IETF-109 Hackathon

IPWAVE Basic Protocols Project

November 9-13, 2020
Online

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I E T F

IP Wireless Access in Vehicular Environments (IPWAVE) Basic Protocols
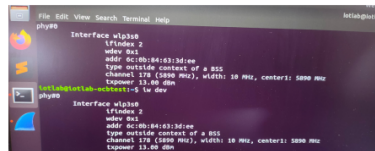
Champion: Jaehoon (Paul) Jeong (SKKU)

IETF-109 Hackathon
Context-Aware Navigator Protocol (CNP) over IPWAVE

Environment Setup

ITS G5/DSRC 5.9GHz channel

Professors:
- **Jaehoon (Paul) Jeong (SKKU)**
- **Younghan Kim (SSU)**

Students:
- **Yiwen (Chris) Shen (SKKU)**
- **Bien Aime Mugabarigira (SKKU)**
- **Xiaohong (Dawn) Yu (SKKU)**
- **Jae Won Lee (SKKU)**
- **Kyoungjae Sun (SSU)**
- **Jinho Park (KNU)**

Enabling OCB Mode

WAVE Protocol Stack

		Non-safety Apps	Safety Apps	
Security	Management	TCP/UDP	WSMP	1609.3
		IPv6		
		LLC		1609.4
		WAVE MAC (with Channel Coordination)		802.11-OCB
		WAVE PHY		

1609.2

Objectives:
- Demonstrate IPWAVE Basic Protocols
- IPv6 packet transmission by two OCB-enabled wifi modules
- Discover technology gaps for IPWAVE

Where to get source code:
- Git-hub open source:
  https://github.com/ipwave-hackathon-ietf

How to set up an environment:
Hardware
- Two laptops with AR94XX wifi modules (ath9k)
- Webcam: embedded or USB type
Software
- OS: OCB-enabled Linux kernel (version 4.4) in Ubuntu 18.04
- Tools: iw > v4.0

Implementation Contents:
- Develop a Vehicular Communication System for safe and secure driving using IETF IPWAVE protocols
- Transmission of IPv6 over IEEE 802.11-OCB
- Linux Kernel Compiling for OCB mode (Kernel version 4.4)
- Vehicular Mobility Information (VMI) option in IP-based vehicular network
- IPv6 packet transmission by two OCB-enabled WiFi modules
  - UDP Packets transmission by Python script
  - Video streaming by GStreamer

성균관대학교
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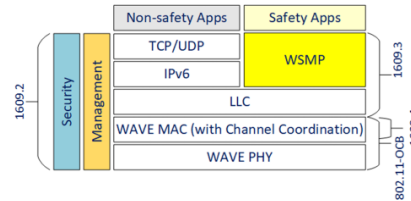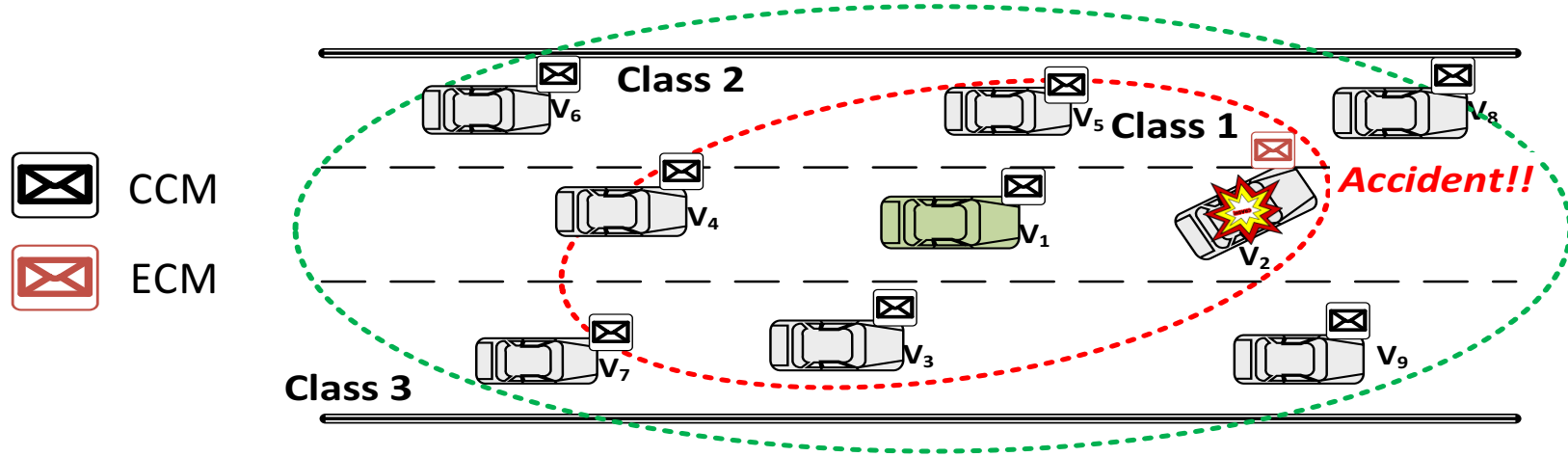
IETF

