Report for IPWAVE Basic Protocols Project @ IETF-104 Hackathon

IETF 104, Prague
March 29, 2019

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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
IP Wireless Access in Vehicular Environments (IPWAVE) Basic Protocols Project
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Professors
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- Younghan Kim (SSU)

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

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/sKYa0MC6Jg

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
IPWAVE Hackathon Project Activity
Vehicular Network Architecture for V2I and V2V Networking
Multihop DAD in Vehicular ND

1. Address Registration Request
2. Forward Request
3. Start Multihop DAD
4. DAD passed, Create NCE
5. Feedback DAD Result
6. Forward DAD Result

RSU1 Communication Range

Mobility Anchor (MA)

Road-Side Unit

RSU1

V2I

V2V

Vehicle $V_1$

Vehicle $V_2$
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

- Non-safety Apps
  - TCP/UDP
  - IPv6
- Safety Apps
  - WSMP
  - LLC
  - WAVE MAC (with Channel Coordination)
  - WAVE PHY
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

<table>
<thead>
<tr>
<th>OS</th>
<th>Ubuntu Linux 16.04</th>
</tr>
</thead>
<tbody>
<tr>
<td>OMNeT++</td>
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Open-Source Depository of IPWAVE Basic Protocols Project

Github link: https://github.com/ipwave-hackathon-ietf

No description, website, or topics provided.

- chinentori: First commit
- inet4
- veins-veins-4.7.1: First commit

Latest commit 08cb3ba Mar 18, 2019
Demonstration Video Clip of IPWAVE Basic Protocols Project

Youtube link: https://youtu.be/sKYfa0MC6Jg