

IP 차량 네트워킹 기반 주변 인식 내비게이터

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목차

- 1. IETF IPWAVE 워킹그룹 표준화
 - Introduction to Vehicular Networking
 - IPv6 over IEEE 802.11-OCB
 - IPWAVE Problem Statement Draft
- 2. 주변 인식 내비게이터 프로토콜
 - 주변 인식 내비게이터 프로토콜
 - 주변 인식 내비게이터 기반 충돌 회피 기술
 - IETF-108 IPWAVE Hackathon Project





Introduction to Vehicular Networking

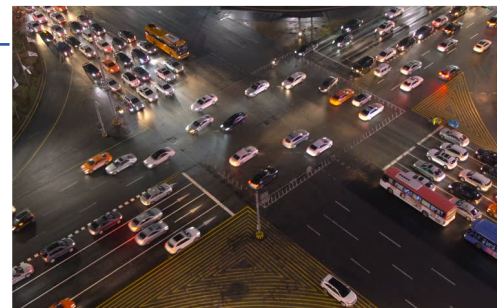
Use Cases of Vehicular Networking



Vehicle Traffic Release



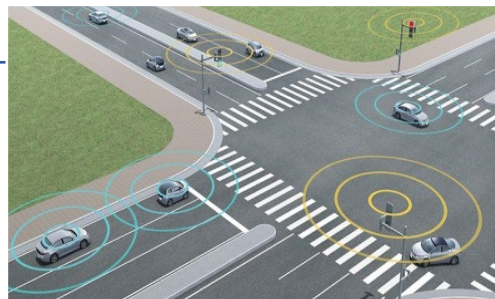
City Road Emergency



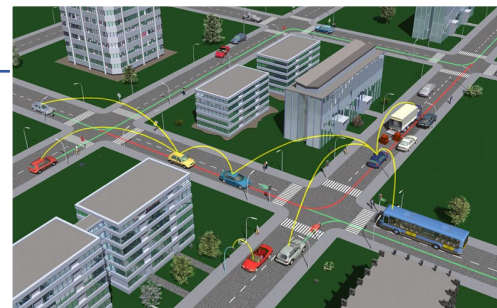
Road Intersection Passing



Navigation

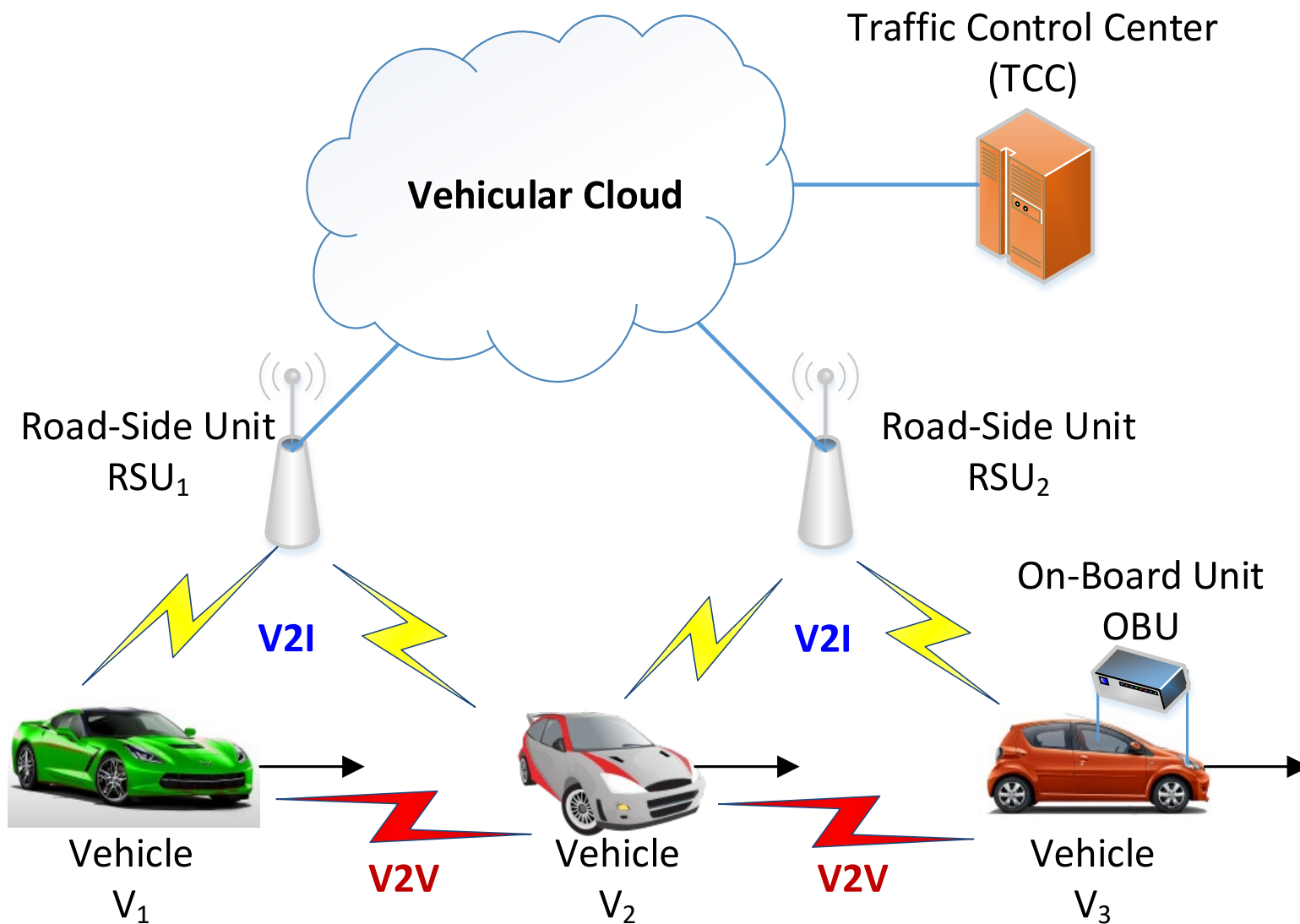


Connected Automated Vehicles

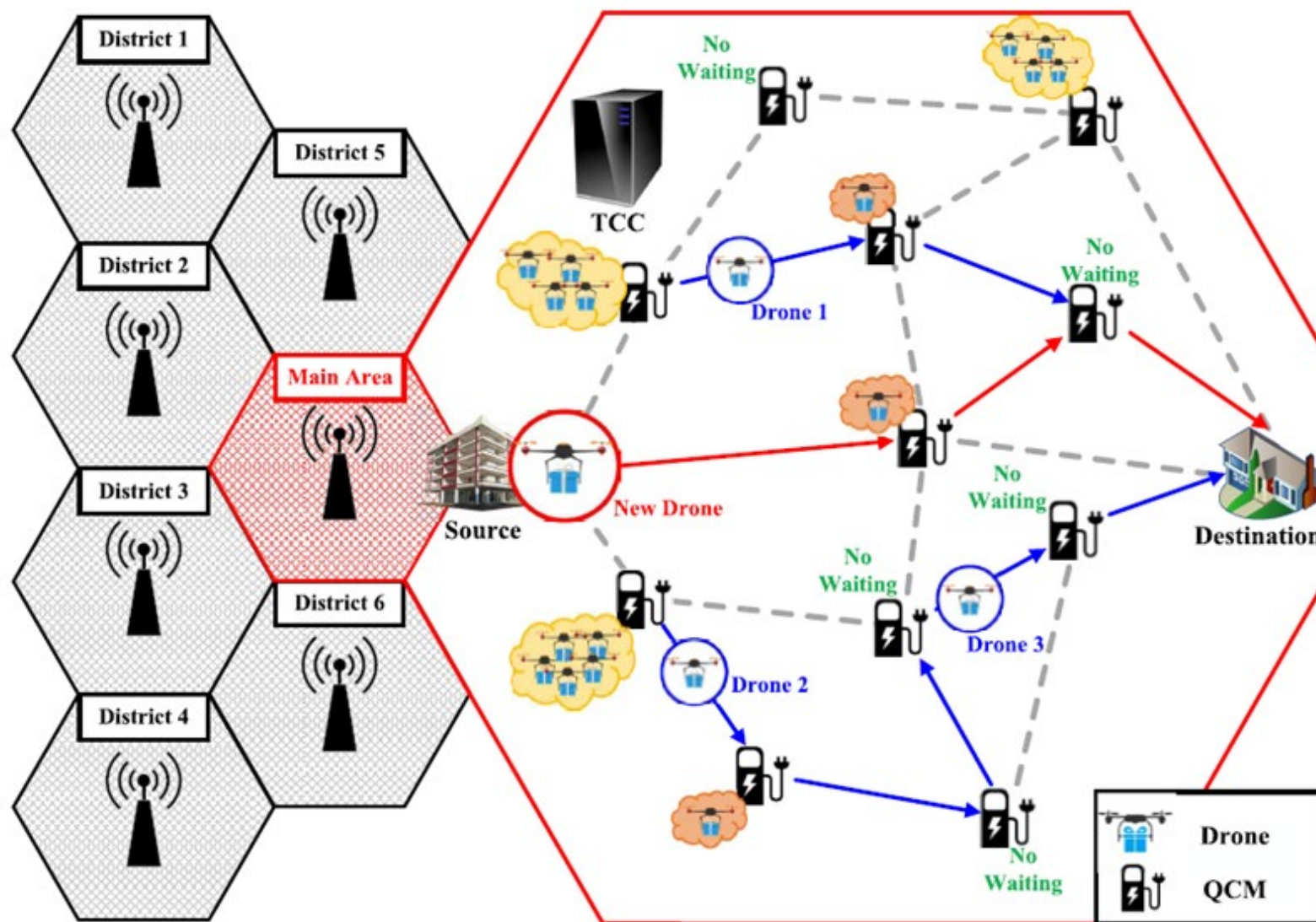


Vehicle Data Forwarding Services

Vehicular Networks



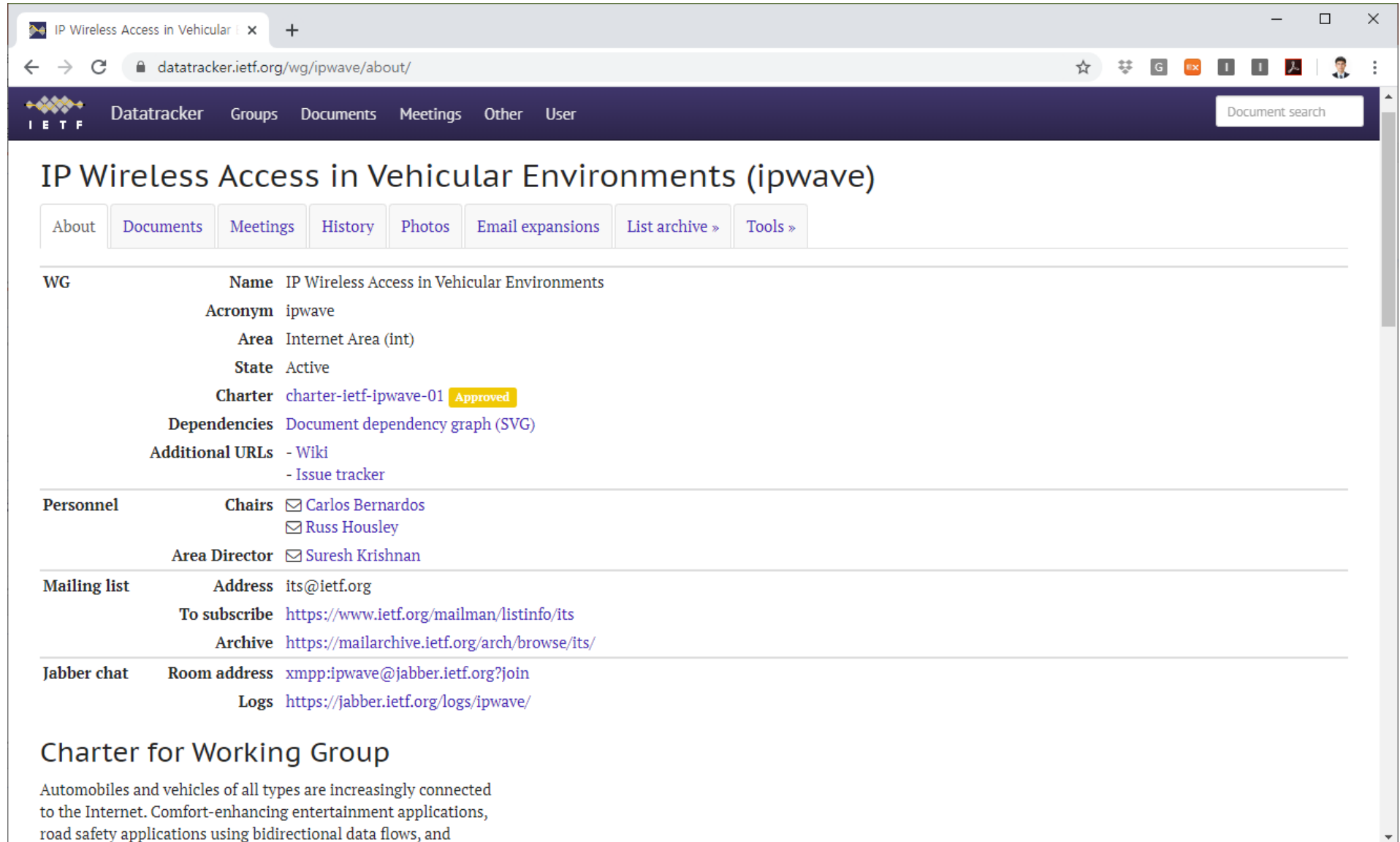
Wireless Drone Networks





IPWAVE 워킹그룹 표준화

IPWAVE Working Group (1/2)



The screenshot shows a web browser window displaying the IPWAVE Working Group page. The browser's address bar shows the URL `datatracker.ietf.org/wg/ipwave/about/`. The page has a dark blue header with the IETF logo and navigation links: Datatracker, Groups, Documents, Meetings, Other, and User. A search bar is located on the right side of the header.

IP Wireless Access in Vehicular Environments (ipwave)

Navigation tabs: About, Documents, Meetings, History, Photos, Email expansions, List archive », Tools »

WG	Name	IP Wireless Access in Vehicular Environments
	Acronym	ipwave
	Area	Internet Area (int)
	State	Active