Previous Hackathon Work

- IETF-106 Hackathon Project
  - IPv6 Packet Transmission over two OCB-enabled WiFi modules in vehicular networks

- IETF-108 Hackathon Project
  - Simulation of Context-Aware Navigation Protocol for road crash avoidance

Hackathon Plan

- Support of Context-Aware Navigation Protocol over IPWAVE
  - draft-jeong-ipwave-context-aware-navigator-02

- To implement the enhanced IPv6 ND in Ubuntu Linux Kernel to enable the proposed a new ND option for vehicle driving safety.

- To test the modified Linux Kernel for a robot car (i.e., Aion Robotics R1) to verify the CNP for crash avoidance.
  - https://www.aionrobotics.com/products

LIDAR/Laser Scanner Device

Wireless Communication Devices (802.11-OCB/4G-LTE/5G)

Cameras

Inertial Sensors

Vehicle Radar

Vehicle Computer (e.g., embedded system)

Context-Aware Navigation Protocol over IPWAVE

❖ **Road-Context Awareness through Light-weight Message Exchange**

- **Cooperation Context Message (CCM) and Emergency Context Message (ECM) Options**

Reference 1: "Context-Aware Navigation Protocol for IP-Based Vehicular Networks",
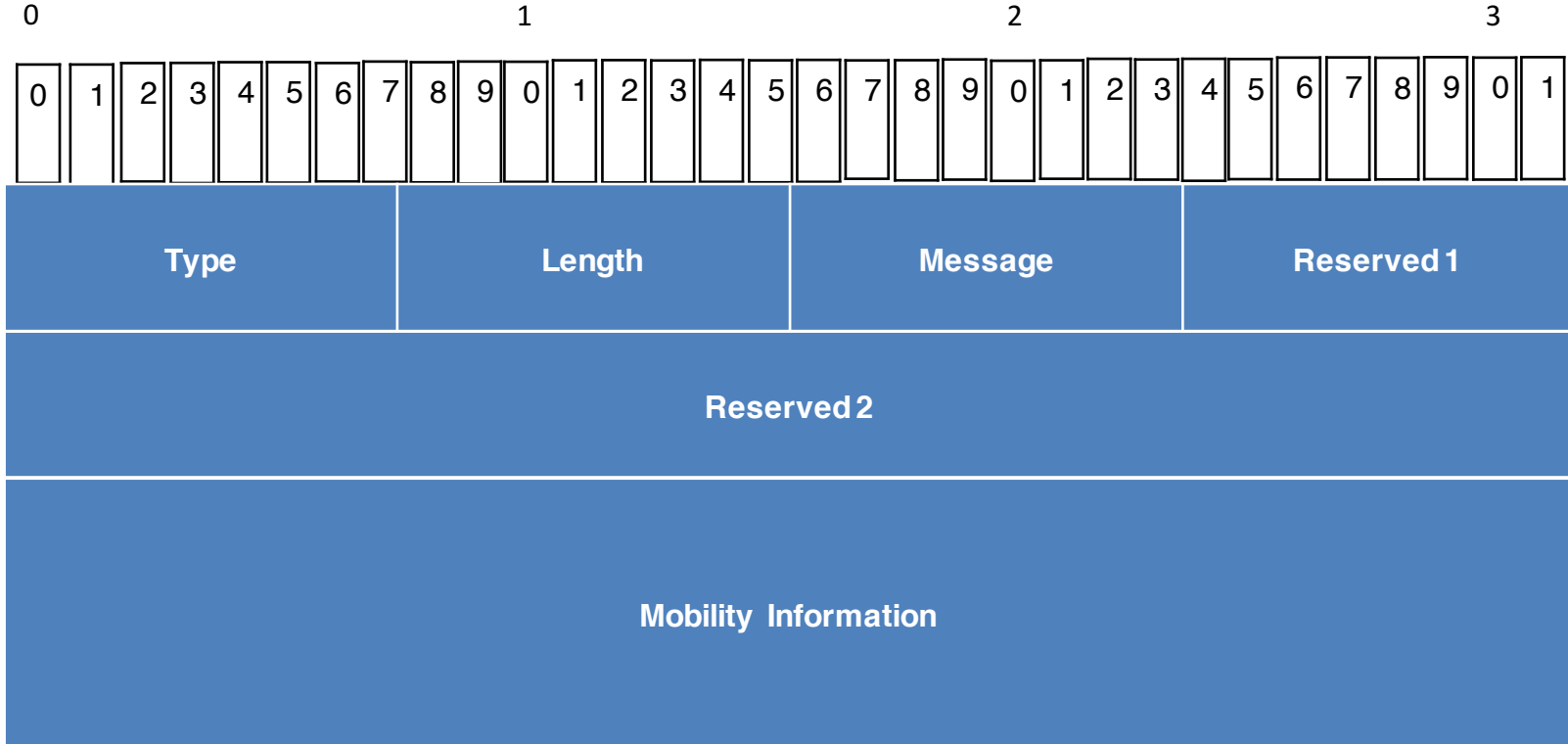https://tools.ietf.org/html/draft-jeong-ipwave-context-aware-navigator-02

