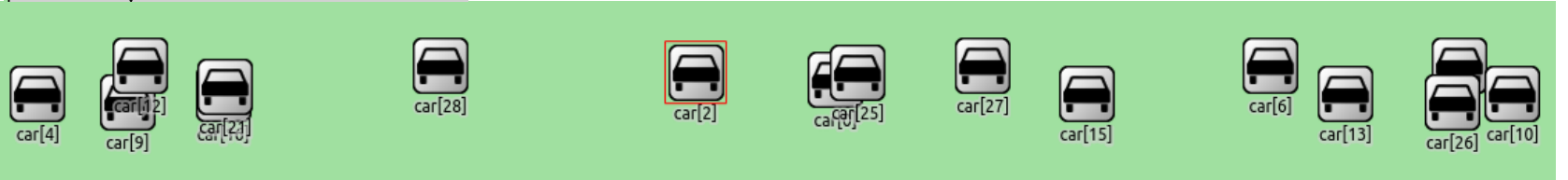
# Hackathon Plan

- Simulation
  - To test the applicability of IPWAVE protocols in C-V2X
  - To simulate Context-Aware Navigation Protocol (CNP) with C-V2X
- Cooperation Context Message (CCM) and Emergency Context Message (ECM) for CNP application in 3GPP-LTE
- Test of the coexistence of IEEE 802.11-OCB vehicular protocol stack and the C-V2X access layer

# What got done (1/2)



- A highway scenario simulation in SUMO & OMNeT++
- IPv6 Network Layer implementation

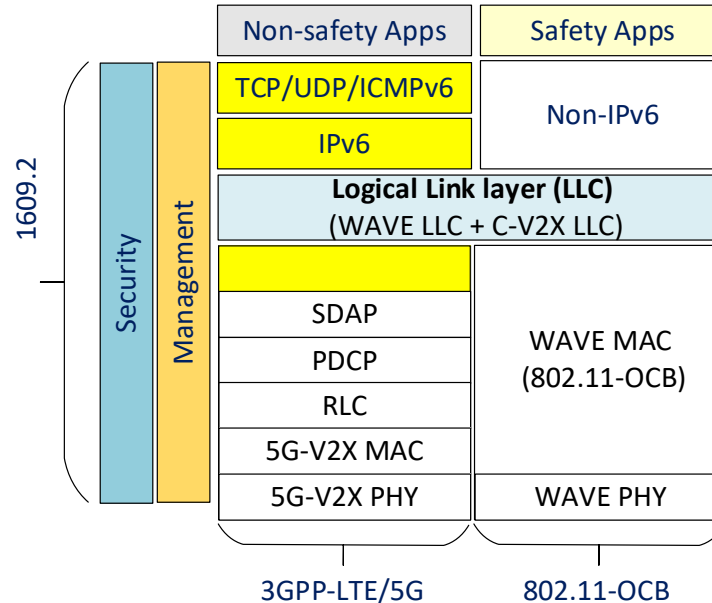


# What got done (2/2)

- Simulation implementation of IPWAVE Context-Aware Navigation Protocol (CNP) with C-V2X
  - Adaptation of Cooperation Context Message (CCM) by V2V within the Mode4 application.
  - Exchange of Emergency Context Message (ECM) with higher priority over CCM within IPv6 enabled vehicular network.

# What we learned

- Heterogenous vehicular Network
- Coexistence of IEEE 802.11-OCB based IPWAVE and C-V2X-based IPWAVE
- Cooperation Context Message (CCM) and Emergency Context Message (ECM) for CNP can be transmitted over 3GPP-LTE mode 4.



# Open Sources

URL: <https://github.com/ipwave-hackathon-ietf/ipwave-hackathon-ietf-114>

The screenshot shows the GitHub interface for the repository `ipwave-hackathon-ietf/ipwave-hackathon-ietf-114`. The repository is public and has a dark theme. The navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Wiki, Security, Insights, and Settings. The repository name is displayed at the top, along with a 'Public' badge and an 'Edit' button. Below the navigation bar, the repository's branch structure is shown: 'master' (selected), '1 branch', and '0 tags'. There are buttons for 'Go to file', 'Add file', and 'Code'. The commit history is displayed, showing a single commit by 'mubienaime' with the message 'first commit'. The commit details include the commit hash '4abc92e', the time 'yesterday', and '2 commits'. Below the commit details, a table lists the files included in the commit: 'inet', 'simulte', 'veins-veins-5.1', and '.gitignore', all with the message 'first commit' and the time 'yesterday'. At the bottom, there is a prompt to 'Add a README' to help people understand the project.

ipwave-hackathon-ietf / ipwave-hackathon-ietf-114 Public

<> Code Issues Pull requests Actions Projects Wiki Security Insights Settings

master 1 branch 0 tags Go to file Add file Code

mubienaime first commit 4abc92e yesterday 2 commits

inet	first commit	yesterday
simulte	first commit	yesterday
veins-veins-5.1	first commit	yesterday
.gitignore	first commit	yesterday

Help people interested in this repository understand your project by adding a README. Add a README

# Wrap Up

## Professors:

- Jaehoon (Paul) Jeong (SKKU)
- Younghan Kim (SSU)
- Yiwen (Chris) Shen (Kyungsung University)

## Team members:

- Bien Aime Mugabarigira (SKKU)
- Junhee Kwon (SKKU)
- Hyeonah Jung (SKKU)



# Appendix

- (1) Simulation Environment Preparation Guide
- (2) Implementation Environment

# Simulation Environment

- OS: Ubuntu 16.04
- Simulators:
  - SUMO 1.0.0
  - OMNeT++ 5.4.1
- GNU GCC 7.3
- Open Sources:
  - <https://github.com/ipwave-hackathon-ietf/ipwave-hackathon-ietf-114>
  - Veins 5.0
  - INET 3.6.6

# Configurations

- Install OMNeT++ following the procedure in the installation manual:  
<https://doc.omnetpp.org/omnetpp/InstallGuide.pdf>
- Install proper SUMO version
- Import projects in OMNeT++ workspace
  - Import INET by
    - File → Import → General → Existing projects into workspace
  - Similarly, as INET, import SimuLTE
  - Import veins:
    - »Specifically, search for nested project and install both veins and veins\_inet3 projects.

# Project References

- Activate project features to ensure SimuLTE runs correctly.
- Right-click on lte project and choose Properties
- Then, Project References and tick inet, veins and veins\_inet3
- Run the scenario in veins:
- *python2 sumo-launchd.py*
- Run the simulation by:
  - *lte → simulations → mode4 → omnetpp and in set inifile configuration, choose Hachathon112*

- References:
  - [http://www.cs.ucc.ie/cv2x/media/OpenCV2X\\_Documentation.pdf](http://www.cs.ucc.ie/cv2x/media/OpenCV2X_Documentation.pdf)