	Charter	charter-ietf-ipwave-01 Approved
	Dependencies	Document dependency graph (SVG)
Additional URLs	- Wiki	
	- Issue tracker	
Personnel	Chairs	✉ Carlos Bernardos ✉ Russ Housley
	Area Director	✉ Suresh Krishnan
Mailing list	Address	its@ietf.org
	To subscribe	https://www.ietf.org/mailman/listinfo/its
	Archive	https://mailarchive.ietf.org/arch/browse/its/
Jabber chat	Room address	xmpp:ipwave@jabber.ietf.org?join
	Logs	https://jabber.ietf.org/logs/ipwave/

Charter for Working Group

Automobiles and vehicles of all types are increasingly connected to the Internet. Comfort-enhancing entertainment applications, road safety applications using bidirectional data flows, and

IPWAVE Working Group (2/2)

- IPWAVE (IP Wireless Access in Vehicular Networks) Working Group (WG)
 - IPWAVE WG aims at the standardization of IP-based networking such as Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I).
- The main deliverable documents are:
 - IPv6 over IEEE 802.11-OCB (Outside the Context of a Basic service set).
 - IPWAVE Problem Statement and Use Cases
- After the IPWAVE Problem Statement document is published, IPWAVE WG will work for rechartering to develop IPWAVE protocols such as
 - Vehicular Neighbor Discovery
 - Vehicular Mobility Management
 - Vehicular Security and Privacy

IPWAVE Documents (1/2)

IP Wireless Access in Vehicular | x +

← → ↻ datatracker.ietf.org/wg/ipwave/documents/

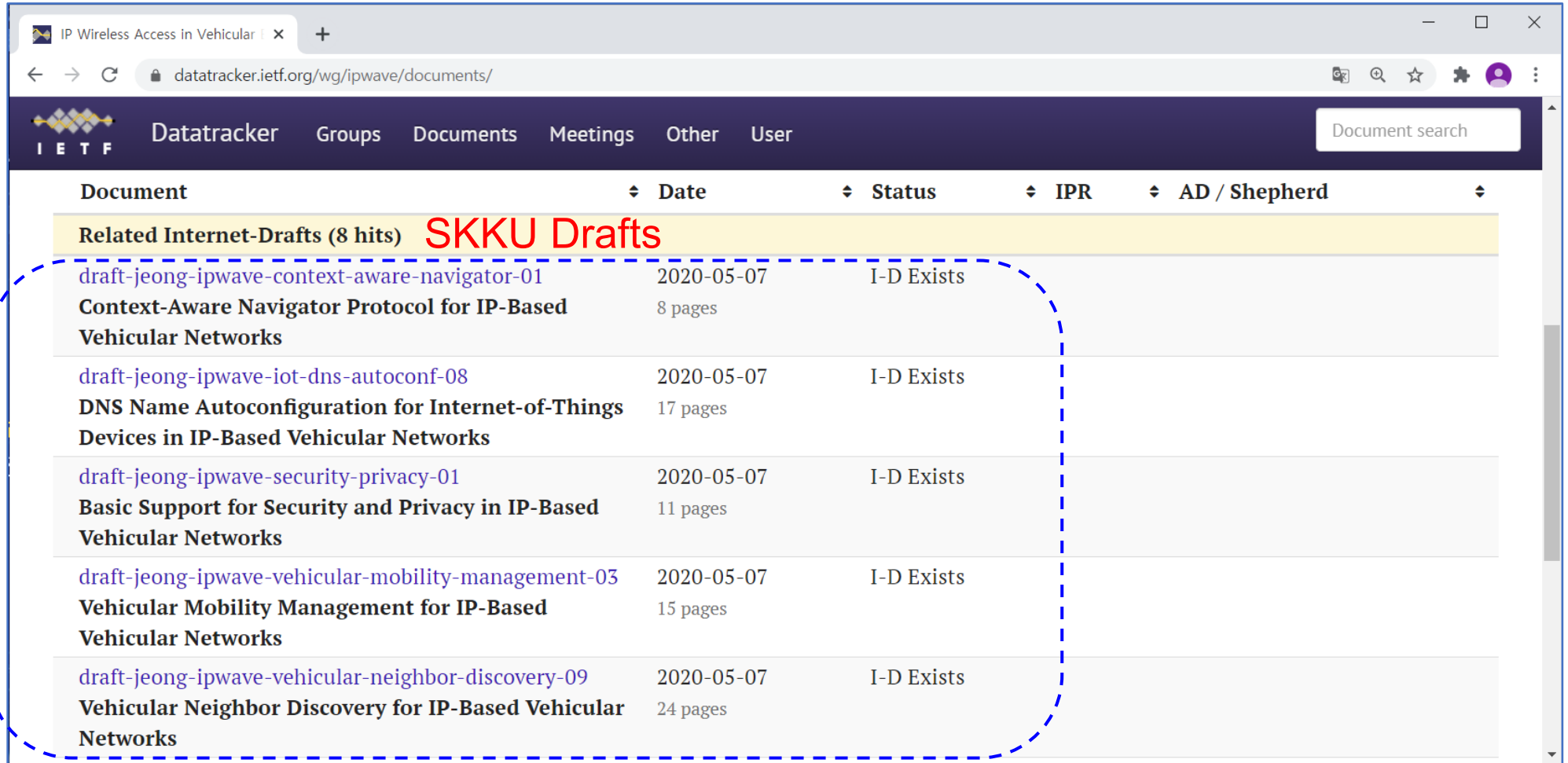
I E T F Datatracker Groups Documents Meetings Other User Document search