Reference 2: "Context-Aware Navigator for Road Safety in Vehicular Cyber-Physical Systems",
ICCE-Asia, June 2018. http://iotlab.skku.edu/publications/international-conference/ICCE-ASIA-CAN.pdf

Vehicle Mobility Information (VMI)

VMI Option as an ND Option:

0	1	2	3
0 1 2 3 4 5 6 7 8 9	0 1 2 3 4 5	6 7 8 9 0 1 2 3	4 5 6 7 8 9 0 1
Type	Length	Message	Reserved 1
Reserved 2			
Mobility Information			

Type: CCM or ECM Options

Setup Environment

Atheros WiFi 802.11-OCB

Environment Setup
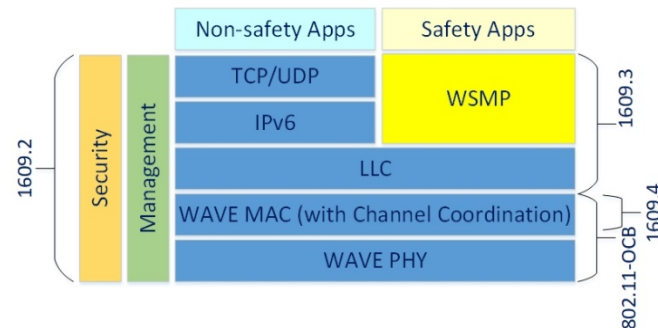
What got done

- Extending the neighbor discovery options regenerates the kernel compilation errors.
  - It requires to make modifications to kernel kbuild (i.e., kernel configuration file).

- We got the feasibility to extend the Linux kernel's IPv6 neighbor discovery implementation and add the Vehicle Mobility Information (VMI) option for driving safety purpose.

- Next Steps
  - To fix the compilation errors for such VMI option.
  - To extend the IPv6 ND of Ubuntu Linux Kernel in a Robot Car to support Context-Aware Navigator Protocol over IPWAVE.

Open Source Project at Github

https://github.com/ipwave-hackathon-ietf/ipwave-hackathon-ietf-109

IPWAVE Hackathon Project

Wrap Up

Hackathon Team

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- Jaewon Lee (SKKU)
- Kyoungjae Sun (SSU)
- Jinho Park (KNU)

IPWAVE hackathon team worked in collaboration with I2NSF and BMWG teams.