IP Wireless Access in Vehicular Environments (ipwave)

About Documents Meetings History Photos Email expansions List archive » Tools »

Document	↕ Date	↕ Status	↕ IPR	↕ AD / Shepherd
Active Internet-Draft (1 hit) SKKU WG Draft				
draft-ietf-ipwave-vehicular-networking-19 IPv6 Wireless Access in Vehicular Environments (IPWAVE): Problem Statement and Use Cases	2020-07-29 39 pages	AD Evaluation for 2 days Submitted to IESG for Publication:Informational		Erik Kline ✉ Carlos Bernardos ✉
RFC (1 hit)				
RFC 8691 (was draft-ietf-ipwave-ipv6-over-80211ocb) Basic Support for IPv6 Networks Operating Outside the Context of a Basic Service Set over IEEE Std 802.11	2019-12 29 pages	Proposed Standard RFC		Suresh Krishnan ✉ Carlos Bernardos ✉

IPWAVE Documents (2/2)



Document	Date	Status	IPR	AD / Shepherd
Related Internet-Drafts (8 hits) SKKU Drafts				
draft-jeong-ipwave-context-aware-navigator-01 Context-Aware Navigator Protocol for IP-Based Vehicular Networks	2020-05-07 8 pages	I-D Exists		
draft-jeong-ipwave-iot-dns-autoconf-08 DNS Name Autoconfiguration for Internet-of-Things Devices in IP-Based Vehicular Networks	2020-05-07 17 pages	I-D Exists		
draft-jeong-ipwave-security-privacy-01 Basic Support for Security and Privacy in IP-Based Vehicular Networks	2020-05-07 11 pages	I-D Exists		
draft-jeong-ipwave-vehicular-mobility-management-03 Vehicular Mobility Management for IP-Based Vehicular Networks	2020-05-07 15 pages	I-D Exists		
draft-jeong-ipwave-vehicular-neighbor-discovery-09 Vehicular Neighbor Discovery for IP-Based Vehicular Networks	2020-05-07 24 pages	I-D Exists		



IPv6 over IEEE 802.11-OCB

(RFC 8691 - Basic Support for IPv6 Networks Operating Outside the Context of a Basic Service Set over IEEE Std 802.11)

IPv6 over IEEE 802.11-OCB (1/3)

- IPv6 over IEEE 802.11-OCB Document

- Objective

- It aims at the specification of IPv6 extension for delivering an IPv6 packet in V2V and V2I over IEEE 802.11-OCB link.
 - It provides methods and settings, and describes limitations for using IPv6 to communicate among nodes over a IEEE 802.11-OCB link with minimal change.

- Document name

- RFC 8691

- Document link

- <https://datatracker.ietf.org/doc/rfc8691/>

- Document status

- RFC - Proposed Standard



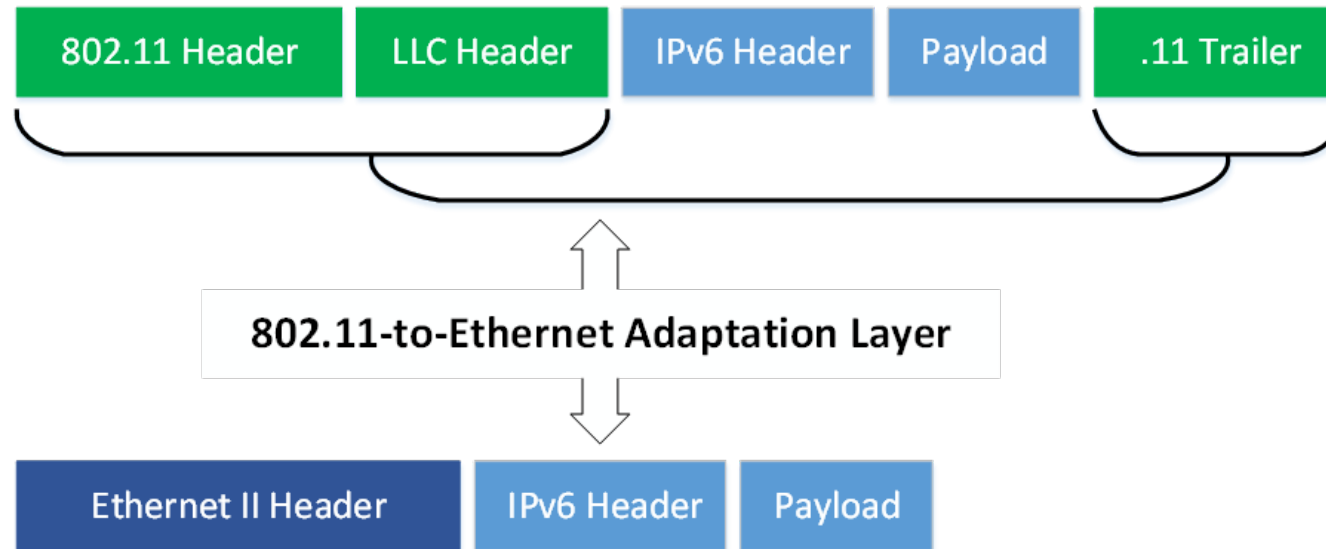
IPv6 over IEEE 802.11-OCB (2/3)

- Main Subjects of IPv6 over IEEE 802.11-OCB
 - Maximum Transmission Unit (MTU)
 - Frame Format
 - Link-Local Address
 - Stateless Autoconfiguration
 - Address Mapping
 - Subnet Structure
 - Security and Privacy Considerations

IPv6 over IEEE 802.11-OCB (3/3)

- Frame Format

- IP packets must be transmitted as QoS Data frames over 802.11-OCB.
 - The QoS Data frame format is specified in IEEE 802.11 specification.
- The 802.11-OCB QoS Data Frame contains an 802.11 header + a Logical Link Control (LLC) header + IPv6 datagram.
 - The Type field in the LLC header must be set to 0x86DD (IPv6).
 - The mapping to the 802.11 data service must use a “priority” value of 1, which specifies the use of QoS with a “Background” user priority.





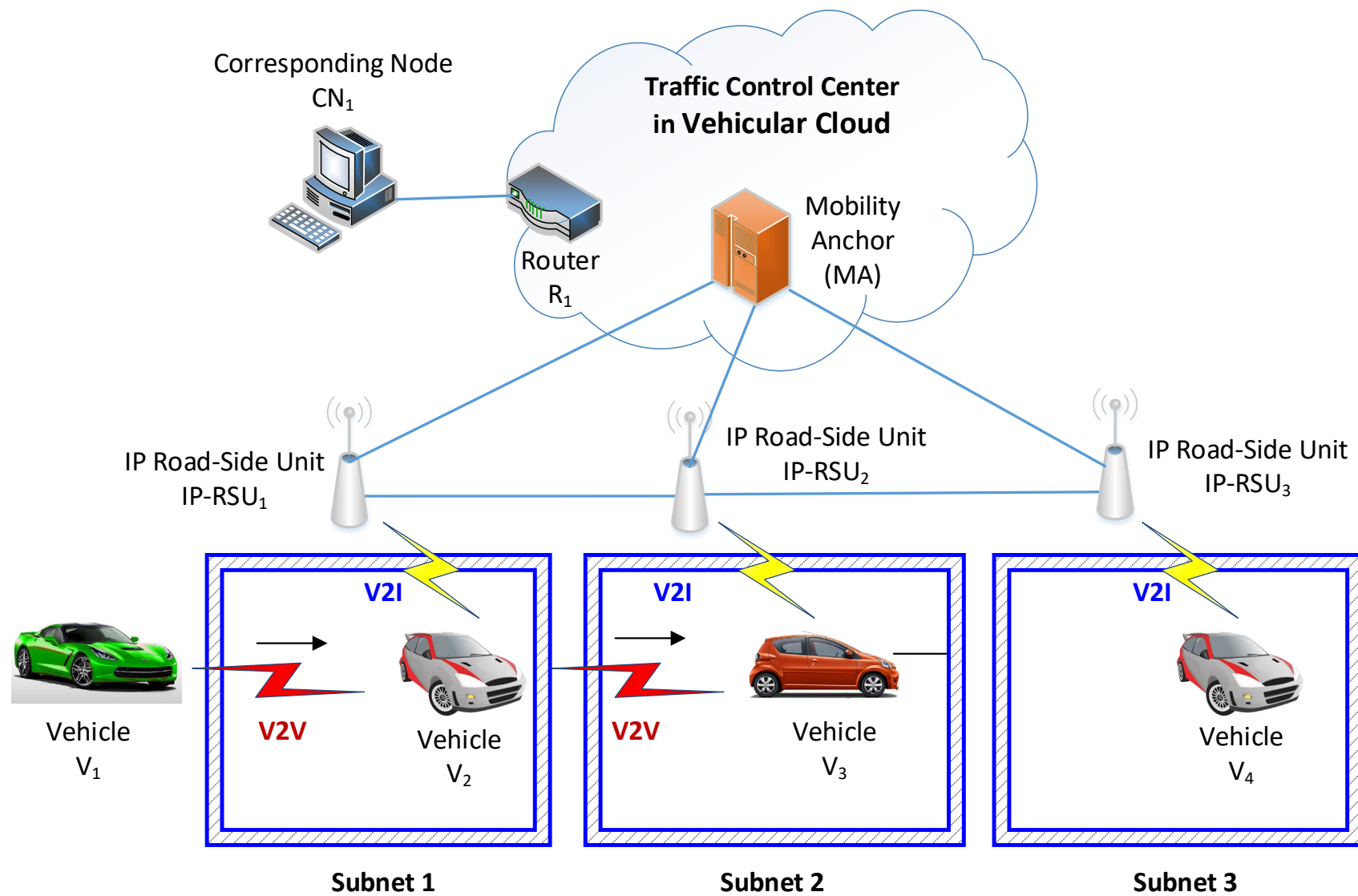
IPv6 Wireless Access in Vehicular Environments (IPWAVE): Problem Statement and Use Cases (draft-ietf-ipwave-vehicular-networking-19)

Jaehoon Paul Jeong
(Editor)

IPWAVE Problem Statement Draft

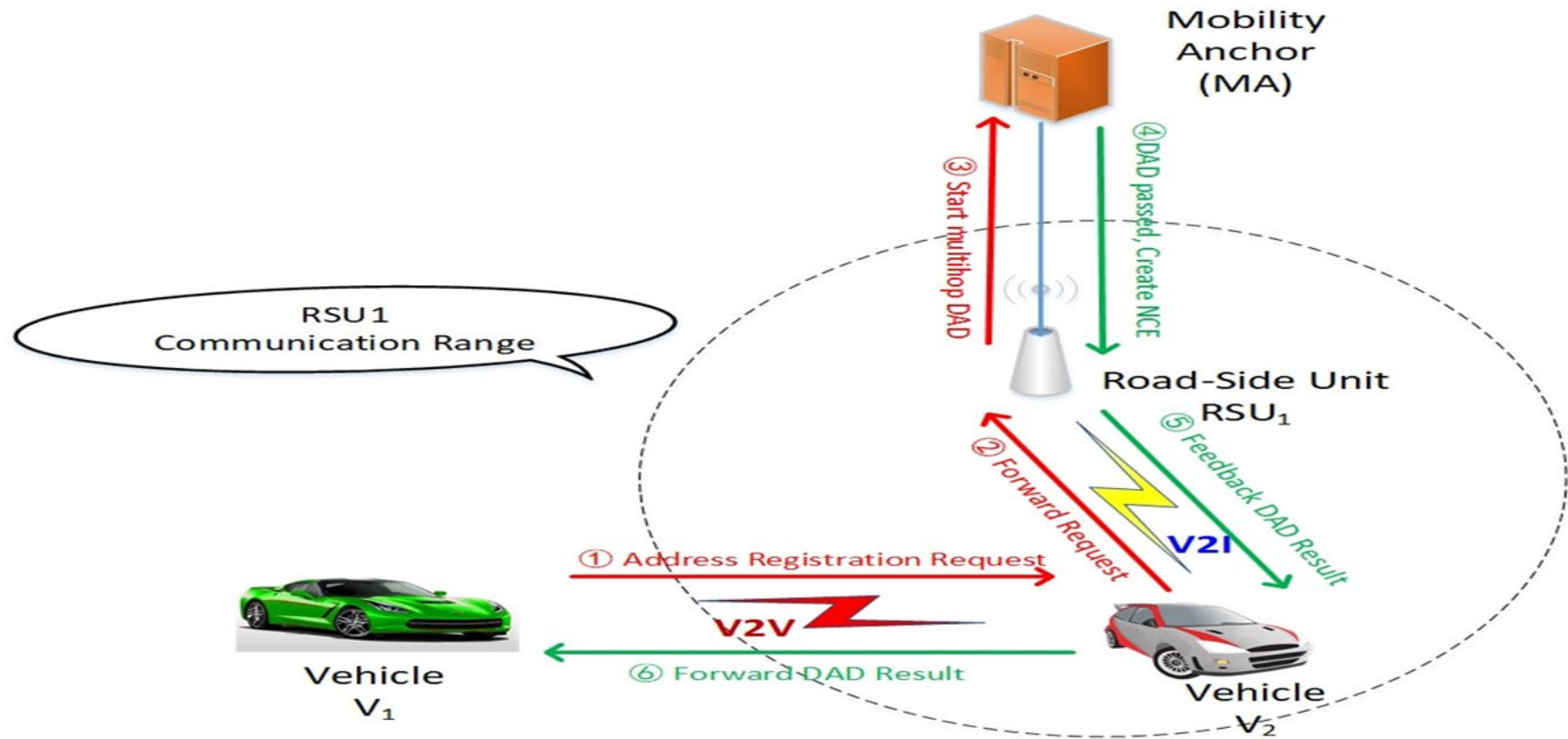
- IPWAVE Problem Statement and Use Cases Document
 - Objective
 - It aims at the problem statement of IPWAVE along with possible use cases in V2V, V2I, and V2X using IEEE 802.11-OCB links.
 - It covers three subjects such as IPv6 Neighbor Discovery, IP Mobility Management, and Security & Privacy.
 - Document name
 - draft-ietf-ipwave-vehicular-networking-19
 - Document link
 - <https://datatracker.ietf.org/doc/draft-ietf-ipwave-vehicular-networking/>
 - Document status
 - Submitted to IESG

Vehicular Network Architecture



Vehicular Neighbor Discovery (VND)

- Address Registration and DAD via a Relay Vehicle

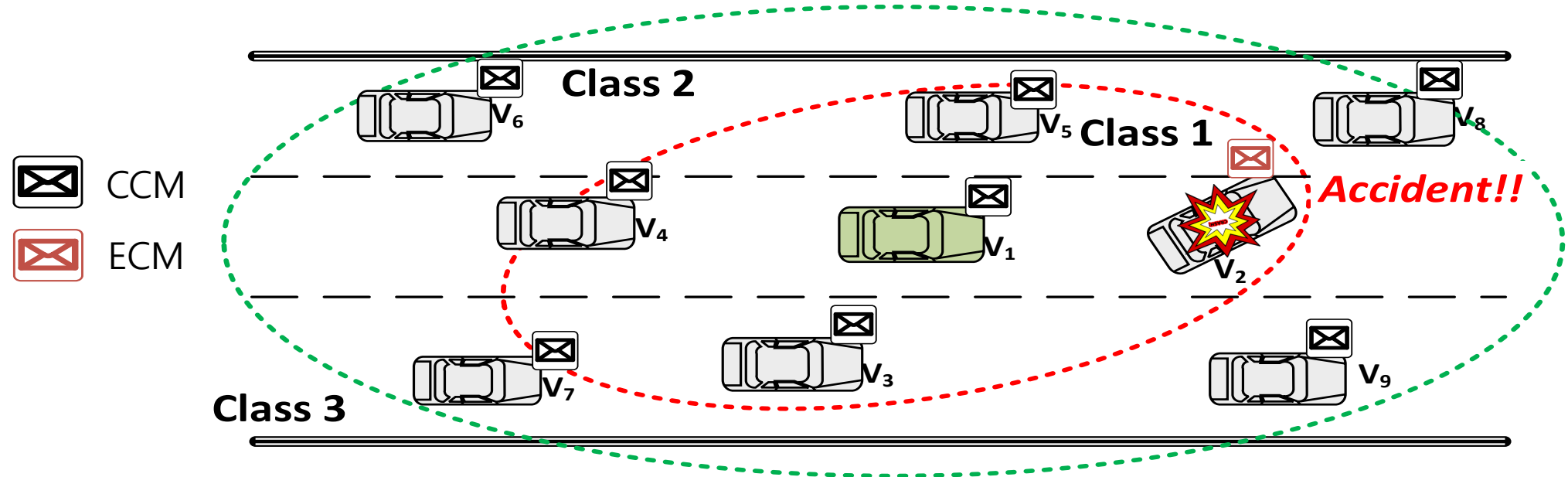


뉴 노멀 시대 선도를 위한 ICT 표준의 역할



주변 인식 내비게이터 프로토콜

Context-Aware Navigator Protocol (CNP)



❖ Road-Context Awareness through Light-weight Message Exchange

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

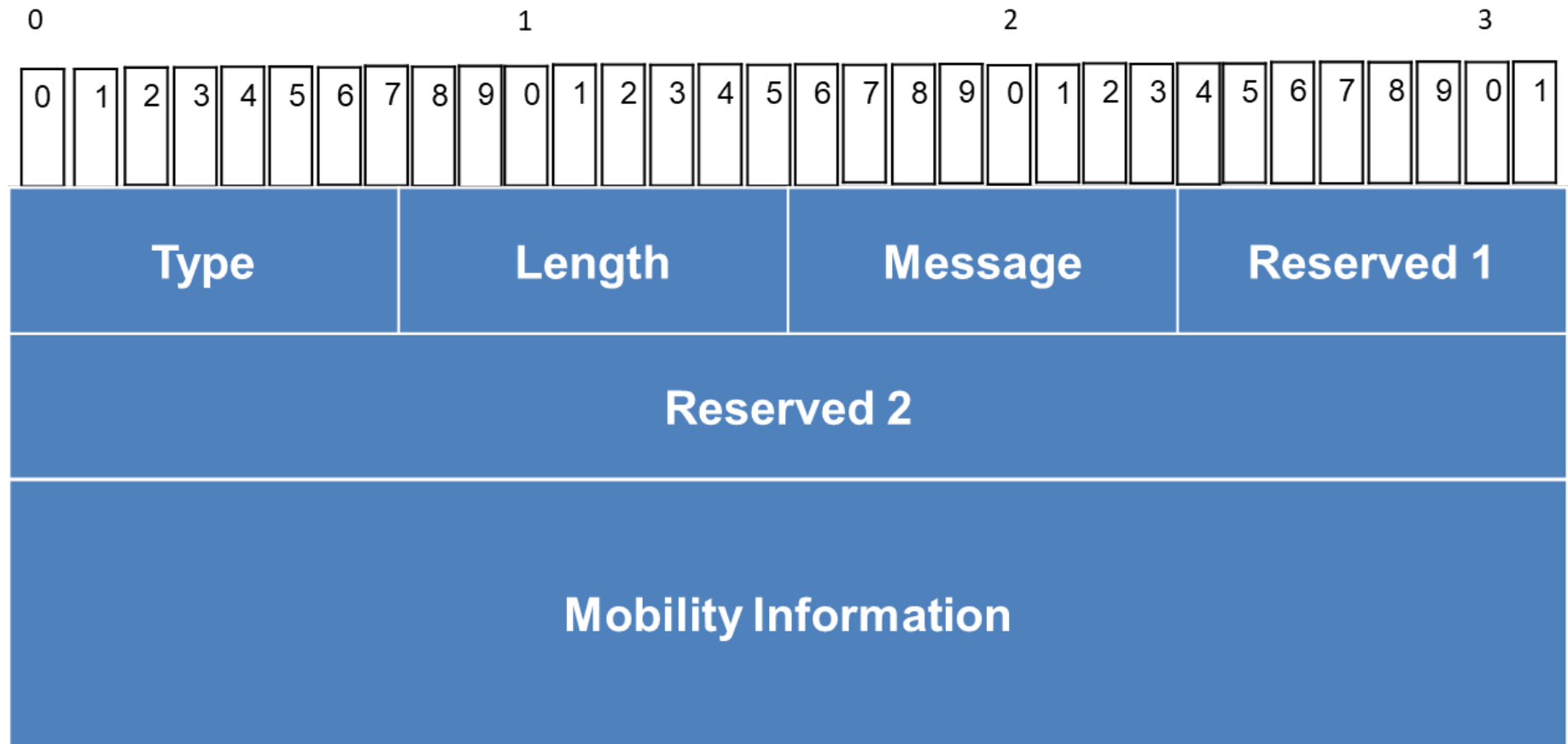
Reference: "Context-Aware Navigator for Road Safety in Vehicular Cyber-Physical Systems", The Third International Conference On Consumer Electronics (ICCE) Asia, June 2018.

<http://iotlab.skku.edu/publications/international-conference/ICCE-ASIA-CAN.pdf>

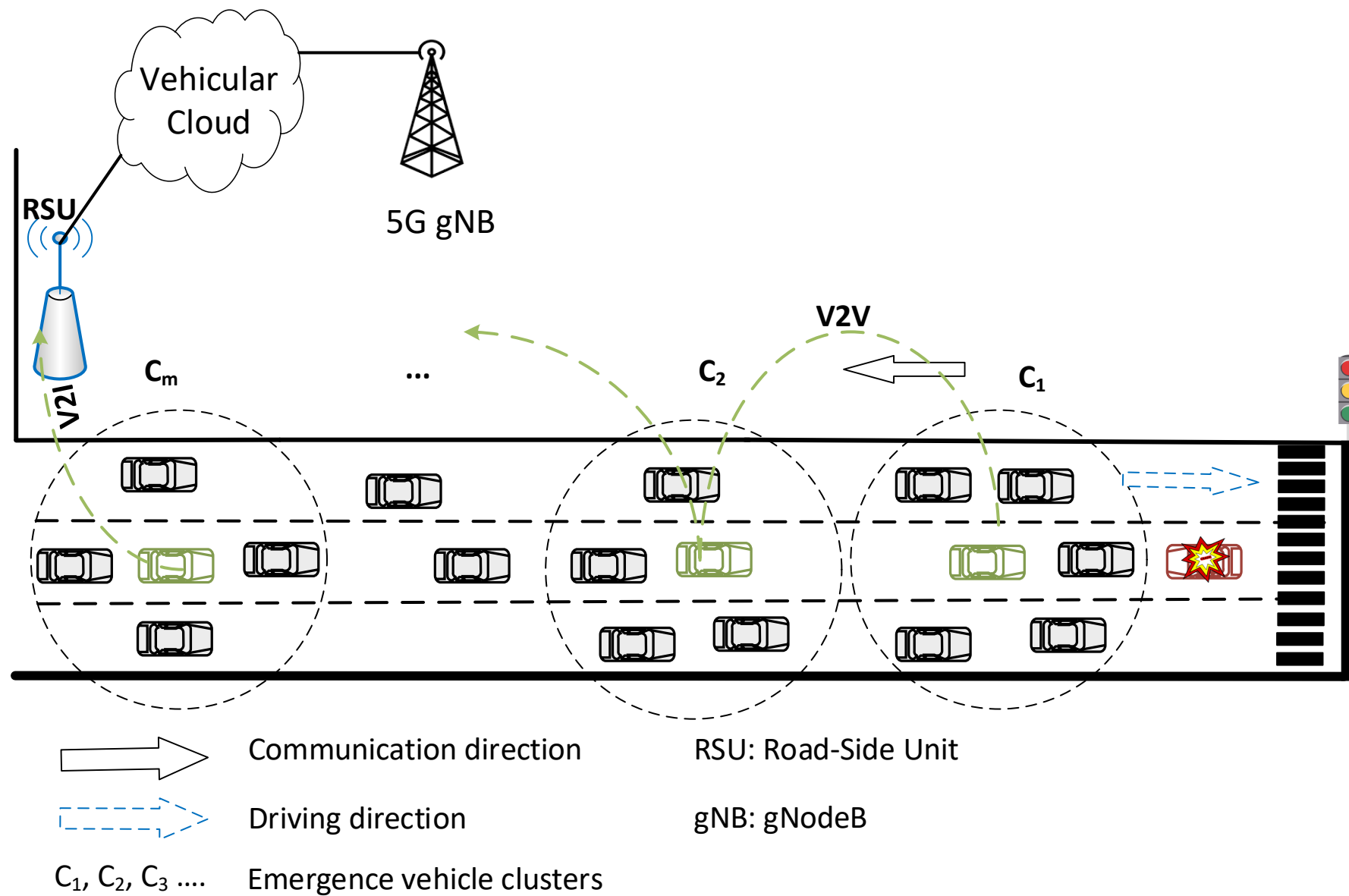
Vehicle Mobility Information (VMI)

VMI Option as an ND Option:

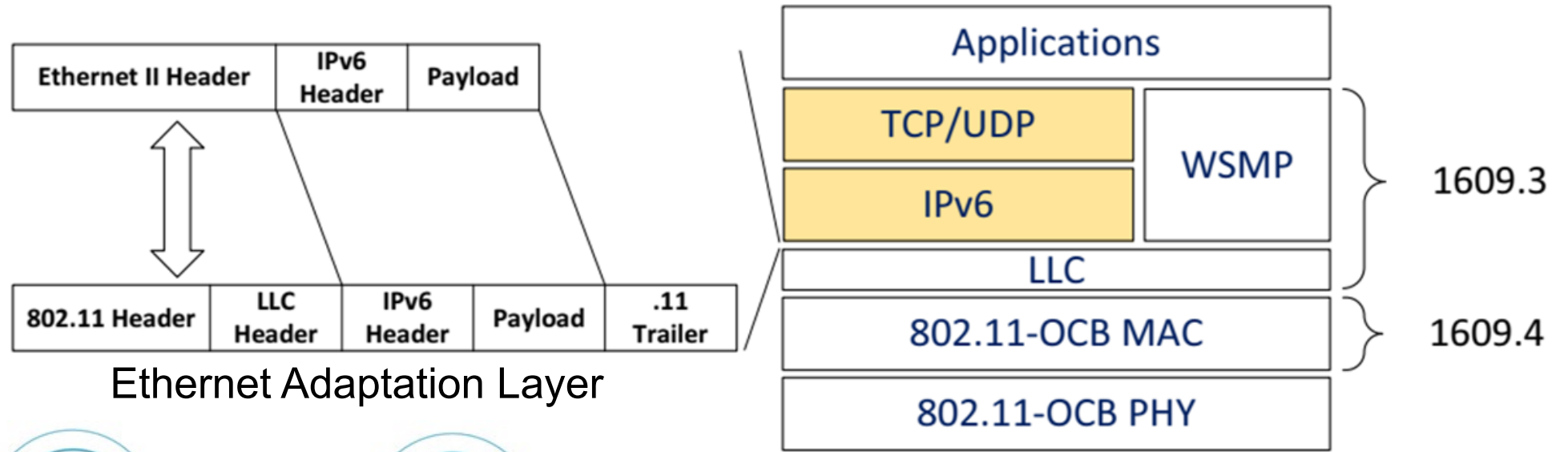
- Type: CCM or ECM
- Mobility Information: Vehicle Speed, Direction, Position, Driver's Action (e.g., Braking and Accelerating)



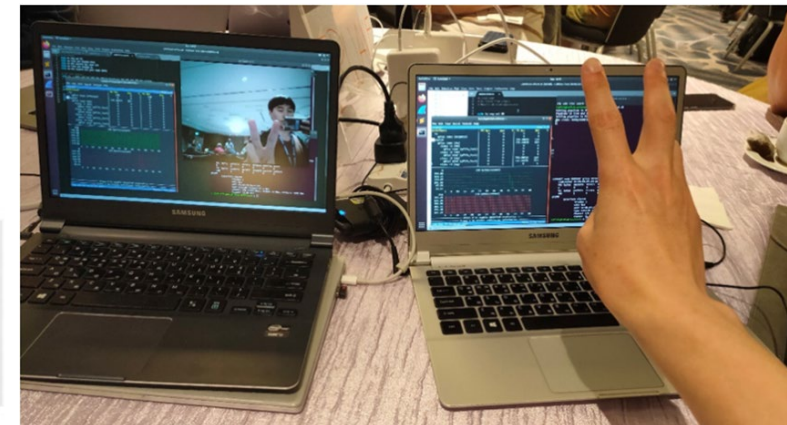
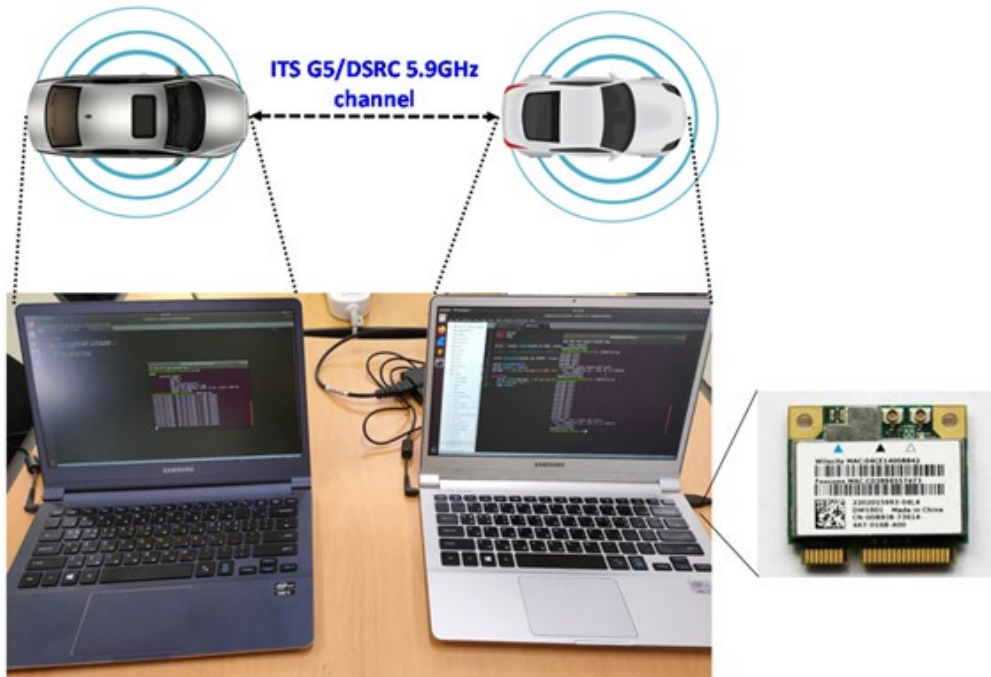
Collision Avoidance with CNP



IPWAVE Communications for CNP

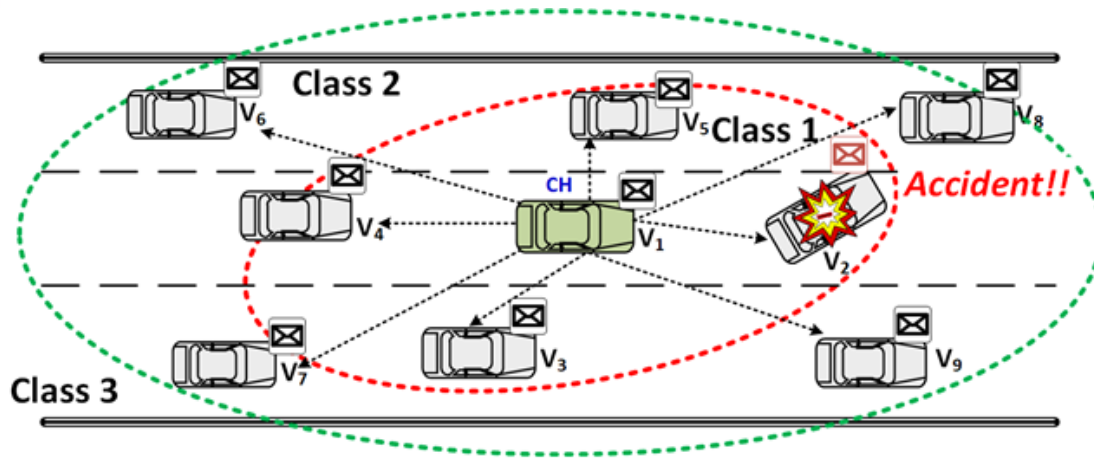


IEEE WAVE Protocol Stack



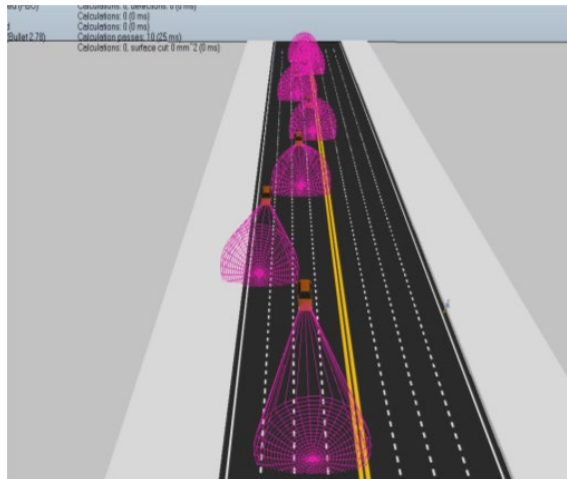
Video Delivery over IPWAVE

Simulation and Implementation of CNP

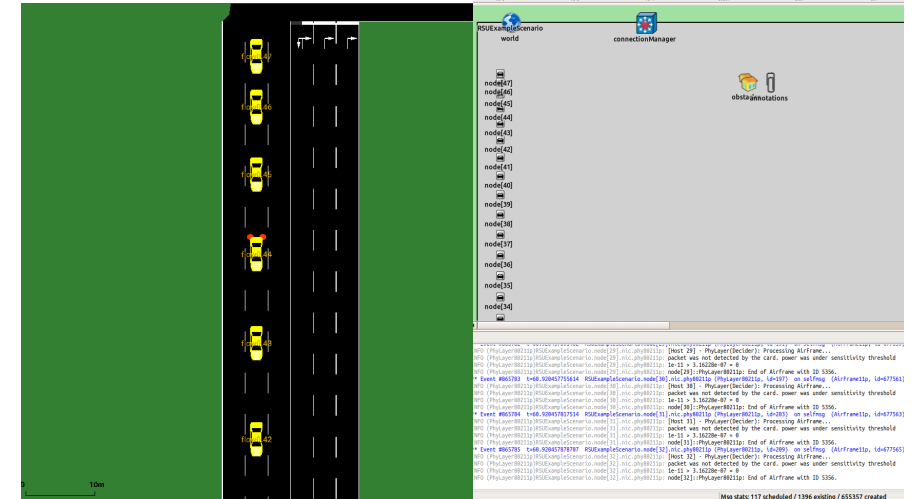


뉴 노멀 시대
선도를 위한
ICT 표준의
역할

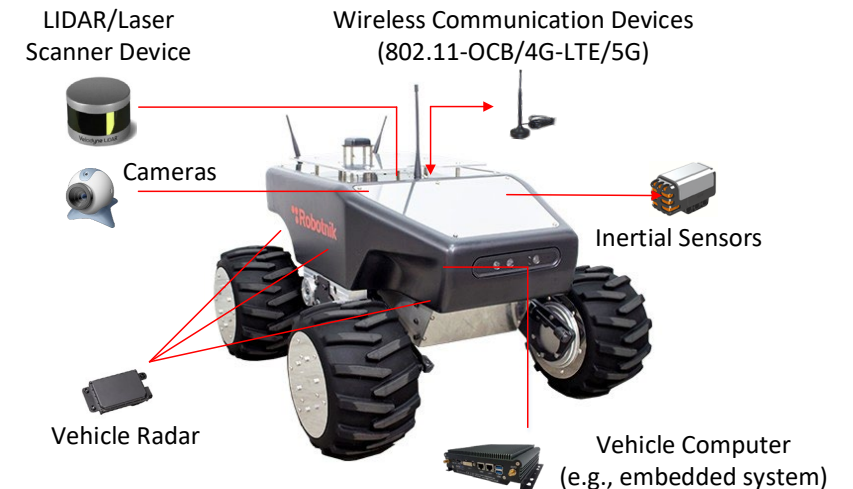
주변 인식 내비게이션 서비스



주변 인식 내비게이터 앱



차량 네트워크 시뮬레이터



자율주행 로봇카 시작품

성균관대의 IPWAVE 워킹그룹(WG) 표준화 진행상황

1) IPWAVE WG 표준화 문서

- IPWAVE Problem Statement and Use Cases
- Vehicular Neighbor Discovery
- Vehicular Mobility Management
- Vehicular Security and Privacy
- Context-Aware Navigator Protocol
- IPWAVE DNS Name Autoconfiguration



2) IETF 해커톤에서 오픈소스로 구현하여 기술 PoC

- IPWAVE Basic Protocols Project



3) IETF IPWAVE WG에 해커톤 프로젝트 기반 표준 제안

- Vehicular Neighbor Discovery와 Context-Aware Navigator Protocol을 구현하여 POC함
- 차후에 IPWAVE WG이 Rechartering을 하여 Protocol을 개발할 때 제안한 기법들을 WG 문서로 추진할 계획임.



IETF-108 IPWAVE Hackathon Project

IETF-108 Hackathon Project Poster

IP Wireless Access in Vehicular Environments (IPWAVE) Basic Protocols

Champion: Jaehoon (Paul) Jeong (SKKU)



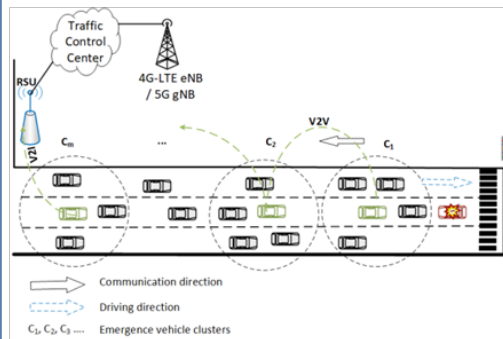
Professor:

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

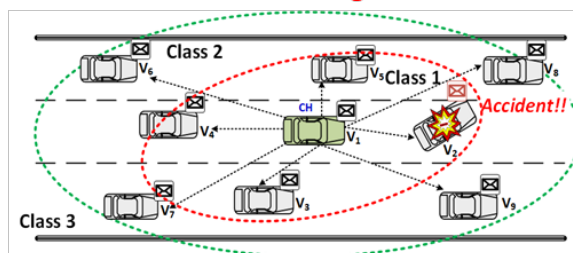
Students:

- Bien Aime Mugabarigira (SKKU)
- Yiwen Chris Shen (SKKU)
- Ahn Yeoseop (SKKU)
- Kyoungjae Sun (SSU)

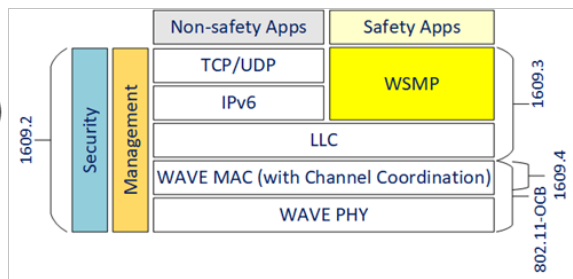
Vehicular Network Architecture



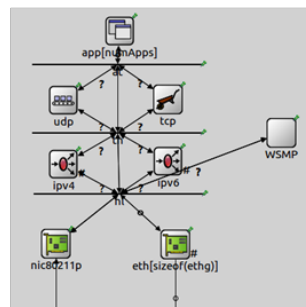
Context-Aware Navigator Protocol



WAVE Protocol Stack



Vehicle Structure in OMNeT++



Objectives:

- Demonstrate IPWAVE Basic Protocols
- Discover technology gaps for IPWAVE

Where to get source code:

- Git-hub open source:
<https://github.com/ipwave-hackathon-ietf>

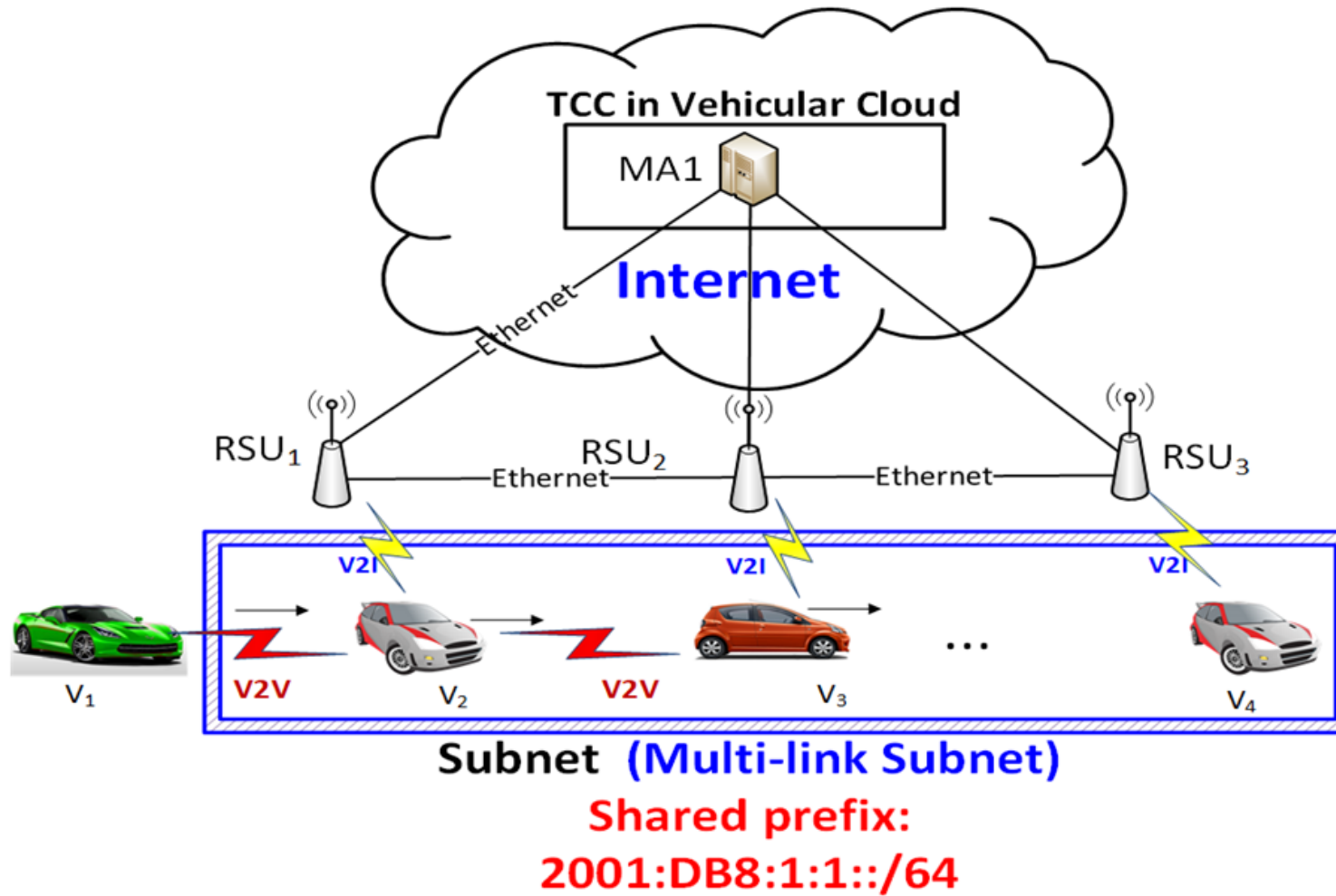
How to set up an environment:

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

Implementation Contents:

- Proof of Concept (POC) of IPv6-Based Context-Aware Navigator Protocol
- IPv6 mobility information sharing for safe driving in roadways
- Coordinated path planning for obstacle and collision avoidance in roadways
- Efficient driving information exchange in IP-based vehicular networks
- Network-based coordinated driving environment sensing and perception
- Vehicular Simulations of IPWAVE with OMNeT++, SUMO, and VEINS

Vehicular Network for Simulation of CNP



Simulation of CNP (1/2)

✓ Two RSUs:

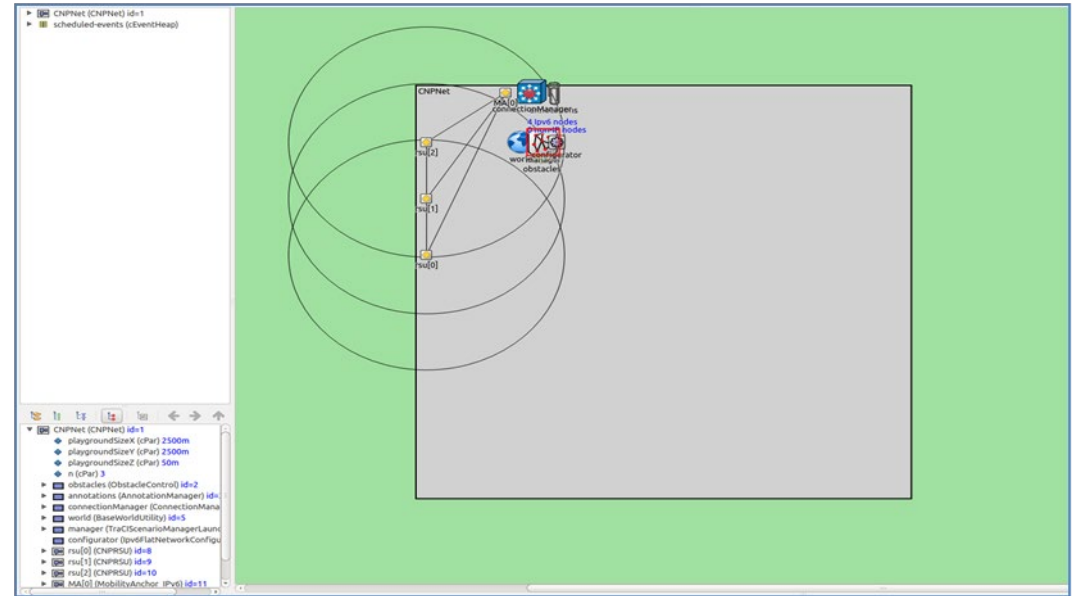
- They belong to one subnet.
- They are connected with each other through Ethernet.

✓ Multiple Vehicles:

- They are driving through a road segment.

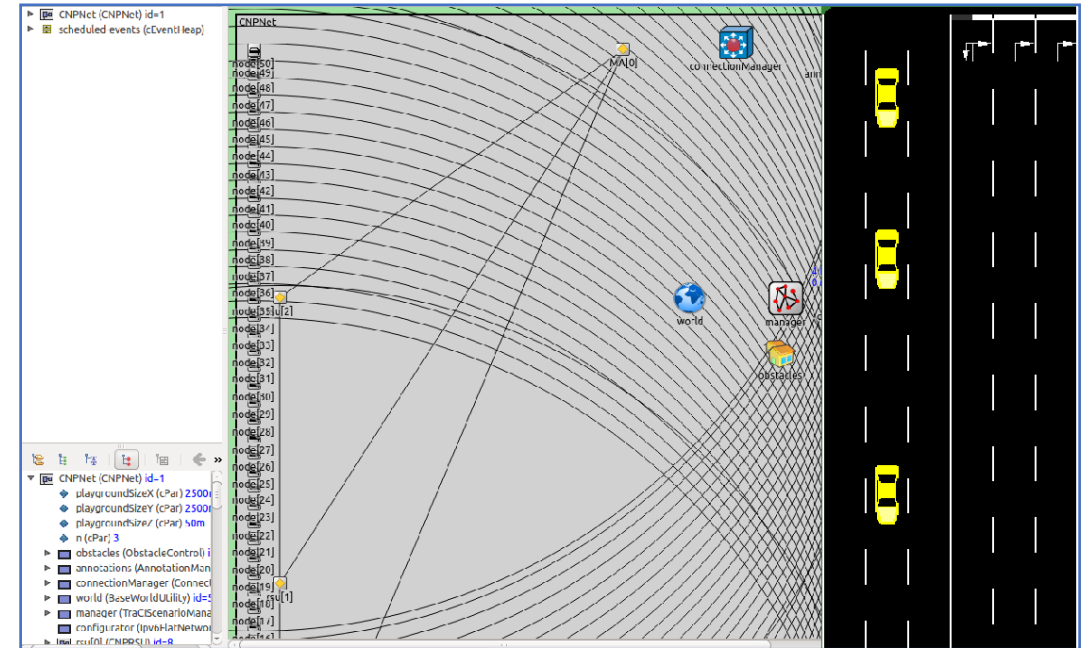
✓ Mobility Anchor (MA):

- MA manages RSUs and vehicles for the mobility management of the vehicles.



Simulation of CNP (2/2)

- We set up an IP-based vehicular network with 3 RSUs and 1 MA.
- Mobility information is exchanged among vehicles by CNP over IPWAVE.
- A coordinated maneuver for collision avoidance is performed by vehicles when an obstacle is detected.
- We implemented CNP, but the types of VMI are not separated yet.
 - This separation will be done in the IETF-109 Hackathon Project.



IPWAVE Open Source Project in GitHub

GitHub - ipwave-hackathon-ietf / ipwave-hackathon-ietf-108

Why GitHub? Team Enterprise Explore Marketplace Pricing Search Sign in Sign up

ipwave-hackathon-ietf / ipwave-hackathon-ietf-108 Watch 0 Star 1 Fork 1

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master 1 branch 0 tags Go to file Code

mubienaime July 24 commit 9ecee39 on 24 Jul 2 commits

CNPveins	July 24 commit	2 months ago
IETF 2020	July 24 commit	2 months ago
inet	July 24 commit	2 months ago
sumo-0.32.0	July 20 commit	2 months ago

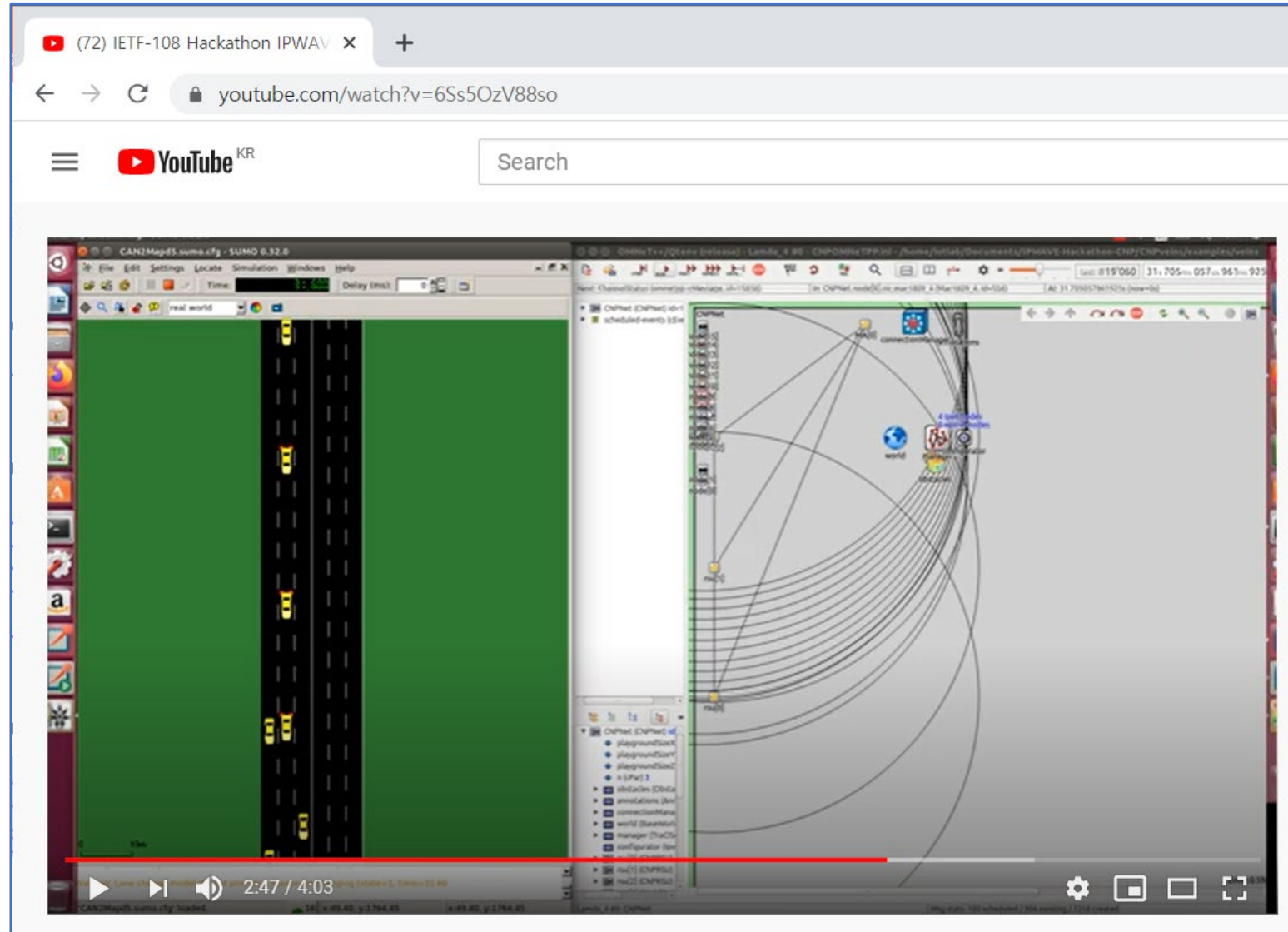
About
No description, website, or topics provided.

Releases
No releases published

Packages

<https://github.com/ipwave-hackathon-ietf/ipwave-hackathon-ietf-108>

Demonstration of CNP in YouTube



<https://www.youtube.com/watch?v=6Ss5OzV88so>

결론 및 향후 계획

- 차량 네트워킹을 위한 IETF IPWAVE 표준화 동향을 살펴보았다.
 - Use Cases of IPWAVE
 - IPv6 Delivery over IEEE 802.11-OCB
 - IPWAVE Problem Statement and Use Cases
 - Vehicular Neighbor Discovery and Vehicular Mobility Management
- IP WAVE 기반 주변 인식 내비게이터 프로토콜을 살펴보았다.
 - Context-Aware Navigator Protocol (CNP)
 - Collision Avoidance with CNP
 - IPWAVE Communications for CNP
 - Simulation and Implementation of CNP
- IETF-109 해커톤 참석 및 IPWAVE WG 표준화
 - 2020년 11월에 개최되는 IETF-109 정기회의 및 해커톤에 참석
 - CNP를 로봇카에 구현하여 POC를 하여 IPWAVE 표준화에 활용